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JAWAHAR NAVODAYA VIDYALAYA

Entrance Exam 2021

Conducted by
Navodaya Vidyalaya Samiti

ENGLISH

HINDI

GENERAL SCIENCE

MATHEMATICS

With Solved Paper 2020

9

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Complied & Edited by
Arihant 'Expert Team'

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SYLLABUS

ENGLISH

Comprehension (Unseen Passage), Word and Sentence Structure, Spelling, Rearranging jumbled words , Passivation, Use of degrees of comparison, Modal auxiliaries , Use of prepositions , Tense forms, Reported speech

हिन्दी

(क) भाषिक अनुप्रयोग और व्याकरणिक कुशलताएँ

वर्ण विचार/वर्तनी विवेक, शब्दभेद (स्त्रोत/उत्पत्ति), पर्याय/विलोम, शब्द विवेक (शब्द प्रयोग में सूक्ष्म अंतर), पद भेद (व्याकरणिक कोटि) की पहचान, पद परिचय, अशुद्ध वाक्य को शुद्ध करना, वाक्य रचनान्तरण (सरल/संयुक्त/मिश्र), मुहावरा, लोकोक्ति

(ख) अपठित बोधात्मक प्रश्न

GENERAL SCIENCE

Food – Crop Production and Management; Microorganism; Food Preservation, Materials I – Synthetic fibers; Plastics; Metals and Non – metals, Material II – Coal and Petroleum; Refining of Petroleum; Fossil Fuels; Combustion and Flame, Living / Non living; Cell structure and Function; Conservation of Plants and Animals – Wildlife, Sanctuary and National Parks, Reproduction – Asexual and Sexual, Reproduction, Reaching the age of adolescence, Force – Frictional Force; Gravitational Force; Thrust and Pressure, Light – Reflection of Light; Multiple Reflection; Human eye; Care of the Eyes; Sound; Human ears; Loudness and Pitch, Audible and inaudible Sounds, Chemical Effects of Electric Current; Electroplating, Natural Phenomena – Lightning; Earthquakes, Pollution of Air and Water, Solar system; Stars and Constellations

MATHEMATICS

Rational Numbers, Squares and Square Roots, Cubes and Cube Roots, Exponents and Powers, Direct and Inverse Proportions, Comparing Quantities (Percentage, Profit and Loss, Discount, Simple and Compound Interest), Algebraic Expressions and Identities including Factorization, Linear Equations in One Variable, Understanding Quadrilaterals (Parallelogram, rhombus, rectangle, square, kite) , Mensuration: *(a) Area of plane figures , (b) Surface area and volume of cube, cuboid and cylinder* , Data Handling (Bar graph, pie chart, organizing data, probability)

JAWAHAR
NAVODAYA
VIDYALAYA

SOLVED PAPER
2020

Jawahar Navodaya Vidyalaya

Entrance Exam Class 9

SOLVED PAPER 2020

Part I हिन्दी

1. 'स्वतन्त्र' का विलोम है
(a) गुलाम (b) परतन्त्र (c) आजाद (d) अधीन

2. नीचे दिए गए शब्दों में से कौन-सा शब्द अनेकार्थी है?
(a) घर (b) तन (c) साँझ (d) कल

3. नीचे दिए गए शब्दों में से कौन-सा शब्द 'आँख' का पर्यायवाची नहीं है?
(a) नैन (b) चक्षु (c) नयन (d) मीन

4. 'विचार' शब्द में 'इक' जोड़ने पर शब्द बनेगा
(a) विचारिक (b) वैचरिक
(c) वैचारिक (d) विचारीक

5. 'ईमानदारी' शब्द ..... संज्ञा है।
(a) भाववाचक (b) गुणवाचक
(c) समूहवाचक (d) जातिवाचक

6. 'रोजी-रोटी' शब्द ..... है
(a) संज्ञा (b) सर्वनाम (c) शब्द-युग्म (d) विशेषण

7. 'फल' शब्द का बहुवचन है
(a) फल (b) फलों (c) फलन (d) फलां

8. 'ढाँढस बँधाना' का अर्थ है
(a) आशीर्वाद देना (b) तसल्ली देना
(c) आज्ञा देना (d) निवेदन करना

9. 'आग लगने पर कुआँ खोदना' मुहावरे का अर्थ है
(a) अवसरवादी होना
(b) पाखंडी होना
(c) पहले से सावधान न होना
(d) समय देखकर तत्पर होना

10. शुद्ध रूप छाँटिए।
(a) सहीष्णुता (b) सहिश्णुता
(c) सहीस्नुता (d) सहिष्णुता

निर्देश (प्र.सं. 11-15) *निम्नलिखित अनुच्छेद को ध्यानपूर्वक पढ़कर दिए गए प्रश्नों के उत्तर के लिए सही विकल्प का चयन कीजिए।*

साँझ होने लगी थी, धूप की सुनहरी परछाइयाँ सिन्दूरी साँझ की बाँहों में समा गई। मैं इस साँझ को अपने तन की आँखों से देखता हूँ और मन की आँखों से उस दादी की छवि को जो मानस पटल पर उभर आई। तन की आँख सिर्फ आज देखती है जबकि मन की आँख तमाम बीते हुए कल। मन की इसी आँख ने मुझे अपनी दिवंगत दादी की याद दिला दी जो बचपन में हमें साँझ के समय घर के बाहर जाने से रोकती थी। कहती थी 'संजा बिरयां घर के बाहर नयी जानो बेटा, दीया बत्ती के टेम घर रेनो।' तर्क देती थी कि गोधूलि बेला में जब गायें भी अपने घर लौटती हैं अपने बछड़े के पास, तो फिर तुम क्यों घर के बाहर जाते हो? वह कहती रहती थी और हम थोड़ी देर उनकी गोद में बैठकर घर लौटती गायों को देखते, उनकी आँख बचाकर घर के बाहर भाग जाया करते थे। यह सिलसिला बचपन में चलता रहा। बचपन की दहलीज लाँघी, जीवन संघर्ष में यौवन उलझा और अब वार्धक्य में स्मृतियों के भँवर में घूम रहे हैं। इस सांध्य बेला में साँझ खूब याद आती है। ऐसी जाने कितनी साँझे याद आयी और बीत गई लेकिन दादी की 'संजा बिरयां' बीतती नहीं। सोचता हूँ तो बार-बार लगता है कि वह संध्या के समय के बाहर न जाने की मनुहार करते जब गायों के गोधूलि बेला में अपने-अपने घर लौटने का उदाहरण देती थी तो क्या यह उनकी समझ थी या उनका संस्कार?

11. अनुच्छेद में साँझ को सिन्दूरी इसलिए कहा गया है, क्योंकि
(a) साँझ बहुत गहरे लाल रंग की होती है
(b) शाम के समय आकाश में लालिमा होती है
(c) शाम को लोग जी भरकर मौज-मस्ती करते हैं
(d) साँझ के समय लोग लाल रंग का प्रयोग करते हैं

12. "..... लेकिन दादी की 'संजा बिरयाँ' 'बीतती ही नहीं" का अर्थ है
(a) दादी के जीवन में साँझ हमेशा रही।
(b) दादी की साँझ वाली बात कभी खत्म नहीं होती।
(c) दादी की साँझ वाली बात हमेशा याद रहती है।
(d) दादी की साँझ वाली बात का अर्थ आज समझ आया।

13. मन की आँखों को पुल का पर्याय क्यों कहा गया है?
(a) वे अतीत और भविष्य को जोड़ती हैं
(b) वे अतीत और भविष्य को डूबने से बचाती हैं
(c) वे आजकल आज को ही देखती हैं
(d) वे पुल की तरह दिखती हैं

14. इस अनुच्छेद में 'सांध्य बेला' का अर्थ है
(a) शाम का समय
(b) उम्र का एक पड़ाव
(c) सुखद समय
(d) दुखद समय

15. अनुच्छेद में लेखक ने ..... के बहाने दादी, बचपन, गोधूलि से जुड़ी यादों को साझा किया है।
(a) मन (b) आँखों
(c) साँझ (d) गायों

Part II English

Directions (Q.Nos. 16-19) *Choose the appropriate option to complete the passage/sentence.*

Man.....(16)..... is believed to have evolved from apes,.....(17)..... a curious mixture of varied motives. He is not only.....(18).....subjects of needs .....(19)..... also their creator. He also seeks to satisfy his needs and caters to his desires.

16. (a) which (b) when (c) while (d) who

17. (a) am (b) are (c) is (d) has

18. (a) to (b) the (c) a (d) an

19. (a) but (b) and (c) to (d) the

20. Convert into Passive voice.
'We must face the new situations with a creative mind.'
(a) New situations need faced by us with a creative mind
(b) New situations must face us with a creative mind
(c) New situations must be faced by us with a creative mind
(d) Everyone should face the new situations with a creative mind

21. Give a word most similar in meaning to the word 'exhorting'?
(a) urging (b) supporting
(c) demanding (d) clarifying

22. Opposite meaning of the word 'seeks' is
(a) deplores (b) avoids
(c) vanishes (d) approaches

Directions (Q.Nos.23-25) *Which option fits best in the blanks.*

23. I..... we should accept the offer.
(a) think (b) will think
(c) should think (d) would think

24. Neither he nor his servant.....
(a) leave (b) have left (c) has left (d) is left

25. My sister is ..... than I am.
(a) more stronger (b) most stronger
(c) stronger (d) strong

Direction (Q.No. 26) *Give one word for the following phrase.*

26. One who eats everything
(a) omnipotent (b) insolvent
(c) irresistible (d) omnivorous

Direction (Q. No. 27) *Select the alternative which best expresses the same sentence in Indirect speech.*

27. He said, "can you sing ?" and I said, "no."
(a) He asked me that could I sing and I refused.
(b) He asked me if I could sing and I replied that I could not.
(c) I denied, when he asked me if you could sing.
(d) He asked me if I could sing and I said no.

Passage

Directions (Q.Nos. 28-30) *Read the following passage carefully and answer the questions that follows.*

The Aryans were keen hunters and caught lions and hunted bears with dogs. But their favourite sport was racing in chariots drawn by swift horses. After the races, they had open-air dancing and singing. Like other ancient people, they worshipped at first many Gods of the storms. For a long time their chief God was Indra. As centuries passed and the Aryans settled and developed their farming and trade in the conquered lands, the people became divided into four main castes, the Brahmans, the Kshatriyas, the Vaishyas and the

Shudras. The duties of these four groups were described in ancient laws called the 'Manu Samhita' or the Laws of Manu.

28. The favourite sport of the Aryans was
(a) hunting (b) chariot race
(c) horse race (d) dancing and singing

29. For a long time, the chief God of the Aryans was
(a) Sun God (b) the God of storms
(c) Indra (d) God of sky

30. Who helped the Aryans in hunting?
(a) Lions (b) Dogs
(c) Bears (d) Their God

Part III Mathematics

Directions (Q.Nos. 31-65) *For each question, four possible choices have been given, out of which only one is correct. You are to select the correct answer and fill in the OMR sheet.*

31. Which of the following is not true?
(a) $\frac{8}{7}+\frac{3}{8}=\frac{3}{8}+\frac{8}{7}$ (b) $\frac{8}{7}\times\frac{3}{8}=\frac{3}{8}\times\frac{8}{7}$
(c) $\frac{8}{7}\div\frac{3}{8}=\frac{8}{7}\times\frac{8}{3}$ (d) $\frac{8}{7}-\frac{3}{8}=\frac{3}{8}-\frac{8}{7}$

32. The product of a non-zero rational number and its reciprocal is
(a) 1
(b) 0
(c) rational number itself
(d) reciprocal of rational number

33. Square of which of the following number will have 6 at its unit place?
(a) 38 (b) 24 (c) 32 (d) 45

34. How many natural numbers exist between the squares of 28 and 29?
(a) 30 (b) 58 (c) 56 (d) 60

35. The value of $\sqrt{\sqrt{256}+\sqrt{81}}$ is
(a) 5 (b) 6
(c) 7 (d) 8

36. Which one of the following will have cube root ending with 3?
(a) 35937 (b) 46656
(c) 39304 (d) 50653

37. $0.04\times0.04\times0.04=?$
(a) 0.064 (b) 0.00064
(c) 0.0064 (d) 0.000064

38. The least number by which 81 be divided to make a perfect cube is.....
(a) 1 (b) 3 (c) 2 (d) 4

39. The standard form of 12300000 is .....
(a) 1.23×10^8 (b) 12.3×10^8
(c) 1.23×10^7 (d) 1.23×10^9

40. $Z\times(Z^2)^{-4}=?$
(a) Z^{-7} (b) Z^7 (c) Z^{-8} (d) Z^8

41. If a family of 10 persons purchases ration for 15 days and five guests join the family from the first day. How long will the ration last?
(a) 15 days (b) 12 days (c) 10 days (d) 8 days

42. If the distance travelled by a rickshaw in one hour is 10 km, the distance covered by the same rickshaw with the same speed in one minute will be
(a) $\frac{250}{9}$ m (b) $\frac{500}{9}$ m (c) 1000 m (d) $\frac{500}{3}$ m

43. If Nidhi purchases a book of ₹ 500 and GST is 12 per cent. She will pay ₹ .....
(a) 60 (b) 560 (c) 640 (d) 660

44. If a number is increased by 30% and then decreased by 30%, the net increase/decrease percentage will be
(a) 9 (b) 4 (c) 16 (d) 1

45. The compound interest on ₹ 10 at the rate of 10% per annum for two years will be .....
(a) ₹ 2 (b) ₹ 2.10
(c) ₹ 2.20 (d) ₹ 2.30

46. Which of the following is like $32z^2y^2x^2$?
(a) $8z^2\times3y^2\times x^2$ (b) $6z^2\times6x^2\times y^2$
(c) $8y^2\times4x^2\times z^2$ (d) $6z^2\times3x^2\times y^2$

47. The irreducible factorisation of $63z^2y^3x$ is.....
(a) $9z^2y^3x$ (b) $9z^2\times7y^2\times2x$
(c) $9z^2\times7x\times y^2$ (d) $3z^2\times7x\times3y^3$

48. $\left(\frac{3a}{5}+\frac{2b}{3}\right)\left(\frac{3a}{5}-\frac{2b}{3}\right)=?$
(a) $\frac{3a^2}{5}-\frac{2b^2}{3}$ (b) $\frac{9a^2}{5}-\frac{4b^2}{9}$
(c) $\frac{9a^2}{25}-\frac{4b^2}{9}$ (d) $\frac{9a^2}{25}-\frac{4b^2}{3}$

49. $(2005)^2-(1995)^2=?$
(a) 40000 (b) 4000 (c) 4025 (d) 40225

50. The area of a square is $9x^2+24xy+16y^2$. Its side will be
(a) $3x-4y^2$ (b) $3x-4y$ (c) $3x+4y^2$ (d) $3x+4y$

51. If $3x - 4(64 - x) = 10$, then $x = ?$
(a) 133 (b) 38 (c) –286 (d) 66.5

52. The present age of the father is three times than that of his son. After three years the age of the father will be 7 yr more than twice the age of the son. The present age of the son is ..... yr.
(a) 8 (b) 9 (c) 10 (d) 11

53. The sum of five consecutive multiples of 6 is 2040. Find the largest multiple.
(a) 420 (b) 528 (c) 456 (d) 450

54. 15 added to the product of y and 13 give us 54. The value of y is
(a) 2 (b) $\frac{69}{13}$ (c) 3 (d) 4

55. The four angles of a quadrilateral are in the ratio of 3 : 4 : 5 : 6. The largest angle is
(a) 160° (b) 80° (c) 100° (d) 120°

56. In a quadrilateral $ABCD$, $AB = 6$ cm, $CD = 8$ cm and sum of angles A and D is 180°. This is .....
(a) parallelogram (b) trapezium
(c) rhombus (d) square

57. One of the diagonals of a rhombus is equal to its side. Its larger angle is
(a) 120° (b) 90°
(c) 60° (d) 160°

58. The diagonals of a rhombus are 5 cm and 7 cm. Its area will be .....cm^2.
(a) 12 (b) 17.5 (c) 35 (d) 70

59. The area of the largest triangle that can be fitted into a rectangle of the length L units and width B units will be ..... $units^2$.
(a) $\frac{LB}{3}$ (b) $\frac{LB}{6}$ (c) $\frac{LB}{4}$ (d) $\frac{LB}{2}$

60. 360 m^3 water is used to irrigate rectangular field of length 40m and width 18m. The height of the water level in the field will be ..... m.
(a) 0.5 (b) 1 (c) 1.5 (d) 0.2

61. If the side of a cube is increased to three times, its volume will become..... times.
(a) 6 (b) 9 (c) 21 (d) 27

62. The radii of two cylinders are in the ratio of 1 : 2 and heights are in ratio of 2 : 5. The ratio of their volume will be
(a) 1 : 10 (b) 1 : 8
(c) 1 : 5 (d) 2 : 9

63. How many cubic metres of earth must be dug to construct a 7 m deep well and diameter is 2 m?
(a) 35 (b) 32
(c) 22 (d) 14

64. A dice is thrown two times. The sum of numbers appearing on the dice can be ..... outcomes.
(a) 5 (b) 6
(c) 11 (d) 18

65. The range of the following data is .....
$-6, -8, 3, 2, 1, 4, 2, 5$
(a) 10 (b) 13
(c) 11 (d) 8

Part IV General Science

Directions (Q. Nos. 66-100) *For each question four possible choices have been given, out of which only one is correct. You are to select the correct answer and fill in OMR sheet.*

66. *Lactobacillus* is a/an ..... .
(a) bacteria (b) algae
(c) protozoan (d) fungus

67. ..... is used in sowing.
(a) Sickle (b) Hoe
(c) Seed drill (d) Sprinkler

68. Influenza is caused in human beings by .....
(a) bacteria (b) virus
(c) *Amoeba* (d) fungus

69. Smallpox vaccine was discovered by.....
(a) Louis Pasteur (b) Robert Koch
(c) Edward Jenner (d) Fleming

70. Which one of the following is a thermosetting plastic?
(a) Nylon (b) PVC
(c) Rubber (d) Bakelite

71. Which one of the following reacts vigorously with cold water?
(a) Sodium (b) Carbon
(c) Aluminium (d) Magnesium

72. Which property of copper is used for making electric wires?
(a) Ductility (b) Good conductor
(c) Insulation (d) Being solid

73. Which of the following is not a constituent of petroleum?
(a) Paraffin wax (b) Lubricating oil
(c) Coke (d) Petrol

74. Which one of the following is not a natural resource?
(a) Water (b) Minerals
(c) Soil (d) Rayon

75. The black thick liquid with unpleasant smell is known as
(a) kerosene (b) coal-tar
(c) petrol (d) coke

76. Species is found exclusively in a specific habitat
(a) Endemic (b) Extinct
(c) Endangered (d) Fauna

77. The environmental impact of clearing large patches of forests for cultivation of crops is
(a) soil pollution (b) soil fertility
(c)soil erosion (d) soil conservation

78. The leaves are green due to.....
(a) ribosome (b) mitochondria
(c) chloroplast (d) chlorophyll

79. Which one of the following is found in cells of plants, animals as well as bacteria?
(a) Chloroplast (b) Cell membrane
(c) Nucleus (d) Cell wall

80. Hen.....
(a) undergoes external fertilisation
(b) is oviparous
(c) is viviparous
(d) undergoes internal fertilisation

81. In *Amoeba*, reproduction takes place by .....
(a) external fertilisation (b) internal fertilisation
(c) budding (d) binary fission

82. Insufficient production of ..... in the tadpoles leads to their incomplete development.
(a) thyroxine (b) insulin
(c) nutrients (d) ducts

83. At the onset of puberty ..... is released by testes.
(a) thyroxine (b) insulin
(c) testosterone (d) adrenaline

84. A gas filled balloon moves up because.....
(a) gravity force does not act on the ballon
(b) there is no frictional force on the balloon
(c) upward force on the balloon is more than gravitational force
(d) upward force on the balloon is more than frictional force

85. Two thermocol balls held close to each other move away because of ..... force.
(a) magnetic (b) electrostatic
(c) gravitational (d) frictional

86. Wearing of cartilage in the body..... friction.
(a) increases
(b) decreases
(c) does not effect
(d) may increase or decrease

87. The handle of a cricket bat is usually rough to ..... .
(a) get more run (b) get ball on bat
(c) decrease friction (d) increase friction

88. If we increase the vibration in an object the time period will.....
(a) increase in same proportion
(b) increase in inverse proportion
(c) decrease in same proportion
(d) decrease in inverse proportion

89. Ultrasound has ..... frequency of vibration.
(a) 20 Hz
(b) between 20 to 20000 Hz
(c) above 20000 Hz
(d) less than 20 Hz

90. Iron is painted to ..... .
(a) give shiny appearance
(b) keep it for long
(c) save it from corrosion
(d) save it from electric current

91. ..... of the following is not good conductor of electricity.
(a) Tap water (b) Vegetable oil
(c) Vinegar (d) Lemon juice

92. Earthquakes can cause.....
(a) Tsunami, Floods, Landslide
(b) Tsunami, Lightening, Floods
(c) Tsunami, Lightening, Landslide
(d) Floods, Lightening, Landslide

93. When you rub the back of a plastic pen in your hair and bring it near a small piece of paper it attracts paper due to.....
(a) electrostatic force (b) friction
(c) magnetic force (d) gravity

94. If the object is 5 cm away from the plane mirror, the image formed by it and the object will be ..... cm apart.
(a) 2.5 (b) 5
(c) 10 (d) 15

95. A ray of light can reflected ..... times by two plane mirrors placed parallel and facing each other.
(a) 2 (b) 4
(c) 8 (d) infinite

96. Planet venus is also known as .....
(a) Pole star (b) Morning star
(c) Star sirius (d) Jupiter

97. A star is fifteen light years away from earth. The light emitted by it today will be seen after ..... years.
(a) 5 (b) 10
(c) 15 (d) 30

98. Tree plantation month of July/August every year is known as.....
(a) van mahotsav
(b) plantation month
(c) forest conservation month
(d) wildlife month

99. ..... is responsible for acid rain.
(a) Carbon dioxide
(b) Sulphur dioxide
(c) Carbon monoxide
(d) Chlorofluorocarbons

100. Which of the following groups contains all synthetic substances?
(a) Nylon, terylene, wool
(b) Cotton, polycot, rayon
(c) PVC, polythene, bakelite
(d) Acrylic, silk, wool

Answers

1. (b)	2. (d)	3. (d)	4. (c)	5. (a)	6. (c)	7. (a)	8. (b)	9. (c)	10. (d)
11. (b)	12. (c)	13. (a)	14. (a)	15. (c)	16. (d)	17. (c)	18. (c)	19. (a)	20. (c)
21. (a)	22. (b)	23. (a)	24. (c)	25. (c)	26. (d)	27. (b)	28. (b)	29. (c)	30. (b)
31. (d)	32. (a)	33. (b)	34. (c)	35. (a)	36. (a)	37. (d)	38. (b)	39. (c)	40. (a)
41. (c)	42. (d)	43. (b)	44. (a)	45. (b)	46. (c)	47. (d)	48. (c)	49. (a)	50. (d)
51. (b)	52. (c)	53. (a)	54. (c)	55. (d)	56. (b)	57. (a)	58. (b)	59. (d)	60. (a)
61. (d)	62. (a)	63. (c)	64. (d)	65. (b)	66. (a)	67. (c)	68. (b)	69. (c)	70. (d)
71. (a)	72. (b)	73. (b)	74. (d)	75. (b)	76. (a)	77. (c)	78. (d)	79. (b)	80. (b,d)
81. (d)	82. (a)	83. (c)	84. (c)	85. (b)	86. (a)	87. (d)	88. (c)	89. (c)	90. (c)
91. (b)	92. (a)	93. (a)	94. (c)	95. (d)	96. (b)	97. (c)	98. (a)	99. (b)	100. (c)

Hints and Solutions

1. (b) 'स्वतन्त्र' का विलोम परतन्त्र है क्योंकि स्वतन्त्र का अर्थ है जो दूसरे के अधीन न हो तथा परतन्त्र का अर्थ है जो दूसरे के अधीन या वश में हो। इस प्रकार ये दोनों शब्द एक-दूसरे के विपरीत या उल्टे हैं। अतः ये विलोमार्थक शब्द हैं। अन्य विकल्पों में, गुलाम-आजाद का तथा अधीन-स्वाधीन का विलोम शब्द है।

2. (d) जिन शब्दों के एक से अधिक अर्थ होते हैं, उन्हें अनेकार्थी शब्द कहते हैं जैसे–'कल'-बीता हुआ कल, आने वाला कल, मशीन, मधुर, आराम, सुख आदि। अतः विकल्प (d) सही उत्तर है।

3. (d) दिए गए विकल्पों में से मीन, 'आँख' का पर्यायवाची नहीं है, क्योंकि यह मछली का पर्यायवाची है। इसके अन्य पर्यायवाची मत्स्य, मकर, शफरी, जलजीवन, झख, इष आदि हैं। अतः विकल्प (d) सही उत्तर है।

4. (c) 'विचार' शब्द में 'इक' प्रत्यय जोड़ने से वैचारिक शब्द बनेगा। 'इक' प्रत्यय से बने अन्य शब्द इस प्रकार हैं- सामाजिक, वैज्ञानिक, धार्मिक, सांस्कृतिक, साहित्यिक आदि। अतः विकल्प (c) सही उत्तर है।

5. (a) जो संज्ञा शब्द, गुण, भाव, दशा, अवस्था, कर्म आदि का बोध कराते हैं, उन्हें भाववाचक संज्ञा कहते हैं जैसे- भूख, थकावट, घृणा, सुन्दरता आदि। 'ईमानदार' शब्द में 'ई' प्रत्यय जोड़ने से ईमानदारी भाववाचक संज्ञा शब्द बना है। अतः विकल्प (a) सही उत्तर है।

6. (c) 'रोजी-रोटी' शब्द प्रतिनिधि शब्द-युग्म है। इन दोनों शब्दों का प्रयोग काम-धन्धा तथा भोजन की व्यवस्था करने के सन्दर्भ में किया जाता है। अतः विकल्प (c) सही उत्तर है।

7. (a) शब्द के जिस रूप से उसके एक से अधिक होने का बोध होता है, वह बहुवचन कहलाता है जैसे- घोड़े, नदियाँ, गाड़ियाँ आदि। कुछ शब्द ऐसे होते हैं जो एकवचन तथा बहुवचन में समान रहते हैं जैसे- फल, राजा, जनता, घर, दूध आदि। अतः विकल्प (a) सही उत्तर है।

8. (b) 'ढाँढस बँधाना' मुहावरे का अर्थ है–तसल्ली देना। जैसे- परीक्षा में अनुत्तीर्ण होने पर अमित ने अपने मित्र अर्जुन को ढाँढस बँधाया। अतः विकल्प (b) सही उत्तर है।

9. (c) 'आग लगने पर कुआँ खोदना' मुहावरे का अर्थ है संकट आने पर प्रतिकार का उपाय ढूँढ़ना या पहले से कोई उपाय न करना। दिए गए विकल्पों में, पहले से सावधान न होना इसी अर्थ में प्रयुक्त होता है। अतः विकल्प (c) सही उत्तर है।

10. (d) दिए गए विकल्पों में से 'सहिष्णुता' शुद्ध वर्तनी वाला शब्द है जिसका अर्थ है- सहन करना। अतः विकल्प (d) सही उत्तर है।

11. (b) अनुच्छेद में साँझ को सिंदूरी इसलिए कहा गया है, क्योंकि शाम के समय आकाश में लालिमा होती है। यह लालिमा सिंदूर के रंग के समान लगती है। अतः विकल्प (b) सही उत्तर है।

12. (c) "..... लेकिन दादी की 'संजा बिरयां' बीतती ही नहीं" का अर्थ है कि दादी की साँझ वाली बात लेखक को हमेशा याद रहती है। अतः विकल्प (c) सही उत्तर है।

13. (a) मन की आँखों को पुल का पर्याय इसलिए कहा गया है, क्योंकि वे अतीत और भविष्य को जोड़ती हैं। अतः विकल्प (a) सही उत्तर है।

14. (a) इस अनुच्छेद में 'सांध्य बेला' का अर्थ शाम का समय है। शाम का समय बहुत रमणीय होता है जिसका वर्णन लेखक ने इस अनुच्छेद में किया है। अतः विकल्प (a) सही उत्तर है।

15. (c) अनुच्छेद में लेखक ने साँझ यानी शाम के बहाने दादी, बचपन, गोधूलि से जुड़ी यादों को साझा किया है। अतः विकल्प (c) सही उत्तर है।

16. (d) With a person, pronoun 'who' is appropriately used. Hence, option (d) is the correct answer.

17. (c) Since, the subject is singular (species of man). So, with singular subject, singular verb 'is' would be used. Hence, option (c) is the correct answer.

18. (c) 'He' refers to the complete human species. Hence, article 'a' is the appropriate filler.

19. (a) Certain conjunctions come in pairs. In the sentence, not only has been used. 'Not only' always comes in pair with 'but also'. Hence, option (a) is the correct answer.

20. (c) While converting an active voice sentence into passive voice, then the verb takes the third form as the sentence has the modal verb. Therefore, 'face' become 'faced'. Hence, option (c) is the correct answer.

21. (a) The word 'exhorting' means to strongly encourage or urge someone to do something. Hence, option (a) is the correct option.

22. (b) The word 'seeks' means try to find or discover by searching or questioning. From the given options, option (b) 'avoids' (meaning to keep oneself away from finding something) is its correct antonym.

23. (a) As the sentence is in present tense, so option (a) 'think' is the correct option.

24. (c) When two subjects are connected by either or, neither ... nor, not only ..... but also the verb is used according to the subject that is closest to the verb (Here his servant). Hence, option (c) 'has left' is the correct answer.

25. (c) In the given sentence, there is a comparison between 'sister' and 'I'. Therefore, comparative form of adjective 'stronger' would be used, since, stronger is the comparative adjective.

Hence, option (c) is the correct answer.

26. (d) One who eats everything is called omnivorous.

27. (b) In the given Direct speech, a question is asked. Hence, said would be replaced by 'asked' and the question would start with 'if'. Further, there is also a reply. Hence, 'replied' would be used with 'that'. Therefore, option (b) is its correct answer.

28. (b) According to the given passage, the Aryans were hunter who also enjoyed dancing and singing. But their favourite sport was chariot races run by horses.

29. (c) For a long time, the chief God of the Aryans was 'Indra'.

30. (b) In the given passage, it is stated that the Aryans hunted with their dogs.

31. (d) Option (a), $\frac{8}{7}+\frac{3}{8}=\frac{3}{8}+\frac{8}{7}$, it is true.

[$\because$ the sum of two fractions be commutative]

Option (b), $\frac{8}{7}\times\frac{3}{8}=\frac{3}{8}\times\frac{8}{7}$, it is true.

[$\because$ multiply of two fractions be commutative]

Option (c), $\frac{8}{7}\div\frac{3}{8}=\frac{8}{7}\times\frac{8}{3}$, it is true. $\left[\because \frac{1}{\frac{a}{b}}=\frac{b}{a}\right]$

Option (d), $\frac{8}{7}-\frac{3}{8}=\frac{3}{8}-\frac{8}{7}$, it is not true.

[$\because$ the difference of two fractions is not be commutative]

32. (a) The product of a non-zero rational number and its reciprocal be 1.

For example a is any non-zero rational number, then

Reciprocal number of $a = \frac{1}{a}$

$\therefore$ Both product $= a \times \frac{1}{a} = 1$

33. (b) Option (a), unit digit in square of $38 = 4$ $[\because 8 \times 8 = 64]$

Option (b), unit digit in square of $24 = 6$ $[\because 4 \times 4 = 16]$

Option (c), unit digit in square of $32 = 4$ $[\because 2 \times 2 = 4]$

Option (d), unit digit in square of $45 = 5$ $[\because 5 \times 5 = 25]$

Hence, option (b) is correct answer.

34. (c) Square of $28 = (28)^2 = 784$

Square of $29 = (29)^2 = 841$

$\therefore$ Total number of natural numbers between of 784 and $841 = 841 - 784 - 1 = 56$

35. (a) Given expression $= \sqrt{\sqrt{256} + \sqrt{81}}$

$= \sqrt{\sqrt{2\times2\times2\times2\times2\times2\times2\times2} + \sqrt{3\times3\times3\times3}}$

$= \sqrt{2\times2\times2\times2 + 3\times3} = \sqrt{16+9} = \sqrt{25} = \sqrt{5\times5} = 5$

Alternate Method

Given expression $= \sqrt{\sqrt{256} + \sqrt{81}}$

$= \sqrt{16+9}$ $[\because \sqrt{256} = 16, \sqrt{81} = 9]$

$= \sqrt{25} = 5$

36. (a) Given, Unit digit of cube of number = 3

$\therefore$ Unit digit of number = unit digit of $(3\times3\times3)$

= unit digit of 27

= 7

Hence, unit digit 3 will be cube root of 35937.

$\therefore$ Option (a) is correct answer.

37. (d) $? = 0.04 \times 0.04 \times 0.04$

$= \frac{4}{100} \times \frac{4}{100} \times \frac{4}{100} = \frac{64}{1000000}$

$= 0.000064$

[here, the number of zero in denominator is 6, so the decimal in numerator before 6 digit from last digit]

38. (b) Prime factors of 81

$81 = 3\times3\times3\times3$

$\because$ In perfect cube numbers, the group formed of three-three factors of prime factors.

$\therefore$ To divide of 81 by 3, will be get a perfect cube number.

Hence, option (b) is correct answer.

39. (c) The standard form of

$12300000 = 1.23 \times 10^7$

[$\because$ only one digit before decimal is standard form of any number and to write the sum of all zero in power of 10 and also to remove of all zero]

40. (a) $Z \times (Z^2)^{-4} = ?$

$\Rightarrow \quad ? = Z \times (Z)^{-8}$ $[\because (a^m)^n = (a)^{mn}]$

$\Rightarrow \quad ? = (Z)^{1-8}$ $[\because a^m \cdot a^n = a^{m+n}]$

$\Rightarrow \quad ? = Z^{-7}$

41. (c) Let x days will the ration last to come five guests.

Persons	Days
10 ↓	15 ↑
15	x

(Reciprocal ratio)

$\therefore \quad \frac{10}{15} = \frac{x}{15} \Rightarrow x = 10$

Hence, the ration will last in 10 days.

42. (d) Cover distance in 1 h by rickshaw = 10 km

or cover distance in 60 min by rickshaw = 10 km $[\because 1 \text{ h} = 60 \text{ min}]$

$\therefore$ Cover distance in 1 min by rickshaw $= \frac{10}{60}$ km

$= \frac{10 \times 1000}{60}$ m $[\because 1 \text{ km} = 1000 \text{ m}]$

$= \frac{500}{3}$ m

43. (b) Cost of book = ₹ 500

GST = 12%

$\therefore$ GST for book = 12% of ₹ 500

$= 500 \times \frac{12}{100} = 5 \times 12 =$ ₹ 60

$\therefore$ Pay by Nidhi = Cost of book + GST for book

= 500 + 60 = ₹ 560

44. (a) Let the number be 100.

Number to increasing of 30% in number

= 100 + 30% of 100

$= 100 + 100 \times \frac{30}{100}$

$= 100 + 30 = 130$

Now, number to decreasing of 30% in number

= 130 − 30% of 130

$= 130 - 130 \times \frac{30}{100}$

$= 130 - 39 = 91$

$\therefore$ Decrease percentage in number will be

$= \frac{100 - 91}{100} \times 100\%$

$= 9\%$

Alternate Method

If a number r% increase and then r% decrease,

then always net decrease $=\left(\frac{r}{10}\right)^2\%$

$\therefore$ Net decrease percentage in number

$$=\left(\frac{30}{10}\right)^2\% = 9\%$$

45. (b) Principal = ₹10,

Interest rate = 10% per annum

Time = 2 yr

$\therefore$ Compound amount = Principal $\left(1+\frac{\text{rate}}{100}\right)^{\text{Time}}$

$$=10\left(1+\frac{10}{100}\right)^2$$

$$=10\times\frac{11}{10}\times\frac{11}{10}=\frac{121}{10}=12.10$$

$\therefore$ Compound interest = Compound Amount − Principal

$$=12.10-10$$

$$=₹\,2.10$$

46. (c) Like term of $32z^2y^2x^2 = 8\times4\times z^2\times y^2\times x^2$

$$=8y^2\times4x^2\times z^2$$

47. (d) Irreducible factorisation of $63z^2y^3x$

$$=3\times3\times7\times z^2\times y^3\times x$$

$$=3z^2\times7x\times3y^3$$

48. (c) $? = \left(\frac{3a}{5}+\frac{2b}{3}\right)\left(\frac{3a}{5}-\frac{2b}{3}\right)$

$$=\left(\frac{3a}{5}\right)^2-\left(\frac{2b}{3}\right)^2 \quad [\because (a+b)(a-b)=a^2-b^2]$$

$$=\frac{9a^2}{25}-\frac{4b^2}{9}$$

49. (a) $? = (2005)^2-(1995)^2$

$$=(2005+1995)(2005-1995)$$

$$[\because a^2-b^2=(a+b)(a-b)]$$

$$=4000\times10$$

$$=40000$$

50. (d) Area of square $= 9x^2+24xy+16y^2$

$\Rightarrow$ $(\text{side})^2=(3x)^2+2\cdot(3x)\cdot(4y)+(4y)^2$

$\Rightarrow$ $(\text{side})^2=(3x+4y)^2$ $[\because a^2+2ab+b^2=(a+b)^2]$

$\Rightarrow$ side $= 3x+4y$

51. (b) $3x-4(64-x)=10$

$\Rightarrow$ $3x-256+4x=10 \Rightarrow 7x=10+256$

$\Rightarrow$ $x=\frac{266}{7}\Rightarrow x=38$

52. (c) Let present age of son be x yr.

$\therefore$ Present age of father = 3x

According to the question,

Father's age after three years

= 2 [son's age after three years +7]

$\Rightarrow$ $3x+3=2(x+3)+7$

$\Rightarrow$ $3x+3=2x+6+7$

$\Rightarrow$ $3x-2x=13-3\Rightarrow x=10$

Hence, the present age of son is 10 yr.

53. (a) Let five consecutive multiples of 6 be $6x, 6(x+1), 6(x+2), 6(x+3)$ and $6(x+4)$, respectively.

According to the question,

Sum of five consecutive multiples of 6 = 2040

$\Rightarrow 6x+6x+6+6x+12+6x+18+6x+24=2040$

$\Rightarrow$ $30x+60=2040$

$\Rightarrow 30x=2040-60 \Rightarrow 30x=1980 \Rightarrow x=\frac{1980}{30}=66$

$\therefore$ The largest multiple $= 6(x+4)$

$$=6(66+4)=6\times70=420$$

54. (c) According to the question, $y\times13+15=54$

$\Rightarrow 13y=54-15\Rightarrow 13y=39\Rightarrow y=\frac{39}{13}\Rightarrow y=3$

55. (d) Let four angles of a quadrilateral be 3x, 4x, 5x and 6x respectively.

$\because$ Sum of four angles of a quadrilateral = 360°

$\Rightarrow$ $3x+4x+5x+6x=360°$

$\Rightarrow$ $18x=360°$

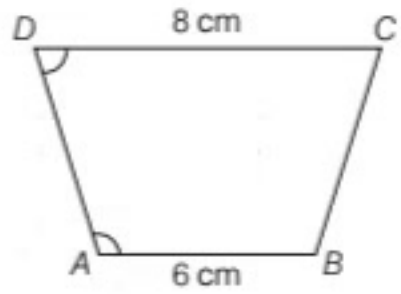
$\Rightarrow$ $x=\frac{360°}{18}=20°$

$\therefore$ The largest angle $= 6x = 6\times20° = 120°$

56. (b) Given, in quadrilateral ABCD

AB = 6 cm, CD = 8 cm

and $\angle A+\angle D=180°$



$\because$ $\angle A+\angle D=180°$

$\therefore$ AB || CD

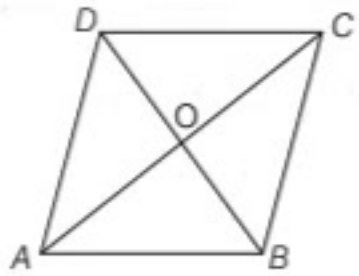
and AB = 6 cm,

CD = 8 cm

$\therefore$ ABCD will not be a square, parallelogram and rhombus.

Hence, ABCD is a trapezium.

57. (a) Let in rhombus ABCD, diagonal BD is equal of side.



Then, in ΔABD, $AB = AD = BD$

$\therefore \Delta ABD$ is an equilateral triangle.

Then, $\angle DBA = 60^o$

and $\angle ABC = 2 \times \angle DBA = 2 \times 60^o = 120^o$

In ΔABC, side AC will be the largest, then $\angle ABC$ will be the largest.

Hence, the largest angle $= 120^o$

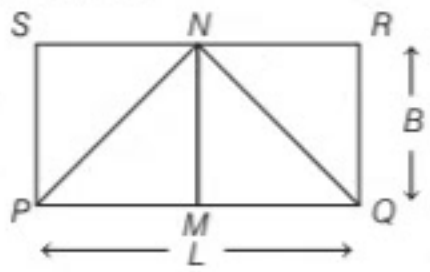
58. (b) Given, the diagonals of a rhombus are 5 cm and 7 cm.

$\therefore$ Area of rhombus $= \frac{1}{2} \times$ product of diagonals

$$= \frac{1}{2} \times 5 \times 7 = \frac{35}{2} = 17.5 \text{cm}^2$$

59. (d) Given, length of rectangle = L unit

breadth = B unit



In rectangle PQRS,

$$PQ = SR = L \text{ and } QR = PS = B$$

In triangle to be fitted into rectangle PQRS,

$$\text{Base} = PQ \text{ or } SR = L \text{ unit}$$

and height $= NM = PS = QR = B$ unit

$\therefore$ Area of the largest triangle $= \frac{1}{2} \times$ base $\times$ height

$$= \frac{1}{2} \times L \times B = \frac{LB}{2}$$

60. (a) Given, length of rectangular field = 40 m

Breadth = 18 m

Let height of water level in field be h m.

$\therefore$ Volume of water in field

$$= \text{length} \times \text{breadth} \times \text{height}$$

$\Rightarrow \quad 360 = 40 \times 18 \times h$

$\Rightarrow \quad h = \frac{360}{40 \times 18} = \frac{1}{2}$ m

$\Rightarrow \quad h = 0.5$ m

61. (d) Let side of cube be a, then

volume of first cube $= a^3$

New side of cube to increased to three times of side of cube = 3a

$\therefore$ New volume of cube $= (3a)^3$

$$= 27a^3$$

$$= 27 \times \text{volume of first cube}$$

Hence, volume will be 27 times of first cube.

62. (a) Given, the ratio of radii of two Cylinders is 1 : 2 and heights is 2 : 5.

Let radii of cylinders are r_1, r_2 and heights h_1, h_2, then

$$\frac{r_1}{r_2} = \frac{1}{2} \text{ and } \frac{h_1}{h_2} = \frac{2}{5}$$

$$\therefore \frac{\text{Volume of first cylinder}}{\text{Volume of second cylinder}} = \frac{\pi r_1^2 h_1}{\pi r_2^2 h_2}$$

$$= \left(\frac{r_1}{r_2}\right)^2 \times \left(\frac{h_1}{h_2}\right)$$

$$= \left(\frac{1}{2}\right)^2 \times \frac{2}{5} = \frac{1}{4} \times \frac{2}{5} = \frac{1}{10}$$

Hence, the ratio of volumes of cylinders is 1 : 10.

63. (c) Given, deep of well, h = 7 m

Diameter of well, d = 2 m

$\therefore$ Radius of well, $r = \frac{d}{2} = \frac{2}{2} = 1$ m

$\therefore$ Volume of mud for dug the well = Volume of well

$$= \pi r^2 h$$

[$\because$ the shape of a well is same as a cylinder]

$$= \frac{22}{7} \times (1)^2 \times 7 = 22 \text{ cubic metres}$$

64. (d) Total number of possible outcomes of a throw of a dice = 6

Total number of possible outcomes of two throw of a dice $= 6 \times 6 = 36$

The sum of numbers to come on throw two times of a dice will be equal in two-two position i.e (2, 3) or (3, 2).

$\therefore$ Required possible outcomes $= \frac{1}{2} \times 36 = 18$

65. (b) Given data,

$$-6, -8, 3, 2, 1, 4, 2, 5$$

Ascending order of data

$$-8, -6, 1, 2, 2, 3, 4, 5$$

$\therefore$ Range $= 5 - (-8)$

[$\because$ range = value of the largest data − value of the smallest data]

$$= 5 + 8 = 13$$

66. (a) *Lactobacillus* is a rod-shaped and gram positive bacteria. It mainly grows in milk and convert it into curd. During its growth, it utilises milk sugar called lactose and convert it into lactic acid through the process of fermentation. Thus, it is commonly known as Lactic Acid Bacteria (LAB).

67. (c) Seed drill is used in sowing. It is an agriculture equipment that sows the seeds precisely in the soil at proper depth and distance. It improves the ratio of crop yield.

68. (b) Influenza, commonly known as 'flu' is an infectious disease caused by *Orthomyxo virus* in human beings. The most common symptoms this disease include high fever, sore throat, sneezing, cough, headaches, fatigue, muscles aches, etc. Amantadine is used for the treatment of influenza.

69. (c) Smallpox vaccine was discovered by Edward Jenner in 1796. Smallpox is caused by infection of *Variola* virus. This virus is transmitted directly from person to person through airborne respiratory droplets produced by coughs and sneezes, saliva, skin to skin contact, etc. symptoms first appear 10 to 14 days after infection. The most common symptoms include fever, headache, severe fatigue, vomiting, rashes, blisters, etc.

70. (d) Bakelite is a thermosetting plastic. Thermosetting plastic is a polymer irreversible becomes rigid when heated. Due to its high resistance to electricity and heat, is used in automotive components and industrial applications like kitchenware products.

71. (a) Sodium react vigorously with cold water and produce sodium hydroxide and hydrogen. The reaction is exothermic.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2O$$

72. (b) Copper is a good conductor, it is used for making electric wires. Copper is a soft malleable and ductile metal with very high thermal and electrical conductivity.

73. (b) Lubricating oil is not a constituent of petroleum. It is used to reduce the friction, heat and wear between mechanical components that are in contact with each other, and remaining other are constituent of petroleums like paraffin wax, petrol, coke.

74. (d) Rayon is not a natural resource. Rayon is a man-made redeveloped cellulose fiber. It is made from natural sources such as wood and agricultural products. Rayon fiber is a synthetic textile material.

75. (b) Coal-tar is black thick liquid with unpleasant smell. It is by-product of the production of coke and coal gas from coal. It is distillation yield compounds, as benzene, anthracene and phenol.

76. (a) Endemic species are those species of plants and animals which are only found exclusively in a specific habitat. For example-Kangaroos are only found in Australia and Asiatic lions also known as the Indian lions are only found in Gir National Park of Gujarat in India.

77. (c) The environmental impact of clearing large patches of forests for cultivation of crops is soil erosion. It is the removal of top fertile layer of the soil, which most amount of organic nutrient rich materials. When trees are cut down, the roots of plants are bind to the soil particles and prevent them from being carried away by strong wind or water.

78. (d) The leaves are green due to the presence of chlorophyll. It is a green colour pigment found in the thylakoid membranes of the chloroplast in the leaves. It absorbs deep blue and red light and reflects green colour. It absorbs the light energy from the sun, which is important for plants to make their food through photosynthesis.

79. (b) Cell membrane or plasma membrane is found in cells of plants, animals as well as bacteria. It is outermost living, and delicate covering of cell. It separates the contents of the cell from its external environment. It helps to maintain the shape of the cell and acts as a mechanical barrier.

80. (b, d) Hen is an oviparous bird which lays eggs. In all birds, internal fertilisation takes place. Thus, the development of embryo occurs outside the body. Hence, option (b) and (d) both are correct.

81. (d) *Amoeba* is an unicellular protozoan organism, in which the reproduction mainly takes place by binary fission in favourable conditions. It is a mode of asexual reproduction. In this process the parent cell divides into two daughter cells of equal size. These are genetically identical to each other.

82. (a) Insufficient production of thyroxine leads to incomplete development of tadpole larva into adult (metamorphism). Iodine is required for the production of thyroxine. If the water body in which larva is present lacks sufficient iodine, then it will also affect the metamorphism of tadpole.

83. (c) At the onset of puberty in males, (sex hormone) testosterone is released by testes. It helps in the production of sperms in testes and development of secondary sexual characters like deeper voices growth of facial hair, growth in height, etc.

84. (c) A gas filled balloon moves up because upward force on the balloon is more than gravitational force, only then the balloon will be able to go up against this force.

85. (b) Two thermocol balls held close to each other move away because of electrostatic force. The balls have similar charges. They move away due to repulsion between similar charges.

86. (a) Wearing of cartilage in the body increases friction between bones. It is a connective tissue, which reduces friction and acts as a cushion between joints and helps to provide support and flexibility to the body. When it is present in nose, ear, trachea and layrx, it does not effect friction.

87. (d) The handle of a cricket bat is usually rough to increase friction to have a better grip, therefore it doesn't slip out in the hand of the cricketer while batting.

88. (c) If we increase the vibration in an object, the time period will decrease in same proportion.
Since, a time period is the time taken for one complete cycle of vibration, i.e.

$$\text{Time period} = \frac{1}{\text{Frequency}}$$

Where, frequency is the number of vibrations that occur per second.

89. (c) Ultrasound has frequency of vibration above 20000 Hz. It cannot be heared by human being. Dogs can hear ultrasound of frequency upto 50000 Hz.

90. (c) Iron is painted to save it from corrosion. After painting, iron surface does not come in contact with moisture and air, which causes corrosion.

91. (b) Vegetable oil is not good conductor of electricity because it does not contain ions. While lemon juice contains citric ion which conducts electricity. Tap water solution is a good conductor of electricity due to presence of dissolved salts in it. Vinegar when dissolved in water, it breaks into acetate ions which conduct electricity.

92. (a) Earthquake can cause Tsunami, Floods and Landslide. When the lithospheric plates moves, the surface of the earth vibrates. The vibrations can travel all round the earth. These vibrations are called earthquake.

93. (a) When you rub the back of a plastic pen in your hair and bring it near a small piece of paper, it attracts paper due to electrostatic force. After rubbing, when you bring the pen near a small piece of paper, the excess electrons on pen attract charges on the piece of paper and when positive and negative charges come close, they attract each other and piece of paper sticks to the pen.

94. (c) Distance of object to plane mirror = 5 cm
Then, the distance of image to plane mirror = 5 cm
∴ The distance of object to image
= distance of object to plane mirror
+ distance of image to plane mirror
= (5+ 5) cm = 10 cm
So distance of object to image = 10 cm.

95. (d) A ray of light can be reflected infinite times by two plane mirrors placed parallel and facing each other because each reflected ray would be the incident ray for the other mirror.

96. (b) Planet Venus is also known as morning star or an evening star because sometimes it appears in the eastern sky before sunrise. Sometimes, it appears in Western sky just after sunset. It is the brightest planet in the night sky.

97. (c) Light year is the unit of measurement of distance. One light year is equal to the distance travelled by light in one year. Therefore, if a star is fifteen light year away from earth, then the light emitted by it today will be seen after 15 years.

98. (a) Tree plantation month as July/August every year is known as Van Mahotsav. It is a special program of afforestation that takes place in various state of India during the first week July/August of monsoon.

99. (b) Sulphur dioxide (SO_2) and nitrogen oxide (NO_2) are responsible for acid rain. Acid rain results when sulphur dioxide (SO_2) and nitrogen oxide (NO_2) are emitted into the atmosphere and transported by wind and air currents. SO_2 and NO_2 react with water, oxygen and other chemicals to form sulphuric acid and nitric acids, then mix with water and other materials before falling to the ground.

100. (c) PVC, polythene, bakelite are synthetic substances.
PVC is a synthetic leather, PVC leather fabric is made by combining polyvinylchloride and lubricants and then applying to a base material.
Polythene is a type of plastic made into thin sheets or bags.
Bakelite due to its high resistance to electricity and heat is used in industrial applications.

Jawahar Navodaya Vidyalaya

Entrance Exam Class IX

SOLVED PAPER 2019

Part I हिन्दी

1. शुद्ध रूप छाँटिए
(a) कृपया (b) किरपा (c) कृप्या (d) क्रिप्या

2. 'अजेय' का विलोम शब्द होता है
(a) विजित (b) परास्त (c) जेय (d) पराजित

3. 'अंगुली पर नचाना' का उपयुक्त अर्थ है
(a) इशारा करना (b) वश में रखना
(c) बहुत मेहनत करना (d) ताने देना

4. 'जहाँ जाना कठिन हो' उसे कहते हैं
(a) दुर्गम (b) कठिनतम
(c) कष्टपूर्ण (d) अगम्य

5. पच्चीस वर्ष पूरे करने के उपलक्ष्य में हमारा विद्यालय ..... मनाएगा।
(a) स्वर्ण जयन्ती (b) रजत जयन्ती
(c) कांस्य जयन्ती (d) हीरक जयन्ती

6. "आँकना" शब्द का पर्यायवाची है
(a) तोलना (b) परखना
(c) मोलभाव करना (d) अनुमान लगाना

7. निम्नलिखित में से वाक्य के शुद्ध रूप का चयन कीजिए
(a) वह दस कक्षा में पढ़ता है।
(b) वह दसवीं कक्षा में पढ़ता है।
(c) वह दसवें कक्षा में पढ़ता है।
(d) वह दशमीं कक्षा में पढ़ता है।

8. 'आशा', 'अविश्वसनीय', 'प्रोत्साहित' तथा 'यह' शब्दों में से क्रिया कौन सी है?
(a) आशा (b) अविश्वसनीय
(c) प्रोत्साहित (d) यह

9. 'अपादान' कारक की विभक्ति है
(a) ने (b) को
(c) से (d) को, के लिए

10. 'कार्तिकेय' में निम्नलिखित में से कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष (c) द्विगु (d) बहुव्रीहि

निर्देश *निम्नलिखित अनुच्छेद को ध्यानपूर्वक पढ़कर दिए गए प्रश्नों के उत्तर के लिए सही विकल्प का चयन कीजिए।*

महात्मा ज्योतिबा फुले (ज्योतिराव गोविंदराव फुले) को 19वीं सदी का प्रमुख समाज सेवक माना जाता है। ज्योतिबा का लालन-पालन सगुनाबाई नामक एक दाई ने किया। जातिगत भेद-भाव के कारण उन्हें विद्यालय छोड़ना पड़ा। अरबी-फारसी के विद्वान गफ्फार बेग मुंशी एवं फादर लिजीट साहब ज्योतिबा के पड़ोसी थे। उन्होंने बालक ज्योतिबा की प्रतिभा एवं शिक्षा के प्रति रुचि देखकर उन्हें पुनः विद्यालय भेजने का प्रयास किया। वह अपने मित्र सदाशिव बल्लाल गोंडवे के साथ समाज, धर्म और देश के बारे में चिन्तन किया करते। उन्हें शिक्षा से वंचित रखा जाता था। ज्योतिबा को इस स्थिति पर बड़ा दुःख होता था। उन्होंने स्त्री और दलितों की शिक्षा के लिए सामाजिक संघर्ष का बीड़ा उठाया।

11. ज्योतिबा फुले को स्कूल ..... के कारण छोड़ना पड़ा।
(a) समाज सुधारक होने (b) शिक्षा में मन न लगने
(c) अनाथ होने (d) जातिगत भेद-भाव

12. ज्योतिबा फुले का पोषण किसने किया?
(a) उनकी माँ ने (b) एक दाई ने
(c) उनके पिता ने (d) समाज ने

13. ज्योतिबा फुले ने किसके उद्धार के लिए काम किया?
(a) केवल स्त्री शिक्षा (b) दलितों
(c) दलितों और स्त्री शिक्षा (d) सभी की शिक्षा

14. ज्योतिबा फुले किस के साथ देश के बारे में चिन्तन करते थे?
(a) सदाशिव बल्लाल गोंडवे (b) गफ्फार बेग मुंशी
(c) फादर लिजीट (d) सगुनाबाई

15. 'विद्वान्' शब्द का विलोम है:
(a) निरक्षर (b) साक्षर (c) मूर्ख (d) अहंकारी

Part II English

Directions (Q. 16 to 19) *Answer by choosing the appropriate option to complete the passage/sentence.*

We should remember that all religions preach good ..... (16) in life, the ..... (17) of which should rest on ethics. Without the basis of morality, philosophy would remain ..... (18) polemics and religion meaningless or in vain. Nobody can say that she is religious ..... (19) she is truthful.

16. (a) behaviour (b) deportment
(c) appearance (d) conduct

17. (a) basis (b) foundation
(c) fundamental (d) ground

18. (a) mere (b) simply
(c) merely (d) only

19. (a) if (b) until (c) unless (d) till

20. Fill in the blank.
A family ..... an educated mother is an advanced family.
(a) with (b) of (c) without (d) including

Direction (Q. Nos. 21 and 22) *Which option fits best in the blanks?*

21. The doctor ..... an operation.
(a) do (b) performed
(c) is performed (d) done

22. He thought my car ..... for sale.
(a) is (b) was (c) has been (d)going

Direction (Q. Nos. 21 and 22) *Which option can replace the underlined words?*

23. The Principal asked the students to give their request black and white.
(a) Written in black (b) Painted in black colour
(c) Written form (d) As the form of speech

24. The minister was accused of indulging in nepotism.
(a) hatred (b) partiality
(c) condemnation (d) indifference

25. Select the alternative which best expresses the same sentence in indirect speech.
Socrates said, "Virtue is its own reward"
(a) Socrates said that virtue had its own reward
(b) Socrates said that virtue is its own reward
(c) Socrates said that virtue was its own reward
(d) Socrates said that virtue have its own reward

26. Select the alternative which best expresses the same sentence in active/passive voice.
A week is made of seven days
(a) There are seven days in a week
(b) Seven days makes a week
(c) A week has seven days
(d) Seven days make a week

Passage

Read the following passage and answer Q. 27-30

Just as some men like to play football or cricket, so some men like to climb mountains. This is often very difficult to do so, for mountains are not just big hills. Paths are usually very steep. Some mountain sides are straight up and down, so that it may take many hours to climb as little as one hundred feet. There is always the danger that you may fall off and be killed or injured. Men talk about conquering a mountain. It is a wonderful feeling to reach the top of a mountain after climbing for hours and may be, even for days. You look down and see the whole country below you. You feel god-like. Two Italian prisoners of war escaped from a prison camp in Kenya during the war. They did not try to get back to their own country, for they knew that was impossible. Instead, they climbed to the top of Mount Kenya, and then they came down again and gave themselves up. They had wanted to get that feeling of freedom that one has, after climbing a difficult mountain.

27. Some men like to climb mountains because
(a) they know the trick of climbing
(b) they don't like to play football or cricket
(c) they want to have wonderful feeling
(d) they like to face danger

28. To climb mountains is often difficult because
(a) mountains are big hills
(b) it consumes more time
(b) prisoners often escape from camps and battle there
(d) paths are steep and uneven

29. Mountaineering is not a very popular sport like football or cricket because
(a) there are no spectators in this sport
(b) it may take many hours or even days
(c) not many people are prepared to risk their lives
(d) people don't want to enjoy a god-like feeling

30. It is a wonderful feeling ..... . It refers to
(a) the steep path
(b) the prisoners
(c) the mountain
(d) mountaineering

Part III Mathematics

Directions *For each question* (Q. Nos. 31 to 65) *four possible choices have been given, out of which only one is correct. You are to select the correct answer and fill in the OMR sheet.*

31. Which one of the following rational number is additive identity for rational numbers?
(a) 0 (b) 1 (c) 2 (d) 3

32. Multiplicative invese of $\frac{0}{1}$ is
(a) 1 (b) –1 (c) 0 (d) undefined

33. Which one of the following will have odd unit digit?
(a) 52^2 (b) 56^2 (c) 57^2 (d) 58^2

34. How many natural numbers lie between 52^2 and 53^2?
(a) 101 (b) 104 (c) 107 (d) 110

35. The unit digit in cube of 143 is
(a) 1 (b) 3 (c) 7 (d) 9

36. Which one of the following numbers is a perfect cube?
(a) 2836 (b) 4094 (c) 1828 (d) 1331

37. If $\sqrt[3]{0.000125} = x$, then $x =$
(a) 0.05 (b) 0.005
(c) 0.5 (d) 0.0005

38. In a number pattern 27, 64, 125, y, the value of y will be
(a) 37 (b) 216
(c) 61 (d) 186

39. The standard form of 0.0000040 is
(a) 4.0×10^{-4} (b) 4.0×10^{-5}
(c) 4.0×10^{-6} (d) 4.0×10^{-7}

40. $(3/4)^5 / (5/3)^5 = ?$
(a) $(3/4/5/3)^5$ (b) $(3/4/5/3)^0$
(c) $(3/4 \times 5/3)^5$ (d) $(3/4/5/3)^{10}$

41. A toy is purchased at ₹ 1320 including 5% SGST and 5% CGST. The actual price of the toy without GST is
(a) ₹ 1400 (b) ₹ 1300
(c) ₹ 1200 (d) ₹ 1150

42. A shopkeeper sells a pen set at 20% profit to another shopkeeper who sells it at a loss of 20%. If price of pen set was ₹ 112, what is net profit or loss on total transaction?
(a) 2% loss (b) 2% profit
(c) 4% profit (d) 4% loss

43. The difference of the compound interest and the simple interest on ₹ 50000 at 4% annually for 2 yr will be
(a) ₹ 40 (b) ₹ 50 (c) ₹ 80 (d) ₹ 160

44. Which of the following vary inversely with each other?
(a) speed and distance covered
(b) speed and time taken
(c) distance travelled and time taken
(d) distance covered and fare paid

45. A student reaches her school in 20 min with an average speed of 12 km/h. If she wants to reach her school 8 min earlier, her speed should be
(a) 8 km/h (b) 12 km/h
(c) 20 km/h (d) 15 km/h

46. Which of the following is an identity?
(a) $(z-x)^2 = z^2 + x^2$ (b) $z^2 - x^2 = (z+x)^2$
(c) $(z-x)^2 = z^2 + 2zx - x^2$ (d) $(z-x)^2 = z^2 - 2zx + x^2$

47. The irreducible factorisation of $(121x^2 - 169y^2)$ is
(a) $(11x+13y)(11x-13y)$ (b) $(11x^2 - 13y^2)$
(c) $(11x+13)(11x+13y)$ (d) $(11x-13y)^2$

48. $(999)^2 - (995)^2 = ?$
(a) 1894 (b) 1994
(c) 2094 (d) 7976

49. $-3x^2y^2 + x^2y^2 - 2x^2y^2 = ?$
(a) $4x^2y^2$ (b) $6x^2y^2$
(c) $-4x^2y^2$ (d) $-6x^2y^2$

50. The area of rectangle is $5(y+3)(y^2-16)$. It's one side is $5(y^2 - y - 12)$. What is its other side?
(a) $(y-12)$ (b) $(y-15)$ (c) $(y-4)$ (d) $(y+4)$

51. Twenty one added to thrice a whole number gives 99. The number is
(a) 26 (b) 27 (c) 28 (d) 29

52. The sum of five consecutive odd numbers is 295. The smallest number is
(a) 51 (b) 53 (c) 55 (d) 57

53. The present age of the father is three years less than five times the age of his son. After 5 yr the age of father will be 3 yr more than three times the age of the son. The present age of the son is
(a) 8 yr (b) 7 yr
(c) 6 yr (d) 9 yr

54. The unit digit in a two digit number is two times the digit in tens place. If the digits are replaced with each other, the number becomes 18 more than the first number. What is the first number?
(a) 12 (b) 36 (c) 48 (d) 24

55. If the interior angle of a regular polygon is 108°. The polygon has ..... sides.
(a) 4 (b) 5 (c) 6 (d) 10

56. The angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4. The largest angle is
(a) 36° (b) 72°
(c) 144° (d) 108°

57. How many non-overlapping triangles can be formed in 11 sided polygon by joining the vertices?
(a) 11 (b) 10 (c) 8 (d) 9

58. A cube whose side is 5 cm will have total surface area = ... cm^2.
(a) 150 (b) 60 (c) 80 (d) 120

59. A regular hexagon is inscribed in a circle of radius 6 cm. The perimeter of the regular hexagon is ... cm.
(a) 18 (b) 72
(c) 36 (d) 48

60. If the radius of a cylinder is increased from 4 cm to 16 cm and the surface area of it kept same. If its height is 4 cm, what will be its new height?
(a) 4 cm (b) 1 cm (c) 2 cm (d) 3 cm

61. The volume of a cylinder which exactly fits into a cube of side 4 cm is ..... π cm^3.
(a) 8 (b) 16 (c) 24 (d)48

62. A cube with 5y side will have ..... volume.
(a) $27y^3$ (b) $25y^3$
(c) $50y^3$ (d) $125y^3$

63. The dimensions of a godwon are 20m, 25m and 10m. In this how many boxes of the dimension 2 m × 1.25 m × 1m can be kept?
(a) 2000 (b) 4000
(c) 6000 (d) 8000

64. The possibility of getting an odd number when a dice is rolled is
(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

65. The first and the second class interval of a grouped data are 5-10, 10-15. Its fifth class interval is
(a) 20-25 (b) 25-30 (c) 30-35 (d) 35-40

Part IV General Science

Directions (Q. Nos. 66 to 100) *For each question four possible choices have been given, out of which only one is correct. You are to select the correct answer and fill in OMR sheet.*

66. Which one of the following is not an essential condition to grow maize?
(a) Humidity (b) Low temperature
(c) Rainfall (d) High temperature

67. Which of the following tools is used by the farmer to remove weeds from the field?
(a) Hoe (b) Plough
(c) Axe (d) Cultivator

68. Pathogenic microorganisms present in host cells are killed by ..... medicines.
(a) antibiotics (b) antibodies
(c) pain killer (d) vaccines

69. Penicillin was discovered by
(a) Louis Pasteur (b) Robert Koch
(c) Alexander Fleming (d) Edward Jenner

70. Polycot is obtained by mixing
(a) nylon and wool (b) polyester and wool
(c) nylon and cotton (d) polyester and cotton

71. Aqueous solution of which of the following oxides turns blue litmus red?
(a) Sulphur dioxide (b) Magnesium oxide
(c) Iron oxide (d) Copper oxide

72. Which one of the following is used for making crackers?
(a) Copper (b) Sulphur (c) Iron (d) Chlorine

73. Naphthalene balls are obtained from
(a) petroleum (b) paraffin wax
(c) coal tar (d) coal gas

74. Coal is formed from the remains of
(a) vegetation only
(b) both egetation and animals
(c) animals only
(d) None of the above

75. When coal burns in air ..... gas is mainly produced.
(a) SO_2 (b) NO_2 (c) CO (d) CO_2

76. The process of separating the various constituents of petroleum is known as
(a) carponisation (b) refining
(c) distillation (d) purification

77. Which of the following is an exhaustible natural resource?
(a) Oxygen (b) Air
(c) Sunlight (d) Forests

78. ..... is meant for the conservation of biodiversity in their natural habitat.
(a) Wildlife sanctuary (b) Zoological garden
(c) Botanical garden (d) Dams

79. Clearning of large patches of forests for cultivation of crops may lead to
(a) soil erosion (b) soil pollution
(c) soil conservation (d) soil fertility

80. Which of the following is found in an animal cell but not in plant cell?
(a) Cell wall (b) Mitochondria
(c) Cell membrance (d) Nucleus

81. Chromosomes are present in
(a) nucleolus (b) nucleus
(c) ribosome (d) mitochondria

82. Which one of the following is oviparous?
(a) Human being (b) Dog
(c) Cow (d) Hen

83. Two cells that fuse to give zygote are called
(a) gametes (b) embryo
(c) foetus (d) ovum

84. ..... should be present in the water for metamorphosis of tadpoles.
(a) Chlorine (b) Carbon (c) Sulphur (d) Iodine

85. Deficiency of thyroxin in the body causes
(a) salt imbalance (b) diabetes
(c) goitre (d) dwarfism

86. While walking on the ground we apply force on
(a) shoes (b) ground
(c) gravitational (d) friction

87. In preparing a chapatti from dough ..... force is applied.
(a) Muscular (b) Friction
(c) Gravitation (d) Magnetic

88. Mobil oil is applied on iron shutters to..... friction.
(a) increase (b) decrease
(c) remove (d) keep same

89. The surface of mortar and pestle (silbatta) used for grinding is etched again after long use to ..... friction.
(a) keep same (b) remove
(c) increase (d) decrease

90. To increase loudness of sound ..... of vibration of sound.
(a) decrease its frequency
(b) increase its frequency
(c) decrease its amplitude
(d) increase its amplitude

91. If we listen to the sound of lightening 10, after observing, it how far are we from the place where lightening occurs?
(Take, speed of sound = 330 m/s)
(a) 825 m (b) 1650 m
(c) 3300 m (d) 330 m

92. Electric current can produce ..... effect.
(a) only thermal and chemical
(b) only thermal and magnetic
(c) only magnetic and chemical
(d) all the three types of

93. In which of the following solution conduction of electricity will not take place?
(a) Tap water (b) Vegetable oil
(c) Vinegar (d) Lemon juice

94. The movement of the earth's plates can cause
(a) tsunami (b) cyclones
(c) earthquakes (d) thunderstorms

95. The outermost layer of earth is called
(a) inner core (b) crust
(c) mantle (d) outer core

96. The planet venus appears in the ..... sky before sunrise.
(a) Eastern (b) Western
(c) Northern (d) Southern

97. Hari saw full moon on a particular day. After ..... days he will be able to see full moon again.
(a) 15 (b) 20
(c) 29 (d) 30

98. Which of the following is a greenhouse gas?
(a) Nitrogen (b) Oxygen
(c) Chlorine (d) Water vapour

99. The ocasion of tree plantation in July/Ausgust is called
(a) Forest Conservation Day
(b) Van Mahostav
(c) Wildlife Mahotsav
(d) Plantation Month

100. The acid rain contains ..... in more quantity.
(a) SO_2 (b) CO
(c) CO_2 (d) H_2S

Answers

1. (a)	2. (c)	3. (b)	4. (a)	5. (b)	6. (b)	7. (b)	8. (*)	9. (c)	10. (d)
11. (d)	12. (b)	13. (c)	14. (a)	15. (c)	16. (a)	17. (a)	18. (a)	19. (c)	20. (d)
21. (b)	22. (b)	23. (c)	24. (b)	25. (b)	26. (d)	27. (c)	28. (d)	29. (b)	30. (d)
31. (a)	32. (d)	33. (c)	34. (b)	35. (c)	36. (d)	37. (a)	38. (b)	39. (c)	40. (a)
41. (c)	42. (d)	43. (c)	44. (b)	45. (c)	46. (d)	47. (a)	48. (d)	49. (c)	50. (d)
51. (a)	52. (c)	53. (a)	54. (d)	55. (b)	56. (c)	57. (d)	58. (a)	59. (c)	60. (b)
61. (b)	62. (d)	63. (a)	64. (c)	65. (b)	66. (b)	67. (a)	68. (a)	69. (c)	70. (d)
71. (a)	72. (a)	73. (c)	74. (b)	75. (d)	76. (b)	77. (d)	78. (a)	79. (a)	80. (*)
81. (b)	82. (d)	83. (a)	84. (d)	85. (c)	86. (b)	87. (a)	88. (b)	89. (d)	90. (d)
91. (c)	92. (d)	93. (b)	94. (c)	95. (b)	96. (a)	97. (d)	98. (d)	99. (b)	100. (a)

Hints and Solutions

30. (d) Wonderful feeling refers to 'mountaineering'.

31. (a) Zero (0) is additive identity for rational numbers because no change is obtained when adding zero (0) to any other rational number.

32. (d) $\because$ Multiplicative inverse of any number

$$= \text{reciprocal of itself}$$

Hence, Multiplicative inverse of $\frac{0}{1} = \frac{1}{0/1} = \frac{1}{0}$

$$= \infty \text{ (undefined)}$$

33. (c) Except 57, all other given numbers contain an even number at their unit's place and we know that the square of an even number is always an even number and the square of an odd number is always an odd number. Therefore, on squaring 57 we will get an odd digit at its unit's place.

34. (b) $\therefore$ Required total number of natural numbers

$$= [(53)^2 - (52)^2] - 1$$

$$= [(53-52)(53+52)] - 1$$

$$[\because a^2 - b^2 = (a+b)(a-b)]$$

$$= [1 \times 105] - 1$$

$$= 104$$

35. (c) $\therefore$ Unit digit in cube of 143 = unit digit of $(143)^3$

$$= \text{Unit digit of } (3)^3$$

$$= \text{Unit digit of } 27$$

$$= 7$$

36. (d) Cube of $11 = (11)^3 = 11 \times 11 \times 11 = 1331$

Hence, 1331 is a perfect cube.

37. (a) $\sqrt[3]{0.000125} = x$

$$\Rightarrow \quad \sqrt[3]{\frac{125}{1000000}} = x$$

$$\Rightarrow \quad \sqrt[3]{\frac{5 \times 5 \times 5}{100 \times 100 \times 100}} = x \Rightarrow \frac{5}{100} = x$$

$$\therefore \quad x = 0.05$$

38. (b) The correct pattern of numbers is as follows

$$\begin{array}{ccccccc} 27 & , & 64 & , & 125 & , & y \\ \downarrow & & \downarrow & & \downarrow & & \downarrow \\ (3)^3 & & (4)^3 & & (5)^3 & & (6)^3 \\ & +1 & & +1 & & +1 & \end{array}$$

Hence, $y = (6)^3 = 216$

39. (c) $\therefore$ Standard form of 0.0000040

$$= \frac{4.0}{10^6} = 4.0 \times 10^{-6} \quad \left[\because \frac{1}{a^m} = a^{-m}\right]$$

40. (a) $\therefore \dfrac{\left(\frac{3}{4}\right)^5}{\left(\frac{5}{3}\right)^5} = \left(\dfrac{\frac{3}{4}}{\frac{5}{3}}\right)^5 \quad \left[\because \dfrac{a^m}{b^m} = \left(\dfrac{a}{b}\right)^m\right]$

41. (c) Cost price of toy = ₹1320

$$\therefore \quad \frac{\text{Actual Price} \times (100 + \text{GST\%})}{100} = \text{Cost Price}$$

$$\Rightarrow \quad \frac{\text{Actual Price} \times (100 + 5 + 5)}{100} = 1320$$

$$\Rightarrow \quad \text{Actual Price} \times \frac{110}{100} = 1320$$

$\therefore$ Actual Price (without GST)

$$= \frac{1320 \times 100}{110} = ₹\ 1200$$

42. (d) CP of pen set for first shopkeeper = ₹ 112

SP of pen set for first shopkeeper

$$= CP \times \frac{(100 + \text{Profit } \%)}{100}$$

$$= 112 \times \frac{(100 + 20)}{100}$$

$$= \frac{112 \times 120}{100} = ₹134.40$$

CP of pen set for second shopkeeper = ₹ 134.40

SP of pen set for second shopkeeper

$$= \frac{CP \times (100 - \text{Loss}\%)}{100}$$

$$= 134.40 \times \frac{(100 - 20)}{100}$$

$$= 134.40 \times \frac{80}{100} = ₹107.52$$

$\because$ Initial CP > Last SP, then definitely loss occurred.

$\therefore$ Loss percentage $= \frac{\text{Loss}}{CP} \times 100$

$$= \frac{112 - 107.52}{112} \times 100$$

$$= \frac{4.48 \times 100}{112} = 4\%$$

43. (c) Given, principal = ₹ 50000, Rate = 4%, Time = 2yrs

$\therefore$ Required difference

= Compound interest − Simple interest

$$= \text{Principal}\left(1 + \frac{\text{Rate}}{100}\right)^{\text{Time}} - \text{Principal} - \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$

$$= 50000\left[\left(1 + \frac{4}{100}\right)^2 - 1 - \frac{4 \times 2}{100}\right]$$

$$= 50000\left[\left(\frac{26}{25}\right)^2 - 1 - \frac{2}{25}\right]$$

$$= 50000\left[\frac{676}{625} - 1 - \frac{2}{25}\right]$$

$$= 50000\left[\frac{676 - 625 - 50}{625}\right] = \frac{50000}{625} = ₹\,80$$

Alternate Method : Principal = ₹ 50000,

Rate = 4%, Time = 2yr

$\therefore$ Required difference

$$= \text{Principal}\left(\frac{\text{Rate}}{100}\right)^{\text{Time}} = 50000\left(\frac{4}{100}\right)^2$$

$$= 50000 \times \left(\frac{1}{25}\right)^2 = 50000 \times \frac{1}{625}$$

$$= ₹\,80$$

44. (b) We know that, Speed $= \frac{\text{Distance}}{\text{Time}}$

If distance is constant, then

$$\text{Speed} \propto \frac{1}{\text{Time}}$$

Hence, speed and time taken vary inversely with each other.

45. (c) Let the distance = x,

Then, speed $= \frac{\text{Distance}}{\text{Time}}$

$$12 = \frac{x}{\frac{20}{60}} \qquad \left[\because 1\,\text{min} = \frac{1}{60}\text{h}\right]$$

$$\therefore \qquad x = \frac{12}{3} = 4\text{ km}$$

Again, new speed $= \frac{4}{\frac{20-8}{60}} = \frac{4 \times 60}{12} = 20\text{ km/h}$

46. (d) By $(a - b)^2 = a^2 - 2ab + b^2$

$\therefore \quad (z - x)^2 = z^2 - 2zx + x^2$

Hence, option (d) is an identity.

47. (a) $(121x^2 - 169y^2) = (11x)^2 - (13y)^2$

$$= (11x + 13y)(11x - 13y)$$

$$[\because a^2 - b^2 = (a + b)(a - b)]$$

Hence, irreducile factorisation of $= (121x^2 - 169y^2)$

$$= (11x + 13y)(11x - 13y)$$

48. (d) $(999)^2 - (995)^2 = (999 + 995)(999 - 995)$

$$[\because a^2 - b^2 = (a + b)(a - b)]$$

$$= (1994)(4) = 7976$$

49. (c) $-3x^2y^2 + x^2y^2 - 2x^2y^2 = -2x^2y^2 - 2x^2y^2$

$$= -4x^2y^2$$

50. (d) Given, area of rectangle $= 5(y + 3)(y^2 - 16)$

One side of rectangle $= 5(y^{-2} - y - 12)$

$\because$ Area of rectangle = One side (length) × second side (breadth)

$5(y + 3)(y^2 - 16) = 5(y^2 - y - 12) \times$ second side (breadth)

$\therefore$ Second side (breadth)

$$= \frac{y + 3[(y)^2 - (4)^2]}{y - 4y\ 3y - 12}$$

$$= \frac{(y + 3)(y - 4)(y + 4)}{y(y\ 4) + 3(y - 4)}$$

$$= \frac{(y + 3)(y + 4)(y - 4)}{(y - 4)(y + 3)}$$

$$= y + 4$$

51. (a) Let the number = x
Accoding to the question,
$$3x + 21 = 99$$
$\Rightarrow$ $3x = 78$
$\therefore$ $x = 26$

52. (c) Let the five consecutive odd numbers $x, x+2, x+4, x+6$ and $x+8$.
Accoding to the question,
$x + x + 2 + x + 4 + x + 6 + x + 8 = 295$
$\Rightarrow$ $5x + 20 = 295$
$\Rightarrow$ $5x = 275$
$\therefore$ $x = 55$
Hence, smallest odd number is 55.

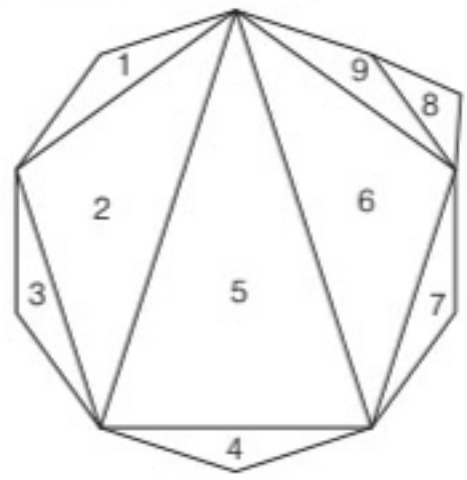
53. (a) Let age of son = x
Then, age of father = $5x - 3$
According to the question,
$$5x - 3 + 5 = 3(x + 5) + 3$$
$\Rightarrow$ $5x + 2 = 3x + 15 + 3$
$\Rightarrow$ $2x = 16$
$\therefore$ $x = 8$
Hence, age of son = 8 yr

54. (d) Let tenth digit of a number = x
Then, unit digit of a number = $2x$
$\because$ Number $= 10 \times x + 2x = 12x$
According to the question,
$$20x + x - 12x = 18$$
$\Rightarrow$ $21x - 12x = 18$
$\Rightarrow$ $9x = 18$
$\therefore$ $x = 2$
Hence, original number $= 12 \times 2 = 24$

55. (b) $\because$ Each interior angle of a polygon
$$= \frac{2(n-2) \times 90^\circ}{n}$$
$$108^\circ = \frac{2(n-2) \times 90^\circ}{n}$$
$\Rightarrow$ $108^\circ n = 180^\circ n - 360^\circ$
$\Rightarrow$ $72n = 360^\circ$
$\therefore$ $n = 5$
Hence, total sides of a polygon = 5

56. (c) Let the angles of quadrilateral be $x, 2x, 3x$ and $4x$.
According to the question,
Sum of all angles of quadrilateral = 360°
$$x + 2x + 3x + 4x = 360^\circ$$
$\Rightarrow$ $10x = 360^\circ$
$\therefore$ $x = 36^\circ$
Hence, largest angle of quadrilateral $= 4 \times 36^\circ$
$= 144^\circ$

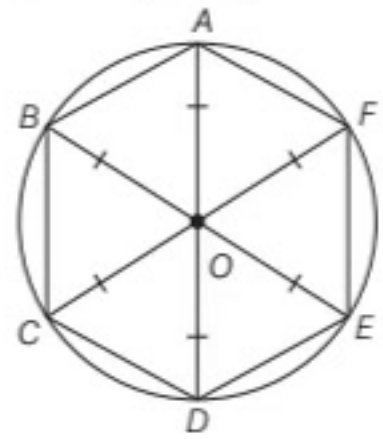
57. (d) According to the question,



Hence, total number of triangle = 9

58. (a) Given, side of cube = 5 cm
$\therefore$ Surface area of cube $= 6 \times (\text{side})^2 = 6 \times (5)^2$
$= 6 \times 25 = 150\ \text{cm}^2$

59. (c) According to the question,



$\because OA = OB = OC = OD = OE = OF = 6$ cm (radius)
$\therefore$ All ltriangles formed in regular hexagon is 'Equilateral Triangle'.
$\angle AOB = \angle AOF = \angle FOE = \angle EOD$
$= \angle DOC = \angle COB = \frac{360^\circ}{6} = 60^\circ$
$\therefore AB = BC = CD = DE = EF = FA = 6$ cm
Hence, Perimeter of hexagon $= 6 \times$ side
$= 6 \times 6 = 36$ cm

60. (b) Original radius of cylinder $(r_1) = 4$ cm
New radius of cylinder $(r_2) = 16$ cm
Original height of cylinder $(h_1) = 4$ cm
New height of cylinder $= h_2$
According to the question,
Original curved surface area = After increment curved surface area
$$2\pi r_1 h_1 = 2\pi r_2 h_2$$
$\Rightarrow$ $4 \times 4 = 16 \times h_2$
$\therefore$ $h_2 = \frac{16}{16} = 1$ cm

61. (b) Given,
Height of cylinder = side of cube = 4 cm
and radius of cylinder $= \frac{\text{Side of cube}}{2} = 2\text{cm}$
Hence, volume of cylinder $= \pi r^2 h$
$= \pi \times (2)^2 \times 4$
$= 16\pi \text{ cm}^3$

62. (d) $\therefore$ Volume of cube $= (\text{side})^3$
$= (5y)^3 = 5y \times 5y \times 5y$
$= 125y^3$

63. (a) $\therefore$ Required number of boxes
$= \frac{\text{volume of godown}}{\text{volume of each box}}$
[$\because$ Volume of cuboid = length × breadth × height]
$= \frac{20 \times 25 \times 10}{2 \times 1.25 \times 1} = 2000$

64. (c) Total numbers shown on dice $n(S)$
$= 6 (1, 2, 3, 4, 5, 6)$
Total odd numbers $n(E) = 3 (1, 3, 5)$
$\therefore$ Required possibility $= \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$

65. (b) According to question

First Class Interval	Second Class Interval	Third Class Interval	Fourth Class Interval	Fifth Class Interval
5-10	10-15	15-20	20-25	25-30

66. (b) Low temperature is not an essential condition to grow maize. It is a kharif (summer) crop, so, it needs high temperature (above 30°C) for its growth and seed setting.

67. (a) Hoe is used by the farmer to remove weeds from the field. It is an ancient and versatile agricultural and horticultural hand tool used to shape soil, remove weeds, etc.

68. (a) Pathogenic microorganisms present in the host cells are killed by antibiotics. Antibiotics are substances that inhibits the growth of or destroys microorganisms.

69. (c) Penicillin was discovered by Alexander Fleming in 1928. Now, over 7000 antibiotics are known so far which are used to cure many human diseases caused by microorganisms.

70. (d) Polycot is made by combing (mixing) cotton and polyester. It is used to prepare clothes such as traffic jackets, etc.

71. (a) Sulphur is a non-metal and it forms an acidic oxide, i.e. sulphur dioxide (SO_2) whose aqueous solution which turns blue litmus red.

72. (a) Copper is used for making crackers.

73. (c) Naphthalene ball is an aromatic hydrocarbon which is obtained from coal tar while aliphatic are obtained from petroleum such as paraffin wax, etc.

74. (b) Coal is formed from the remains of both vegetation and animals because when these plants and animals died.Due to the high temperature, high pressure and absence of oxygen, they are converted into coal.

75. (d) When coal burns in presence of air CO_2 (carbon dioxide) gas is mainly produced.

$$\underset{\text{(Coal)}}{C} + \underset{\text{(Oxygen)}}{O_2} \longrightarrow \underset{\text{(Carbon dioxide)}}{CO_2} + \text{Heat}$$

76. (b) Petroleum is a mixture of various constituents like petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc. The process of separating various constituents of petroleum is known as refining.

77. (d) Forest is an exhaustible (non-renewable), natural resource but oxygen, air and sunlight are renewable natural resources.

78. (a) Wildlife sanctuaries are meant for the conservation of biodiversity in their natural habitat. In these places, animals and plants are protected in their natural; habitat and activities like hunting, poaching, felling trees are strictly prohibited.

79. (a) Clearing of land patches of forests for cultivation of crops may lead to soil erosion. It is a process of removal of top fertile soil by various factors like wind, water, etc.

80. (*) The question is not correct. If we read plant cell in place of animal cell then answer would be (a). Plant cell have cell wall which is not found in animal cell.

81. (b) Chromosomes are present in nucleus. These are condensed form of DNA packed with histone proteins. There are specific number of chromosome for every species of organisms. For example, there are 23 pairs of chromosomes in every cell of human body.

82. (d) Hen is oviparous animal. It lays eggs. Cow, dogs and human beings are viviparous animals which give birth to young ones.

83. (a) Two cells that fuse to give zygote are called gametes. These are formed in sexually reproducing

organisms in male and female individuals. Males produce sperms and females produce ova or egg cell in their respective reproductive systems.

84. (d) Iodine should be present in the water for metamorphosis of tadpoles. It is essential for the production of thyroxine hormones by tadpoles which brings about metamorphosis in them.

85. (c) Deficiency of thyroxin in human body causes a disease called goitre. In this, the neck area (where thyroid gland is present) swells because of malfunctioning of thyroid gland due to iodine deficiency.

86. (b) According to Newton's third law, every action has an equal and opposite reaction. This is relevant to walking because when you put your foot on the ground, you are applying a force to it. In doing this. the ground also actually applies an equal force onto your foot, in the opposite direction, pushing you forward.

87. (a) Muscular force is applied to change the shape of a ball of dough to a chapatti. This force leads to the change in shape and size of chapatti.

88. (b) Mobil oil is applied on iron shutters to decrease the friction. After the applying of mobil oil, the shutter become very smooth and we could easily de-shutter it by applying less effort.

89. (c) After prolonged use, the mortar and pestle (silbatta) loose the roughness due to which frictional force reduces and it does not work. So, we have to make it rough again for increase friction.

90. (d) To increase loudness of sound, increase its amplitude of vibration of sound because loudness of sound is depend on amplitude of vibration of sound.

91. (c) Given, speed of sound = 330 m/s
and time, $t = 10$ s

We know that, speed $= \dfrac{\text{distance}}{\text{time}}$

$\therefore$ distance = speed × time

So, distance travelled by sound in 10s.

$= 330 \times 10 = 3300$ m

92. (d) Electric current can produce thermal, chemical and magnetic effect. It depends on that medium on which it flowing through.

93. (b) The solution of vegetable oil does not conduct the electricity because it is a bad conductor of electricity there is no free electron in its structure. Tap water, vinegar and lemon juice are good conductors of electricity and free electrons are presented in their structure so they can conduct the electricity.

94. (c) The movement of the earth's plates can cause earthquakes. These plates are also called tectonic plates. When tectonic plates collide, one rides over the other, causing earthquakes.

Tsunami occurs due to displacement of large volume of water, generally in ocean or a lake. Cyclones is caused by a combination of strong winds driving water on shore and the lower atmosphere pressure thunderstorm occurs during rainfall.

95. (b) The outermost layer of earth is called crust. It is composed of low density rocks. Inner core is the innermost layer of earth. Above the earth's core, earth's vantle layer lies. Earth's outer core lies above the earth's inner core and below the mantle.

96. (a) The planet venus appears in the eastern sky before sunrise.

97. (c) The time interval between a full moon and next repetition of full moon is 29 days.

98. (d) Water vapours are considered as greenhouse gases alongwith CH_4, CO_2, etc. These gases absorb solar radiation and are responsible for raising earth's temperature due to greenhouse effect.

99. (b) The occassion of tree plantation in July/August is called Van Mahotsav. It was started by Kulpati Kanaiyal Lal Munshi, Union Minister for agriculture for creating interest in masses for tree plantation and afforestations.

100. (a) The acid rain contains SO_2 in more quantity. It reacts with rain droplets and form sulphuric acid (H_2SO_4). When it falls on surface of earth, it damages plant and, animal life alongwith monuments.

JAWAHAR NAVODAYA VIDYALAYA

CLASS IX ENTRANCE EXAM

SOLVED PAPER 2018

Part I English

Directions (Q. Nos. 1-15) *Read the passage carefully and choose the best answer to each question out of the four alternatives.*

Passage

Chameleons can make their skin colour change, but not because they decide to. The colour changes to help the chameleon avoid its enemies. It is a form of camouflage, a disguise that lets it blend in with its surroundings. The changes are actually determined by environmental factors, such as light and temperature.

Bright sunlight causes the skin to get darken. On cool nights, the colour fades to a creamy colour. The colour also changes when chameleons are excited, angry or afraid. The colour change is rapid and increases when the chameleon is handled, injured, or approached by another chameleon. There are many types of chameleons. Almost half of them are found on the African Island of Madagascar. The others mostly occur in the Sahara desert, with few in Western Asia and Southern Europe. Chameleons live in trees; where they usually eat insects. Very large chameleons may even use their sticky tongues to catch birds.

1. A chameleon's colour changes to help it
   (a) fly away
   (b) look beautiful
   (c) avoid its enemies
   (d) attract prey

2. Chameleons change colour when they are
   (a) excited, angry or hungry
   (b) afraid, excited or angry
   (c) angry, excited or happy
   (d) afraid, angry or hungry

3. The colour changing ability of a chameleon is a form of camouflage which is a
   (a) colour that fades
   (b) disguise that lets it blend in with its surroundings
   (c) dance done by chameleons
   (d) disease which affects chameleons

4. The colour changes are determined by
   (a) light and wind
   (b) light and pressure
   (c) light and temperature
   (d) pressure and temperature

5. Half of the world's chameleons are found
   (a) on the Asian Island of Madagascar
   (b) in the Sahara Desert
   (c) on the African Island of Madagascar
   (d) in the continent of Asia

Directions (Q. Nos. 6-8) *Fill in the blanks with the correct parts of speech from the given alternatives.*

6. How much did you spend ..... roses?
   (a) in (b) on (c) of (d) from

7. I could hardly recognise him ..... I saw him.
   (a) after (b) but (c) and (d) when

8. Our teacher encouraged ..... setting the poem to music.
   (a) his (b) him (c) he (d) he's

9. Choose the correct passive from of the given sentence from the following
   Don't subject the animals to cruelty
   (a) The animals are not to be subjected to cruelty
   (b) The animals shall not be subjected to cruelty
   (c) The animals will not be subjected to cruelty
   (d) The animals should not be subjected to cruelty

Directions (Q. Nos. 10 and 11) *Fill in the blanks with a suitable clause to complete the sentences*

10. No one knows..... .
(a) who he is (b) whom he is
(c) why he is (d) when he is

11. She will not let you go ..... .
(a) unless you will bless her
(b) unless you do not bless her
(c) unless you bless her (d) if you bless her

Directions (Q. Nos. 12 and 13) *Choose the one word which can be substituted for the given words / sentences.*

12. That which can be drunk.
(a) edible (b) palatable
(c) culpable (d) potable

13. Something that is beyond the power of nature.
(a) Supernatural
(b) magical
(c) preternatural
(d) unnatural

Directions (Q. Nos. 14 and 15) *In the following questions choose the word opposite in meaning to the given word.*

14. Boisterous
(a) Naughty (b) Quiet
(c) Reserved (d) Bouncy

15. Veteran
(a) Activist (b) Enthusiast
(c) Novice (d) Master

Part II हिन्दी

16. 'श्याम कल मुम्बई जाएगा' वाक्य में कौन-सा काल है?
(a) भूतकाल
(b) भविष्यत् काल
(c) वर्तमान काल
(d) उपरोक्त में से कोई नहीं

17. 'समुद्र अधिक गहरा है' इस वाक्य का शुद्ध रूप क्या है?
(a) समुद्र बड़ा गहरा है
(b) समुद्र अधिकांश गहरा है
(c) समुद्र बहुत गहरा है
(d) समुद्र की गहराई अधिक ज्यादा है

18. 'सजीव' का विलोम शब्द होगा
(a) निर्जीव (b) अजीव
(c) परजीव (d) इनमें से कोई नहीं

19. 'भवन-भुवन' भिन्नार्थक शब्दों के उचित युग्मों का चयन कीजिए।
(a) मकान-संसार (b) पराक्रम-ग्रन्थ
(c) मकान-घर (d) हंस-घर

निर्देश (प्र. सं. 20-24) *दिए गए अनुच्छेद को ध्यानपूर्वक पढ़िए और उससे सम्बन्धित प्रश्नों के उत्तर दीजिए।*

सच्चे वीर अपने प्रेम के जोर से लोगों को सदा के लिए बाँध देते हैं। वीरता की अभिव्यक्ति कई प्रकार से कभी लड़ने-मरने से, खून बहाने से, तोप तलवार के सामने बलिदान करने से, तो कभी जीवन के गूढ़ तत्त्व और सत्य की तलाश में बुद्ध जैसे राजा विरक्त होकर वीर हो जाते हैं। वीरता एक प्रकार की अन्तः प्रेरणा है। जब कभी उसका विकास हुआ तभी एक रौनक, एक रंग, एक बहार संसार में छा गई। वीरता हमेशा निराली और नई होती है, वीरों को बनाने के कारखाने नहीं होते, वे तो देवदार के वृक्ष की भाँति जीवन रूपी वन में स्वयं पैदा होते हैं और बिना किसी के पानी दिए, बिना किसी के दूध पिलाए बढ़ते हैं। "जीवन के केन्द्र में निवास करो और सत्य की चट्टान पर दृढ़ता से खड़े हो जाओ। बाहर की सतह छोड़कर जीवन के अन्दर की तहों मे पहुँचे तब नए रंग खिलेंगे।" यही वीरता का सन्देश है।

20. वीरता कैसी प्रेरणा है?
(a) अन्त: (b) बाह्य
(c) फलित (d) ये सभी

21. देवदार वृक्ष से किसकी तुलना की गई है
(a) खाने-पीने की (b) वीरों की
(c) मनुष्य की (d) वीरता की

22. निम्नलिखित में से कौन-सा रूप वीरता का नहीं है?
(a) क्रोध (b) युद्ध (c) त्याग (d) दान

23. वीरता का एक विशेष लक्षण है
(a) नयापन (b) नकल (c) हास्य (d) करुणा

24. वीरता का सन्देश क्या है?
(a) यह संकल्प कि किसी भी हालत में युद्ध जीतना है
(b) बुद्ध जैसे राजा की भाँति विरक्त होना
(c) उद्देश्य के लिए सच्चाई पर चट्टान की तरह अटल रहना
(d) हमेशा नया और निराला रहना

25. 'लोहे के चने चबाना' मुहावरे का अर्थ है।
(a) कठिन कार्य करना (b) अधिक परेशान करना
(c) चने चबाना (d) उपरोक्त में से कोई नहीं

26. 'अतिथि' का पर्यायवाची है
(a) भगवान (b) विकास
(c) वसन (d) आगन्तुक

27. 'जिसके समान कोई दूसरा न हो' के लिए एक शब्द है
(a) अचल (b) अद्वितीय
(c) अनगिनत (d) अभिज्ञ

28. निम्न में कौन-सा शब्द शुद्ध है?
(a) अविषकार (b) आविषकार
(c) आविष्कार (d) अवनिषकार

29. उत्पत्ति के आधार पर शब्द के कितने प्रकार होते हैं?
(a) तीन (b) चार
(c) एक (d) दो

30. विशेषण जिस संज्ञा या सर्वनाम शब्द की विशेषता बताते हैं, उन्हें ..... कहते हैं।
(a) विशेष्य
(b) गुणवाचक विशेषण
(c) संख्यावाचक विशेषण
(d) परिमाणवाचक विशेषण

Part III Mathematics

31. The difference in the measures of two complementary angles is 12°, then the measures of the angles, are
(a) $51^\circ, 39^\circ$ (b) $60^\circ, 30^\circ$
(c) $45^\circ, 45^\circ$ (d) $51^\circ, 51^\circ$

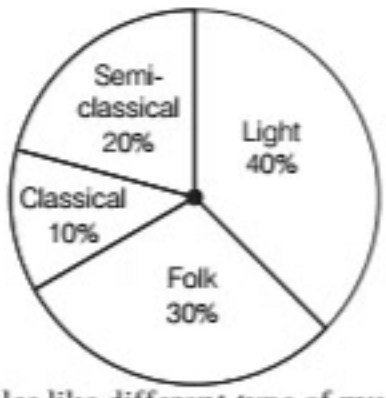
32. The surface area of a sphere of diameter 14 cm, is
(a) 166 cm^2 (b) 196 cm^2
(c) 661 cm^2 (d) 616 cm^2

33. The sum of three consecutive even numbers is 138, then the greatest of these numbers is
(a) 44 (b) 46
(c) 42 (d) 48

34. The factorisation of $84 - 2r - 2r^2$, is
(a) $(6 - r)(r + 7)$ (b) $(7 - r)(r + 6)$
(c) $2(6 - r)(r + 7)$ (d) $2(7 - r)(r + 7)$

35. If $\frac{x^2 + y^2}{x^2 - y^2} = \frac{17}{8}$, then the value of $x : y$, is
(a) 3:5 (b) 5:3
(c) 3:8 (d) 5:8

Directions (Q. Nos. 36 and 37) *A pie chart is given below*



Peoples like different type of music

36. Which type of music is liked by the maximum number of people ?
(a) Semi-Classical (b) Classical
(c) Light (d) Folk

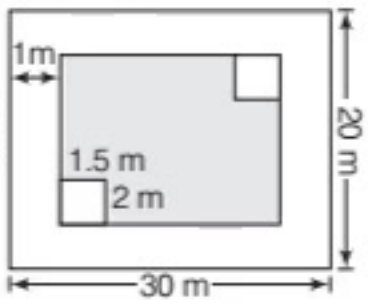
37. If a cassette company were to make 1000 CD'S, how many of semi-classical and folk would they make ?
(a) 200, 400 (b) 100, 300
(c) 200, 300 (d) 100, 400

38. The value of $\frac{\sqrt{24} + \sqrt{216}}{\sqrt{96}}$, is
(a) 8 (b) 6 (c) 4 (d) 2

39. Navin purchased a cellphone for ₹ 12000 and sold it for ₹ 8000, then his loss per cent, is
(a) 30% (b) 33%
(c) $33\frac{1}{3}\%$ (d) $34\frac{1}{3}\%$

40. The value of $(3x + 2y)^2 + (3x - 2y)^2$, is
(a) $9x^2 + 4y^2$ (b) $18x^2 + 8y^2$
(c) $12xy$ (d) $24xy$

41. There are two rectangular flower beds of size 1.5 m × 2 m each in the park as shown in the given figure and the rest has grass on it, then the area covered by grass, is



(a) 498 m^2 (b) 948 m^2
(c) 894 m^2 (d) 849 m^2

42. If $5^{3x-1} \div 25 = 125$, then the value of x, is
(a) 4 (b) 3
(c) 2 (d) 1

43. A car is travelling 60 km in 2 h, then the distance travelled by the car in 6 h, if the speed remains constant, is
(a) 60 km (b) 120 km
(c) 180 km (d) 240 km

44. If $x - \frac{1}{x} = 7$, then the value of $x^2 + \frac{1}{x^2}$, is
(a) 49 (b) 50
(c) 51 (d) 52

45. A pair of integers whose product is–36 and whose difference is 15, is
(a) –3,12 (b) –12, 3
(c) 9, – 4 (d) 4, – 9

46. The HCF of $\frac{12}{7}, \frac{18}{7}, \frac{24}{7}$, is
(a) 12/7 (b) 6/7 (c) 4/7 (d) 3/7

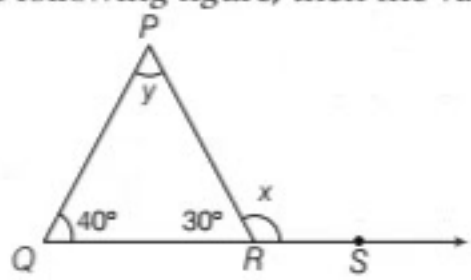
47. By prime factorisation , the value of the cube root of 5832, is
(a) 16 (b) 17 (c) 18 (d) 19

48. If two interior angles on the same side of a transversal intersecting two parallel lines are in the ratio 3 : 2 , then the greater of the two angles, is
(a) 72° (b) 36° (c) 108° (d) 44°

49. The nature of $(-5 + 2\sqrt{5} - \sqrt{5})$ is
(a) natural (b) integer
(c) rational (d) irrational

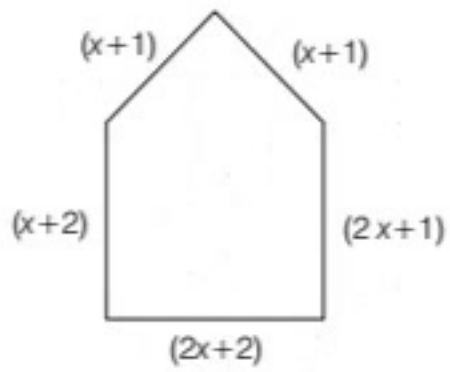
50. If the total surface area of a cube is 486 cm^2, then its lateral surface area.
(a) 243 cm^2 (b) 342 cm^2 (c) 324 cm^2 (d) 432 cm^2

51. In the following figure, then the value of $2x$, is



(a) 300° (b) 200° (c) 100° (d) 50°

52. For what value of x, the perimeter of shape is 77 cm ?



(a) 14 cm (b) 12 cm (c) 10 cm (d) 8 cm

53. If $p(x) = x^3 - 4x^2 + x + 6$, then the value of $p(3)$ is
(a) 27 (b) 10 (c) 4 (d) 0

54. If $a : b = 5 : 3$, then the value of $(5a + 8b) : (6a - 7b)$, is
(a) 9 : 49 (b) 49 : 9
(c) 11 : 50 (d) 50 : 11

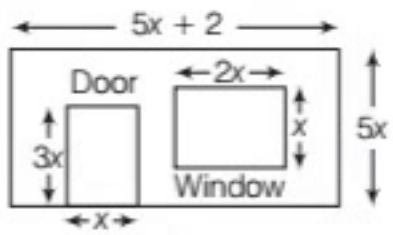
55. If you have a spinning wheel with 3 green sectors, 5 black sectors and 10 red sectors , then the probability of getting a non-black sector, is
(a) $\frac{1}{9}$ (b) $\frac{1}{6}$
(c) $\frac{5}{9}$ (d) $\frac{13}{18}$

56. The value of $\sqrt{248 + \sqrt{52 + \sqrt{144}}}$, is
(a) 17 (b) 16
(c) 15 (d) 14

57. Find the compound interest on ₹ 48000 for one year at 8% per annum, when compunded half-yearly.
(a) ₹ 51916 (b) ₹ 51916.80
(c) ₹ 3916.80 (d) ₹ 3910.80

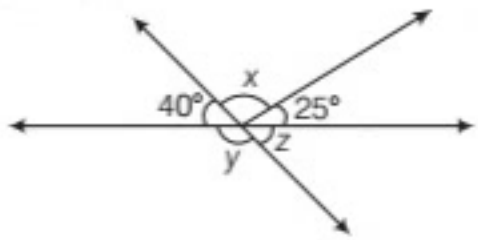
58. If lemons were bought at ₹ 48 per dozen and sold at the rate of ₹ 48 per 10, then the gain or loss per cent, is
(a) 40% profit (b) 40% loss
(c) 20% profit (d) 20% loss

59. The alongside figure shows the dimensions of a wall having a window and a door of a room. Then, the algebraic expression for the area of the wall to be painted, is



(a) $x(2x + 1)$ sq unit
(b) $2x(x + 1)$ sq unit
(c) $10x(2x + 1)$ sq unit
(d) $(x + 1)$ sq unit

60. The values of the angles x, y and z are respectively, (see figure)



(a) 115°, 140°, 40° (b) 40°, 140°, 115°
(c) 140°, 40°, 115° (d) 115°, 40°, 140°

61. If some migratory birds travel as much as 15000 km to escape the extreme climatic conditions at home, then the distance in meters using scientific notation, is
(a) 1.5×10^4 m
(b) 1.5×10^5 m
(c) 1.5×10^6 m
(d) 1.5×10^7 m

62. 30 persons can reap a field in 17 days. How many more persons should be engaged to reap the same field in 10 days ?
(a) 17 (b) 30
(c) 51 (d) 21

63. A negative integer and a positive integer whose difference is +2, are
(a) −1, 3 (b) −2, 4 (c) −1, 1 (d) −4, 6

64. Six bells begin to toll together at the interval of 10 s, 15sec, 20sec, 25sec, 30sec, 35sec respectively , then how many times will they toll together in the span of 7 h ?
(a) 12 (b) 10 (c) 8 (d) 6

65. Difference of two perfect cubes is 189. If the cube root of the smaller of the two numbers is 3, the cube root of the larger number, is
(a) 27 (b) 36 (c) 9 (d) 6

Part IV General Science

66. During dry weather while combing hair, sometimes we experience hair flying apart. The force responsible for this is
(a) force of gravity
(b) electrostatic force
(c) force of friction
(d) magnetic force

67. On heating one end of iron rod, other end also gets heated. Such materials are called
(a) good conductor of heat
(b) good insulator of heat
(c) bad conductor of heat
(d) heater

68. Which one records the distance travelled by a vehicle?
(a) Speedometer (b) Manometer
(c) Motometer (d) Odometer

69. The pressure exerted by liquid due to increase in depth
(a) reduces
(b) increases
(c) remains same
(d) depends on the nature of liquid

70. Which of the following is not always necessary to observe a shadow?
(a) Sun (b) Screen
(c) Source of light (d) Opaque object

71. The objects which partially allow the light to pass through it are called
(a) transparent (b) luminous
(c) opaque (d) translucent

72. Which of the following can never form a circular shadow?
(a) A ball (b) A flat disc
(c) A shoe box (d) An ice-cream cone

73. Bouncing back of ray of light from shining surface on which it was incident is known as
(a) refraction (b) bending
(c) reflection (d) dispersion

74. The normal range of vocal cords in women is
(a) 20 mm (b) 10 mm (c) 15mm (d) 40 mm

75. The loudness of sound is determined by its
(a) amplitude of vibration
(b) ratio of amplitude and frequence of vibration
(c) frequency of vibration
(d) product of amplitude and frequency of vibration

76. Pick the synthetic fibre out of the following.
(a) Cotton
(b) Nylon
(c) Jute
(d) Wool

77. Wool fibre cannot be obtained from which of the following?
(a) Goat
(b) Liama
(c) Alpaca
(d) Moth

78. Phenolphthalein is a synthetic indicator and its colours in acidic and basic solutions respectively are
(a) red and blue
(b) blue and red
(c) pink and colourless
(d) colourless and pink

79. Which of the following is not a common property of plastics?
(a) Non-reactive
(b) Light in weight
(c) Durable
(d) Good conductor of electricity

80. Choose the correct statement from the following.
(a) It is difficult to transport natural gas through pipes
(b) The disadvantage of natural gas is that it cannot be used directly for burning in homes
(c) Natural gas is stored under high pressure as compressed natural gas
(d) Natural gas cannot be used for power generation

81. If a person's clothes catch fire, the best way to extinguish the fire is to
(a) throw water on the clothes
(b) use fire extinguisher
(c) cover the person with a woolen blanket
(d) cover the person with a polythene sheet

82. Turmeric is a natural indicator. On adding its paste to acid and base separately, which colours would be observed?
(a) Yellow in both acid and base
(b) Yellow in acid and red in base
(c) Pink in acid and yellow in base
(d) Red in acid and blue in base

83. Which of the following is not a plastid?
(a) Chloroplast (b) Chromoplast
(c) Leucoplast (d) Ribosome

84. Which of these does not prevent growth of bacteria?
(a) Salt (b) Oil
(c) Sugar (d) Water

85. Potable water is the water which is
(a) obtained from a river
(b) obtained from a lake
(c) pure and fit for drinking
(d) used only for washing clothes

86. Scientist who discovered the fermentation
(a) Alexander Fleming
(b) Louis Pasteur
(c) Johann Mendel
(d) Charles Darwin

87. Given below is a list of edible plants.
(i) Banana (ii) Pumpkin
(iii) Lady finger (iv) Brinjal
Which pair of plants has two or more edible parts?
(a) (i) and (ii) (b) (ii) and (iii)
(c) (ii) and (iv) (d) (i) and (iv)

88. Cyanocobalamin is vitamin
(a) B_{12} (b) B_1
(c) B_2 (d) K

89. Minerals and vitamins present in food are
(a) protective (b) energy giving
(c) body building (d) roughage

90. The most common carrier of communicable diseases is
(a) ant (b) housefly
(c) dragonfly (d) spider

91. Pathogenic microorganisms present in host cells are killed by medicines called
(a) pain killer
(b) antibodies
(c) antibiotics
(d) vaccines

92. Which of the following reproduces only inside a host cell?
(a) Bacteria (b) Virus
(c) Amoeba (d) Fungus

93. A disease in human beings caused by virus is
(a) typhoid (b) influenza
(c) dysentery (d) cholera

94. Carrot and radish food obtained from plants are examples of
(a) stem (b) roots
(c) leaves (d) flowers

95. Diseases occurring due to the deficiency of one or other nutrients is called
(a) dietary disease
(b) chronic disease
(c) deficiency disease
(d) transmitted disease

96. Carbohydrates can be tested by using which of the following?
(a) Iodine (b) Caustic soda
(c) Copper sulphate (d) Fehling's solution

97. The bread or idli dough rises because of
(a) heat (b) grinding
(c) growth of yeast cells (d) kneading

98. Read the food items gives below.
(i) Wheat (ii) Ghee
(iii) Iodised salt (iv) Spinach (palak)
Which of the above food items are energy giving foods?
(a) (i)and (iv) (b) (ii) and (iv)
(c) (i) and (ii) (d) (iii) and (iv)

99. The male parts of the flower are called
(a) pistils (b) carpels
(c) stamens (d) styles

100. The swollen part at the base of a flower from which the whorls of the flower radiate is called the
(a) thalamus (b) pedicel
(c) pistil (d) carpel

Answers

1	(c)	2	(b)	3	(b)	4	(c)	5	(c)	6	(b)	7	(d)	8	(b)	9	(d)	10	(a)
11	(c)	12	(b)	13	(a)	14	(b)	15	(c)	16	(b)	17	(c)	18	(a)	19	(a)	20	(a)
21	(b)	22	(a)	23	(a)	24	(c)	25	(a)	26	(d)	27	(b)	28	(c)	29	(b)	30	(a)
31	(a)	32	(d)	33	(b)	34	(c)	35	(b)	36	(c)	37	(c)	38	(d)	39	(c)	40	(b)
41	(a)	42	(c)	43	(c)	44	(c)	45	(a)	46	(b)	47	(c)	48	(c)	49	(d)	50	(c)
51	(a)	52	(c)	53	(d)	54	(b)	55	(d)	56	(b)	57	(c)	58	(c)	59	(c)	60	(a)
61	(d)	62	(d)	63	(c)	64	(a)	65	(d)	66	(b)	67	(d)	68	(d)	69	(b)	70	(a)
71	(d)	72	(c)	73	(c)	74	(c)	75	(a)	76	(b)	77	(d)	78	(d)	79	(d)	80	(c)
81	(c)	82	(b)	83	(d)	84	(d)	85	(c)	86	(b)	87	(c)	88	(a)	89	(a)	90	(b)
91	(c)	92	(b)	93	(b)	94	(b)	95	(c)	96	(d)	97	(c)	98	(a)	99	(c)	100	(a)

Hints & Solutions

31. Let one angle be $x°$.

Therefore, other complement angle be $90° - x°$

[$\because$ sum of two complementary angles is 90°]

Given, difference of two complementary angles $= 12°$

$\therefore x° - (90° - x°) = 12°$

$\Rightarrow x° - 90° + x° = 12°$

$\Rightarrow 2x° = 12° + 90° \Rightarrow 2x° = 102°$

[on transposing (– 90°) from LHS to RHS]

On dividing both sides by 2, we get

$$\frac{2x°}{2} = \frac{102}{2} \quad \Rightarrow \quad x° = 51°$$

$\therefore$ One angle = 51°

and its complement angle = 90° – 51° = 39°

Hence, the required complementary angles are 51° and 39°.

32. We have, diameter = 14 cm

$\therefore$ Radius $(r) = \frac{14}{2} = 7$ cm

$\therefore$ Surface area of a sphere $= 4\pi r^2$

$$= 4 \times \frac{22}{7} \times 7^2 = 4 \times 22 \times 7 = 616 \text{ cm}^2$$

33. Let the first even number be x.

Second consecutive even number $= x + 2$

and third consecutive even number

$= (x + 2) + 2 = x + 4$

So, as per the given condition, we have

$$x + x + 2 + x + 4 = 132$$

$$\Rightarrow \quad 3x + 6 = 132$$

$$\Rightarrow \quad 3x = 132 - 6 \Rightarrow 3x = 126$$

$$\Rightarrow \quad x = 126 \times \frac{1}{3} = 42$$

$\therefore$ Second number = 42 + 2 = 44

and third number = 42 + 4 = 46

So, the greatest number = 46

34. $84 - 2r - 2r^2 = -2(r^2 + r - 42)$

$= -2(r^2 + 7r - 6r - 42)$

$= -2[r(r + 7) - 6(r + 7)]$

$= -2(r - 6)(r + 7) = 2(6 - r)(r + 7)$

35. Given, $\frac{x^2 + y^2}{x^2 - y^2} = \frac{17}{8}$

On applying componendo and dividendo, we get

$$\frac{(x^2 + y^2) + (x^2 - y^2)}{(x^2 + y^2) - (x^2 - y^2)} = \frac{17 + 8}{17 - 8}$$

$$\Rightarrow \quad \frac{2x^2}{2y^2} = \frac{25}{9} \Rightarrow \frac{x^2}{y^2} = \left(\frac{5}{3}\right)^2$$

On taking square root both sides, we get

$$\frac{x}{y} = \frac{5}{3}$$

$$\therefore \quad x : y = 5 : 3$$

36. Here, greatest sector represent 40% of whole circle, so maximum number of people like Light music.

37. Total number of CD's = 1000

$\therefore$ Number of semi-classicial CD's = 20% of 1000

$$= \frac{20}{100} \times 1000 = 200$$

Number of folk music CD's = 30% of 1000

$$= \frac{30}{100} \times 1000 = 300$$

38. $\because \sqrt{24} = \sqrt{2\times2\times2\times3} = 2\sqrt{6}$

$$\sqrt{216} = \sqrt{3\times3\times3\times2\times2\times2} = 6\sqrt{6}$$

$$\sqrt{96} = \sqrt{2\times2\times2\times2\times2\times3} = 4\sqrt{6}$$

So, $\frac{2\sqrt{6}+6\sqrt{6}}{4\sqrt{6}} = \frac{\sqrt{6}(2+6)}{4\sqrt{6}} = \frac{8\sqrt{6}}{4\sqrt{6}} = \frac{8}{4} = 2$

39. Given, CP = ₹12000, SP = ₹8000

Loss = CP − SP = 12000 − 8000 = ₹4000

$\therefore$ Loss% $= \frac{\text{Loss}}{\text{Cost price}} \times 100$

$$= \frac{4000}{12000} \times 100 = \frac{100}{3}\% = 33\frac{1}{3}\%$$

40. $\because (3x + 2y)^2 = (3x)^2 + (2y)^2 + 2\times(3x)(2y)$

$$= 9x^2 + 4y^2 + 12xy$$

Similarly, $(3x - 2y)^2 = 9x^2 + 4y^2 - 12xy$

$\therefore$ $(3x + 2y)^2 + (3x - 2y)^2$

$$= (9x^2 + 4y^2 + 12xy) + (9x^2 + 4y^2 - 12xy)$$

$$= 18x^2 + 8y^2$$

41. Area covered by the grass = Area of the park left after cementing the path − Area of rectangular beds

$$= 504\ \text{m}^2 - 2\times(1.5\times2)\ \text{m}^2 = 504\ \text{m}^2 - 6\ \text{m}^2$$

$$= 498\ \text{m}^2$$

42. We have, $5^{3x-1} \div 25 = 125$

$\Rightarrow$ $5^{3x-1} \times \frac{1}{25} = 125 \Rightarrow \frac{5^{3x}}{5} \times \frac{1}{5\times5} = 5\times5\times5$

$\Rightarrow$ $5^{3x} \times \frac{1}{5^3} = 5^3$

$\Rightarrow$ $5^{3x} = 5^3 \times 5^3 \Rightarrow 5^{3x} = 5^{3+3} = 5^6$

$\Rightarrow$ $3x = 6$ [$\because$ bases are same]

$\Rightarrow$ $x = 6 \times \frac{1}{3} = 2$

43. If the speed of car remains constant.

Then, distance is directly proportional to time,

i.e. $d \propto t$

Here, $d_1 = 60$ km, $t_1 = 2$ and $d_2 = ?$, $t_2 = 6$

$\Rightarrow$ $\frac{d_1}{t_1} = \frac{d_2}{t_2}$ [$\because d$ = distance, t = time]

$$\frac{60}{2} = \frac{d_2}{6}$$

$\therefore$ $d_2 = \frac{60\times6}{2} = 180$ km

So, 180 km travelled by the car in 6 h.

44. It is given that

$$x - \frac{1}{x} = 7 \quad \ldots(\text{i})$$

On squaring Eq.(i) both sides, we get

$$\left(x - \frac{1}{x}\right)^2 = (7)^2$$

$\Rightarrow$ $(x)^2 + \left(\frac{1}{x}\right)^2 - 2\times x\times\frac{1}{x} = 49$

[in LHS using identity, $(a-b)^2 = a^2 + b^2 - 2ab$]

$\Rightarrow$ $x^2 + \frac{1}{x^2} - 2 = 49 \Rightarrow x^2 + \frac{1}{x^2} = 49 + 2$

$\Rightarrow$ $x^2 + \frac{1}{x^2} = 51$

45. For a pair of integers whose product is −36 and whose difference = 15

So, first integer = − 3 and second integer = 12

Their product

$$= (-3)\times12 = -(3\times12) = -36$$

and the difference between these two integer is 15.

46. HCF of $\frac{12}{7}, \frac{18}{7}, \frac{24}{7} = \frac{\text{HCF}(12, 18, 24)}{\text{LCM}(7, 7, 7)} = \frac{6}{7}$

47. The prime factorisation of 5832

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

$$5832 = \underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$$

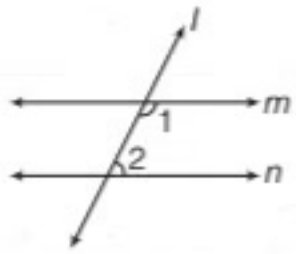
Therefore,

$$\sqrt[3]{5832} = \sqrt{2\times2\times2\times3\times3\times3\times3\times3\times3}$$

$$2\times3\times3 = 18$$

48. Let l be a transversal intersecting two parallel lines m and n.

Let $\angle 1 = 3x$ and $\angle 2 = 2x$



Also, $\angle 1 + \angle 2 = 180°$

$\Rightarrow \quad 3x + 2x = 180°$

$\Rightarrow \quad x = 36°$

$\therefore \quad \angle 1 = 3 \times 36° = 108°$

and $\quad \angle 2 = 2 \times 36° = 72°$

So, the greater of the two angles is 108°.

49. We have, $-5 + 2\sqrt{5} - \sqrt{5} = -5 + \sqrt{5}$

Here, -5 is a rational number and $\sqrt{5}$ is an irrational number. We know that, the addition of a rational number and an irrational number is always an irrational number.

Thus, $(-5 + \sqrt{5})$ is an irrational number.

Hence, $(-5 + 2\sqrt{5} - \sqrt{5})$ is an irrational number.

50. Given, total surface area of the cube $= 486\ \text{cm}^2$

But we know that, total surface area of cube

$= 6a^2 \quad [\because a = \text{edge of the cube}]$

$\therefore \quad 6a^2 = 486$

$\Rightarrow \quad a^2 = \frac{486}{6} = 81$

$\Rightarrow \quad a = \sqrt{81} = 9\ \text{cm}$

[on taking positive square root]

We know that, lateral surface area of cube

$= 4a^2 = 4(9)^2 = 4 \times 81 = 324\ \text{cm}^2$

51. In the given triangle, $\angle P = y$, $\angle Q = 40°$,

$\angle PRQ = 30°$, $\angle SRP = x$

We know that, the sum of all angles in a triangle is equal to 180°.

$\therefore \quad \angle PQR + \angle QPR + \angle PRQ = 180°$

$\Rightarrow \quad 40° + y + 30° = 180°$

$\Rightarrow \quad y = 180° - 70° = 110°$

Also, the sum of interior opposite angles is equal to exterior angle.

$\because \quad 40° + 110° = 150° = x$

$\Rightarrow \quad x = 150°$

Now, $2x = 2 \times 150°$

$\therefore \quad 2x = 300°$

52. We have, perimeter = 77 cm

$(x + 1) + (x + 2) + (2x + 2) + (2x + 1) + (x + 1) = 77$

$\Rightarrow \quad 7x + 7 = 77 \Rightarrow 7x = (77 - 7)$

$\Rightarrow \quad 7x = 70 \Rightarrow x = 70 \times \frac{1}{7} \Rightarrow x = 10$

Hence, the required value of x is 10 cm.

53. Given, $p(x) = x^3 - 4x^2 + x + 6 \quad \ldots(\text{i})$

Put $x = 3$ in Eq. (i), we get

$p(3) = (3)^3 - 4(3)^2 + 3 + 6$

$= 27 - 36 + 9 = 0$

54. Given, $a : b = 5 : 3$

$\therefore \quad \frac{a}{b} = \frac{5}{3}$

Now, $\frac{5a + 8b}{6a - 7b} = \frac{\frac{5a}{b} + \frac{8b}{b}}{\frac{6a}{b} - \frac{7b}{b}}$

[divided numerator and denominator by b]

$= \frac{5 \times \frac{5}{3} + 8}{6 \times \frac{5}{3} - 7} = \frac{\frac{25}{3} + 8}{\frac{30}{3} - 7} = \frac{\frac{25 + 24}{3}}{\frac{30 - 21}{3}}$

$= \frac{\frac{49}{3}}{\frac{9}{3}} = \frac{49}{3} \times \frac{3}{9} = \frac{49}{9} \quad \left[\because \frac{a}{b} = \frac{5}{3}\right]$

$\therefore \quad (5a + 8b) : (6a - 7b) = 49 : 9$

55. Total number of sector = 3 green + 5 black + 10 red = 18

Number of non-black sectors i.e. number of green and red sectors = 3 + 10 = 13

$\therefore$ Probability of getting a non-black sector $= \frac{13}{18}$

56. Given that, $\sqrt{248 + \sqrt{52 + \sqrt{144}}}$

$= \sqrt{248 + \sqrt{52 + 12}} \quad [\because 144 = (12)^2]$

$= \sqrt{248 + \sqrt{64}}$

$= \sqrt{248 + 8}$ $[\because 64 = (8)^2]$

$= \sqrt{256} = 16$

Hence, value of the expression is 16.

57. Here, principle $(P) = ₹48000$

Rate $(R) = 8\%$ per annum

Time $(n) = 1$ yr

when interest is compounded half-yearly, then

$$A = P\left(1 + \frac{R}{200}\right)^2 = 48000\left(1 + \frac{8}{200}\right)^2$$

$$= 48000 \times \frac{26}{25} \times \frac{26}{25} = 76.8 \times 26 \times 26$$

$= ₹\ 51916.80$

$\therefore$ Compound Interest (CI) $= A - P$

$= ₹\ (51916.80 - 48000) = ₹\ 3916.80$

59. According to the given figure,

Area of wall = Length × Breadth

$= (5x + 2) \times 5x$

$= 5x \times 5x + 5x \times 2$

$= 25x^2 + 10x$ sq unit

Area of window $= 2x \times x = 2x^2$ sq unit

and area of door $= 3x \times x = 3x^2$ sq unit

Now, total area of window and door

$= 2x^2 + 3x^2$

$= 5x^2$ sq unit

Thus, remaining area of wall to be painted

$= (25x^2 + 10x) - (5x^2)$

$= 25x^2 + 10x - 5x^2$

$= 20x^2 + 10x$

$= 10x\,(2x + 1)$ sq unit

60. $\angle y + 40° = 180°$ [by linear pair]

$\Rightarrow$ $\angle y = 180° - 40°$

$\Rightarrow$ $\angle y = 140°$

$\angle z = 40°$ [vertically opposite angles]

$\because \angle x + 25° + \angle z = 180°$ [by linear pair]

$\angle x + 25° + 40° = 180°$

$\angle x = 180° - 65° = 115°$

Hence, $\angle x = 115°, \angle y = 140°$

and $\angle z = 40°$

61. Given, birds travel = 15000 km

So, 15000 km = 15000 × 1000 m

$[\because 1 \text{ km} = 1000 \text{ m}]$

$= 15 \times 10^3 \times 10^3$ m

In scientific notation $= 15 \times 10^6$ m

$[\because a^m \times a^n = a^{m+n}]$

$= 1.5 \times 10^7$ m

So, birds travel 1.5×10^7 m.

62. Since, more persons can reap a field in lesser days.

Hence, number of persons and number of days to reap a field are in inverse proportion.

Let number of persons $= n$ and number of days $= d$.

Here, $n_1 = 30, d_1 = 17, d_2 = 10$ and $n_2 = ?$

In case of inverse proportion,

$n_1 d_1 = n_2 d_2$

$\Rightarrow$ $30 \times 17 = n_2 \times 10$

$\Rightarrow$ $n_2 = \dfrac{30 \times 17}{10} = 51$

Hence, number of more persons which should be engaged $= 51 - 30 = 21$

63. For a negative integer and a positive integer whose difference is +2

First integer = 1

and second integer = −1

$\therefore$ $1 - (-1) = 1 + 1 = 2$

64. We have to find the LCM of 10, 15, 20, 25, 30, 35

2	10, 15, 20, 25, 30, 35
2	5, 15, 10, 25, 15, 35
3	5, 15, 5, 25, 15, 35
5	5, 5, 5, 25, 5, 35
5	1, 1, 1, 5, 1, 7
7	1, 1, 1, 1, 1, 7
	1, 1, 1, 1, 1, 1

$\therefore$ LCM $= 2 \times 2 \times 3 \times 5 \times 5 \times 7 = 2100$

In 7 hour (7 × 3600 sec), then the ring will toll together, $= \dfrac{7 \times 3600}{2100} = 12$ times

JAWAHAR
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ENGLISH

CHAPTER

01

USE OF PREPOSITIONS

Prepositions are the part of speech that show the relationship of a noun or pronoun with other words in a sentence. e.g. on, in, to, after, with etc.

e.g. (i) There is a painting on the wall.
(ii) Shilpa is very smart at her work.
(iii) Geeta lives in New Zealand.

Prepositions play a vital role to relate two nouns or pronouns, a noun with a pronoun etc. So, a sound knowledge of prepositions and their rules are must to have good command over English.

Classification of Preposition

Prepositions can be broadly classified into two main categories as:

1. Simple Preposition

Simple prepositions are the basic (or fundamental) words which are not formed from any other words and which are used to denote place, time etc of the actions.

at	by	for
from	in	into
of	off	on
out	over	till
to	up	upon
with	under	down

2. Compound Preposition

These are generally formed by adding prefixes (such as 'a' which means 'not', 'be' which means 'by') to simple prepositions.

above	about	across
along	among	against
after	around	between
beyond	before	behind
beside	besides	beneath
towards	since	inside
outside	within	without

Uses of Preposition

Preposition of Time

They are used with the words expressing time to denote when an action took place.

In

It is used with larger periods of time such as month, year, century, era etc.

e.g. (i) In April.
(ii) In the month of June.
(iii) In 1997.
(iv) In the 20th century.

It is used with seasons.

(i) In summer. (ii) In winter etc.

It is also used with parts of a day.

e.g. (i) In the morning.
(ii) In the afternoon.

Except night, dawn, dusk which take 'at'.

On

It is used with

(i) Days
e.g. On Monday, On Friday etc.
(ii) Dates
e.g. On 1st March.
(iii) Days followed by parts of days.
e.g. On Monday morning.

At

It is used with point of time.

e.g. (i) At 6 pm. (ii) At 9 o'clock.

From and To

It is used when 'start time' and 'end time' are known.

e.g. (i) The guest lecture is from 2 pm to 3 pm.
(ii) Ritu organised the cultural events in the college from her second year to the final year.

Note No preposition is used when the nouns of time are preceded by 'last, next or this'.
e.g. last week, this month, next year etc.

Since

It is generally used in 'Perfect tense' and 'Perfect Continuous tense', with the point of time (i.e. When the action started).

e.g. (i) Annie has been waiting for the bus since 9 o'clock.
(ii) We have been living here since 2002.

For

It is also used in 'Perfect tense' and 'Perfect Continuous tense', with the period of time (i.e. the total duration for which the action continued).

e.g. (i) Annie has been waiting for the bus for half an hour.
(ii) We have lived here for 13 years.

By

It is used to express the deadline.

e.g. (i) You must complete your work by this evening.
(ii) My students will have got a government job by the end of this year.

Preposition of Place

They are used with the names of places to denote where an action took place or where a thing is located.

In

- It is used with cities, towns, states, countries, continents etc.

e.g. (i) I live in Madhya Pradesh.
(ii) The headquarter of SAARC is in Kathmandu.
(iii) The temperature is too low in Antarctica.

- It is used with street, road etc.
  e.g. Some people are standing in the street.
- It is used with directions.
  e.g. His house is *in* the North.

At

- It is used with parts of bigger places.

e.g. (i) Shishir lives at Nehru Nagar.
(ii) I will wait at the airport.

- It is used for parts of road, street etc.

e.g. (i) Some people are standing at the corner of the street.
(ii) My house is at the end of this lane.

Preposition of Position

In

When the things are inside something.

e.g. (i) There is a diamond in her ring.
(ii) In this room, there are 7 items of furniture.

Into

When the things are going (or being kept) inside from outside.

e.g. (i) The boy jumped into the river.
(ii) Sara is keeping her mobile into the bag.

On

Used to denote position of thing with respect to surface (touching the surface).

e.g. (i) There is a beautiful vase on her table.
(ii) The artist carved a nice picture on the wall.

Upon

To show the continuous action (of keeping a thing on a surface).

e.g. (i) Their marketing team are hanging the banners upon the poles.
(ii) Sanu was keeping the bottle upon the table, when I saw her.

Over

When a thing is exactly upwards some other i.e. the thing is above something and not touching it.

e.g. (i) There is a bridge over the river.
(ii) There is a chandelier over the table.

Above (higher in level)

When something is at a higher level than some other thing.

e.g. (i) Her level of intelligence is above all.
(ii) There are two shelves above the study table.

Under

When something is exactly below some other thing and the two things are not touching each other.

e.g. (i) The man sat under the tree.
(ii) A pen is lying under your chair.

Beneath

When a thing is under some other thing and it is touching its surface.

e.g. There are many minerals beneath the Earth.

Below (At a lower level with respect to something)

e.g. (i) Their office is located below our office.
(ii) A river is flowing below the mountain, in that picture.

By (Prepositions used with vehicles)

We use 'by' with all kinds of vehicles.

e.g. (i) I usually go to office by bus.
(ii) Rinnie goes to school by bicycle.

Some Other Important Prepositions

To

Used for denoting movement between the places.

e.g. Nadira went to Bhopal last week.

Towards

Denotes direction

e.g. (i) This road goes towards his home.
(ii) Bangladesh is towards the East of India.

Across

Denotes expansion

e.g. Their business is spread across the country.

Behind

At the back of something (someone).

e.g. We don't know what there is behind that door.

In front of

At the face of something.

e.g. There is an ice-cream parlour in front of my house.

Between

Used for two persons/things.

e.g. (i) Chintu is sitting between Vibhuti and Pushkar.
(ii) There is a red box between the blue and the orange one.

Among

Used for more than two persons/things.

e.g. (i) Saniya is the tallest among all girls.
(ii) This is one wrong sentence among these sentences.

For

Used for purpose and reason.

e.g. (i) All these toys are for you.
(ii) I am leaving for Manipur tomorrow.

With

Used to show relation of tools with action.

e.g. (i) She cuts clothes with scissors.
(ii) He is writing a letter with a pen.

PRACTICE EXERCISE

Directions (Q.Nos 1-20) *Choose the correct preposition given in the options to complete the following sentences.*

1. This is a comfortable house to live .....
(a) by (b) on
(c) at (d) in

2. We should not spend money ..... luxuries.
(a) at (b) for
(c) on (d) with

3. I gave him a chair to sit ..... .
(a) to (b) on
(c) at (d) in

4. The new term begins ..... 1st June.
(a) at (b) on
(c) in (d) from

5. He poured the tea ..... the mug.
(a) to (b) into
(c) on (d) in

6. Shiva is good ..... Biology.
(a) on (b) in
(c) at (d) for

7. Zeba writes ..... night.
(a) to (b) at
(c) in (d) on

8. Geeta went ..... the room.
(a) from (b) in
(c) into (d) for

9. He said that he was very pleased ..... my work.
(a) by (b) with
(c) on (d) at

10. He is not satisfied ..... your performance.
(a) in (b) with (c) at (d) from

11. You should explain this ..... them.
(a) on (b) to (c) at (d) with

12. My father taught Mathematics ..... me.
(a) of (b) for
(c) to (d) towards

13. He has been absent ..... Monday.
(a) in (b) since
(c) for (d) from

14. I have not been to the theatre ..... a long time.
(a) till (b) since
(c) for (d) from

15. The girls have been playing badminton ..... two hours.
(a) from (b) since
(c) for (d) by

16. His cousin has been ill ..... Monday.
(a) in (b) for
(c) from (d) since

17. Her mother died ..... breast cancer.
(a) in (b) with
(c) by (d) of

18. He will wait ..... you return.
(a) to (b) till
(c) since (d) for

19. This material is different ..... that.
(a) in (b) from
(c) to (d) with

20. Rohan was running ..... the road.
(a) from (b) through
(c) at (d) along

Directions (Q. Nos 21-25) *In the following questions, there is an error in the sentence. Find the part of the sentence which has an error.*

21. The woodcutter was cutting the branches from his axe.
(a) The woodcutter (b) was cutting
(c) the branches (d) from his ace

22. After a few minutes Ramesh jumped in the river from the bridge.
(a) After a few minutes (b) Ramesh jumped
(c) in the river (d) from the bridge

23. From ten years my father has been teaching in this school.
(a) From ten years (b) my father
(c) has been teaching (d) in this school

24. I wanted to talk them so I was ringing them.
(a) I wanted to (b) talk them
(c) so I was (d) ringing them

25. It is raining heavily so she will stand in that tree.
(a) It is raining (b) heavily so she
(c) will stand (d) in that tree

Answers

1	(d)	2	(c)	3	(b)	4	(b)	5	(b)	6	(c)	7	(b)	8	(c)	9	(b)	10	(b)
11	(b)	12	(c)	13	(b)	14	(c)	15	(c)	16	(d)	17	(d)	18	(b)	19	(b)	20	(d)
21	(d)	22	(c)	23	(a)	24	(b)	25	(d)										

CHAPTER

02

ADJECTIVE AND DEGREE OF COMPARISON

Adjectives are used to modify noun or pronoun. In this chapter, we will study the types and uses of adjectives.

An adjective is a word that modifies a noun or a pronoun. Adjectives are used to tell which one, what kind, how many or how much about nouns and pronouns.

e.g. Good, poor, some, many, that etc.

Types of Adjectives

There are seven types of adjectives. They are as follows

1. Descriptive Adjectives

The descriptive adjective describes the kind or quality of the noun it modifies.

e.g. (i) I have a big cat at my house.

(ii) Delhi is a large city.

2. Proper Adjectives

Adjectives that are formed from proper nouns i.e. specific people, places, things or ideas are known as Proper adjectives.

e.g. (i) A group of American tourists visited India recently.

(ii) We have to attend a French lecture today.

3. Numeral Adjective

Those adjectives which are used to show the number of a noun are known as Numeral adjectives.

e.g. (i) Sunday is the first day of the week.
(ii) We have five sense organs.
(iii) Most girls like shopping.

Numeral Adjectives

- Definite numeral adjective [one, two, ten etc.]
- Indefinite numeral adjective [all, some, few, little etc.]

Definite Numeral Adjective

Those adjectives that denote the exact number are known as Definite numeral adjectives.

e.g. (i) The Taj Mahal has four pillars.
(ii) Vivek stood first in the final exams.

The definite numeral adjectives are classified into the following categories

Cardinals (How many)	**Ordinals** (Series)
One, two, three, four, five, etc.	First, second, third, fourth, fifth etc.

Indefinite Numeral Adjective

Those adjectives that do not denote the exact number are known as Indefinite numeral adjectives.

e.g. (i) I don't like all the vegetables.
(ii) I have a few novels written by Shakespeare.

4. Distributive Adjectives

Those adjectives that are used to refer to each one of a noun are known as Distributive numeral adjectives.

e.g. (i) Every student must get his turn.
(ii) They speak to another person.

5. Demonstrative Adjectives

Those adjectives that are used to point out a noun are known as Demonstrative adjectives.

e.g. (i) That girl is very beautiful.
(ii) These grapes are sweet.

6. Possessive Adjectives

These adjectives are used to show the possession of the noun which they qualify.

e.g. (i) His father was at home.
(ii) You should help your friends.

my, your, our, his, her, their, its.

7. Interrogative Adjectives

Those adjectives that are used alongwith the noun to ask questions are known as interrogative adjectives.

e.g. (i) Whose pen is this?
(ii) Which car was she driving?

Degree of Comparison

There are three degrees of comparison of an adjective namely; positive, comparative and superlative.

e.g., (i) The student was clever. (positive degree)
(ii) The student was cleverer than his friend. (comparative degree)
(iii) The student was the cleverest boy of his class. (superlative degree)

Positive Degree

Positive degree of adjective qualifies a noun in simple form and shows equal level of quality in comparison.

e.g. (i) My cousin was very brave.
(ii) He was quite happy.

Comparative Degree

Comparative degree of adjective qualifies a noun with higher quality and shows one noun better than the other.

e.g. (i) He is braver than his brother.
(ii) You are taller than I.

Superlative Degree

Superlative degree of adjective qualifies a noun or nouns with highest quality and shows something the best.

e.g., (i) I am the richest boy of the class.
(ii) It was the most difficult question.

List of Degrees of Comparison

1. By adding 'er' and 'est'

Positive	Comparative	Superlative
Bright	brighter	brightest
Bold	bolder	boldest
Clever	cleverer	cleverest
Cold	colder	coldest
Fast	faster	fastest
Great	greater	greatest
High	higher	highest
Long	longer	longest
Small	smaller	smallest
Strong	stronger	strongest
Sweet	sweeter	sweetest
Young	younger	youngest

2. By adding 'r' and 'st' to the adjectives ending in 'e'

Positive	Comparative	Superlative
Brave	braver	bravest
Large	larger	largest
Nice	nicer	nicest
Noble	nobler	noblest
Simple	simpler	simplest
Wise	wiser	wisest
White	whiter	whitest

3. By removing the final 'y' and adding 'ier' and 'iest'

Positive	Comparative	Superlative
Costly	costlier	costliest
Easy	easier	easiest
Happy	happier	happiest
Heavy	heavier	heaviest
Wealthy	wealthier	wealthiest

4. By doubling the final consonants (When the last letter is a consonant and the second last a vowel) and adding 'er' and 'est'

Positive	Comparative	Superlative
Big	bigger	biggest
Dim	dimmer	dimmest
Hot	hotter	hottest
Thin	thinner	thinnest

5. By using 'more' and 'most'

Positive	Comparative	Superlative
Active	more active	most active
Careful	more careful	most careful
Courageous	more courageous	most courageous
Cunning	more cunning	most cunning
Difficult	more difficult	most difficult
Famous	more famous	most famous
Faithful	more faithful	most faithful
Splendid	more splendid	most splendid

6. Irregular Comparisons

Positive	Comparative	Superlative
Bad	worse	worst
Evil	worse	worst
Ill	worse	worst
Late	later	latest
Many	more	most
Near	nearer	nearest
Old	older	oldest
Old	elder	eldest

PRACTICE EXERCISE

Directions (Q. Nos 1-5) *Name the underlined adjective.*

1. Everybody wanted to listen that beautiful song.
   (a) Proper Adjective
   (b) Interrogative Adjective
   (c) Numeral Adjective
   (d) Descriptive Adjective

2. There were four windows in my room.
   (a) Numeral Adjective
   (b) Possessive Adjective
   (c) Demonstrative Adjective
   (d) Distributive Adjective

3. On his sister's birthday he invited Indian players.
   (a) Numeral Adjective
   (b) Descriptive Adjective
   (c) Proper Adjective
   (d) Demonstrative Adjective

4. She does not drive my car.
   (a) Descriptive Adjective
   (b) Proper Adjective
   (c) Interrogative Adjective
   (d) Possessive Adjective

5. I could not catch those monkeys.
   (a) Distributive Adjective
   (b) Demostrative Adjective
   (c) Possessive Adjective
   (d) Numeral Adjective

Directions (Q. Nos 6-10) *Choose the adjective in the following sentences.*

6. Preeti with her brother topped the class.
   (a) Preeti (b) with
   (c) her (d) the

7. Ramesh has stolen those bikes from the school.
   (a) has (b) those
   (c) bikes (d) from

8. Every page was written by me.
   (a) Every (b) page
   (c) was (d) me

9. You must prepare the first chapter properly.
   (a) You (b) prepare
   (c) first (d) properly

10. We should not wear American clothes.
    (a) We (b) should
    (c) wear (d) American

Directions (Q. Nos 11-20) *Fill in the blanks with suitable adjective as given in the options.*

11. Arun is the ..... boy of our class.
    (a) tall (b) taller
    (c) more tall (d) tallest

12. This story is ..... than that.
    (a) interesting (b) more interesting
    (c) interested (d) interest

13. My car was ..... new as yours.
    (a) as (b) than
    (c) of (d) from

14. Amitabh Bachchan is the ..... popular bollywood star.
    (a) very (b) much
    (c) extremely (d) most

15. The colour of my shirt is brighter than that of .....
    (a) of (b) yours
    (c) extremely (d) most

16. 'Successful' is for 'success', ... is for Honesty.
    (a) Honest (b) Honestful
    (c) Honestly (d) Honour

17. 'Cleverer' is for 'Clever', ... is for entertaining.
    (a) entertainer (b) more entertaining
    (c) outertainings (d) entertainment

18. 'Best' is for 'Good', 'Worst' is for ..... .
(a) Poor (b) Rich (c) Bad (d) Weak

19. 'Interesting' is for 'Interest', ... is for 'Friend'.
(a) Friendful (b) Friendfully
(c) Friendship (d) Friendly

20. The adjective of 'Help' is 'Helpful' so the adjective of 'Mislead' is ..... .
(a) Misleading (b) Misleadful
(c) Misleaded (d) Missing

Directions (Q. Nos 21-25) *In the following questions, there is an error in the sentence. Find the part of the sentence which has an error.*

21. This is the more difficult question. I have ever solved.
(a) This is the (b) ever solved
(c) I have (d) more difficult

22. His friends are rich than mine.
(a) His friends (b) are
(c) rich than (d) mine

23. He has a few milk in his glass.
(a) He has
(b) a few milk
(c) in his
(d) glass

24. Ours history teacher does not beat any student during her period.
(a) Ours history teacher
(b) does not beat
(c) any student
(d) during her period

25. Reena is not so cleverer as her sister.
(a) Reena is
(b) not so cleverer
(c) as her
(d) sister

Answers

1	(d)	2	(a)	3	(c)	4	(d)	5	(b)	6	(c)	7	(b)	8	(a)	9	(c)	10	(d)
11	(d)	12	(b)	13	(a)	14	(d)	15	(b)	16	(a)	17	(b)	18	(c)	19	(d)	20	(a)
21	(d)	22	(c)	23	(b)	24	(a)	25	(b)										

CHAPTER

03

VERB AND MODAL AUXILIARIES

Verbs are words that show an action, occurrence or state of being. In this chapter you will learn verb, its types and uses of some modal auxiliaries.

A verb is a word that expresses an action or a state or an existence. e.g. go, run, play etc.

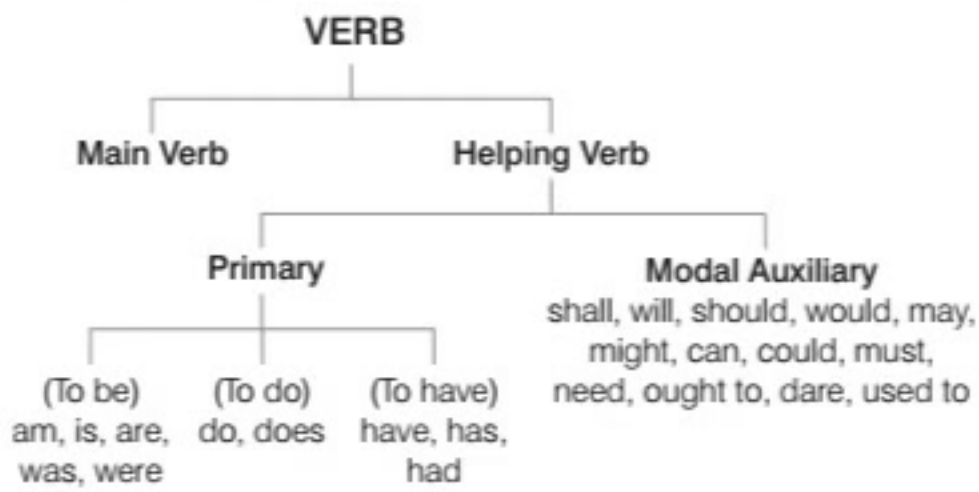
(i) Nirbhay swims in the swimming pool everyday. (Action)

(ii) The water is cold. (State)

(iii) The great pyramids are in Egypt. (Existence)

(iv) I think its nice. (Feeling)

Types of Verb



Main Verb

Verb (action) that comes after 'Helping Verb' and is done directly by or on the subject is called main verb.

e.g. (i) Sushil jumps on the roof.
(ii) We have insulted those students.
(iii) The mobile was sold.

Helping Verb

(i) Primary Helping Verb

Verb that comes before main verb and tells its time and mood, is called 'helping verb'.

e.g. (i) My landlord does not (helping verb) walk (main verb) in the morning.
(ii) The notes were being (helping verb) counted. (main verb)

is, are, am, was, were, do not, does not, did not, has, have, had.

(ii) Modal Auxiliary

A verb used to express the mood (mode) or attitude of a speaker is called Modal auxiliary.

e.g. can, could, may, might, should, must etc.

Uses of Some Modals

1. May and Might

The modals 'may' and 'might' are used to express possibility, permission, wish or prayer.

e.g. (i) It might rain. (Possibility)
(ii) May I come in? (Permission)
(iii) May you live long! (Wish or Prayer)

2. Can and Could

The modals 'can' and 'could' are used to express ability, polite request, offer etc.

e.g. (i) She can write English well : (Ability)
(ii) Could you please lend me some money. (Polite request)
(iii) Can I help you? (Offer)

3. Should

The modal 'should' is used to express advice, obligation, expectation etc.

e.g. (i) You should do more exercise. (Advice)
(ii) We should report the incident. (Obligation)
(iii) Rahul should have landed by now. (Expectation)

4. Must

The modal 'must' is used to express compulsion or strong obligation, necessity, probability, determination etc.

e.g., (i) They must pay the fine. (Strong Obligation)
(ii) We must get up early and start on our way. (Necessity)
(iii) I must have my own way. (Determination)

5. Ought to

The modal 'ought' is used to express duty, necessity etc.

e.g., (i) We ought to help the poor and needy. (Duty)
(ii) You ought to exercise regularly. (Necessity)

PRACTICE EXERCISE

Directions (Q. Nos 1-10) *Fill in the blanks with suitable verb as given in the options.*

1. You and I did not …… (help) them.
(a) help (b) helped
(c) helps (d) helping

2. She has …… (insult) the boy.
(a) insult (b) insulted
(c) insults (d) insulting

3. Before some days my father …… (buy) a car.
(a) buy (b) bought
(c) buys (d) buying

4. The old lady is ..... (cross) the road.
(a) cross (b) crossed
(c) crosses (d) crossing

5. My sister …… (wash) her face after every two hours daily.
(a) wash (b) washed
(c) washes (d) washing

6. Water …… very essential for life.
(a) are (b) were (c) has (d) is

7. The fox was hungry so it …… wandering here and there in the forest.
(a) is (b) was
(c) are (d) had

8. All the girls …… submitted their project.
(a) have (b) will
(c) has (d) can

9. The brave soldier …… to die for his country.
(a) want (b) wants
(c) wanted (d) wanting

10. His dog …… bark at the strangers.
(a) is not
(b) has not
(c) was not
(d) does not

Directions (Q. Nos 11-20) *Fill in the blanks with the most appropriate modal verb out of the following options.*

11. The man is seriously injured so he ……..... be admitted in the hospital.
(a) can (b) may
(c) will (d) must

12. Ravina has a headache so she ……. solve this sum.
(a) cannot (b) should not
(c) will not (d) could not

13. He is weak in studies but in exam he ……. help you.
(a) will (b) may
(c) should (d) must

14. The weather was fine so we ..... go out to play cricket.
(a) should (b) will
(c) can (d) could

15. Everybody ……. respect his teacher.
(a) can (b) will
(c) should (d) could

16. …… I sit on your seat?
(a) May (b) Can
(c) Will (d) Must

17. He has a lot of money. So he …… certainly buy this car.
(a) could (b) should
(c) might (d) will

18. You …… keep your shoes out of the temple.
(a) could (b) can
(c) should (d) will

19. He has learned English. Now he …… talk to anybody.
(a) will (b) should
(c) may (d) can

20. We …… educate our children.
(a) may (b) must
(c) might (d) could

Directions (Q. Nos 21-25) *In the following questions, there is an error in the sentence. Find the part of the sentence which has and error.*

21. Yesterday was holiday so I play all the day.
(a) Yesterday (b) was holiday
(c) so I play (d) all the day

22. My sister goes to temple daily but she does not worshipped.
(a) My sister goes (b) to temple daily
(c) but she does not (d) worshipped

23. He is very tired so he should not run fast.
(a) He is
(b) very tired
(c) so he should not
(d) run fast

24. We should hurried otherwise we will get late.
(a) We should
(b) hurried
(c) otherwise we will
(d) get late

25. These books have been sell by us.
(a) These books (b) have been
(c) sell (d) by us

Answers

1	(a)	2	(b)	3	(b)	4	(d)	5	(c)	6	(d)	7	(b)	8	(a)	9	(b)	10	(d)
11	(d)	12	(a)	13	(b)	14	(d)	15	(c)	16	(a)	17	(d)	18	(c)	19	(d)	20	(b)
21	(c)	22	(d)	23	(c)	24	(b)	25	(c)										

CHAPTER

04

TENSE FORMS

Tenses play a crucial role in the English language. It denotes the time an action takes place. In this chapter, we will study the rules related to tenses.

Tense shows the time and the flow of an action.

Kinds of Tense

Present Tense	Past Tense	Future Tense
Simple Present	Simple Past	Simple Future
Present Continuous	Past Continuous	Future Continuous
Present Perfect	Past Perfect	Future Perfect
Present Perfect Continuous	Past Perfect Continuous	Future Perfect Continuous

1. Present Tense

A verb that refers to present time is said to be in Present tense.

e.g. Sachin plays cricket. Present tense is further divided into four sub-types

(i) Simple Present Tense

It expresses habitual and routine actions related to present time.

Affirmative Subject + verb[1] or verb[1] + s/es + object.

e.g. Rohit writes a letter.

Negative Subject + do/does + not + verb[1] + object.

e.g. Rohit does not write a letter.

Interrogative Do/Does + subject + verb[1] + object ?

e.g. Does Rohit write a letter?

(ii) Present Continuous Tense

It expresses the action in progress at the time of spoken.

Affirmative Subject + is/are/am + verb^1 + ing + object.

e.g. Rohit is writing a letter.

Negative Subject + is/are/am + not + verb^1 + ing + object.

e.g. Rohit is not writing a letter.

Interrogative Is/Are/Am + subject + verb^1 + ing + object ?

e.g. Is Rohit writing a letter?

(iii) Present Perfect Tense

It expresses complete action with a present effect.

Affirmative Subject + has/have + verb^3 + object.

e.g. Rohit has written a letter.

Negative Subject + has/have + not + verb^3 + object.

e.g. Rohit has not written a letter.

Interrogative Has/Have + subject + verb^3 + object ?

e.g. Has Rohit written a letter?

(iv) Present Perfect Continuous Tense

It expresses an action that started in past and is still going on.

Affirmative Subject + has/have + been + verb^1 + ing + object + since/for + time.

e.g. Rohit has been writing a letter for ten minutes.

Negative Subject + has/have + not + been + verb^1 + ing + object + since/for + time.

e.g. Rohit has not been writing a letter since morning.

Interrogative Has/Have + subject + been + verb^1+ ing + object + since/for + time ?

e.g. Has Rohit been writing a letter for two hours?

2. Past Tense

A verb that refers to past time is said to be in Past tense.

e.g. Sachin played cricket.

Past tense is further divided into four sub-types.

(i) Simple Past Tense

It expresses an action that started in past and ended in past.

Affirmative Subject + verb^2 + object.

e.g. I met him yesterday.

Negative Subject + did not + verb^1 + object.

e.g. I did not meet him yesterday.

Interrogative Did + subject + verb^1 + object ?

e.g. Did I meet him yesterday?

(ii) Past Continuous Tense

It expresses an action that was going on at some point in the past.

Affirmative Subject + was/were + verb^1 + ing + object.

e.g. The boys were playing in the ground.

Negative Subject + was/were + not + verb^1 + ing + object.

e.g. The boys were not playing in the ground.

Interrogative Was/Were + subject + verb^1 + ing object ?

e.g. Were the boys playing in the ground?

(iii) Past Perfect Tense

It expresses the action that was completed before the time of speaking.

Affirmative Subject + had + verb^3 + object.

e.g. She had read the story.

Negative Subject + had + not + verb^3 + object.

e.g. She had not read the story.

Interrogative Had + subject + verb^3 + object ?

e.g. Had she read the story?

(iv) Past Perfect Continuous Tense

It expresses an action that started in past and was continued up until another time in past.

Affirmative Subject + had + been + verb^1 + ing + object + since/for + time.

e.g. They had been waiting for us for three hours.

Negative Subject + had + not + been + verb^1 + ing + object + since/for + time.

e.g. They had not been waiting for us since 10 o'clock.

Interrogative Had + subject + been + verb[1] + ing + object + since/for + time ?

e.g. Had they been waiting for us since morning?

3. Future Tense

A verb that refers to future time is said to be in future tense.

e.g. Sachin will play cricket.

Future tense is further divided into four sub-types.

(i) Future Simple Tense

It expresses an action that is performed in future time.

Affirmative Subject + will/shall + verb[1] + object.

e.g. He will send a letter.

Negative Subject + will/shall + not + verb[1] + object.

e.g. He will not send me a letter.

Interrogative Will/Shall + subject + verb[1] + object ?

e.g. Will he send me a letter?

(ii) Future Continuous Tense

It expresses an action that will be continuous in future time.

Affirmative Subject + will/shall + be + verb[1] + ing + object.

e.g. Reena will be cooking food.

Negative Subject + will/shall + not + be + verb[1] + ing + object.

e.g. Reena will not be cooking food.

Interrogative Will/Shall + subject + be + verb[1] + ing + object ?

e.g. Will Reena be cooking food?

(iii) Future Perfect Tense

It expresses an action that is assumed to be completed in future time.

Affirmative Subject + will/shall + have + verb[3] + object.

e.g. You will have seen the car.

Negative Subject + will/shall + not + have + verb[3] + object.

e.g. You will not have seen the car.

Interrogative Will/Shall + subject + have + verb[3] + object ?

e.g. Will you have seen the car?

(iv) Future Perfect Continuous Tense

It expresses an action that is assumed to continue up until a point in the future.

Affirmative Subject + will/shall + have + been + verb[1] + ing + object + since/for + time.

e.g. Mother will have been cleaning house for two hours.

Negative Subject + will/shall + not + have + been + verb[1] + ing + object + since/for + time.

e.g. Mother will not have been cleaning house since 2 o'clock.

Interrogative Will/Shall + subject + have + been + verb[1] + ing + object + since/for + time ?

e.g. Will mother have been cleaning house for 10 minutes?

PRACTICE EXERCISE

Directions (Q. Nos. 1-5) *Identify the suitable tense form of the following sentences.*

1. He stole my pen last night.
(a) Present Continuous (b) Past Simple
(c) Future Simple (d) Present Perfect

2. Mohan was watching a movie on TV.
(a) Past Continuous
(b) Past Simple
(c) Future Simple
(d) Present Perfect

3. I have been to Agra in January.
(a) Present Continuous (b) Past Simple
(c) Future Simple (d) Present Perfect

4. Mohan was absent in last class.
(a) Present Continuous (b) Past Simple
(c) Future Simple (d) Present Perfect

5. He will have been teaching in this college after his PhD.
(a) Present Continuous
(b) Past Simple
(c) Future Simple
(d) Future Perfect Continuous

Directions (Q. Nos. 6-10) *Complete the following sentences with the correct form of verb tense.*

6. The Prime Minister said that it ..... him great pleasure to meet the soldiers that evening.
(a) gives (b) gave
(c) was giving (d) is giving

7. This ..... an easy quiz so far.
(a) has been (b) had been
(c) was (d) will have been

8. They ..... in an apartment right now because they can't find a cheap house.
(a) have been living (b) are living
(c) had been living (d) were living

9. Everyone ..... when the earthquake hit the small town.
(a) is sleeping (b) slept
(c) was sleeping (d) will be sleeping

10. He ..... by herself since his divorce.
(a) has been living (b) had been living
(c) is living (d) was living

Directions (Q. Nos. 11-15) *Complete the following sentences with the correct form of verb as given in the brackets.*

11. I was angry that I ..... (make) such a stupid mistake.
(a) has made (b) had made
(c) am making (d) None of these

12. I predict that by 2020, man ..... (land) on Mars.
(a) will have landed (b) will land
(c) will be landing (d) None of these

13. I ..... (see) a wonderful film in the cinema last night.
(a) see (b) saw
(c) have seen (d) None of these

14. The plane ..... (take off) in a few minutes.
(a) will be taking off (b) is taking off
(c) took off (d) None of these

15. I ..... (get up) at 7 every morning but today I was late.
(a) got up (b) will get up
(c) get up (d) None of these

Directions (Q. Nos. 16-20) *In the following questions, a sentence is given with an error in it. Find out that part of the sentence which has the error. If there is no error; the answer is (d). (Ignore errors of Punctuation, if any.)*

16. I missed the last bus which I usually catch (a)/and have to stay back (b)/at the bus stop last night. (c)/No error (d)

17. Her goal is to win gold medal (a)/in the Asian games and (b)/made her country proud. (c)/No error (d)

18. He firmly believe that (a)/ if any disease is detected early then (b)/ it can be cured by yoga. (c)/No error (d)

19. Ram takes charge of (a)/ the project within a few days (b)/ of appointment. (c)/No error (d)

20. Economists have predicted that (a)/ the country's economic growth (b)/falls low to eight per cent this year. (c)/No error (d)

Answers

1	(b)	2	(a)	3	(d)	4	(b)	5	(d)	6	(b)	7	(a)	8	(b)	9	(c)	10	(a)
11	(b)	12	(a)	13	(b)	14	(b)	15	(c)	16	(b)	17	(c)	18	(a)	19	(a)	20	(c)

CHAPTER

05

WORD AND SENTENCE

The knowledge of word structure and sentence structure is of great importance as it helps in changing the form of a word and formation of correct sentence with proper placing of parts of speech.

A type of word formation in which a verb or an adjective (or other part of speech) is transformed into a noun is called nominalisation. Nominalisation leads to the formation of a noun from a verb or an adjective.

e.g. (i) Occur (Verb) - Occurrence (Noun)
(ii) Easy (Adjective) - Ease (Noun)

Formation of Nouns from Verbs

Nouns are usually formed by adding a suffix to the verb. Given below are the examples of the nouns that are formed by adding a suffix to the verb.

1. By adding 'ation'

Verb	Noun
Agitate	Agitation
Adapt	Adaptation
Alienate	Alienation
Animate	Animation
Admire	Admiration
Activate	Activation

Verb	Noun
Accelerate	Acceleration
Civilise	Civilisation
Cancel	Cancellation
Combine	Combination
Conform	Conformation
Devastate	Devastation
Exam	Examination
Intimate	Intimation
Oblige	Obligation
Prepare	Preparation
Resign	Resignation

2. **By adding 'ication'**

Verb	Noun
Amplify	Amplification
Authenticate	Authentication
Apply	Application
Certify	Certification
Glorify	Glorification
Imply	Implication
Justify	Justification
Multiply	Multiplication
Modify	Modification
Quantify	Quantification
Signify	Signification

3. **By adding 'ment'**

Verb	Noun
Appoint	Appointment
Abandon	Abandonment
Align	Alignment
Amaze	Amazement
Depart	Department
Enact	Enactment
Employ	Employment
Improve	Improvement
Nourish	Nourishment
Procure	Procurement
Settle	Settlement
Wonder	Wonderment

4. **By adding 'ure'**

Verb	Noun
Close	Closure
Context	Contexture
Enclose	Enclosure
Expose	Exposure
Fail	Failure
Please	Pleasure

5. **By adding 'ance'**

Verb	Noun
Accept	Acceptance
Absorb	Absorbance
Allow	Allowance
Avoid	Avoidance
Clear	Clearance
Comply	Compliance
Disturb	Disturbance
Govern	Governance
Hinder	Hindrance
Insure	Insurance
Perform	Performance

6. **By adding 'ion'**

Verb	Noun
Abort	Abortion
Act	Action
Attract	Attraction
Celebrate	Celebration
Calculate	Calculation
Collect	Collection
Contradict	Contradiction

Verb	Noun
Disperse	Dispersion
Duplicate	Duplication
Demote	Demotion
Generate	Generation
Incubate	Incubation

7. **By adding 'ence'**

Verb	Noun
Absent	Absence
Emerge	Emergence
Exist	Existence
Excel	Excellence
Insist	Insistence
Occur	Occurrence
Prefer	Preference
Reside	Residence

8. **By adding 'age'**

Verb	Noun
Assemble	Assemblage
Block	Blockage
Carry	Carriage
Cover	Coverage
Drain	Drainage
Link	Linkage
Marry	Marriage
Pack	Package
Pass	Passage
Post	Postage

9. **By adding 'al'**

Verb	Noun
Disapprove	Disapproval
Dismiss	Dismissal
Propose	Proposal
Try	Trial
Survive	Survival

10. **By adding 'sion'**

Verb	Noun
Admit	Admission
Concede	Concession
Emit	Emission
Omit	Omission
Permit	Permission
Submit	Submission

Formation of Nouns From Adjectives

1. **By adding 'ness'**

Adjective	Noun
Fit	Fitness
Hard	Hardness
Rough	Roughness
Rude	Rudeness
Smart	Smartness
Soft	Softness
Sweet	Sweetness
Sharp	Sharpness
Tough	Toughness
Happy	Happiness

2. **By adding 'ry'**

Adjective	Noun
Brave	Bravery
Gallant	Gallantry

3. **By adding 'th'**

Adjective	Noun
Deep	Depth
Long	Length
True	Truth
Warm	Warmth
Wide	Width

4. **By adding 'ity'**

Adjective	Noun
Active	Activity
Curious	Curiosity
Generous	Generosity
Extreme	Extremity
Clear	Clarity
Able	Ability
Brief	Brevity
Capable	Capability

5. **By adding 'ty'**

Adjective	Noun
Cruel	Cruelty
Poor	Poverty

6. **By replacing 'nt' with 'nce'**

Adjective	Noun
Intelligent	Intelligence
Brilliant	Brilliance
Excellent	Excellence
Dependant	Dependence
Prudent	Prudence
Confident	Confidence

Sentence Structure

A sentence is a group of words giving a complete thought. A sentence can consist of a single clause or several clauses.

A group of related words containing a subject and a verb, is called clause.

Types of Clause

Principal Clause

The clause that does not start with any conjunction is Called Principal clause. The principal clause (also called Independent clause) expresses a complete thought.

e.g. He is sad because he lost the match.
↑
Principal clause

Subordinate Clause

The clause that starts with a conjunction is called, Subordinate clause. Subordinate clause is also called Dependent clause.

(i) He told me that you were ill.
↑ ↑
Principal clause Subordinate clause

(ii) If it rains, I will stay at home.
↑ ↑
Subordinate clause Principal clause

Types of Subordinate Clause

(a) Noun Clause

A noun clause is a subordinate clause that acts as noun. These clauses start with that, how, what, when, where, who etc.

e.g. (i) He asked me what I needed.
(ii) She informed us that her brother had died.

(b) Relative Clause

These clauses start with relative pronoun and adverb like who, which, when, where etc.

e.g. (i) He knows the teacher who teaches us English.
(ii) I went into the kitchen where my mother was cooking food.

(c) Adverb Clause

Adverb clause is a subordinate clause that acts as adverb in a sentence. These clauses start with conjunctions of time like when, before after, till, until etc and with conjunction of condition like if, unless, as long as etc.

e.g. (i) We will wait till he comes.
(ii) If you want to pass, you must work hard.

PRACTICE EXERCISE

Directions (Q.Nos 1-5) *Give the Noun form of the following verbs.*

1. Admit
(a) Admitting (b) Admitted
(c) Admission (d) Admits

2. Appreciate
(a) Appreciation (b) Appreciating
(c) Appreciated (d) Appreciates

3. Settle
(a) Settled (b) Settling
(c) Settles (d) Settlement

4. Correct
(a) Correction
(b) Corrected
(c) Corrects
(d) Correcting

5. Close
(a) Closes (b) Closing
(c) Closure (d) Closed

Directions (Q.Nos 6-10) *Give the verb form of the following noun.*

6. Success
(a) Succeed (b) Successful
(c) Successfully (d) Successive

7. Certification
(a) Certificate
(b) Certified
(c) Certify
(d) Certificates

8. Insurance
(a) Insurable (b) Insure
(c) Insured (d) Insuringly

9. Action
(a) Actor (b) Acting
(c) Act (d) Actress

10. Failure
(a) Failed (b) Failures
(c) Fault (d) Fail

Directions (Q.Nos 11-15) *Give the noun form of the following adjectives.*

11. Clear
(a) Clearly (b) Clarity
(c) Clarify (d) Cleared

12. Fearful
(a) Fear (b) Feared
(c) Frightening (d) Fearing

13. Friendly
(a) Friendfully
(b) Friendliest
(c) Friend
(d) Friendlier

14. True
(a) Trueness (b) Truth
(c) Truthful (d) Truly

15. Able
(a) To be able (b) Abled
(c) Ableness (d) Ability

Directions (Q.Nos 16-20) *Give the adjectives form of the following Nouns.*

16. Confide
(a) Confirm (b) Confident
(c) Confide (d) Confided

17. Bravery
(a) Braveness (b) Braved
(c) Brave (d) Braveful

18. Miser
(a) Miserable (b) Misery
(c) Miserity (d) Miserly

19. Softness
(a) Softly (b) Soft
(c) Softed (d) Softful

20. Civilisation
(a) Civilised
(b) Civil
(c) Well-civilised
(d) Sub-civilised

Directions (Q. Nos. 21-25) *Complete the following sentences with the most suitable clause.*

21. Yesterday, we found a pen ..... .
(a) who was shining (b) whom was shining
(c) which was shining (d) where was shining

22. I will stay here ..... .
(a) that you come back (b) so you come back
(c) as you come back (d) until you come back

23. Kavita is walking fast ..... .
(a) so that she may reach school on time
(b) because she may reach school on time
(c) when she may reach school on time
(d) where she may reach school on time

24. ..... he will get the highest marks.
(a) Although he studies hard
(b) If he studies hard
(c) And he studies hard
(d) Because he studies hard

25. We do not know the reason ..... .
(a) When he is upset (b) that he is upset
(c) why he is upset (d) what he is upset

Directions (Q. Nos. 26-30) *Fill in the blanks with suitable option of the following sentences.*

26. Alexander Fleming was the man ..... discovered Penicillin.
(a) what (b) who (c) which (d) how

27. The school ..... I was educated, has been demolished.
(a) where (b) when (c) which (d) why

28. I remember the year ..... I passed the high school.
(a) who (b) which (c) when (d) what

29. The watch ..... he was wearing, was mine.
(a) which (b) who (c) when (d) why

30. I like the people ..... respect their elders.
(a) where (b) when (c) what (d) who

Direction (Q.Nos. 31-35) *Find the error part in the following sentences.*

31. She told me which she would be delighted to come.
(a) She told (b) me which
(c) she would be (d) delighted to come

32. Pay attention to whom I am going to say.
(a) Pay attention (b) to whom
(c) I am going (d) to say

33. I don't know which I can get out of this mess.
(a) I don't know (b) which I can
(c) get out of (d) this mess

34. He asked me what I knew his name.
(a) He asked (b) me what
(c) I knew (d) his name

35. I want to know which she is angry with me.
(a) I want (b) to know
(c) which she is (d) angry with me

Answers

1	(c)	2	(a)	3	(d)	4	(a)	5	(c)	6	(a)	7	(c)	8	(b)	9	(c)	10	(d)
11	(b)	12	(a)	13	(c)	14	(b)	15	(d)	16	(b)	17	(c)	18	(d)	19	(b)	20	(a)
21	(c)	22	(d)	23	(a)	24	(b)	25	(c)	26	(b)	27	(a)	28	(c)	29	(a)	30	(d)
31	(b)	32	(b)	33	(b)	34	(b)	35	(c)										

CHAPTER

06

SENTENCE IMPROVEMENT

The aim of sentence Improvement question is to test the candidate's ability to identity error in a part of sentence and improve the same.

In these type of questions, a sentence is given with a bold/underlined word or phrase in it. The candidate is required to improve the highlighted/underlined word or phrase by choosing the suitable option given below the sentence. In case, the phrase/word cannot be improved further, the candidate can select the 'No Improvement' option as the answer.

e.g.

(i) His powerful desire brought about his downfall.

(a) His wishful desire (b) His desire for power

(c) His eager desire (d) No improvement

Ans. (b) 'Desire' means 'a strong feeling of wanting to have something'. Hence wanting to have something. Hence, 'to improve the given sentence, option (b) 'His desire' for power' will be used.

(ii) If he wants <u>farther</u> help, send him to me.

(a) further (b) much

(c) best (d) No improvement

Ans (a) To improve the given sentence, 'farther' should be replaced by 'further'. 'Farther' is used for physical distance but 'further' is used for something additional or to a greater degree.

PRACTICE EXERCISE

Directions (Q. Nos. 1-32) *In the following questions, a sentence / part of the sentence has been underlined. Below are given alternatives (a), (b), (c) and (d) which may improve the underlined part. Choose the correct alternative. In case no improvement is needed, your answer is option (d) 'No Improvement'.*

1. When his teacher saw him last, he ran to catch the school bus.
(a) has run (b) was running
(c) had run (d) No improvement

2. I asked her where is she going.
(a) where she is going
(b) where was she going
(c) where she was going
(d) No improvement

3. The patient was released from the hospital yesterday.
(a) fired (b) discharged
(c) thrown out (d) No improvement

4. You must apologise to his teacher for making noise in the class.
(a) with (b) for
(c) at (d) No improvement

5. The employees wished each and other on New Year's Day.
(a) one other (b) one another
(c) each another (d) No improvement

6. Every Sunday we go out for shopping.
(a) for shops (b) to shopping
(c) for shop (d) No improvement

7. Prem was rejected so he was too young.
(a) because (b) yet
(c) but (d) No improvement

8. All his family members are in Agra.
(a) All of his family members
(b) All the members in his family
(c) All the members of his family
(d) No improvement

9. Indra has returned my books yesterday.
(a) had returned (b) has had returned
(c) returned (d) No improvement

10. Most children are liking chocolate.
(a) likes (b) like
(c) were liking (d) No improvement

11. My brother gifted me the more expensive car.
(a) a much (b) a most
(c) the most (d) No improvement

12. Either Raghav or Saurabh are going to be selected for the match.
(a) has (b) is
(c) have been (d) No improvement

13. If I were the Chief Minister of Delhi, I would ban all processions.
(a) will be (b) was
(c) am (d) No improvement

14. Vijay took disadvantage of the situation and cheated many people in his society.
(a) chance (b) advantage
(c) courage (d) No improvement

15. The police grabbed him for armed robbery.
(a) released (b) arrested
(c) captured (d) No improvement

16. No sooner had the teacher entered the room and the student rushed to their seats.
(a) when (b) than
(c) but (d) No improvement

17. The team will be giving blood in the hospital at 10 a.m. tomorrow.
(a) exchanging (b) contributing
(c) donating (d) No improvement

18. The painter has not finished painting the door.
(a) to paint (b) the paint of
(c) the painting (d) No improvement

19. Reema is more healthier than Seema.
(a) healthier (b) healthiest
(c) healthy (d) No improvement

20. Hardik was left in from the team because he hasn't been playing too well lately.
(a) got out (b) thrown out
(c) left out (d) No improvement

21. He does not drink, nor he smokes.
(a) nor smokes he (b) nor does he smoke
(c) nor he does smoke (d) No improvement

22. The doctor who I met yesterday was Mehul's father.
(a) which (b) whom
(c) that (d) No improvement

23. Hardly had I finished my lunch when my cousin arrived.
(a) before (b) then
(c) after (d) No improvement

24. Each of our students pay their tuition fee at the beginning of the month.
(a) student pay their (b) students pays their
(c) students pays his (d) No improvement

25. We demonstrated to them, how we were prepared the artistic patterns.
(a) are prepared (b) have prepared
(c) had prepared (d) No improvement

26. She was the oldest of the two sisters.
(a) eldest of two sisters
(b) oldest between the two sisters
(c) older than her sister
(d) No improvement

27. The patient could have been saved if he had been taken to the hospital in time.
(a) could be saved
(b) could save
(c) had been saved
(d) No improvement

28. The war has had a negative impact over the economy of the country.
(a) in the economy (b) on the economy
(c) in economy (d) No improvement

29. Each furniture on display in this hall is on sale.
(a) Each of the furniture
(b) Each one of the furniture
(c) Each piece of furniture
(d) No improvement

30. I find difficult to understand why Vikas has remained silent on this matter.
(a) I find it difficult
(b) I find very difficult
(c) I find somewhat difficult
(d) No improvement

Answers

1	(b)	2	(c)	3	(b)	4	(d)	5	(b)	6	(d)	7	(a)	8	(c)	9	(c)	10	(b)
11	(c)	12	(b)	13	(d)	14	(b)	15	(b)	16	(b)	17	(c)	18	(d)	19	(a)	20	(c)
21	(b)	22	(b)	23	(d)	24	(c)	25	(c)	26	(a)	27	(d)	28	(b)	29	(c)	30	(a)

CHAPTER

07

PASSIVATION

Passivisation is the transformation of Active Voice form to passive voice form.

Voice is that form of verb which shows whether the subject does the activity or has the activity been done to the subject.

Kinds of Voice

There are two kinds of voice

1. **Active Voice** A verb is said to be in the active voice when its form shows that the person or thing denoted as the subject does the activity.

   e.g. The peon opened the gate.

2. **Passive Voice** A verb is said to be in the passive voice when its form shows that the activity is done to the person or thing denoted as the subject.

   e.g. The gate was opened by the peon.

Active and Passive voices are integral part of written as well as spoken English. A Sentence can be described in two ways either in active voice or in passive voice.

Conversion of Active into Passive Voice

- Use the subject of the Active Voice as the object and the object of the Active Voice as the subject.
- Always use the third form of the verb in the passive voice.
- Put preposition 'by' after the third form of the verb.
- Helping verbs in the passive voice :
  - Present Indefinite Tense—is/am/are
  - Present Continuous Tense—is/am/ are+ being
  - Present Perfect Tense—has/have +been
  - Past Indefinite Tense—was/were
  - Past Continuous Tense—was/were +being
  - Past Perfect Tense—had+been

- Future Indefinite Tense—will/shall+be
- Future Perfect Tense—will/shall + have been

- Change the subject of the Active Voice into the object of the pronoun. *e.g.*

I	me
We	us
You	you
They	them
He	him
She	her
Who	by whom

Note The passive form of the Future Continuous Tense and Perfect Continuous Tenses is not used.

More to Remember about the Change of Voice

1. Verbs with Two Objects

Such sentences can be converted into the passive voice in two ways.

e.g. She gave them a book. *(Active Voice)*

A book was given to them by her. *(Passive Voice)*

or

They were given a book by her.

2. Verbs with Modal Auxiliaries

Transform the sentences with Modals into the Passive Voice in the following way :

Modal auxiliary + be + V_{III}

e.g. He may defeat you. *(Active Voice)*

You may be defeated by him. *(Passive Voice)*

3. Interrogative sentences (Question word)

Convert these sentences into passive voice in the following way :

Given question word + the relevant helping verb + V_{III}

e.g. Why are you doing this? *(Active Voice)*

Why is this being done by you? *(Passive Voice)*

4. Imperative sentences

Imperative sentences can be converted into passive voice in following ways :

(a) Let + subject + be + V_{III}

e.g. Bring a glass of water. *(Active Voice)*

Let a glass of water be brought. *(Passive Voice)*

(b) Subject + should + be + V_{III}

e.g. Help the poor. *(Active Voice)*

The poor should be helped. *(Passive Voice)*

(c) If the imperative sentence has the word 'Kindly/Please', start the passive form with 'You are requested to.

e.g. (i) Please sit down. *(Active Voice)*

You are requested to sit down. *(Passive Voice)*

(ii) Kindly remit my fine. *(Active Voice)*

You are requested to remit my fine. *(Passive Voice)*

PRACTICE EXERCISE

Directions (Q.Nos 1-5) *Choose the most suitable option in the following sentences.*

1. Passive voice of the sentence "She offered them a seat" is
   (a) They are offered a seat by she.
   (b) They are offered a seat by her.
   (c) A seat is offered to them by her.
   (d) A seat was offered to them by her.

2. Passive voice of the sentence "Thomas feeds the dog" is
   (a) The dog was fed by him.
   (b) The dog is fed by him.
   (c) The dog was fed by Thomas.
   (d) The dog is fed by Thomas.

3. Active voice of the sentence "Some advice will be given to you by the doctor."
(a) The Doctor will give you some advice.
(b) Doctor shall give you some advice.
(c) Doctor has to give you some advice.
(d) Doctor had to given by some advice.

4. Passive voice of the sentence
'They were calling us".
(a) I was called by them.
(b) We are called by them.
(c) We were being called by them.
(d) We had to be called by them.

5. Active voice of the sentence
"Water could be thrown by her".
(a) She can throw water.
(b) She could throw water.
(c) She will throw water.
(d) She throws water.

Directions (Q. Nos 6-10) *Fill in the blanks with suitable option.*

6. The book is being ..... by me.
(a) read
(b) reading
(c) reads
(d) do read

7. Lucky draw ..... be won by him.
(a) shall (b) will
(c) shall have (d) will have

8. A stone ..... being thrown by him yesterday.
(a) was (b) is
(c) has (d) were

9. The match has ..... abandoned due to rain.
(a) be (b) been
(c) being (d) None of these

10. The mango is ..... eaten by the boys.
(a) be (b) been
(c) being (d) None of these

Directions (Q. Nos 11-15) *Choose the correct option of the following questions.*

11. Julie answered the questions. (Active)
The questions ..... answered by Julie. (Passive)
(a) are (b) have been
(c) were (d) None of these

12. The gardener has planted some trees. (Active)
Some trees ..... planted by the gardener. (Passive)
(a) are (b) have been
(c) had been (d) were

13. Some one is repairing the instrument. (Active)
The instrument ..... repaired. (Passive)
(a) is being (b) was being
(c) has been (d) was

14. I love apples. (Active)
Apples ..... loved by me. (Passive)
(a) is (b) are
(c) were (d) have been

15. The team had won the game. (Active)
The game ..... won by the team. (Passive)
(a) had been (b) has been
(c) was (d) None of these

Answers

1	(d)	2	(d)	3	(a)	4	(c)	5	(b)	6	(a)	7	(b)	8	(a)	9	(b)	10	(c)
11	(c)	12	(b)	13	(a)	14	(b)	15	(a)										

CHAPTER

08

REPORTED SPEECH

In this chapter you will learn usage and transformation of direct and indirect speech.

Direct Speech

When we convey the words of a person in his actual words, this is called Direct Speech. We use inverted commas to mark off the exact words of the speaker.

e.g. He said "I am going to the cinema".

Indirect Speech

When we convey the words of a person without using his exact words, this is called Indirect Speech.

e.g. He said that the was going to the cinema.

Reporting Verb

It is the verb of the sentence which is outside inverted commas.

Reported Speech

It is the matter quoted within inverted commas. When Direct Speech is transformed into Indirect Speech, following change are made:

1. Reporting verb
2. Inverted commas
3. Tense
4. Pronouns in the Reported Speech
5. Adverbs of Time and Place

1. Change of Reporting Verb

A. In **Assertive** sentences the reporting verb is changed into **tell** or **told.**

B. In **Interrogative** sentences the reporting verb is changed into **asked** or **inquired of**.

C. In **Imperative** sentences the reporting verb is changed into **ordered, advised, requested, proposed, forbade, suggested** etc according to the sense of the sentence.

D. In **Exclamatory** sentences, the reporting verb is changed into **exclaimed with joy, exclaimed with sorrow, exclaimed with surprise** etc according to the sense of the sentence.

E. In **Optative** sentences, (prayers and wishes) the Reporting Verb is changed into **wished** or **prayed.**

2. Removal of Inverted Commas

A. In **Assertive** sentences, **that** is used in place of inverted commas.

B. **Interrogative** sentences

(a) Sentences which start **Auxiliary verbs** (do, did, is, are, was, were, can, may etc), **if** or **whether** is used in place of inverted commas.

(b) Sentences start with **question words** (who, why, what, where, etc), inverted commas are replaced by question word itself.

C. In **Imperative** sentences **to** or **not to** is used in place of inverted commas.

D. In **Exclamatory** sentences **that** is used in place of inverted commas.

E. In **Optative** sentences, **that** is used in place of inverted commas.

4. Change of Tense

A. If the **Reporting verb** is in **Present or Future tense,** the tense of Reported speech does not change.

e.g. 1. He says to me, "I know you."
He tells me that he knows me.

2. She will say to me, "I need your help."
She will tell me that she needs my help.

B. If the **Reporting verb** is in the **Past tense,** the tense of Reported speech changes as :

Direct	Indirect
Simple Present	Simple Past
Present Continuous	Past Continuous
Present Perfect	Past Perfect
Present Perfect Continuous	Past Perfect Continuous
Simple Past	Past Perfect
Past Continuous	Past Perfect Continuous
Past Perfect	No change
Past Perfect Continuous	No change

Note :

Shall is changed into **should.**
Will is changed into **would.**
May is changed into **might.**
Can is changed into **could.**

e.g. (i) He said to me, "I don't believe you."
He told me that he didn't believe me.

(ii) They said to him, "We are going to play."
They told him that they were going to play.

(iii) He said to the teacher, "I have done my homework."
He told the teacher that he had done his home work.

(iv) They said to me, "She has been living here for five years."
They told me that she had been living there for five years.

(v) He said, "I wrote a letter."
He said that he had written a letter.

(vi) We said to her, "We were going to you."
We told her that we had been going to her.

(vii) He said, "I shall meet her."
He said that he would meet her.

(viii) The teacher said to me, "You will do it."
The teacher told me that I would do it.

(ix) We said to them, "We can defeat you."
We told them that we could defeat them.

(x) He said, "She may write."
He said that she might write.

C. If the Reported speech is a **universal truth, habitual fact** or **historical fact,** the tense of Reported speech does not change.

e.g.

(i) My father said to me , "Work is worship."
My father told me that work is worship.

(ii) The teacher said, "India got freedom in 1947."
The teacher said that India got freedom in 1947.

3. Change of Pronoun

A. First person of the Reported speech changes according to the subject of the Reporting verb.

B. Second person of the Reported speech changes according to the object of the Reporting verb.

C. Third person does not change.

Remember it as

1	2	3
S	O	N

1 → First person S → Subject
2 → Second person O → Object
3 → Third person N → No change

e.g.

(i) I said to Ram, "You can meet her."
I told Ram that he could meet her.

(ii) Rashmi said to me, "He is my friend."
Rashmi told me that he was her friend.

5. Change of Adverbs of Time and Place

Words expressing nearness in time or place are generally changed into words expressing distance.

now	becomes	**then**
here	becomes	**there**
ago	becomes	**before**
thus	becomes	**so**
this	becomes	**that**
these	becomes	**those**
today	becomes	**that day**
tomorrow	becomes	**the next day**
yesterday	becomes	**the previous day**
last night	becomes	**the night before**
next week	becomes	**the following week**

PRACTICE EXERCISE

Directions (Q. Nos 1-5) *Select the correct indirect speech of the following sentences.*

1. John said, "I love this city".
(a) John said that I love this city
(b) John said that he loved that city
(c) John said if I love that city
(d) John told that he loved this city

2. She says to Anita, "We have to go home".
(a) She told Anita that we have to go home
(b) She tells Anita that we have to go home
(c) She tells Anita that they have to go home
(d) She asked Anita if they have to go home

3. I said to you "Will you have a book"?
(a) I asked you if you would have a book
(b) I told you if you would have a book
(c) I ask you if I would have a book
(d) I asked you that you will have a book

4. She said to me, "What are you writing"?
(a) She asked me if she was writing
(b) She ask me that what I was writing
(c) She told me what she was writing
(d) She asked me what I was writing

5. I said to him, "Ravi should obey his teacher".
(a) I tell him that Ravi should obey his teacher
(b) I told him that Ravi should obey his teacher
(c) I ask him that he should obey his teacher
(d) I tell him if Ravi should obey my teacher

Directions (Q.Nos 6-15) *Choose the correct option from the given set of options according to the rules of reported speech.*

6. I asked Prerna ..... she travelled to office.
(a) what (b) how
(c) where (d) who

7. Sita said that she ..... already cooked.
(a) has been (b) had been
(c) have (d) had

8. A crazy man asked me whether I ..... the way to paradise.
(a) know
(b) knew
(c) knows
(d) knowing

9. Leela asked her friends at ..... time she would come back.
(a) what (b) where
(c) when (d) how

10. The man asked mechanic by what time he would ..... fixed the tyre of the car.
(a) has (b) had
(c) have (d) be

11. Varun asks Tarun where he went ..... .
(a) yesterday (b) today
(c) tomorrow (d) the previous day

12. She asked ..... there was anything special.
(a) how (b) can
(c) if (d) where

13. Gupta exclaimed with ..... that he could sense a fire in the adjacent building.
(a) joy (b) sorrow
(c) pain (d) fear

14. He exclaimed with sorrow that they ..... lost the game.
(a) had (b) have
(c) has (d) had been

15. She told me ..... she had been to London.
(a) if (b) that
(c) whether (d) when

Answers

1	*(b)*	2	*(c)*	3	*(a)*	4	*(d)*	5	*(b)*	6	*(b)*	7	*(d)*	8	*(b)*	9	*(a)*	10	*(c)*
11	*(d)*	12	*(c)*	13	*(d)*	14	*(a)*	15	*(b)*										

CHAPTER

09

SYNONYMS AND ANTONYMS

Synonyms and Antonyms are the words that are used to replace a word with its similar as well as opposite meaning word as to express a same or opposite idea.

- Synonyms are the words which are similar to each other in meaning.
- Antonyms are the words which are opposite to each other in meaning.

List of Important Words with their Synonyms and Antonyms

Word	Synonyms	Antonyms
Absolve	pardon, forgive	compel, accuse
Accord	agreement, harmony	disagreement, discord
Authentic	genuine, reliable	fictitious, unreal
Alien	foreigner, outsider	native, resident
Affront	provoke, irreverence	conciliate, mollify
Adversity	misfortune, calamity	prosperity, fortune
Amplify	enlarge, extend	lessen, contract
Admonish	counsel, reprove	approve, applaud
Adherent	follower, disciple	rival, adversary
Awkward	clumsy, rough	clever, apt
Abortive	vain, unproductive	effectual, productive
Brittle	delicate, fragile	tough, enduring
Bleak	dismal, gloomy	bright, pleasant
Barbarous	uncivilized, savage	cultured, humane
Baffle	frustrate, perplex	compose, facilitate
Contrary	dissimilar, conflicting	similar, alike
Contradict	deny, oppose	approve, confirm
Contempt	scorn, disregard	regard, praise
Consolidate	solidify, strengthen	separate, weaken
Consequence	effect, outcome	origin, start

Word	Synonyms	Antonyms
Consent	agree, permit	object, disagree
Concede	yield, permit	deny, reject
Comprise	include, contain	reject, lack
Compassion	kindness, sympathy	cruelty, barbarity
Concur	approve, agree	differ, disagree
Chaste	virtuous, pure	sullied, lustful
Capable	competent, able	incompetent, inept
Captivate	charm, fascinate	disillusion, offend
Calamity	adversity, misfortune	happiness, fortune
Cavity	depth, depression	elevation, projection
Cease	terminate, desist	begin, originate
Disdain	detest, despise	approve, praise
Demolish	ruin, devastate	repair, construct
Delicious	palatable, tasteful	distasteful, unsavoury
Deliberate	cautious, intentional	rash, sudden
Defer	prolong, suspend	accelerate, expedite
Dedicate	devote, consecrate	refuse, negate
Decipher	interpret, reveal	misinterpret, distort
Decay	collapse, decompose	flourish, progress
Evident	obvious, apparent	obscure, concealed
Evade	avoid, elude	acknowledge, confront
Eternal	perpetual, endless	temporary, momentary
Esteem	respect, regard	ridicule, spurn
Eradicate	destroy, exterminate	secure, plant
Epitome	precise, example	increment, expansion
Enormous	colossal, mammoth	diminutive, negligible
Endeavour	undertake, aspire	cease, quit
Eliminate	expel, oust	restore, accept
Elevate	dignify, heighten	demote, denounce
Eccentric	strange, abnormal	natural, conventional
Fabricate	construct, produce	destroy, dismantle
Frivolous	petty, worthless	solemn, significant
Fragile	weak, infirm	enduring, tough
Forsake	desert, renounce	hold, maintain
Fluctuate	deflect, vacillate	stabilise, resolve
Flimsy	trifling, transparent	firm, tenacious
Feeble	weak, frail	strong, robust
Fantastic	fanciful, uncommon	ordinary, normal
Fanatical	narrow-minded, biased	liberal, tolerant
Fallacy	delusion, mistake	veracity, truth
Gracious	courteous, beneficent	rude, unforgiving
Gorgeous	magnificent, dazzling	dull, unpretentious

Word	Synonyms	Antonyms
Hypocrisy	deception, affectation	sincerity, honesty
Hideous	frightful, shocking	attractive, alluring
Hazard	Peril, danger	conviction, security
Haughty	arrogant, pompous	humble, submissive
Haphazard	random, unsorted	considered, arranged
Hamper	retard, prevent	promote, facilitate
Irrepressible	irresistible, unconfined	composed, hesitant
Invincible	unconquerable, impregnable	effeminate, languid
Intrinsic	genuine, fundamental	extraneous, incidental
Insolvent	indigent, destitute	wealthy, solvent
Insipid	tasteless, vapid	delicious, luscious
Inevitable	unavoidable, ascertained	unlikely, doubtful
Incompetent	inefficient, unskilled	dexterous, skilled
Impious	irreligious, unholy	pious, devout
Impartial	just, unbiased	prejudiced, biased
Impair	diminish, deteriorate	restore, revive
Immunity	prerogative, privilege	blame, censure
Immerse	submerge, involve	emerge, uncover
Immense	huge, enormous	puny, insignificant
Justify	defend, exculpate	impute, arraign
Just	honest, impartial	unequal, unfair
Judicious	thoughtful, prudent	irrational, foolish
Keen	sharp, poignant	vapid, insipid
Luxuriant	profuse, abundant	scanty, meagre
Lure	attract, entice	repel, dissuade
Lucid	sound, rational	obscure, hidden
Listless	indifferent, inattentive	brisk, attentive
Liberal	magnanimous, generous	stingy, malicious
Liable	accountable, bound	unaccountable, apt to
Lenient	compassionate, merciful	cruel, severe
Lavish	abundant, excessive	scarce, deficient
Mutual	joint, identical	separate, distinct
Momentous	notable, eventful	trivial, insignificant
Modest	humble, courteous	arrogant, pompous
Mitigate	alleviate, relieve	augment, enhance
Minute	diminutive, miniature	large, colossal
Numerous	profuse, various	scarce, deficient
Nullify	cancel, annul	confirm, uphold
Novice	tyro, beginner	veteran, ingenious
Outrage	offence, maltreatment	praise, favour
Outbreak	eruption, insurrection	compliance, subjection
Ornamental	decorative, adorned	unseemly, plain

Word	Synonyms	Antonyms
Ordain	order, impose	revoke, abolish
Opaque	obscure, shady	transparent, bright
Offspring	descendant, sibling	ancestor, forefather
Offensive	abhorrent, arrogant	docile, compliant
Obvious	evident, apparent	obscure, ambiguous
Obstruct	impede, prevent	hasten, encourage
Prudent	cautious, discreet	impetuous, unwise
Provoke	inflame, incite	pacify, comfort
Profuse	lavish, abundant	scarce, scantly
Prodigy	miracle, marvel	normal, average
Premature	precocious, untimely	belated, opportune
Precarious	doubtful, insecure	assured, undeniable
Pompous	haughty, arrogant	unpretentious, humble
Peerless	matchless, unrivalled	mediocre, commonplace
Paramount	foremost, eminent	trivial, inferior
Pamper	flatter, indulge	deny, disparage
Placid	tranquil, calm	turbulent, hostile
Quaint	queer, strange	familiar, usual
Questionable	dubious, disputable	reliable, authentic
Reverence	respect, esteem	disrespect, affront
Ratify	consent, approve	deny, dissent
Ravage	destroy, ruin	reconstruct, renovate
Redeem	recover, liberate	conserve, lose
Ruthless	remorseless, inhumane	compassionate, lenient
Remote	inaccessible, farther	adjoining, adjacent
Remorse	regret, penitence	ruthlessness, obduracy
Resentment	displeasure, wrath	content, cheer
Superficial	partial, shallow	profound, discerning
Substantial	considerable, solid	tenuous, fragile
Subsequent	consequent, following	preceding, previous
Scanty	scarce, insufficient	lavish, multitude
Shrewd	cunning, crafty	simple, imbecile
Solicit	entreat, implore	protest, oppose
Slander	defame, malign	applaud, approve
Shabby	miserable, impoverished	prosperous, thriving
Saucy	impudent, insolent	modest, humble
Trivial	trifling, insignificant	significant, important
Transient	temporal, transitory	lasting, enduring
Timid	diffident, coward	bold, intrepid
Temperate	cool, moderate	boisterous, violent
Tedious	wearisome, irksome	exhilarating, lively
Taboo	prohibit, ban	permit, consent

Word	Synonyms	Antonyms
Vulgar	inelegant, offensive	elegant, civil
Volatile	light, changing	heavy, ponderous
Vanity	conceit, pretension	modesty, humility
Vigilant	cautious, alert	careless, negligent
Valid	genuine, authentic	fallacious, deceptive
Wicked	vicious, immoral	virtuous, noble
Yoke	connect, harness	liberate, release
Yield	surrender, abdicate	resist, protest
Yearn	languish, crave	content, satisfy
Zest	delight, enthusiasm	disgust, passive
Zenith	summit, apex	nadir, base
Zeal	eagerness, fervour	apathy, lethargy
Zig-zag	oblique, wayward	straight, unbent

PRACTICE EXERCISE

Directions (Q. Nos. 1-10) *Choose the appropriate synonym of the words given below.*

1. Tired
   (a) Hopeful (b) Sick
   (c) Energetic (d) Sleepy
2. Happy
   (a) Unfortunate (b) Joyful
   (c) Sad (d) Worried
3. Messy
   (a) Dirty (b) Tidy
   (c) Spotless (d) Clean
4. Center
   (a) Right (b) Left
   (c) Middle (d) Above
5. Brief
   (a) Short (b) Small
   (c) Limited (d) Little
6. Costly
   (a) Cheap
   (b) Expensive
   (c) Inexpensive
   (d) Money
7. Eligible
   (a) False (b) Actual
   (c) Unsuitable (d) Qualified
8. Guest
   (a) Host
   (b) Visitor
   (c) Landlord
   (d) Practical
9. Famous
   (a) Unpopular (b) Fictitious
   (c) Well-known (d) Unknown
10. Wicked
   (a) Shy (b) Insane
   (c) Loyal (d) Evil

Directions (Q. Nos. 11-20) *Choose the appropriate antonym of the words given below.*

11. Clean
(a) Tidy (b) Old
(c) Broken (d) Dirty

12. Stay
(a) Wait (b) Sit
(c) Remain (d) Leave

13. Quiet
(a) Speechless (b) Silent
(c) Mute (d) Noisy

14. Beautiful
(a) Wonderful (b) Graceful
(c) Ugly (d) Handsome

15. Modern
(a) Update (b) Recent
(c) Current (d) Ancient

16. Divided
(a) United (b) Dignified
(c) Separated (d) Isolated

17. Mighty
(a) Ferocious
(b) Forceful
(c) Weak
(d) Tough

18. Busy
(a) Relaxed (b) Occupied
(c) Engaged (d) Lazy

19. Gain
(a) Lost (b) Loose (c) Fall (d) Loss

20. Shy
(a) Bold
(b) Reseryed
(c) Odd
(d) Nervous

Answers

1	*(d)*	2	*(b)*	3	*(a)*	4	*(c)*	5	*(a)*	6	*(b)*	7	*(d)*	8	*(b)*	9	*(c)*	10	*(d)*
11	*(d)*	12	*(d)*	13	*(d)*	14	*(c)*	15	*(d)*	16	*(a)*	17	*(c)*	18	*(a)*	19	*(d)*	20	*(a)*

CHAPTER

10

ONE WORD SUBSTITUTION

'One word Substitution' is one of the essential parts of vocabulary. It is asked in various competitive exams. It simply means that a sentence is replaced with a single word. One requires a good vocabulary to solve the questions.

e.g. The life history of a person written by himself can be substituted with 'autobiography'.

One word substitute is very important part of vocabulary. The main purpose of this is to shorten a sentence or phrase into a single word.

Some Commonly Used One Word Substitutions

- **Agenda**–a list of headings of the business to be transacted at a meeting
- **Amphibian**–animals which live both on land and sea
- **Anthology**–a collection of poems
- **Anthropologist**–one, who studies the evolution of mankind
- **Aquatic**–animals/plants which live in water
- **Archives**–a place where government or public records are kept
- **Astrologer**–a person who studies the influence of heavenly bodies on human beings
- **Atheist**–a person who does not believe in God
- **Audience**–a number of people listening to a lecture
- **Autobiography**–the life history of a person written by himself
- **Axiom**–a statement which is accepted as true without proof
- **Bibliophile**–a lover and collector of books
- **Biennial**–an event which happens once in 2 years
- **Bouquet**–a collection of flowers
- **Carnivorous**–one who lives on flesh

- **Calligraphist**–a person, who writes beautiful handwriting
- **Cardiologist**–a person who is specialist in heart diseases
- **Cartographer**–one who draws maps
- **Chauffeur**–one who is employed to drive a motorcar
- **Choreographer**–one who teaches dancing
- **Cloak room**–a place for luggage at railway station
- **Crèche**–a nursery where children are cared for while their parents are at work
- **Curator**–a person in charge of a museum
- **Edible**–fit to be eaten
- **Encyclopedia**–a book that contains information on various subjects
- **Fatal**–causing death
- **Fauna**–the animals of a certain region
- **Feminist**–one who supportas feminism
- **Flora**–the plants of a particular region
- **Florist**–one who deals in flowers
- **Fragile**–easily broken
- **Herbivorous**–one who lives on herbs
- **Hive**–a place for bees
- **Horticulture**–the art of cultivating and managing gardens
- **Horizon**–a line at which the earth and the sky seem to meet
- **Insolvent/Bankrupt**–a person who is unable to pay his debts
- **Inaudible**–a sound that cannot be heard
- **Inaccessible**–that cannot be easily approached
- **Illegible**–incapable of being read
- **Invigilator**–one who supervises in the examination hall
- **Infirmary**–a home or room used for ill or injured people
- **Infanticide**–murder of an infant
- **Infantry**–soldiers who fight on foot
- **Inflammable**–liable to catch fire easily
- **Linguist**–one who is skilled in foreign languages
- **Mortuary**–a place where dead bodies are kept for post mortem
- **Martyr**–one who dies for a noble cause
- **Maiden speech**–the first speech delivered by a person
- **Mint**–a place where coins are made
- **Mammals**–animals which give milk
- **Namesake**–a person having same name as another
- **Optimist**–a person who looks at the brighter side of things
- **Orphan**–one who has lost his parents
- **Omnipresent**–one who is present everywhere
- **Omnipotent**–one who is having unlimited power and influence
- **Omniscient**–one who knows everything
- **Opaque**–that which cannot be seen through
- **Orphanage**–a home for orphans
- **Omnivorous**–one who eats everything
- **Pessimist**–a person who looks at the darker side of things
- **Potable**–fit to drink
- **Post mortem**–an examination of dead body
- **Panacea**–a remedy for all diseases
- **Pediatrician**–a person who is specialist in child diseases
- **Pedestrian**–one who goes on foot
- **Portable**–that can be carried easily
- **Suicide**–murder of oneself
- **Stable**–a place for horses
- **Sanatorium**–a place for the sick to recover health
- **Transparent**–that which can be seen through
- **Uxoricide**–murder of one's wife
- **Volunteer**–one who offers one's services
- **Versatile**–interested in and clever at many different things
- **Wardrobe**–a place for clothes

PRACTICE EXERCISE

Directions (Q. Nos. 1-20) *Out of the four alternatives, choose the one which can be substituted for the given words.*

1. One not concerned with right or wrong
(a) moral (b) amoral
(c) immoral (d) immortal

2. Call upon God or any other power (like law) etc for help or protection
(a) invocation (b) involution
(c) inundation (d) revocation

3. Act of deceiving somebody in order to make money
(a) fraud (b) robbery
(c) pickpocket (d) theft

4. A person who is unable to pay his debts
(a) solvent (b) banker
(c) insolvent (d) lender

5. A person coming to a foreign land to settle there
(a) immigrant (b) emigrant
(c) tourist (d) settler

6. Something capable of being done
(a) probable (b) feasible
(c) tenable (d) explicable

7. Killing of a child
(a) homicide (b) genocide
(c) infanticide (d) suicide

8. Lasting only for a moment
(a) momentous (b) momentary
(c) trivial (d) petty

9. One who hates mankind
(a) philanthropist
(b) terrorist
(c) misanthrope
(d) misogynist

10. One who walks on ropes
(a) funambulist (b) upholsterer
(c) acrobat (d) aviator

11. Deep in thought
(a) ballad (b) pensive
(c) pesky (d) apathy

12. Without risk of punishment
(a) impudent (b) impunity
(c) inexorable (d) imperturbable

13. The sound of the funeral bell
(a) knell (b) spell
(c) dong (d) ding-dong

14. The worship of idols or images
(a) atheism (b) theism
(c) idolatry (d) iconoclasm

15. A home for dog
(a) kennel (b) lair
(c) den (d) cage

16. One who intervenes between two or more parties to settle differences
(a) neutral (b) intermediary
(c) judge (d) connoisseur

17. One who hates women
(a) philanthropist (b) ascetic
(c) misogamist (d) misogynist

18. A voice that cannot be heard
(a) unheard (b) faint
(c) audible (d) inaudible

19. Murder of a man
(a) regicide (b) fratricide
(c) homicide (d) genocide

20. Animal that feeds on plants
(a) carnivorous (b) herbivorous
(c) insectivorous (d) graminivorous

Answers

1	*(b)*	2	*(a)*	3	*(a)*	4	*(c)*	5	*(a)*	6	*(b)*	7	*(c)*	8	*(b)*	9	*(c)*	10	*(a)*
11	*(b)*	12	*(b)*	13	*(a)*	14	*(c)*	15	*(a)*	16	*(b)*	17	*(d)*	18	*(d)*	19	*(c)*	20	*(b)*

CHAPTER

11

STRUCTURE SPELLINGS

Spelling text is an assessment test to check a student's ability to spell a word correctly.

As it is vital, so it holds a good place in the examination too. A great number of questions are asked based on the spellings.
e.g.

1. Find the correctly spelled word in the following options.
   (a) Adulation (b) Adlation (c) Adulatin (d) Addulation
   Ans. *(a)* 'Adulation' is the correctly spelled word which means excessive admiration or praise.
2. Find the wrongly spelled word in the following options.
   (a) Puncture (b) Pudding (c) Pungent (d) Puntuation
   Ans. *(d)* 'Puntuation' is the wrongly spelt word as the correct spelling is 'Punctuation' which means the marks such as comma, full stop…etc. used in writing to separate sentences.

Correct spelling of a word is very important to clear its meaning and uses. Until a word is correctly spelt, it does not fulfil its purpose so it is imperative to write correct spelling.

Commonly Misspelt Words

A

absence	accommodate
achieve	acquire
across	address
advertise	accessory
apparent	argument
athlete	awful

B

balance	basically
beginning	believe
benefited	breathe
brilliant	business

C

calendar	category
ceiling	cemetery
certain	chief
citizen	coming
committee	competition
convenience	criticise

D

decide	definite
deposit	describe
desperate	develop
difference	dilemma
disappear	disappoint
discipline	

E

embarrass	environment
equipped	exaggerate
excellent	except
exercise	existence
expect	experience
experiment	explanation

F

familiar	fascinating
finally	foreign
forward	fundamental

G

generally	government
grammar	guarantee
guidance	goal

H

happiness	humorous

I

identity	imaginary
imitation	immediately
incidentally	independent
intelligent	interesting
interfere	interpretation
interruption	invitation
irrelevant	irritable
island	important

J

jealous	judgement
jewellery	joker

K

knowledge	knowingly

L

laboratory	length
lesson	library
license	loneliness
lose	lying

M

marriage	medicine
miniature	mathematics
mysterious	moon

N

naturally	necessary
neighbour	neither
noticeable	

O

occasion	occurred
official	often
omission	operate
optimism	original

P

parallel	particularly
peculiar	perceive
perform	permanent
persevere	personally
persuade	picture
piece	planning
pleasant	political
possess	possible
practical	prefer
prejudice	presence
privilege	probably
professional	promise

Q

quantity	quarter
quiet	quit
quite	queen

R

realise	receive
recognise	recommend
reference	religious
repetition	restaurant
rhythm	ridiculous

S

sacrifice	safety
scissors	secretary
separate	shining
similar	sincerely
soldier	speech
stopping	strength
studying	successful
surely	surprise
succeed	star

T	
temperature	temporary
throw	through
toward	tries

U	
until	unusual
usually	useful

V	
village	vain
vigilant	van

W	
weird	welcome
whether	weather

PRACTICE EXERCISE

Directions (Q. Nos. 1-15): *In each of the following questions, a word has been written in four different ways, out of which only one is correctly spelt. Find the correctly spelt word.*

1. (a) Amatuer (b) Amature (c) Amateur (d) Ameteur

2. (a) Accessory (b) Acessarry (c) Acessary (d) Accessrry

3. (a) Benefitid (b) Benefitted (c) Benifitted (d) Benifited

4. (a) Busisness (b) Business (c) Buisiness (d) Bussiness

5. (a) Commetti (b) Commitee (c) Committee (d) Committey

6. (a) Jewellery (b) Jewelery (c) Jwellry (d) Jewellry

7. (a) Mathemetics (b) Mathematics (c) Mathamatics (d) Mathametics

8. (a) Necessarry (b) Necessory (c) Necesary (d) Necessary

9. (a) Servent (b) Sarvent (c) Servant (d) Sarvant

10. (a) Tarriff (b) Tariff (c) Tarif (d) Tarrif

11. (a) Accountancy (b) Acountancy (c) Acoountancy (d) Acounttancy

12. (a) Centigrede (b) Centegrade (c) Centigrate (d) Centigrade

13. (a) Influenza (b) Influanza (c) Inflluenza (d) Influenga

14. (a) Jubille (b) Jubile (c) Jubilee (d) Jubillee

15. (a) Labouratory (b) Laboratory (c) Labortory (d) Laboratry

Directions (Q. Nos. 16-18): *In each of the following questions, one of the four words is wrongly spelt. Find out that word, the spelling of which is wrong.*

16. (a) rational (b) sarvival (c) demolish (d) release

17. (a) reproach (b) actualise (c) gathuring (d) clothing

18. (a) garbage (b) couragious (c) criminal (d) regular

Answers

1	(c)	2	(a)	3	(b)	4	(b)	5	(c)	6	(a)	7	(b)	8	(d)	9	(c)	10	(b)
11	(a)	12	(d)	13	(a)	14	(c)	15	(b)	16	(b)	17	(c)	18	(b)				

CHAPTER

12

REARRANGING JUMBLED WORDS

In rearranging jumbled words, a student is required to form a meaningful sentence from the given jumbled words. A student must be able to recognise the subject, verb as well as object (if any) so that he is able to make meaningful sentences.

e.g. Rearrange the given words/group of words to make a meaningful sentence. Place to place/because/I/travel/move from/like to/I

I travel because I like to move from place to place.

'Rearrangement of jumbled words' has been included in the book to test the understanding of the students to form a meaningful sentence using the words given in random order.

PRACTICE EXERCISE

Directions (Q. Nos. 1-16) *Rearrange the following words/group of words to make meaningful sentences. Choose the correct sequence given in the options.*

1. Television (A)/watch (B)/Do your parents (C)/in the evening (D).
(a) B A C D (b) C B A D (c) B C A D (d) C A B D

2. It gives me (A)/ I enjoy (B)/ of freedom (C)/ the sense (D).
(a) B A C D (b) C B A D
(c) B D C A (d) C D B A

3. have to pay (A)/ very heavy (B)/ the poor farmers (C)/ taxes (D).
(a) B A C D (b) B C A D
(c) A C D B (d)C A B D

4. flour and rice (A)/ we usually buy (B)/ to save money (C)/ for the whole one year in one go (D).
(a) D B C A (b) B A D C
(c) D C A B (d) A C B D

5. was higher than (A)/ the price of sugar (B)/ of honey (C)/ the price (D).
(a) B A D C (b) D C A B
(c) B A C D (d) B C A D

6. A major lack of (A)/ Information on (B)/ there is (C)/ this subject (D).
(a) B A C D (b) C B A D
(c) C A B D (d) C D B A

7. are constantly (A)/ they (B)/ with other people (C)/ finding faults (D).
(a) B A D C (b) B C A D
(c) C B A D (d) C D A B

8. the largest (A)/ Elephant is (B)/ the present day (C)/ land animal of (D).
(a) A B D C (b) B A D C
(c) D B C A (d) C B A D

9. Camel (A)/ hump on (B)/ its back (C)/ has a big (D).
(a) B A C D (b) C A B D
(c) D C A B (d) A D B C

10. brother (A)/ has your (B)/ got a (C)/ job? (D)
(a) A C B D (b) B A C D
(c) D B A C (d) C A B D

11. is like a (A)/ body (B)/ world without water (C)/ without life (D).
(a) B A C D (b) C A B D
(c) C B D A (d) D B C A

12. make our life (A)/ good friends (B)/ happy (C)/ extremely (D).
(a) A C B D (b) B A C D
(c) B A D C (d) D C A B

13. not easy to find (A)/ but now-a-days (B)/ good friends (C)/ It is (D).
(a) B A C D (b) B D A C
(c) B A D C (d) C D A B

14. do not know (A)/ good friendship (B)/ the value of (C)/ infact many (D).
(a) C D A B
(b) B A C D
(c) D A C B
(d) B C A D

15. a period of (A)/ childhood is (B)/ and physical growth (C)/ mental (D).
(a) B A D C (b) B C D A
(c) A B C D (d) D B C A

16. this development is (A)/ healthy environment (B)/ only in (C)/ possible (D).
(a) B A C D
(b) A D C B
(c) B C D A
(d) D C B A

Directions (Q. Nos. 17-30) *In the following questions sentence is given in jumbled order. Four alternatives are given. Choose the correct option.*

17. Koalas/hardly/are/drink/animals/that/water.
(a) Koalas are hardly animals that water drink.
(b) Koalas are animals that hardly drink water.
(c) Hardly Koalas are animals that drink water.
(d) Animals are Koalas that hardly drink water.

18. Water supply/ get/ they/ they eat/ all their/ from/ the leaves.
(a) All their water supply they get from the leaves they eat
(b) Water supply they get from they eat the leaves
(c) They get all their water supply from the leaves they eat
(d) From the leaves they eat, they get all their water supply

19. Inhabited/ so/ tree leaves/ by koalas/ in areas/ of/ is high/ demand.
(a) So, in areas inhabited by koalas demand of tree leaves is high
(b) Inhabited areas by koalas in demand of tree leaves is so high
(c) Demand of tree leaves is high in areas so inhabited by koalas
(d) Demand of tree leaves is so high by koalas so inhabited areas in

20. One group/ it takes/ to support/ several acres/ of koalas/ of trees.
(a) To support one group of Koalas it takes several acres of trees
(b) It takes several acres of koalas to support one group of trees
(c) It takes several acres of trees to support one group of koalas
(d) It takes to support one group of koalas several acres of trees

21. Has/ taken several/ Government/ measures/ to support/ the lives/ of koalas.
(a) Several measures has taken Government to support the lives of koalas
(b) Government has taken several measures to support the lives of koalas
(c) Government several measures has been taken to support the lives of koalas
(d) To support the lives of koalas several measures has taken Government

22. Are/ eating/ birds/ small/ wagtails/ insect.
(a) Small eating insect birds are wagtails
(b) Wagtails are small insect eating birds
(c) Eating small insect are wagtails birds
(d) Birds are wagtails small eating insect

23. Eight/of/wagtails/there/about/are/species.
(a) There are about eight species of wagtails.
(b) Eight species of wagtails there are about.
(c) There about species of wagtails about are.
(d) Wagtails there are about eight of species.

24. Highest/ world's/ some of / the/ peaks/ Himalayas/ in/ the/ are
(a) Some of the world's highest peaks are in the Himalayas
(b) Highest peaks of some of the world's are in the Himalayas
(c) In the Himalayas some of the highest peaks of the world are
(d) Some of the highest are peaks in Himalayas

25. Highest/ Peak/ the/ is/ Mount/ Everest
(a) Peak is the highest Mount Everest.
(b) Mount Everest is the highest Peak.
(c) Is the highest Peak Mount Everest.
(d) Everest Mount Peak is the highest

26. Believer/ he/ truth/ non-violence/ was/ and/ of.
(a) Believer he was of non-violence and truth
(b) He was believer of truth and non-violence
(c) Of truth and non-violence he was believer of
(d) Was he truth and non-violence of believer

27. Concerned/ the poor/ the untouchables/ was/ and/ he/ about.
(a) He was concerned about the poor and the untouchables
(b) Was concerned he about the poor and the untouchables
(c) He about the poor and the untouchables was concerned
(d) Was concerned he about the poor and the untouchables

28. Downtrodden/ call/ used to/ Harijans/ he/ as.
(a) As Harijans he used to call downtrodden.
(b) He used to call downtrodden as Harijans.
(c) Used to call he as downtrodden Harijans.
(d) Downtrodden as Harijans he used to call.

Answers

1	(b)	2	(c)	3	(d)	4	(b)	5	(a)	6	(c)	7	(a)	8	(b)	9	(d)	10	(b)
11	(b)	12	(c)	13	(b)	14	(c)	15	(a)	16	(b)	17	(b)	18	(c)	19	(a)	20	(c)
21	(b)	22	(b)	23	(a)	24	(a)	25	(b)	26	(b)	27	(a)	28	(b)				

CHAPTER

13

CLOZE TEST

In Cloze Test, a passage having some blanks is given. The blanks are numbered and for each blank four options are given at the end of the passage. The candidate is required to fill the blanks by choosing the suitable words from the given options that makes the passage meaningful and grammatically correct.

Cloze test is an assessment test to analyse the grammatical and vocabulary knowledge of a student.

Tips for Solving Cloze Test Questions

1. Read the given passage thoroughly to get an idea of the content of the passage.
2. While selecting the appropriate word to fill a given blank, the candidate should read the sentence with the blank and guess the part of speech that is required to fill the blank.
3. Now read next sentence and try to fill the blank in same way, you fill the first blank.
4. Once the candidate has selected all the options for the blanks given in a passage, he/she must read the passage with replacing the blanks and check whether passage becomes meaningful or not.
   Note Good vocabulary and knowledge of Phrasal verbs helps in solving the Cloze test questions accurately. So, a candidate must Improve his vocabulary to solve questions based on Cloze Test.

PRACTICE EXERCISE

Directions (Passages 1-10) *In each of the following passages, there are blanks and each blank has been numbered. These numbers are printed below the passage and against each four words are suggested, one of which fits the blank appropriately. Find out the appropriate word in each case.*

Passage 1

A food chain is a..... (1) between plants and animals. It starts with a plant. The next part of the link is a plant eater. When the prairie plants were uprooted, the animals that.....(2) on them lost their food source. So, while the farmers..... (3) more food for people, they broke the animals' food chain. For example, if a bird needs..... (4) to eat and the plant is gone, that bird will not be able to survive. And the animals that ate that bird won't have any food, either.

Questions

1. (a) link (b) source (c) base (d) chain
2. (a) lived (b) relied (c) cook (d) depended
3. (a) created (b) cooked (c) produced (d) sold
4. (a) flowers (b) fruits (c) seeds (d) roots

Passage 2

.....(1) figured out how the Earth changes. Earth orbits the Sun once each year. It travels once around the Sun every 365 days. The other eight planets in our solar system also .....(2) around the Sun. All travel in a pattern called an .....(3) , which is a kind of oval. So, at times Earth is .....(4) from the Sun.

Questions

1. (a) Doctors (b) Scientists (c) Astronauts (d) Teachers
2. (a) play (b) travel (c) orbit (d) circle
3. (a) circle (b) ellipse (c) eclipse (d) movement
4. (a) farther (b) closer (c) in front (d) opposite

Passage 3

Today there are cell phones. They do not need..... (1). They use signals that travel..... (2) the air. Some people now do not have a landline any more. They just use their cell phone. It can connect people. It can .....(3) music from the Internet. Some people even use their computers to talk .....(4) other people.

Questions

1. (a) receivers (b) wires (c) operators (d) connections
2. (a) from (b) of (c) by (d) through
3. (a) listen (b) upgrade (c) download (d) broadcast
4. (a) with (b) to (c) against (d) from

Passage 4

There is a fable about the ant and the grasshopper. The grasshopper played all summer while the ant .....(1). The ant got ready for winter. The ant was a hard worker. It dug a hole to stay in .....(2) winter. It carried food to that hole. When winter came, the ant was able to live. The grasshopper did not have any food. It had no place to stay. Winter was a great .....(3) for the grasshopper. It asked the ant for help. The ant was .....(4). The ant did help the grasshopper.

Questions

1. (a) toiled (b) relaxed (c) died (d) teased
2. (a) between (b) around (c) during (d) the
3. (a) risk (b) challenge (c) joy (d) adventure
4. (a) cruel (b) giant (c) generous (d) miser

Passage 5

India is an agricultural country. Most of the people live in villages and are .....(1). They grow cereals, pulses, vegetables and fruits. The farmers leads a .....(2) life. They get up early in the morning and go to the fields. They stay and work on the farm late till evening. The farmers usually live in kutcha houses. Though, they work hard they .....(3) poor. Farmers eat simple food; wear simple clothes and rear animals like cows, buffaloes and oxen. .....(4) them there would be no cereals for us to eat.

Questions

1. (a) farmers (b) businessmen (c) politicians (d) doctors
2. (a) tough (b) prosperous (c) easy (d) bad
3. (a) become (b) live (c) remain (d) die
4. (a) With (b) Without (c) By (d) From

Passage 6

The Sun is a huge ball of .....(1). It has a diameter of 1,392,000 km. It is so huge that it can hold millions of planets inside it. The Sun is mainly made .....(2) of hydrogen and helium gas. The surface of the Sun is known as the photosphere. The photosphere is surrounded by a .....(3) layer of gas known as the chromospheres.

Without the Sun, there would be no .....(4) on Earth. There would be no plants, no animals and no human beings. As, all the living things on Earth get their .....(5) from the Sun for their survival.

Questions

1. (a) gases (b) coals (c) fireworks (d) planets
2. (a) from (b) with (c) up (d) upon
3. (a) thick (b) thin (c) circular (d) during
4. (a) animal (b) life (c) energy (d) heat
5. (a) food (b) heat (c) hydrogen (d) energy

Passage 7

Firefighters have to take .....(1) tests to make sure their bodies are strong enough to do all of the work required. They have to be able to carry heavy objects, go up many flights of stairs, and work for a long time. Firefighters also go .....(2) frequent training. They need to be aware of the latest techniques in fighting fires, and keeping themselves and others safe. Not only do they .....(3) themselves, but they also talk to other people about fire .....(4). Some schools have the firefighters come in every year to .....(5) kids about how to stay safe around fire.

Questions

1. (a) biological (b) laboratory (c) physical (d) mental
2. (a) about (b) through (c) against (d) with
3. (a) save (b) learn (c) train (d) talk
4. (a) safety (b) alarm (c) fighters (d) extinguisher
5. (a) train (b) save (c) address (d) teach

Passage 8

Remembering Mahatma Gandhi, the Prime Minister .....(1) the nation that on 2nd October, 2014, the countrymen .....(2) to fulfill the dream of the Father of the Nation of a 'Clean India' by his 150th birth.....(3) (in 2019). Pitching on "Swachh

Bharat", the Prime Minister .....(4) the youth of the nation to come forward and .....(5) to the scheduled survey so that their cities do not lack behind in survey rankings.

Questions

1. (a) addressed
   (b) mentioned
   (c) reminded
   (d) remembered
2. (a) gifted (b) pledged
   (c) promised (d) ordered
3. (a) year
   (b) annual
   (c) anniversary
   (d) party
4. (a) urged (b) suggested
   (c) requested (d) ordered
5. (a) complete (b) do
   (c) make (d) contribute

Passage 9

The much awaited New Year is finally here. While you might have made .....(1) to exercise daily, read 20 books before the year ends, splurge less on clothes or learn to .....(2) a musical instrument, but have you spared a thought about your .....(3) life? In case, you are still figuring out what all you can do to climb up the corporate ladder in 2018, we have got you covered.

We have compiled a list of six small changes that can make a huge .....(4) in your career. Apart from increasing your daily productivity and managing the stress levels at workplace, these habits would also help you to .....(5) a better work life balance.

Questions

1. (a) plans (b) reports
   (c) expenses (d) resolutions
2. (a) play (b) make
   (c) teach (d) perform
3. (a) personal (b) professional
   (c) economical (d) social
4. (a) gap (b) difference
   (c) deviation (d) profit
5. (a) gain (b) find
   (c) maintain (d) achieve

Passage 10

Delhi is the capital of India. People from all parts of the country and the world .....(1) to Delhi. There are many historical buildings in Delhi. People .....(2) the Rajghat, Shantivan and Vijayghat. We visited Delhi last year .....(3) our cousins. It was a .....(4) experience as we visited many places in Delhi. The place I liked the .....(5) was the India Gate.

Questions

1. (a) came (b) comes
   (c) come (d) coming
2. (a) visited (b) visits
   (c) visiting (d) visit
3. (a) for (b) with
   (c) on (d) without
4. (a) grim (b) greatly
   (c) medium (d) great
5. (a) much (b) more
   (c) most (d) fast

Answers

Passage 1

1	*(a)*	2	*(d)*	3	*(c)*	4	*(c)*

Passage 2

1	*(b)*	2	*(c)*	3	*(b)*	4	*(a)*

Passage 3

1	*(b)*	2	*(d)*	3	*(c)*	4	*(b)*

Passage 4

1	*(a)*	2	*(c)*	3	*(b)*	4	*(c)*

Passage 5

1	*(a)*	2	*(a)*	3	*(c)*	4	*(b)*

Passage 6

1	*(a)*	2	*(c)*	3	*(b)*	4	*(b)*	5	*(d)*

Passage 7

1	*(c)*	2	*(b)*	3	*(c)*	4	*(a)*	5	*(d)*

Passage 8

1	*(c)*	2	*(b)*	3	*(c)*	4	*(a)*	5	*(d)*

Passage 9

1	*(d)*	2	*(a)*	3	*(b)*	4	*(b)*	5	*(d)*

Passage 10

1	*(c)*	2	*(d)*	3	*(b)*	4	*(d)*	5	*(c)*

CHAPTER

14

COMPREHENSION

(Unseen Passage)

A comprehension test consists of a passage upon which questions are asked. The main purpose of unseen passages is to test the candidate's ability to understand the content of the given text. Therefore, a student is required to read the passage carefully and choose the correct answer out of the alternatives, given under the questions.

In Comprehension, students are supposed to give the answers of the questions on the basis of their understanding of the passage.

Tips to Solve Comprehension

1. Read the given passage thoroughly to get the central idea of the passage.
2. Study the questions thoroughly. Turn to the relevant portions of the passage and choose the correct answer.
3. The answers must be based on the information given in the passage. You should not choose the answer according to your own thought or opinion.

PRACTICE EXERCISE

Passage 1

Mahatma Gandhi is unanimously looked upon as the greatest man of the world today. This is no underserved epithet. The ideals or self-sacrifice and love of truth which he has brought before the world's eyes are simply

adorable. His message of truth has awakened the sleeping population of India. But Gandhiji, like all other personages, belongs not only to a particular country but the whole world. His philanthropic mission is exemplary in the history of mankind. It is no wonder if the future progeny will look upon him as the incarnation of God himself.

1. What has awakened the sleeping population of India?
   (a) Gandhiji's message of truth
   (b) Gandhiji's faith in non-violence
   (c) Gandhiji's ideal of self-sacrifice
   (d) Gandhiji's vision of free India
2. Like all other personages Gandhiji
   (a) belongs to the whole world
   (b) likes truth
   (c) believes only in non-violence
   (d) is worshipped as God
3. It is no wonder if the future generation will look upon Mahatma Gandhi as
   (a) a great man of India
   (b) a lover of human kind
   (c) the incarnation of God himself
   (d) a divine person
4. The two ideals Gandhiji brought before the world are
   (a) self-sacrifice and love of truth
   (b) truth and non-violence
   (c) self-sacrifice and non-violence
   (d) truth and tolerance

Passage 2

The arrival of the train did not disturb Sir Mohan Lal's sangfroid. He continued to sip his Scotch and ordered the bearer to tell him when he had moved the luggage to a first class compartment. Excitement, bustle and hurry were exhibitions of bad breeding, and Sir Mohan was eminently well-bred. He wanted everything 'tickety-boo' and orderly. In his five years abroad, Sir Mohan had acquired the manners and attitudes of the upper classes. He rarely spoke Hindustani. When he did, it was like an Englishman's, only the very necessary words and properly anglicised. But he fancied his English, finished and refined at no less a place than the University of Oxford. He was fond of conversation and like a cultured Englishman he could talk on almost any subject-books, politics, people. How frequently had he heard English people say that he spoke like an Englishman !

1. Sir Mohan Lal is portrayed as
   (a) an Indophile (b) a true Englishman
   (c) a Hindu (d) an Anglophile
2. When Sir Mohan Lal spoke Hindustani it was
   (a) colloquial Hindi (b) literary Hindi
   (c) Indian English (d) anglicised Hindi
3. According to Sir Mohan Lal, a well-bred person would
   (a) remain aloof from the crowd
   (b) like to drink only Scotch in public
   (c) always be calm and orderly
   (d) speak like an Englishman
4. According to the passage, a cultured Englishman is able to talk effortlessly on
   (a) art and culture (b) modern science
   (c) human civilisation (d) almost any subject

Passage 3

There was once a boy who would never pay any attention to his studies. His parents sent him to school but he took to playing on the road and did not care for the opinion of even those friends who helped him in danger. One day a gentleman who was on the look out for a boy-servant, happened to come across him, wandering all alone in the street. He carried him away to a different-town and made him work day and night as a servant. Now, the boy repented his folly and one day while his master was fast asleep, he slipped away and after a good deal of trouble, reached home. He applied himself hard to his books now and rose, in after life, to be a great man.

1. Who took to playing on the road?
   (a) A servant (b) A boy
   (c) Parents (d) A gentleman
2. Who helped him in danger?
   (a) Friends (b) Parents
   (c) A gentleman (d) A boy-servant

3. What did the gentleman make him to do day and night?
   (a) Play (b) Study
   (c) Work (d) Sleep
4. "The boy slipped away when the master was....".
   (a) working (b) sleeping
   (c) playing cards (d) having lunch

Passage 4

The Earth is known as a 'watery planet' because it is the only planet of the solar system containing water in abundance. The presence of life on our planet is mainly due to water and air. More than two-thirds of the Earth's surface is covered with water. Oceans contain about 97% of the total water available on the Earth's surface. The fresh water found in the form of snow and ice on the ground and water in lakes and rivers accounts for the remaining 3%. Ocean water is always saline. Hence, it is not of direct use to man. It is however, important as it provides the bulk of water vapour that enters the atmosphere where it forms clouds.

1. The presence of life on our Earth is due to
   (a) good food and crops
   (b) good roads and motor cars
   (c) air and water
   (d) sunlight
2. ... surface of the Earth is covered with water.
   (a) More than half
   (b) More than two-thirds
   (c) Less than half
   (d) Less than two-thirds
3. Spot the correct statement.
   (a) Man uses ocean water directly
   (b) Fresh water is always saline
   (c) Ocean water is always saline
   (d) Earth gets water from Sun
4. Clouds are formed
   (a) by the water vapours
   (b) by the sunlight
   (c) by the ice and snow
   (d) by air and sunlight

Passage 5

In our approach to life, be it pragmatic or otherwise a basic fact that confronts us squarely and unmistakably is the desire for peace, security and happiness. Different forms of life at different levels of existence make- up the teeming denizens of this Earth of ours. And no matter whether they belong or the higher groups such as human beings or to the lower groups such as animals, all beings primarily seek peace, comfort and security. Life is as dear to a mute creature as it is to a man. Even the lowliest insect strives for protection against dangers that threaten its life. Just as each, one of us wants to live and not to die, so do all other creatures.

1. The author's main point is that
   (a) different forms of life are found on Earth
   (b) different levels of existence are possible
   (c) peace and security are the chief goals of all living beings
   (d) even the weakest creature struggles to preserve its life
2. How is life of a mute creature?
   (a) They are ignorant
   (b) It is as dear as a man itself
   (c) Cannot be forecast
   (d) It is comfortable
3. According to the passage, the higher groups are mentioned as
   (a) all the animals (b) all human beings
   (c) under threaten (d) mute like insects
4. Who does want to die?
   (a) None of us and all other creature
   (b) Happiness, peace
   (c) Human beings
   (d) Lower groups of animals

Passage 6

One of the major crises facing the country is the looming water shortage. A recent report of the UN has named India among the worst countries for poor quality of water. The report ranks 122 countries according to the quality of their water as well as their ability and commitment to improve the situation. Belgium is considered the worst

basically because of the quality of its ground water. Rains failed in most parts of India last year and the vast areas of Rajasthan, Madhya Pradesh, Andhra and Odisha were in the grip of devastating drought. People without water turn desperate and violent. Villagers in Rajasthan last year attacked the Food Corporation godowns. Worse may be coming. With man refusing to control pollution (America, the world's greatest polluter, refuses to co-operate with, other countries) the world's getting hotter. This means that the great ice shelves (weighing billions of tonnes) of the Antarctic are collapsing. We cannot even conceptualise the dangerous consequences.

1. Belgium is suffering acutely because
   (a) the sluggish pace of its economy
   (b) the discharge of industrial effluents
   (c) quality of its ground water
   (d) rising cost of living
2. Villagers in Rajasthan attacked Food Corporation godowns because of
   (a) low prices offered to them for wheat
   (b) refusal of Food Corporation to buy wheat from the local farmers
   (c) no financial help from the government bodies
   (d) shortage of water
3. What major crisis is the country facing today?
   (a) Rainfall (b) Water shortage
   (c) Drought (d) Violent
4. The world's greatest polluter country is
   (a) India (b) America
   (c) Belgium (d) Unknown

Passage 7

In Asia and much of Third World, trees are still destroyed in the old-fashioned way: they are cut down for fuel and cropland. In Europe, there is new and potentially more deadly culprit, The Germans call it 'Waldsterben', the dying forest syndrome. But the disease is far more than a German phenomenon. Since, it was first observed by German scientists in the, autumn of 1980, the mysterious malady has raced across Europe, blighting woods in countries as far apart as Sweden and Italy. Explanations for the epidemic range from a cyclic change in the environment to a baffling form of tree cancer. But the most convincing evidence points to air pollution. Indeed saving the rapidly deteriorating forests of Europe will probably require a two-pronged strategy an offensive campaign that includes the breeding of pollution- immune trees and a defensive scheme that calls for reductions in toxic emissions. But both will require more money than is currently being spent on such measures, as well as total commitment to protecting the environment.

1. Saving the trees of European forests
   (a) should not be difficult because of the advances in experimental research
   (b) appears to be a hopeless task and therefore pointless to undertake
   (c) requires a much bigger budget
   (d) demands vigilance and punitive measures against those who cut down the trees
2. The dying forest syndrome is a disease that
   (a) is peculiar to the forests of Asia
   (b) has spread rapidly over the forests of Europe
   (c) is confined to the forests of Germany
   (d) has affected forests all over the world
3. The writer suggests that
   (a) it is no longer possible to grow trees in industrialised areas
   (b) pollution immune trees will absorb toxic emissions
   (c) all pollution-prone tress should be destroyed
   (d) it is not possible to grow trees that remain unaffected by pollution
4. The writer's approach toward the problem of forest devastation in one of
   (a) tolerance (b) indifference
   (c) well through-out strategy
   (d) despondency

Passage 8

Ravi Shankar has a large circle of friends and is very popular at parties. Everybody admires him for his fine sense of humour everybody, that is, except his six-years old daughter Meenakshi. Recently, one of Ravi's friends asked him to make a speech at a reception. This is the sort of thing that Ravi loves. He prepared the speech carefully and went to the

party with Meenakshi. He had included a large number of funny stories in the speech and , of course, it was a great success. As soon as he had finished, Meenakshi told him she wanted to go home. Ravi was a little disappointed by this but he did as his daughter asked. On the way home, he asked Meenakshi if she had enjoyed the speech. To his surprise, she said she hadn't. Ravi asked her why this was so and she told him that she did not like to see so many people laughing at him.

1. Ravi was popular because
   (a) he made speeches (b) he told stories
   (c) he had a good sense of humour
   (d) he loved parties
2. Ravi loves to
   (a) meet people (b) talk to his daughter
   (c) make a speech (d) make people laugh
3. Ravi went to the party
   (a) with his wife (b) with his daughter
   (c) with his mother (d) with his friend
4. Ravi was disappointed because
   (a) Meenakshi did not enjoy his speech
   (b) Meenakshi wanted to go home immediately after the speech
   (c) people did not like his speech
   (d) Meenakshi did not like people laughing at Ravi

Passage 9

A woodpecker is a kind of bird. Woodpeckers are found all over the world except in the North and South poles, Australia and New Zealand. There are over 200 different kinds of woodpeckers. The two largest woodpeckers, the imperial woodpecker and the ivory-billed woodpecker are most likely extinct. Animals that are extinct are no longer found on Earth. Woodpeckers have sharp bills for drilling into wood and short, stiff tails. Woodpeckers also have very long tongues, which help them get at insects deep within trees. Woodpeckers are often heard drumming loudly on trees. Woodpeckers can even become pests if they learn to drum on siding of a house.

1. Why do woodpeckers have long tongues?
   (a) So they can drum on trees
   (b) To get at insects on the ground
   (c) To get at insects within trees
   (d) To eat seeds
2. When do woodpeckers sometimes become pests?
   (a) When they become extinct
   (b) When they drum on houses
   (c) When they eat suet
   (d) When they visit feeders
3. Woodpeckers are not found in
   (a) South Poles (b) Australia
   (c) New Zealand (d) All of these
4. Woodpeckers use their sharp bills for
   (a) flying high ,
   (b) drilling wood
   (c) sitting on the tree branches
   (d) drinking

Passage 10

The martyrs who laid down their lives for the freedom of the country, had a lofty vision of the future. They wanted the nation to be free from all the slavery and bondage. They wanted an India in which all the communities would live in prefect harmony and in which there would be no high class and no lowpass and no low class of people, the curse of untouchability having been wiped out completely. Women would enjoy equal rights with men and contribute their fullest to the making of a great nation. Such a vision was in keeping with the ancient glory of the country renowned for its splendid achievements in literature, art and culture. We must now revitalise this ancient culture of ours with tolerance as its masthead. If we forget or cease to take pride in our noble heritage. We shall have to face severe indictment in the court of history which is a ruthless judge and seldom spares the erring people.

1. The martyrs who died for the freedom of India wanted
   (a) the country to be the strongest nation in the world
   (b) the country to rule over the other nations
   (c) the country to be free from slavery
   (d) the people to give up their antiquated customs

2. These martyrs wanted that
   (a) there should be reservation in the jobs for the backward section of the society
   (b) there should be perfect communal love and peace in the country
   (c) the old caste system should be retained in the future
   (d) the women should look after their families only
3. We must strive with our total commitment
   (a) defeat and overcome the enemies of the nation
   (b) revitalise our rich past culture
   (c) inject scientific temper into our past culture
   (d) make scientific advancements
4. Our freedom fighters envisioned that in free India
   (a) there should be an egalitarian society
   (b) women would enjoy higher privileges and rights than others
   (c) the country would be taken forward by some selected classes of the society
   (d) industrialisation should occupy the top priority

Passage 11

Dr. S Radhakrishnan, the illustrious philosopher statesman of India, was one of the greatest sons of our motherland. He cautioned the world against the domination of Science in society. It is erroneous to claim that scientific knowledge would bring with it perpetual progress and a steady improvement in human relations. The recent period of great scientific achievements has also increased human misery in the world wars, concentration camps, atomic destruction, cold war, deadly wars in the middle East, Persian Gulf and at many other places in the world. Growth in human wisdom has not been commensurate with the increase in scientific knowledge and power. The fear of universal destruction hangs over the world. There is a feeling of disenchantment, anxiety and even despair. Science had failed to liberate man from the tyranny of his own nature. Mankind is passing through a critical period and an education of the human spirit has become essential. In order to remake society, man has to remake himself. If humanity is to survive, man must integrate his knowledge with a social responsibility.

1. Dr. S Radhakrishnan has
   (a) emphasised that science should be banished from the society
   (b) opposed the teaching of Science in educational institutions
   (c) favoured scientific thinking in life
   (d) counseled that preponderance of Science in life does not necessarily generate happiness
2. The recent past of tremendous scientific progress has
   (a) made the world a very happy place
   (b) led to global warming
   (c) brought about internal transformation in men
   (d) shown that human wisdom has not kept pace with galloping scientific knowledge
3. Man is despaired of Science because
   (a) Science has given too much knowledge
   (b) Science has brought him excessive material comforts
   (c) he has become a captive of science
   (d) he is confronted with the nightmare of total annihilation of the world
4. Man can save humanity only if he
   (a) abandons science
   (b) brings about an internal transformation in himself
   (c) makes his life more comfortable with scientific gadgets
   (d) goes back to nature and primitive times
5. In this passage, the writer has tried to show that
   (a) science is the only savior that shall lead humanity forward
   (b) science can bring about an end to all the wars
   (c) social change comes with the advancement of science
   (d) human wisdom must grow proportionately with growth of knowledge to evolve a creative integration to help mankind

Passage 12

I found that Mrs Heep slowly came nearer to me and Uriah got opposite to me, and they gave me all the best food on the table. They began to talk about their aunts; and I told them about my aunt. They talked about fathers and mothers, and I told them about my father and mother; and then I stopped because my aunt had advised me to be silent on that subject. But I had no chance against Uriah and Mrs Heep. They did what they liked with me. They got out of me things which I did not wish to tell.

1. The speaker told Uriah and Mrs Heep about his aunt because
   (a) they pleaded with him to do so
   (b) he liked talking about his aunt
   (c) they first talked about their aunts
   (d) they forced him to talk about his aunt
2. The speaker stopped talking about his parents because
   (a) he did not like the subject
   (b) he could not remember the details
   (c) his parents had forbidden him to do so
   (d) his aunt had told him not to discuss his parents
3. Uriah and Mrs Heep gave the speaker good food because
   (a) they were fond of him
   (b) they were kind by nature
   (c) the speaker asked for special treatment
   (d) they wanted to elicit information from him
4. When the speaker found that the Heeps were frank with him, he
   (a) admired their frankness
   (b) became suspicious of their motives
   (c) told them all they wanted to know
   (d) did not know what to do
5. The Heeps did what they liked with the speaker because
   (a) he was a fool
   (b) he was overwhelmed by their kindness
   (c) he forgot his aunt's advice
   (d) he was eager to tell them everything

Passage 13

Most of us use the products of science railways, aeroplanes, electricity, wireless and thousands of others-without thinking how did they come into existence. We take them for granted, as if we were entitled to them as a matter of right. And we are very proud of the fact that we live in an advanced age and act ourselves very advanced. Now, there is no doubt that our age is a very different one from previous ages and I think it is perfectly correct to say that it is far more advanced. But that is a different thing from saying that we as individuals or groups are more advanced. It would be the height of absurdity to say that because an engine driver can run an engine and Plato or Socrates could not, the engine driver is more advanced than, or is superior to, Plato or Socrates. But it would be perfectly correct to say that the engine itself is a more advanced method of locomotion than Plato's chariot was.

1. Which one of the following statements is correct?
   (a) An engine driver cannot be compared to Plato or Socrates
   (b) Plato or Socrates is in no way inferior to the engine driver
   (c) Plato or Socrates surpassed the engine driver in every respect
   (d) An engine driver is cleverer than Plato or Socrates
2. People today are very proud because they
   (a) live in a philosophically advanced age
   (b) live in a spiritually advanced age
   (c) enjoy digital communications
   (d) live in a scientifically advanced age
3. Many of us make use of Machines
   (a) with full knowledge of their genesis
   (b) without knowing how were they invented
   (c) with very little knowledge of their mechanism
   (d) without any knowledge of their historical significance
4. In this passage, the writer mentions Plato and Socrates to emphasise that
   (a) they had a great respect for learning
   (b) they were men of great scholarship

(c) people as individuals in the modern age are not more advanced than-their predecessors
(d) the engine is a better mode of locomotion than Plato's chariot

5. Which is not the product of science?
(a) Wireless (b) Aeroplanes
(c) Electricity (d) Wood

Passage 14

"As a farmer I was determined that we should get on the computer bandwagon", says Krishnappa Jagannath, the 40-years old head of the Gram Panchayat who initiated the whole process three years ago. With tips from a computer-savvy brother in the US, Jagannath drew up a plan and convinced others of its merit. Within no time, he was able to raise ₹ 65000 from the public, enough for the purchase of two assembled Pentium II computers. That was easy enough. But who would operate these machines? Jagannath decided that it had to be the villagers themselves. He got in touch with a software company, which agreed to train the villagers. Although wary initially, the people knew it was worth a try. As they realised it was not so difficult, more and more villagers joined in. Those like TS Shobha who showed a greater aptitude were sent for extensive training.

1. Initially Krishnappa Jagannath raised ₹ 65000
(a) as a loan from bank
(b) as a loan from Gram Panchayat
(c) from the public
(d) as a borrowing from his brother in the US

2. Krishnappa Jagannath is a
(a) computer engineer trained in the US
(b) head of the Gram Panchayat
(c) district Magistrate of Belandur
(d) senior secondary school teacher in Belandur

3. Initially the major problem which confronted the villagers was
(a) whether branded or assembled computers should be purchased
(b) arranging finance for purchase of computers
(c) as to who would operate the machines
(d) getting clearance from the Government authorities

4. TS Shobha was sent for extensive training because she
(a) was graduate
(b) showed a great aptitude for computers
(c) had a computer savvy brother in the US
(d) was very influential

5. Computer training for the villagers was arranged through
(a) computer society of India
(b) a software company
(c) Government of Karnataka
(d) a non-government organisation

Passage 15

It will be a mistake to think that he was given only 'bouquets' he also received many 'brickbats'. The Christian missionaries took alarm at his popularity. They used to raise funds by preaching that India was a land of heathens waiting to be saved by Christianity. The American press now began to say that it was a shame that anybody should try to teach India religion; rather the world should sit at her feet to learn it. Vivekananda also said that, India did not need religion but material support. The missionaries found that the subscriptions they had so long been receiving from the people were steadily declining. They blamed it on Swamiji. They now started denigrating him in all manner of ways. They even began to spread scandals against his personal character. Strangely enough, even some of his own countrymen joined them in this for reasons of their own. But 'Truth alone prevails', as Swamiji always preached. He did not try to defend himself, but others stood up for him and vehemently protested. Finally, all such mean attempts failed and his reputation only rose higher and higher.

1. The passage teaches us
(a) not to believe in religions other than our own
(b) not to get involved in scandals
(c) not to visit foreign lands
(d) not to deviate from the path of truth

2. Vivekananda was criticised by missionaries in America because
(a) he was a bad student of Western theology
(b) he opposed the tenets of Christianity
(c) Americans had become very fond of him
(d) he did not allow them to raise funds in India

3. Swami Vivekananda told the American people that India
   (a) did not approve of the Catholic Church
   (b) would teach religion to those who sit at her feet
   (c) required religious and material help
   (d) was self sufficient in religion though poor
4. Vivekananda's rapport with the American people
   (a) helped India get substantial aid
   (b) made his friends desert him
   (c) annoyed the American Government
   (d) caused a drop in Church's collection
5. Vivekananda did not defend himself because
   (a) he believed in the ultimate triumph of truth
   (b) he was in a foreign land
   (c) some of his countrymen were opposing him
   (d) he had brought many friends a long to fight for him

Passage 16

After submitting his resignation, Albert came out and took the long narrow road leading to the railway station which was one of the busiest roads in the city. Sad and depressed and worried about looking for a new job, Albert looked around for a cigarette shop. He walked up to the end of the road, but found no tobacconist. It was odd that such a busy thoroughfare with thousands of people passing through did not even have a single cigarette shop. He suddenly felt that it was no longer necessary for him to hunt for a job. He decided to open a tobacco shop himself. It was bound to be profitable, he felt.

1. After submitting his resignation, Albert came out worried about
   (a) a shelter
   (b) cigarettes
   (c) a job
   (d) the next available train
2. Albert was sad and depressed because
   (a) he had no money for the train journey
   (b) he had to walk on a long road
   (c) he was not able to buy cigarettes
   (d) he was worried about finding a job
3. There was no cigarette shop on that road because
   (a) smoking is banned in that area
   (b) just by chance nobody had opened one on that road
   (c) it was a very narrow road
   (d) cigarette shop owners do not make any profit
4. Albert decided not to look for a new job because
   (a) the thought of having to look for a job greatly distressed him
   (b) he did not want to work at all
   (c) there was no hope of finding a job
   (d) he saw the possibility of self-employment
5. A cigarette shop on a busy road was bound to be profitable because
   (a) cigarette shops are known to make a great deal of profit
   (b) any shop on a busy street would attract a large number of customers
   (c) cigarettes are inexpensive items and people buy them willingly
   (d) a cigarette shop on a busy road would attract a large number of customers

Passage 17

She regarded herself as the luckiest person on the Earth. Each of her sons insisted that she should stay with him. Many times, there were hot exchanges among the brothers on the issue. Her husband had left her an abundance of wealth and large property. She was so much overwhelmed with their devotion and affection that she distributed all her wealth and property among them ignoring the advice of her well wishers. Now her sons began to avoid her as if she were suffering from some infectious disease. Each turned her out of his house with one excuse or the other. One said that her presence disturbed the peace of his family. Another said that the education of his children suffered on her account. The third accused her of stealing money. She died heart broken in a home for the destitute.

1. She regards herself as the luckiest one as
   (a) she had three sons
   (b) her sons were apparently devoted to her
   (c) she had a lot of wealth
   (d) she was living with her family

2. She received so much love and affection from her sons because
   (a) they felt indebted to their mother
   (b) they wanted to keep her happy
   (c) she had lost her husband at an early age
   (d) she possessed abundance of wealth and large property
3. She distributed property and wealth among her sons because
   (a) she was overwhelmed with their devotion and affection
   (b) they wanted it
   (c) she was on the verge of death
   (d) she had lost interest in property
4. Her sons avoided her after she had given them her wealth and property because
   (a) she could not adjust in their family
   (b) she was suffering from an infectious disease
   (c) she was left with no wealth and property
   (d) she spoilt their children
5. She died heart broken because
   (a) she had lost all money
   (b) she was ill treated at the home for the destitute
   (c) she could not bear separation from her sons
   (d) her sons had abandoned her

Passage 18

It is said that once three old men set out on a journey together. One of them was bald, the second was a philosopher and the third was a barber. At nightfall, they decided that each one of them should sit for watch turn by turn. The barber was to keep watch first of all, the philosopher after that and the bald man last of all. So, the philosopher and the bald man went to sleep and the barber was on watch. For some time, he kept awake but in the end, he felt tired of it and he thought of some diversion as otherwise it was difficult for him to pass time. Then he took out the razor from his box and shaved the head of the philosopher. At the fixed time, he woke up the philosopher and himself went to sleep. When the philosopher got up and felt his head all over, he was startled and said in surprise, "It was my turn but this wretched fellow has awakened bald man."

1. Why did the philosopher get up?
   (a) He realised that his head was being shaved off
   (b) It was his turn to keep watch
   (c) He was awakened by the barber
   (d) He had a bad dream
2. Who went to sleep first?
   (a) The philosopher and the barber
   (b) The barber and the bald man
   (c) The bald man and the philosopher
   (d) The barber
3. Why did the barber shave off the head of the philosopher?
   (a) The barber was jealous of the philosopher
   (b) The barber wanted to indulge in some fun
   (c) The barber wanted the philosopher to keep watch
   (d) The barber was feeling drowsy
4. Which one of the following is the correct sequence decided upon by the three to keep watch turn by turn?
   (a) Barber - bald man - philosopher
   (b) Bald man - philosopher - barber
   (c) Barber - philosopher - bald man
   (d) Bald man - barber - philosopher
5. Which one of the following statements is not correct?
   (a) All the three men decided to keep watch one by one
   (b) The barber woke up the bald man
   (c) The head of the philosopher was shaved off
   (d) The philosopher was startled on feeling his head all over

Answers

Passage 1

1 *(a)* 2 *(a)* 3 *(c)* 4 *(a)*

Passage 2

1 *(d)* 2 *(d)* 3 *(c)* 4 *(d)*

Passage 3

1 *(b)* 2 *(a)* 3 *(c)* 4 *(b)*

Passage 4

1 *(c)* 2 *(b)* 3 *(c)* 4 *(a)*

Passage 5

1 *(c)* 2 *(b)* 3 *(b)* 4 *(a)*

Passage 6

1 *(c)* 2 *(d)* 3 *(b)* 4 *(b)*

Passage 7

1 *(c)* 2 *(b)* 3 *(d)* 4 *(c)*

Passage 8

1 *(c)* 2 *(c)* 3 *(b)* 4 *(b)*

Passage 9

1 *(c)* 2 *(c)* 3 *(d)* 4 *(b)*

Passage 10

1 *(c)* 2 *(b)* 3 *(b)* 4 *(a)*

Passage 11

1 *(d)* 2 *(d)* 3 *(d)* 4 *(b)* 5 *(d)*

Passage 12

1 *(c)* 2 *(d)* 3 *(d)* 4 *(c)* 5 *(b)*

Passage 13

1 *(a)* 2 *(d)* 3 *(b)* 4 *(c)* 5 *(d)*

Passage 14

1 *(c)* 2 *(b)* 3 *(c)* 4 *(b)* 5 *(b)*

Passage 15

1 *(d)* 2 *(c)* 3 *(d)* 4 *(d)* 5 *(a)*

Passage 16

1 *(c)* 2 *(d)* 3 *(b)* 4 *(d)* 5 *(b)*

Passage 17

1 *(b)* 2 *(d)* 3 *(a)* 4 *(c)* 5 *(d)*

Passage 18

1 *(b)* 2 *(c)* 3 *(b)* 4 *(c)* 5 *(b)*

JAWAHAR
NAVODAYA
VIDYALAYA

हिन्दी

अध्याय
01

वर्ण-विचार व वर्तनी विवेक

प्रस्तुत अध्याय वर्ण, वर्णमाला, स्वर, व्यंजन तथा वर्तनी सम्बन्धी अशुद्धियों को कैसे दूर करें आदि पर आधारित है।

वर्ण की परिभाषा

"भाषा की वह सबसे छोटी इकाई, जिसके और टुकड़े न किए जा सकें, वर्ण कहलाती है।"

वर्ण भाषा का आधार होते हैं, जिनसे शब्दों की रचना होती है।

उदाहरण

किसान फसल उगाएगा।

किसान = क् + इ + स् + आ + न् + अ
फसल = फ + अ + स् + अ + ल् + अ
उगाएगा = उ + ग् + आ + ए + ग् + आ

उपर्युक्त वाक्य तीन शब्दों से मिलकर बना है। यहाँ 'किसान', 'फसल' और 'उगाएगा' तीनों ही शब्द छः वर्णों से बने हैं। अब इनके और टुकड़े करना सम्भव नहीं है।

वर्णमाला

वर्णों का समूह वर्णमाला कहलाता है। अन्य शब्दों में "किसी भाषा में वर्णों के व्यवस्थित समूह को वर्णमाला कहते हैं।"

वर्णों के भेद

वर्णों के दो भेद होते हैं

1. स्वर

जिन वर्णों के उच्चारण में किसी अन्य वर्ण की सहायता नहीं लेनी पड़ती तथा जिनके उच्चारण बिना रुकावट के बाहर निकलते हों, उन्हें स्वर कहते हैं;

जैसे—अ, आ, इ, ई, उ, ऊ.....आदि।

स्वर के तीन भेद होते हैं; जैसे–

(i) **ह्रस्व स्वर** जिन वर्णों के उच्चारण में बहुत कम समय लगता है, उन्हें ह्रस्व स्वर कहते हैं। इनकी संख्या **चार** है–**अ, इ, उ** और **ऋ**।

(ii) **दीर्घ स्वर** जिन वर्णों के उच्चारण में ह्रस्व स्वर से अधिक समय लगता है, उन्हें दीर्घ स्वर कहते हैं। इनकी संख्या **सात** है–**आ, ई, ऊ, ए, ऐ, ओ** और **औ**।

(iii) **प्लुत स्वर** जिन वर्णों के उच्चारण में दीर्घ स्वर से अधिक समय लगता है, उन्हें प्लुत स्वर कहते हैं। इनका प्रयोग प्राय: किसी को पुकारने के लिए किया जाता है; जैसे–ओऽम, राऽम, हेऽऽ आदि।

स्वरों की मात्राएँ

जब शब्दों की शुरूआत स्वर से होती है, तो उन्हें मूल रूप में लिखा जाता है। व्यंजन के साथ इनका प्रयोग मूल रूप में न करके मात्रा के रूप में किया जाता है।

प्रत्येक स्वर के लिए अलग-अलग मात्राएँ निश्चित हैं। इन्हीं मात्राओं के रूप में ये स्वर व्यंजन से जुड़ते हैं।

उदाहरण

स्वर	मात्रा	प्रयोग एवं मात्रायुक्त शब्द	
अ	कोई मात्रा नहीं	क् + अ = क	कल, कब
आ	ा	क् + आ = का	काल, काम
इ	ि	क् + इ = कि	किधर, किनारा
ई	ी	क् + ई = की	कील, कीचड़
उ	ु	क् + उ = कु	कुल, कुछ
ऊ	ू	क् + ऊ = कू	कूदना, कूप
ऋ	ृ	क् + ऋ = कृ	कृषक, कृपा
ए	े	क् + ए = के	केशव, केवल
ऐ	ै	क + ऐ = कै	कैलाश, कैसा
ओ	ो	क् + ओ = को	कोयला, कोप
औ	ौ	क् + औ = कौ	कौशल, कौरव

2. व्यंजन

जिन वर्णों के उच्चारण में स्वतन्त्र रूप से स्वरों की मदद लेनी पड़ती है तथा जिनका उच्चारण स्वतन्त्र रूप से नहीं किया जा सकता है, उन्हें व्यंजन कहते हैं; जैसे–क, ख, ट, फ, य, ह आदि। इनकी संख्या **33** होती है।

व्यंजन के निम्न आधार पर भेद किए जा सकते हैं

(i) उच्चारण के आधार पर

(a) **स्पर्श व्यंजन** जिन व्यंजन वर्णों के उच्चारण में हवा मुँह के विभिन्न भागों को छूती हुई या स्पर्श कर बाहर निकलती है, उन्हें स्पर्श व्यंजन कहते हैं। इनकी संख्या 25 है। ये व्यंजन हैं

क वर्ग	क	ख	ग	घ	ङ	(उच्चारण स्थान कण्ठ)
च वर्ग	च	छ	ज	झ	ञ	(उच्चारण स्थान तालु)
ट वर्ग	ट	ठ	ड	ढ	ण	(उच्चारण स्थान मूर्द्धा)
त वर्ग	त	थ	द	ध	न	(उच्चारण स्थान दाँत)
प वर्ग	प	फ	ब	भ	म	(उच्चारण स्थान ओष्ठ)

इनमें प्रत्येक वर्ग के अन्तिम वर्ण (अक्षर) को **पंचमाक्षर** भी कहा जाता है।

(b) **अन्त:स्थ व्यंजन** जिन व्यंजनों का उच्चारण करते समय जीभ, मुँह के किसी भी भाग से पूरी स्पर्श नहीं करती है और न ही स्वरों के समान स्वतन्त्र रूप से बाहर निकलती है, उन्हें अन्त:स्थ व्यंजन कहा जाता है। इनका उच्चारण स्वर एवं व्यंजन के बीच का होता है। इनकी संख्या **चार** है। ये व्यंजन हैं–**य, र, ल** और **व**।

'व' को दंतोष्ठ्य व्यंजन भी कहा जाता है, क्योंकि इसके उच्चारण में दाँत और होठों का परस्पर स्पर्श होता है।

(c) **ऊष्म व्यंजन** जिन व्यंजनों का उच्चारण करते समय हवा मुँह से रगड़ खाकर ऊष्मा (गर्मी) उत्पन्न करती है, उन्हें ऊष्म व्यंजन कहते हैं। इनकी संख्या **चार** है। ये व्यंजन वर्ण हैं-श, ष, स और ह।

(ii) श्वास (प्राण) की मात्रा के आधार पर

इस आधार पर व्यंजनों के दो भेद होते हैं

(a) **अल्पप्राण** जिन व्यंजनों के उच्चारण में श्वास वायु कम निकलती है, उन्हें अल्पप्राण व्यंजन कहते हैं। प्रत्येक वर्ग का पहला, तीसरा और पाँचवाँ व्यंजन अल्पप्राण होता है; जैसे—

वर्ग	पहला	तीसरा	पाँचवाँ
क वर्ग	क	ग	ङ
च वर्ग	च	ज	ञ

(b) **महाप्राण** जिन व्यंजनों के उच्चारण में श्वास वायु अधिक मात्रा में निकलती है, उन्हें महाप्राण व्यंजन कहते हैं। प्रत्येक वर्ग का दूसरा और चौथा व्यंजन महाप्राण होता है; जैसे–

वर्ग	दूसरा	चौथा
क वर्ग	ख	घ
च वर्ग	छ	झ

संयुक्त व्यंजन

जब दो-या-दो से अधिक व्यंजन परस्पर मिलते हैं, तो उसे संयुक्त व्यंजन कहते हैं। उदाहरणार्थ-च्छ, क्क, क्ष, त्र आदि संयुक्त व्यंजन के उदाहरण हैं। संयुक्त व्यंजन को व्यंजन-गुच्छ भी कहते हैं। इन्हें निम्न रूपों में व्यक्त किया जा सकता है—

1. संयुक्त व्यंजनों के स्वतन्त्र प्रयोग में क्ष, त्र, ज्ञ एवं श्र चार ऐसे संयुक्त व्यंजन हैं, जिन्हें स्वतन्त्र रूप में प्रयोग किया जाता है।
   क्ष = क् + ष, **त्र** = त् + र, **ज्ञ** = ज् + ञ, **श्र** = श् + र
   क्ष = क्षमा, क्षत्रिय, कक्षा
   त्र - त्रिशूल, शत्रु, स्वतन्त्र
   ज्ञ = ज्ञान, विज्ञान, विज्ञ
   श्र - श्रमिक, परिश्रम, श्रेष्ठ
2. द्विवत्व व्यंजन के रूप में
   न् + **न** = प्रसन्न, **द्** + **द** = उद्देश्य, **ज्** + **ज** = सज्जन
3. संयुक्ताक्षर रूप में
   द् + **य** = उद्योग, **त्** + **प** = उत्पन्न, **स्** + **थ** = स्थान

आगत व्यंजन

हिन्दी में उर्दू-फारसी, अरबी भाषाओं के शब्द प्रयुक्त होते हैं। इनके शुद्ध उदाहरण के कुछ वर्णों के नीचे नुक्ता (बिन्दु) लगाया जाता है।

उदाहरण—ज़मींदार, ज़रा, .फीचर, फ़ीरोज, कज़ाकी आदि।

अनुस्वार

इसका उच्चारण 'न' या 'म' के स्वर रहित रूप जैसा होता है। इसका प्रयोग वर्तमान में पंचम वर्णों के स्थान पर किया जाता है। इसका चिह्न (ं) है। ये पंचम वर्ण हैं- 'ङ', 'ञ', 'ण', 'न' और 'म'।

उदाहरण गङ्गा-गंगा, चञ्चल-चंचल, ठण्डा-ठंडा
नन्दन-नंदन, सम्बन्ध-संबंध

अनुनासिक

इसके उच्चारण में नाक और मुँह दोनों से आवाज आती है। इसका दूसरा नाम चन्द्रबिन्दु भी है, जिसका चिह्न (ँ) है।

उदाहरण आँख, गाँव, पाँव, चाँद आदि।

जिन शब्दों में शिरोरेखा के ऊपर मात्रा होती है, वहाँ अनुनासिक का प्रयोग बिन्दु के रूप में किया जाता है; जैसे—मैं, गोंद, होंगे, भोंपू, कोंपलें आदि।

'र' के विभिन्न रूप

(i) 'र' का स्वर रहित रूप किसी व्यंजन के पूर्व आने पर वह अगले वर्ण पर रेफ र्‍ के रूप में लगता है; जैसे—धर्म, कर्त्तव्य, वर्षा, अर्पण आदि।

(ii) 'र' का स्वर सहित रूप किसी व्यंजन के बाद आने पर वह उस व्यंजन के निचले भाग में जुड़ जाता है। इसे पदेन कहा जाता है; जैसे-प्रमोद, व्रत, वज्र, भ्रम, क्रम, ग्रह आदि।

(iii) 'र' का स्वर युक्त रूप 'ट' एवं 'ड' वर्णों के साथ अलग रूप धारण कर लेता है; जैसे—ट्रक, ड्रामा आदि।

(iv) 'त्' के साथ 'र' मिलकर 'त्र' और श् के साथ मिलकर 'श्र' बन जाता है; जैसे—त्रिकोण, मन्त्र, श्रमिक, परिश्रम आदि।

वर्तनी तथा उच्चारण

लिखने की रीति को वर्तनी कहा जाता है। वर्तनी का सम्बन्ध उच्चारण से होता है। हिन्दी में जो बोला जाता है, वही लिखा जाता है। उच्चारण अशुद्ध होने पर वर्तनी भी अशुद्ध होती है। प्राय: लोग जिन शब्दों के उच्चारण एवं वर्तनी में अशुद्धियाँ करते हैं, उन शब्दों के अशुद्ध और शुद्ध रूप को *निम्न तालिका में देखा जा सकता है*

स्वर सम्बन्धी अशुद्धियाँ

अशुद्ध	*शुद्ध*	*अशुद्ध*	*शुद्ध*
अकाश	आकाश	पुत्रि	पुत्री
अहार	आहार	श्रीमति	श्रीमती
साधू	साधु	वधु	वधू
त्यौहार	त्योहार	गोरव	गौरव
दांत	दाँत	प्राय	प्राय:

व्यंजन सम्बन्धी अशुद्धियाँ

अशुद्ध	*शुद्ध*	*अशुद्ध*	*शुद्ध*
आकांछा	आकांक्षा	छन	क्षण
जोग	योग	जमुना	यमुना
पेड	पेड़	मेढ़क	मेढक
खाणा	खाना	रसायण	रसायन

अभ्यास प्रश्न

1. भाषा की सबसे छोटी इकाई है
(a) शब्द (b) वाक्य (c) वर्ण (d) वाक्यांश

2. वर्णों का व्यवस्थित समूह कहलाता है
(a) कहावतें (b) शब्दमाला
(c) व्यंजनमाला (d) वर्णमाला

3. वर्णों के कितने भेद होते हैं?
(a) दो (b) तीन (c) चार (d) पाँच

4. किन वर्णों के उच्चारण में अन्य वर्ण की आवश्यकता नहीं पड़ती?
(a) व्यंजन (b) संयुक्त व्यंजन
(c) स्वर (d) आगत स्वर

5. निम्न में से ह्रस्व स्वरों का सही समूह है
(a) अ, इ, ऊ, ए (b) अ, इ, उ, ऋ
(c) आ, ई, ऊ, ऋ (d) अ, आ, इ, ई, ऋ

6. किन वर्णों के उच्चारण में दीर्घ स्वर से अधिक समय लगता है?
(a) प्लुत स्वर (b) ह्रस्व स्वर (c) दीर्घ स्वर (d) संयुक्त स्वर

7. व्यंजनों की संख्या होती है
(a) 85 (b) 33 (c) 36 (d) 40

8. स्पर्श व्यंजनों की संख्या होती है
(a) 26 (b) 27 (c) 15 (d) 25

9. 'ट' वर्ग के वर्णों का उच्चारण स्थान है
(a) कण्ठ (b) तालु (c) मूर्द्धा (d) ओष्ठ

10. दन्तोष्ठ्य व्यंजन है?
(a) य (b) र (c) ल (d) व

11. श्वास की मात्रा के आधार पर व्यंजनों के कितने भेद होते हैं?
(a) 1 (b) 3 (c) 4 (d) 5

12. किन व्यंजनों के उच्चारण में श्वास वायु कम निकलती है?
(a) महाप्राण (b) अल्पप्राण
(c) स्वर (d) संयुक्त व्यंजन

13. अल्पप्राण होता है
(a) वर्ग का पहला, दूसरा, तीसरा व्यंजन
(b) वर्ग का दूसरा, चौथा व्यंजन
(c) वर्ग का पहला, तीसरा, पाँचवाँ व्यंजन
(d) वर्ग का पहला, चौथा व्यंजन

14. निम्न में महाप्राण व्यंजन है
(a) क (b) ख (c) ग (d) ज

15. ऊष्म व्यंजनों का उचित समूह है
(a) य, र, श, ष (b) श, ष, स, ह
(c) ल, व, ष, स (d) य, र, श, ष

16. 'ज्ञ' किन दो व्यंजनों से बना है?
(a) ग् और य (b) ज् और य
(c) ज् और ञ (d) ज् और ङ

17. 'श्र' का व्यंजन रूप है
(a) श + र् (b) श् + र
(c) ष् + र (d) स् + र

18. आगत व्यंजन है
(a) प (b) फ (c) फ़ (d) ब

19. निम्न में पंचम वर्ण है
(a) त (b) थ (c) म (d) ह

निर्देश (प्रश्न संख्या 20-24) *में दिए गए अशुद्ध शब्दों के लिए शुद्ध शब्दों का चयन कीजिए*

20.
(a) नरज (b) नाराज (c) नारज (d) नरजा

21.
(a) गुर (b) गूरू (c) गूरु (d) गुरु

22.
(a) रूची (b) रुचि (c) रुची (d) रूचीन्

23.
(a) नूपुर (b) नूपूर (c) नुपुरु (d) नूपुरू

24. (a) उज्जवल (b) उजवल
(c) उज्ज्वल (d) उजज्वल

उत्तरमाला

1.	(c)	2.	(b)	3.	(a)	4.	(c)	5.	(b)	6.	(a)	7.	(b)	8.	(d)	9.	(c)	10.	(d)
11.	(a)	12.	(b)	13.	(c)	14.	(b)	15.	(b)	16.	(c)	17.	(b)	18.	(c)	19.	(c)	20.	(b)
21.	(d)	22.	(b)	23.	(a)	24.	(c)												

अध्याय
02

शब्द-भेद
(स्रोत/उत्पत्ति)

प्रस्तुत अध्याय स्रोतों या उत्पत्ति के आधार पर शब्दों के वर्गीकरण पर आधारित है। इसके अन्तर्गत तत्सम, तद्भव देशज, विदेशज आदि शब्दों के प्रकारों का अध्ययन करेंगे

शब्द

वर्णों के मेल से बना स्वतन्त्र तथा अर्थपूर्ण वर्ण-समूह **शब्द** कहलाता है। शब्दों का वर्गीकरण चार आधारों पर होता है—अर्थ, रचना, उत्पत्ति या स्रोत तथा रूपान्तर।

यहाँ हम उत्पत्ति या स्रोत के आधार पर शब्दों का अध्ययन करेंगे।

***उत्पत्ति** या **स्रोत** के आधार पर शब्द चार प्रकार के माने गए हैं*

1. **तत्सम** 'तत्सम' ऐसे शब्द हैं, जो संस्कृत के शब्द होते हुए भी अपने मूल रूप में हिन्दी में प्रयुक्त होते हैं; जैसे—अग्नि, अश्रु इत्यादि।

   उदाहरण अग्नि, अष्ट, अंचल अश्रु, कृषि, कर्म, कपाट, कूप, कोश, कोकिल, चन्द्र, सूर्य, दुग्ध, भूमि, नग्न, नवीन, पर्वत, मध्य, मयूर, भ्रमर, रात्रि, सर्प, स्नान, शाक, ग्रीष्म, आर्द्र, गृह, दन्त, शताब्दी, सदी, चूर्ण, धूलि, नक्र, चर्य, नक्षत्र, निष्ठुर, पिप्पल, पुण्य, पूर्ण, तिक्त, तप्त, त्रोटक, तालक, तीक्ष्ण, पुष्कर, पत्र, पञ्जर, प्रतिवास, पाषाण, प्रस्तर, चंचु, चैत्र, कोटि, कर्पूर, अक्षि इत्यादि।

2. **तद्भव** तद्भव संस्कृत के ऐसे शब्द हैं, जिनका हिन्दी में आकर रूप परिवर्तित हो गया है; जैसे—अग्नि से आग, अश्रु से आँसू इत्यादि।

   उदाहरण आग, आठ, आँचल, आँसू, खेतों, काम, किवाड़, कुआँ, कोयल, चाँद, सूरज, दूध, माटी, पहाड़, बीच, मोर, भँवरा, रात, साँप, नहाना, सूखा, गर्मी, दाँत, बरस, धरती, दही, जीभ, हाथ, चूरण, धूल , नाक, चाम, नखत, निठुर, पीपल, पुन्य, पूरण, तीता, ताप, तीखा, पोखर, पत्ता, पिंजर, पड़ोस, पत्थर, पहाड़, चोंच, चैत, करोड़, कपूर, आँख, नैन, पता, पंछी, पीतल, पूस आदि।

3. **देशज** देशज ऐसे शब्द हैं, जो स्थानीय बोलियों से हिन्दी में आए हैं; जैसे—पेट, पगड़ी, गोड़ इत्यादि।

उदाहरण कटोरा, खिड़की, खिचड़ी, लोटा, लड़का, गाड़ी, ठठेरा, डिबिया, चिड़िया, जूता, कौड़ी, पानी, पगड़ी, तेन्दुआ, फुनगी, टहनी, सेठ, माथा, पेट, लात, मुक्का, थप्पड़, चाँटा, अचानक, अटपटा, ऊलजलूल, कचोटना, करकना, खोखला, गद्दा, खद्दर, खूँटी, घमण्ड, गुप-चुप, गोंद, चट्टान, चप्पल, गेंदा आदि। इन्हें देशज शब्द कहा जाता है।

4. **विदेशज** हिन्दी भाषा में बहुत से शब्द विदेशी भाषाओं के समाविष्ट हो गए हैं, जिन्हें हिन्दी में सहजता से प्रयुक्त किया जाता है, इन्हें विदेशज शब्द कहा जाता है। *कुछ विदेशी भाषाओं के प्रमुख विदेशज शब्द निम्नलिखित हैं*

(अ) **अरबी-शब्द**

अदा	अजब	अमीर	अदावत	अक्ल	असर
अहमक़	अल्लाह	आसार	आख़िर	आदमी	आदत
इनाम	इज़्ज़त	इमारत	इस्तीफ़ा	इलाज	ईमान
उम्दा	उम्र	एहसान	औरत	औलाद	कुसूर
कदम	क़ब्र	क़सर	कत्ताल	क़र्ज	किस्सा
किस्मत	किला	क़सम	क़ीमत	कसरत	कुर्सी
किताब	कायदा	ख़बर	ख़त्म	ख़त	खराब
खुतूत	खयाल	ग़रीब	जुलूस	जिस्म	जलसा
जनाब	जवाहर	जवाब	जहाज़	जालिम	ज़िक्र
तमाम	तकाज़ा	तक़दीर	रियाज़	ताक़िया	तमाशा
तरफ	तरक्की	तजुरबा	तादाद	दाखिल	दिमाग़
दवा	दावा	दावत	दफ़्तर	दग़ा	दाग़
दुआ	दुजा	दिक	दुनिया	दौलत	दीन

(आ) **फारसी-शब्द**

अफ़सोस	आबदार	आतिशबाजी	अदा	आमदनी	आवार
औलिया	अंजीर	अनार	अंगूर	आईना	आफ़त
आवाज	आइन्दा	उम्मीद	इत्र	ईमानदार	कबूतर
कुश्ती	किशमिश	किनारा	ख़ामोश	खरगोश	ख़ुश
गर्द	गल्ला	गोला	गवाह	गिरफ़्तार	गरम
गिरह	गुलाब	गोश्त	चश्मा	चाबुक	चादर
चालाक	चिराग़	चेहरा	जंग	ज़हर	ज़िन्दगी
जादू	जागीर	जुरमाना	जोश	तरकश	तमाशा
तेज़	तनख़्वाह	ताज़ा	दीवार	देहान्त	दुकान
दंगल	दिल	दवा	नापसन्द	नापाक	नौजवान
पाजामा	पाक	परदा	परहेज	परवाह	पलंग

(इ) **तुर्की-शब्द**

आगा	आका	उजबक	उर्दू	कालीन	क़ाबू
कैंची	कुली	कुर्की	चिक	चमचा	चेचक
चारपाई	चाक़ू	चुगल	चोगा	चकमक	जाजिम
तोप	तुरुक	तमगा	तलाश	बेग़म	बहादुर
बुलबुल	बीवी	दरोगा	लफंगा	लाश	मुग़ल

(इ) **पश्तो-शब्द**

अखरोट	अटकल	गड़बड़	गुण्डा	जमालगोटा	भड़ास
नगाड़ा	पठान	पटाखा	मटरगश्ती	रुहेला	लुच्चा
अगस्त	अप्रैल	अक्तूबर	अपील	ऑफिसर	अर्दली
इंच	इंजिन	इंजीनियर	इनकमटैक्स	इनक्रीमेण्ट	एडवांस
एजेण्ट	कम्पनी	कमीशन	कमिश्नर	कॉलेज	पंक्चर
स्कूल	स्टेशन	मोटर	कैलेण्डर	कमेटी	कॉंग्रेस
कॉपी	कॉलर	स्कूटर	साइलिक	बस	टैक्सी
कार	टेबल	इंजेक्शन	डॉक्टर	थर्मामीटर	मलेरिया
जज	डिग्री	जेलर	टिकट	टेनिस	डायरी
मास्टर	ड्राइवर	दिसम्बर	नर्स	नम्बर	पॉकेट
पार्क	पार्टी	पार्सल	पेन्सिल	पेट्रोल	प्लेग
पुलिस	प्रेस	फैक्टरी	मनीऑडर	फीस	फुट

पुर्तगाली (पुर्तगीज) शब्द

पुर्तगाली (पुर्तगीज) शब्द निम्नलिखित हैं।

अनानास, अचार, आलमारी, आल्पीन, कमीज, काजू, कनस्तर, सागौन, कमरा, गमला, बदाम, चाबी, तम्बाकू, नीलम, परात, पावरोटी, पादरी, पिस्तोल, फीता, बाल्टी, सन्तरा, इस्पात, इस्तिरी, फर्मा, मस्तुल, मेज, कोको, पपीता, गोभी, तौलिया, लबादा आदि।

रोमन अगरेज़ी महीनों के नाम—फरवरी, जुलाई, दिसम्बर

फ्राँसीसी अँगरेज़ी, कूपन, कारतूस

डच तुरुप, बम, ड्रिल, स्काउट

जर्मन किण्डरगार्टन, ब्लिट्ज़, नात्सी

चीनी चाय, लीची, पटाखा, तूफ़ान

जापानी रिक्शा

अफ्रीकी वेंजो

लैटिन इंच, एजेण्डा, कोटा, कोरम, जनवरी, अक्तूबर, नवम्बर, पेंशन, मशाल, स्कूल।

संकर शब्द हिन्दी में कुछ शब्द दो भाषाओं के शब्दों के मेल से बन गए हैं, इन्हें संकर शब्द कहते हैं; जैसे—रेलगाड़ी, सजायाफ्ता , अजायबघर, मालगाड़ी, गोताखोर आदि।

अभ्यास प्रश्न

1. उत्पत्ति के आधार पर शब्द कितने प्रकार के माने गए हैं?
(a) चार (b) पाँच (c) छः (d) सात

2. तत्सम शब्द हैं
(a) देशज शब्द (b) अपभ्रंश
(c) संस्कृत शब्द (d) विदेशज शब्द

3. जिनका हिन्दी में आकर रूप परिवर्तित हो गया है, वे शब्द हैं
(a) तद्भव (b) तत्सम (c) देशज (d) विदेशज

निर्देश (प्र. सं. 4-8) *दिए गए शब्दों में कौन-सा तत्सम शब्द है?*

4. (a) ताप (b) दूध (c) कुष्ठ (d) पत्ता

5. (a) नाक (b) नक्र (c) पड़ोस (d) नैन

6. (a) कर्पूर (b) चोंच (c) आँख (d) पत्ता

7. (a) कोटि (b) लाख (c) अटपटा (d) चाम

8. (a) पड़ोस (b) घमण्ड (c) पञ्जर (d) पूरण

निर्देश (प्र. सं. 9-15) *दिए गए शब्दों के उचित, तद्भव रूप लिखिए*

9. चैत्र
(a) चैत (b) चत्र (c) चेत (d) चेत्र

10. शुष्क
(a) शुक (b) सूख (c) सूखा (d) सुष्क

11. सूत्र
(a) शुत्र (b) शत्रू (c) सुत्र (d) सूत

12. हस्त
(a) हस्ति (b) हाथि (c) हाथी (d) हाथ

13. हरिद्रा
(a) हरिद्र (b) हल्दी (c) हरीद्रा (d) हलद

14. सर्प
(a) सपेरा (b) साँप (c) सरप (d) भुजंग

15. श्वास
(a) वास (b) शास (c) साँस (d) शवास

16. 'पगड़ी' शब्द है
(a) तत्सम (b) तद्भव (c) देशज (d) विदेशज

17. 'अचानक' शब्द है
(a) देशज (b) तद्भव (c) विदेशज (d) तत्सम

18. 'घमण्ड' शब्द है
(a) विदेशज (b) देशज (c) तत्सम (d) तद्भव

19. 'थप्पड़' शब्द हैं
(a) तत्सम (b) देशज (c) तद्भव (d) विदेशज

20. 'चप्पल' शब्द है
(a) विदेशज (b) तत्सम (c) देशज (d) तद्भव

21. 'जुलूस' शब्द निम्न में से कौन-सी भाषा का शब्द है?
(a) फारसी (b) तुर्की (c) अरबी (d) रोमन

22. 'नापसन्द' शब्द कौन-सी भाषा का शब्द है?
(a) फारसी (b) तुर्की (c) अरबी (d) अंग्रेजी

23. 'लाश' कौन-सी भाषा का शब्द है?
(a) अरबी (b) फारसी (c) पश्तो (d) तुर्की

24. 'चकमक' कौन-सी भाषा का शब्द है?
(a) अरबी (b) तुर्की (c) फारसी (d) अंग्रेजी

25. 'अखरोट' कौन-सी भाषा का शब्द है?
(a) पश्तो (b) तुर्की (c) अरबी (d) फारसी

26. 'एजेण्डा' कौन-सी भाषा का शब्द है?
(a) अंग्रेजी (b) रूसी (c) लैटिन (d) जापानी

27. 'तुरुप' शब्द किस भाषा से है?
(a) अंग्रेजी (b) लैटिन (c) डच (d) तुर्की

28. 'रिक्शा' है
(a) लैटिन शब्द (b) जापानी शब्द
(c) रोमन शब्द (d) अफ्रीकी शब्द

29. 'चाय' किस भाषा से सम्बन्धित है?
(a) चीनी (b) लैटिन
(c) पुर्तगाली (d) अरबी

30. 'गोताखोर' शब्द है
(a) तद्भव (b) तत्सम (c) विदेशज (d) संकर

उत्तरमाला

1.	(a)	2.	(c)	3.	(a)	4.	(c)	5.	(b)	6.	(a)	7.	(a)	8.	(c)	9.	(a)	10.	(c)
11.	(d)	12.	(d)	13.	(b)	14.	(b)	15.	(c)	16.	(c)	17.	(a)	18.	(b)	19.	(b)	20.	(c)
21.	(c)	22.	(a)	23.	(d)	24.	(b)	25.	(a)	26.	(c)	27.	(c)	28.	(b)	29.	(a)	30.	(d)

अध्याय

03

पर्याय / विलोम

प्रस्तुत अध्याय पर्यायवाची शब्दों व विलोम शब्दों पर आधारित है।

वे शब्द, जो अर्थ की दृष्टि से, लगभग समान होते हैं, पर्यायवाची शब्द कहलाते हैं। आइए कुछ पर्यायवाची शब्दों का अध्ययन करते हैं

पर्यायवाची शब्दों के उदाहरण

- आग — अग्नि, अनल, पावक, कृशानु, वह्नि, ज्वाला, शिखी, वैश्वानर, शुचि, हुताशन।
- अश्व — घोड़ा, घोटक, तुरंग, हय, बाजि, सैन्धव, तुरंगम्, अर्वा, प्रमथ, दुर्मुख।
- अमृत — सुधा, पीयूष, अमिय, सोम, जीवन, जीवनोदक।
- आँख — नेत्र, नयन, लोचन, विलोचन, अक्षि, चक्षु, दृक्, चाष।
- आकाश — अम्बर, अभ्र, नभ, गगन, अनन्त, शून्य, व्योम, अन्तरिक्ष, आसमान, अब्द, विहायस।
- इन्द्र — सुरेन्द्र, सुरेश, देवेश, महेन्द्र, पुरन्दर, सुरपति, वासव, शक्र, देवराज, सुराधिप, शतमन्यु, मेघवाहन, शचीश, मस्त्वान, विबुधेश।
- ईश्वर — जगन्नाथ, परमात्मा, प्रभु, जगदीश, भगवान, ईश, परमेश्वर, सच्चिदानन्द, जगतानन्द, जीवेश।
- कमल — नीरज, सरोज, जलज, अम्बुज, पंकज, सरसिज, नलिन, अरविन्द, पद्म, शतदल, उत्पल, कुवलय, राजीव, पयोज।
- कमला — इन्दिरा, पद्मा, पद्मासना, सिन्धुजा, श्री, विष्णु प्रिया, हरिप्रिया, सिन्धुतनया, लक्ष्मी, अब्धिजा, पद्मालया।
- गणेश — विनायक, लम्बोदर, गजानन, गणपति, वक्रतुण्ड, महाकाय, गजवदन, एकदन्त, विघ्नविनाशक, भवानीनन्दन, मोदकप्रिय, गिरिजानन्दन, गणनायक, हेरंब।
- गंगा — सुरसरि, सुरसरिता, भागीरथी, मन्दाकिनी, विष्णुपदी, जाह्नवी, त्रिपथगा, सुरधुनि, सुरापगा, देवापगा, देवनिमग्ना।

पर्याय/विलोम

- चन्द्रमा — चाँद, हिमांशु, सुधांशु, सुधाकर, राकापति, राकेश, शशि, मृगाँक, कलानिधि, सारंग, निशापति, कलाधर, मयंक, हिमकर, शीतांशु, द्विजराज, अब्धिज, पतम, तुहिनकर, तुहिनांशु।
- चिड़िया — पक्षी, पंछी, विहग, विहंग, विहंगम्, पतंग, शकुंत, परिन्दा, पखेरु, खग, खेचर, नभचर, पतत्री, पतम, वारंक।
- जल — पानी, नीर, अम्बु, सलिल, वारि, उदक, तोय, पय, जीवन, तामर।
- दुर्गा — चण्डिका, चण्डी, भवानी, काली, कल्याणी, महिषासुरमर्दिनी, अजा, अभया, कुमारी, सुभद्रा, भव्या, अम्बा, महागौरी, चामुण्डा, शाम्भवी।
- नदी — सरिता, नद, आपगा, तरंगिणी, निर्झरिणी, प्रवाहिणी।
- पर्वत — गिरि, पहाड़, भूधर, शैल, महीधर, धरणीधर, नग, शिखर, अद्रि, तुंग, धराधार।
- पृथ्वी — भूमि, धरती, धरा, भू, धरणी, वसुन्धरा, धारित्री, क्षिति, मही, वसुधा, भूमि, इला, उर्वी, पुहुमी, विपुला।
- बादल — घन, मेघ, जलधर, नीरद, वारिद, पयोद, जीमूत, अभ्र, अम्बुद, अब्द, पयोवाह, पयोमुच्, विहंग, नदनु, नभधुज, नभोगज, नभ्राज।
- बिजली — चपला, तड़ित, दामिनी, सौदामिनी, विद्युत, अतिभी, क्षणप्रभा, बीजुरी, चंचला।
- महादेव — शम्भु, शिव, शंकर, चन्द्रशेखर, शशिधर, गिरीश, नीलकण्ठ, वैद्यनाथ, विश्वनाथ, महेश्वर, कृतिवास, वृहदेश्वर, कैलाशपति, अमृतेश, पुष्कल, महालिंग, विष्कम्भी।
- राजा — नृप, भूप, महीप, महीपति, नरपति, नरेश, भूपति, राव, सम्राट, अवनीश, देव, नरेन्द्र, महिपाल, अधिपति, मानवेन्द्र, नरनाह, नरपति, नृपति।
- रात्रि — रात, निशा, रैन, रजनी, यामिनी, विभावरी, राका, शर्वरी।
- विष्णु — अच्युत, उपेन्द्र, कमलापति, चक्रपाणि, चतुर्भुज, जनार्दन, दामोदर, देवकीनन्दन, पुरुषोत्तम, मुकुन्द, नारायण, रमाकान्त, रमेश, वनमाली, जगदीश, पतत्रिकेतन, गरुड़ध्वज, पद्माक्ष, पद्माधीश, पद्मेश, परमपुरुष, पद्मनाभ, पूरूजित।
- सरस्वती — भारती, शारदा, वीणापाणि, महाश्वेता, ज्ञानदा, ब्राह्मी, वागीशा, वाग्देवी।
- पवन — अनिल, पवमान, प्रवात, वायु, हवा, मारुत, समीर, समीरण, मातरिश्वा, प्रभंजन, धूलिध्वज।
- धनुष — कोदण्ड, कमान, चाप, धनु, शरासन, तृणता, कुवाण।
- मधुकर — मधुप, भ्रमर, भौंरा, भँवरा, अलि, मिलिन्द, भृंग, शिलीमुख।
- मोर — मयूर, शिखी, मेहप्रिय, बर्हिण, सारंग।
- राक्षस — दानव, दैत्य, असुर, खेचर, देवारि, दनुज, यातुधान, पुरुषाद्य (पुरुषाद्य), नराश, प्रघस।
- यमुना — कालिन्दी, कृष्णा, अर्कजा, सूर्यतनया।
- तलवार — असि, करवाल, कृपाण, चन्द्रहास, खड्ग, धारुजल, रिसिक।
- प्रकाश — रोशनी, उजाला, चिराग, आभा, चमक, छवि, ज्योति, प्रभा।
- वन — अरण्य, कानन, विपिन, जंगल।
- वृक्ष — पादप, पेड़, विटप, तरु, अग, अगम, द्रुम, अवरोरुह, तरूवर।
- समुद्र — सागर, सिन्धु, वारिधि, जलनिधि, अम्बुधि, अकूपाद, पारावार, नदीश, अर्णव, अब्धि, जलधाम, वारीन्द्र, वारीश, धेन।
- साँप — नाग, भुजंग, अहि, विषधर, पन्नग, व्याल, सर्प, फणीश, मणी, काकोदर, चक्षुश्रवा, दृक्कर्ण, उरग।
- सूर्य — दिनकर, दिवाकर, प्रभाकर, अंशुमाली, अर्क, अग, आदित्य, तपन, तरणि, दिनेश, पतंग, भानु, मार्तंड, रवि, सवितृ, सूर, विहंगम, ज्योतिरीश, दिव्यांशु, हेलि।
- सिंह — शेर, हरि, केहरि, केसरी, मृगेन्द्र, मृगराज, वनराज, शार्दूल, महावीर, नदनु।
- सोना — कंचन, कनक, हेम, स्वर्ण, हिरण्य, कुन्दन, सुवर्ण, तपनीय, हाटक, जातरूप, रुक्म।
- स्त्री — नारी, कामिनी, औरत, महिला, वनिता, वामा, अबला, रमणी, वासिता।
- हिमालय — हिमाद्रि, पर्वतराज, नगराज, नगपति, हिमगिरि, शैलेश, शैलेन्द्र।
- हाथी — गज, द्विप, करि, करिवर, हस्ती, कुंजर, मतंग, कुम्भी, मातंग, वितुण्ड, वासुरा।
- हनुमान — पवन कुमार, पवनपुत्र, अंजनीपुत्र, आंजनेय, कपीश, केशरीनन्दन, पवनसुत, मारुतिनन्दन, रामदूत, महावीर, विक्रम, बजरंगी, पवनतनय।

विपरीतार्थक (विलोम) शब्द

जो शब्द एक-दूसरे का विपरीत अर्थ देते हैं अर्थात् उल्टे होते हैं, विलोम शब्द कहलाते हैं। आइए कुछ विलोम शब्दों का अध्ययन करते हैं।

विपरीतार्थक (विलोम) शब्दों के उदाहरण

शब्द	विपरीतार्थक शब्द	शब्द	विपरीतार्थक शब्द
अक्षम	सक्षम	अगम	सुगम
अनाथ	सनाथ	अनुकूल	प्रतिकूल
अनुराग	विराग	अन्दर	बाहर
अर्थ	अनर्थ	अथ	इति
अवनति	उन्नति	अस्त	उदय
अन्तरंग	बहिरंग	अत्यधिक	अल्प
अन्तर्मुखी	बहिर्मुखी	अतिवृष्टि	अनावृष्टि
अन्धकार	प्रकाश	अल्पायु	दीर्घायु
अनुरक्ति	विरक्ति	अपमान	सम्मान
अमृत	विष	आय	व्यय
आशा	निराशा	आधुनिक	प्राचीन
आयात	निर्यात	आकर्षण	विकर्षण
आस्तिक	नास्तिक	आकाश	पाताल
आलोक	तिमिर	अनुलोम	प्रतिलोम
अग्रज	अनुज	अल्पसंख्यक	बहुसंख्यक
अधुनातन	पुरातन	असभ्य	सभ्य
अनावरण	आवरण	अकर्मण्य	कर्मण्य
अपराह्न	पूर्वाह्न	आविर्भाव	तिरोभाव
अनुचित	उचित	आरोही	अवरोही
आदान	प्रदान	आज्ञा	अवज्ञा
इहलौकिक	पारलौकिक	ईश्वर	अनीश्वर
ईमानदार	बेईमान	उत्थान	पतन
उत्कृष्ट	निकृष्ट	उपकार	अपकार
उदात्त	अनुदात्त	उषाकाल	संध्याकाल
उपस्थिति	अनुपस्थिति	उपयोगी	अनुपयोगी
ऊसर	उपजाऊ	निरक्षर	साक्षर
एकेश्वरवाद	बहुदेववाद	प्रवृत्ति	निवृत्ति
ऐक्य	अनैक्य	हित	अहित
ऐतिहासिक	अनैतिहासिक	पतनोन्मुख	विकासोन्मुख
औचित्य	अनौचित्य	प्राण	निष्प्राण
औपचारिक	अनौपचारिक	प्रस्थान	आगमन
कीर्ति	अपकीर्ति	परमार्थ	स्वार्थ
कोमल	कठोर	बाह्य	अभ्यन्तर
कपटी	निष्कपट	बहिष्कार	अंगीकार

शब्द	विपरीतार्थक शब्द	शब्द	विपरीतार्थक शब्द
खण्डन	मण्डन	भ्रान्त	निर्भ्रान्त
खुशी	गम	भक्षक	रक्षक
गणतन्त्र	राजतन्त्र	भद्र	अभद्र
गृहस्थ	संन्यासी	भाग्य	अभाग्य
गरल	सुधा	भाव	अभाव
गुप्त	प्रकट	भेद	अभेद
घात	प्रतिघात	भौतिक	आध्यात्मिक
घृणा	प्रेम	भूत	भविष्य
चिरन्तन	नश्वर	मृदुल	कठोर
चिन्तित	निश्चिन्त	महात्मा	दुरात्मा
चमकदार	आभाहीन	मौखिक	लिखित
चंचल	गम्भीर	योग्य	अयोग्य
जड़	चेतन	युवा	वृद्ध
जन्म	मृत्यु	रिक्त	पूर्ण
जीवन	मरण	रत	विरत
ज्वार	भाटा	रागी	विरागी
जय	पराजय	रूपवान	कुरूप
ज्योति	तम	रचना	ध्वंस
जटिल	सरल	विशिष्ट	साधारण
जागृति	सुषुप्ति	विशेष	सामान्य
ताप	शीत	विस्तृत	संक्षिप्त
तीव्र	मन्द	विफलता	सफलता
दिवा	रात्रि	विस्तीर्ण	संकीर्ण
दुर्जन	सज्जन	विवाद	निर्विवाद
ध्वंस	निर्माण	विरह	मिलन
निष्काम	सकाम	विपन्न	सम्पन्न
न्यून	अधिक	विरोध	समर्थन
व्यष्टि	समष्टि	साकार	निराकार
शान्ति	अशान्ति	सामिष	निरामिष
शुष्कता	आर्द्रता	स्तुति	निन्दा
शोक	हर्ष	सुमार्ग	कुमार्ग
सापेक्ष	निरपेक्ष	क्षम्य	अक्षम्य
स्थायी	अस्थायी	क्षय	अक्षय
संकल्प	विकल्प	ज्ञात	अज्ञात

अभ्यास प्रश्न

1. 'मनोज' निम्नलिखित में किसका पर्यायवाची शब्द है?
(a) विष्णु (b) ब्रह्मा
(c) महादेव (d) कामदेव

2. निम्नलिखित में कौन-सा शब्द 'इन्द्र' का पर्यायवाची है?
(a) महेश (b) प्रजापति
(c) पुरन्दर (d) गजानन

3. निम्नलिखित में कौन-सा शब्द 'सरस्वती' का पर्यायवाची है ?
(a) इन्दिरा (b) इन्द्राणी
(c) महाश्वेता (d) भव्या

4. निम्नलिखित में कौन-सा शब्द 'सूर्य' का पर्यायवाची है ?
(a) हिमांशु (b) सुधांशु
(c) दिव्यांशु (d) तुहिनांशु

5. निम्नलिखित में कौन-सा एक 'आकाश' का पर्यायवाची शब्द नहीं है?
(a) पुहुमी (b) अभ्र
(c) नभ (d) शून्य

6. निम्न में कौन-सा शब्द 'तलवार' का पर्यायवाची नहीं है?
(a) चन्द्रहास (b) करवाल
(c) असि (d) अरि

7. निम्नलिखित में कौन-सा शब्द 'आँसू' का पर्यायवाची है?
(a) विलोचन (b) अश्रु
(c) नयन (d) वारि

8. 'अर्क' किस शब्द का पर्यायवाची शब्द है?
(a) दवा (b) विष
(c) सूर्य (d) बिजली

9. 'पयोधर' किस शब्द का पर्यायवाची शब्द है?
(a) सर्प (b) सूर्य
(c) बादल (d) आकाश

10. निम्नलिखित में कौन 'पक्षी' का पर्यायवाची नहीं है?
(a) विहंग (b) खेचर
(c) पंछी (d) नग

11. 'मर्कट' किसका पर्यायवाची शब्द है?
(a) हाथी (b) घोड़ा
(c) बन्दर (d) सिंह

12. 'उरग' किस शब्द का पर्यायवाची शब्द है?
(a) सर्प (b) पक्षी
(c) हाथी (d) घोड़ा

13. निम्न में 'सागर' का पर्यायवाची शब्द है?
(a) आकाश (b) पर्वत
(c) पारावार (d) शतदल

14. निम्न में कौन-सा शब्द 'सिंह' का पर्यायवाची है?
(a) मार्जार (b) मर्कट
(c) शार्दूल (d) वासुरा

15. निम्न में कौन-सा शब्द 'वन' का पर्यायवाची नहीं है?
(a) कानन (b) विपिन
(c) जंगल (d) नदनु

16. निम्न में कौन-सा शब्द 'सोना' का पर्यायवाची है?
(a) मिलिन्द (b) द्रुम
(c) चमक (d) हाटक

17. 'आत्मा' शब्द का विपरीतार्थक शब्द होगा
(a) अनात्म (b) परमात्मा
(c) आत्माहीन (d) शरीर

18. 'परोपकारी' शब्द का विपरीतार्थक शब्द होगा
(a) उपकारी (b) स्वार्थी
(c) क्षमाप्रार्थी (d) दुर्जन

19. 'राजा' का विपरीतार्थक शब्द क्या होगा?
(a) रानी (b) प्रजा
(c) सेना (d) सिपाही

20. 'आध्यात्मिक' शब्द का विपरीतार्थक शब्द क्या होगा?
(a) योग (b) सांसारिकता
(c) इहलौकिक (d) भौतिक

21. 'आरोहण' का विलोम शब्द क्या है?
(a) अवरोहण (b) आरोही
(c) अवरोही (d) तोरण

22. 'उच्छवास' का विपरीतार्थक शब्द क्या होगा?
(a) नि:श्वास (b) विश्वास
(c) उत्साह (d) श्वास

23. 'इहलोक' का विपरीतार्थक शब्द क्या होगा?
(a) परलोक (b) स्वर्ग
(c) इन्द्रलोक (d) आकाश

24. 'आगमन' का विपरीतार्थक शब्द क्या होगा?
(a) निष्गमन (b) प्रस्थान
(c) अनुगमन (d) निष्कासन

25. 'शुक्ल' का सही विपरीतार्थक शब्द क्या है?
(a) पूर्णिमा (b) अमावस्या
(c) ग्रहण (d) कृष्ण

26. 'निरर्थक' का सही विपरीतार्थक शब्द क्या है?
(a) अर्थहीन (b) सार्थक
(c) साक्षर (d) समर्थक

27. 'प्राचीन' का सही विपरीतार्थक शब्द क्या है?
(a) परम्परागत (b) युगीन
(c) अर्वाचीन (d) मध्यकालीन

28. 'साकार' का सही विपरीतार्थक शब्द क्या है?
(a) बेकार (b) प्रकार
(c) निराकार (d) लम्बाकार

29. 'सापेक्ष' का विपरीतार्थक शब्द क्या है?
(a) निरपेक्ष (b) आपेक्ष
(c) आक्षेप (d) प्रक्षेप

30. 'कृतज्ञ' का विपरीतार्थक शब्द क्या है?
(a) अक्षय (b) भिज्ञ
(c) कृतघ्न (d) विघ्न

31. 'क्षणिक' का सही विलोम है
(a) पल (b) मार्मिक
(c) स्थायी (d) शाश्वत

32. 'दीर्घ' का विलोम होगा
(a) बड़ा (b) ह्रस्व (c) छोटा (d) लम्बा

33. 'उत्थान' का विपरीतार्थक शब्द है
(a) निकट (b) पतन
(c) उन्नति (d) अवनति

34. 'आय' के लिए विलोम शब्द बताइए
(a) व्यय (b) खर्च
(c) सम्पन्न (d) विपन्न

35. 'समता' का विलोम होगा
(a) विषमता (b) साधारणता
(c) विषम (d) सम

निर्देश (प्र. सं. 36-40) *में दिए गए शब्दों के उचित विलोम शब्द का चयन कीजिए*

36. स्वर्ग
(a) धरती (b) आकाश
(c) पाताल (d) नरक

37. आहूत
(a) व्याधि (b) अनाहूत
(c) सन्तोष (d) विहूत

38. व्यक्त
(a) व्यक्तहीन (b) अन्वय
(c) अव्यक्त (d) प्रव्यक्त

39. एक
(a) दो (b) एकैक
(c) प्रत्येक (d) अनेक

40. साधारण
(a) विशेष (b) सामान्य
(c) सरल (d) विशेषता

उत्तरमाला

1.	(d)	2.	(c)	3.	(c)	4.	(c)	5.	(a)	6.	(d)	7.	(b)	8.	(c)	9.	(a)	10.	(d)
11.	(c)	12.	(a)	13.	(c)	14.	(c)	15.	(d)	16.	(d)	17.	(b)	18.	(b)	19.	(b)	20.	(d)
21.	(a)	22.	(a)	23.	(a)	24.	(b)	25.	(d)	26.	(b)	27.	(c)	28.	(c)	29.	(a)	30.	(c)
31.	(d)	32.	(b)	33.	(b)	34.	(a)	35.	(a)	36.	(d)	37.	(b)	38.	(c)	39.	(d)	40.	(a)

अध्याय

04

शब्द विवेक

(शब्द प्रयोग में सूक्ष्म अन्तर)

प्रस्तुत अध्याय सूक्ष्म अन्तर रखने वाले शब्दों; जैसे- समान प्रतीत होने वाले शब्द, श्रुति सम भिन्नार्थक शब्द आदि पर आधारित है।

समान प्रतीत होने वाले शब्द

कुछ शब्द ऐसे होते हैं, जो समान अर्थ देते हुए प्रतीत होते हैं, उनके अर्थ में सूक्ष्म अन्तर होता है। ये शब्द पर्यायवाची जैसे लगते हैं।

शब्द	अर्थ
अपराध	कानून का उल्लंघन
पाप	सामाजिक नियमों की अवहेलना
बेटी	अपनी पुत्री
लड़की	कोई भी लड़की
पुत्र	अपना बेटा
लड़का	कोई भी लड़का
उपहास	दूसरों का मजाक उड़ाना
परिहास	हँसी-मजाक करना
अर्पण	देना, सौंपना
दान	वापस न लेने के भाव से देना
अवस्था	पैदा होने से अब तक की आयु
आयु	पूरे जीवन की अवधि
अनिवार्य	जिसे मना न किया जा सके
आवश्यक	महत्त्वपूर्ण
अनुमति	किसी काम की सहमति
आदेश	वैधानिक अधिकार के साथ कहना
अनुपम	जिसकी उपमा न हो
अद्वितीय	जिसके समान दूसरा न हो

शब्द	अर्थ
लोभ	पाने की इच्छा
तृष्णा	जरूरत से ज्यादा पाने की इच्छा
अस्त्र	जिसे फेंककर मारा जाए
शस्त्र	जिसे पकड़कर मारा जाए
अज्ञ	जिसे कुछ भी ज्ञान न हो
मूर्ख	समझाने पर भी न समझने वाला
पुरस्कार	अच्छे कार्य का इनाम
पारितोषिक	प्रतियोगिता में जीता हुआ इनाम
विवेक	अच्छाई-बुराई की पहचान
ज्ञान	किसी विषय की जानकारी
दुर्गम	जहाँ पहुँचना कठिन हो
अगम	जहाँ पहुँचना सम्भव हो
प्रेम	सभी के प्रति
स्नेह	छोटों के प्रति
अमूल्य	जिसका मूल्य न हो
बहुमूल्य	बहुत कीमती
अनुरोध	सामान्य लोगों से आग्रह
प्रार्थना	ईश्वर से अनुरोध
दुराचार	बुरा आचरण
अत्याचार	जुल्म करना
कष्ट	शारीरिक कष्ट (पीड़ा)
क्लेश	मानसिक पीड़ा
छाया	वृक्ष या निर्जीव वस्तु की छाया
परछाई	सजीव वस्तु (प्राणी) की छाया
अतिरिक्त	इच्छा से अधिक
अत्यन्त	बहुत अधिक
अहंकार	खुद को बड़ा समझने का झूठा घमण्ड
अभिमान	अपने को बड़ा, दूसरों को हीन समझना
सुख	लाभ होने पर खुश होना
आनन्द	सुख-दुःख से ऊपर उठना
अभिनन्दन	बड़े व्यक्ति का स्वागत
स्वागत	पारम्परिक विधि से सत्कार करना

श्रुतिसम भिन्नार्थक शब्द

(शब्द-युग्म) कुछ शब्द उच्चारण और सुनने में एक जैसे लगते हैं, परन्तु उनके अर्थ में पर्याप्त भिन्नता होती है, ऐसे शब्दों को श्रुतिसम भिन्नार्थक या समरूपी भिन्नार्थक शब्द कहा जाता है।

उदाहरणार्थ अन्न शब्द का अर्थ अनाज है, वहीं इससे मिलते-जुलते शब्द अन्य का अर्थ है, दूसरा।

शब्द	अर्थ	वाक्य-प्रयोग
अचल	पर्वत	यह **अचल** बहुत ऊँचा है।
अचला	पृथ्वी	**अचला** हमारा पोषण करती है।
अनिल	हवा	**अनिल** के वेग से दीपक बुझ गया।
अनल	आग	**अनल** से अनेक झोंपड़ियाँ जल गईं।
अचार	आम, नींबू आदि से बना	माँ के हाथ से बना यह **अचार** स्वादिष्ट है।
आचार	आचरण	गाँधीजी का **आचार-विचार** उच्च कोटि का था।
अस्त्र	हथियार	आतंकियों को देखते ही जवानों ने **अस्त्र** उठा लिए।
अस्तर	खोल, कवर	इस रजाई का **अस्तर** अब बदल देना चाहिए।
अंश	हिस्सा	मजदूरों ने लाभ में अपना **अंश** माँगा।
अंस	कन्धा	जवान के **अंस** को छूती हुई गोली निकल गई।
अशक्त	कमजोर	बुढ़ापे में लोग **अशक्त** हो जाते हैं।
आसक्त	मोहित	खिले फूल को देख भ्रमर **आसक्त** हो गया।
अवलम्ब	सहारा	ईश्वर ही गरीबों का **अवलम्ब** है।
अविलम्ब	शीघ्र	इस मरीज को **अविलम्ब** दवा देनी चाहिए।
अपेक्षा	तुलना में	राम की **अपेक्षा** श्याम लम्बा है।
उपेक्षा	निरादर	हमें गरीबों की **उपेक्षा** नहीं करनी चाहिए।
ओर	दिशा	पूरब की **ओर** से सूरज निकलता है।
और	तथा	सुमन **और** पूनम दोनों ही यहाँ आएँगी।
उपयुक्त	ठीक	मेरे लिए यही खाना **उपयुक्त** रहेगा।
उपर्युक्त	ऊपर कहा गया	**उपर्युक्त** वाक्य का अर्थ समझने का प्रयास करो।
कलि	कलियुग	इस **कलि** में न्याय-अन्याय का भेद मिट गया है।
कली	फूल की पूर्वावस्था	गुलाब के पौधे पर दो **कलियाँ** आ गई हैं।
कपट	छल	हमें किसी से भी **कपट** नहीं करना चाहिए।
कपाट	दरवाजा	भिखारी को देखते ही उसने **कपाट** बन्द कर लिए।
कुल	सारा	मेरे पास **कुल** अस्सी रुपए हैं।
कूल	किनारा	नदी के **कूल** पर सारस बैठे थे।
कल	आने वाला/ बीता दिन	**कल** आसमान में बादल घिरे थे।
काल	समय; मौत	**काल** के सामने सब विवश हो जाते हैं।
कान्ति	चमक	रमा के चेहरे पर **कान्ति** है।
क्रान्ति	परिवर्तन	बिजली आने से गाँवों में **क्रान्ति** आ गई है।

शब्द विवेक (शब्द प्रयोग में सूक्ष्म अन्तर)

शब्द	अर्थ	वाक्य-प्रयोग
कड़ाई	कठोरता	पुलिस ने चोर से **कड़ाई** से पूछताछ की।
कढ़ाई	बेल बूटे बनाना	रचना ने **कढ़ाई** वाली साड़ी खरीदी।
ग्रह	सूर्य, तारे आदि	सौर मण्डल में नौ **ग्रह** हैं।
गृह	घर	उदय को आज गृहकार्य नहीं मिला है।
गुर	उपाय, कौशल	सपेरे ने अपने **गुर** से साँप को पकड़ लिया।
गुरु	अध्यापक	**गुरु** ही हमें विविधि प्रकार का ज्ञान देते हैं।
चर	सेवक	वह सारा काम **चर** से कराता है।
चार	संख्या	दो और दो **चार** होते हैं।
चिर	लम्बा, दीर्घ	वह मेरा **चिर** मित्र है।
चीर	वस्त्र	सम्राट हर्ष गरीबों को **चीर** दिया करता था।
छत्र	छाता	राजा के आस-पास लोग **छत्र** लेकर चल रहे थे।
छात्र	विद्यार्थी	**छात्र** को निरन्तर परिश्रम करना चाहिए।
तन	शरीर	गर्मी के कारण तन-मन व्याकुल हो रहा था।
तान	धुन	मुरली की **तान** सुनकर गोपियाँ मदहोश हो जाती थीं।
तरंग	लहर	समुद्र में भयंकर **तरंगें** उठ रही थीं।
तुरंग	घोड़ा	यह **तुरंग** उत्तम प्रजाति का है।
थल	जमीन	सूर्य उगते ही **जल-थल** सुशोभित हो गया।
थाल	बर्तन, थाली	**थाल** में तरह-तरह के फल रखे थे।
दिन	दिवस	सप्ताह में सात **दिन** होते हैं।
दीन	गरीब	**दीन** उपेक्षित जीवन जीने को विवश रहते हैं।

शब्द	अर्थ	वाक्य-प्रयोग
दवा	औषधि	यहाँ गरीबों को मुफ्त **दवाएँ** दी जाती हैं।
दावा	हक जताना	पड़ोसी देश पाकिस्तान, कश्मीर पर अपना **दावा** करता है।
नीर	पानी	पेड़ के कटे तने से **नीर** टपक रहा था।
नीड़	घोंसला	पक्षी **नीड़** की ओर लौट रहे थे।
पवन	हवा	**पवन** के बिना जीना असम्भव है।
पावन	पवित्र	गंगा **पावन** नदी है।
प्राचीन	पुराना	यह किला बहुत ही **प्राचीन** है।
प्राचीर	दीवार	लालकिले की **प्राचीर** बहुत ही मजबूत है।
प्रमाण	सबूत	चोरों ने सारे **प्रमाण** नष्ट कर दिए थे।
प्रणाम	नमस्ते	प्रातः काल माता-पिता को **प्रणाम** करना चाहिए।
मूल	जड़	**मूल** कटने से पौधा मुरझा गया।
मूल्य	दाम	इस पुस्तक का **दाम** एक सौ पचास रुपए है।
योग	जोड़	दो और दो का **योग** चार होता है।
योग्य	लायक	राधिका इन सबमें **योग्य** है।
सुत	बेटा	हनुमान को पवन **सुत** भी कहा जाता है।
सूत	धागा	यह आसन **सूत** का बना है।
सलिल	पानी	हिमालय से निकलने वाली नदियाँ **सलिल** से भरी रहती हैं।
सलिला	नदी	ऋषि प्रातःकाल **सलिला** में नहाते थे।
समान	बराबर	कबीर, राम और रहीम को **समान** मानते थे।
सामान	वस्तुएँ	मुझे रसोई का **सामान** खरीदना है।

अभ्यास प्रश्न

निर्देश प्रश्न संख्या (1-15) *में दिए गए वाक्यों में उचित विकल्प की सहायता से रिक्त स्थानों की पूर्ति कीजिए।*

1. यह कार्य ····· है। इसे मना नहीं किया जा सकता
(a) आवश्यक (b) जरूरी
(c) अनिवार्य (d) अवश्य

2. राहुल के साथ ····· मत करो। वह जल्दी ही गम्भीर हो जाता है
(a) उपहास (b) परिहास
(c) हास (d) छेड़-छाड़

3. आज आपने अच्छा कार्य किया, इसलिए तुम्हें ····· दिया जाएगा।
(a) धन (b) पारितोषिक
(c) पुरस्कार (d) दण्ड

4. उसे अपने आपका विधायक होने का ····· है
(a) अभिमान (b) अहंकार (c) मान (d) सम्मान

5. आए हुए मेहमानों का ····· करो
(a) अभिनन्दन (b) आदर
(c) स्वागत (d) उपहास

6. प्रभु से ····· करो कि पिताजी जल्दी स्वस्थ हो जाएँ
(a) आराधना (b) अनुरोध
(c) आग्रह (d) प्रार्थना

7. माँ का प्यार ····· होता है
(a) अमूल्य
(b) बहुमूल्य
(c) मूल्यवान
(d) कीमती

8. तुम ..... हो। समझाने पर भी नहीं समझते
(a) अपढ़ (b) अज्ञ
(c) मूर्ख (d) निरक्षर

9. उसके पास ऐसा ..... है, जिसे वह फेंककर मार सकता है
(a) शस्त्र (b) अस्त्र (c) हथियार (d) बन्दूक

10. तुम्हें इस कार्य की ..... है
(a) आज्ञा (b) आदेश
(c) अधिकार (d) अनुमति

11. उस वृक्ष की ..... बहुत घनी है
(a) परछाईं (b) छाया (c) पत्तियाँ (d) शाखाएँ

12. मैं अपनी छोटी बहन से ..... रखता हूँ
(a) प्रेम (b) प्यार (c) स्नेह (d) क्रोध

13. यह राम की ..... है
(a) लड़की (b) लड़का (c) पुत्र (d) पुत्री

14. वह ..... है। उसने कानून का उल्लंघन किया है
(a) पापी (b) अपराधी
(c) अत्याचारी (d) आलसी

15. भगवान बुद्ध ने कहा था कि ..... ही दु:खों का कारण है
(a) लोभ (b) तृष्णा
(c) लालच (d) ईर्ष्या

निर्देश (प्रश्न संख्या 16-30) *में दिए गए शब्द-युग्मों के उचित अर्थ के लिए सही विकल्प का चयन कीजिए*

16. अनिल-अनल
(a) हवा-आग (b) आग-हवा
(c) जल-आग (d) आग-जल

17. अधम-अधर्म
(a) जय-पराजय (b) पराजय-जय
(c) नीच-पाप (d) पाप-नीच

18. इत्र-इतर
(a) सुगन्धि-दूसरा (b) दूसरा-सुगन्धि
(c) प्रथम-द्वितीय (d) दूसरा-पहला

19. कृपण-कृपाण
(a) व्यंग्य-कंजूस (b) कंजूस-व्यंग्य
(c) तलवार-कंजूस (d) कंजूस-तलवार

20. कुल-कूल
(a) किनारा-वंश (b) वंश-किनारा
(c) वस्त्र-जल (d) जल-वस्त्र

21. कर्म-क्रम
(a) काम-दाम (b) दाम-काम
(c) काम-चरण (d) चरण-काम

22. कृत-क्रीत
(a) करना-भरना
(b) भरना-करना
(c) किया हुआ-खरीदा हुआ
(d) खरीदा हुआ-किया हुआ

23. अश्व-अश्म
(a) घोड़ा-शिकारी (b) घोड़ा-पत्थर
(c) घोड़ा-कोड़ा (d) रचना-यश

24. अलि-अली
(a) फूल-फल (b) धूल-फूल
(c) भौंरा-सखी (d) नदी-सागर

25. शम-सम
(a) वन-शिव (b) लय-विभाजन
(c) बाण-बराबर (d) शान्ति-बराबर

26. स्वर्ण-सवर्ण
(a) सोना-चाँदी (b) सोना-उच्च जाति
(c) सखा-सखी (d) उच्च जाति-नीच जाति

27. सर-शर
(a) तालाब-बाण (b) पानी-तालाब
(c) सिर-बाण (d) बाण-तालाब

28. लक्ष्य-लक्ष
(a) उद्देश्य-लाख (b) गिनती-विनती
(c) लाख-उद्देश्य (d) लाख-करोड़

29. विपिन -विपन्न
(a) वन-गाँव (b) शहर-गाँव
(c) गाँव-शहर (d) वन-विपत्तिग्रस्त

30. भव्य-भव
(a) संसार-शानदार
(b) यश-अपयश
(c) शानदार-संसार
(d) लोक-परलोक

उत्तरमाला

1.	(c)	2.	(a)	3.	(c)	4.	(b)	5.	(c)	6.	(d)	7.	(a)	8.	(c)	9.	(b)	10.	(d)
11.	(b)	12.	(c)	13.	(d)	14.	(b)	15.	(b)	16.	(a)	17.	(c)	18.	(a)	19.	(d)	20.	(b)
21.	(c)	22.	(c)	23.	(b)	24.	(c)	25.	(d)	26.	(b)	27.	(a)	28.	(a)	29.	(d)	30.	(c)

अध्याय

05

पद भेद (व्याकरणिक कोटि) की पहचान

प्रस्तुत अध्याय पद के विभिन्न भेदों; जैसे-पद संज्ञा, सर्वनाम, क्रिया, विशेषण,अव्यय आदि पर आधारित है।

पद

जब कोई सार्थक शब्द वाक्य में प्रयोग किया जाता है, तो उसे पद कहते हैं।

दूसरे शब्दों में, ''व्याकरण के नियमों के अनुसार विभक्ति, वचन, लिंग, काल आदि की योग्यता रखने वाला वर्णों का समूह 'पद' कहलाता है।

जैसे—राजा वन में गया।

उपर्युक्त वाक्य 'राजा', 'वन', 'में' और 'गया' चार पदों से बना है।

पद के भेद

पद के पाँच भेद होते हैं

1. संज्ञा

संज्ञा वह विकारी शब्द है, जिससे वस्तु, व्यक्ति, भाव तथा प्राणियों के नाम का बोध होता है। वस्तु से किसी पदार्थ का भाव ही नहीं, उनके धर्म (स्वभाव) को सूचित करने वाले शब्द भी 'संज्ञा' होते हैं।

संज्ञा के पाँच भेद हैं

(i) **जातिवाचक संज्ञा** जिन शब्दों से एक ही प्रकार की वस्तुओं अथवा व्यक्तियों का बोध हो, उन्हें 'जातिवाचक संज्ञा' कहा जाता है; जैसे—नदी, आदमी, पेड़, नगर इत्यादि। सम्बन्धियों, व्यवसायों, पदों, पशु-पक्षियों तथा प्राकृतिक तत्त्वों के नाम जातिवाचक संज्ञा के रूप में आते हैं।

(ii) **व्यक्तिवाचक संज्ञा** जिस शब्द से किसी खास व्यक्ति या वस्तु का बोध हो, उसे 'व्यक्तिवाचक संज्ञा' कहते हैं; जैसे—राम, गंगा, ब्रिटेन इत्यादि।

व्यक्तियों, नदियों, देशों, नगरों, समुद्रों, पहाड़ों, त्योहार तथा दिनों के नाम 'व्यक्तिवाचक संज्ञा' होते हैं।

(iii) **भाववाचक संज्ञा** जिन शब्दों के द्वारा व्यक्ति अथवा वस्तु की स्वाभाविक क्रिया-व्यापार तथा भावदशा सामने आती है, वह 'भाववाचक संज्ञा' है; जैसे— भलाई, दयालु, मिठास इत्यादि।

भाववाचक संज्ञा का निर्माण जातिवाचक संज्ञा के अतिरिक्त सर्वनाम, क्रिया, विशेषण तथा अव्यय में प्रत्यय लगाकर बनाया जाता है; जैसे लड़का (जातिवाचक संज्ञा)—लड़कपन (भाववाचक संज्ञा)

अपना (सर्वनाम)—अपनापन (भाववाचक संज्ञा)

(iv) **समूहवाचक संज्ञा** जिन शब्दों से व्यक्ति या वस्तुओं की अधिक संख्या का भाव प्रकट होता है, उन्हें 'समूहवाचक संज्ञा' कहते हैं; जैसे— मेला, दल, सभा, गुच्छा, कुंज इत्यादि।

(v) **द्रव्यवाचक संज्ञा** जिन शब्दों से तरल वस्तु या नाप-तौल की वस्तुओं का बोध होता है, उन्हें 'द्रव्यवाचक संज्ञा' कहते हैं; जैसे—सोना, लोहा, दूध इत्यादि।

संज्ञा विकारी शब्द होते हैं। विकार शब्दों के रूप तथा प्रयोग को परिवर्तित करता है। संज्ञा के रूप में परिवर्तन लिंग, वचन तथा कारक चिह्नों के कारण होता है।

2. सर्वनाम

संज्ञा शब्दों के स्थान पर प्रयुक्त होने वाले शब्द, सर्वनाम कहलाते हैं; जैसे—मैं, हम, उसका, तुम्हारा, वह, यह, कोई, कौन आदि।

सर्वनाम के भेद

सर्वनाम छः प्रकार के होते हैं

(i) पुरुषवाचक सर्वनाम

जो सर्वनाम बोलने वाले, सुनने वाले या जिसकी बात की जाए उसके विषय में ज्ञान कराते हैं, पुरुषवाचक सर्वनाम कहलाते हैं।

इसके तीन भेद होते हैं

(a) **उत्तम पुरुष** बोलने वाला उत्तम पुरुष कहलाता है; जैसे— मैं, हम, मेरा आदि।

उदाहरण

- मैं उससे बात करूँगा।
- यह काम मेरा नहीं है।
- हम अब आजाद हैं।

(b) **मध्यम पुरुष** जिससे बात की जाती है, वह मध्यम पुरुष कहलाता है; जैसे— तू, तुम, तेरा आदि।

उदाहरण

- तुझे राम की बात माननी होगी।
- तुम आज लखनऊ जाओ।
- तेरा काम पढ़ना है।

(c) **अन्य पुरुष** जिसके बारे में बात की जाती है, वह अन्य पुरुष होता है; जैसे— वह, वे, उनका, उसके, उसकी आदि।

उदाहरण

- वह इस काम को कर लेगा।
- मुझे उनके पास जाना होगा।
- उसकी किताब मेरे पास है।

(ii) निश्चयवाचक सर्वनाम

वे सर्वनाम, जिनसे किसी निश्चित वस्तु का ज्ञान होता है, उसे निश्चयवाचक सर्वनाम कहते हैं; जैसे— यह, वह आदि। इसे संकेतवाचक सर्वनाम भी कहते हैं।

उदाहरण एक बार फिर वह जीत गया।

(iii) अनिश्चयवाचक सर्वनाम

वे सर्वनाम, जिनसे किसी वस्तु का निश्चित ज्ञान न हो, उसे अनिश्चयवाचक सर्वनाम कहते हैं; जैसे— कोई, कुछ, सब आदि।

उदाहरण सड़क पर कोई गिर गया।

(iv) सम्बन्धवाचक सर्वनाम

वे सर्वनाम, जो एक शब्द का दूसरे के साथ सम्बन्ध जोड़ते हैं, उसे सम्बन्धवाचक सर्वनाम कहते हैं; जैसे—जिसकी लाठी उसकी भैंस, जो करेगा सो भरेगा आदि में रेखांकित शब्द सम्बन्धवाचक सर्वनाम हैं।

(v) प्रश्नवाचक सर्वनाम

वे सर्वनाम, जो प्रश्न पूछने के लिए प्रयोग होते हैं, उन्हें प्रश्नवाचक सर्वनाम कहते हैं; जैसे— कौन, कैसे, क्या आदि।

उदाहरण तुम कौन हो?

(vi) निजवाचक सर्वनाम

वे सर्वनाम, जहाँ वक्ता अपने लिए 'आप' शब्द का प्रयोग करता है, वहाँ निजवाचक सर्वनाम होता है; जैसे— आप भला तो जग भला।

3. क्रिया

जिन शब्दों से किसी कार्य का करना या होना पाया जाता है, उन्हें **क्रिया** कहते हैं; जैसे—अनिल स्कूल जा रहा है।

मोहन ने खाना खाया।

इन वाक्यों में **जा रहा है, खाया** से कार्य के होने का पता चलता है। अत: ये (जाना, खाना) क्रियाएँ हैं। कार्य को करने वाला 'कर्ता' कहलाता है।

धातु धातु क्रिया के मूल रूप को कहते हैं। इन्हीं धातुओं से भिन्न-भिन्न क्रियाओं का निर्माण होता है; जैसे—पी, खा, जा, आ, पढ़, चल इत्यादि।

क्रिया के प्रकार

कर्म के आधार पर क्रिया के दो प्रकार होते हैं

(i) सकर्मक क्रिया

जिन वाक्यों में क्रियाएँ अपने कर्म के साथ होती हैं, उन्हें सकर्मक क्रियाएँ कहते हैं; जैसे— कृष्ण कुत्ते को रोटी खिलाता है।

इसमें क्रिया 'खिलाना' का प्रभाव कुत्ते पर पड़ता है अर्थात् कुत्ते को खिलाना क्रिया का कर्म है। अत: यह एक सकर्मक क्रिया है।

(ii) अकर्मक क्रिया

जो क्रियाएँ बिना कर्म के वाक्यों में आती हैं, अकर्मक क्रियाएँ कहलाती हैं; जैसे—सविता हँसती है।

इसमें 'हँसना' क्रिया का किसी पर प्रभाव नहीं पड़ता, इसलिए यह अकर्मक क्रिया है।

संरचना की दृष्टि से क्रिया के पाँच भेद होते हैं

(i) सामान्य क्रिया

यह क्रिया का सामान्य रूप होता है। सामान्यतया इसका ही अधिक उपयोग किया जाता है।

उदाहरण ने पतंग उड़ाई।

- चित्रकार ने चित्र बनाया।
- हमने कमरे की सफाई की।
- रचना ने नया सूट खरीदा।

उपरोक्त वाक्यों के रेखांकित अंश सामान्य क्रियाएँ हैं।

(ii) संयुक्त क्रिया

जिन वाक्यों में एक से अधिक क्रिया मिलकर एक ही कार्य को पूरा करती हैं, उन्हें संयुक्त क्रिया कहते हैं।

उदाहरण

- राम ने पुस्तक पढ़ ली।
- गायक घण्टों तक गाता रहा।

उपरोक्त वाक्यों के रेखांकित अंश संयुक्त क्रियाएँ हैं।

(iii) नाम धातु क्रिया

जो क्रियाएँ संज्ञा, सर्वनाम, विशेषण तथा अनुकरणात्मक शब्दों से बनती हैं, उन्हें नाम धातु क्रिया कहते हैं।

उदाहरण

- दोनों औरतें देर तक बतियाती रहीं।
- चोर झुठलाने का प्रयास करता रहा।

उपरोक्त वाक्यों के रेखांकित अंश नाम धातु क्रियाएँ हैं।

(iv) प्रेरणार्थक क्रिया

जब कर्ता स्वयं कार्य न करके दूसरों को करने की प्रेरणा देता है या दूसरों से उस कार्य को करवाता है, तो इसे प्रेरणार्थक क्रिया कहते हैं।

उदाहरण

- मोहन नौकर से खाना बनवाता है।
- रमा नौकरानी से कपड़े धुलवाती है।

उपरोक्त वाक्यों के रेखांकित अंश प्रेरणार्थक क्रियाएँ हैं।

(v) पूर्वकालिक क्रिया

जब मुख्य क्रिया से ठीक पहले कोई क्रिया की जाती है, तो उसे पूर्वकालिक क्रिया कहते हैं।

उदाहरण

- लड़का पढ़कर लिखने लगा।
- मजदूर खाना खाकर सो गया।

उपरोक्त रेखांकित अंश पूर्वकालिक क्रियाएँ हैं।

4. विशेषण

जिस शब्द से संज्ञा या सर्वनाम की विशेषता प्रकट होती है, वह विशेषण कहलाता है; जैसे—यह सुन्दर घर है।

इस वाक्य में 'सुन्दर' विशेषण है, क्योंकि यह 'घर' की विशेषता बता रहा है।

विशेष्य

विशेषण जिस संज्ञा या सर्वनाम शब्द की विशेषता बताते हैं, उन्हें विशेष्य कहते हैं; जैसे—मोहन एक 'ईमानदार' लड़का है। इस वाक्य में 'ईमानदार' शब्द 'मोहन' की विशेषता बता रहा है। अत: यहाँ 'ईमानदार' विशेषण तथा 'मोहन' शब्द विशेष्य है।

प्रविशेषण

विशेषण की भी विशेषता बताने वाले शब्द प्रविशेषण कहलाते हैं; जैसे—राजू बुहत अच्छा लड़का है।

उपरोक्त वाक्य में 'अच्छा' विशेषण है और 'बहुत' प्रविशेषण है।

विशेषण के प्रकार

विशेषण चार प्रकार के होते हैं

(i) गुणवाचक विशेषण

जिन शब्दों से किसी संज्ञा या सर्वनाम के गुण, दिशा, दोष, रंग, काल, दशा, आकार, स्थान आदि का पता चलता है, वे गुणवाचक विशेषण होते हैं;

जैसे— अच्छा, सुन्दर, कुरूप, नीच, सफेद, नीला, नया, पुराना, स्वस्थ, रोगी, बाहरी, भीतरी आदि।

(ii) संख्यावाचक विशेषण

जिस विशेषण से संख्या का बोध होता है, वे संख्यावाचक विशेषण होते हैं; जैसे—तीसरा, पाँचवाँ, दोगुना, प्रत्येक, बहुत आदि।

(iii) परिमाणवाचक विशेषण

जिस विशेषण से नाप-तौल आदि का पता चलता है, वे परिमाणवाचक विशेषण होते हैं; जैसे— पाँच किलो, ढाई मीटर, जरा-सा, बहुत-सा, कुछ आदि।

(iv) संकेतवाचक विशेषण

जो विशेषण संज्ञा की ओर संकेत करें, वे संकेतवाचक विशेषण होते हैं; जैसे— यह घर, वह आदमी, यह बाग, वह लड़की आदि।

विशेषण शब्दों की रचना

विशेषण शब्दों की रचना संज्ञा, सर्वनाम, क्रिया और अव्यय शब्दों में प्रत्यय लगाकर की जाती है।

संज्ञा से विशेषण बनाना

कुछ संज्ञा शब्दों से बने विशेषण निम्नलिखित हैं

संज्ञा	विशेषण	संज्ञा	विशेषण
नगर	नागरिक	उत्साह	उत्साही
आलस	आलसी	यश	यशस्वी
ऋण	ऋणी	कल्पना	काल्पनिक
इतिहास	ऐतिहासिक	भूगोल	भौगोलिक
विज्ञान	वैज्ञानिक	दिन	दैनिक
भूमि	भौमिक	पुष्प	पुष्पित
परिवार	पारिवारिक	समाज	सामाजिक
प्रान्त	प्रान्तीय	शहर	शहरी

सर्वनाम से विशेषण बनाना

कुछ सर्वनामों से बने विशेषण निम्नलिखित हैं

सर्वनाम	विशेषण	सर्वनाम	विशेषण
यह	ऐसा	जो	जैसा
कौन	कैसा	तुम	तुम-सा
वह	वैसा	मैं	मुझ-सा

क्रिया से विशेषण बनाना

कुछ क्रिया शब्दों से बने विशेषण निम्नलिखित हैं

क्रिया	विशेषण	क्रिया	विशेषण
भागना	भगोड़ा	भूलना	भुलक्कड़
बेचना	बिकाऊ	मरना	मरणशील
लड़ना	लड़ाकू	मिलना	मिलनसार
पूजना	पूजनीय	देखना	दिखावटी
पीना	पियक्कड़	पढ़ना	पढ़ाकू

अव्यय से विशेषण बनाना

कुछ अव्यय शब्दों से बने विशेषण निम्नलिखित हैं

अव्यय	विशेषण	अव्यय	विशेषण
ऊपर	ऊपरी	नीचे	निचला
आगे	अगला	पीछे	पिछला
बाहर	बाहरी	भीतर	भीतरी

5. अव्यय

जिन शब्दों पर लिंग, वचन और काल का कोई प्रभाव नहीं पड़ता, अव्यय या अविकारी शब्द कहलाते हैं; जैसे—

- रानी घर के अन्दर है।
- राजा घर के अन्दर था।
- वे घर के अन्दर हैं।
- लड़के घर के अन्दर हैं।

यहाँ रेखांकित अंश अव्यय हैं, क्योंकि उन पर लिंग, वचन व काल का कोई प्रभाव नहीं पड़ा है।

अव्यय के मुख्यत: चार भेद होते हैं

(i) क्रिया-विशेषण

जो अव्यय क्रिया की विशेषता प्रकट करे, उसे क्रिया-विशेषण कहते हैं।

क्रिया-विशेषण के चार भेद होते हैं

(a) **कालवाचक** इससे क्रिया (काम) होने के समय का बोध होता है; जैसे—कल, परसो, जब, कभी, फिर, बाद, आदि।

(b) **स्थानवाचक/दिशावाचक** इससे क्रिया होने के स्थान/दिशा का बोध होता है; जैसे—यहाँ, वहाँ, कहाँ, जहाँ आदि।

(c) **रीतिवाचक** इससे क्रिया होने की रीति ढंग का बोध होता है; जैसे—धीरे-धीरे, ज्यों-त्यों, जैसे-तैसे, कैसे, ऐसे आदि।

(d) **परिमाणवाचक** इससे क्रिया की मात्रा (आधिक्य, न्यूनता या पर्याप्तता) का बोध होता है; जैसे—कुछ अधिक, बहुत खूब, कम, जरा, इतना, उतना, कितना आदि।

(ii) सम्बन्धबोधक अव्यय

अव्यय शब्द संज्ञा या सर्वनाम शब्दों का सम्बन्ध वाक्य के अन्य शब्दों से जोड़ते हैं, उन्हें सम्बन्धबोधक अव्यय कहते हैं।

उदाहरण

- नदी की ओर जंगल है।
- विद्यालय के सामने कूड़ा मत फैलाना।

उपरोक्त वाक्यों में रेखांकित अंश सम्बन्ध जोड़ने का कार्य कर रहे हैं। अत: ये सम्बन्धबोधक हैं।

सम्बन्धबोधक शब्दों से पहले 'के', 'से' जैसे परसर्ग अवश्य लगे होते हैं।

काल, दिशा, स्थान, कारण उद्देश्य आदि के आधार पर इनके निम्नलिखित भेद हैं

- **कालवाचक** के पश्चात्, के बाद, के पहले
- **दिशावाचक** की ओर, की तरफ
- **स्थानवाचक** के ऊपर, के नीचे, की बगल
- **कारणवाचक** के कारण, की वजह से
- **उद्देश्यवाचक** के लिए, के हेतु, के वास्ते
- **साधनवाचक** के सहारे, की मदद से
- **तुलनावाचक** की अपेक्षा, से अच्छा, से बढ़िया
- **संगवाचक** के साथ, के संग
- **विषयवाचक** के बारे में, के विषय में
- **समतावाचक** की भाँति, के तुल्य, के योग्य

(iii) समुच्चयबोधक अव्यय

जो अव्यय शब्दों, वाक्यांशों अथवा वाक्यों को जोड़ने का कार्य करते हैं, उसे समुच्चयबोधक अव्यय कहते हैं; जैसे—तथा, एवं, अथवा, किन्तु, परन्तु आदि।

समुच्चयबोधक अव्यय के दो भेद होते हैं

(a) **समानाधिकरण** इसके द्वारा मुख्य वाक्य या एक ही प्रकार के शब्द जोड़े जाते हैं। *इसके चार भेद होते हैं*

- संयोजक और, एवं, तथा
- विभाजक या, अथवा, नहीं तो, चाहे-चाहे क्या-क्या, न-न, न ···· और, न।
- विरोधदर्शक पर, परन्तु, किन्तु, लेकिन, न केवल बल्कि, वरन्
- **परिणाम** (निमित्त) **दर्शक** इसलिए, अत:, अतएव।

(b) **व्यधिकरण** इसके द्वारा मुख्य वाक्य के साथ आश्रित वाक्य जोड़े जाते हैं।

इसके चार भेद होते हैं

- **कारणवाचक** क्योंकि, चूँकि, इसलिए कि
- **उद्देश्यवाचक** कि, ताकि, जिससे कि
- **संकेतवाचक** यदि/अगर ····· तो, यद्यपि ····· तथापि, चाहे ····· पर, हालाँकि ····· तो भी।
- **स्वरूपवाचक** कि, अर्थात्, मानो

(iv) विस्मयादिबोधक अव्यय

ऐसे अव्ययों से हर्ष, शोक, आश्चर्य, आदि। मनोभावों का बोध होता है, इसलिए इन्हें भावबोधक अव्यय भी कहा जाता है।

ये अव्यय निम्न प्रकार के होते हैं

- **हर्षबोधक** वाह! वाह! शाबाश! आहा! जय!
- **शोकबोधक** आह! ओह! अह! हाय! ऊह! काश!
- **आश्चर्यबोधक** ए! ऐं! ओहो! क्या! वाह!
- **तिरस्कारबोधक** हट! दुर! अरे! छिह! वाह!
- **सम्बोधन बोधक** रे! री! अरे! अरी, अजी, भई
- **अनुमोदन बोधक** हाँ! हो! ठीक! अच्छा!

व्याकरणिक कोटि

पद के भेदों के अतिरिक्त आइए महत्त्वपूर्ण व्याकरणिक कोटि के अंगों का अध्ययन करते हैं।

1. लिंग

संज्ञा के जिस रूप से व्यक्ति या वस्तु की नर अथवा मादा जाति का पता चले, उसे लिंग कहते हैं। *हिन्दी भाषा में लिंग के दो रूप हैं*

1. **पुल्लिंग** वे सभी शब्द, जिनसे पुरुष जाति का बोध होता है, पुल्लिंग कहलाते हैं; जैसे— शेर, बन्दर इत्यादि।
2. **स्त्रीलिंग** वे सभी शब्द, जिनसे स्त्री जाति का बोध होता है, स्त्रीलिंग कहलाते हैं; जैसे—शेरनी, बन्दरिया इत्यादि।

2. वचन

संज्ञा या सर्वनाम के जिस रूप से संख्या का बोध होता है, उसे वचन कहते हैं; जैसे—घड़ी और घड़ियाँ, यहाँ घड़ी' में एक संख्या का तथा 'घड़ियाँ' में एक से अधिक संख्या का बोध होता है।

वचन के प्रकार

हिन्दी भाषा में दो वचन होते हैं– एकवचन एवं बहुवचन।

एकवचन से एक का बोध होता है; जैसे–लड़की, तोता आदि।

बहुवचन से 'एक से अधिक' का बोध होता है; जैसे–लड़कियाँ, तोते आदि।

3. कारक

संज्ञा व सर्वनाम के जिस रूप से उसकी क्रिया अथवा दूसरे शब्द के साथ सम्बन्ध स्थापित होता है, उसे कारक कहते हैं।

कारक आठ प्रकार के होते हैं– कर्ता, कर्म, करण, सम्प्रदान, अपादान, सम्बन्ध, अधिकरण, सम्बोधन।

हिन्दी कारकों की विभक्ति का प्रयोग निम्न प्रकार होता है

कारक का नाम	कारक की विभक्ति चिह्न
कर्ता	ने
कर्म	को
करण	से
सम्प्रदान	को, के लिए
अपादान	से (पृथकता का भाव)
सम्बन्ध	का, की, के
अधिकरण	में, पर
सम्बोधन	हे! अरे! अजी! उफ!

कारक विभक्ति के प्रयोग के प्रमुख उदाहरण

कर्ता
राम ने खाना खाया।
मैंने उसे पढ़ाया।

कर्म
पिता ने पुत्र को डाँटा।
कृतिका ने काजल को पीटा।

करण
गीता कलम से लिखती है।
प्रीति चाकू से फल काट रही है।

सम्प्रदान
सीता ने राम को मिठाइयाँ दीं।
श्याम के लिए एक पुस्तक दो।

अपादान
वृक्ष से पत्ता गिरा।
छत्त से पतंग उड़ाई।

सम्बन्ध
यह राम की पुस्तक है।
गोदान प्रेमचन्द का उपन्यास है।

अधिकरण कारक
वृक्ष पर कौआ बैठा है।
तालाब में अनेक मछलियाँ हैं।

सम्बोधन कारक
हे प्रभु! हम सदाचारी बनें।
अरे! तुमने यह क्या किया?

4. काल

क्रिया के कार्य-व्यापार का समय क्रिया के जिस रूपान्तर से होता है, उसे 'काल' कहते हैं।

काल के तीन भेद हैं

(i) वर्तमान काल

'वर्तमान काल' से क्रिया की निरन्तरता का पता चलता है।

वर्तमान काल के पाँच भेद हैं

(a) सामान्य वर्तमान काल
(b) तात्कालिक वर्तमान काल
(c) पूर्ण वर्तमान काल
(d) संदिग्ध वर्तमान काल तथा
(e) सम्भाव्य वर्तमान काल।

(ii) भूतकाल

क्रिया के जिस रूप से कार्य की समाप्ति का बोध हो, उसे 'भूतकाल' कहते हैं। *भूतकाल के छह भेद हैं*

(a) सामान्य भूतकाल (b) आसन्न भूतकाल
(c) पूर्ण भूतकाल (d) अपूर्ण भूतकाल
(e) संदिग्ध भूतकाल (f) हेतुहेतुमद् भूतकाल।

(iii) भविष्यत् काल

भविष्य में होने वाली क्रिया-व्यापार को 'भविष्यत् काल' कहते हैं। *'भविष्यत् काल' के तीन भेद होते हैं*

(a) सामान्य (b) सम्भाव्य तथा (c) हेतुहेतुमद् भविष्य।

उदाहरण
- **वर्तमान काल** वह खा रहा है।
- **भूतकाल** वह खा रहा था।
- **भविष्यत् काल** वह खाएगा।

अभ्यास प्रश्न

1. जब कोई सार्थक शब्द, वाक्य में प्रयोग किया जाता है, तो उसे क्या कहते हैं?
   (a) वाक्य (b) वाक्यांश
   (c) पद (d) पदांश
2. पद के कितने भेद होते हैं?
   (a) पाँच (b) छः
   (c) सात (d) आठ
3. 'राम वन गए' वाक्य में संज्ञा शब्द है/हैं
   (a) राम (b) वन
   (c) राम, वन (d) गए
4. निम्नलिखित में जातिवाचक संज्ञा है
   (a) राम (b) गंगा
   (c) भलाई (d) पेड़
5. निम्नलिखित में भाववाचक संज्ञा है
   (a) गंगा (b) लड़का
   (c) मिठास (d) सेवक
6. 'तुम्हें उसकी बात माननी होगी' वाक्य में रेखांकित शब्द कौन-से सर्वनाम का भेद है?
   (a) निजवाचक सर्वनाम
   (b) पुरुषवाचक सर्वनाम
   (c) निश्चयवाचक सर्वनाम
   (d) अनिश्चयवाचक सर्वनाम
7. 'राधा नाचती है' वाक्य में क्रिया का कौन-सा प्रकार है?
   (a) सकर्मक क्रिया (b) अकर्मक क्रिया
   (c) संयुक्त क्रिया (d) प्रेरणार्थक क्रिया
8. निम्न में कौन-सा वाक्य प्रेरणार्थक क्रिया का उदाहरण है?
   (a) दोनों भाई देर तक बतियाते रहे।
   (b) श्यामू ने खाना खा लिया।
   (c) शमा मुझसे रोज खाना बनवाती है।
   (d) यह पत्र लिखकर सो जाओ।
9. 'यश' संज्ञा शब्द से बना विशेषण है
   (a) यशसा (b) यशस्वी
   (c) यशत्व (d) यशी
10. 'भूगोल' शब्द से बना विशेषण है
   (a) भौगोलिक (b) भूगोलीय
   (c) भूगोलिक (d) भूगोली
11. अव्यय होते हैं
   (a) जिन पर लिंग, वचन और कारक का प्रभाव पड़ता है
   (b) जिन पर केवल लिंग और वचन का प्रभाव पड़ता है
   (c) जिन पर लिंग, वचन और कारक का कोई प्रभाव नहीं पड़ता
   (d) जिन पर केवल कारक का प्रभाव पड़ता है
12. अव्यय के मुख्यत: कितने भेद होते हैं?
   (a) दो (b) तीन
   (c) चार (d) छः
13. 'मैं कल वहाँ गया' में क्रिया-विशेषण है
   (a) मैं (b) वहाँ
   (c) कल (d) गया
14. 'मैंने विधि के साथ खाना खाया।' वाक्य में रेखांकित अंश है
   (a) समुच्चयबोधक अव्यय
   (b) सम्बन्धबोधक अव्यय
   (c) क्रिया-विशेषण
   (d) विस्मयादिबोधक अव्यय
15. सर्वनाम के कितने भेद होते है?
   (a) एक
   (b) दो
   (c) छः
   (d) सात
16. निम्न में विस्मयादिबोधक अव्यय है
   (a) के योग्य (b) की ओर
   (c) कभी (d) शाबाश!

निर्देश (प्र. सं. 17-19) *में दिए गए शब्दों के उचित स्त्रीलिंग का चयन कीजिए*

17. माली
   (a) मालिनी (b) मालिन
   (c) मालि (d) मलिनी
18. बाघ
   (a) सिंहनी (b) शेरनी
   (c) बाघिन (d) बाघिनी
19. सम्राट
   (a) साम्राज्ञी (b) सम्राटिनी
   (c) रानी (d) महारानी

निर्देश (प्र. सं. 20-22) *में दिए गए शब्दों के लिए उचित बहुवचन का चयन कीजिए।*

20. चिड़िया
(a) चिड़ियाएँ (b) चिड़िएँ
(c) चिड़ी (d) चिड़ियाँ

21. गुरु
(a) गुरुएँ (b) गुरुजन
(c) गुरुवर्ग (d) गुरुदत्त

22. विद्यार्थी
(a) विद्यार्थीगण (b) विद्यार्थीजन
(c) विद्यार्थीवर्ग (d) विद्यार्थीदल

निर्देश (प्र. सं. 23-28) *में दिए गए पदों के बीच लगने वाले उचित कारक-चिह्न का चयन कीजिए।*

23. राजपुत्र
(a) के लिए (b) के
(c) को (d) का

24. कर्जमुक्त
(a) का (b) के लिए
(c) से (d) में

25. शोकमग्न
(a) में (b) का
(c) से (d) पर

26. मदांध
(a) से (b) में
(c) पर (d) का

27. घुड़सवार
(a) में (b) पर
(c) के लिए (d) की

28. तुलसीकृत
(a) में (b) के द्वारा
(c) पर (d) को

29. 'उसने खाना खाया' में काल है
(a) भूतकाल (b) वर्तमान काल
(c) भविष्यत्काल (d) इनमें से कोई नहीं

30. 'राहुल बस से जाएगा' में कौन-सा काल है?
(a) वर्तमान काल
(b) भूतकाल
(c) भविष्यत्काल
(d) उपरोक्त में से कोई नहीं

31. 'कविता सो रही है' में कौन-सा काल है?
(a) वर्तमान काल (b) भूतकाल
(c) भविष्यत्काल (d) इनमें से कोई नहीं

32. वर्तमान काल के कितने भेद होते हैं?
(a) तीन (b) दो
(c) पाँच (d) छः

33. भूतकाल के कितने भेद होते हैं?
(a) तीन (b) छः
(c) चार (d) पाँच

34. भविष्यत् काल के कितने भेद होते हैं?
(a) दो (b) तीन
(c) चार (d) पाँच

उत्तरमाला

1.	(c)	2.	(a)	3.	(c)	4.	(d)	5.	(c)	6.	(b)	7.	(b)	8.	(c)	9.	(b)	10.	(a)
11.	(c)	12.	(c)	13.	(b)	14.	(b)	15.	(c)	16.	(d)	17.	(b)	18.	(c)	19.	(a)	20.	(d)
21.	(b)	22.	(a)	23.	(d)	24.	(c)	25.	(a)	26.	(a)	27.	(b)	28.	(b)	29.	(a)	30.	(c)
31.	(a)	32.	(c)	33.	(b)	34.	(b)												

अध्याय

06

पद परिचय

प्रस्तुत अध्याय पद परिचय; जैसे-संज्ञा, सर्वनाम, क्रिया, विशेषण तथा अव्यय आदि पर आधारित है।

किसी व्यक्ति, वस्तु आदि से सम्बन्धित कोई जानकारी देना उस व्यक्ति, वस्तु का परिचय कहलाता है। जब हम किसी से उसके विषय में कुछ पूछते हैं, तो वह उसका परिचय होता है। इसी तरह पद के विषय में बताना भी उसका 'पद परिचय' कहलाता है।

किसी सार्थक वाक्य में जो शब्द होते हैं, उन्हें पद कहते हैं। अत: उन पदों का परिचय देना ही 'पद परिचय' कहलाता है।

पद परिचय के अन्तर्गत किसी पद का व्याकरणिक रूप से पूर्ण परिचय दिया जाता है अर्थात् वाक्य में उस पद की स्थिति, उसका लिंग, वचन, कारक तथा अन्य पदों से उसका क्या सम्बन्ध है आदि से अवगत कराना; जैसे—राजा शहर जाता है।

राजा व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'जाता है' क्रिया का कर्ता

शहर जातिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्म कारक, 'जाता है' क्रिया का कर्म

जाता है सकर्मक क्रिया, पुल्लिंग, एकवचन, 'जा' धातु, वर्तमान काल, 'राजा' कर्ता की क्रिया

अत: उपर्युक्त वाक्य में तीन पद हैं-'राजा', 'शहर' और 'जाता है' और यहाँ पर इन तीनों का व्याकरणिक कोटि के आधार पर परिचय कराया गया है।

पिछले अध्याय में हमने बताया कि पद पाँच प्रकार के होते हैं; संज्ञा, सर्वनाम, विशेषण, क्रिया तथा अव्यय। इन सभी पदों का परिचय किस प्रकार दिया जाता है, आइए इस विषय पर विचार करते हैं

संज्ञा का पद परिचय

संज्ञा का पद परिचय देते समय हमें निम्न बिन्दुओं की जानकारी होना आवश्यक है

1. संज्ञा के भेद, 2. लिंग, 3. वचन, 4. कारक तथा 5. क्रिया के साथ पद का सम्बन्ध

जैसे—मोहन घर से जाता है।

मोहन व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'जाता है' क्रिया का कर्ता

घर जातिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्म कारक, 'जाता है' क्रिया का कर्म

सर्वनाम का पद परिचय

सर्वनाम का पद परिचय देते समय निम्न बिन्दुओं की जानकारी होना आवश्यक है

1. सर्वनाम का भेद, उपभेद, 2. लिंग, 3. वचन,

4. कारक तथा 5. क्रिया के साथ सम्बन्ध

जैसे राहुल ने उसे क्यों मारा?

'उसे' उपर्युक्त वाक्य में सर्वनाम है। अत: इसका परिचय हम इस प्रकार देंगे।

उसे पुरुषवाचक सर्वनाम का अन्य पुरुष, उभय लिंग, एकवचन, कर्म कारक, 'मारा' क्रिया का कर्म।

उभय लिंग से तात्पर्य उन शब्दों से है, जो पुल्लिंग तथा स्त्रीलिंग दोनों शब्दों के लिए प्रयोग किए जा सकते हैं; जैसे—

उस कुर्सी को वहाँ रख दो। (स्त्रीलिंग)

उस कम्प्यूटर को यहाँ ले आओ। (पुल्लिंग)

विशेषण का पद परिचय

विशेषण का पद परिचय देते समय निम्न बिन्दुओं की जानकारी होना आवश्यक है

1. विशेषण के भेद, उपभेद, 2. लिंग, 3. वचन, 4. कारक 5. विशेष्य

जैसे राहुल कल ईमानदार लकड़हारे से मिला।

ईमानदार गुणवाचक विशेषण, पुल्लिंग, एकवचन, करण कारक, 'लकड़हारे' विशेष्य का विशेषण।

क्रिया का पद परिचय

क्रिया का पद परिचय देते समय निम्न बिन्दुओं की जानकारी होना आवश्यक है

1. क्रिया के भेद (कर्म के आधार पर) 2. लिंग 3. वचन 4. धातु 5. काल 6. कर्ता का संकेत

जैसे कवि ने एक कविता लिखी।

लिखी सकर्मक क्रिया, एकवचन, स्त्रीलिंग, 'लिख' धातु, भूतकाल, 'कवि' इसका कर्ता।

अव्यय का पद परिचय

हम जानते हैं कि अव्यय के मुख्यत: चार भेद होते हैं

1. क्रिया विशेषण
2. सम्बन्धबोधक
3. समुच्चयबोधक
4. विस्मयादिबोधक

अत: **क्रिया विशेषण** का पद परिचय देते समय हमें *निम्न बिन्दुओं की जानकारी देनी होगी*

1. क्रिया विशेषण के भेद, उपभेद, 2. विशेष्य-क्रिया का संकेत

जैसे राहुल स्कूल धीरे-धीरे गया।

धीरे-धीरे रीतिवाचक क्रिया विशेषण, 'गया' क्रिया की विशेषता बता रहा है।

सम्बन्धबोधक का पद परिचय देते समय हमें *निम्न बिन्दुओं की जानकारी देनी होगी*

1. सम्बन्धबोधक का भेद, उपभेद,
2. पदों/पदबन्धों/वाक्यांशों से सम्बन्ध

जैसे यह कार्य राम की वजह से सफल हुआ।

की वजह से कारणवाचक सम्बन्धबोधक अव्यय, राम का सम्बन्ध अन्य शब्दों से जोड़ता है।

समुच्चयबोधक का पद परिचय देते समय हमें *निम्न बिन्दुओं की जानकारी देनी होगी*

1. समुच्चयबोधक का भेद, उपभेद, 2. संयुक्त शब्द या वाक्य;

जैसे राहुल को घर जाना होगा, क्योंकि उसकी माँ ने उसे बुलाया है।

क्योंकि कारणवाचक व्यधिकरण समुच्चयबोधक अव्यय, 'राहुल को घर जाना होगा वाक्य को दूसरे वाक्य से मिला रहा है

विस्मयादिबोधक का पद परिचय देते समय *निम्न जानकारी देनी होगी*

1. विस्मयादिबोधक का भेद, उपभेद 2. सूचक भाव

जैसे हा! राहुल के दादा जी का स्वर्गवास हो गया।

हा!.....विस्मयादिबोधक अव्यय, शोक सूचक

अभ्यास प्रश्न

1. पद परिचय क्या है?
   (a) शब्दों के भेद बताना
   (b) वाक्यों की जानकारी देना
   (c) वाक्य में पदों की स्थिति बताना
   (d) पदों का वाक्यों से सम्बन्ध बताना

2. निम्न में से कौन पद का एक भेद है?
   (a) लिंग (b) संज्ञा
   (c) वचन (d) कारक

3. निम्न में से कौन पद का एक भेद है?
   (a) अव्यय (b) कारक
   (c) लिंग (d) वचन

4. 'करीना बहुत तेज दौड़ती है' वाक्य में 'बहुत' शब्द क्या है?
   (a) विशेषण (b) क्रिया-विशेषण
   (c) विशेष्य (d) प्रविशेषण

5. 'रवि के कंचे बिखर गए' वाक्य में 'बिखर गए 'संयुक्त क्रिया में कौन-सा वचन है?
   (a) द्विवचन
   (b) बहुवचन
   (c) एकवचन
   (d) उपरोक्त में से कोई नहीं

निर्देश (प्रश्न संख्या 6-20) में दिए गए वाक्यों में रेखांकित अंशों के उचित पद परिचय का चयन कीजिए

6. साहिल कल अमेरिका जाएगा।
   (a) व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, करण कारक, 'जाएगा' क्रिया का कर्ता
   (b) व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'जाएगा' क्रिया का कर्ता
   (c) जातिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'जाएगा' क्रिया का कर्ता
   (d) भाववाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'जाएगा' क्रिया का कर्ता

7. रवि मुम्बई चला गया।
   (a) भाववाचक संज्ञा, पुल्लिंग, बहुवचन, कर्म कारक 'चली गई' क्रिया का कर्म
   (b) व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्म कारक, 'चली गई' क्रिया का कर्म
   (c) व्यक्तिवाचक संज्ञा, स्त्रीलिंग, एकवचन, कर्म कारक, 'चली गई' क्रिया का कर्म
   (d) व्यक्तिवाचक संज्ञा, पुल्लिंग, एकवचन, कर्ता कारक, 'चली गई' क्रिया का कर्ता

8. तुम्हें उसकी बात माननी चाहिए।
   (a) पुरुषवाचक सर्वनाम, अन्य पुरुष, स्त्रीलिंग, एकवचन कर्म कारक, 'माननी चाहिए' क्रिया का कर्म
   (b) निश्चयवाचक सर्वनाम, अन्य पुरुष, स्त्रीलिंग, एकवचन, कर्म कारक, 'माननी चाहिए' क्रिया का कर्म
   (c) पुरुषवाचक सर्वनाम, उत्तम पुरुष, स्त्रीलिंग, एकवचन, कर्म कारक, 'माननी चाहिए' क्रिया का कर्म
   (d) पुरुषवाचक सर्वनाम, अन्य पुरुष, पुल्लिंग, एकवचन कर्म कारक, 'माननी चाहिए' क्रिया का कर्म

9. उन्होंने कल क्या देखा?
   (a) निजवाचक सर्वनाम, अन्य पुरुष, उभय लिंग, बहुवचन, कर्ता कारक 'देखा' क्रिया का कर्ता
   (b) निजवाचक सर्वनाम, अन्य पुरुष, उभय लिंग, बहुवचन, कर्म कारक, 'देखा' क्रिया का कर्म
   (c) पुरुषवाचक सर्वनाम, अन्य पुरुष, उभय लिंग, बहुवचन, कर्ता कारक, 'देखा' क्रिया का कर्ता
   (d) पुरुषवाचक सर्वनाम, अन्य पुरुष, उभय लिंग, एकवचन, कर्ता कारक, 'देखा' क्रिया का कर्ता

10. कृष्णा विद्यालय जाता है।
   (a) अकर्मक क्रिया, पुल्लिंग, एकवचन, 'जा' धातु, वर्तमान काल, 'कृष्णा' इसका कर्ता
   (b) सकर्मक क्रिया, स्त्रीलिंग, एकवचन, 'जा' धातु, वर्तमान काल, 'कृष्णा' इसका कर्ता
   (c) सकर्मक क्रिया, पुल्लिंग, बहुवचन, 'जा' धातु, वर्तमान काल, 'कृष्णा' इसका कर्ता
   (d) सकर्मक क्रिया, पुल्लिंग, एकवचन, 'जा' धातु, वर्तमान काल, 'कृष्णा' इसका कर्ता

11. विरेन्द्र कल तालाब में गिर गया।
   (a) सकर्मक क्रिया, स्त्रीलिंग, 'गिर' धातु, भूतकाल, 'विरेन्द्र' इसका कर्ता
   (b) सकर्मक क्रिया, पुल्लिंग, 'गिर' धातु, वर्तमान काल, 'विरेन्द्र' इसका कर्ता
   (c) सकर्मक क्रिया, संयुक्त क्रिया, एकवचन, पुल्लिंग, 'गिर' धातु, भूतकाल, 'विरेन्द्र' इसका कर्ता
   (d) अकर्मक क्रिया, पुल्लिंग, 'गिर' धातु, भूतकाल, 'विरेन्द्र, इसका कर्ता

12. मुझे कल यह मैच खेलना होगा।
   (a) सकर्मक क्रिया, पुल्लिंग, बहुवचन, 'खेल' धातु, भविष्यत् काल, 'मुझे' इसका कर्ता
   (b) अकर्मक क्रिया, पुल्लिंग, 'खेल' धातु, भविष्यत् काल, 'मुझे' इसका कर्ता

(c) सकर्मक क्रिया, पुल्लिंग, एकवचन, 'खेल' धातु, भविष्यत् काल, 'मुझे' इसका कर्ता

(d) सकर्मक क्रिया, स्त्रीलिंग, 'खेल' धातु, भविष्यत् काल, 'मुझे' इसका कर्ता

13. मुझे लगता है कि यह भीतरी षड्यन्त्र है।

(a) परिमाणवाचक विशेषण, पुल्लिंग, एकवचन कर्म कारक, 'षड्यन्त्र' का विशेषण

(b) गुणवाचक विशेषण, पुल्लिंग, एकवचन, कर्म कारक, 'षड्यन्त्र' का विशेषण

(c) गुणवाचक विशेषण, पुल्लिंग, बहुवचन, कर्म कारक, 'षड्यन्त्र' का विशेषण

(d) परिमाणवाचक विशेषण, पुल्लिंग, बहुवचन, कर्म कारक, 'षड्यन्त्र' का विशेषण

14. वह व्यक्ति अन्दर नहीं आना चाहिए।

(a) संख्यावाचक विशेषण, पुल्लिंग, एकवचन, कर्म कारक, 'व्यक्ति' का विशेषण

(b) संकेतवाचक विशेषण, पुल्लिंग, एकवचन, कर्ता कारक, 'व्यक्ति' का विशेषण

(c) संकेतवाचक विशेषण, स्त्रीलिंग, एकवचन, कर्ता कारक, 'व्यक्ति' का विशेषण

(d) संख्यावाचक विशेषण, पुल्लिंग, एकवचन, कर्ता कारक, 'व्यक्ति' का विशेषण

15. तुम मुझे परसो मिलना।

(a) कालवाचक क्रिया विशेषण, 'मिलना' क्रिया की विशेषता बता रहा है।

(b) स्थानवाचक क्रिया विशेषण, 'मिलना' क्रिया की विशेषता बता रहा है

(c) रीतिवाचक क्रिया विशेषण, 'मिलना' क्रिया की विशेषता बता रहा है

(d) परिमाणवाचक क्रिया विशेषण, 'मिलना' क्रिया की विशेषता बता रहा है।

16. मैंने कल दिव्या के साथ पूजा की।

(a) स्वरूपवाचक व्यधिकरण समुच्चयबोधक अव्यय, दिव्या का सम्बन्ध अन्य शब्दों से जोड़ता है।

(b) संगवाचक सम्बन्धबोधक अव्यय, दिव्या का सम्बन्ध अन्य शब्दों से जोड़ता है।

(c) समुच्चयबोधक अव्यय, दिव्या का सम्बन्ध अन्य शब्दों से जोड़ता है।

(d) उद्देश्यवाचक सम्बन्धबोधक अव्यय, दिव्या का सम्बन्ध अन्य शब्दों से जोड़ता है

17. तुम्हें यह यज्ञ करना ही होगा, ताकि तुम रण में विजयी हो सको।

(a) उद्देश्यवाचक व्यधिकरण समुच्चयबोधक अव्यय, 'तुम्हें.....होगा' वाक्य को दूसरे वाक्य से जोड़ता है।

(b) रीतिवाचक क्रिया विशेषण, 'होगा' क्रिया की विशेषता बता रहा है।

(c) कारणवाचक व्यधिकरण समुच्चयबोधक अव्यय, 'तुम्हें.....होगा' वाक्य को दूसरे वाक्य से जोड़ता है।

(d) कालवाचक सम्बन्धबोधक अव्यय, 'तुम्हें' का सम्बन्ध अन्य शब्दों से जोड़ता है।

18. मैं चला तो जाता किन्तु मुझे और भी काम हैं।

(a) सम्बन्धबोधक अव्यय, 'मैं' का सम्बन्ध अन्य शब्दों से जोड़ता है।

(b) उद्देश्यवाचक व्यधिकरण समुच्चयबोधक अव्यय, 'मैं'.....जाता' वाक्य को दूसरे वाक्य से जोड़ता है।

(c) विरोधदर्शक समानाधिकरण समुच्चयबोधक अव्यय, मैं.....जाता' वाक्य को दूसरे वाक्य से जोड़ता है।

(d) संयोजक समानाधिकरण समुच्चयबोधक अव्यय, 'मैं'.....जाता' वाक्य को दूसरे वाक्य से जोड़ता है।

19. वाह! हमने यह मैच जीत लिया।

(a) विस्मयादिबोधक अव्यय, शोक सूचक

(b) विस्मयादिबोधक अव्यय, हर्ष सूचक

(c) विस्मयादिबोधक अव्यय, आश्चर्य सूचक

(d) विस्मयादिबोधक अव्यय, अनुमोदन सूचक

20. क्या! तुम भी थे वहाँ।

(a) विस्मयादिबोधक अव्यय, हर्ष सूचक

(b) विस्मटयादिबोधक अव्यय, घृणा सूचक

(c) विस्मयादिबोधक अव्यय, शोक सूचक

(d) विस्मयादिबोधक अव्यय, आश्चर्य सूचक

उत्तरमाला

1.	(c)	2.	(b)	3.	(a)	4.	(d)	5.	(b)	6.	(b)	7.	(b)	8.	(a)	9.	(c)	10.	(d)
11.	(c)	12.	(c)	13.	(b)	14.	(b)	15.	(a)	16.	(b)	17.	(a)	18.	(c)	19.	(b)	20.	(d)

अध्याय

07

समास

प्रस्तुत अध्याय में समास और समास के भेदों का वर्णन किया है।

समास का अर्थ 'संक्षिप्त' होता है। कम-से-कम शब्दों में अधिक-से-अधिक अर्थ प्रकट करना 'समास' का लक्ष्य होता है। वस्तुत: दो या दो से अधिक शब्दों का परस्पर सम्बन्ध बताने वाले शब्दों अथवा प्रत्ययों का लोप होने पर जो नया शब्द बनता है, उसे **सामासिक शब्द** अथवा **सामासिक पद** कहते हैं।

दो या दो से अधिक शब्दों अथवा पदों के संयोग को **समास** कहा जाता है। 'सामासिक शब्द' अथवा 'पद' को अर्थ के अनुकूल विभाजित करना 'विग्रह' कहलाता है।

सामान्यतया समास के चार भेद होते हैं

1. अव्ययीभाव समास

जिस सामासिक पद का पूर्वपद प्रधान हो तथा सामासिक पद अव्यय हो, उसे अव्ययीभाव कहते हैं। इस समास में सम्पूर्ण पद क्रिया-विशेषण अव्यय हो जाता है; जैसे—प्रतिदिन, यथासम्भव, आमरण इत्यादि।

उदाहरण

पद	विग्रह	पद	विग्रह
अनुकूल	मन के अनुसार	यथास्थान	स्थान के अनुसार
अनुरूप	रूप के अनुसार	यथासमय	समय के अनुसार
अभ्यागत	अभि आगत	यथाशीघ्र	शीघ्रता से
आजन्म	जन्म से लेकर	यथाक्रम	क्रम के अनुसार

2. तत्पुरुष समास

तत्पुरुष समास का अन्तिम पद प्रधान होता है। ऐसे समास में प्राय: प्रथम पद विशेषण तथा द्वितीय पद विशेष्य होता है। द्वितीय पद के विशेष्य होने के कारण समास में इसकी प्रधानता होती है।

ऐसे समास तीन प्रकार के हैं—तत्पुरुष, कर्मधारय तथा द्विगु। तत्पुरुष के छ: भेद हैं। *ये हैं*—कर्म, करण, सम्प्रदान, अपादान, सम्बन्ध तथा अधिकरण तत्पुरुष समास। कर्मधारय तथा द्विगु तत्पुरूष के भेद हैं।

कर्म (द्वितीय) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
कठफोड़वा	काठ को फोड़ने वाला	यशप्राप्त	यश को प्राप्त
कुम्भकार	कुम्भ को बनाने वाला	गिरिधर	गिरि को धारण करने वाला
गृहागत	गृह को आगत	मनोहर	मन को हरने वाला

करण (तृतीय) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
अकालपीड़ित	अकाल से पीड़ित	करुणापूर्ण	करुणा से पूर्ण
अन्धकारयुक्त	अन्धकार से युक्त	जलाभिषेक	जल से अभिषेक
कर्मवीर	कर्म से वीर	तुलसीकृत	तुलसी द्वारा रचित

सम्प्रदान (चतुर्थी) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
देशभक्ति	देश के लिए भक्ति	युद्धभूमि	युद्ध के लिए भूमि
देवालय	देव के लिए आलय	विधानसभा	विधान के लिए सभा
धर्मशाला	धर्म के लिए शाला	स्नानघर	स्नान के लिए घर

अपादान (पंचमी) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
अन्नहीन	अन्न से हीन	कर्त्तव्यच्युत	कर्त्तव्य से च्युत
कर्महीन	कर्म से हीन	भयभीत	भय से डरा हुआ
जातिभ्रष्ट	जाति से भ्रष्ट	वनरहित	वन से रहित

सम्बन्ध (षष्ठी) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
विद्याभ्यास	विद्या का अभ्यास	छात्रावास	छात्र का आवास
सेनापति	सेना का पति	गंगाजल	गंगा का जल
आनन्दाश्रम	आनन्द का आश्रम	जलयान	जल का यान

अधिकरण (सप्तमी) तत्पुरुष के उदाहरण

पद	विग्रह	पद	विग्रह
गृहप्रवेश	गृह में प्रवेश	कविश्रेष्ठ	कवियों में श्रेष्ठ
आत्मनिर्भर	आत्म पर निर्भर	कृषिप्रधान	कृषि में प्रधान
युधिष्ठिर	युद्ध में स्थिर	रणधीर	रण में धीर

तत्पुरुष समास के दो उपभेद हैं—

कर्मधारय समास

जिस तत्पुरुष समास के समस्त पद समान रूप से प्रधान हों तथा विशेष्य-विशेषण या उपमेय-उपमान के भाव को प्राप्त होते हैं तथा जिनके लिंग, वचन भी समान हों, वहाँ कर्मधारय समास होता है।

कर्मधारय समास चार प्रकार के होते हैं—

1. विशेषण पूर्वपद
2. विशेष्य पूर्वपद
3. विशेषणोभय पद
4. विशेष्योभय पद।

उदाहरण

पद	विग्रह	पद	विग्रह
नीलकमल	नीला कमल	महाकाव्य	महान् काव्य
महात्मा	महान् आत्मा	श्यामसुन्दर	श्याम जो सुन्दर है
महावीर	महान् वीर	चन्द्रवदन	चन्द्र के समान मुख

द्विगु समास

जिस समास का पहला पद संख्याबोधक हो, वह द्विगु समास कहलाता है। द्विगु समास दो प्रकार के होते हैं—**1.** समाहार द्विगु **2.** उपपद प्रधान द्विगु। **उदाहरण**

पद	विग्रह	पद	विग्रह
त्रिभुवन	तीन भुवनों का समाहार	चतुर्वेद	चार वेदों का समाहार
नवग्रह	नौ ग्रहों का समाहार	पंचमुख	पाँच मुखों का समाहार
चौराहा	चार राहों का समाहार	तिमाही	तीन माहों का समाहार

3. बहुव्रीहि समास

जहाँ दोनों पदों को छोड़कर अन्य पद की प्रधानता हो, वहाँ बहुव्रीहि समास होता है।

उदाहरण

पद	विग्रह
चतुरानन	चार हैं आनन जिसके अर्थात् ब्रह्मा
लम्बोदर	लम्बा है उदर जिसका अर्थात् गणेश
वीणापाणि	वीणा है कर में जिसके अर्थात् सरस्वती
नीलाम्बर	नीला है जिसका अम्बर अर्थात् श्रीकृष्ण

4. द्वन्द्व समास

द्वन्द्व समास में सभी पद प्रधान होते हैं। इस समास के दोनों पदों के बीच में योजक चिह्न लगा होता है; जैसे—और, या, अथवा आदि। द्वन्द्व समास के तीन भेद होते हैं—**1.** इतरेत्तर द्वन्द्व **2.** समाहार द्वन्द्व **3.** वैकल्पिक द्वन्द्व।

उदाहरण

पद	विग्रह
अन्न-जल	अन्न और जल
आग-पानी	आग और पानी
मार-पीट	मार या पीट
धन-दौलत	धन, दौलत आदि
पाप-पुण्य	पाप या पुण्य इत्यादि।

अभ्यास प्रश्न

1. 'यथाशक्ति' में कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष
(c) द्वन्द्व (d) अव्ययीभाव

2. 'त्रिभुज' शब्द में कौन-सा समास है?
(a) षष्ठी तत्पुरुष (b) द्विगु
(c) मध्यम पद लोपी (d) अलुक

3. 'देशभक्त' में कौन-सा समास है?
(a) षष्ठी तत्पुरुष (b) द्वन्द्व
(c) बहुव्रीहि (d) अव्ययीभाव

4. 'चतुर्भुज' शब्द में कौन-सा समास है?
(a) द्विगु (b) अव्ययीभाव
(c) बहुव्रीहि (d) तत्पुरुष

5. 'दही-बड़ा' शब्द में कौन-सा समास है?
(a) सप्तमी तत्पुरुष (b) द्विगु
(c) मध्यम पद लोपी (d) अलुक

6. 'आजकल' शब्द में कौन-सा समास है?
(a) अव्ययीभाव (b) तत्पुरुष
(c) कर्मधारय (d) द्वन्द्व

7. 'पंचपात्र' शब्द में कौन-सा समास है?
(a) कर्मधारय (b) बहुव्रीहि
(c) द्विगु (d) तत्पुरुष

8. 'शोकाकुल' शब्द में कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष
(c) द्वन्द्व (d) द्विगु

9. 'नीलगाय' में कौन-सा समास है?
(a) तत्पुरुष (b) अव्ययीभाव
(c) कर्मधारय (d) द्वन्द्व

10. 'रोगपीड़ित' में कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष
(c) द्वन्द्व (d) अव्ययीभाव

11. 'पंचानन' में कौन-सा समास है?
(a) द्विगु (b) बहुव्रीहि
(c) कर्मधारय (d) अव्ययीभाव

12. 'रसोईघर' में कौन-सा समास है?
(a) तत्पुरुष (b) बहुव्रीहि
(c) द्वन्द्व (d) कर्मधारय

13. 'लोकनायक' में कौन-सा समास है?
(a) तत्पुरुष (b) द्विगु
(c) द्वन्द्व (d) अव्ययीभाव

14. 'लौहपुरुष' में कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष
(c) द्वन्द्व (d) द्विगु

15. 'मुँहतोड़' में कौन-सा समास है?
(a) तत्पुरुष (b) अव्ययीभाव
(c) द्विगु (d) द्वन्द्व

16. 'नीलकण्ठ' में कौन-सा समास है?
(a) तत्पुरुष (b) बहुव्रीहि
(c) द्विगु (d) द्वन्द्व

17. 'मृगनयन' में कौन-सा समास है?
(a) कर्मधारय (b) द्विगु
(c) द्वन्द्व (d) तत्पुरुष

18. 'कृषि प्रधान' में कौन-सा समास है?
(a) तत्पुरुष (b) द्विगु
(c) द्वन्द्व (d) कर्मधारय

19. 'दूध-रोटी' में कौन-सा समास है?
(a) तत्पुरुष (b) द्वन्द्व
(c) द्विगु (d) कर्मधारय

20. 'भूदान' में कौन-सा समास है?
(a) अव्ययीभाव
(b) तत्पुरुष
(c) कर्मधारय
(d) द्विगु

21. 'देशसेवा' में कौन-सा समास है?
(a) कर्मधारय (b) द्विगु
(c) तत्पुरुष (d) बहुव्रीहि

22. 'दिनकर' में कौन-सा समास है?
(a) तत्पुरुष (b) द्विगु
(c) द्वन्द्व (d) कर्मधारय

23. 'शरणागत' में कौन-सा समास है?
(a) कर्मधारय (b) तत्पुरुष
(c) बहुव्रीहि (d) द्विगु

24. 'अजातशत्रु' में कौन-सा समास है?
(a) तत्पुरुष (b) द्वन्द्व
(c) कर्मधारय (d) बहुव्रीहि

25. 'पंजाब' में कौन-सा समास है?
(a) बहुव्रीहि (b) कर्मधारय
(c) तत्पुरुष (d) द्विगु

26. 'श्रमसाध्य' में कौन-सा समास है?
(a) तत्पुरुष (b) बहुव्रीहि
(c) द्विगु (d) द्वन्द्व

27. 'मातृभाषा' में कौन-सा समास है?
(a) द्विगु (b) द्वन्द्व
(c) तत्पुरुष (d) कर्मधारय

28. निम्नलिखित में से कौन अव्ययीभाव समास का उदाहरण नहीं है?
(a) यथाशक्ति (b) बेमतलब
(c) प्रतिवर्ष (d) लोकप्रिय

29. निम्न शब्दों में कौन कर्मधारय समास का उदाहरण है?
(a) यथोचित (b) पर्णकुटीर
(c) दोपहर (d) विद्यालय

30. निम्न शब्दों में कौन द्विगु समास का उदाहरण है?
(a) सतसई (b) हानि-लाभ
(c) दीनानाथ (d) लौहपुरुष

उत्तरमाला

1.	(d)	2.	(b)	3.	(a)	4.	(c)	5.	(a)	6.	(d)	7.	(c)	8.	(b)	9.	(c)	10.	(b)
11.	(b)	12.	(a)	13.	(a)	14.	(a)	15.	(a)	16.	(b)	17.	(a)	18.	(a)	19.	(b)	20.	(b)
21.	(c)	22.	(a)	23.	(b)	24.	(d)	25.	(d)	26.	(a)	27.	(c)	28.	(d)	29.	(b)	30.	(a)

अध्याय

08

अशुद्ध वाक्य को शुद्ध करना

वाक्य का सम्पूर्ण सौन्दर्य और अर्थ पदों अथवा शब्दों की सुव्यवस्था पर आधारित है। पदों एवं शब्दों की शक्ति तथा सहजता पर ध्यान देकर ही हम अपनी भाषा को प्रवाहमयी बना सकते हैं। वाक्यों के प्रयोग में होने वाली सामान्य अशुद्धियों की ओर ध्यान आकृष्ट करना जरूरी है। व्याकरणिक नियमों के सही प्रयोग तथा क्रियान्वयन द्वारा ही वाक्य-शुद्धि सम्भव है।

वाक्य-संरचना में आने वाली सामान्य अशुद्धियाँ

वाक्यों के प्रयोग में संज्ञा, सर्वनाम, क्रिया, विशेषण तथा क्रिया-विशेषण की क्रमबद्धता का होना जरूरी है। वाक्य में अर्थ तथा ध्वनि की संगति पर विशेष ध्यान देने की जरूरत होती है। व्यर्थ शब्दों का प्रयोग वाक्य को बोझिल तथा अप्रासंगिक बना देता है। वाक्यों में पुनरुक्ति एक दोष है। एक ही शब्द का बार-बार आना अजीब और असहज लगता है। वाक्य में सामान्य रूप से प्रचलित तथा अर्थपूर्ण शब्दों का प्रयोग होना चाहिए। संज्ञा शब्दों की जगह 'सर्वनाम' का प्रयोग वाक्य को सारगर्भित बनाता है। *वाक्य में निम्न प्रकार की गलतियाँ अकसर होती हैं, जिन पर ध्यान देना जरूरी है*

1. 'प्रत्येक', 'किसी' तथा 'कोई' का प्रयोग सर्वदा एकवचन में होता है। बहुवचन में इनका प्रयोग गलत होता है।
2. 'द्वारा' तथा 'से' के प्रयोग में अन्तर है। किसी व्यक्ति के माध्यम से सम्पादित होने वाले कार्य को 'द्वारा' का प्रयोग कर प्रकट किया जाता है, जबकि व्यक्ति को छोड़कर अन्य संज्ञा शब्दों में 'से' का प्रयोग किया जाना चाहिए।
3. व्यक्तिवाचक संज्ञा के अर्थ में क्रिया का रूप उक्त संज्ञा के लिंग तथा वचन द्वारा परिचालित होता है।
4. बहुवचन तथा स्त्रीलिंग निर्माण में प्राय: गलतियाँ होती हैं। सबसे अधिक गलती गया, गई, हुआ, हुई, किया, किए के प्रयोग में होती है। क्रिया का एकवचन 'गया' है। अत: इसका बहुवचन 'गए' तथा स्त्रीलिंग रूप 'गई' होना चाहिए, जबकि अकसर 'गए' का प्रयोग बहुवचन के रूप में होता है। 'हुआ' के बहुवचन रूप 'हुए' तथा स्त्रीलिंग रूप 'हुई' सही है।

प्रस्तुत अध्याय 'हिन्दी वाक्यों में होने वाली अशुद्धियाँ कैसी होती हैं' और 'इन्हें कैसे दूर किया जाए आदि पर आधारित हैं'।

वाक्यों के अशुद्ध तथा शुद्ध रूप अध्ययन की सुविधा के लिए नीचे दिए जा रहे हैं।

वाक्यों की सामान्य अशुद्धियाँ तथा उनके शुद्ध रूप

अशुद्ध वाक्य	शुद्ध वाक्य
हिन्दुओं के अनेकों देवता हैं।	हिन्दुओं के अनेक देवता हैं।
राम और श्याम जाता है।	राम और श्याम जाते हैं।
श्रीराम के भाई लक्ष्मण था।	श्रीराम के भाई लक्ष्मण थे।
राकेश और सरिता जाती है।	राकेश और सरिता जाते हैं।
कई भारत के लोग विदेशों में उच्च पद पर हैं।	भारत के कई लोग विदेशों में उच्च पद पर हैं।
उसने मुझे एक कलम दिए हैं।	उसने मुझे एक कलम दी है।
हम लोगों ने इसको सोचा है।	हम लोगों ने इस पर सोचा है।
मेरे मन से एक विचार आया।	मेरे मन में एक विचार आया।
कोई लड़के को बुलाओ।	किसी लड़के को बुलाओ।
किसी आदमी अँधेरे में दिखा।	कोई आदमी अँधेरे में दिखा।
कविता भारत की वन्दना पर है।	कविता में भारत की वन्दना है।
सरिता भात खायी।	सरिता ने भात खाया।
राम ने रोटी खाया।	राम ने रोटी खायी।
किसकी यह कलम है?	यह किसकी कलम है?
यह कविता अनेकों भाव को प्रकट करती है।	यह कविता अनेक भावों को प्रकट करती है।
शायद वह अवश्य आए।	शायद वह आएगा।
वहाँ भारी-भरकम भीड़ थी।	वहाँ भारी भीड़ थी।
कमरा लोगों से लबालब भरा था।	कमरा लोगों से खचाखच भरा था।
साहित्य और समाज का घनघोर सम्बन्ध है।	साहित्य और समाज का अभिन्न सम्बन्ध है।
वह सकुशलतापूर्वक लौट आया।	वह सकुशल लौट आया।
रेलगाड़ी से जाना है, तो रेलगाड़ी का समय पूछ लो।	रेलगाड़ी से जाना है, तो उसका समय पूछ लो।
यह सड़क स्टेशन तक जाता है।	यह सड़क स्टेशन तक जाती है।
उसने जोर से चिल्लाया।	वह जोर से चिल्लाया।
लगता है, तीन बजा है।	लगता है, तीन बजे हैं।
परिश्रम का बदला अच्छा होता है।	परिश्रम का फल अच्छा होता है।
वहाँ अनाधिकार प्रवेश-निषिद्ध है।	वहाँ अनधिकार प्रवेश-निषिद्ध है।
वह अपने हाथ से स्वयं काम करता है।	वह अपना काम स्वयं करता है।
लड़का मिठाई लेकर भागता हुआ घर आया।	लड़का मिठाई लेकर दौड़ता हुआ घर आया।
अभ्यास करने ही से हम हिन्दी शुद्ध लिख सकते हैं।	अभ्यास करने से ही हम हिन्दी शुद्ध लिख सकते हैं।
हिन्दी में अनेकों ग्रन्थों का अनुवाद हुआ है।	हिन्दी में अनेक ग्रन्थों का अनुवाद हुआ है।
आकाश में तारेगण चमक रहे थे।	आकाश में तारे चमक रहे थे।
आजकल इधर भ्रष्टाचार का बोलबाला है।	आजकल भ्रष्टाचार का बोलबाला है।
आप गए वहाँ क्यों थे ?	आप वहीं क्यों गए थे ?
आपसे इसको स्पष्टीकरण करने को कहा गया था।	आपसे इसको स्पष्ट करने को कहा गया था।
इस काम में शिथिल होना अच्छा नहीं।	इस काम में शिथिलता अच्छी नहीं।
इसकी वास्तविक कारण बताओ।	इसका वास्तविक कारण बताओ।
उसको घबराना पड़ा।	वह घबरा गया।
उसका प्राण उड़ गया।	उसके प्राण उड़ गए।
उसके आँखों से आँसू बह रहा था।	उसकी आँखों से आँसू बह रहे थे।
नेताजी का बहुत भारी सम्मान हुआ।	नेताजी का बहुत सम्मान हुआ।
प्रत्येक आदमियों को शिक्षा की जरूरत है।	प्रत्येक आदमी को शिक्षा की जरूरत है।
वह तो अवश्य ही जाएगा।	वह अवश्य जाएगा।
भारतीयों में यह भावना चाहिए, कि भारत उनका है।	भारतीयों में यह भावना होनी चाहिए कि भारत हमारा है।
झूठ कभी भी नहीं बोलना चाहिए।	झूठ कभी नहीं बोलना चाहिए।
तुलसीदास ने 'रामचरित मानस' को लिखा।	तुलसीदास ने 'रामचरितमानस' की रचना की।
मैं आपका दर्शन करने आया हूँ।	मैं आपके दर्शन करने आया हूँ।
शायद यह काम जरूर हो जाएगा।	यह काम जरूर हो जाएगा।
विद्युत का आविष्कार कौन किया था ?	विद्युत का आविष्कार किसने किया था ?
पुत्र की सफलता पर पिता बहुत खुशी था।	पुत्र की सफलता पर पिता बहुत खुश था।
प्रत्येक मैचों में उसने अच्छा खेला है।	प्रत्येक मैच में उसने अच्छा खेला है।
बाघ देखकर उसका होश उड़ गया।	बाघ देखकर उसके होश उड़ गए।
उसकी परीक्षाफल निकल गई।	उसका परीक्षाफल निकल गया।
बाढ़ से फसल सर्वनाश हो रही है।	बाढ़ से फसल का सर्वनाश हो रहा है।
मुझसे यह काम सम्भव नहीं हो सकता है।	मुझसे यह काम सम्भव नहीं है।
राम, मोहन और मैं चलेगा।	राम, मोहन और मैं चलूँगा।
पिता का उत्तरदायित्व पुत्र के ऊपर होता है।	पिता का उत्तरदायित्व पुत्र पर होता है।
थोड़ी देर बाद वे वापस लौट आए।	थोड़ी देर बाद वे लौट आए।

अभ्यास प्रश्न

1. 'यह कविता भाव को प्रकट करती है।'—वाक्य का शुद्ध रूप क्या होगा?
   (a) यह कविता अनेकों भाव प्रकट करती है।
   (b) यह कविता भावों को प्रकट करती है।
   (c) यह कविता में भावों को प्रकट करती है।
   (d) यह कविता भाव प्रकट करती है।
2. 'कृष्ण के अनेकों नाम हैं।'—वाक्य का शुद्ध रूप है
   (a) कृष्ण को अनेकों नाम हैं।
   (b) कृष्ण के अनेक नाम हैं।
   (c) कृष्ण अनेकों नामों से ज्ञात हैं।
   (d) कृष्ण के अनेक नामों से ज्ञात हैं।
3. 'शोक है कि आपके पत्र का जवाब नहीं दिया।'—वाक्य का शुद्ध रूप है
   (a) चिन्ता है कि आपके पत्र का जवाब नहीं दिया।
   (b) पत्र का जवाब देना जरूरी नहीं है।
   (c) खेद है कि आपके पत्र का जवाब नहीं दिया।
   (d) संतप्त हूँ कि आपके पत्र का जवाब नहीं दिया।
4. 'खजुराहो देखने लायक स्थल है।'—इस वाक्य का शुद्ध रूप क्या है?
   (a) खजुराहो देखने योग्य स्थल है।
   (b) खजुराहो दर्शनीय स्थल है।
   (c) खजुराहो दार्शनिक स्थल है।
   (d) खजुराहो भ्रमण योग्य स्थल है।
5. 'मेरा बात कोई नहीं मानता।'—इस वाक्य का शुद्ध रूप क्या है?
   (a) मेरा बात कोई मानता नहीं है।
   (b) मेरी बात कोई नहीं मानता।
   (c) मेरी बात किसी नहीं मानता।
   (d) मेरा बात कोई मानता नहीं।
6. 'हम तो अवश्य ही जाएँगे'। —इस वाक्य का शुद्ध रूप क्या है?
   (a) हम तो अवश्य ही जाऊँगा।
   (b) हम तो अवश्य जाएँगे।
   (c) हम अवश्य जाएँगे।
   (d) हमें अवश्य जाना ही है।
7. 'उसके चाचा को लड़की हुई है।'—इस वाक्य का शुद्ध रूप क्या है?
   (a) उसकी चाचा की लड़की हुई है।
   (b) उसके चाचा के लड़की हुई है।
   (c) उसके चाचा की लड़की हुई है।
   (d) उसके चाचा के लड़की हुआ है।
8. 'साँप देखकर उसका होश उड़ गया'। —इस वाक्य का शुद्ध रूप क्या है?
   (a) साँप देखते ही उसका होश उड़ गया।
   (b) साँप को देखकर उसका होश उड़ गया।
   (c) साँप को देखकर उसके होश उड़ गए।
   (d) साँप देख उसका होश उड़ गया।
9. 'मैं आपका दर्शन चाहता हूँ।'—वाक्य का शुद्ध रूप क्या होगा?
   (a) मैं आपका दर्शन चाहते हैं।
   (b) मैं आपके दर्शन चाहता हूँ।
   (c) मैं आपकी दर्शन चाहता हूँ।
   (d) मैं आपको दर्शन चाहता हूँ।
10. 'काशी सदा भारतीय संस्कृति का केन्द्र रहा है।'—इस वाक्य का शुद्ध रूप क्या है?
    (a) काशी भारतीय संस्कृति का केन्द्र रहा है।
    (b) काशी सदा भारतीय संस्कृति का केन्द्र रही है।
    (c) काशी सदा भारतीय संस्कृति की केन्द्र रहा है।
    (d) काशी सदा भारतीय संस्कृति की केन्द्र रही है।
11. 'प्रत्येक व्यक्तियों को जीने का अधिकार है।'—इस वाक्य का शुद्ध रूप क्या है?
    (a) प्रत्येक व्यक्तियों को जीने का अधिकार है।
    (b) प्रत्येक व्यक्ति को जीने का अधिकार है।
    (c) प्रत्येक व्यक्ति को जीने की अधिकार है।
    (d) प्रत्येक व्यक्तियों को जीने की अधिकार है।
12. 'उसने मुक्तकण्ठ से गीत गाया।'—इस वाक्य का शुद्ध रूप क्या है?
    (a) उसने मुक्तकण्ठ होकर गीत गाया।
    (b) उसने मुक्तकण्ठ गीत गाया।
    (c) उसने मुक्तहस्त गीत गाया।
    (d) उसने मुक्तकण्ठ में गीत गाया।

13. 'मैं आपके प्रति श्रद्धा करता हूँ।'—इस वाक्य का शुद्ध रूप क्या है?
(a) मैं आपकी प्रति श्रद्धा करता हूँ।
(b) मैं आपके प्रति श्रद्धा रखता हूँ।
(c) मैं आपके प्रति श्रद्धा प्रदान करता हूँ।
(d) मेरी आप पर श्रद्धा है।

14. 'हमारा शिक्षक प्रश्न पूछते हैं।'—इस वाक्य का शुद्ध रूप क्या है?
(a) हमारे शिक्षक प्रश्न पूछते हैं।
(b) हमारा शिक्षक प्रश्न पूछता है।
(c) हमारे शिक्षक प्रश्न करते हैं।
(d) हमारे शिक्षक प्रश्न करता है।

15. 'राम, लक्ष्मण तथा सीता वन गई।'—इस वाक्य का शुद्ध रूप क्या है?
(a) राम, लक्ष्मण तथा सीता वन गई।
(b) राम, लक्ष्मण तथा सीता वन गए।
(c) राम, लक्ष्मण तथा सीता वन में गई।
(d) उपरोक्त में से कोई नहीं

16. 'तुमने आज तक किसी काम को नहीं किया।'—इस वाक्य का शुद्ध रूप क्या है?
(a) तुमने आज तक कोई काम नहीं किया।
(b) तुमने आज तक किसी काम नहीं किया।
(c) तुमने आज तक कोई काम को नहीं किया।
(d) तुमने आज तक काम को नहीं किया।

17. 'नेहरू जी से यह काम पूरा हुआ।'—इस वाक्य का शुद्ध रूप क्या है?
(a) नेहरू जी के कारण से यह काम पूरा हुआ।
(b) नेहरू जी द्वारा यह काम पूरा हुआ।
(c) नेहरू जी द्वारा से यह काम पूरा हुआ।
(d) नेहरू जी ने यह काम पूरा हुआ।

18. 'सविता के पास दो कलमें तथा तीन किताबें हैं।'—इस वाक्य का शुद्ध रूप क्या है?
(a) सविता के पास दो कलमें तथा तीन किताब है।
(b) सविता के पास दो कलमें और तीन किताब हैं।
(c) सविता के पास दो कलम तथा तीन किताबें हैं।
(d) उपरोक्त में से कोई नहीं

19. 'राम ने कहा कि उसे कोई आपत्ति नहीं है।'—इस वाक्य का शुद्ध रूप क्या है?
(a) राम का कहना है कि उसे कोई आपत्ति नहीं है।
(b) राम ने कहा कि उसे आपत्ति नहीं है।
(c) राम ने माना कि उसे कोई आपत्ति नहीं है।
(d) राम ने कहा कि मुझे कोई आपत्ति नहीं है।

20. 'कोई ने तुम्हारे बारे में बताया था'—इस वाक्य का शुद्ध रूप क्या है?
(a) कोई ने तुम्हारे बारे में बताया।
(b) किसी ने तुम्हारे बारे में बताया था।
(c) कोई से तुम्हारे बारे में पता चला।
(d) कोई के द्वारा तुम्हारे बारे में पता चला।

21. 'आपने मेरे ऊपर बड़ी कृपा की।'—इस वाक्य का शुद्ध रूप क्या है?
(a) आपकी मेरे ऊपर बड़ी कृपा है।
(b) आपने मुझ पर बड़ी कृपा की।
(c) आपकी मेरे पर बड़ी कृपा की।
(d) आपकी मेरे ऊपर बड़ी कृपा की।

22. 'इस कथा की क्या रहस्य है?'—इस वाक्य का शुद्ध रूप क्या है?
(a) इस कथा के क्या रहस्य है?
(b) इस कथा का क्या रहस्य है?
(c) इस की कथा रहस्य क्या है?
(d) इस कथा में रहस्य क्या है?

23. 'आभारी सदा हम आपके रहेंगे।'—इस वाक्य का शुद्ध रूप क्या है?
(a) हम सदा आपके आभारी रहेंगे।
(b) सदा हम आपके आभारी रहेंगे।
(c) सदा आपके हम आभारी रहेंगे।
(d) आपके हम सदा आभारी रहेंगे।

24. 'आँसू से सारा बदन भीग गया।'—इस वाक्य का शुद्ध रूप क्या है?
(a) आँसू से सारा बदन भीग गया।
(b) आँसुयों से सारा बदन भीग गया।
(c) आँसुओं से सारा बदन भीग गया।
(d) आँसुओं द्वारा सारा बदन भीग गया।

25. 'उनके आँख से आँसू बह रही थी'—इस वाक्य का शुद्ध रूप क्या है?
(a) उनके आँख से आँसू बह रहा था।
(b) उनकी आँख से आँसू बह रहा था।
(c) उनकी आँखों से आँसू बह रहे थे।
(d) उपरोक्त में से कोई नहीं।

26. 'उन्होंने इस बात पर आपत्ति प्रकट की।'—इस वाक्य का शुद्ध रूप क्या है?
(a) उन्होंने इस बात पर आपत्ति की।
(b) उन्होंने इस बात के ऊपर आपत्ति की।
(c) उन्होंने इस बात में आपत्ति प्रकट की।
(d) उन्होंने इस बात से आपत्ति प्रकट की।

27. 'सीता को बहुत काम करनी है।'—इस वाक्य का शुद्ध रूप क्या है?
(a) सीता को बहुत काम करना है।
(b) सीता ने बहुत काम करनी है।
(c) सीता की बहुत काम करनी है।
(d) सीता को काम करनी है।

28. 'साहित्य और समाज में घनघोर सम्बन्ध है।'—इस वाक्य का शुद्ध रूप क्या है?
(a) साहित्य और समाज में महान् सम्बन्ध है।
(b) साहित्य और समाज में अभिन्न सम्बन्ध है।
(c) साहित्य और समाज में विभिन्न सम्बन्ध है।
(d) साहित्य और समाज में कोई सम्बन्ध नहीं है।

29. 'उसने एक मोती का हार खरीदा।'—इस वाक्य का शुद्ध रूप क्या है?
(a) उसने एक मोतियों का हार खरीदा।
(b) उसने मोती का एक हार खरीदा।
(c) उसने मोतियों का हार खरीदा।
(d) उसने एक मोती का एक हार खरीदा।

30. 'उसने अपने घोड़ा का पानी पिलाया।'—इस वाक्य का शुद्ध रूप क्या है?
(a) उसने अपने घोड़े को पानी पिलाया।
(b) उसने अपने घोड़े को पानी पिलाई।
(c) उसने अपने घोड़ा को पानी पिलाया।
(d) उसने अपने घोड़ा को पानी पिलायी।

31. 'तेरे कितने बहनें हैं?'—वाक्य का शुद्ध रूप क्या होगा?
(a) तेरा कितनी बहन हैं? (b) तुम्हें कितनी बहनें हैं?
(c) तेरी कितनी बहनें हैं? (d) तुम क्या बहनें हो?

32. 'हम अपना प्राण दूँगा।'—वाक्य का शुद्ध रूप क्या है?
(a) हम अपना प्राण दे दूँगा।
(b) हमें अपना प्राण दूँगा।
(c) मैं अपने प्राण दे दूँगा।
(d) हमें अपने प्राण दूँगा।

33. 'राम समाज सेवा में होता है।'—वाक्य का शुद्ध रूप क्या है?
(a) राम समाज-सेवा में होता रहा है।
(b) राम समाज सेवा करता है।
(c) राम समाज में सेवा करता है।
(d) राम समाज सेवा होता है।

34. 'गंगाजल' पवित्र होती है।'—वाक्य का शुद्ध रूप क्या है?
(a) 'गंगाजल' पवित्र होते हैं।
(b) गंगा का जल पवित्र होती है।
(c) गंगाजल पवित्र होता है।
(d) गंगा में जल पवित्र होती है।

35. 'तुम तुम्हारे घर जाओ।'—वाक्य का शुद्ध रूप क्या है?
(a) तुम अपने घर जाओ (b) तुम तुम्हें घर जाओ
(c) तुम तुमरे घर जाओ (d) तुम तुम्हारी घर जाओ

36. 'पुलिस चोर को देख कर भाग गया।'—वाक्य का शुद्ध रूप क्या है?
(a) पुलिस ने चोर को देख कर भाग गया।
(b) पुलिस चोर को देख भाग गया।
(c) पुलिस को देख चोर भाग गया।
(d) पुलिस चोर से देख कर भाग गया।

37. 'उसने मुझे फूल की माला दी।'—वाक्य का शुद्ध रूप है
(a) उसने मुझे फूलों की माला दी।
(b) उसने मुझको फूलों की माला दी।
(c) उसने मुझे फूल माला दी।
(d) उसने मुझको फूल की माला दी।

38. 'शायद वह अवश्य जाएगा।'—वाक्य का शुद्ध रूप है
(a) वह अवश्य जाएगा।
(b) वह शायद अवश्य जाएगा।
(c) वह अवश्य शायद जाएगा।
(d) वह शायद जाएगा अवश्य।

39. 'इस चित्र की रचना किसने की?' वाक्य का शुद्ध रूप है
(a) चित्र की रचना किसने की?
(b) इस चित्र को किसने रचा?
(c) इस चित्र का निर्माण किसने किया?
(d) इस चित्र का चित्रण कौन किया?

40. 'रामू को धन्यवाद दो' वाक्य का शुद्ध रूप है
(a) रामू की धन्यवाद दो
(b) रामू पर धन्यवाद दो
(c) रामू के लिए धन्यवाद दो
(d) रामू का धन्यवाद करो

उत्तरमाला

1.	(b)	2.	(b)	3.	(c)	4.	(b)	5.	(b)	6.	(b)	7.	(b)	8.	(c)	9.	(b)	10.	(b)
11.	(b)	12.	(b)	13.	(b)	14.	(c)	15.	(b)	16.	(a)	17.	(b)	18.	(c)	19.	(d)	20.	(b)
21.	(b)	22.	(b)	23.	(a)	24.	(c)	25.	(c)	26.	(a)	27.	(a)	28.	(b)	29.	(b)	30.	(a)
31.	(c)	32.	(c)	33.	(b)	34.	(c)	35.	(a)	36.	(c)	37.	(a)	38.	(a)	39.	(c)	40.	(d)

अध्याय
09

वाक्य रचनान्तरण
(सरल वाक्य/संयुक्त वाक्य/मिश्र वाक्य)

प्रस्तुत अध्याय रचना के आधार पर वाक्य के भेद तथा वाक्य परिवर्तन या रचनान्तरण पर आधारित है।

वाक्य का अर्थ

हम अपने मन के भावों को व्यक्त करने के लिए शब्दों का सहारा लेते हैं। शब्दों का एक व्यवस्थित तथा निश्चित अर्थ का बोध कराने वाला समूह ही वाक्य कहलाता है। अत: शब्दों का व्यवस्थित क्रम एवं सार्थक समूह वाक्य कहलाता है।

उदाहरण (i) प्रधानमन्त्री ने स्वच्छ भारत अभियान चलाया।
(ii) हमें अपने आस-पास सदैव स्वच्छ रखना चाहिए।

वाक्य रचना वाक्य में अनेक तत्त्व होते हैं पर वाक्य में कर्ता और क्रिया का होना अनिवार्य है। इनके बिना वाक्य रचना कठिन है।

वाक्य के अंग

वाक्य के दो अंग होते हैं

(i) **उद्देश्य** वाक्य में जिसके सम्बन्ध में बात की जाए, उसे उद्देश्य कहते हैं।

उदाहरण (i) **सूरज** पूरब में निकलता है।
(ii) **चाँद** बादलों में छिप गया।

इन वाक्यों में 'सूरज' और 'चाँद' के विषय में कुछ कहा जा रहा है। अत: ये उद्देश्य हैं।

(ii) **विधेय** वाक्य में उद्देश्य के बारे में जो कुछ कहा जाता है, उसे विधेय कहते हैं।

उदाहरण (i) पक्षी <u>कलरव करते हैं</u>।
(ii) फूल <u>खूबसूरत होते हैं</u>।

इन वाक्यों के रेखांकित अंश विधेय हैं, क्योंकि वे अपने उद्देश्य क्रमश: 'पक्षी' और 'फूल' के बारे में कुछ कह रहे हैं।

वाक्य के भेद

वाक्यों का विभाजन दो आधारों पर होता है—अर्थ के आधार पर तथा रचना के आधार पर।

यहाँ हम 'रचना के आधार पर' वाक्यों के विभाजन का अध्ययन करेंगे।

रचना के आधार पर

रचना के आधार पर वाक्य तीन प्रकार के होते हैं

1. सरल वाक्य

जिन वाक्यों में एक उद्देश्य और एक विधेय होता है, उसे सरल वाक्य कहते हैं।

उदाहरण

(i) सैनिक देश की रखवाली करते हैं।

(ii) किसान फसल उगाते हैं।

(iii) पक्षी अंडे देते हैं।

(iv) डॉक्टर रोगी को दवाएँ देता है।

2. संयुक्त वाक्य

जिन वाक्यों में एक या दो स्वतन्त्र वाक्य या उपवाक्य समुच्चयबोधक अव्ययों से जुड़े होते हैं, उन्हें संयुक्त वाक्य कहते हैं।

उदाहरण

(i) मजदूर आया और काम करने लगा।

(ii) आसमान में बादल छाए, परन्तु वर्षा न हुई।

(iii) वह अस्वस्थ थी इसलिए यहाँ नहीं आई।

उपर्युक्त वाक्यों में दो सरल वाक्यों या उपवाक्यों को क्रमश: 'और', 'परन्तु' एवं 'इसलिए' द्वारा जोड़ा गया है। अत: ये संयुक्त वाक्य हैं।

3. मिश्र वाक्य

जिन वाक्यों में एक प्रधान उपवाक्य हो तथा दूसरा उपवाक्य उस पर आश्रित हो, उसे मिश्र वाक्य कहते हैं।

उदाहरण

(i) प्रधानमन्त्री श्री नरेन्द्र मोदी ने कहा कि देशवासी स्वच्छ भारत अभियान को सफल बनाएँ।

(ii) यह वही छात्र है, जिसने वृद्धा को सड़क पार कराई थी।

(iii) जब मैंने उसे देखा तब वह मुस्कुराने लगी।

उपर्युक्त वाक्यों में एक प्रधान उपवाक्य है तथा दूसरा आश्रित उपवाक्य उस पर आश्रित है। अत: ये मिश्र वाक्य हैं।

वाक्य परिवर्तन या वाक्य रचनान्तरण

वाक्य के अर्थ में बिना कोई परिवर्तन किए उसे वाक्य के एक प्रकार से दूसरे प्रकार के वाक्य में परिवर्तन करना 'वाक्य परिवर्तन' या 'वाक्य रचनान्तरण' कहलाता है।

नीचे कुछ वाक्य रचनान्तरण के उदाहरण दिए गए हैं, उनका ध्यानपूर्वक अध्ययन कीजिए।

1. सरल वाक्यों का मिश्र वाक्यों में रचनान्तरण

(i) **सरल वाक्य** रमेश ने स्वयं को निरपराध बताया।
मिश्र वाक्य रमेश ने बताया कि वह निरपराध है।

(ii) **सरल वाक्य** कम अंक लाने के बावजूद वह परिश्रमी है।
मिश्र वाक्य यद्यपि वह कम अंक लाया, किन्तु वह परिश्रमी है।

(iii) **सरल वाक्य** सफल होने के बाद भी उसके अन्दर अहंकार नहीं है।
मिश्र वाक्य यद्यपि वह सफल है, फिर भी उसके अन्दर अहंकार नहीं है।

2. सरल वाक्यों का संयुक्त वाक्यों में रचनान्तरण

(i) **सरल वाक्य** छुट्टी की घण्टी बजते ही वह चला गया।
संयुक्त वाक्य छुट्टी की घण्टी बजी और वह चला गया।

(ii) **सरल वाक्य** सुबह होते ही सभी विद्यालय जाने लगे।
संयुक्त वाक्य सुबह हुई और सभी विद्यालय जाने लगे।

(iii) **सरल वाक्य** गरीबी के कारण रमेशचन्द की शादी नहीं हुई।
संयुक्त वाक्य रमेशचन्द गरीब था, इस कारण उसकी शादी नहीं हो सकी।

3. मिश्र वाक्यों का सरल वाक्यों में रचनान्तरण

(i) **मिश्र वाक्य** उसने कहा कि मैं निरपराध हूँ।
सरल वाक्य उसने स्वयं को निरपराध बताया।

(ii) **मिश्र वाक्य** जो व्यक्ति व्यायाम करते हैं, उनकी आयु लम्बी होती है।
सरल वाक्य व्यायाम करने से व्यक्ति की आयु लम्बी होती है।

(iii) **मिश्र वाक्य** दूरदर्शन पर समाचार समाप्त हुआ कि बिजली कट गई।
सरल वाक्य दूरदर्शन पर समाचार समाप्त होते ही बिजली कट गई।

4. **मिश्र वाक्यों का संयुक्त वाक्यों में रचनान्तरण**

(i) **मिश्र वाक्य** जब राजीव घर गया अनीता रो रही थी।

संयुक्त वाक्य राजीव घर गया तो अनीता रो रही थी।

(ii) **मिश्र वाक्य** यदि आराम करना चाहते हो तो थोड़ी दूर और चलो।

संयुक्त वाक्य आराम करना है इसलिए थोड़ी दूर और चलो।

(iii) **मिश्र वाक्य** जैसे-ही अंशुल ऑफिस पहुँचा, बॉस ने उसे डाँटना शुरू कर दिया।

संयुक्त वाक्य अंशुल ऑफिस पहुँचा और बॉस ने उसे डाँटना शुरू कर दिया।

5. **संयुक्त वाक्यों का सरल वाक्यों में रचनान्तरण**

(i) **संयुक्त वाक्य** दूरदर्शन पर समाचार समाप्त हुआ और बिजली कट गई।

सरल वाक्य दूरदर्शन पर समाचार समाप्त होते ही बिजली कट गई।

(ii) **संयुक्त वाक्य** सूर्योदय हुआ और अँधेरा मिट गया।

सरल वाक्य सूर्योदय होते ही अँधेरा मिट गया।

(iii) **संयुक्त वाक्य** सुग्रीव ने दु:ख भरी बातें सुनाईं और भगवान राम द्रवित हो उठे।

सरल वाक्य सुग्रीव की दु:ख भरी बातें सुनकर भगवान राम द्रवित हो उठे।

6. **संयुक्त वाक्यों का मिश्र वाक्यों में रचनान्तरण**

(i) **संयुक्त वाक्य** मजदूर आया और काम करने लगा।

मिश्र वाक्य जैसे ही मजदूर आया, वह काम करने लगा।

(ii) **संयुक्त वाक्य** आसमान में बादल छाए, परन्तु वर्षा न हुई।

मिश्र वाक्य-यद्यपि आसमान में बादल छाए, किन्तु वर्षा न हुई।

(iii) **संयुक्त वाक्य** वह अस्वस्थ थी इसलिए यहाँ नहीं आई।

मिश्र वाक्य क्योंकि वह अस्वस्थ थी, इसलिए यहाँ नहीं आई।

अभ्यास प्रश्न

1. शब्दों का व्यवस्थित क्रम तथा सार्थक समूह कहलाता है
(a) पद (b) वाक्य
(c) पदबन्ध (d) शब्द

2. वाक्य में किसका होना अनिवार्य है?
(a) कर्ता और कर्म का (b) कर्ता और क्रिया का
(c) क्रिया और कारक का (d) कारक और वचन का

3. वाक्य के कितने अंग होते हैं?
(a) दो (b) तीन
(c) चार (d) पाँच

4. जिसके सम्बन्ध में बात की जाए, उसे कहते हैं
(a) उद्देश्य (b) वाक्य
(c) विधेय (d) कर्म

5. वाक्य के कितने भेद होते हैं?
(a) तीन (b) चार
(c) दो (d) पाँच

6. रचना के आधार पर वाक्य कितने प्रकार के होते हैं?
(a) दो (b) चार
(c) तीन (d) पाँच

निर्देश (प्रश्न संख्या 7-10) *में दिए गए सरल वाक्यों के लिए उचित मिश्र वाक्यों का चयन कीजिए।*

7. राजीव ने घर पहुँचते ही पहले मुझे कॉल की।
(a) राजीव जैसे ही घर पहुँचा तुरन्त उसने मुझे कॉल की।
(b) राजीव घर पहुँचा और पहले मुझे कॉल की।
(c) राजीव ने घर पहुँचकर मुझे पहले कॉल की।
(d) जैसे ही राजीव घर पहुँचा, उसने पहले मुझे कॉल की।

8. निर्धन होने के कारण अनु की सगाई टूट गई।
(a) सगाई तो टूटनी ही थी, क्योंकि अनु निर्धन थी।
(b) अनु निर्धन थी, इसलिए उसकी सगाई टूट गई।
(c) निर्धन होने की वजह से अनु की सगाई टूट गई।
(d) क्योंकि अनु निर्धन थी, इसलिए उसकी सगाई टूट गई।

9. चपरासी ने घण्टी बजाकर बच्चों को बुलाया।
(a) चपरासी ने घण्टी बजाई और बच्चों को बुलाया।
(b) घण्टी बजी और चपरासी ने बच्चों को बुला लिया।
(c) जब चपरासी ने घण्टी बजाई तब बच्चों को बुलाया।
(d) चपरासी ने बच्चों को बुलाने के लिए घण्टी बजाई।

10. एक धनी व्यक्ति होने के बावजूद अंशुल अपने नौकर रामू का आदर करता है।
(a) अंशुल धनी व्यक्ति है और अपने नौकर रामू का आदर करता है।
(b) धनी व्यक्ति होने के कारण अंशुल अपने नौकर रामू का आदर करता है।
(c) यद्यपि अंशुल एक धनी व्यक्ति है, फिर भी वह अपने नौकर रामू का आदर करता है।
(d) अंशुल धनी व्यक्ति होने के कारण अपने नौकर रामू का आदर करता है।

निर्देश (प्रश्न संख्या 11-14) *तक के सरल वाक्यों के लिए उचित संयुक्त वाक्यों का चयन कीजिए।*

11. बुखार होने के कारण मैं विद्यालय नहीं जा सका।
(a) बुखार था, इसलिए मैं विद्यालय नहीं गया।
(b) मुझे बुखार था, इसलिए मैं विद्यालय नहीं जा सका।
(c) यद्यपि मुझे बुखार था, परन्तु मैं विद्यालय गया।
(d) जैसे ही मुझे बुखार हुआ, मैं विद्यालय नहीं जा सका।

12. बाजार जाकर अहमद ने सामान खरीदा।
(a) बाजार जाते ही अहमद ने सामान खरीदा।
(b) अहमद बाजार गया और उसने सामान खरीदा।
(c) जब अहमद बाजार गया, तब उसने सामान खरीदा।
(d) क्योंकि अहमद बाजार गया, इसलिए उसने सामान खरीदा।

13. मेहनत करने के बावजूद भी मजदूर को लाभ नहीं मिलता।
(a) मजदूर मेहनत करता है, परन्तु उसे लाभ नहीं मिलता।
(b) यद्यपि मजदूर मेहनत करता है, परन्तु फिर भी उसे लाभ नहीं मिलता।
(c) हालाँकि मजदूर ने मेहनत की, पर उसे लाभ नहीं मिला।
(d) मेहनत करते-करते भी मजदूर को लाभ नहीं मिलता।

14. बादल घिरते ही अँधेरा छा गया।
(a) बादल घिरे तथा अँधेरा छा गया।
(b) जैसे ही बादल घिरे अँधेरा छा गया।
(c) बादल घिरने के कारण अँधेरा छा गया।
(d) बादल घिरे ही थे कि अँधेरा छा गया।

निर्देश (प्रश्न संख्या 15-18) *तक के मिश्र वाक्यों के लिए उचित सरल वाक्यों का चयन कीजिए।*

15. जैसे ही वह मेरे पास आया मैंने उसे पकड़ लिया।
(a) वह मेरे पास आया और मैंने उसे पकड़ लिया।
(b) मेरे पास आते ही मैंने उसे पकड़ लिया।
(c) मेरे पास आने के कारण मैंने उसे पकड़ लिया।
(d) ज्योंहि वह मेरे पास आया, त्योंहि मैंने उसे पकड़ लिया।

16. यदि तुम चाहो, तो यह हो सकता है।
(a) तुमने चाहा तो यह हो सकता है।
(b) तुम्हारे चाहने से यह हो सकता है।
(c) जैसे ही तुम चाहो, तो यह हो सकता है।
(d) तुम्हारे चाहने के कारण यह हो जाएगा।

17. यद्यपि मेघनाद महापराक्रमी था, पर लक्ष्मण के हाथों मारा गया।
(a) यदि मेघनाथ महापराक्रमी होता, तो लक्ष्मण के हाथों मारा न जाता।
(b) लक्ष्मण ने महापराक्रमी मेघनाद को मार डाला।
(c) महापराक्रमी होने के बावजूद मेघनाद लक्ष्मण के हाथों मारा गया।
(d) मेघनाद महापराक्रमी था, परन्तु लक्ष्मण के हाथों मारा गया।

18. क्योंकि आज घने बादल छाए थे, इसलिए वर्षा हो गई।
(a) बादल घने थे इसलिए बरस गए।
(b) आज घने बादल छाए थे, इसलिए वर्षा हो गई।
(c) आज घने बादल छाए होने के कारण वर्षा हो गई।
(d) घने बादल छाए थे और आज वर्षा हो गई।

निर्देश (प्रश्न संख्या 19-22) *तक के मिश्र वाक्यों के लिए उचित संयुक्त वाक्यों का चयन कीजिए।*

19. जैसे ही राम ने घर में प्रवेश किया, दादी ने रोना शुरू कर दिया।
(a) राम घर में आया और दादी ने रोना शुरू कर दिया।
(b) राम ने दादी के घर में प्रवेश करते ही रोना शुरू कर दिया।
(c) राम के घर में प्रवेश करते ही दादी ने रोना शुरू कर दिया।
(d) राम ने घर में प्रवेश किया और दादी ने रोना शुरू कर दिया।

20. यदि उत्तीर्ण होना चाहते हो, तो कठिन परिश्रम करो।
(a) उत्तीर्ण होना है तो कठिन परिश्रम करो।
(b) उत्तीर्ण होने के लिए कठिन परिश्रम करो।
(c) कठिन परिश्रम के लिए उत्तीर्ण होओ।
(d) उत्तीर्ण होना चाहते हो, इसलिए कठिन परिश्रम करो।

21. यद्यपि बाहर बहुत अँधेरा था, फिर भी रवि घर से निकल पड़ा।
(a) क्योंकि बाहर बहुत अँधेरा था, इसलिए रवि घर से निकल पड़ा।
(b) बाहर अँधेरा होने के बावजूद रवि घर से निकल पड़ा।
(c) बाहर बहुत अँधेरा था सो रवि घर से निकल पड़ा।
(d) बाहर बहुत अँधेरा था, किन्तु रवि घर से निकल पड़ा।

22. क्योंकि छत पर कुछ आवाजें हुई, इसलिए रवि उधर भागा।
(a) छत पर कुछ आवाजें हुई इसलिए रवि उधर भागा।
(b) छत पर आवाजें होने के कारण रवि उधर भागा।
(c) छत पर कुछ आवाजें होने के बावजूद रवि उधर भागा।
(d) छत की तरफ रवि भागा क्योंकि वहाँ कुछ आवाजें हुईं।

निर्देश (प्रश्न संख्या 23-26) *तक के संयुक्त वाक्यों के लिए उचित सरल वाक्यों का चयन कीजिए।*

23. कबीर कल घर आया और घर में एक टीवी लाया।
(a) कबीर कल घर आते ही एक टीवी लाया।
(b) कबीर जैसे ही घर आया, वह एक टीवी लाया।
(c) कबीर ने घर में आते ही एक टीवी खरीद लिया।
(d) कबीर जैसे ही घर में आया, तुरन्त एक टीवी ले आया।

24. अभी रात शेष है इसलिए आराम करो।
(a) रात शेष है, तो आराम करो।
(b) रात शेष होने के कारण अभी आराम करो।
(c) आराम करो क्योंकि अभी रात शेष है।
(d) रात शेष थी, इसलिए मैंने आराम किया।

25. उस गुफा में तीन दरवाजे थे, परन्तु वे बाहर नहीं निकल पाए।
(a) क्योंकि उस गुफा में तीन दरवाजे थे, परन्तु वे बाहर नहीं निकल पाए।
(b) गुफा में तीन दरवाजे होने के बावजूद भी वे बाहर नहीं निकल पाए।
(c) उस गुफा में तीन दरवाजे होने के कारण भी वे बाहर नहीं निकल पाए।
(d) क्योंकि उस गुफा में तीन दरवाजे थे इसलिए वे बाहर नहीं निकल पाए।

26. बारिश रुक गई और सूर्य निकल आया।
(a) बारिश रुक गई इसलिए सूर्य निकल आया।
(b) यदि बारिश रुकगी तो सूर्य निकल आएगा।
(c) बारिश रुपते ही सूर्य निकल आया।
(d) जैसे ही बारिश रुकी, सूर्य निकल आया।

निर्देश (प्रश्न संख्या 27-30) *तक के संयुक्त वाक्यों के लिए उचित मिश्र वाक्यों का चयन कीजिए।*

27. राहुल ने पाठ पढ़ा और सारी कक्षा हँस पड़ी।
(a) जैसे ही राहुल ने पाठ पढ़ा, सारी कक्षा हँस पड़ी।
(b) यद्यपि राहुल ने पाठ पढ़ा पर सारी कक्षा हँस पड़ी।
(c) राहुल के पाठ पढ़ते ही सारी कक्षा हँस पड़ी।
(d) राहुल ने पाठ पढ़ा, इसलिए सारी कक्षा हँस पड़ी।

28. नीता ने कविता पढ़ी और सभी ने तालियाँ बजाईं।
(a) नीता के कविता पढ़ते ही सभी ने तालियाँ बजाईं।
(b) जैसे ही नीता ने कविता पढ़ी, सभी ने तालियाँ बजाईं।
(c) नीता की कविता सुनकर सब तालियाँ बजाने लगे।
(d) कविता पढ़ते ही नीता के लिए सभी ने तालियाँ बजाईं।

29. बच्चे शोर मचा रहे थे, इसलिए उन्हें डाँट पड़ी।
(a) बच्चों के शोर मचाते ही उन्हें डाँट पड़ी।
(b) बच्चों ने शोर मचाया और उन्हें डाँट पड़ी।
(c) बच्चों के शोर मचाने से उन्हें डाँट खानी पड़ी।
(d) क्योंकि बच्चे शोर मचा रहे थे, इसलिए उन्हें डाँट पड़ी।

30. दीनानाथ को कल धन मिला और उसने अपना कर्ज चुका दिया।
(a) जैसे ही दीनानाथ को कल धन मिला, उसने अपना कर्ज चुका दिया।
(b) दीनानाथ को कल धन मिलते ही उसने अपना कर्ज चुका दिया।
(c) दीनानाथ को कल धन मिला इसलिए उसने अपना कर्ज चुका दिया।
(d) दीनानाथ को कल धन मिलते ही उसने जमीन खरीद ली।

उत्तरमाला

1.	(b)	2.	(b)	3.	(a)	4.	(a)	5.	(c)	6.	(c)	7.	(d)	8.	(d)	9.	(c)	10.	(c)
11.	(b)	12.	(b)	13.	(a)	14.	(a)	15.	(b)	16.	(b)	17.	(c)	18.	(c)	19.	(d)	20.	(d)
21.	(d)	22.	(a)	23.	(a)	24.	(b)	25.	(b)	26.	(c)	27.	(a)	28.	(b)	29.	(d)	30.	(a)

अध्याय
10

मुहावरे तथा लोकोक्तियाँ

प्रस्तुत अध्याय मुहावरे तथा लोकोक्तियों पर आधारित हैं।

मुहावरा

मुहावरा उन वाक्यांशों को कहा जाता है, जो सामान्य अर्थ की जगह विलक्षण अर्थ प्रकट करते हैं। इनका वाक्य में प्रयोग करने से विदग्धता, वक्रोक्ति तथा विलक्षणता का समावेश होता है। मुहावरों के प्रयोग से भाषा में सहज प्रवाह तथा संगठन आता है। हिन्दी में मुहावरों का प्रयोग अत्यधिक होता है, यह भाषा के विस्तार का द्योतक है।

मुहावरे तथा उनके सामान्य अर्थ

1. आँख का काँटा होना

   अर्थ शत्रु होना

   वाक्य-प्रयोग अरे! मोहन को किशन के पास मत भेजो। मोहन तो किशन की आँख का काँटा है।

2. आँखों में खून उतरना

   अर्थ अधिक गुस्सा आना

   वाक्य-प्रयोग राहुल ने मेरे सारे महत्त्वपूर्ण पेपर खराब कर दिए थे। यह देखकर मेरी आँखों में खून उतर आया।

3. आँखे फेर लेना

   अर्थ उदासीन हो जाना

   वाक्य-प्रयोग मैंने राजीव के बुरे समय में उसकी काफी सहायता की, लेकिन आज मुझ पर आई विपत्ति को देखकर राजीव ने आँखे फेर ली।

4. आँख का तारा

अर्थ बहुत प्यारा होना

वाक्य-प्रयोग पिंकी अपने माता-पिता की इकलौती संतान होने के कारण उनकी आँख का तारा है।

5. आँख दिखाना

अर्थ क्रोध करना

वाक्य प्रयोग राहुल की पत्नी राहुल को जब देखो तब आँख दिखाती रहती है।

6. आँखों में धूल झोंकना

अर्थ धोखा देना

वाक्य-प्रयोग तुमने कल अपने पिता जी से धूम्रपान न करने का वायदा किया था, लेकिन आज तुमने सिगरेट पीकर अपने पिता जी की आँखों में धूल झोंकी है।

7. आँख में पानी न होना

अर्थ शर्म का नहीं होना

वाक्य-प्रयोग तुम्हारी आँख में पानी नहीं है, जो तुम अपनी माता को बुरा-भला कह रहे हो।

8. अपना-सा मुँह लेकर रहना

अर्थ लज्जित होना

वाक्य-प्रयोग अपने छोटे भाई से अपने लिए अपशब्द सुनकर महताब अपना-सा मुँह लेकर रह गया।

9. अपना उल्लू सीधा करना

अर्थ बेवकूफ बनाकर काम निकालना

वाक्य-प्रयोग राहुल ने झूठी नौकरी का बहाना बनाकर अपने पिता जी से पैसे ले लिए। अपना उल्लू सीधा करना तो कोई राहुल से सीखे।

10. अपनी खिचड़ी अलग पकाना

अर्थ अलग-अलग रहना

वाक्य-प्रयोग माही तो अपनी खिचड़ी अलग ही पकाता है, उसे किसी से कोई मतलब ही नहीं।

11. आग बबूला होना

अर्थ अधिक क्रोधित होना

वाक्य-प्रयोग हेमा को देखते ही उसके पिता जी आग बबूला हो गए। उसने काम ही ऐसा किया था।

12. अपने पैरों पर खड़ा होना

अर्थ आत्मनिर्भर होना

वाक्य-प्रयोग रवि के लिए एक-से-बढ़कर एक रिश्ते आते हैं। सही भी है आखिर वो अपने पैरों पर जो खड़ा है।

13. जहर का घूँट पीना

अर्थ क्रोध को दबा जाना

वाक्य-प्रयोग सलीना को उसके पति बीच बाजार में ही धमकाने लगे, लेकिन सलीना जहर का घूँट पीकर ही रह गई, कुछ न बोली।

14. जी नहीं भरना

अर्थ सन्तोष नहीं आना

वाक्य-प्रयोग रेखा के लड़के को देखकर भी जी नहीं भरता। कितना प्यारा बच्चा है वह!

15. झक मारना

अर्थ व्यर्थ समय व्यतीत करना

वाक्य-प्रयोग उस शराबी से झक मत मारो। उसे कुछ भी समझ नहीं आएगा।

16. टेढ़ी खीर होना

अर्थ मुश्किल काम

वाक्य-प्रयोग रानी के पिता को समझाना टेढ़ी खीर है। अत: पिकनिक पर जाने का ख्याल छोड़ ही दो।

17. ठोकर मारना

अर्थ त्याग देना

वाक्य-प्रयोग कवि ने शीना को ठुकराकर लाखों रुपए को ठोकर मार दी।

18. ठण्डा होना

अर्थ शान्त हो जाना

वाक्य-प्रयोग अब तुम्हारे पिता जी ठण्डे हो गए हैं। तुम घर जा सकते हो।

19. डंक मारना

अर्थ कटु वचन कहना

वाक्य प्रयोग यूँ मुझे डंक न मारो, वरना मैं इस घर से चला जाऊँगा।

20. डूबते को तिनके का सहारा

अर्थ आपातकाल की सहायता

वाक्य प्रयोग डॉक्टर श्याम के आने से रवि को डूबते को तिनके का सहारा मिल गया, क्योंकि सभी डॉक्टरों ने उसे मना कर दिया था।

21. ढाक के तीन पात

अर्थ सदा एक-सा रहना

वाक्य-प्रयोग मोहन को समझाना ढाक के तीन पात की तरह है।

आइए कुछ अन्य मुहावरों तथा उनके अर्थ का अध्ययन करते हैं

मुहावरा	सामान्य अर्थ
• आठ-आठ आँसू बहाना	पश्चाताप करना
• आसन डोलना	विचलित होना
• आसमान टूट पड़ना	विपत्ति का आना
• आस्तीन का साँप	कपटी मित्र
• ईद का चाँद होना	कभी-कभी दिखना
• उल्टी गंगा बहाना	उल्टा काम करना
• कलेजे का टुकड़ा	बहुत प्यारा
• कलेजे पर साँप लोटना	ईर्ष्या होना
• कलेजा ठण्डा होना	सन्तोष होना
• काँटा दूर होना	बाधा दूर होना
• कान लगाना	ध्यान देना
• कान भरना	शिकायत करना
• खाक में मिलना	बर्बाद होना
• खून खौलना	क्रोधित होना
• घड़ों पानी पड़ना	लज्जित होना
• घाट-घाट का पानी पीना	बहुत अनुभवी होना
• घोड़े बेचकर सोना	निश्चिंत होकर सोना
• चादर तानकर सोना	निश्चिंत होना
• चैन की वंशी बजाना	आनन्दित जीवन व्यतीत करना
• छक्के छुड़ाना	परास्त करना
• छठी का दूध याद आना	बहुत परेशान होना
• जमीन-आसमान एक करना	बहुत सारे उपाय करना
• जमीन पर पैर न रहना	बहुत घमण्ड करना
• तलवे चाटना	खुशामद करना
• तारे गिनना	चिन्तित रहना
• तीन-तेरह करना	बिखेर देना
• दो टूक बात करना	स्पष्ट कह देना
• दुम दबाकर भागना	कायरता-पूर्वक भागना
• नाक कट जाना	प्रतिष्ठा समाप्त होना
• नाक का बाल होना	बहुत प्रिय होना
• नाक में दम करना	परेशान करना
• नाक रगड़ना	विनती करना
• नौ-दो ग्यारह होना	भाग जाना
• पानी-पानी होना	शर्मिन्दा होना
• पीठ ठोंकना	शाबाशी देना
• पौ-बारह होना	लाभ-ही-लाभ होना
• बरस पड़ना	क्रोधित होना
• मुँह उतरना	उदास होना
• मुँह छिपाना	शर्म करना
• मुँह की खाना	बुरी तरह हारना
• मुँह में पानी आना	किसी चीज को पाने के लिए लालच होना
• रात-दिन एक करना	कठोर परिश्रम करना
• रोड़ा अटकाना	बाधा डालना
• लकीर का फकीर होना	परम्परावादी होना

मुहावरा	सामान्य अर्थ
• लोहा मानना	प्रभुत्व स्वीकार करना
• शेखी बघारना	डींग हाँकना
• सन्न रह जाना	आश्चर्यचकित होना
• सिर उठाना	विरोध करना
• हँसी उड़ाना	उपहास करना
• हवा से बातें करना	बहुत तेज दौड़ना

मुहावरा	सामान्य अर्थ
• हथियार डाल देना	हार मान लेना
• होश उड़ जाना	आशंका से परेशान होना
• हौसला पस्त होना	उत्साह न रह जाना
• होश ठिकाने होना	भ्रांति दूर होना

लोकोक्तियाँ

लोकोक्तियाँ अथवा कहावतें समाज में प्रचलित कथन होते हैं। यह एक पूर्ण वाक्य होता है, इसका प्रयोग एक स्वतन्त्र वाक्य के रूप में ही होता है। अनुभव के द्वारा बताई गई बातें लोकोक्तियों के रूप में प्रसिद्ध हुईं। लोकोक्तियों अथवा कहावतों के प्रयोग से वार्तालाप में प्रभाव उत्पन्न होता है। इनके पीछे कोई कहानी या घटना की प्रवृत्ति को महत्त्व मिलता है।

लोकोक्तियाँ (कहावतें) तथा उनके सामान्य अर्थ

लोकोक्ति (कहावत)	सामान्य अर्थ
• अधजल गगरी छलकत जाए	अधम व्यक्ति अल्प प्राप्ति पर अहंकारी हो जाता है।
• अब पछताये होत क्या जब चिड़ियाँ चुग गई खेत	नुकसान के बाद पछताने का क्या फायदा।
• आँख का अंधा नाम नयनसुख	नाम के विपरीत गुण होना।
• आम के आम गुठलियों के दाम	दोहरा लाभ।
• उलटा चोर कोतवाल को डाँटे	दोषी होने पर भी धौंस जमाना।
• ऊँची दुकान फीका पकवान	केवल बाहरी दिखावा।
• का वर्षा जब कृषि सुखानी	अवसर के बाद सहायता व्यर्थ है।
• थोथा चना बाजे घना	अल्पज्ञ बढ़-चढ़कर बोलता है।
• अन्त भला तो सब भला	परिणाम अच्छा तो सब अच्छा।
• अंधेर नगरी चौपट राजा	लापरवाह राजा के कारण देश तबाह हो जाता है।
• अक्ल बड़ी या भैंस	बुद्धि का महत्त्व अधिक है।
• अपने मुँह मियाँ मिट्ठू	अपनी बड़ाई आप करना।
• आँख एक नहीं कजरौटा दस-दस	व्यर्थ आडम्बर।
• कब्र में पाँव लटकना	मरने का समय।

• करत-करत अभ्यास के जड़मति होत सुजान	प्रयत्न करने से सफलता मिलती है।
• काला अक्षर भैंस बराबर	न पढ़ा न लिखा (निरक्षर)।
• खेत खाये गदहा, मार खाये जोलहा	दोष किसी का दण्ड किसी को।
• एक तो करेला, दूसरे नीम चढ़ा	एक के साथ दूसरा दोष।
• खोदा पहाड़ निकली चुहिया	परिश्रम अधिक, लाभ कम।
• घर का भेदी लंका ढाहे	आपसी फूट सबसे बड़ी कमजोरी।
• घर की मुर्गी दाल बराबर	सहज प्राप्त वस्तु को आदर नहीं मिलता।
• चार दिन की चाँदनी फिर अँधेरी रात	सुख थोड़े ही दिन का होता है।
• चिराग तले अँधेरा	निकट में ही असहज प्रवृत्ति।
• चोर की दाढ़ी में तिनका	दोषी हमेशा चौकन्ना रहता है।
• छोटा मुँह बड़ी बात	अपनी योग्यता से बढ़कर बात करना।
• जिसकी लाठी उसकी भैंस	शक्तिसम्पन्न का प्रभाव रहना।
• जिन खोजा तिन पाइयाँ गहरे पानी पैठ	परिश्रम से सफलता मिलती है।
• जैसी करनी वैसी भरनी	जैसा काम, वैसा परिणाम।
• तीन में, न तेरह में	किसी महत्त्व का नहीं होना।
• दाल-भात में मूसलचन्द	किसी बात में दखल देना।
• न रहेगा बाँस न बजेगी बाँसुरी	मूल कारण को ही समाप्त करना।
• नेकी और पूछ-पूछ	भलाई के लिए अनुमति क्या?
• बिल्ली के गले में घंटी	कठिन काम पूरा करना।
• बोया पेड़ बबूल का आम कहाँ से होय	जैसा कर्म वैसे फल की प्राप्ति।
• भूखे भजन न होय गोपाला	आवश्यकताओं की पूर्ति के बिना सब कुछ व्यर्थ।
• मरता क्या न करता	मजबूरी में आदमी सब कुछ करता है।
• मुँह में राम बगल में छुरी	ऊपर से मित्र, अन्दर से शत्रु।
• समरथ को नहीं दोष गोसाईं	सामर्थ्यवान को कोई दोष नहीं लगता।
• साँच को आँच नहीं	सच्चे आदमी को कोई खतरा नहीं।
• सिर मुँडाते ओले पड़े	शुरू में ही विघ्न पड़ना।
• होनहार बिरवान के होत चीकने पात	भविष्य के गुण प्रारम्भ में ही दिखाई देते हैं।
• हाथ कंगन को आरसी क्या	प्रत्यक्ष के लिए प्रमाण क्या ?
• रस्सी जल गई, पर ऐंठन न गई	पतन के बाद भी अहंकार।

अभ्यास प्रश्न

1. 'कान देना' मुहावरे का सही अर्थ क्या है?
   (a) होशियार होना (b) ध्यान देना
   (c) ध्यान न देना (d) कुछ न सुनना
2. 'मुँह दिखाना' मुहावरे का सही अर्थ क्या है?
   (a) लज्जित होना (b) प्रत्यक्ष होना
   (c) उदास होना (d) क्रोधित होना
3. 'सर्द हो जाना' मुहावरे का सही अर्थ क्या है?
   (a) झूठ बोलना (b) ठण्डा लगना
   (c) दुविधा में पड़ना (d) डर जाना
4. 'आग में घी डालना' मुहावरे का सही अर्थ क्या है?
   (a) और भड़काना (b) आग लगाना
   (c) अपने मन की करना (d) व्यर्थ का कार्य करना
5. 'काला अक्षर, भैंस बराबर' मुहावरे का सही अर्थ क्या है?
   (a) निरक्षर (b) अक्षर भैंस बराबर होना
   (c) बहुत पढ़ा-लिखा (d) बेरोजगार व्यक्ति
6. 'आस्तीन का साँप' मुहावरे का सही अर्थ क्या है?
   (a) अच्छा दोस्त (b) कपटी दोस्त
   (c) विषैला साँप (d) पालतू साँप
7. 'कान भरना' मुहावरे का सही अर्थ क्या है?
   (a) रूई डालना (b) साफ करना
   (c) शिकायत करना (d) बहकाना
8. 'नाक रगड़ना' मुहावरे का सही अर्थ क्या है?
   (a) नाक पर चोट लगना (b) विनती करना
   (c) इज्जत देना (d) दबाव डालना
9. 'गाल बजाना' मुहावरे का सही अर्थ क्या है?
   (a) बीमारी होना (b) डींग हाँकना
   (c) बाजा बजाना (d) चिल्लाना
10. 'लल्लो-चप्पो करना' मुहावरे का सही अर्थ क्या है?
   (a) डींग मारना (b) खुशामद करना
   (c) शिकायत करना (d) बातें बनाना

11. 'घड़ों पानी पड़ जाना' मुहावरे का सही अर्थ क्या है?
(a) पानी डालना (b) परेशान करना
(c) लज्जित होना (d) स्नान करना

12. 'दाँत काटी रोटी होना' मुहावरे का सही अर्थ क्या है?
(a) शत्रु होना (b) कपटी मित्र
(c) अच्छा दोस्त (d) कटुता होना

13. 'अपना उल्लू सीधा करना' मुहावरे का सही अर्थ क्या है?
(a) खुशामद करना (b) अपना काम निकालना
(c) कम महत्त्व देना (d) परेशान करना

14. 'आत्मनिर्भर होना' किस मुहावरे का सही अर्थ है?
(a) अपनी खिचड़ी अलग पकाना
(b) अपने पैरों पर खड़ा होना
(c) ईद का चाँद होना
(d) आँच न आने देना

15. 'प्रतिकूल कार्य' किस मुहावरे का सही अर्थ है?
(a) ईंट से ईंट बजाना (b) उगल देना
(c) उल्टी गंगा बहाना (d) उड़ती चिड़िया पहचानना

16. 'दाँतों तले उँगली दबाना' मुहावरे का सही अर्थ क्या है?
(a) पीछे पड़ना (b) शोक करना
(c) चकित होना (d) बहाना करना

17. 'नाकों चने चबाना' मुहावरा किस अर्थ में प्रयुक्त होता है?
(a) कठिन परिश्रम करना (b) विश्राम करना
(c) गुस्सा करना (d) मुँह बन्द करना

18. 'टेढ़ी खीर होना' मुहावरे का सही अर्थ क्या है?
(a) सरल कार्य होना (b) कठिन कार्य होना
(c) निश्चित होना (d) असमंजस की स्थिति

19. 'कमर कसना' मुहावरे का सही अर्थ क्या है?
(a) सतर्क रहना (b) दण्डित करना
(c) दृढ़ निश्चय करना (d) परिश्रम करना

20. 'गर्दन उठाना' मुहावरे का सही अर्थ क्या है?
(a) प्रतिवाद करना
(b) पीछे पड़ना
(c) सिर पर सवार होना
(d) उदास होना

21. 'ऊँट के मुँह में जीरा' लोकोक्ति का सही अर्थ क्या है?
(a) बहुत थोड़ा
(b) ऊँट को जीरा खिलाना
(c) ऊँट के बीमारी होना
(d) पेट भरना

22. 'सब धन बाईस पंसेरी' लोकोक्ति का सही अर्थ क्या है?
(a) बहुत सस्ता होना
(b) बहुत महँगा होना
(c) अच्छा-बुरा सबको समान समझना
(d) सुविधा भोगी होना

23. 'एक पंथ दो काज' का सही अर्थ है
(a) अनेक कार्य करना
(b) सोच-विचार करना
(c) एक साथ दो लाभ
(d) दो लाभ का पद ग्रहण करना

24. 'धोबी का कुत्ता न घर का न घाट का' लोकोक्ति का सही अर्थ क्या है?
(a) धीरे-धीरे चलना (b) कहीं ठिकाना नहीं होना
(c) मार खाना (d) सहायक नहीं होना

25. 'नाच न जाने आँगन टेढ़ा' लोकोक्ति का सही अर्थ क्या है?
(a) काम न आने पर बहाना करना
(b) परिश्रम से जी चुराना
(c) बाह्य प्रदर्शन
(d) नुकसान से डरना

26. 'दाल-भात में मूसलचन्द' लोकोक्ति का सही अर्थ क्या है?
(a) खाने में बाधा आना
(b) भोजन के लिए तैयार
(c) किसी काम में दखल देना
(d) अपनों को महत्त्व नहीं देना

27. 'दाल में काला होना' लोकोक्ति का सही अर्थ क्या है?
(a) सही बात (b) सन्देहास्पद होना
(c) दाल खराब होना (d) शिकायत करना

28. 'हाथ कंगन को आरसी क्या' लोकोक्ति का सही अर्थ क्या है?
(a) प्रत्यक्ष को प्रमाण की जरूरत नहीं
(b) हाथ के कंगन में चेहरा देखना
(c) उचित न्याय
(d) देखने में सज्जन, हृदय से कपटी

29. 'उल्टे बाँस बरेली को' लोकोक्ति का सही अर्थ क्या है?
(a) प्रतिकूल कार्य करना
(b) उचित कार्य करना
(c) शर्त पूरी करना
(d) दूसरों को उपदेश देना

30. 'इधर कुआँ, उधर खाई' लोकोक्ति का सही अर्थ क्या है?
(a) दोनों ओर संकट का होना
(b) परिश्रम अधिक, लाभ कम
(c) देखने में सज्जन, हृदय से कपटी
(d) स्वयं ही मुसीबत खड़ी करना

31. 'बीड़ा उठाना' मुहावरे का सही अर्थ क्या है?
(a) किसी कार्य को पूर्ण करने का संकल्प
(b) कष्ट से उबारना
(c) कर्त्तव्य से मुक्त होना
(d) अधिक मात्रा में होना

32. 'भूत सवार होना' मुहावरे का सही अर्थ है
(a) काम के प्रति जागरूक होना
(b) सनक सवार होना
(c) व्यर्थ का कार्य करना
(d) उत्तरदायित्व उठाना

33. 'बेड़ा पार लगाना' मुहावरे का सही अर्थ है
(a) बाढ़ आना (b) कष्ट से उबारना
(c) इच्छा पूर्ण करना (d) भेद खुलना

34. 'तरस खाना' मुहावरे का सही अर्थ है
(a) क्रोध करना (b) दया करना
(c) आश्चर्य करना (d) डींग मारना

35. 'टक्कर लेना' मुहावरे का सही अर्थ है
(a) इनकार करना
(b) मुकाबला करना
(c) नष्ट करना
(d) ठोकर लगना

36. 'बिल्ली के गले में घंटी' लोकोक्ति का सही अर्थ क्या है?
(a) दुविधापूर्ण स्थिति (b) कठिन काम पूरा करना
(c) ताकतवर की जीत (d) असहाय अवस्था

37. 'का वर्षा जब कृषि सुखाने' लोकोक्ति का सही अर्थ क्या है?
(a) अवसर चूक जाने के बाद सारे साधन बेकार
(b) बेमेल वस्तु
(c) परिश्रम से कम मिलना
(d) अवसर के अनुसार कार्य करना

38. 'दूध का दूध पानी का पानी' लोकोक्ति का सही अर्थ क्या है?
(a) दो तरफा लाभ
(b) निष्पक्ष न्याय
(c) किसी झंझट में नहीं रहना
(d) अच्छा मौका मिलना

39. 'साँच को आँच नहीं' लोकोक्ति का सही अर्थ क्या है?
(a) सच को किसी का डर नहीं होता
(b) समय पर कार्य करना
(c) विश्वासी व्यक्ति
(d) साँचे में आँच नहीं समा सकती

40. 'मुख में राम, बगल में छुरी' लोकोक्ति का सही अर्थ क्या है?
(a) कपटी व्यक्ति (b) भक्त तथा शाक्त
(c) एकमत नहीं होना (d) दूसरे का धन

उत्तरमाला

1.	(b)	2.	(b)	3.	(d)	4.	(a)	5.	(a)	6.	(b)	7.	(c)	8.	(b)	9.	(b)	10.	(b)
11.	(c)	12.	(c)	13.	(b)	14.	(b)	15.	(c)	16.	(c)	17.	(a)	18.	(b)	19.	(c)	20.	(a)
21.	(a)	22.	(c)	23.	(c)	24.	(b)	25.	(a)	26.	(c)	27.	(b)	28.	(a)	29.	(a)	30.	(a)
31.	(a)	32.	(b)	33.	(c)	34.	(b)	35.	(b)	36.	(b)	37.	(a)	38.	(b)	39.	(a)	40.	(a)

अध्याय
11

वाक्यांश के लिए एक शब्द

हिन्दी में 'वाक्यांश के लिए एक शब्द' का प्रयोग संस्कृत की अपेक्षा कम होता है। वस्तुत: कम-से-कम शब्दों में अधिक-से-अधिक विचारों की अभिव्यक्ति के लिए 'वाक्यांश के लिए एक शब्द' का प्रयोग उपयोगी होता है। ऐसे शब्दों को 'अनेक शब्दों के बदले एक शब्द' भी कहते हैं।

प्रतियोगिता परीक्षाओं में हिन्दी भाषा के प्रश्न-पत्र में 'वाक्यांश के लिए एक शब्द' वाले प्रश्न अवश्य पूछे जाते हैं। इसलिए यह जरूरी है कि ऐसे प्रश्नों का अध्ययन गम्भीरता से किया जाए। यहाँ 'वाक्यांश के लिए एक शब्द' के कुछ परीक्षोपयोगी उदाहरण दिए जा रहे हैं

हिन्दी में एक वाक्य, वाक्यांश अथवा अनेक शब्दों के लिए एक शब्द के प्रयोग की परम्परा संस्कृत से आई है। हिन्दी में ऐसे शब्दों का प्रयोग रूढ़ तौर पर होता है।

महत्त्वपूर्ण वाक्यांशों के लिए एक शब्द

वाक्यांश	एक शब्द
जिसका आदि न हो	अनादि
जिसका अन्त न हो	अनन्त
जिसके आने की तिथि निश्चित न हो	अतिथि
जिसे जीता न जा सके	अजेय
जिसके समान कोई दूसरा न हो	अद्वितीय
जो पहले कभी नहीं हुआ	अभूतपूर्व
जिसके टुकड़े न हो सकें	अखण्ड
जो गाए जाने योग्य न हो	अगेय
जिसकी गहराई का पता न हो	अथाह
जो बीत चुका है	अतीत
जो सदा से चला आ रहा है	अनवरत
जिसकी कल्पना न की जा सके	अकल्पनीय

वाक्यांश	एक शब्द
कम खाने वाला	अल्पाहारी
जिसका जन्म न हो सके	अजन्मा
जिसकी तुलना न की जा सके	अतुलनीय
जो कानून के विरुद्ध हो	अवैध
बड़ा भाई	अग्रज
जहाँ जाना सम्भव न हो	अगम
जिसे कभी बुढ़ापा न आए	अजर
जो आँखों के सामने न हो	अप्रत्यक्ष
जो कभी मरता न हो	अमर
अवसर के अनुसार बदल जाने वाला	अवसरवादी
जिसमें चेतना न हो	अचेतन
जो कभी मरता नहीं	अमर्त्य
जो आगे की न सोचता हो	अदूरदर्शी
मन में होने वाला ज्ञान	अन्तर्ज्ञान
धरती और आकाश के बीच का स्थान	अन्तरिक्ष
वध करने के योग्य	वध्य
दूसरे के पीछे चलने वाला	अनुयायी
जिसे स्पर्श करना वर्जित हो	अस्पृश्य
जिसका कोई शत्रु न हो	अजातशत्रु
जिसका मूल्य आँका न जा सके	अमूल्य
जो इस संसार से बाहर की वस्तु हो	अलौकिक
जिसके पास कुछ न हो	अकिंचन
जो कानून के प्रतिकूल हो	अवैध
दोपहर के बाद का समय	अपराह्न
अधिक बढ़ा-चढ़ा कर कहना	अतिशयोक्ति
जो कुछ नहीं जानता हो	अज्ञ
जिसमें कुछ करने की क्षमता न हो	अक्षम
जिसकी उपमा न हो	अनुपम
जिसका निवारण न हो सकता हो	अनिवारणीय
जिसकी अपेक्षा न हो	अनपेक्षित

वाक्यांश	एक शब्द
छोटा भाई	अनुज
जो वाणी द्वारा व्यक्त न किया जा सके	अनिर्वचनीय
अपनी प्रशंसा करने वाला	आत्मश्लाघी
ईश्वर में विश्वास रखने वाला	आस्तिक
आदि से अन्त तक	आद्योपान्त, आद्यंत
एक ही आदमी का अधिकार	एकाधिकार
जहाँ कोई दूसरा न हो	एकान्त
जो अपनी इच्छा पर निर्भर हो	ऐच्छिक
कार्य करने वाला व्यक्ति	कार्यकर्ता
क्रम के अनुसार	क्रमानुसार
आलोचना करने वाला	आलोचक
जिसकी आयु लम्बी हो	दीर्घायु
जो बहुत बोलता हो	वाचाल
जो स्वयं पैदा हुआ हो	स्वयंभू
जो किसी के पक्ष में न हो	तटस्थ
जिसके हाथ में वज्र हो	वज्रपाणि
जिसकी आत्मा महान् हो	महात्मा
जिसका रूप अच्छा न हो	कुरूप
तीनों लोकों का स्वामी	त्रिलोकी
जो अभी पैदा हुआ हो	नवजात
जंगल में लगने वाली आग (दावानल)	दावाग्नि
जो जन्म से अन्धा हो	जन्मान्ध
जो क्षमा करने योग्य हो	क्षम्य
जिस पुरुष की पत्नी की मृत्यु हो गई हो	विधुर
जिसका आचरण अच्छा हो	सदाचार
जो उच्च कुल में पैदा हुआ हो	कुलीन
जिस पर उपकार किया गया हो	उपकृत
जो धर्म का काम करे	धर्मात्मा

अभ्यास प्रश्न

1. 'जिसके समान कोई दूसरा न हो' वाक्यांश के लिए एक शब्द है
(a) शक्तिशाली
(b) प्रतिभाशाली
(c) अद्वितीय
(d) पराक्रमी

2. 'आवश्यकता से अधिक धन का त्याग' कहलाता है
(a) अपरिगृहण (b) अपरिग्रह
(c) इन्द्रियनिग्रह (d) परिग्रह

3. 'जिसके पास कुछ भी न हो' उसे कहेंगे
(a) गरीब (b) दरिद्र
(c) अकिंचन (d) विनीत

4. 'जिसका ज्ञान इन्द्रियों द्वारा न हो' उसे कहेंगे
(a) इन्द्रियरहित (b) मतिहीन
(c) इन्द्रीमय (d) अगोचर

5. 'जिसे जीता न जा सकता हो' उसे कहेंगे
(a) अभय (b) अजेय
(c) विजय (d) इनमें से कोई नहीं

6. 'सबसे प्रथम गिना जाने वाला' कहलाता है
(a) प्रथम (b) अग्रज
(c) आरम्भ (d) अग्रगण्य

7. 'वह कवि जो तत्काल कविता करने में कुशल हो'
(a) सुकवि (b) महाकवि
(c) आशुकवि (d) राजकवि

8. 'आरम्भ से अन्त तक' के लिए एक शब्द क्या होगा?
(a) आरम्भिक (b) आद्योपन्त
(c) आद्योपान्त (d) सम्पूर्ण

9. 'जिसे मापा न जा सकता हो', कहलाता है
(a) अमापित (b) अपर
(c) अनुपेय (d) अपरिमेय

10. 'परम्परागत उक्ति' को कहते हैं
(a) अनुश्रुति (b) सूक्ति
(c) विरक्ति (d) इनमें से कोई नहीं

11. 'जो स्त्री सूर्य भी नहीं देख पाती', उसे कहेंगे
(a) असूर्यपश्या (b) अनूढ़ा
(c) सूर्यपुत्री (d) असूर्ययश्मा

12. 'जिसका कोई शत्रु पैदा ही न हुआ हो', के लिए एक शब्द है
(a) स्कन्दगुप्त (b) अजातशत्रु
(c) अजानबाहु (d) अजेय

13. 'धन को व्यर्थ ही खर्च करने वाला' होता है
(a) व्ययी (b) धनिक
(c) मितव्ययी (d) अपव्ययी

14. जिसके हस्ताक्षर नीचे अंकित हों, को कहते हैं
(a) अधोहस्ताक्षर (b) हस्ताक्षरित
(c) अधोहस्ताक्षरकर्ता (d) अनुमोदन

15. 'बरसात बिलकुल न होना', कहलाता है
(a) अनवृष्टि (b) अल्पवृष्टि
(c) अनासृष्टि (d) अनावृष्टि

16. 'सरकार के प्रयास से जारी होने वाली सूचना' कहलाती है
(a) संसूचना (b) अध्यादेश
(c) राज्यादेश (d) अधिसूचना

17. 'जो किसी के प्रति आसक्त हो' कहलाएगा
(a) आसक्ति (b) आस्थावान
(c) अनुरक्त (d) विरक्त

18. 'बहुत दान देने वाले' को कहेंगे
(a) दानी (b) औढरदानी
(c) दीनदयाल (d) दानवीर

19. 'जो शीघ्र प्रसन्न हो जाए', उसे कहेंगे
(a) प्रसन्नचित्त (b) प्रसून
(c) प्रसन्ना (d) आशुतोष

20. 'जिसकी भुजाएँ घुटनों तक लम्बी हों' उसे कहते हैं
(a) अजानबाहु (b) आजानुबाहु
(c) समबाहु (d) विषमबाहु

21. 'आघ्रेय' का अर्थ होता है
(a) सुगन्धित पदार्थ
(b) सुगन्धहीन पदार्थ
(c) जिसे सूँघा न जा सके
(d) जिसे सूँघा जा सके

22. 'जिसकी इच्छा की गई हो', वह कहलाता है
(a) इच्छित (b) ईप्सित
(c) आकांक्षा (d) महत्त्वाकांक्षा

23. 'जो इन्द्र पर विजय प्राप्त कर चुका हो' कहलाएगा
(a) इन्द्रजेय (b) इन्दु
(c) जितेन्द्रिय (d) इन्द्रजीत

24. 'घटनाओं का कालक्रम से किया गया वर्णन' कहलाता है
(a) इतिवृत (b) कहानी
(c) संस्मरण (d) नाटक

25. 'जो दो में निष्ठा रखता हो', उसे कहते हैं
(a) निष्ठावान (b) निर्जरा
(c) निर्लिप्त (d) उभयनिष्ठ

26. 'इन्द्रियों को भ्रमित करने वाला' कहलाता है
(a) ऐन्द्रिक (b) ऐन्द्रजालिक
(c) इन्द्रिलोलुप (d) इनमें से कोई नहीं

27. 'धर्मपत्नी से उत्पन्न पुत्र' को कहते हैं
(a) धर्मपुत्र (b) औरस
(c) बलशाली (d) तेजस्वी

28. 'काँटों से भरा हुआ' कहलाता है
(a) कण्टक (b) कण्टका
(c) गुलदस्ता (d) कण्टकाकीर्ण

29. 'अपने ही कुल के नाशक' को कहते हैं
(a) वंशज (b) कपूत
(c) कुलटा (d) कुलांगार

30. 'कुश की नोक-सी तीखी बुद्धि' को कहते हैं
(a) विद्वान् (b) कुशा
(c) कुशाग्रबुद्धि (d) मन्दबुद्धि

31. 'शुद्ध आत्मा' का मनुष्य कहलाता है
(a) पवित्र (b) दार्शनिक
(c) कृतात्मा (d) शुद्धोधन

32. 'उपकार को भूल जाने वाला' व्यक्ति होता है
(a) कृतज्ञ (b) कृतकृत्य
(c) दुष्ट (d) कृतघ्न

33. 'उपकार को याद रखने वाला' व्यक्ति कहलाता है
(a) कृतज्ञ (b) कृतघ्न
(c) कर्मठ (d) कृतकृत्य

34. 'गंगा से उत्पन्न' होने वाले को कहते हैं
(a) गांगेय (b) गंगू (c) गंगपुत्र (d) गंगीय

35. 'सायंकाल गायों के चरकर लौटने का समय' कहलाता है
(a) संध्या (b) गोधूलि
(c) गोधूम (d) गोकाल

36. 'चक्र धारण करने वाला' होता है
(a) चक्रेश (b) चक्रधर
(c) चक्रेषु (d) चक्रक

37. 'जिनके चार-चार पैर होते हैं', उन्हें कहते हैं
(a) चतुष्पद
(b) चौपाय
(c) चतुदर्शी
(d) चौरा

38. 'दूसरों के दोष देखने वाला' कहलाता है
(a) आलोचक (b) निन्दक
(c) छिद्रान्वेषी (d) ईर्ष्यालु

39. 'जीने की इच्छा' को कहते हैं
(a) महत्त्वाकांक्षा (b) सत्आकांक्षा
(c) जिजीविषा (d) विजयकामना

40. 'जीतने की इच्छा रखने वाला' कहलाता है
(a) जिगीषा (b) जिगीषु (c) उन्माद (d) आकांक्षी

उत्तरमाला

1.	(c)	2.	(b)	3.	(c)	4.	(d)	5.	(b)	6.	(d)	7.	(c)	8.	(c)	9.	(d)	10.	(a)
11.	(a)	12.	(b)	13.	(d)	14.	(c)	15.	(d)	16.	(d)	17.	(c)	18.	(b)	19.	(d)	20.	(b)
21.	(d)	22.	(b)	23.	(d)	24.	(a)	25.	(d)	26.	(b)	27.	(b)	28.	(d)	29.	(d)	30.	(c)
31.	(d)	32.	(d)	33.	(a)	34.	(a)	35.	(b)	36.	(b)	37.	(a)	38.	(c)	39.	(c)	40.	(b)

अध्याय
12

अपठित बोधात्मक प्रश्न

प्रस्तुत अध्याय अपठित गद्यांशों तथा उनसे सम्बन्धित प्रश्नों पर आधारित है।

अपठित गद्यांश पाठ्य-पुस्तकों से सम्बन्धित नहीं होते। इनका उद्देश्य ऐसे प्रश्नों को परीक्षार्थियों के समक्ष रखना है, जिससे उनकी बौद्धिक क्षमता, भाषा दक्षता तथा गद्यांश को समझने की क्षमता का परीक्षण किया जा सके। प्रश्नों के उत्तर देने से पूर्व परीक्षार्थी को एकाग्रता के साथ गद्यांश का अध्ययन करना चाहिए।

उत्तर देते समय ध्यान रखने योग्य बातें—

1. अपठित गद्यांश को ध्यानपूर्वक पढ़कर उसके भावों को पूर्णत: आत्मसात् करना चाहिए।
2. गद्यांश के भीतर ही प्रश्नों के उत्तर (विकल्प) मौजूद होते हैं। कभी-कभी गद्यांश के शब्दों अथवा भावों से जुड़े ऐसे भी प्रश्न किए जाते हैं, जिनके उत्तर गद्यांश में मौजूद नहीं होते, किन्तु गद्यांश को समझकर परीक्षार्थी आसानी से उत्तर दे सकते हैं।
3. यदि गद्यांश का शीर्षक पूछा जाता है, तो उसके केन्द्रीय भाव पर ध्यान देते हुए, शीर्षक की पहचान करनी चाहिए।
4. रेखांकित शब्दों के अर्थ तथा व्याकरण सम्बन्धी प्रश्नों के उत्तर देते समय प्रसंग को ध्यान में रखना जरूरी है।

साधित उदाहरण

उदाहरण 1

नैनो तकनीक से विश्व में नवीन आशा का संचार हुआ है। भविष्य में इस तकनीक से मनुष्य को होने वाले लाभ की कल्पना की जा सकती है। नैनो तकनीक ने यह सम्भव कर दिया है कि मनुष्य अपनी इच्छा से नये परमाणु तथा उनके समूहों का निर्माण कर सकता है तथा उन्हें यथास्थान स्थापित कर सकता है। नैनो तकनीक ने असीमित क्षेत्रों में अपने लिए स्थान निर्धारित किया है। आने वाले समय में जीवन का प्रत्येक आयाम इस तकनीक से आच्छादित होगा। स्वास्थ्य के क्षेत्र में कैंसर तथा एड्स जैसी बीमारियों को समाप्त करने में यह सक्षम होगा, ऐसी कल्पना की जा रही है। नैनो तकनीक से बनाई जाने वाली दवाइयाँ किसी साइड-इफेक्ट के बिना मरीज को राहत पहुँचाने में सक्षम होंगी।

'नैनो' शब्द ग्रीक भाषा के 'नैनोज' से बना है, जिसका अर्थ होता है – 'सूक्ष्म', लेकिन विज्ञान की अन्तर्राष्ट्रीय मापन प्रणाली में नैनोमीटर एक मीटर का अरबवाँ भाग होता है। वैज्ञानिकों का मानना है कि पदार्थों के स्थूल गुणधर्म का परमाण्विक गुणधर्म में परिवर्तन नैनोमीटर स्तर पर सम्भव है। इसी प्रक्रिया को अपनाकर नये पदार्थों का निर्माण किया जा सकता है, जो अपने मूल पदार्थों के गुणधर्म से भिन्न हो। भारत में नैनो तकनीक पर अनुसन्धान की प्रक्रिया उस स्तर की नहीं हुई है, जहाँ से हमारी प्रतिस्पर्द्धा विकसित देशों से हो सके।

प्रश्न

1. 'नैनो तकनीक' ने विश्व चेतना पर क्या असर डाला है?
   (a) नवीन आशा का संचार हुआ है
   (b) असुरक्षा की भावना बढ़ी है
   (c) प्रतिस्पर्द्धा का भाव आया है
   (d) आतंकवाद का खतरा बढ़ा है
2. 'नैनो तकनीक' का प्रयोग किन क्षेत्रों में सम्भव है?
   (a) केवल कृषि में
   (b) केवल स्वास्थ्य में
   (c) असीमित क्षेत्रों में
   (d) अन्तरिक्ष के क्षेत्र में
3. 'नैनो' किस भाषा का शब्द है?
   (a) चीनी (b) जापानी
   (c) ग्रीक (d) स्पेनिश
4. 'नैनो मीटर' एक मीटर का ...हिस्सा है।
   (a) सौवाँ
   (b) हजारवाँ
   (c) अरबवाँ
   (d) उपरोक्त में से कोई नहीं
5. 'नवीन' का विलोम शब्द होगा
   (a) अर्वाचीन
   (b) प्राचीन
   (c) पुरातन
   (d) नूतन

उत्तर

1. *(a)* 2. *(c)* 3. *(c)* 4. *(c)* 5. *(b)*

उदाहरण 2

सेवा, त्याग तथा दान-धर्म का भारतीय सांस्कृतिक चेतना में अत्यधिक महत्त्व है। भारतीय दर्शन ने जीव मात्र को ईश्वरीय रूप माना है। आत्मा तथा परमात्मा के विचार ने हमारे जीवन को सहज, सुगम एवं परमार्थकारी बनाया है। सारा विश्व हमारा घर है और हम सभी की भलाई के लिए कामना करें, यही हमारे जीवन का परम लक्ष्य निर्धारित किया गया है। अपने कर्त्तव्यों का पालन करते हुए, जीवन में शुचिता और गम्भीरता का समावेश कर इसे सुखी बनाने में सहायक हो सकते हैं। हमें चाहिए कि हम अपने अन्त:करण को शुद्ध कर रूढ़ियों, अन्धपरम्पराओं से पृथक् होकर सेवा-मात्र को अपना मार्ग बनावें। किसी दीन-दु:खी को देखकर यदि हमारे हृदय में पीड़ा का अनुभव नहीं होता तो अवश्य ही हमने अपनी महान् संस्कृति और दर्शन से कुछ भी नहीं सीखा है। हमें यह समझना चाहिए कि पीड़ित व्यक्ति भी हमारी तरह हाड़-मांस का जीवित प्राणी है, जिसके भीतर अनुभव करने वाली इन्द्रियाँ हैं। भूख-प्यास सबको लगती है। यदि हमारे सामने कोई व्यक्ति भूखा-प्यासा, वस्त्र विहीन रहता है तो हमारे लिए यह गर्व की बात नहीं कि हम लम्बी-लम्बी मोटरगाड़ियों से धूल उड़ाते चलते हैं। आज भारतीय संस्कृति पर उपभोक्तावादी पाश्चात्य संस्कृति की कालिमा का प्रभाव पड़ा है, जिसके कारण हम 'बन्धुत्व' और 'सहानुभूति' को भूलते जा रहे हैं।

प्रश्न

1. भारतीय संस्कृति में किस प्रवृत्ति का महत्त्व रहा है?
   (a) सेवा, त्याग तथा दान-धर्म
   (b) जातिवाद, भ्रष्टाचार तथा अपराधीकरण
   (c) अस्पृश्यता
   (d) बेईमानी
2. हमारे जीवन का परम लक्ष्य क्या होना चाहिए?
   (a) सबकी भलाई
   (b) पूजा-पाठ
   (c) धन कमाना
   (d) नौकरी पाना

3. भारतीय संस्कृति पर किसका प्रभाव आधुनिक समय में बढ़ता जा रहा है?
   (a) उपभोक्तावादी संस्कृति
   (b) बन्धुत्व तथा प्रेम की संस्कृति
   (c) इस्लामी संस्कृति
   (d) वैदिक संस्कृति
4. 'शुचिता' का अर्थ है
   (a) यथार्थता
   (b) सत्यता
   (c) पवित्रता
   (d) निश्छलता
5. दीन-दु:खियों के प्रति हमारा क्या भाव होना चाहिए?
   (a) सहायता का
   (b) बच-निकलने का
   (c) मतलब नहीं रखना चाहिए
   (d) अस्पृश्यता का

उत्तर

1. *(a)* 2. *(a)* 3. *(a)* 4. *(c)* 5. *(a)*

उदाहरण 3

1732 ई. में जब मुगल शासक मुहम्मद शाह था, जयसिंह को मालवा का शासक बनाया गया। उसे नियुक्त करने का उद्देश्य मराठों को मालवा से भगाना था, लेकिन जयसिंह इस कार्य को करने में विफल रहा और जयपुर लौट गया। इसी समय मराठों ने मालवा पर आक्रमण कर, उसे अपने अधिकार में कर लिया। इस प्रदेश को सुव्यवस्थित रखने के लिए पेशवा ने जागीर प्रथा प्रारम्भ की तथा स्थानीय सरदारों को जागीरें प्रदान कीं। इसी समय सिन्धिया को उज्जैन, आनन्दराव पवार को धार, होल्कर को मालवा तथा तुकोजी को देवास की जागीरें प्रदान की गईं। इस प्रकार सिन्धिया, होल्कर तथा पवार के नवीन रियासतों की स्थापना का मार्ग प्रशस्त हुआ। ये नवीन रियासत मालवा क्षेत्र के नवयुग के प्रदर्शक बने। इन रियासतों ने मालवा की सांस्कृतिक चेतना को भी प्रभावित किया। 1741 ई. के बाद मुगल साम्राज्य का सम्बन्ध सदा के लिए मालवा से समाप्त हो गया।

प्रश्न

1. मुगल शासक मुहम्मद शाह ने 1732 ई. में किसे मालवा का शासक नियुक्त किया?
   (a) जसवन्त सिंह (b) उदयसिंह
   (c) जयसिंह (d) मानसिंह
2. मालवा पर अधिकार करने के बाद पेशवा ने वहाँ कौन-सी प्रथा प्रारम्भ की?
   (a) इक्ता प्रथा (b) जमींदारी प्रथा
   (c) सैन्य अधिकार प्रथा (d) जागीर प्रथा
3. 'अधिकार' का विलोम शब्द होगा
   (a) कु-अधिकार (b) अनाधिकार
   (c) साधिकार (d) अनधिकार
4. किस वर्ष मुगलों का सम्बन्ध मालवा से सदा के लिए समाप्त हो गया?
   (a) 1765 ई. (b) 1741 ई.
   (c) 1556 ई. (d) 1947 ई.
5. कौन मालवा में नवयुग के पथ प्रदर्शक बने?
   (a) मुगल शासक (b) नवीन रियासत
   (c) अंग्रेजी कम्पनी (d) अफीम की खेती

उत्तर

1. *(c)* 2. *(d)* 3. *(d)* 4. *(b)* 5. *(b)*

उदाहरण 4

भारत में तीव्र आर्थिक विकास की दृष्टि से देखें, तो शहरीकरण एक स्वाभाविक प्रक्रिया है। नई आर्थिक नीति लागू करने से पूर्व शहरीकरण के दुष्प्रभावों की ओर शायद हमारे नीति-निर्माताओं की सोच नहीं गई थी। यही कारण है कि मलिन बस्तियों में रहने वाले शहरी गरीब आज भी मूलभूत आवश्यकताओं से वंचित हैं। इन मलिन बस्तियों में रहने वाली जनसंख्या ऐसे लोगों की है, जो शोषण के बावजूद भी बेहतर रोजगार अवसरों की अनुपलब्धता के कारण गाँव से शहरों की ओर पलायन करने को मजबूर हुए। भारत में अभी शहरी जनसंख्या 38 करोड़ 20 लाख है, जो 20 वर्षों में दुगनी हो जाएगी। शहर की जनसंख्या में वृद्धि के साथ शहरीकरण की प्रवृत्ति में तेजी आ रही है, इससे गरीबों की संख्या में भी वृद्धि हो रही है। रोजगार की स्थिति गाँवों की अपेक्षा शहरों में अच्छी है, लेकिन यह अधिक खुश करने वाला नहीं है। योजना आयोग की रिपोर्ट के अनुसार 6 करोड़ 82 लाख अर्थात् 25% शहरी लोग गरीबी-रेखा से नीचे जीवन व्यतीत कर रहे हैं।

प्रश्न

1. 'शहरीकरण' किस व्यवस्था की स्वाभाविक प्रक्रिया है?
   (a) ग्रामीण विकास (b) ओलम्पिक का आयोजन
   (c) तीव्र आर्थिक विकास (d) पूँजी-निवेश
2. शहरी-गरीबी का निर्धारण कौन करता है?
   (a) राष्ट्रपति (b) राज्यपाल
   (c) वित्त आयोग (d) योजना आयोग
3. 'अनुपलब्धता' का विलोम शब्द होगा
   (a) उपलब्धि
   (b) उपलब्धता
   (c) उपलब्ध
   (d) अनुपलब्ध

4. मलिन बस्तियों में रहने वालों की क्या स्थिति है?
(a) बहुत अच्छी
(b) मूलभूत अनिवार्यताओं से वंचित हैं
(c) कोई आवश्यकता नहीं है
(d) स्थिति का लेखा-जोखा नहीं है

5. शहरी क्षेत्रों के गरीबों की संख्या कितनी मानी गई है?
(a) नगण्य
(b) 6 करोड़ 82 लाख
(c) 38 करोड़ 20 लाख
(d) 10 करोड़ 25 लाख

उत्तर

1. *(c)* 2. *(d)* 3. *(b)* 4. *(b)* 5. *(b)*

उदाहरण 5

क्या आपने हुदहुद पक्षी का नाम सुना है? क्या आपने उसे देखा है? यह लगभग मैना जैसे आकार का होता है। रंग में हल्का-भूरा यह पक्षी देखने में बहुत आकर्षक लगता है। इसके परों और पूँछ पर काली-सफेद जेब्रा जैसी धारियाँ होती हैं। नर हुदहुद और मादा हुदहुद देखने में एक जैसे लगते हैं। इसकी चोंच लम्बी-पतली और हल्की-सी मुड़ी हुई होती है। इससे यह आसानी से कीड़े पकड़ सकता है। हुदहुद पक्षी अधिकतर समूहों में नहीं रहता। यह अकेला या अपने साथी हुदहुद के साथ हमेशा जमीन पर ही चुगता है। कभी-कभी हुदहुद कठफोड़वे जैसा लगता है, लेकिन यह उससे बिलकुल अलग होता है। हुदहुद पूरे भारत में पाया जाता है। इसे हरे मैदान सबसे अधिक पसन्द हैं। गाँव, शहर सभी जगह हुदहुद को आप देख सकते हैं। इसे इनसानों के आस-पास रहना ही अच्छा लगता है। मिट्टी खोदते समय यह अपने पंखों को बन्द किए रहता है। इसकी आवाज बहुत सुरीली होती है। यह हू-पो-पो जैसी आवाज निकालता है, इस कारण इसका एक नाम हूप्पो भी है। हुदहुद का भोजन कीड़े, लार्वा-प्यूपा आदि है।

प्रश्न

1. हुदहुद का आकार कैसा होता है?
(a) तोते जैसा (b) कौए जैसा
(c) कबूतर जैसा (d) मैना जैसा

2. हुदहुद का रंग कैसा होता है?
(a) हलका लाल (b) हलका सफेद
(c) हलका भूरा (d) हलका काला

3. 'सुरीली का विलोम शब्द होगा?
(a) बेसुरी
(b) कुरीली
(c) कड़वा
(d) मधुर

4. कभी-कभी हुदहुद कैसा लगता है?
(a) कोयल जैसा (b) कठफोड़वे जैसा
(c) मोर जैसा (d) गौरैया जैसा

5. हुदहुद का एक अन्य नाम है?
(a) हूप्पो (b) हू-पो-पो
(c) हपो (d) हुदहुदीं

उत्तर

1. *(d)* 2. *(c)* 3. *(a)* 4. *(b)* 5. *(a)*

उदाहरण 6

राज्य एक दायित्वपूर्ण संस्था है। वर्तमान परिस्थिति में राज्य की भूमिका समाप्त होना असम्भव है और परम्परागत मार्क्सवादी धारणा कि राज्य स्वयमेव समाप्त हो जाएगा, जनता के लिए भी हितकर नहीं है। जनता के हितों को सुरक्षित रखने के लिए क्रान्ति के पश्चात् भी राज्य की आवश्यकता है। राज्य आर्थिक व्यवस्था से संचालित होता है, जिस देश में जैसी आर्थिक व्यवस्था होगी राज्य उसी रूप में ढल जायेगा। यदि व्यवस्था, पूँजीवादी है, तो राज्य का नियन्त्रण साधनों पर नहीं रहेगा, वहीं यदि व्यवस्था साम्यवादी है तो राज्य का स्वरूप लोक कल्याणकारी हो जाएगा। आशय यह है कि आर्थिक व्यवस्था सर्वाधिक महत्त्वपूर्ण है।

आज विश्व के अधिकांश राज्य पूँजीवादी व्यवस्था में आते हैं। इसमें राज्य की प्राथमिकता क्या हो, यह एक अति महत्त्वपूर्ण प्रश्न है। जिस प्रकार एक परिवार सर्वप्रथम अपने जीवन की सुरक्षा एवं पोषण-निमित्त उपाय करता है वही राज्य का भी दायित्व है। जिस प्रकार लाखों लोग भारत जैसे गरीब राज्य में प्राकृतिक आपदाओं यथा बाढ़, सूखा, भूकम्प इत्यादि में कीड़े-मकोड़े की भाँति नष्ट हो जाते हैं, सर्वप्रथम राज्य को उनकी सुरक्षा हेतु कदम उठाने चाहिए।

प्रश्न

1. जनता के हितों को सुरक्षित रखने के लिए किस संस्था की आवश्यकता बनी रहेगी?
(a) व्यापारियों की (b) उद्योगपतियों की
(c) राज्य की (d) इनमें से कोई नहीं

2. विश्व में आज सर्वाधिक कौन-सी व्यवस्था प्रचलित है?
(a) पूँजीवादी व्यवस्था (b) मिश्रित व्यवस्था
(c) साम्यवादी व्यवस्था (d) इनमें से कोई नहीं

3. राज्य संचालित होता है
(a) राज्य के मुखिया से समान दायित्वों का निर्वाह
(b) अधिकारियों से
(c) आर्थिक व्यवस्था से
(d) उपरोक्त सभी

4. प्राकृतिक का विलोम शब्द होगा
   (a) कृत्रिम (b) स्वाभाविक
   (c) अप्राकृतिक (d) नैसर्गिक
5. प्रस्तुत गद्यांश का उपयुक्त शीर्षक है
   (a) राज्य (b) राज्य का स्वरूप
   (c) राज्य का दायित्व (d) इनमें से कोई नहीं

उत्तर

1. *(c)* 2. *(a)* 3. *(c)* 4. *(a)* 5. *(c)*

उदाहरण 7

चुनाव पूर्व सर्वेक्षण एवं एक्जिट पोल का लोकतन्त्र में क्या महत्त्व है? यह प्रश्न विचारणीय है। लोकतन्त्र रूपी वृक्ष जनता द्वारा रोपा और सींचा जाता है, इसके पल्लवन एवं पुष्पन में मीडिया की विशेष भूमिका होती है। भारत एक लोकतान्त्रिक राष्ट्र है। लोकतान्त्रिक राष्ट्र में नागरिकों को विशिष्ट अधिकार और स्वतन्त्रताएँ प्राप्त होती हैं। भारतीय संविधान ने भी अनुच्छेद 19 (i) के अन्तर्गत नागरिकों को अभिव्यक्ति की स्वतन्त्रता प्रदान की है, लेकिन जनता के व्यापक हित पर प्रतिकूल प्रभाव डालने वाली स्वतन्त्रता बाधित भी की जानी चाहिए।

वर्तमान में बाजारवाद अपने उत्कर्ष पर है और मीडिया इसके दुष्प्रभाव से अनछुआ नहीं है। यह कहना अतिशयोक्ति न होगी कि आज मीडिया भी अधिकाधिक संख्या में प्रसार और धन पाने को बुभुक्षित है। मीडिया सत्ताधारी और मजबूत राजनीतिक दलों के प्रभाव में भी रहता है। ये दल धन के बल पर लोक रुझान को अपने पक्ष में दिखाने में सफल हो जाते हैं और सम्पूर्ण चुनाव प्रक्रिया को ही धता बता देते हैं। इस प्रकार सत्ता एवं धन इन सर्वेक्षणों को प्रभावित करते हैं। इन्हें दूध का धुला नहीं कहा जा सकता। भारत जैसे लोकतान्त्रिक राष्ट्र में जहाँ जनता निर्वाचन प्रक्रिया के माध्यम से अपना मत अभिव्यक्त करती है, वहाँ इन सर्वेक्षणों के औचित्य-अनौचित्य पर विचार किया जाना चाहिए।

1. प्रतिकूल प्रभाव डालने वाली स्वतन्त्रता क्यों बाधित होनी चाहिए?
   (a) श्रेष्ठ लोकतन्त्र की स्थापना हेतु
   (b) वोट के सही उपयोग हेतु
   (c) साफ-सुथरी चुनाव प्रक्रिया हेतु
   (d) लोकहित को सर्वोपरि रखने हेतु
2. लेखक ने 'दूध का धुला न होना' किसे कहा है?
   (a) मीडिया से सम्बन्धित लोगों को
   (b) चुनाव पूर्व सर्वेक्षण एवं एक्जिट पोल को
   (c) सत्ताधारी और बड़े राजनीतिक दलों को
   (d) संसद और न्यायालय को
3. भारतीय संविधान ने किस अनुच्छेद के अन्तर्गत नागरिको को अभिव्यक्ति की स्वतन्त्रता प्रदान की है?
   (a) 19 (ii)
   (b) 19 (i)
   (c) 19 (iii)
   (d) 19 (iv)
4. सही विलोम शब्द युग्म है
   (a) प्रचार-प्रसार (b) पवित्र-पौर्वात्य
   (c) औचित्य-अनौचित्य (d) उचित-समुचित
5. उपरोक्त गद्यांश का उपयुक्त शीर्षक बताइए
   (a) चुनाव पूर्व सर्वेक्षण
   (b) चुनाव पूर्व सर्वेक्षण एवं एक्जिट पोल
   (c) चुनाव प्रक्रिया
   (d) लोकतन्त्र और चुनाव सर्वेक्षण

उत्तर

1. *(d)* 2. *(a)* 3. *(c)* 4. *(c)* 5. *(b)*

उदाहरण 8

शिक्षा जीवन के सर्वांगीण विकास हेतु अनिवार्य है। शिक्षा के बिना मनुष्य विवेकशील और शिष्ट नहीं बन सकता। विवेक से मनुष्य में सही और गलत का चयन करने की क्षमता उत्पन्न होती है। विवेक से ही मनुष्य के भीतर उसके चहुँओर नित्य प्रति होते घटनाक्रमों के प्रति एक छिद्रान्वेषी दृष्टिकोण उत्पन्न होता है। शिक्षा ही मानव को मानव के प्रति मानवीय भावनाओं से पोषित करती है।

शिक्षा से मनुष्य अपने परिवेश के प्रति जाग्रत होकर कर्त्तव्याभिमुख हो जाता है। 'स्व' से 'पर' की ओर अग्रसर होने लगता है। निर्बल की सहायता करना, दुखियों के दु:ख दूर करने का प्रयास करना, दूसरों के दु:ख से दु:खी हो जाना और दूसरों के सुख से स्वयं सुख का अनुभव करना जैसी बातें एक शिक्षित मानव में सरलता से देखने को मिल जाती हैं।

इतिहास, साहित्य, राजनीतिशास्त्र, समाजशास्त्र, दर्शनशास्त्र इत्यादि पढ़कर विद्यार्थी विद्वान् ही नहीं बनता वरन् उसमें एक विशिष्ट जीवन दृष्टि, रचनात्मकता और परिपक्वता का सृजन भी होता है। शिक्षित सामाजिक परिवेश में व्यक्ति अशिक्षित सामाजिक परिवेश की तुलना में सदैव ही उच्च स्तर पर जीवन यापन करता है। परन्तु आज शिक्षा का अर्थ बदल रहा है। शिक्षा भौतिक आकांक्षा की चेरी बनती जा रही है। व्यावसायिक शिक्षा के अंधानुकरण में छात्र सैद्धान्तिक शिक्षा से दूर होते जा रहे हैं।

1. छिद्रान्वेषी दृष्टिकोण से लेखक का क्या तात्पर्य है?
   (a) समन्वय की भावना उत्पन्न होना
   (b) उपयुक्त और अनुपयुक्त का बोध होना
   (c) मानवीयता का विकास होना
   (d) विवेकशीलता का विकास होना

2. "शिक्षा ही मानव को मानव के प्रति मानवीय भावनाओं से पोषित करती है।" इस कथन के लिए उपयुक्त विकल्प चुनिए
(a) कटुता
(b) सहृदयता की भावना का विकास
(c) विनम्रता की भावना का विकास
(d) घृणा की भावना का विकास

3. शिक्षा से मनुष्य 'स्व' से 'पर' की ओर अभिगमन करने लगता है, क्यों?
(a) शिक्षा मनुष्य को संवेदनशील बनाती है
(b) शिक्षा से मनुष्य में सेवा भाव उत्पन्न होता है
(c) शिक्षा मनुष्य को कर्त्तव्यपरायण बनाती है
(d) शिक्षा मनुष्य में मानवीय भाव भरती है

4. सर्वांगीण का विलोम शब्द है
(a) सम्पूर्ण
(b) अर्द्धांगीण
(c) पूर्ण
(d) अपूर्ण

5. उपर्युक्त गद्यांश का उपयुक्त शीर्षक क्या होगा?
(a) शिक्षा
(b) शिक्षा का जीवन में महत्त्व
(c) शिक्षा का बदलता स्वरूप
(d) सैद्धान्तिक व व्यावसायिक शिक्षा

उत्तर

1. *(b)* 2. *(b)* 3. *(c)* 4. *(d)* 5. *(b)*

उदाहरण 9

सन्तुलित आहार हमारे लिए बहुत महत्त्वपूर्ण है। सन्तुलित आहार लेने से हमारा शरीर रोगों से सुरक्षित और हृष्ट-पुष्ट रहता है। जिस आहार में सभी पोषक तत्त्व सम्मिलित होते हैं, उसे सन्तुलित आहार कहते हैं। सन्तुलित आहार से हम बहुत से खतरनाक रोगों से बचे रह सकते हैं। उन खतरनाक रोगों में से एक रोग 'एनीमिया' है। इससे हमारे शरीर में खून की कमी हो जाती है। यूँ तो इस रोग का सबसे बड़ा कारण पौष्टिक आहार की कमी है, परन्तु इस रोग का एक और बड़ा कारण है - पेट में कीड़े होना। ये कीड़े हमारे शरीर में दूषित पानी पीने और दूषित खाद्य पदार्थों के खाने से प्रवेश कर जाते हैं। अत: हमें स्वच्छ और ताजा पानी ही पीना चाहिए तथा खाद्य पदार्थों को खाते समय भी हमें यह ध्यान रखना चाहिए कि वे दूषित न हों। भोजन करने से पहले हमें हाथों को अच्छी तरह से धो लेना चाहिए। शौच के लिए हमेशा शौचालयों का ही प्रयोग करना चाहिए। अत: स्वस्थ जीवन के लिए सन्तुलित आहार और स्वच्छता अत्यन्त आवश्यक है।

1. सन्तुलित आहार किसे कहते हैं?
(a) जिस आहार में सभी पोषक तत्त्व सम्मिलित हों
(b) जिस आहार में पोषक तत्त्वों का होना जरूरी नहीं है
(c) केवल फल
(d) केवल हरी तरकारियाँ

2. एनीमिया का लक्षण है
(a) शरीर हृष्ट-पुष्ट होना
(b) शरीर में त्वचा का लाल होना
(c) शरीर में खून की कमी होना
(d) मुँह में छाले होना

2. एनीमिया का लक्षण हैं
(a) शरीर हृष्ट पुष्ट होना
(b) शरीर में त्वचा का लाल होना
(c) शरीर में खून की कमी होना
(d) मुँह में छाले होना

3. एनीमिया रोक का एक अन्य बड़ा कारण है
(a) सिर में जूँ होना
(b) पेट में कीड़े होना
(c) अधिक पानी पीना
(d) ज्यादा सोजन करना

4. कीड़े हमारे शरीर में प्रवेश करते हैं
(a) स्वच्छ रहने से
(b) ताजा और स्वच्छ पानी पीने से
(c) ताजे फल खाने से
(d) दूषित पानी और खाद्य पदार्थ-लेने से

5. हृष्ट-पुष्ट का विलोम शब्द होगा
(a) कुपोषित (b) पुष्टता
(c) दौर्बल्य (d) दुर्बल

उत्तर

1. *(b)* 2. *(a)* 3. *(c)* 4. *(b)* 5. *(d)*

उदाहरण 10

सौन्दर्य की परख अनेक प्रकार से की जाती है। बाह्य सौन्दर्य की परख समझना तथा उसकी अभिव्यक्ति करना सरल है। जब रूप के साथ चरित्र का भी स्पर्श हो जाता है तब उसमें रसास्वादन की अनुभूति भी होती है। एक वस्तु सुन्दर तथा मनोहर कही जा सकती है, परन्तु सुन्दर वस्तु केवल इन्द्रियों को सन्तुष्ट करती है, जबकि मनोरम वस्तु चित्त को भी आनन्दित करती है। इस दृष्टि से कवि जयदेव का वसन्त चित्रण सुन्दर है तथा कालिदास का प्रकृति वर्णन मनोहर है, क्योंकि उसमें चरित्र की प्रधानता है। 'सुन्दर' शब्द संकीर्ण है, जबकि 'मनोहर' व्यापक तथा विस्तृत है। साहित्य में साधारण वस्तु भी विशेष प्रतीत होती है तथा उसे मनोहर कहते हैं।

1. सौन्दर्य की परख की जाती है
   (a) आनन्द की मात्रा के आधार पर
   (b) इन्द्रियों की सन्तुष्टि के आधार पर
   (c) रूप के आधार पर
   (d) मनोहरता के आधार पर
2. रसास्वादन की अनुभूति का बोध होता है
   (a) चरित्र स्पर्शी रूप से (b) चित्त के आनन्द से
   (c) सौन्दर्य अभिव्यक्ति से (d) इन्द्रिय सुख मात्र से
3. कवि जयदेव का 'वसन्त चित्रण' सुन्दर है, पर मनोहर नहीं, क्योंकि
   (a) यह इन्द्रिय सुखदायक है
   (b) इसमें केवल सौन्दर्य वर्णन है
   (c) यह चित्त को आनन्दित नहीं करता
   (d) इसमें अनुभूति नहीं है
4. संकीर्ण का विलोम शब्द है
   (a) प्रसार (b) विस्तीर्ण
   (c) कीर्ण (d) विकर्ण
5. ऊपर दिए गए गद्यांश का उपयुक्त शीर्षक है
   (a) साहित्य और सौन्दर्य
   (b) अभिव्यक्ति की अनुभूति
   (c) सुन्दरता बनाम मनोहरता
   (d) सुन्दरता की संकीर्णता

उत्तर

1. *(b)* 2. *(a)* 3. *(b)* 4. *(b)* 5. *(c)*

उदाहरण 11

विज्ञान शब्द की परिभाषा और क्षेत्र तथा इसकी प्रौद्योगिकी से भिन्नता के विषय में स्पष्ट ज्ञान होना आवश्यक है। कुछ शक्तिशाली व्यक्तियों में, जिनके पास मानव जाति के भविष्य की चाबी है, शायद विज्ञान ही सिर्फ एक महत्त्वपूर्ण अनुपम स्थिति में बिना किसी आपत्ति के सबके द्वारा स्वीकार किया जाने वाला विषय है।

आज विज्ञान से हमारा अर्थ हमारे विश्व और उसके परिवेश के मूल ज्ञान से, इसके सभी क्षेत्रों में ज्ञान की नियन्त्रित और नियमित खोज से है। परन्तु इस ज्ञान का प्रयोग जरूरी नहीं कि सार्वजनिक प्रयोजनों के लिए किया जाए। प्रौद्योगिकी में हम उन अनगिनत विधियों का उल्लेख करते हैं जिनसे विज्ञान को मानव सेवा के लिए प्रयुक्त किया जा सके। दोनों में स्पष्ट अन्तर बताने के लिए आणविक विज्ञान और प्रौद्योगिकी के वर्तमान सर्वाधिक लोकप्रिय क्षेत्रों से उदाहरण दिए जा सकते हैं। यह 'विज्ञान' है जिसमें भारी धात्विक तत्त्व यूरेनियम के नाभिक से अलग या विखण्डित हुए अंशों की प्रकृति और संख्या का मापन होता है। यह प्रौद्योगिकी है जिसमें इस वैज्ञानिक 'ज्ञान' का प्रयोग बिजली बनाने के लिए परमाणु बिजलीघर की रूप-रेखा या उसे बनाने में किया जाता है। यह भी प्रौद्योगिकी है जो नैतिक रंग ले लेती है और नैतिकता तथा अनैतिकता को अंकित करती है। विज्ञान तटस्थ या अनैतिक है और कभी भी नैतिक आचार या मानवीय कल्याण का विरोध नहीं कर सकता, यद्यपि एक वैज्ञानिक और तकनीशियन एक मानव होने के नाते इसका विरोध कर सकते हैं।

1. उपर्युक्त अवतरण किस प्रकार का है?
   (a) अलंकारिक (b) वृत्तात्मक
   (c) वर्णनात्मक (d) व्याख्यात्मक
2. लेखक प्रयत्न कर रहा है
   (a) विज्ञान की तरफ अच्छे व्यवहार के समर्थन का
   (b) हम विज्ञान को लोगों की भलाई के लिए प्रयोग करते हैं, के सुझाव का
   (c) भौतिक विज्ञान की अपेक्षा नैतिक विज्ञान के अध्ययन का
   (d) विज्ञान और तकनीकी के बीच भेद का
3. लेखक के अनुसार विज्ञान
   (a) ही सिर्फ एक शक्ति है, जो मानव जाति के भविष्य को निर्धारित करती है
   (b) मानवीय भाग्य को निर्धारित करने वाली कुछ शक्तियों में से एक है
   (c) भविष्य में मानव कल्याण का केवल यही एक साधन होगा
   (d) मनुष्य की प्रगति के रास्ते में आने वाली बहुत-सी बाधाओं में से एक है
4. यूरेनियम के केन्द्र के विखण्डन का अध्ययन क्या हो सकता है?
   (a) आधुनिक तकनीकी के एक उदाहरण का विचार
   (b) विद्युत के सिद्धान्तों के प्रयोग का विचार
   (c) किसी भी नैतिक उलझाव के न होने का विचार
   (d) सभी मनुष्यों की भलाई के लिए महत्त्वपूर्ण होने का विचार
5. निम्न में गलत विलोम शब्द-युग्म है
   (a) नैतिक-अनैतिक
   (b) वैज्ञानिक-अवैज्ञानिक
   (c) विरोध-अविरोध
   (d) ज्ञान-अज्ञान

उत्तर

1. *(d)* 2. *(d)* 3. *(a)* 4. *(b)* 5. *(c)*

उदाहरण 12

राष्ट्रीय भावना के अभ्युदय एवं विकास के लिए भाषा भी एक प्रमुख तत्त्व है। मानव समुदाय अपनी संवेदनाओं, भावनाओं एवं विचारों की अभिव्यक्ति हेतु भाषा का साधन अपरिहार्यत: अपनाता है। इसके अतिरिक्त उसके पास कोई विकल्प नहीं है। दिव्य ईश्वरीय आनन्दानुभूति के सम्बन्ध में भले ही कबीर ने 'गूंगे केरी शर्करा' उक्ति का प्रयोग किया था पर इससे उनका लक्ष्य शब्द-रूपी भाषा के महत्त्व को नकारना नहीं था। प्रत्युत उन्होंने भाषा को 'बहता नीर' कहकर भाषा की गरिमा प्रतिपादित की थी। विद्वानों की मान्यता है कि किसी एक राष्ट्र के भू-भाग की भौगोलिक विविधताएँ तथा उसके पर्वत, सागर, सरिताओं आदि की बाधाएँ उस राष्ट्र के निवासियों के परस्पर मिलने-जुलने में अवरोधक सिद्ध हो सकती हैं। उसी प्रकार भाषागत विभिन्नता से भी उनके पारस्परिक सम्बन्धों में निर्बाधता नहीं रह पाती। आधुनिक विज्ञान के युग में यातायात एवं संचार के साधनों की प्रगति से भौगोलिक बाधाएँ अब पहले की तरह बाधित नहीं करतीं। इसी प्रकार यदि राष्ट्र की एक सम्पर्क भाषा का विकास हो जाए तो पारस्परिक सम्बन्धों के गतिरोध बहुत सीमा तक समाप्त हो सकते हैं।

मानव-समुदाय को जीवित, जाग्रत एवं जीवन्त शरीर की संज्ञा दी जा सकती है, उसका अपना एक निश्चित व्यक्तित्व होता है। भाषा अभिव्यक्ति के माध्यम से इस व्यक्तित्व को साकार करती है। उसके अमूर्त मानसिक वैचारिक स्वरूप को मूर्त एवं बिम्बात्मक रूप प्रदान करती है। मनुष्यों के विविध समुदाय हैं। उनकी विविध भावनाएँ हैं, विचारधाराएँ हैं, संकल्प एवं आदर्श हैं।

1. उपर्युक्त अनुच्छेद का सर्वाधिक उपयुक्त शीर्षक है
   (a) व्यक्तित्व विकास और भाषा
   (b) भाषा बहता नीर
   (c) राष्ट्रीयता और भाषा-तत्त्व
   (d) साहित्य और भाषा-तत्त्व
2. भाव एवं विचार-विनिमय का सक्षम साधन है
   (a) काव्य साहित्य
   (b) प्रतीक एवं संकेत
   (c) शब्दरूपी भाषा
   (d) ललित कलाएँ
3. आधुनिक विज्ञान के युग में किन साधनो की प्रगति से भौगोलिक बाधाएँ पहले की तरह प्रभावित नहीं करती?
   (a) यातायात
   (b) संचार
   (c) संसाधन
   (d) (a) व (b) दोनों
4. मानव समुदाय को किसको सत्ता दी जा सकती है?
   (a) जीवित शरीर (b) भाषागत समुदाय
   (c) जीवित वं जागृत शरीर (d) उपरोक्त में से कोई नहीं
5. साकार का विलोम शब्द है
   (a) निराकार (b) अकार
   (c) आकार (d) विकार

उत्तर

1. *(c)* 2. *(c)* 3. *(d)* 4. *(c)* 5. *(a)*

उदाहरण 13

बाल श्रम ने भारत माता के दैदीप्यमान मस्तक को मलिनतापूर्ण बना दिया है। उद्योगों और विभिन्न कल-कारखानों में हाड़तोड़ परिश्रम करते बच्चों को देख मानवता रो पड़ती है। भट्टियों पर काम करते हुए मालिकों के लिए अपने शरीर का होम करने वाले मासूम आँख, नाक एवं फेफड़ों की गम्भीर बीमारियों के शिकार हो रहे हैं। इनकी नियति ही ऐसी है कि मनुष्य जीवन के चक्र का अहम भाग जवानी इनके लिए नहीं बना है। ये तो सीधे ही वृद्धावस्था को प्राप्त करते हैं। कथित मालिकों की झिड़कियाँ और गाहे-बगाहे मार झेलते इन बालक-बालिकाओं का जीवन देखकर प्रतीत होता है कि सृष्टा ने अत्यधिक क्रूरता से इनका भाग्य रचा है। नियोक्ताओं के लिए बाल श्रम का उपयोग निरापद है। इसके माध्यम से वे अनुचित लाभ उठाकर अपना पथ कंटकविहीन कर लेते हैं। बाल श्रम रूपी असुर के बन्धन में जकड़ी बालिकाओं और किशोरियों की स्थिति और भी भयानक है। माता-पिता की दारिद्रय-मुक्ति हेतु भागीरथी प्रयास करती बालिकाएँ स्वयं एक सर्वभोग्या जलधारा के रूप में प्रवाहमान हैं। जिन्हें जब चाहे ठेकेदार और नियोक्ता पी डालते हैं और अभिभावक विवशतावश चूँ तक नहीं कर पाते।

1. "भारतमाता के दैदीप्यमान मस्तक को मलिनतापूर्ण बना दिया है" इस कथन में कौन-सा अलंकार अभिव्यक्त हो रहा है?
   (a) वक्रोक्ति अलंकार (b) मानवीकरण अलंकार
   (c) अन्योक्ति अलंकार (d) पुनरुक्ति प्रकाश अलंकार
2. "सृष्टा ने अत्यधिक क्रूरता से इनके भाग्य को रचा है" यह कथन इस सन्दर्भ में प्रयुक्त हुआ है
   (a) माता-पिता ने बच्चों को बाल श्रम के लिए विवश किया है
   (b) निर्माण क्षेत्रों के लोगों ने बाल श्रमिकों को बढ़ावा दिया है
   (c) भाग्य दोष के कारण बच्चों को बाल श्रमिक बनना पड़ा है
   (d) क्रूर नियोक्ता बाल श्रमिकों के भाग्य का अंश गटक जाते हैं

3. "नियोक्ताओं के लिए बाल श्रम का उपयोग निरापद है।" इस वाक्य से क्या अभिप्राय है?
(a) बाल श्रमिकों के यौन शोषण में सुविधा
(b) श्रम के सर्वांग शोषण की सुविधा
(c) बाल श्रमिक हानि नहीं पहुँचाते
(d) बाल श्रमिक कम मजदूरी पर मिल जाते हैं

4. 'निरापद' का विलोम शब्द होगा
(a) पदच्छीन (b) विपद
(c) पद (d) आपद

5. उपर्युक्त गद्यांश का उपयुक्त शीर्षक होगा
(a) बालश्रम और समाज (b) बालश्रम
(c) बाल शोषण (d) बाल यौन शोषण

उत्तर

1. *(b)* 2. *(c)* 3. *(c)* 4. *(d)* 5. *(b)*

उदाहरण 14

चिपको आन्दोलन एक महत्त्वपूर्ण पर्यावरण-रक्षा का आन्दोलन है। यह आन्दोलन इसलिए महत्त्वपूर्ण है, क्योंकि इस आन्दोलन के तहत् वनों की कटाई का विरोध किया गया था। यह आन्दोलन उत्तर प्रदेश के चमोली जिले (अब उत्तराखण्ड में) में वर्ष 1973 को शुरू हुआ। इस आन्दोलन के सूत्रधार भारत के प्रसिद्ध पर्यावरणविद् सुन्दरलाल बुहगुणा, चण्डीप्रसाद भट्ट और श्रीमती गौरा देवी थे। इस आन्दोलन के जरिए किसानों द्वारा राज्य के वन विभाग के ठेकेदारों द्वारा होने वाली वनों की कटाई का विरोध किया गया। स्त्री-पुरुष, बच्चे सभी ने इस आन्दोलन में बढ़-चढ़कर हिस्सा लिया। जब भी ठेकेदार किसी वृक्ष को काटने का आदेश देते था, तो स्त्री-पुरुष उस पेड़ से चिपककर उसका विरोध करते थे। इसलिए इस आन्दोलन का नाम चिपकों आन्दोलन पड़ा। वर्ष 1978 में इस आन्दोलन को 'सम्यक् जीविका पुरस्कार' से सम्मनित किया गया। इस आन्दोलन की मुख्य उपलब्धि थी- भारत में 1980 का वन संरक्षण अधिनियम और केन्द्र सरकार में पर्यावरण का गठन। धीरे-धीरे यह आन्दोलन उत्तराखण्ड के अलावा अन्य राज्यों में भी फैल गया।

1. चिपको आन्दोलन के तहत् किसका विरोध किया गया?
(a) शिकार करने पर (b) वनों की कटाई का
(c) धूम्रपान का (d) वन्य जीव तस्करी का

2. इस आन्दोलन की शुरूआत कब हुई?
(a) वर्ष 1973 में (b) वर्ष 1974 में
(c) वर्ष 1970 में (d) वर्ष 1975 में

3. चिपको आन्दोलन कहाँ से प्रारम्भ हुआ?
(a) गढ़वाल से (b) हरिद्वार जिले से
(c) चमोली जिले से (d) देहरादून से

4. चिपको आन्दोलन के सूत्रधार थे
(a) भीम राव अम्बेडकर (b) इन्दिरा गाँधी
(c) महात्मा गाँधी (d) सुन्दरलाल बहुगुणा

5. सम्यक् का विलोम शब्द है
(a) समुचित (b) उचित
(c) अनुपयुक्त (d) उपयुक्त

उत्तर

1. *(c)* 2. *(b)* 3. *(a)* 4. *(d)* 5. *(c)*

उदाहरण 15

वर्तमान भोगवादी व्यवस्था में प्रत्येक वस्तु को 'उपभोग' की कसौटी पर कसा जा रहा है। इसके चलते नारी देह एक प्रमुख 'उपभोग्य' वस्तु बन गई है। यही कारण है कि आज वेश्यावृत्ति ने चकलाघरों से बाहर निकलकर संभ्रान्त कही जाने वाली कालोनियों तक अपने पाँव पसार लिए हैं। आज पढ़ी-लिखी लड़कियाँ भी कालगर्ल और सेक्स-वर्कर के रूप में कार्य कर रही हैं। यह सामाजिक अधोगति का स्पष्ट संकेत है। इतना ही नहीं वेश्यावृत्ति से एड्स जैसी लाइलाज बीमारी के भी भयावह स्थिति में पहुँचने का संकट सामने खड़ा है।

वेश्यावृत्ति को बढ़ावा देने में दृश्य एवं प्रचार माध्यमों की खासी भूमिका है। आज टेलीविजन और फिल्मों में नारी और पुरुष देह को उत्तेजक रूप में दर्शाया जा रहा है। इसका प्रमुख दुष्प्रभाव यह है कि समाज में कम वय में ही विपरीत लिंग के प्रति आकर्षण बढ़ा है, जो युवाओं की यौनाकांक्षाएँ जाग्रत कर उन्हें उनकी पूर्ति हेतु उद्वेलित किए रहता है। यही उद्वेलन उन्हें अन्ततः वेश्यागमन हेतु प्रेरित करता है।

यौनाकांक्षा को तृप्त करने के लिए जब साठ या उससे अधिक वर्ष के लोग वेश्याओं के पास जाते हैं तब समाज के समक्ष एक प्रश्नचिह्न अंकित हो जाता है।

आज यह प्रश्न सबके सम्मुख खड़ा है कि लड़कियाँ वेश्यावृत्ति के अन्धकूप में किस प्रकार आ गिरती हैं। वास्तविक स्थिति यह है कि इस धन्धे में धकेली गई अधिकांश लड़कियाँ 'सर्वहारा' वर्ग से ही होती हैं और उन्हें वेश्यावृत्ति के लिए मजबूर होना पड़ता है, परन्तु यह भी सत्य है कि शहरों की शिक्षित लड़कियाँ भी शानो-शौकत और शार्टकट रास्ते से धन कमाने की लालसा से इस कार्य में संलग्न हो जाती हैं। यह तथ्य सामने आ चुका है कि गरीबी के कारण वेश्यावृत्ति करने पर विवश लड़कियाँ समाज के प्रति तिरस्कृत दृष्टिकोण रखती हैं। उनके स्थानों पर वे 'सेक्स-वर्कर' का दर्जा पाने के लिए संघर्षरत हैं।

1. 'उपभोग की कसौटी' से लेखक का क्या तात्पर्य है?
(a) नारी आज भोग्या के रूप में प्रदर्शित की जा रही है
(b) वेश्यागामी नारी का उपभोग कर रहे हैं
(c) उपयोगिता और अनुपयोगिता का निर्धारण
(d) नारी के विभिन्न उपयोगों का निर्धारण

2. 'सेक्स-वर्कर' किसे कहा गया है?
(a) वेश्यावृत्ति से जुड़े दलालों को
(b) वेश्यावृत्ति करने वाली स्त्रियों को
(c) सम्भ्रान्त कही जाने वाली वेश्याओं को
(d) वेश्यावृत्ति को बढ़ावा देने वाले लोगों को

3. 'सम्भ्रान्त' का विलोम शब्द है
(a) भ्रान्त (b) कुलीन
(c) अप्रतिष्ठित (d) प्रतिष्ठित

4. 'सर्वहारा' वर्ग से क्या अभिप्राय है?
(a) जीवनयापन हेतु कोई भी रास्ता अपनाने का
(b) सभी लोगों के लिए कार्य करने वाले लोग
(c) सभी प्रकार का आहार ग्रहण करने वाले लोग
(d) आर्थिक रूप से दुर्बल लोग

5. उपर्युक्त गद्यांश का उपयुक्त शीर्षक हो सकता है
(a) वेश्यावृत्ति
(b) वेश्यावृत्ति और मीडिया
(c) वेश्यावृत्ति और समाज
(d) वेश्यावृत्ति के स्वरूप

उत्तर

1. *(c)* 2. *(b)* 3. *(c)* 4. *(d)* 5. *(a)*

उदाहरण 16

पाश्चात्य सभ्यता एवं संस्कृति में बहुत-सी अच्छी बातें होते हुए भी वह मूलत: अधिकार प्रधान, भोग प्रधान है, उसमें अपने सुख की प्रवृत्ति प्रधान है। इसलिए यहाँ प्रधान जोर शरीर-सुख-भोग तथा उसके निमित्त अगणित साधन जुटाने की ओर है; जबकि भारतीय संस्कृति अनेक बुराइयों के होते हुए भी मुख्यत: धर्म प्रधान, कर्त्तव्य प्रधान, त्याग और तपस्या प्रवृत्ति-मूलक संस्कृति है। विश्व-मानव या विश्व-मानवता एवं संस्कृति का निर्माण तभी सम्भव है जब मनुष्य अपने शरीर का विचार इस सीमा तक न करे कि उस प्रयत्न में वह आत्मा, वह प्राण ज्योति ही तिरोहित हो जाए, जिससे मानव, मानव है। स्पष्टत: भारतीय संस्कृति में, अहिंसक जीवन निर्माण की, दूसरों के लिए जीने की सम्भावनाएँ अधिक होने से गाँधी जी की श्रद्धा थी कि भारतीय संस्कृति ही हमारे जीवन का दीप है और वही विश्व-संस्कृति या विश्व-मानवता की आधारशिला बन सकती है।

1. पाश्चात्य संस्कृति के सम्बन्ध में सत्य है
(a) वह भौतिकवादी संस्कृति है
(b) वह शारीरिक सुख प्रदाता संस्कृति है
(c) वह भारतीय संस्कृति से उत्प्रेरित है
(d) वह यथार्थवादी संस्कृति है

2. इनमें से कौन-सा कथन सत्य है?
(a) पाश्चात्य संस्कृति पूर्णत: निवृत्ति-मूलक है
(b) पाश्चात्य एवं भारतीय संस्कृति में गुण-दोष विद्यमान हैं
(c) पाश्चात्य संस्कृति प्रवृत्ति एवं निवृत्ति मूलक का मिश्रण है
(d) भारतीय संस्कृति स्वार्थ एवं परार्थ भाव का मिश्रण है

3. 'पाश्चात्य' का विलोम शब्द है
(a) पूर्व (b) उत्तरीय (c) पौर्वात्य (d) दाक्षिण्य

4. परदु:खकातरता से सम्बन्धित कथन है
(a) अहिंसक प्रवृत्ति और दूसरों के लिए जीना
(b) धर्म, कर्त्तव्य, त्याग एवं विश्व मानवता
(c) आत्मा एवं प्राण ज्योति का उत्कर्ष
(d) परोपकार हेतु सुख-साधन जुटाना

5. उपर्युक्त गद्यांश का सर्वाधिक उपयुक्त शीर्षक है
(a) पाश्चात्य एवं भारतीय संस्कृति
(b) भारतीय संस्कृति
(c) भारतीय संस्कृति, मानवीय संस्कृति
(d) भारतीय संस्कृति, सर्वश्रेष्ठ संस्कृति

उत्तर

1. *(a)* 2. *(b)* 3. *(c)* 4. *(a)* 5. *(d)*

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GENERAL SCIENCE

CHAPTER

01

FORCE AND PRESSURE

In this chapter, we concentrate on the concept of force and pressure and also discuss about the different types of forces like as frictional force, magnetic force, electrostatic force, gravitational force and daily life application of pressure.

Force

Force is the push or pull which changes the position of body or tend to change the position of body.

Unit of force in SI system is Newton and in CGS system is Dyne.

Relation between the Newton and Dyne

$$1\ N = 1\ kg \times m/s^2$$
$$= 1000\ g \times 100\ cm/s^2$$
$$= 100000\ gcm/s^2 = 10^5\ dyne$$

Thus, $1\ N = 10^5$ dyne

Types of Forces

There are different types of forces which are categorised into two groups, i.e. contact forces and non-contact forces.

Contact Forces

- Contact forces are those forces which come in action only when two objects are in the actual contact with each other.
- These forces are further divided into two groups, i.e. **muscular force** and **frictional force**.
- Every action has an equal and opposite reaction. Action-reacion force are example of contact force.

Muscular Force

- The force which results due to the action of muscles is called **muscular force**.

- Both human beings and animals exert muscular force to do some work, e.g. We use muscular force in our daily life activities like walking, jumping, climbing, stretching squeezing, etc.

Frictional Force

- If we slide or try to slide a body over a surface, the motion is resisted by a bonding between the body and the surface. This resistance is called frictional force.
- The opposite force that comes into play when one body tends to move over the surface of another body but actually motion has yet not started is called static friction.
- The maximum value of the static frictional force which comes into play when a body just begins to slide over the surface of another body is called limiting frictional force.
- When two bodies actually roll on each other (as in case of ball bearing), the rolling friction comes into play.
- When two bodies actually slide over each other, sliding friction comes into play.
- When a body moves over the other body, then the force of friction acting between two surfaces in contact in relative motion is called kinetic friction.

Non-Contact Forces

- Non-contact forces are those forces which come into action without any contact with one another, e.g. **magnetic force**, **electrostatic force** and **gravitational force**.

Magnetic Force

- It is a fact that magnet can exert a force (of attraction) even without touching them. Thus, **magnetic force** is non-contact force.
- A magnet also exerts a magnetic force on another magnet placed near it.
- This force can be either attractive or repulsive. For like poles, facing towards each other there is a force of repulsion, while for unlike poles facing each other, there is a force of attraction.

Electrostatic Force

- An object having stationary electric charges on it is called **electrically charged object**.
- The fundamental property of matter, which takes part in electric and magnetic effects is electric charge.
- As the charges are of two types, i.e. positive and negative, so the term electrostatics refers to stationary electric charges.
- Force exerted by an electrically charged object is called **electrostatic force** which can be either attractive or replusive.
- The electrostatic force of interaction can be exerted by a charged body on another charged or uncharged body even if they are not in touch with each other, therefore electrostatic force is an example of non-contact force.

Gravitational Force

- Each and every body in this universe attract each other bodies with a certain force and this force is called **gravitational force.**
- The earth revolves around the sun in an orbit and it is due to gravitational force of attraction between them.
- In this case, if we release a small stone from some height, then it falls down towards the earth. It is due to reason, that the earth exerts an attractive force on the stone and pulls it down.
- The force with which the earth attracts the objects towards it, is called force of **gravity** or **simply gravity**.
  The gravitational force is **non-contact force**.
- Gravitational force (or gravity) is given by
  $F = mg$

Note Like the earth, other planets also attract the object towards it. In that case, the term gravity is the attractive force on the objects (nearby) towards that planet.

Thrust

- It is the force acting on an object perpendicular to its surface.

- The effect of thrust depends on the area on which it acts.
- The unit of thrust is the same as that of force, i.e. the SI unit of thrust is Newton (N). It is a vector quantity.

Pressure

- It is the force acting perpendicularly on a unit area of an object.

$$\text{Pressure } (p) = \frac{\text{Force } (F)}{\text{Area } (A)} = \frac{\text{Thrust}}{\text{Area}}$$

- The SI unit of pressure is Nm^{-2}, which is also called pascal (Pa) named after the scientist **Blaise Pascal**. It is a scalar quantity.

$$1 \text{ Pa} = 1 \text{Nm}^{-2}$$

- The same force acting on a smaller area exerts a large pressure while a force on a larger area exerts small pressure.

Some Daily Life Applications of Pressure

- The handles of bags, suitcases, etc., are made broad, so that less pressure is exerted on the hand.
- Buildings are provided with board foundations, so that the pressure exerted on the ground becomes less.
- Railway tracks are laid on cement or iron sleepers, so that the pressure exerted by train could spread over the larger area and thus pressure decreases.
- Pins, needles and nails are provided with sharp pointed ends to reduce the area and hence to increase the pressure.
- Cutting tools have sharp edges to reduce the area, so that with lesser force, more pressure could exerted.
- Pressure on ground is more when a man is walking than when he is standing because in case of walking, the effective area is less.
- Depression is much more when a man stands on the cushion than when he lies down on its because in standing case, area is lesser than in case of lying.
- The tractors have broad tyres, to create less pressure on the ground, so that types do not sink into comparatively soft ground in the field.

Atmospheric Pressure

The pressure exerted by the atmospheric gases is known as atmospheric pressure.

$$1 \text{ atm} = 1.01 \times 10^5 \text{N/m}^2$$

PRACTICE EXERCISE

1. The CGS unit of force is
(a) Dyne (b) Pascal
(c) Joule (d) Watt

2. Force by the virtue of bodies in contact is called
(a) contact force (b) non-contact force
(c) weak force (d) strong force

3. If no force acts on a body, it will
(a) shape gets deformed
(b) move fastly
(c) either in rest or in motion
(d) stop moving

4. When we apply a force of 1 N, we can hold a body whose mass is approximately equal to
(a) 100 mg (b) 100 g
(c) 1 kg (d) 10 kg

5. A force of a given magnitude acts on a body. The acceleration of the body depends on the
(a) mass
(b) volume
(c) density
(d) shape

6. Kicking a ball with our legs is an example of force of
(a) friction (b) gravitation
(c) muscular (d) magnetic

7. The action-reaction forces
(a) act on the same body
(b) act on different bodies
(c) act long different lines
(d) act in the same direction

8. Friction force between two rough surfaces can be ..... by using lubricant.
(a) increased (b) decreased
(c) removed (d) kept same

9. Consider a porter standing on a platform with a suitcase which presses his head with a force of 300 N. The reaction forces is exerted by
(a) the head on the suitcase
(b) the earth on the suitcase
(c) the earth on the porter
(d) the suitcase on the earth

10. Sometimes, car skids on rainy season
(a) water increases the friction between the road and the tyres
(b) it is not possible to apply brakes on a wet road
(c) the friction between the brake shoes and the wheels is reduced
(d) water reduces the friction between the road and the tyres

11. Which of the following is not true regarding friction.
(a) Friction wears down machine parts
(b) Friction helps us walk
(c) Friction helps a ship move through water
(d) Friction produces heat

12. Ball bearings are used in bicycles, cars, etc., because
(a) the actual area of contact between the wheel and axle is increased
(b) the effective area of contact between the wheel and axle is increased
(c) the effective area of contact between the wheel and axle is reduced
(d) None of the above

13. The force of friction between two bodies is
(a) parallel (b) perpendicular
(c) inclined at 30° (d) inclined at 60°

14. A coin flicked across a table stops because
(a) no force acts on it
(b) it is very heavy
(c) the table exerts a frictional force on it
(d) the earth attracts it

15. The soles of shoes are made up of groves to
(a) increase friction force acts on it
(b) it is very light
(c) the air exerts a frictional force on it
(d) the earth attracts it

16. The fluid friction depends on
(a) Speed of object with respect to fluid.
(b) Size of object.
(c) Shape of object.
(d) All of above.

17. Relation between the SI unit of force and the weight of a 1 kg mass is
(a) 1 kgf = 1 N (b) 1 kgf = 0.98 N
(c) 1 kgf = 9.8 N (d) 1 N = 9.8 kgf

18. The speed of a falling body increases continuously. This is because
(a) no force acts on it
(b) it is very light
(c) the air exerts a frictional force on it
(d) the earth attracts it

19. The force of gravitation acts
(a) only between the sun and the planets moving around it
(b) only between the earth and the bodies on it
(c) between all bodies in the universe
(d) only between the sun and the earth

20. One boy is carrying a bucket of water by his one hand and wood cube with his another hand. If he places the wood cube in the bucket of water, then he will feel
(a) same weight
(b) more weight
(c) less weight
(d) None of these

21. Pressure is
(a) scalar quantity
(b) vector quantity
(c) Both 'a' and 'b'
(d) None of these

22. If a force of 1000 N acts on an area of $100\ m^2$, the pressure equals
(a) $100\ N/m^2$ (b) $10\ N/m^2$
(c) $1000\ N/m^2$ (d) $1000\ Nm^2$

23. The pressure in the bottle filled with water is maximum
(a) in the middle of bottle
(b) at the top of the bottle
(c) first at the top then in the middle
(d) in the bottom of the bottle

24. The bottom of dam is made thick due to
(a) the water exerts low pressure on bottom wall
(b) it is a custom
(c) it looks beautiful
(d) the water exerts more pressure on bottom wall

25. The pressure on earth will be less when the man is
(a) lying
(b) sitting
(c) standing by one foot
(d) standing by two feet

26. What will be the pressure when 30 N force is applied on $120\ cm^2$ area?
(a) $2.5 \times 10^3\ N/m^2$ (b) $5 \times 10^4\ N/m^2$
(c) $2.5 \times 10^2\ N/m^2$ (d) $5 \times 10^3\ N/m^2$

27. A metal cuboid of mass M kg rests on a table surface are of $40\ cm^2$ in contact with the table. The pressure exerted by the cuboid on the table surface is 10000 Pa. Value of M is (given that $g = 10\ ms^{-2}$)
(a) 20 kg (b) 5 kg
(c) 4 kg (d) 2.5 kg

28. One atmospheric pressure is equal to
(a) $1.5 \times 10^6 N/m^2$ (b) $1.01 \times 10^5 N/m^2$
(c) $2.5 \times 10^5 N/m^2$ (d) None of these

Answers

1	(a)	2	(a)	3	(c)	4	(c)	5	(a)	6	(c)	7	(b)	8	(b)	9	(a)	10	(d)
11	(c)	12	(c)	13	(a)	14	(c)	15	(a)	16	(d)	17	(c)	18	(d)	19	(c)	20	(a)
21	(a)	22	(b)	23	(d)	24	(d)	25	(a)	26	(a)	27	(c)	28	(b)				

CHAPTER

02

SOUND

In this chapter, we concentrate on the propagation and characteristics of sound and also discuss range of hearing of audible and waves, infrasonic waves and ultrasonic waves and their uses.

Sound is a form of energy which produces a sensation of hearing in our ears. A sound is produced by the vibration in an object. The sound of human voice is produced due to vibrations in the vocal cords.

Propagation of Sound

- The path through which sound travels is called **medium**, i.e. it can be solid, liquid and gas.
- Sound travels through all states of matter. The velocity of sound is maximum in solids and least in gases.

Terms Related to Sound

Amplitude (*a*)

- The amplitude *(a)* of vibration is defined as the maximum displacement of a vibrating object from its central position.
- The amplitude describes, how much far the oscillating object is displaced from its central position.

Time Period (*t*)

The time period *(t)* is the time taken by a vibrating (oscillating) object to complete one vibration.

Frequency (*f*)

- The frequency *(f)* is defined as the number of oscillations per second.
- Frequency is measured in hertz (Hz).

- When an object makes one vibration in one second, then its frequency is 1 Hz.
- If an object makes 20 oscillations in one second, then its frequency is 20 Hz.

Relation between Time Period and Frequency

Since, the frequency of vibrating body is equal to the reciprocal (or inverse) of its time period.

i.e. $$f = \frac{1}{T}$$

Velocity of sound (v) = frequency × wave length

i.e., $v = n\lambda$

Characteristics of Sound

There are three characteristics of sound by which it can be recognised. These are loudness, pitch and quality.

1. Loudness

- The loudness of sound depends on the amplitude of vibrations of vibrating body. e.g. When a sitar string is plucked lightly, then it vibrates with small amplitude and produces a faint of sound.
- On the other hand, when the sitar string is plucked hard, then it starts vibrating with a large amplitude and produces a loud sound.
- The loudness of sound depends on the amplitude of vibration of sound producing object. Loudness of sound is proportional to the square of the amplitude of the vibration producing the sound, e.g. if the amplitude becomes twice, then the loudness increases by a factor of 4.
- The loudness is expressed in a unit called decibel (dB).

Sound	Loudness
Normal breathing	10 dB
Soft whisper (at 5 m)	30 dB
Normal conversation	60 dB
Busy traffic	70 dB
Average factory	80 dB

Note Above dB, the noise becomes physically painful.

2. Pitch

- The characteristic property of sound by which differentiate between sounds of same loudness is known as pitch of sound.
- Man's voice from a woman's voice on the basis of their pitch or shrillness. The pitch of sound depends on the frequency of vibration of sound producing object.
- When the frequency of vibration is higher, then the sound has a lower pitch, e.g. a drum vibrates with a low frequency. Most of the times, the voice of a woman has a higher frequency and is shriller than that of a man.
- Humming of mosquito has a high pitch but low loudness while roar of a lion has high loudness but low pitch.

3. Quality

- The characteristics of sound which differentiate between two sounds is known as quality of sound.
- The sounds produced by different singers can be distinguished by their quality.

Range of Hearing

1. **Audible or Sound Waves** The frequency (which lies between the) range of 20 Hz to 20000 Hz are called audible or sound waves. These waves are sensitive to human ears.
2. **Inaudible or Infrasonic Waves** The waves frequencies (which is) less than 20 Hz are called infrasonic waves. These waves are produced by sources of bigger size such as earthquakes, volcanic eruptions, ocean waves and by elephants and whales.
3. **Ultrasonic Waves** The frequencies (which is) greater than 20000 Hz are called ultrasonic waves. Human ear cannot detect these waves. But certain creatures like dog, cat, bat, mosquito can detect these waves.
   Bat not only detect but also produce ultrasonic waves.

The applications of Ultrasonic waves are as follows

- For sending signals.
- For measuring the depth of sea.
- For cleaning cloths, aeroplanes and machinery parts of clocks.
- For removing lamp-shoot from the chimney of factories.
- In sterilising of a liquid.
- In ultrasonography.
- In SONAR (Sound Navigation and Ranging).
- SONAR is used for navigation.

Sonometer is a device which is used to study the behaviours of vibrating string.

Earthquake Waves

- An earthquake is a vibration of the earth surface.
- Earthquake waves are seismic waves that are created when energy build up in rocks and they fracture.
- The instrument used to record earthquake waves is called seismograph.
- The Richter scale of earthquakes to measure magnitude was devised by Charles F Richter.

Noise and Music

In our daily life, we hear different types of sounds. Some of these sounds are unpleasant to hear. The unpleasant sounds are called noise. Blowing of horns of motor vehicles, Bursting of crackers, Running of mixer and grinder are examples of Noise.

On the other hand, some sounds are pleasant. The sounds which are pleasant to hear are called musical sounds or music. The sound produced by musical instruments is also a musical sound.

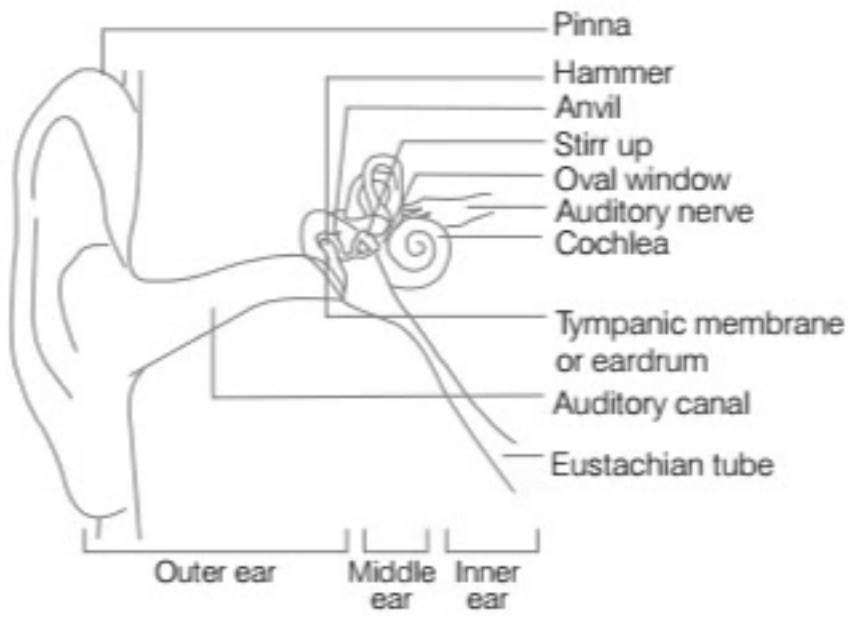
Noise Pollution

The presence of loud, unwanted, and disturbing sounds in our environment is called noise pollution.

Television and transistor radio as high volumes, some Kitchen appliances, desert coolers air conditioners contribute to noise pollution.

Human Ear

The ears are the sense organs which helps us in hearing sound. It allows us to convert pressure variations in air with audible frequencies into electric signals which travel to the brain *via* **auditory nerve**.



Internal Structure of Ear

Structure of Human Ear

The ear consists of three compartments outer ear, middle ear and inner ear

(i) **Outer Ear** It consists of a broad part pinna, ear canal, a thin elastic circular membrane, ear drum.

(ii) **Middle Ear** It consists three small bones viz hammer, anvil and stir up, which are connected with each-other.

(iii) **Inner Ear** It has a coiled tube Cochlea.

The side of cochlea is connected to auditory nerve going into the brain.

PRACTICE EXERCISE

1. Which one of the following statements is correct regarding the velocity of sound?
   (a) It does not depend upon the nature of media
   (b) It is maximum in gases and minimum in liquids
   (c) It is maximum in solids and minimum in liquids
   (d) It is maximum in solids and minimum in gases

2. The ceilings of a concert hall are generally curved because
   (a) they reflect the sound to the audience.
   (b) they can absorb noise.
   (c) it better aeration in the hall.
   (d) as any sound from outside cannot pass through a curved ceilling.

3. A human heart beats 72 times in a minute. Its frequency will be
   (a) 1.9 Hz (b) 1.2 Hz
   (c) 2.5 Hz (d) 8.2 Hz

4. If sound of lightening is heard after 12 seconds of lightening, then distance of observation of sound from the place where lightening occurs, is
   [Given, speed is sound = 330 m/s]
   (a) 1980 m
   (b) 2970 m
   (c) 3960 m
   (d) 1485 m

5. Loudness of sound can be increased by
   (a) increasing frequency.
   (b) decreasing frequency.
   (c) increasing amplitude.
   (d) decreasing amplitude.

6. A sound wave has frequency of 2 kHz and wavelength of 35 cm. If an observer is 1.4 km away from the source. At what time interval could the observer hear the sound?
   (a) 2s (b) 20s
   (c) 0.5s (d) 4s

7. A person rings a metallic bell near a strong concrete wall. He hears the echo after 0.3 s. If the sound moves with a speed of 340 m/s. The wall is far from him?
   (a) 102 m (b) 11 m
   (c) 51 m (d) 30 m

8. A baby recognises her mother by her voice. The characteristics of sound involved is
   (a) quality (b) pitch
   (c) loudness (d) shrillness

9. By which property of sound the change in air temperature is affected ?
   (a) Amplitude (b) Intensity
   (c) Frequency (d) Wavelength

10. Sound waves are similar to the waves
    (a) of laser light passing through air
    (b) generated in a stretched wire by hitting or plucking the wire
    (c) generated in a pipe filled with air by moving the piston attached to the pipe up and down
    (d) generated by the mobile phone towers

11. The range of human audibility lies between
    (a) 10 to 10,000 Hz (b) 20 to 20,000 Hz
    (c) 30 to 30,000 Hz (d) 40 to 40,000 Hz

12. Bat can know about their prey at a long distance even in the night by emitting
    (a) infra-red lights
    (b) ultraviolet lights
    (c) chemicals from their body
    (d) ultrasonic sounds

13. Which one of the following statement is not correct about sound waves?
    (a) Sound waves in gases are longitudinal in nature
    (b) Sound waves having frequency below 20 Hz are known as ultrasonic wave
    (c) Sound waves having higher amplitudes are louder
    (d) Sound waves with high audible frequencies are sharp

14. Which type of sound produced by a bat?
(a) audible (b) subsonic
(c) infrasonic (d) ultrasonic

15. Ultransound cleaner use ultrasonic waves of frequency about ..... .
(a) 40 KHZ (b) 80 KHZ
(c) 5 KHZ (d) 100 KHZ

16. A person standing on railway platform listens to the whistles of arriving and departing trains. The whistle heard is
(a) the same in both cases in all respects
(b) of higher intensity when train arrives
(c) of higher pitch when train arrives
(d) of higher pitch when train departs

17. The unit of noise pollution (level) is measured in
(a) decibel
(b) decimal
(c) ppm
(d) None of these

18. SONAR is a device to measure distance, direction and speed of underwater objects. It is based on
(a) light waves (b) infrasonic waves
(c) ultrasonic waves (d) radio waves

19. The location of submerged objects can be detected by
(a) Radar (b) SONAR
(c) Quasar (d) Pulsar

20. The depth of oceans can be measured by
(a) RADAR (b) SONAR
(c) audible (d) None of these

21. The study of behaviours of vibrating string can be detected by of sound.
(a) Sonometer (b) Barometer
(c) Hydrometer (d) Hygrometer

22. What is the name of the strings which vibrate in our voice box when we talk is
(a) air column (b) pinna
(c) vocal cord (d) string

Answers

1	*(d)*	2	*(b)*	3	*(b)*	4	*(c)*	5	*(c)*	6	*(a)*	7	*(c)*	8	*(a)*	9	*(d)*	10	*(c)*
11	*(b)*	12	*(d)*	13	*(b)*	14	*(d)*	15	*(a)*	16	*(c)*	17	*(a)*	18	*(c)*	19	*(b)*	20	*(b)*
21	*(a)*	22	*(c)*																

CHAPTER

03

CHEMICAL EFFECTS OF ELECTRIC CURRENT

In this chapter, we concentrate on the electric charge and electric current and also discuss effect of current like as chemical effect of current, cell and current measuring devices such as galvanometer, ammeter and voltmeter etc.

Electric Charge

Charge is something that a body attains when it loses or gains the electrons. Charge is of two types

1. Positive charge 2. Negative charge

e.g. When a glass rod is rubbed with silk, the glass rod becomes positively charged while the silk becomes negatively charged.

Electric Current

- The amount of rate of flow of charge through a conductor is called the electric current (i).
- Unit of electric current is ampere.

Conductor and Insulator

- Conductors are the materials through which electric charge can flow easily.
- Most of the metals are conductors of electric charge.

Insulator

- Insulators are the materials through which electric charge cannot flow.
- Glass, rubber, wood are called insulators.

Electric Circuit

An electric circuit consists of all the components such as electric bulbs, electric switch and cell, so that on completion of circuit bulb glows.

Electric Power

It is defined as the amount of electric energy consumed in a circuit per unit time.
Its unit is Watt.

$$1 \text{ watt} = \frac{1 \text{ joule}}{\text{sec}}$$

Commercial unit of electrical energy.

$$1 \text{ kwh} = 1000 \text{ Wh}$$
$$= 1000 \times 3600 \text{ Ws}$$
$$= 3.6 \times 10^6 \text{ Ws} = 3.6 \times 10^6 \text{ J}$$

LED

The device which converts electrical energy into light energy is called LED (Light Emitting Diode).

1. Infrared LEDs are used in burglor-atom-system.
2. In optical communication.
3. LEDs are used as indicator lamp in radio receivers and other electronic equipments.
4. TV and smart phone back lighting.

Chemical Effect of Electric Current

When electric current is passed through conducting liquids, then chemical changes take place. This is called chemical effect of electric current, e.g. cell.

Cell

Cell converts chemical energy into electrical energy. These are of two kinds

1. **Primary Cells** In this type of cells, the chemical energy is converted into electrical energy, but the chemical reactions occurring are irreversible.
2. **Secondary Cells** Secondary cells are those cells in which it is possible to restore electrical energy from the chemicals present in the cell.

Solar Battery

It is a technique by which energy of sun converts into electric energy. It contains a slim rod of silicon covered with arsenic atom, and a layer of boron and silicon. When sunlight falls on it, a small potential difference develops. This phenomenon can be referred as photoelectric effect. It is used to give the power to the artificial satellites.

Electroplating

In this process, a thin layer of a desired metal over another metal is deposited with the help of electric current. It is called electroplating.

Conditions of Electroplating

- The metal article on which the electroplating is to be done is made of negative electrode (cathode). It is connected with negative terminal of battery.
- The metal which is to be deposited is made of positive electrode (anode) connected with positive terminal of battery.
- A water soluble salt of the metal to be deposited is taken as the electrolyte.

Note A fuse wire has very low melting point which is used to protect the electric appliance from high.

Measuring Devices

The electrical devices which are used to measure electrical quantities like current, voltage, power etc, called measuring devices. Ammeter and voltmeter are measuring devices.

Ammeter

- It is a device which is used to measure electric current in a circuit.
- It is connected in series in the circuit. The resistance of an ideal ammeter is zero.

Voltmeter

- It is a device used to measure the potential difference between two points in a circuit. It is connected in parallel in the circuit.
- The resistance of an ideal voltmeter is infinite.

PRACTICE EXERCISE

1. Current in a conductor is due to
(a) motion of free electrons in it
(b) motion of positive ions
(c) free electrons and holes
(d) protons

2. The electrification in a body takes place due to
(a) electron (b) proton
(c) neutron (d) Both (b) and (c)

3. Which of the following is not bad conductor?
(a) Mica (b) Iron (c) Wood (d) Rubber

4. The materials which allow the electric current to pass through them is called
(a) semiconductor (b) non-conductor
(c) bad conductor (d) conductor

5. The full form of LED
(a) Light Emitting Diode (b) Solor Cell
(c) Phote cell (d) None of the above

6. One kWH is equal to
(a) 3.6×10^5 watt (b) 3.6×10^5 Joule
(c) 3.6×10^6 watt (d) 3.6×10^6 Joule

7. Kilowatt hour is the unit of
(a) power (b) energy
(c) thermal power (d) None of these

8. Which one of the following is not the source of electricity ?
(a) Electric source (b) Radio
(c) Battery (d) Dry cell

9. LED is used to convert
(a) mechanical energy into light energy.
(b) chemical energy into light energy.
(c) electrical energy into light energy.
(d) light energy into electrical energy.

10. In dry cell anode is made of
(a) iron (b) zinc
(c) copper (d) carbon

11. Electrolyte used in voltaic cell is
(a) sulphuric acid (b) acetic acid
(c) nitric acid (d) hydrochloric acid

12. The cathode in Daniell cell is made of
(a) iron plate (b) copper plate
(c) zinc plate (d) carbon plate

13. The cell used in artificial satellite is
(a) solar cell (b) dry cell
(c) Daniell cell (d) voltaic cell

14. Positive rod in a voltaic cell is
(a) copper plate (b) silicon
(c) zinc plate (d) carbon rod

15. Inside the bulb
(a) hydrogen is filled (b) air is filled
(c) neon is filled (d) None of these

16. For electroplating nickel on an object, which terminal of the battery is connected to the object?
(a) Positive (b) Negative
(c) Both (a) and (b) (d) None of these

17. The metal which has to be electroplated in the process of electroplating, is made
(a) anode (b) electrolyte
(c) cathode (d) None of these

18. Which one of the following depends on electricity for its work ?
(a) Microwave oven
(b) Kerosene oil lamp
(c) Biogas project
(d) Solar cooker

19. During short-circuiting the current flowing in the electric circuit
(a) reduces substantially
(b) does not change
(c) increase instantaneously
(d) varies continuously

Answers

1	*(a)*	2	*(a)*	3	*(b)*	4	*(d)*	5	*(a)*	6	*(d)*	7	*(b)*	8	*(b)*	9	*(c)*	10	*(d)*
11	*(a)*	12	*(c)*	13	*(a)*	14	*(a)*	15	*(c)*	16	*(b)*	17	*(c)*	18	*(a)*	19	*(c)*		

CHAPTER

04

LIGHT

Light is a form of energy that enables us to see. An object reflects the light rays that fall on it.

These reflected light rays, when received by our eyes, make the object visible to us. We are able to see through a transparent medium as light is transmitted through it. The speed of light in vacuum or in air is 3×10^8 ms^{-1}.

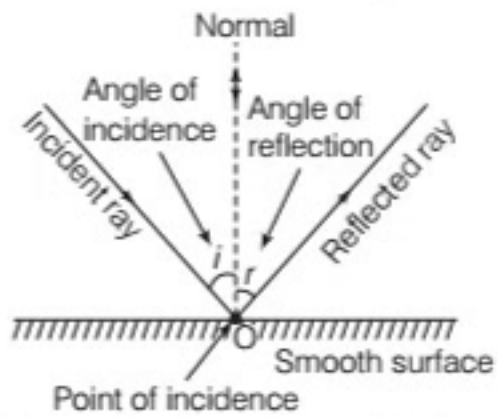
Some Important Terms Related to Light

- **Incident ray** The ray of light which falls on the mirror or smooth surface.
- **Reflected ray** The ray of light which is sent back by the mirror is known as reflected ray.
- **Point of Incidence** The point at which the incident ray falls on the mirror is called the point of incidence.
- **Normal** The normal is a line at right angle to the mirror surface at the point of incidence.
- **Angle of Incidence** This is the angle made by the incident ray with the normal at the point of incidence.
- **Angle of Reflection** This is the angle made by the reflected ray with normal at the point of incidence.

In this chapter, we concentrate on the phenomena of light like as reflection, refraction, dispersion and also describe types of mirror and lens and how lenses and mirror can be used to view of object and human eye.

Reflection of Light

The phenomenon of bouncing back of light rays in the same medium on striking a smooth surface is called reflection of light.



Reflection from Plane Surface

Laws of Reflection

There are two laws of reflection

(i) Angle of incidence is always equal to the angle of reflection. $\angle i = \angle r$

(ii) The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.

Note
- Silver metal is one of the best reflector of light.
- A ray of light which is incident normally on a mirror is reflected back along its own path. Law of reflection can be applied to all kinds of reflecting surface.

Regular and Diffused or Irregular Reflection of Light

- When a beam of incident light is reflected as a parallel beam in one direction, the regular reflection of light takes place from a smooth surface.
- A highly polished metal surface polished wooden table, and still water surface produce regular reflection of light.
- Diffused reflection takes place through the rough surfaces.
- Reflection through cardboard, paper table, walls, unpolished metal objects, etc. are the examples of diffused reflection.
- A book lying on a table can be observed by us due to diffuse reflection of light falling on the book.

Multiple Reflection

The reflection of light back and forth several time between reflecting surfaces is called multiple reflection.

Multiple Images

When two plane mirrors are placed at an angle (θ), then multiple images of an object are formed when the object is placed between the plane mirrors.

The number of image formed $(n) = \frac{360}{\theta} - 1$

where, $\theta = 180°, 120°, 90°, 60°, 45°$ and $0°$.

Mirror

Mirror is a polished surface like glass, which, reflects almost all the light that is incident on it. Mirrors are of two types

(i) Plane Mirror

If the reflecting surface of a mirror is plane, then the mirror is called a plane mirror. Image formed by a plane mirror can be seen only by looking into the mirror. Image formed by a plane mirror has the following properties

- It is always virtual and erect.
- The size of image is equal to the size of the object.
- The image formed is as far behind the mirror as the object is in front of it.
- The image is laterally inverted (i.e. left seems be right and *vice-versa*).

Uses of Plane Mirrors

- Plane mirrors are commonly used as looking glass because the reflection that forms the image is always erect and laterally inverted but they are always virtual.
- Used in making periscopes which is used in submarines.
- Used as blind turns of some busy roads, to see the vehicles coming from other side.
- They are used to make kaleidoscope, a toy which produces beautiful patterns from coloured paper, pieces of glass or small coloured beads.

(ii) Spherical Mirror

If the reflecting surface of the mirror is spherical, then the mirror is called a spherical mirror. Spherical mirrors are of two types

(a) Concave Mirror

- The spherical mirror with inward curve reflecting surface is called **concave mirror**.
- **Image Formed by Concave Mirror** The image formed by concave mirror depends on the distance of the object from the pole of concave mirror.

(b) Convex Mirror

- The spherical mirror with outward curve reflecting surface is called convex mirror.
- **Image Formed by Convex Mirror** The image formed by a convex mirror is always virtual, erect and smaller than the object (diminished).

Uses of Concave and Convex Mirror

- To see the large image of teeth of patient, concave mirrors are used by dentist.
- In torches, headlights of vehicles and search lights to get a strong, straight beam of light, etc. concave mirrors are used as reflectors.
- To see a large image of face, then concave mirrors are used as shaving mirrors.
- To see the traffic at the rear side or backside on the road, convex mirrors are used as rear view mirrors or side view mirrors in vehicle such as cars, scooters, buses, etc.
- Big convex mirrors are used as shop security mirrors. By installing a convex mirror in the shop, the shop owner can keep an eye on the customers.

Refraction of Light

- Change in path of a light ray as it passes from one medium to another medium is called refraction of light.
- A medium in which the speed of light is more, is known as optically rarer medium and in which speed of light is lesser is known as optically denser medium.

Everyday Examples of Refraction of Light

- The bottom of a pool containing water appears to be raised due to refraction of light which takes place when light rays pass from the pool of water into the air.
- The letters appear to be raised when viewed through a glass slab placed over the document because of refraction of light.
- A pencil partially immersed in water appears to be bent because of the refraction of light coming from the part of pencil that is under water.
- A lemon kept in water in a glass tumbler appears to be bigger than its actual size, when viewed from the sides.

Lens

A lens is a piece of transparent glass bound by the two spherical surfaces. Lenses are transparent so that light can pass through. Lenses are mainly of two types

(i) Convex Lens (Converging Lens)

- Convex lens is the lens which is thicker in the middle than at the edges. A beam of parallel rays of light falls on a convex lens from the left side.
- **Image formed by a Convex Lens** The nature and size of the image formed by a convex lens depends on the distance of the object from the convex lens.

(ii) Concave Lens (Diverging Lens)

- Concave lens is the lens which is thinner in the middle than at the edge. A parallel beam of light falls on a concave lens. After passing through the concave lens, the rays of light are diverging (or spreading out).
- **Image formed by a Concave Lens** The image formed by concave lens is always virtual, erect and diminished (or highly diminished).

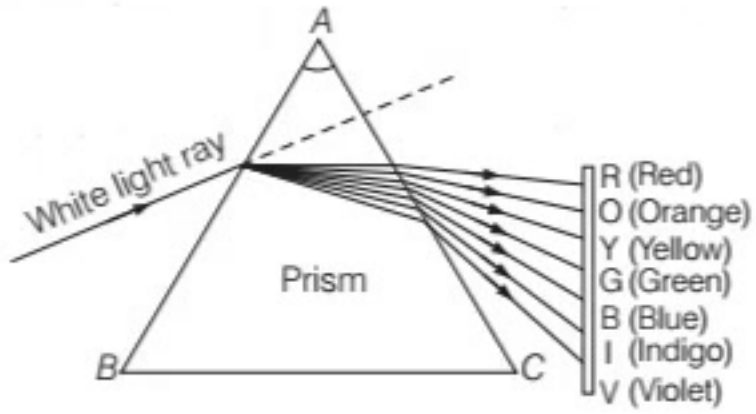
Uses of Lenses

- Convex lenses are used as a magnifying glass. In the manufacturing of spectacles, camera, microscope, telescope and binoculars, convex lenses are used.
- In order to see the image of the person standing outside, concave lenses are used in the peep holes in the door of hotel rooms. Concave lenses are used in making spectacles.

Dispersion of Light

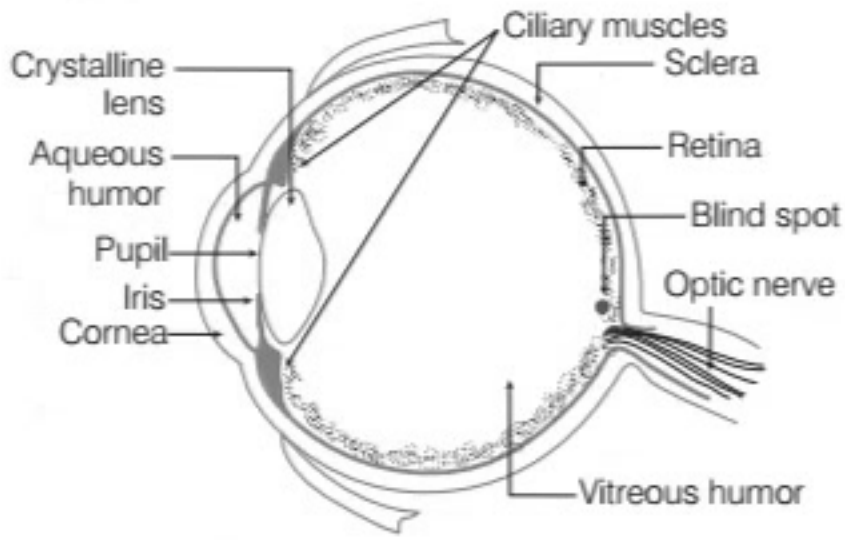
- When a white light ray passes through a transparent prism, then it splits into seven colours. This phenomenon of light is called dispersion of light.

- The seven colours are Violet, Indigo, Blue, Green, Yellow, Orange and Red.
- The deviation in red colour of light is minimum and in Violet colour of light is maximum.
- Red, Green and Blue are primary colours.



Human Eye

- The human eye is one of the most valuable and sensitive sense organ in the human body.
- It enables us to see the wonderful world and colour around us.
- It consists of a lens, which is made up of living tissues.



Internal Structure of Eye

Main parts of eye and their working are given below

- **Eyeball** Eyeball is approximately spherical. Its diameter is 2.3 cm.
- **Cornea** It is made of transparent substance and it is bulging outwards. The light coming from object enters through it.
- **Iris** It is the opaque screen behind the cornea. It has a small aperture at its centre. Generally, the iris is black in colour. It partially covers the front part of the lens.
- **Eye Lens** It is made of transparent and flexible material like jelly made by proteins. It is fixed by ciliary muscles.
- **Ciliary Muscles** The eye lens is held in position by ciliary muscles. Focal length is changed by the action of ciliary muscles.
- **Retina** The screen on which the image is formed in the eye is called **retina**. It is situated behind the lens at the back part of eye. The retina is delicate membrane having large number of light sensitive cells called **rods** and **cones**.
- **Eyelid** It is situated in front of eye which is just like a shutter.
- **Aqueous Humor** It is a viscous liquid filled between cornea and lens which protects the eye with shocks etc.
- **Vitreous Humor** It is a liquid filled between eye lens and retina.

Formation of an Image

An image is formed on the retina by successive refractions at the cornea, the aqueous humor, lens and vitreous humour. A *real, diminished* and *inverted image* of the object is formed on the retina.

The retina is a delicate membrane having enormous number of light-sensitive cells. These light-sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain *via* the optic nerve. The brain interprets these signals and finally, processes the information, so that we perceive objects as they are.

Power of Accommodation of Eye

The power of adjustment of focal length of eye lens with the help of ciliary muscles to see the near and far objects clearly is called the **accommodation of eye**.

Defects and Care of Eyes

(i) Myopia (Short Sightedness)

- It is a defect of eye because of which we cannot see farther objects clearly though we can see near objects clearly.
- Due to this, the length of the eye ball increases, i.e. the distance between eye lens and retina increases and the focal length of eye lens decreases or the curvature of eye lens increases.
- To remove this defect, we have to use that type of lens which is less convergent. Hence, a concave lens must be used.

Causes A person with this defect has the far point nearer than infinity. This defect arises due to the decrease in focal length of the lens because of

- excessive curvature of eye lens,
- elongation of the eyeball.

As a result, the image is formed before retina.

Remedy This defect can be corrected by using concave lens of appropriate power.

(ii) Hypermetropia (Long Sightedness)

- This is the defect of eye because of which we can not see the near objects clearly while we can see distant objects clearly.
- Due to this, the length of eye ball decreases, i.e., distance between eye lens and retina decreases and the focal length of eye lens increases, i.e. the curvature of eye lens decreases.
- To remove this defect, that type of lens must be used which has more converging power. Hence, convex lens of suitable focal length is used.

Causes This defect arises due to following reasons

- Focal length of eye lens becomes large.
- Eyeball becomes too short, so that the image is formed behind retina.

Remedy This defect can be corrected by using convex lens of appropriate power.

(iii) Presbyopia

- This defect is a combination of myopia and hypermetropia.
- This always happens in old age because of loss of accommodation of eye.
- This is remedied by using bi-focal lenses.

Causes This defect arises due to following reasons:

- Weakness of ciliary muscles.
- Hardening of eye lens or loss of elasticity.

Remedy This defect can be corrected by using bifocal or varifocal lenses which consist of both convex and concave lenses. The upper portion consists of a concave lens (for myopia) and lower portion consists of convex lens (for hypermetropia).

(iv) Astigmatism

- In this defect, the horizontal and vertical lines are not seen clearly simultaneously. Either horizontal and vertical lines are seen clearly.
- This is because the cornea is not perfectly spherical.
- This defect is remedied by using cylindrical lens.

Causes This defect arises due to imperfect shape (not perfectly spherical) of cornea or the lens or of both.

Remedy This defect can be corrected by using cylindrical lenses or refractive surgery.

Visually Challenged Person and Braille System

- Some persons may lose their eye sight due to a disease. Some persons cannot see at all from birth.
- Those persons who are unable to see are known as visually challenged persons.
- Such persons develop their other senses more sharply. They try to identify things by touching and by listening to voices more carefully.
- The most popular resources for visually challenged person which can make them read and write is Braille. It is a written language for the visually challenged person.
- Many Indian languages can be read and written by using the Braille system.

PRACTICE EXERCISE

1. We are able to see through a .... medium as light is transmitted through it
   (a) Opaque (b) Transparent
   (c) Translucent (d) Rough

2. Due to which property of light sharp shadows of opaque objects are obtained?
   (a) Light travels in straight line
   (b) Light travels in zig-zag
   (c) Light travels in vacuum
   (d) None of the above

3. Which metal is the best reflector of light?
   (a) Magnesium (b) Zinc
   (c) Copper (d) Silver

4. When all the colours of white light are reflected back from an object, then object will appear
   (a) blue (b) green (c) black (d) white

5. The black board seems black because
   (a) it reflects every colour
   (b) it does not reflect any colour
   (c) it absorbs black colour
   (d) it reflects black colour

6. In which of the following media, the velocity of light is maximum?
   (a) Water (b) Glass
   (c) Diamond (d) Vacuum

7. The stars are visible because
   (a) they are emitting their own light
   (b) they are reflecting the light of sun
   (c) they are away from earth
   (d) they are absorbing the light of sun

8. Number of image formed of an object placed between the two inclined plane mirror at an angle of 90°, is
   (a) 2 (b) 3 (c) 4 (d) 5

9. A virtual image, larger than the object can be produced by
   (a) Plane mirror (b) caneave lons
   (c) convex mirror (d) concave mirror

10. When on object moves towards a convex lens, the size of the image
    (a) decreases
    (b) first decreases than increases
    (c) increases (d) remain the same

11. When light passes through a prism which colour shows maximum deviation?
    (a) Red colour (b) Violet colour
    (c) Blue colour (d) Green Colour

12. When light travels from hot air to cold air, then
    (a) bends towards the normal
    (b) bends away from the normal
    (c) bends towards the normal and scatter
    (d) bends away from the normal and scatter

13. The focal length of convex lens used as a magnifying glass is
    (a) more (b) much more
    (c) less (d) All of these

14. Which one of the following materials cannot be used to make a lens?
    (a) Water (b) Glass (c) Plastic (d) Clay

15. In which of the following conditions the ray will not be deviated on passing through the lens?
    (a) The ray passes through optical centre
    (b) The ray passes through $2F$
    (c) The ray passes through first focus
    (d) The ray passes parallel to principal axis

16. The human eye forms the image of an objects at its
    (a) retina (b) pupil (c) cornea (d) iris

17. The image of an object in case of hypermetropia is formed
    (a) behind the retina (b) at retina
    (c) before retina (d) None of these

18. After looking sun the colour of other things appears
    (a) black (b) white (c) yellow (d) red

19. Human eyes are always paired. What will happen if humans would have only one eye?
(a) the world would become two-dimensional for humans
(b) Humans will not be able to see objects beyond 90°
(c) All the objects will appear faint
(d) All of the above

20. The human eye has a converging lens system that produces an image just like a camera. If the eye views a distant object, which type of image is produced?
(a) Real, erect, same, size
(b) Real, inverted, diminished
(c) Virtual, erect, diminished
(d) Virtual, inverted, magnified

21. A student is asked to sit at the last bench because he cannot read the letters written on blackboard clearly from front seat but still is unable to read the letters written in his textbook. Which of the following statements is correct?
(a) The near point has come closer to him
(b) The far point has come closer to him
(c) The near point has receded away
(d) The far point has receded away

22. What is the function of Iris in human eye?
(a) To control or regulate the amount of coming light to the eye
(b) To return the coming light to the eye
(c) To send the photo to the image lens
(d) None of the above

Answers

1	(b)	2	(a)	3	(d)	4	(d)	5	(b)	6	(d)	7	(a)	8	(b)	9	(d)	10	(b)
11	(b)	12	(a)	13	(c)	14	(d)	15	(a)	16	(a)	17	(a)	18	(a)	19	(a)	20	(b)
21	(c)	22	(a)																

CHAPTER

05

SOME NATURAL PHENOMENA

In this chapter, we will study about the lighting and Earthquakes.

Lightning : A Natural Phenomenon

- During heavy rains and thunderstorms, we sometimes notice brief spark in the sky. These sparks are called lightning.
- Lightning is caused by accumulation of electric charges in the rain clouds.
- To protect from lightning flashes, lightning conductor is used.

Lightning Safeties outside the House

(i) During thundering and lightning, scooters are not safe. So, during lightning we have to leave such vehicle and take shelter.

(ii) During thunderstorms, we should avoid carrying an umbrella over our head. It is due to reason that lightning may strike the top end of the metal rod of umbrella and harm us.

(iii) If we are in forest, then we should take shelter under shorter trees as a short tree is less likely to be hit by lightning.

(iv) If in case, no shelter is available and we are in an open field, then kindly stay away from poles and other metal objects and do not lie on the ground. Instead, squat low on the ground. Place hands on the knees with head between the hands because this position will make us the smallest target to be struck.

Lightning Safeties inside the House

(i) Any contact with telephone cords, electrical wires and metal pipes should be avoided during a thunderstorm.

(ii) Mobile phones and cordless phones should be use.

(iii) Bathing should be avoided during thunderstorms, in order to avoid contact with running water.

(iv) Even the electrical appliances like computers, TVS, etc., should be unplugged. Electrical lights can remain on. They do not cause any harm.

Lightning Conductor

A device which is used to protect buildings from the effects of lightning is known as lightning conductor. It is made up of a thick strip of metal. The top end of lightning conductor is pointed which is fixed above the highest point of the building.

Earthquakes

As we read in previous classes about cyclones and thunderstorm, these natural phenomena can cause the destruction at large scale to human life and property. These natural phenomena can be predicted in advance to some extent so that we can get some time to take some precautionary measures in order to protect ourselves and minimise the damage to life and property.

Presently, there is one natural phenomenon which is not predicted accurately till now. It is an earthquake. Hence, earthquake is a destructive natural phenomenon which cannot be predicted in advance.

Tsunami

Tsunami is a type of earthquake under the ocean floor which generates powerful sea waves. These kinds of waves travel across the ocean at speed upto about 1000 km/h and can be 30 m or more high. Tsunami occurs in a frequent manner in the Pacific ocean.

- As, earthquakes are caused by the movement of plates, the boundaries of the plates are the weak zones where earthquakes are more likely to occur.
- OnRichter scale, the intensity of an earthquake is usually measured. On this scale, a series of numbers from 1 to 12 are written which are used to express the power of earthquakes.
- The seismic waves are those waves which are produced by tremors on the earth surface. These waves are recorded by an instrument called the seismograph.
- By studying about seismic waves, scientists can construct a complete map of the earthquake and also calculate its power to cause destruction.

PRACTICE EXERCISE

1. Lightning conductor
(a) destroys the building
(b) protects the building
(c) does not affect the building
(d) None of the above

2. Lightning occurs due to
(a) rain
(b) wind
(c) electric discharge
(d) None of the above

3. Lightning conductors are used to protect from
(a) lightning flashes (b) earthquake
(c) cyclones (d) thunderstorms

4. Where is the lightning rod attached to protect the building from lightning?
(a) On the top of building
(b) In the middle of building
(c) On the bottom of building
(d) All of the above

5. The outermost layer of the earth is called
(a) mantle (b) outer core
(c) crust (d) inner core

6. The earth's plate responsible for causing earthquake is
(a) the crust of the earth
(b) the mantle of the earth
(c) the inner core of the earth
(d) the outer core of the earth

7. The movement of the earth's plates causes
(a) cyclones (b) lightning
(c) earthquake (d) thunderstorms

8. Tsunami means
(a) earthquake
(b) flood
(c) earthquake under sea
(d) eruption of volcano in sea

9. Richter scale is related to
(a) thunderstorm
(b) thermometer
(c) earthquake
(d) lightning

10. Consider the list of terms given below:
(i) Tsunami
(ii) Landslide
(iii) Floods
(iv) Lightning Earthquakes can cause
(a) (i), (ii) and (iii)
(b) (ii) and (iv)
(c) (ii), (iii) and (iv)
(d) (iii) and (iv)

11. The waves produced on the earth's surface are called
(a) radio waves
(b) longitudinal waves
(c) microwaves
(d) seismic waves

12. Which instrument is used to measure earthquake?
(a) Polygraph
(b) Seismograph
(c) Biometer
(d) Thermometer

Answers

1	*(b)*	2	*(c)*	3	*(a)*	4	*(a)*	5	*(c)*	6	*(d)*	7	*(c)*	8	*(c)*	9	*(c)*	10	*(a)*
11	*(d)*	12	*(b)*																

CHAPTER

06

SOLAR SYSTEM STARS AND CONSTELLATION

In this chapter, we will discuss about our solar system, position of planets and important facts about universe.

Universe

The universe is commonly defined as the totality of everything that exists including all physical matter and energy, the planets, stars, galaxies. The Study of universe is known as cosmology.

Solar System

The solar system consists of the sun, eight planets and their satellites (or moons) and thousands of other smaller heavenly bodies such as asteroids, comets and meteors.

Sun

- The Sun is the centre of the solar system and all these bodies revolve around it. It is the nearest star to the earth.
- Time taken by sunlight to reach the earth is 8 minutes and 16.6 seconds.

Moon

Moon is the only satellite of the earth. It completes its rotation in 27 days, 7hr. 43 min and 11.47 sec and same is the time taken by moon in one revolution around earth.

A waterless area on the moon's surface is called Ocean of storms.

Galaxy

- A galaxy is a vast system of billions of stars, dust and light gases bound by their own gravity. There are 100 billion galaxies in the

universe and each galaxy has, on average, 100 billion stars.

- Our galaxy is **Milky Way Galaxy** (the Akash Ganga) formed after the Big Bang. **Andromeda** is the nearest galaxy to the Milky Way.

Stars

Stars are heavenly bodies made up of hot burning gases and they shine by emitting their own light.

Comets

Comets are made up of frozen gases. They move around the sun in elongated elliptical orbit with the tail always pointing away from the sun.

Constellations

The sky is divided into units to enable the astronomers to identify the position of the stars. These units are called constellations. There are 88 known constellations.

Classification of Planets

- **Inner Planets** They are called as Terrestrial or Rocky planets. They includes Mercury, Venus, Earth and Mars.
- **Outer Planets** They are called as Jovian or Gaseous planets. They include Jupiter, Saturn, Uranus and Neptune.

Note Dwarf Planet According to International Astronomical Union (IAU), it is a celestial body in direct orbit of the Sun, that is massive enough that its shape is controlled by gravitational forces, but has not cleared its neighbourhood. e.g., Pluto, Ceres, Eris, Makemake and Haumea.

- A **light year** is the distance light travels in one year at the speed of 3×10^8 m/s (one light is equal to 9.46×10^{15} metres).
- **Astronomical unit** mean distance between Earth and Sun (1.49×10^8 km). One light year is equal to 60,000 AV.

Important Facts about Universe

Biggest Planet	Jupiter
Biggest Satellite	Jupiter
Blue Planet	Earth
Green Planet	Uranus
Brightest Planet	Venus
Brightest Planet outside Solar System	Sirius (Dog Star)
Closest Star of Solar System	Proxima Centauri
Coldest Planet	Neptune
Evening Star	Venus
Farthest Planet from Sun	Neptune
Planet with maximum number of satellites	Jupiter
Fastest revolution in Solar System	Mercury
Hottest Planet	Venus
Densest Planet	Earth
Fastest rotation in Solar System	Jupiter
Morning Star	Venus
Nearest Planet to Earth	Venus
Nearest Planet to Sun	Mercury
Red Planet	Mars
Slowest Revolution in Solar System	Neptune
Slowest Rotation in Solar System	Venus
Smallest Planet	Mercury
Smallest Satellite	Deimos (Mars)
Earth's Twin	Venus
Only Satellite with an atmosphere like Earth	Titan
Colour of sky for astronaut	Black

PRACTICE EXERCISE

1. 'Our universe is expanding'. This speculation is propounded by
   (a) Newton
   (b) Galileo
   (c) Edwin Hubble
   (d) Copernicus

2. Which one of the following star is the nearest to the Earth?
   (a) Polestar (b) Comet
   (c) Sun (d) Asteroid

3. The distance between the sun and the Earth is
   (a) 1.49×10^2 km (b) 1.49×10^8 km
   (c) 2×10^{20} km (d) 7.46×10^{23} km

4. The moon completes one revolution around Earth in
   (a) 27 days 7 hrs 43 min
   (b) 29 days 3 hrs 20 min
   (c) 20 days 2 hrs 10 min
   (d) 10 days 4 hrs 5 min

5. Which year man firstly landed on the Moon?
   (a) 1963 (b) 1965 (c) 1969 (d) 1972

6. What portion of the moon is visible from the Earth's surface?
   (a) 57% (b) 34%
   (c) 20% (d) 41%

7. The area of the moon's surface where there is no evidence of the water is called
   (a) ocean of storms
   (b) areas of storms
   (c) smoke of storms
   (d) None of these

8. The calm and dark back part of the moon is called
   (a) sea of tranquility
   (b) oceans of storms
   (c) Both (a) and (b)
   (d) None of these

9. Which of the following statement is correct?
   (a) Moon is the only natural satellite of Earth
   (b) The time period of the moon is approx 27.3 days
   (c) The time period of moon is roughly equal to the rotational period of moon about its own axis
   (d) All of the above

10. Aakash Ganga is the common name given to
    (a) Milky way galaxy
    (b) planet Uranus
    (c) Earth
    (d) the Sun

11. The smallest planet in our solar system is
    (a) Earth (b) Jupiter
    (c) Venus (d) Mercury

12. Which of planets is known as 'outer planets'?
    (a) Mercury, Venus, Earth and Mars
    (b) Mercury, Venus, Jupiter and Neptune
    (c) Neptune, Venus, Mercury and Mars
    (d) Jupiter, Saturn, Uranus, Neptune

13. The small groups of planetary pieces which are confined and revolving between Mars and Jupiter are called
    (a) meteors
    (b) comet
    (c) celestial bodies
    (d) asteroids

14. The Earth has the size among all the planets
    (a) fifth (b) third
    (c) fourth (d) seventh

15. The planet whose relevancy as a planet has been ended at Prague Summit of IAU in
    (a) Uranus (b) Pluto
    (c) Mars (d) Neptune

16. The planet which has the largest number of satellites is
(a) Saturn (b) Jupiter
(c) Mars (d) Neptune

17. The planet which completes one revolution in 88 days around the sun is
(a) Mercury (b) Venus
(c) Mars (d) Saturn

18. The largest satellite of the planet Saturn is
(a) Atlas (b) Titan
(c) Tethis (d) None of these

19. Which of the following are true?
(a) A polar satellite goes around the Earth's pole in North-South direction
(b) A geostationary satellite goes around the Earth in East-West direction
(c) A geostationary satellite goes around the Earth in West-East direction
(d) Both (a) and (c)

20. From the space the sky appears to an astronaut
(a) blue (b) red
(c) white (d) black

Answers

1	*(c)*	2	*(c)*	3	*(b)*	4	*(a)*	5	*(c)*	6	*(a)*	7	*(a)*	8	*(a)*	9	*(d)*	10	*(a)*
11	*(d)*	12	*(d)*	13	*(d)*	14	*(a)*	15	*(b)*	16	*(b)*	17	*(a)*	18	*(b)*	19	*(d)*	20	*(d)*

CHAPTER

07

METALS AND NON-METALS

This chapter is one of the most important chapter. In this chapter, we will discuss properties of metals and non-metals.

Metals

Those elements which forms positive ions by losing electrons are called metals. e.g. copper, iron, aluminium, sodium etc.

Important Physical Properties of Metals

(i) **Physical State** All the metals except mercury exist in the solid state at room temperature.

(ii) **Lustre** All the metals have a shiny appearance. This shiny appearance is known as metallic lustre, so metals are used for making jewellery and decorations.

(iii) **Malleability** The property of beating a metal with hammer into sheets is called malleability. Gold and silver are most malleable metals.

(iv) **Ductility** The property that allows metals to be drawn into wires is called ductility. Gold and silver are most ductile metals. Copper and aluminium wires are used in electric fittings.

(v) **Conductivity** Metals are good conductor of heat and electricity. They quickly transmit heat from one end to the other. Silver is the best conductor followed by gold, copper and aluminium. Lead (Pb) is the poorest conductor of heat.

(vi) **Hardness** Metals are usually hard. It is therefore, difficult to cut them but sodium, potassium and magnesium are soft metals and thus, they are easily cut with knife.

(vii) **Melting and Boiling Points** Metals generally have high melting and boiling points but sodium and potassium metals have low melting and boiling points.

Reactivity Series of Metals

- The arrangement of metals in order of decreasing reactivities is called reactivity or activity series. In this series, the most reactive metal is placed at the top whereas the least reactive metal is placed at the bottom.
- As we go down the series, the chemical reactivity of metals decreases.
- All metals which are placed above hydrogen in the activity series, can lose electrons more readily than hydrogen. These metals are called more reactive than hydrogen.
- On the other hand, all metals which are placed below hydrogen in the reactivity series lose electrons less readily than hydrogen and hence, they are regarded as metals less reactive than hydrogen.

Reactivity Series of Metals

K	Potassium	Most reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	Reactivity
Fe	Iron	Increases
Pb	Lead	
H	Hydrogen	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	Least reactive

- Due to their high reactivity potassium and sodium react with moisture present in air. Hence, these are kept submerged in kerosene oil.
- Due to their low reactivity copper, silver, gold, etc., usually do not react with acid.

Important Chemical Properties of Metals

(i) Reaction with Oxygen

- Metals react with oxygen to form oxides these oxides are alkaline or basic in nature.
- Basic metal oxides turn red litmus into blue.

$$\underset{\text{(Sodium reacts vigorously)}}{4Na} + \underset{\text{(Oxygen)}}{O_2} \longrightarrow \underset{\text{(Sodium oxide) (Basic oxide)}}{2Na_2O}$$

$$\underset{\text{(Magnesium) (Metal)}}{2Mg} + \underset{\text{(Oxygen)}}{O_2} \longrightarrow \underset{\text{(Magnesium oxide)}}{2MgO}$$

$$\underset{\text{(Aluminium)}}{4Al} + \underset{\text{(Oxygen)}}{3O_2} \longrightarrow \underset{\text{(Aluminium oxide)}}{2Al_2O_3}$$

$$\underset{\text{(Iron)}}{4Fe} + \underset{\text{(Oxygen)}}{3O_2} \longrightarrow \underset{\text{(Ferric oxide)}}{2Fe_2O_3}$$

(ii) Reaction with Water

- Different metals behave differently in their reaction with water and evolve hydrogen. Sodium reacts violently with water.

$$\underset{\text{(Sodium)}}{2Na} + \underset{\text{(Water)}}{2H_2O} \longrightarrow \underset{\text{(Sodium hydroxide)}}{2NaOH} + \underset{\text{(Hydrogen)}}{H_2}$$

$$\underset{\text{(Magnesium)}}{Mg} + \underset{\text{(Hot water)}}{2H_2O} \longrightarrow \underset{\text{(Magnesium hydroxide)}}{Mg(OH)_2} + \underset{\text{(Hydrogen)}}{H_2}$$

$$\underset{\text{(Zinc)}}{Zn} + \underset{\text{(Steam)}}{H_2O} \longrightarrow \underset{\text{(Zinc oxide)}}{ZnO} + \underset{\text{(Hydrogen)}}{H_2}$$

$$\underset{\text{(Aluminium)}}{2Al} + \underset{\text{(Boil water)}}{6H_2O} \longrightarrow \underset{\text{(Aluminium hydroxide)}}{2Al(OH)_3} + \underset{\text{(Hydrogen)}}{3H_2}$$

Copper (Cu), silver (Ag) and gold (Au) being least reactive metals do not react with water.

(iii) Reaction with Acids

- Metals which are more reactive than hydrogen, evolve hydrogen on reaction with acids. Copper, silver and gold do not react with dilute hydrochloric acid but copper reacts with sulphuric acid and nitric acid.
- Although with nitric acid, metals (except magnesium and manganese) do not evolve hydrogen.

$$\underset{\text{(Magnesium)}}{Mg} + \underset{\text{(Hydrochloric acid)}}{2HCl} \longrightarrow \underset{\text{(Magnesium choride)}}{MgCl_2} + \underset{\text{(Hydrogen)}}{H_2}$$

$$\underset{\text{(Sodium)}}{2Na} + \underset{\text{(Hydrochloric acid)}}{2HCl} \longrightarrow \underset{\text{(Sodium chloride)}}{2NaCl} + \underset{\text{(Hydrogen)}}{H_2}$$

$$\underset{\text{(Zinc)}}{Zn} + \underset{\text{(Hydrochloric acid)}}{2HCl} \longrightarrow \underset{\text{(Zinc chloride)}}{ZnCl_2} + \underset{\text{(Hydrogen)}}{H_2}$$

(iv) Reaction with Bases

All metals do not react with bases to produce hydrogen gas. Some metals react with bases to form salts and hydrogen gas.

$$\underset{\text{(Zinc)}}{Zn} + \underset{\text{(Base)}}{NaOH} \longrightarrow Na_2ZnO_2 + H_2$$

$$\underset{\text{(Aluminium)}}{2Al} + \underset{\text{(Base)}}{2NaOH} + \underset{\text{(Water)}}{2H_2O} \longrightarrow 2NaAlO_2 + 2H_2$$

(v) Displacement Reactions

A more reactive metal can displace less reactive metals from their salt solutions. Less reactive metals cannot displace more reactive metals.

$$\underset{\text{(Iron)}}{Fe} + \underset{\text{(Copper sulphate) (Blue)}}{CuSO_4} \longrightarrow \underset{\text{(Copper)}}{Cu} + \underset{\text{(Iron sulphate) (Green)}}{FeSO_4}$$

$$\underset{\text{(Magnesium)}}{Mg} + \underset{\text{(Copper sulphate) (Blue)}}{CuSO_4} \longrightarrow \underset{\text{(Magnesium sulphate)}}{MgSO_4} + \underset{\text{(Copper)}}{Cu}$$

$$\underset{\text{(Zinc)}}{Zn} + \underset{\text{(Copper sulphate) (Blue)}}{CuSO_4} \longrightarrow \underset{\text{(Zinc sulphate) (Colourless)}}{ZnSO_4} + \underset{\text{(Copper)}}{Cu}$$

Uses of Metals

- Metals are used in making machinery, automobiles, aeroplanes, trans satellites, industrial gadgets, water biolers etc.

Non-Metals

- Those elements which form negative ions by gaining electrons are called **non-metals.** e.g. carbon, iodine, sulphur, oxygen, hydrogen etc. The non-metals are either solids or gases except bromine which is a liquid.

Physical Properties of Non-metals

(i) **Malleability and ductility** Non-metals are neither malleable nor ductile. However, diamond an allotropic form of carbon, is of ductile nature, since it is quite hard.

(ii) **Brittleness** Non-metals are brittle in nature. For instance, sulphur is a brittle solid. If it is hammered, it breaks into pieces.

(iii) **Physical state** Most of the non-metals are soft (if solid). Only diamond, an allotropic form of carbon is the hardest known substance.

(iv) **Lustre** Non-metals do not have lustre, i.e. shining surface. However, diamond, graphite (a form of carbon) and iodine have lustre, even though they are non-metals.

(v) **Electrical and thermal conductivity** Non-metals are generally poor conductors of heat and electricity. Graphite, another allotrope of carbon, is a good conductor of electricity.

(vi) **Melting and boiling points** Generally, non-metals have low melting and boiling points. But non-metals that are solids have comparatively higher boiling points, e.g. B, Si, C etc.

Note The gases like nitrogen, oxygen, carbon dioxide etc., which constitute air are all poor conductors of electricity.

Chemical Properties of Non-metals

- The chemical properties of non-metals is due to their electronegative nature, i.e. tendency to gain electrons in their valence shells to achieve the configuration of nearest noble gas elements.

$$\underset{\substack{\text{(Non-metal)}\\(2, 4)}}{X} + 4e^- \longrightarrow \underset{(2, 8)}{X^{4-}}$$

(i) Reaction With Oxygen

Non-metals react with oxygen to form non-metal oxide which are acidic in nature. The acidic non-metal oxides turn blue litmus to red.

$$\underset{\text{(Sulphur)}}{S} + \underset{\text{(Oxygen)}}{O_2} \longrightarrow \underset{\substack{\text{(Sulphurdioxide)}\\\text{(Acidic oxide)}}}{SO_2}$$

(ii). Reaction with Water

- Non-metals do not react with water or steam to evolve hydrogen gas.
- This is because non-metals cannot give electrons to hydrogen in water and therefore, hydrogen gas cannot be released.

(iii) Reaction with Acids

- Non-metals do not react with dilute acids to release hydrogen gas. The reason is that a non-metal is an electron acceptor, it cannot supply electrons to the H^+ ions of acids to reduce them to hydrogen gas.
- Thus, it cannot displace hydrogen gas from acids. But on heating with concentrated acids, these form oxides or salts.

$$S(s) + 2H_2SO_4\,(\text{conc.}) \xrightarrow{\text{Heat}} 3SO_2(g) + 2H_2O(l)$$

$$S(s) + 6HNO_3\,(\text{conc.}) \xrightarrow{\text{Heat}} H_2SO_4(aq) + \underset{\text{(Reddish brown vapour)}}{6NO_2(g)} + 2H_2O(aq)$$

$$2P(s) + 5H_2SO_4\,(\text{conc.}) \xrightarrow{\text{Heat}} \underset{\text{Phosphoric acid}}{2H_3PO_4(aq)} + 5SO_2(g) + 2H_2O(aq)$$

$$P(s) + 5HNO_3\,(\text{conc.}) \xrightarrow{\text{Heat}} H_3PO_4\,(aq) + 5NO_2(g) + H_2O(l)$$

(iv) Reaction With Bases

Some non-metals react with bases but no hydrogen gas is produced. The reaction of most metals with bases are complex.

(v) Displacement Reaction

Non-metals also show displacement reaction like metals. e.g. $\underset{\text{Chlorine}}{Cl_2} + \underset{\text{Sodium bromide}}{2NaBr} \longrightarrow \underset{\text{Sodium chloride}}{2NaCl} + \underset{\text{Bromine}}{Br_2}$

Differences between Metals and Non-metals

Properties	Metals	Non-metals
Physical	Metals are solid at room temperature except mercury.	Non-metals may be solid, e.g., C, liquid, e.g., Br_2 or gases e.g., O_2, Cl_2 at room temperature.
	They are lustrous.	They are non-lustrous (except iodine).
	They are malleable and ductile.	They are non-malleable and non-ductile.
	They are sonorous (produce ringing sound).	They are non-sonorous.
	They are good conductor of heat and electricity.	They are bad conductor of heat and electricity (except graphite).
	They have high tensile strength.	They have low tensile strength.
	They are usually hard.	They are usually soft.
	They are very strong.	They are not very strong.
	They have high melting and boiling points.	They have low melting and boiling points.
Chemical	They form basic oxides which on dissolving in water, forms base. $4Na + O_2 \longrightarrow 2Na_2O$ $Na_2O + H_2O \longrightarrow \underset{\text{base}}{2NaOH}$	They form acidic and neutral oxides like CO_2, SO_2, (acidic) and CO, N_2O, NO (neutral), etc.
	They displace hydrogen from acids.	They do not displace hydrogen from acids.
	They react with water to evolve hydrogen gas.	They do not react with water to evolve hydrogen gas.

Uses of Non-Metals

Some important uses of non-metals are given below:

(i) Oxygen is used by plants and animals for breathing. It is also used for burning of fuels in homes, factories and transport vehicles.

(ii) Nitrogen is used in making fertilisers to enhance the growth of plants. It is also used in food packaging to keep the food fresh.

(iii) Chlorine is used in the water purification process.

(iv) Iodine is used in the purple coloured solution (tincture iodine) which is applied on wounds as an antiseptic.

(v) Sulphur and phosphorus are used in firework such as crackers, etc.

(vi) Carbon is used as a fuel such as charcoal, coke and coal.

Corrosion

The wasting away of a metal layer-by-layer due to the formation of metal compounds on the surface is called corrosion. Corrosion in case of iron is called rusting. Iron is widely used metal. It corrodes faster when exposed to moist air. The presence of air (oxygen) and water is essential for rusting.

Prevention from Corrosion

Corrosion of metals can be prevented by following processes

(i) **Painting** The most common method of preventing corrosion is to coat the metals surface with paint.

(ii) **Greasing** A coat of oil or grease also protects metals from corrosion by air and moisture.

(iii) **Galvanisation** Another common method of protecting iron from rusting is to coat its surface with a thin layer of a non-corrosive metals like zinc. This process is called galvanisation.

(iv) **Electroplating** Iron and steel are protected from corrosion by coating them with a layer of tin or chromium metals which are resistant to corrosion. This is done by electroplating. A thin layer of tin, deposited on the inner surface of iron containers, makes them safe for storing food.

(v) **Alloying** Some metals when alloyed with other metals become more resistant to corrosion. e.g. iron when alloyed with chromium and nickel forms stainless steel. It is resistant to corrosion and does not rust at all.

Alloy	Percentage composition	Uses
Bronze	Cu = 89%, Sn = 11%	For making statues, coins, utensils etc.
Brass	Cu = 70%, Zn = 30%	For making utensils, parts of machinery, condenser tubes, wires, etc.
Duralumin	Al = 90%, Cu = 4%	Making parts of aeroplanes and automobiles, pressure cookers etc.
Magnalium	Al = 95%, Mg = 5%	Balance beams, some light instruments.
Gun metal	Cu = 90%, Sn = 10%	For making gun barrels.
Bell metal	Cu = 80%, Sn = 20%	For making bells and gongs.
German silver	Cu = 60%, Zn = 20%, Ni = 20%	For making silverware, resistance wires.
Dental alloy	Ag = 34%, Hg = 53%, Sn = 12.5%, Cu = 2%, Zn = 0.5%	For filling cavities of teeth.
Solder	Pb = 50%, Sn = 50%	For soldering two metal or wires metal pieces.
Stainless steel	Fe = 73%, Cr = 18%	Utensils, cycle and automobile parts, shaving

PRACTICE EXERCISE

1. Choose the incorrect information about metals
   (a) metals are lustrous
   (b) metals are brittle
   (c) metals are sonorous
   (d) metals are ductile

2. Which of the following metals is not solid at room temperature?
   (a) Iron (b) Sodium
   (c) Mercury (d) Zinc

3. Which of the following has highest tensile strength?
   (a) Diamond (b) Copper
   (c) Graphite (d) Sulphur

4. Most malleable metal is
   (a) magnesium (b) gold
   (c) iron (d) copper

5. Metals are usually hard. But exception to this fact is
   (a) zinc (b) copper
   (c) iron (d) sodium

6. The metal with exceptionally low melting point is
   (a) potassium (b) copper
   (c) calcium (d) aluminium

7. The most reactive element among the following is
   (a) Na (b) K (c) Ca (d) Mg

8. Which of the following metals is suggested to be stored submerged in kerosene?
   (a) Al (b) Mg (c) Ca (d) Na

9. Which metal is suitable to store acid in its vessel?
   (a) Aluminium (b) Iron
   (c) Copper (d) Zinc

10. Potassium metal should be stored in
    (a) kerosene oil (b) alcohol
    (c) water (d) hydrochloric acid

11. Magnesium reacts with oxygen to give
    (a) MgO_2 (b) MgO
    (c) Mg_2O (d) $Mg(OH)_2$

12. Which of the following reacts vigorously with water?
    (a) Sodium (b) Aluminium
    (c) Copper (d) Iron

13. Which of the following metals does not react with water at all?
    (a) Aluminium (b) Silver
    (c) Gold (d) Both (b) and (c)

14. What would be the product of following reaction?

$$\underset{\text{(Gold)}}{Au} + \underset{\text{(Hydrochloric acid)}}{\text{dil. HCl}} \longrightarrow$$

    (a) $AuCl_2 + H_2$
    (b) $AuCl + H_2$
    (c) $AuCl_3 + H_2$
    (d) No reaction takes place

15. In a reaction, copper can displace
    (a) iron (b) magnesium
    (c) silver (d) All of these

16. Which of the following burns with an explosion in contact with water and air ?
    (a) Na (b) Ca
    (c) Mg (d) Zn

17. Complete the following equation

$$Zn + CuSO_4 \longrightarrow .... + Cu$$

    (a) ZnO (b) $ZnSO_4$
    (c) CuO (d) ZnS

18. A non-metal having lusture is
    (a) iodine (b) bromine
    (c) sulphur (d) carbon

19. The good conductor of electricity is
    (a) graphite
    (b) diamond
    (c) phosphorus
    (d) carborundum

20. Which of the following elements is a metalloid ?
(a) Lead (b) Tin
(c) Antimony (d) Barium

21. Which of the following is the hardest substance ?
(a) Chromium (b) Rubidium
(c) Diamond (d) Iron

22. Which of the following can not be beaten into thin sheets?
(a) Zinc (b) Phosphorus
(c) Copper (d) Iron

23. Non metals reacts with oxygen to form
(a) Basic oxides (b) Acidic oxides
(c) Neutral oxides (d) Salt and water

24. Which of the following oxides in aqueous solution does not turn red litmus blue?
(a) CO_2 (b) Na_2O
(c) MgO (d) Fe_2O_3

25. The metal which is used to make thermometers is
(a) Zinc (b) Aluminium
(c) Iron (d) Mercury

26. Chlorine is used in
(a) food packaging.
(b) water purification process.
(c) galvanising iron.
(d) fireworks

27. Iron rusts faster when
(a) exposed to dry air
(b) exposed to moist air
(c) painted
(d) galvanised

28. Which of the following metals is used in galvanisation of iron?
(a) Aluminium
(b) Copper
(c) Magnesium
(d) Zinc

29. Which of the following is not suggested to prevent metals from corrosion?
(a) Dipping metal in salt solution
(b) Painting
(c) Greasing
(d) Electroplating

30. Coating iron and steel article with chromium metal is done through
(a) greasing (b) galvanisation
(c) electroplating (d) All of these

31. Stainless steel is corrosion resistant because of
(a) alloying (b) painting
(c) greasing (d) electroplating

32. Which of the following elements is highly resistant to corrosion ?
(a) Iron (b) Titanium
(c) Nickel (d) Silver

33. The metal present in brass and bronze is
(a) Zn (b) Mg (c) Cu (d) Al

34. Pick the odd one out
(a) titanium (b) bronze
(c) solder (d) gun metal

35. Which of the following does not contain copper?
(a) German silver (b) Bronze
(c) Brass (d) Duralumin

Answers

1	(b)	2	(c)	3	(b)	4	(b)	5	(d)	6	(a)	7	(b)	8	(d)	9	(c)	10	(a)
11	(b)	12	(a)	13	(d)	14	(d)	15	(c)	16	(a)	17	(b)	18	(a)	19	(a)	20	(c)
21	(c)	22	(b)	23	(b)	24	(a)	25	(d)	26	(b)	27	(b)	28	(d)	29	(a)	30	(c)
31	(a)	32	(c)	33	(c)	34	(a)	35	(d)										

CHAPTER

08

COAL AND PETROLEUM

In this chapter, we will study about some exhaustible natural resource, like coal, petroleum and natural gas. These are also called non-renewable sources of energy. This is because when all the coal, petroleum and natural gas present under the earth will get used up, no more supply of these will be available in the near future.

In this chapter, we will discuss carbon, its various forms, its compounds, fuels and petroleum and their types.

Natural Resources

The various resources which are obtained from the nature are called natural resources, e.g. air, water, soil, etc. On the other hand, paints, synthetic fibres, plastics explosives are man-made materials.

Natural resources can be broadly classified into two kinds:

1. Inexhaustible Natural Resources

The natural resources which are present in an unlimited quantity in nature and are not likely to be exhausted (used up) by human activities, are called inexhaustible natural resources, e.g. sunlight, air. There are never ending supply of inexhaustible resources in nature. They can be used again and again.

2. Exhaustible Natural Resources

The natural resources which are present in a limited quantity in nature and can be exhausted (used up) by human activities, are called exhaustible natural resources, e.g. coal, petroleum, natural gas, minerals, forests, wildlife, etc.

Coal

Coal is the most impure form of carbon. It is obtained from mines. In India, it is found in Raniganj in West Bengal, Jharia in Jharkhand, etc.

Depending upon carbon contents, coal is of the following types

1. Peat (60% carbon)
2. Lignite (70% carbon)
3. Bituminous (78% to 83% carbon)
4. Anthracite (90% carbon)

Bituminous is the common variety of coal and anthracite is the purest form of coal.

Products Obtained from Coal

When coal is heated strongly in the absence of air in closed retorts, various useful products are obtained. The strong heating of coal in the absence of air is called destructive distillation of coal. These are coke, coal tar and coal gas.

1. Coke

It is a tough, porous and black solid substance. It is almost the pure form of carbon. It contains 98 per cent carbon. When coal is heated in the absence of air, then coal gas and coal tar are eliminated and coke is left behind as a black residue.

Uses of Coke

Coke is used

(i) Coke is used as a reducing agent in the extraction of metals such as iron, zinc, etc.

(ii) Coke is used in the manufacture of steel.

(iii) Coke is used as a fuel.

2. Coal Tar

It is a thick, black liquid having an unpleasant smell. It is a mixture of about 200 substances.

Uses of Coal Tar

- The useful carbon compounds present in coal tar include benzene, toluene, naphthalene, phenol, aniline and anthracene.
- The various compounds obtained from coal tar are used as starting materials for manufacturing a large number of substances used in everyday life and in industry like synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, etc.

Note Coal tor has been used for metalling the roads. But, these days bitumen (a petroleum product) is being used increasingly for metalling the roads.

3. Coal Gas

It is a gaseous fuel. It is obtained during the processing of coal to get coke. It is mainly a mixture of methane and hydrogen with some carbon monoxide.

Uses of Coal Gas

- It is used as a fuel in many industries situated near the coal processing plants.
- It has also been used for lighting purposes.
- These days, it is used as a source of heat rather than light.

Petroleum

Petroleum is the dark oily liquid form of fossil fuel.

It is also called crude oil. It is a complex mixture of hydrocarbons.

It is formed from the remains of microorganisms due to action of high pressure, heat and certain catalytic actions over a period of millions of years.

Refining of Petroleum

- Petroleum is a dark oily liquid having an unpleasant odour.
- It is a mixture of solid, liquid and gaseous hydrocarbons such as petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc.
- Before the use of petroleum for specific purposes, it has to be refined (or purified).
- The process of separating the various useful constituents (fractions) of petroleum is known as refining.

- Refining of petroleum is carried out in a petroleum refinery. Petroleum is separated into different fractions by the process of fractional distillation, which is the process of separation in which fractions of petroleum having different boiling point ranges are collected separately.

Various Constituents of Petroleum and their Uses

Constituents of Petroleum	Uses
Petroleum gas in liquid form (LPG)	Fuel for home and industry
Petrol	Motor fuel, aviation fuel, solvent for dry cleaning
Kerosene	Fuel for stoves, lamps and for jet aircrafts
Diesel	Fuel for heavy motor vehicles, electric generators
Lubricating oil	Lubrication
Paraffin wax	Ointments, candles, vaseline, etc.
Bitumen	Paints, road surfacing

Liquefied Petroleum Gas (LPG)

The petroleum gas which has been liquefied under pressure is known as **Liquefied Petroleum Gas (LPG).**

It is the most important fuel used in homes.

It mainly consists of butane.

LPG is a good fuel because of its following advantages

(i) It burns easily.

(ii) It has a high calorific value (about 50,000 kJ/kg)

(iii) It burns with a smokeless flame, so it does not cause air pollution.

(iv) It does not produce any harmful gases

(v) It does not leave behind any solid residue after burning.

(vi) It is easy to handle and convenient to store

Natural Gas

Natural gas mainly consists of methane (95%). Other constituents are ethane and propane. It occurs deep under the earth's crust either alone or along with oil above the petroleum.

Natural gas is used as a starting material for the manufacture of a number of chemicals (petrochemicals) and fertilisers as it is a source of hydrogen gas needed to manufacture the fertilisers.

In India, natural gas has been found in Tripura, Rajasthan, Maharashtra and in the Krishna Godavari delta.

Natural gas is a very important fossil fuel as it is easy to transport through pipes. When it is compressed by applying pressure, it is called Compressed Natural Gas (CNG). CNG is used for power generation. It is now being used as a fuel for transport vehicles as it is a clean fuel and burns without producing any smoke and thus does not cause air pollution.

Advantages of Using Compressed Natural Gas (CNG)

(i) It is a complete fuel and can be used directly in homes and industries.

(ii) It is a clean fuel as it does not leave behind any solid residue after burning.

(iii) It burns easily with a smokeless flame and thus does not cause air pollution.

(iv) It produces a lot of heat.

(v) A great advantage of CNG is that it can be supplied to homes and factories through a network of underground pipes, so additional storage and transport are not required for it. Such a network of pipelines exists in Vadodara (Gujarat), some parts of Delhi and some other places.

(vi) CNG is a good alternative to petrol and diesel in vehicles because it is a clean fuel and does not cause air pollution. It is filled in cylinders.

Note The fossil fuels such as coal, petroleum and natural gas cannot be prepared in the laboratory from dead organisms (plants and animals) because their formation is a very slow process and the conditions for their formation cannot be created in the laboratory.

Some Natural Resources are Limited

- Coal, petroleum and natural gas are the fossil fuels and their amounts in the earth are limited. Fossil fuels, forests and minerals, etc. are exhaustible natural resources.
- If consumed at a rate faster than the rate at which these are formed in nature, they will get exhausted very soon. Once the present stock of these gets exhausted, no new supplies of these fossil fuels will be available to us in the near future because it required millions of year to get converted the dead organisms into these fuels.
- As per present estimate, the known existing petroleum reserves will last at most a few hundred years This would lead to energy crises. Moreover, the burning of these fuels is a major cause of air pollution. Their uses also linked to global warming.

So, we should use these fuels only when absolutely necessary as .

(i) it will reduce air pollution and thus lead to better environment.

(ii) it will reduce the risk of global warming.

(iii) it will ensure their availability for a longer period of time.

Conservation of Coal and Petroleum

Petrol and diesel are the main fuels used for driving vehicles. So, we should make every effort to save these precious fuels. In India, the Petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving the vehicles.

The various tips to avoid wastage of these fuels while driving are as follows

(i) Drive at a constant and moderate speed as far as possible.

(ii) Switch off the engine of vehicle at traffic lights or at a place where you have to wait.

(iii) Ensure correct tyre pressure of the vehicle. Low tyre pressure consumes more fuel.

(iv) Ensure regular maintenance of the vehicle.

PRACTICE EXERCISE

1. Various materials which are obtained from nature are called natural resources. Which of the following is not a natural resource?
(a) Minerals (b) Water
(c) Soil (d) Plastic

2. Air is a natural resource and cannot be exhausted by human activities. It is known as inexhaustible natural resource. Which of the following is another inexhaustible natural resource?
(a) Coal
(b) Petroleum
(c) Sun-light
(d) Minerals

3. Which of the following is a pair of exhaustible natural resources?
(a) Coal and soil (b) Air and sunlight
(c) Water and petroleum
(d) Wildlife and minerals

4. Coal is processed in industries to get some useful products. Which of the following is not obtained from coal?
(a) Coke (b) Coal tar
(c) Coal gas (d) CNG

5. Exhaustible natural resources are:
(a) unlimited in quantity
(b) not dependent on nature
(c) limited in quantity
(d) not exhausted by human activities

6. Fossil fuels are obtained from
(a) remains of non-living materials
(b) dead remains of birds only
(c) dead remains of insects only
(d) dead remains of living organisms

7. Coal is formed from the remains of
(a) vegetation only
(b) animals only
(c) both vegetation and animals
(d) neither vegetation nor animals

8. Which one of the following forms of coal has the lowest percentage of carbon?
(a) Peat (b) Lignite
(c) Bituminous (d) Anthracite

9. Which of the following is the common variety of coal?
(a) Peat (b) Lignite
(c) Anthracite (d) Bituminous

10. The purest form of coal is
(a) anthracite (b) bituminous
(c) peat (d) lignite

11. The allotrope of carbon used to extract metals is
(a) gas carbon (b) coal
(c) coke (d) charcoal

12. Which substance is formed by the carbonisation of dead vegetation?
(a) Coal (b) Coke
(c) Coal gas (d) Coal tar

13. Naphthalene balls are obtained from coal tar and are used as
(a) mosquito repellant (b) honeybee repellant
(c) moth repellant (d) snake repellant

14. Which of the following is not a constituent of petroleum?
(a) Paraffin wax (b) Lubricating oil
(c) Petrol (d) Coke

15. Petroleum was formed from organisms
(a) living on the land
(b) living on the plants
(c) living in the sea
(d) living on the rocks

16. Petrochemical substances are obtained from
(a) LPG and coal
(b) natural gas and petroleum
(c) LPG and petroleum
(d) CNG and petroleum

17. Petrol is a mixture of ..... such as hexane, heptane and octane.
(a) natural gas (b) coal gas
(c) coal tar (d) coal

18. Paraffin oil or kerosene is obtained from petroleum by
(a) refining
(b) fractional distillation
(c) distillation
(d) centrifugation

19. The constituent of natural gas is
(a) ethane (b) methane
(c) butane (d) propane

20. Which of the following burns easily with a smokeless flame and thus does not cause air pollution?
(a) LPG (b) Coal
(c) Petroleum (d) CNG

Answers

1	(d)	2	(c)	3	(d)	4	(d)	5	(c)	6	(d)	7	(a)	8	(a)	9	(d)	10	(a)
11	(c)	12	(a)	13	(c)	14	(d)	15	(c)	16	(b)	17	(b)	18	(b)	19	(b)	20	(d)

CHAPTER

09

FOSSIL FUELS, COMBUSTION AND FLAME

We use different kinds of fuels for various purposes at home, in industry and for running automobiles. These can be cowdung, wood, coal, charcoal, petrol, diesel, Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG), etc.

Some materials burn with flame (e.g. candle) whereas some burn without flame (e.g. coal).

Let us now study the chemical process of burning and the types of flame produced during this process.

In this chapter, we will discuss carbon, its various forms, its compounds, fuels and petroleum and their types.

Combustion

- A chemical process in which a substance reacts with oxygen to give off heat is called combustion.
- The substance that undergoes combustion is said to be combustible.
- It is also called a fuel which can be solid, liquid or gas.
- Sometimes, light is also given off during combustion either as a flame or as a glow, e.g. wood burns by producing a flame, but charcoal burns by producing light in the form of glow.

Combustible and Non-Combustible Substances

As all the substances around us do not burn, so there are two types of substances around us

- **Combustible substances** The substances which burn in air or oxygen are called combustible substances, e.g. petrol, LPG, kerosene, etc.

- **Non-combustible substances** The substances which do not burn in air or oxygen are called non-combustible substances, e.g. water, glass, sand, etc.

Necessary Conditions for Combustion

There are three necessary conditions for combustion. These are

(i) Presence of a combustible substance.

(ii) Presence of a supporter of combustion.

(iii) Heating the combustible substance to its ignition temperature or attainment of ignition temperature.

Supporter of Combustion

- A substance which helps in combustion is called a supporter of combustion, e.g. oxygen (or air).
- When the clothes of a person catch fire, the person is covered with a blanket to extinguish the fire. This is because the supply of air to the burning clothes is cut off by blanket, due to which the burning of clothes stop and the fire gets extinguished.

Ignition Temperature

- Before a substance catches fire and starts burning, it must be heated to a certain minimum temperature. The lowest temperature at which a substance catches fire and starts burning is called its ignition temperature.
- A combustible substance cannot catch fire if its temperature is lower than its ignition temperature.
- e.g. a piece of paper does not catch fire at the room temperature because its ignition temperature is much higher than room temperature. When we apply a burning matchstick to the paper, it starts burning. It is because the heat produced by burning matchstick heats the piece of paper to its ignition temperature and makes it burn.

Use of Kerosene Oil to Burn Wood or Coal

- Ignition temperature of paper or kerosene oil is low, so if some kerosene is sprinkled over the wood, the kerosene starts burning by a lighted matchstick.
- The heat produced by the burning of kerosene makes the wood to burn. The coal pieces are then placed over the burning wood.
- The large heat produced by the burning wood heats the coal to its ignition temperature. In this way, the coal starts burning.

Inflammable Substances

The substances which have very low ignition temperature and can catch fire easily with a flame are called inflammable substances, e.g. petrol, alcohol, LPG, etc.

How Fire can be Controlled

Fire can be extinguished in three ways

- By removing the fuel. But in most cases, fuel cannot be eliminated.
- By cutting off the air supply to the burning substances.

Fire Extinguishers

Substances which are used to extinguish fire are known as fire extinguishers, e.g. sand, water and carbon dioxide.

- The most common fire extinguisher is water but only, when things like wood and paper are on fire. It extinguishes fire by cooling the burning substances. But, if electrical equipment is on fire, water may conduct electricity, so it can give electric shock to the persons involved in fire-fighting. Thus, water cannot be used to extinguish fires caused by electricity.
- For fires involving electrical equipment and inflammable substances like petrol, carbon dioxide (CO_2) is the best extinguisher. CO_2 is denser than air and thus forms a layer around the burning substances, i.e. it covers the fire like a blanket due to which fresh air cannot reach the burning substances. Carbon dioxide can be stored as a liquid at high pressure on cylinders.

Types of Combustion

There are various types of combustion. Three important types of combustion are as follows

(i) Rapid Combustion

The combustion in which a large amount of heat and light are produced in a short time, is called rapid combustion, e.g. immediate burning of cooking gas (LPG) in a gas stove on bringing a burning matchstick or a gas lighter near it, burning of kerosene oil in kerosene stove, etc.

(ii) Spontaneous Combustion

- The combustion which occurs on its own without the help of any external heat, is called spontaneous combustion.
- In spontaneous combustion, the material suddenly bursts into flames without being heated, e.g. white phosphorus burns in air at room temperature on its own.
- The heat required to start the spontaneous combustion is produced internally by the slow oxidation inside the substance.
- Some spontaneous combustion reactions are very dangerous, e.g. the spontaneous combustion of coal dust has resulted in many disastrous fires in coal mines.
- Sometimes, due to the heat of the sun or due to the spark of lightning from the sky, spontaneous combustion of straw (dry grass) and forest wood takes place which leads to forest fire.

(iii) Explosions

- A sudden combustion in which a large amount of heat, light and sound are produced is called explosion.
- A large amount of gases is released quickly in an explosion, e.g. when a cracker is ignited, a sudden explosion takes place with the evolution of heat, light and sound. Explosion can also take place if pressure is applied on the cracker.

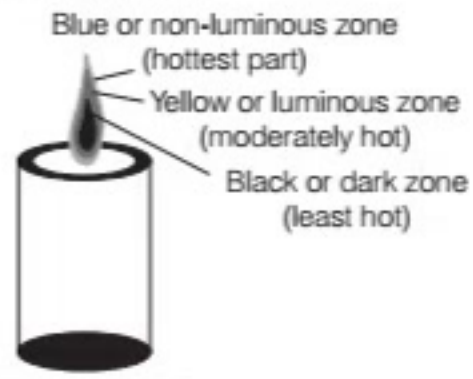
Flame

- The substances which vaporise during burning, give flames, e.g. kerosene oil and molten wax rise through the wick and are vaporised during burning and form flames. On the other hand, charcoal does not vaporise and so does not produce a flame. It just glows.
- When fuels burn, the flame produced depend on the oxygen which is available for burning the fuel.
  - (i) When the supply of oxygen is not sufficient, the fuels burn incompletely producing mainly a yellow flame. e.g. the colour of candle flame is mainly yellow. Also the colour of kerosene lamp flame is yellow.
  - (ii) When the supply of oxygen is sufficient, the fuels burn completely producing mainly a blue flame, e.g. in LPG stoves, the LPG burns with a blue flame.

Structure of a Flame

A flame consists of three zones

- **Innermost zone** It is a dark or black coloured zone. It consists of hot, unburnt vapours of combustible material. It is the least hot part of the flame.
- **Middle zone** It is the bright and luminous zone. It produces a moderate temperature. Here, partial combustion of the fuel takes place.
- **Outermost zone** It is non-luminous zone. Here, complete combustion of the fuel takes place because there is plenty of air around it. It has the highest temperature in the flame, i.e. it is the hottest part of the flame.



Different zones of flame

Fuels

- A fuel may be defined as any substance which supplies heat energy on burning without production of excessively undesirable side products, e.g. wood, coal, LPG, etc.
- A good fuel is one which has the following qualities
  - (i) Readily available (ii) Cheap
  - (iii) Burns easily in air at a moderate rate.
  - (iv) Produces a large amount of heat, i.e. high calorific value.
  - (v) Does not leave behind any undesirable substance.
  - (vi) Low ignition temperature.

Fuel Efficiency: Calorific Value

The total amount of heat in a calories liberated by the complete combustion of unit mass of a fuel in presence of air. It is expressed in cal per gram, kcal/g and kJ/kg.

Burning of Fuels Leads to Harmful Products

The increasing fuel consumption has harmful effects on the environment because burning fuels produce harmful products which pollute the air around us.

These are as follows

(i) Burning of carbon fuels like wood, coal, petroleum releases unburnt carbon particles in air which are dangerous pollutants causing respiratory diseases such as asthma.

For centuries, wood was used as domestic and industrial fuel. But, now it has been replaced by coal and other fuels like LPG. In many rural parts of our country, people still use wood as a fuel because of its easy availability and low cost. However, burning of wood gives a lot of smoke which is very harmful for human beings. It causes respiratory problem. Trees provide us with useful substances which are lost when wood is used as fuel. Moreover, cutting of trees leads to deforestation which is quite harmful to the environment.

(ii) Incomplete combustion of carbon fuels gives carbon monoxide gas which is very poisonous gas. Excessive inhaling of this gas can kill a person.

(iii) Burning of most fuels releases carbon dioxide into air. Increased concentration of carbon dioxide in the air is believed to cause **global warming**. Global warming is the rise in temperature of the atmosphere of the earth. Due to this, the ice in polar regions will melt very fast, producing a lot of water.

(iv) Burning of coal and diesel releases sulphur dioxide gas. It is an extremely suffocating and corrosive gas. It may damage our lungs. Moreover, petrol engines give off gaseous oxides of nitrogen. Oxides of sulphur and nitrogen dissolve in rainwater and form acids. Such rain is called **acid rain.** It is very harmful for crops, buildings and soil.

The use of diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas) because it produces harmful products in very small amounts.

PRACTICE EXERCISE

1. A substance which reacts with oxygen giving heat is called combustible substance. Which one of the following is combustible substance?
   (a) Iron nail
   (b) Stone piece
   (c) Glass
   (d) Wood

2. Which one of the following has the highest calorific value?
   (a) Kerosene (b) LPG
   (c) Biogas (d) Petrol

3. Magnesium ribbon on burning in air produces
   (a) magnesium oxide, water and light
   (b) magnesium oxide and heat
   (c) magnesium oxide, heat and light
   (d) magnesium oxide, water and heat

4. Which of the following is not a combustible substance?
   (a) Camphor (b) Straw
   (c) Glass (d) Alcohol

5. The substance that does not burn with flame is
   (a) LPG (b) Dry glass
   (c) camphor (d) Charcoal

6. On placing an inverted tumbler over a burning candle, the flame extinguishes after some time. This is because of non-availability of
   (a) oxygen
   (b) carbon dioxide
   (c) water vapours
   (d) wax

7. If a person's clothes catch fire, the best way to extinguish the fire is to
   (a) throw water on the clothes
   (b) use fire extinguisher
   (c) cover the persons with a woolen blanket
   (d) cover the person with a polythene sheet

8. The substance expected to have the highest ignition temperature out of the following is
   (a) kerosene (b) coal
   (c) petrol (d) alcohol

9. Choose the correct statement about inflammable substances from the following.
   They have
   (a) low ignition temperature and cannot catch fire easily
   (b) high ignition temperature and can catch fire easily
   (c) low ignition temperature and can catch fire easily
   (d) high ignition temperature and cannot catch fire easily

10. Choose the incorrect statement from the following.
    Forest fires are usually due to
    (a) carelessness of humans
    (b) cutting of trees
    (c) heat of sun
    (d) lightning strike

11. When the supply of oxygen is not sufficient, the fuels burn incompletely producing mainly
    (a) blue flame (b) orange flame
    (c) yellow flame (d) dark blue flame

12. Which zone of the flame has the highest temperature?
    (a) Innermost zone
    (b) Middle zone
    (c) Outermost zone
    (d) None of the above

13. The calorific value of a fuel is expressed in a unit called
    (a) kilojoule litre
    (b) kilojoule gram
    (c) kilogram per mililitre
    (d) kilojoule per kilogram

14. In villages, people use wood as fuel because
(a) it is considered to be an ideal fuel
(b) of its easy availability and low cost
(c) it is environment friendly
(d) it catches fire easily

15. Which among the following is considered as the cleanest fuel?
(a) Cow dung cake
(b) Kerosene
(c) Petrol
(d) Hydrogen gas

16. Choose the incorrect statement from the following.
A good fuel is one which
(a) is readily available
(b) produces a large amount of heat
(c) leaves behind many undesirable substances
(d) burns easily in air at a moderate rate

17. Shyam was cooking potato curry on a chulha. To his surprise he observed that the copper vessel was getting blackened from outside. It may be due to
(a) proper combustion of fuel
(b) improper cooking of potato curry
(c) improper combustion of the fuel
(d) burning of copper vessel

18. Which one of the following has the lowest calorific value?
(a) CH_4 (b) LPG (c) Coal gas (d) H_2

19. The fuel, among the following, that has low calorific value and causes high pollution is
(a) coal (b) cow-dung cake
(c) LPG (d) petrol

20. A gaseous fuel ..... .
(a) gives a high ash content on burning
(b) have low calorific value
(c) cannot passed into pipelines
(d) can be burnt at any moment

Answers

1	*(d)*	2	*(b)*	3	*(c)*	4	*(c)*	5	*(d)*	6	*(a)*	7	*(c)*	8	*(b)*	9	*(c)*	10	*(b)*
11	*(c)*	12	*(c)*	13	*(d)*	14	*(b)*	15	*(d)*	16	*(c)*	17	*(c)*	18	*(c)*	19	*(b)*	20	*(d)*

CHAPTER

10

SYNTHETIC FIBRES AND PLASTICS

In this chapter we will learn about the natural and synthetic fibres, rubbers and different kinds of plastic.

Fibres

- Fibres are long thread-like structure of thinner strands.
- Due to their properties and structure, fibres are utilised to make clothes, ropes carpets, sweaters, etc.
- They may be natural or synthetic (man-made).

Natural Fibres

- These are obtained from plants and animals.
- Cotton and jute fibres are obtained from plants and are called plant fibres.
- While wool and silk are the examples of animal fibres.
- Wool is obtained from the fleece of sheep.
- Silk fibre is drawn from the cocoon of silkworm.

Cotton

- It is most widely used natural fibre.
- Cotton fibre is also known as cotton wool.
- Cotton is a soft fibre that grows around the seeds of cotton plant (cotton bolls) or cotton fruits.

- Cotton plants are usually grown at places having black soil and warm climate.
- In India, cotton is mainly cultivated in Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Punjab, Rajasthan, Tamil Nadu and Karnataka.

Jute

- It is obtained from the stem of jute plant, often called patson.
- It is cultivated during rainy season.
- It is mainly grown in West Bengal, Bihar and Assam.
- Jute is used for making gunny bags or sacks and for wrapping packages and some fine jute fibres are used to make fabric for clothes.

Synthetic Fibres

- The fibres made by man are called man-made or synthetic fibres.
- All the synthetic fibres are prepared by a number of processes using raw materials of petroleum origin, called petrochemicals.
- These are stronger than natural fibres.
- Depending upon the type of chemicals used for manufacturing the synthetic fibres, there are four major types of synthetic fibres which are given below

Synthetic Fibres	Composition	Uses
Rayon (artificial silk)	Obtained by chemical treatment of wood pulp	In textile industry, in manufacturing of tyre cord, to make carpets, for making bed-sheets, curtains, blankets, etc. Due to its texture, it is also called artificial silk.
Nylon (poly-amide)	Made without using any natural raw material (from plant or animal)	For making socks, ropes, tents, brushes, carseat belts, sleeping bags, parachutes, etc.
Polyester (e.g. terylene or dacron)	Made up of the repeating units of a chemical called ester.	In making fabrics like saree, dress materials and curtains, for making water hoses, conveyor belts.
Acrylic (artificial wool e.g. orlon or PAN)	As substitute for wool	For making sweaters, shawls, blankets, carpets, boots and gloves, etc.

Rubber

It can be classified into two forms, i.e. natural and synthetic rubbers.

Natural Rubber

- It is a natural polymer and possesses elastic properties so, it is also called elastomer. It has a variety of uses. It is obtained from rubber latex (a solution of rubber in water).
- This latex is chiefly obtained from the bark of rubber trees found in India, Sri Lanka, Malaysia, Indonesia and South America.

Synthetic Rubbers

These rubbers are made by vulcanisation of natural rubber or polymerisation of some monomers, e.g. Buna-S, Buna-N, Neoprene, etc.

Vulcanisation of Rubber

- Vulcanisation is the heating of natural rubber with sulphur and an appropriate additive at a temperature range between 373-415 K to improve its physical properties. Thus, rubber gets stiffened, i.e. becomes less sticky and plastic, more resistant to swelling by organic liquids and has enhanced elasticity.

Plastics

- A plastic is a synthetic material which can be moulded into desired shape when soft and then hardened to produce a desirable article with durability. Plastic is also a polymer like synthetic fibre.

- A large number of plastic bags, water bottles, buckets, mugs, combs, toothbrush, toys, chairs, tables, covers of electric switches, plugs, sockets, insulation of electric wire, water tanks, etc., are articles made up of plastics.
- Some parts of television, refrigerator, cars, buses, trains, aeroplanes, ships, etc., are also made up of various types of plastics.

Types of Plastics

On the basis of effect of temperature, plastics are of two types

1. Thermoplastics

- The plastics which get deformed easily on heating and can be bent easily are known as thermoplastics, e.g. polythene and Polyvinyl Chloride (PVC).
- Thermoplastics are used for making insulation of electric wires and cables, various types of plastic containers (bottles, jars, etc.), combs, toys, raincoats, packaging materials, etc.

Note 'Polythene' (poly + ethene) is a polymer of a compound known as ethene. It is used for making commonly used polythene bags.

2. Thermosetting Plastics

- The plastics which when moulded once, cannot be softened by heating are known as thermosetting plastics, e.g. bakelite and melamine.
- An article made up of thermosetting plastic will retain its original shape permanently, even on heating.
- Thermosetting plastics are used for making handles of cooking utensils, plates, cups, electric switches, plugs, rockets, telephone instruments, etc.
- Melamine is a versatile material. It resists fire and can tolerate heat better than other plastics. So, it is used for making floor tiles, kitchenware and fabrics which resist fire.

Plastics as Materials of Choice

Due to various qualities and useful properties, plastics are the materials of choice for all sorts of uses. Plastic have many advantages over the traditional materials like metals, wood, etc.

Some important characteristic properties of plastics are given below

1. Plastic is Non-Reactive

- Metals like iron get rusted when left exposed to moisture and air, but plastics do not react with water and air.
- They are not corroded easily. So, they are used to store various kinds of materials including many chemicals.

2. Plastic is Light, Strong and Durable

- Plastic is lighter than metal due to its low density. So, plastic is used in cars, aircrafts and spacecrafts. It has good strength and durability (long lasting).
- Due to lower price, easy availability, light weight, good strength, durability and corrosion-resistance, plastic containers are preferred for storing food, water, milk, jams, pickles and soft drinks, etc.

3. Plastics are Poor Conductors of Heat and Electricity

- Plastics are poor conductors of heat. So, handles of cooking utensils (like frying pans and pressure cookers) are made up of plastic so that we can hold the hot utensils safely without getting our hands burnt.
- Plastics are poor conductors of electricity. So, electrical wires have plastic covering and handles of screw drivers (used by electricians) are made up of plastic, so as to protect us from electric current passing through them.
- Electric switches, plugs and sockets also have plastic covers due to these properties.

Some Plastics and their Uses

Plastics	Starting material (Monomer)	Uses
Polythene	Ethylene	Coats, milk cartons, bread wrappers, carry bags, toys, etc.
Polyvinyl chloride	Vinyl chloride	Rain coats, hand bags, toys, hosepipes, gramophone records and electric insulations, etc.
Polystyrene	Styrene	Ceiling tiles, lining materials for refrigerators, TV cabinets, etc.
Perspex	Methyl methacrylate	Lenses, transparent objects, domes and sky lights, aircraft windows, protective coatings, plastic jewellery, etc.
Teflon	Tetrafluoroethylene	Non-sticky coating for utensils and electric iron sole.

Plastics and the Environment

In our daily routine, we usually get things wrapped in plastic or packed in polythene bags. So, plastic waste keeps getting accumulated in our homes. Ultimately, the plastic wastes are dumped along with the household garbage. The use of plastic materials affects the environment very badly. It is because of the following reasons

(i) Plastic is non-biodegradable and causes environmental pollution as it takes several years to decompose. It is not environment friendly.

(ii) When the plastic waste materials are burnt, they burn very slow. They do not get completely burnt. In the burning process, they release lots of poisonous fumes (gases) into the atmosphere causing air pollution.

(iii) Sometimes, the animals (like cows) eat up the polythene bags and wrappers of food along with the left-over food thrown on garbage dumps. The plastic material chokes the respiratory system of these animals, or forms a lining in their stomachs and can be the cause of their death.

Biodegradable and Non-Biodegradable Materials

- A material which gets decomposed through natural processes, such as action by bacteria, is called **biodegradable material,** e.g., plant wastes (such as peels of vegetables and fruits, fallen leaves, left over food stuffs, etc.), animal wastes, paper, jute, wood, cotton and woollen clothes, etc. They do not cause environmental pollution, so they are environment friendly.
- A material which is not easily decomposed by natural processes, is called **non-biodegradable,** e.g., plastics, glass, tin and aluminium cans, etc. They cause environmental pollution, so they are not environment friendly.

PRACTICE EXERCISE

1. An example of animal fibre is
(a) flax (b) jute
(c) silk (d) cotton

2. Identify the one, which is not obtained from a plant source?
(a) Jute (b) Rubber
(c) Cotton (d) Wool

3. The part of cotton plant that produces the cotton fibre is
(a) cotton boll (b) flower
(c) seed (d) root

4. Jute fibre is obtained from which part of the plant?
(a) Root (b) Stem (c) Fruit (d) Seed

5. Most suitable type of soil for cultivation of cotton is
(a) red soil (b) black soil
(c) loamy soil (d) clay

6. Major source for synthetic fibres are
(a) animal fat (b) oil from plants
(c) petrochemicals (d) All of these

7. The source of rayon is
(a) wood pulp (b) petrochemicals
(c) wax (d) animal fibre

8. The term 'artificial silk' refers to
(a) nylon (b) acrylic
(c) polyster (d) rayon

9. Which of the following is called a polyamide?
(a) Rayon (b) Nylon
(c) Orlon (d) Terylene

10. Dacron is a
(a) polyamide (b) polyester
(c) rubber (d) None of these

11. Which fibre is being used, in place of wool, to make warm clothes?
(a) Polyester (b) Polyamide
(c) Acrylic (d) Rayon

12. The liquid that produces natural rubber is called
(a) flax (b) latex
(c) vulcanised rubber (d) nylon

13. The part of rubber plant which produces latex is
(a) leaves (b) root
(c) fruit (d) bark of stems

14. The example(s) of synthetic rubber is/are
(a) Buna-S (b) Buna-N
(c) Neoprene (d) All of these

15. The element used to vulcanise nature rubber is
(a) sodium (b) phosphorus
(c) sulphur (d) magnesium

16. In vulcanised rubber content of sulphur is around
(a) 3-5% (b) 20-30%
(c) 50-60% (d) 80-90%

17. Which of the following is not a use of vulcanised rubber?
(a) Footwear (b) Balloon
(c) Toys (d) Textiles

18. Plastics are different from fibres because plastics
(a) are always lighter
(b) can be moulded into desired shape
(c) are always transparent
(d) All of the above

19. An example of thermoplastics is
(a) rayon (b) PVC
(c) nylon (d) bakelite

20. Thermosetting plastic are the ones that
(a) can not be softened by heating once moulded
(b) can be remoulded again and again
(c) can be moulded into any shape
(d) Both (a) and (c)

21. An example of thermosetting plastics is
(a) polythene (b) bakelite
(c) PVC (d) polystyrene

22. Which of the following is named as versatile material?
(a) Bakelite (b) Teflon
(c) Melamine (d) Polythene

23. Plastics are used to store various kinds of materials including many chemicals because it is
(a) non-reactive (b) highly reactive
(c) light, durable and strong
(d) poor conductors of heat and electricity

24. Handles of screw drivers (used by electricians) are made up of plastic. It indicates that plastics are
(a) good conductor of electricity
(b) bad conductor of electricity
(c) biodegradable
(d) non-reactive

25. Paper, cotton, jute and woollen clothes etc. are biodegradable materials because
(a) They cause environmental pollution.
(b) They are environmental friendly.
(c) They are synthetic materials.
(d) Both (b) and (c).

26. Which of the following is a non-biodegration materials?
(a) Peels of vegetables and fruits.
(b) Fallen leaves.
(c) Wood
(d) Aluminium cans

27. Electrical switches and plugs are usually made up of
(a) PVC (b) bakelite
(c) nylon (d) polystyrene

28. Kitchenwares and crockery items are made up of
(a) melamine
(b) perspex
(c) PVC
(d) polythene

29. Teflon is not preferred to make
(a) non-sticky frying pan
(b) electric iron sole
(c) gaskets
(d) raincoat

30. Lenses, window pans, etc., are made up of
(a) PVC
(b) polythene
(c) perspex
(d) polystyrene

Answers

1	*(c)*	2	*(d)*	3	*(a)*	4	*(b)*	5	*(c)*	6	*(b)*	7	*(a)*	8	*(d)*	9	*(b)*	10	*(b)*
11	*(c)*	12	*(b)*	13	*(d)*	14	*(d)*	15	*(c)*	16	*(a)*	17	*(d)*	18	*(b)*	19	*(b)*	20	*(d)*
21	*(b)*	22	*(c)*	23	*(a)*	24	*(b)*	25	*(b)*	26	*(d)*	27	*(b)*	28	*(a)*	29	*(d)*	30	*(c)*

CHAPTER

11

CROP PRODUCTION AND MANAGEMENT

Food is a substance that provides us energy to do work grow, remain healthy and protects the body against various diseases and infections. It can be of plant origin or animal origin.

Crops

When plants of same type are grown and cultivated in a field at large scale, it is called a crop and the pattern of growing such crops is called cropping pattern, e.g. wheat crop, paddy crop, etc. The two broad cropping patterns are

(i) **Kharif Crops** The crops that are sown in rainy season are called kharif crops or summer crops. These are sown in June-July and harvested at the end of monsoon season, i.e. during September, e.g. paddy (rice), maize, cotton, groundnut, millets, etc.

(ii) **Rabi Crops** The crops that are grown in winter season are called rabi crops or winter crops. These are sown during October-November and harvested by the end of March, till April end e.g. wheat, gram, pea, mustard and linseed.

All methods of growing crop are discussed in this chapter. Rabi and kharif crops are two main crops in India is produce food. Balance diet is needed by human beings to remain healthy.

Agricultural Practices

Cultivation of crops involves several activities undertaken by farmers over a period of time. These activities or tasks are referred to as agricultural practices.

1. Preparation of Soil

Soil is prepared by sowing seeds by two major methods

(a) Ploughing

- The process of loosening and turning the soil is called ploughing or tilling. It is done by using a plough.
- It is beneficial as it helps the roots to penetrate deeper in the soil, breathe easily, removes weeds. It turns the soil to enrich it with nutrients.

(b) Levelling

- The ploughed soil becomes loose, therefore to prevent soil erosion, the ploughed soil is levelled by pressing it with a wooden or iron leveller.
- Levelling also helps in the uniform distribution of water in the fields during irrigation.

2. Agricultural Implements

The agricultural practices are done by using various tools. These tools are called agricultural implements. These include plough and seed drilll cultivator.

3. Sowing

It is the process of scattering or putting seeds into the soil, so as to grow a new crop plant. It is done with the help of traditional tools (funnel-shaped tool) and seed drill (mechanical method of sowing using a tractor).

4. Adding Manure and Fertilisers

Some substances are added in the soil to provide nutrients to the plant for their healthy growth. These are called as manure and fertilisers.

- **Manures** are organic substances derived from the decomposition of plant and animal wastes like cow dung, urine, etc. Plant and animal wastes are dumped in pits at open places and allowed it to decompose by some microorganisms. The decomposed matter is used as organic manure.
- **Fertilisers** are chemical substances which are rich in a particular nutrient, *e.g.*, unea, ammonium sulphate, potash, etc.

5. Irrigation

- To maintain the moisture of the soil the fields are watered regularly. This process of supplying water at regular intervals is called irrigation.
- The sources of water for irrigation are wells, tubewells, ponds, lakes, rivers, dams and canals.
- The traditional methods of irrigation involve moat or pully system, dhekli and chain pump, etc. The modern methods of irrigation involve sprinkler system and drip system.

6. Protection from Weeds

- While the plants are grown in the field, many small, unwanted plants also germinate and grow in the field along with the crop plant. These unwanted, wild plants that grow along with the cultivated crops are called weeds.
- Many methods are adopted by farmers to remove these weeds and to control their growth. These methods include tilling, using hoe spraying of weedicides like 2-4, D and manually removing them by hands.

7. Harvesting

When crops get matured, they are cut and gathered. This process is called crop harvesting. It occurs in following steps

- Crop is harvested by pulling it out or by cutting it close to the ground. It is either done manually by sickle or by a machine called harvester.
- After that grain seeds are separated from the chaff. It is called threshing. This is carried out with the help of a machine called combine which is a combination of harvester and thresher.
- Then the grains are separated from chaff by the process called winnowing.

8. Storage

- Since the crops/grains have to be kept for longer time, they should be safe from moisture, insects, microorganisms, etc. Therefore, the harvested and cleaned gains are first dried to evaporate moisture.
- It is followed by spraying of insecticides and rodenticides to protect it from rats and insects. After that, the grains are stored in jute bags or metallic bins (silos) and in big godowns).

Food From Animals

- Some animals are reared at home or in farms for then products. When this is done at large scale it is called animal husbandry. We get milk, eggs ghee, butter, meat, etc from different animals.
- At large scale, grains are stored in silos and granaries to protect them from pests. The big containers that are used for the storage of grains in large quantities are called silos. They protect the stored grains from pests and insects.

Components of Food

Our food is usually made up of one or more ingredients, which we get from plants or animals. These are called nutrients as these provide nourishment to our body.

The nutrients present in our food are as follows

	Component	Characteristic	Source
1.	Carbohydrates	• Main source of energy. • Mainly obtained from plant sources.	• Wheat, rice, maize, pearl millet, potato, sugar, banana, mango, etc.
2.	Protein	• Essential for the growth and repair of the body tissues. • Can be of plant or animal origin.	• Animal protein–Milk, cheese, egg, fish or meat. • Vegetable protein–Gram, moong, tuardal, beans, peas, etc.
3.	Fats	• Provide energy to the body. • Can be obtained from plants as well as from animals.	• Animal fat–Butter, ghee, milk, egg. • Plant fat–Groundnut oil, sunflower oil, til oil, nut oil, etc.
4.	Vitamins **Fat soluble** vitamin-A, D, E and K **Water soluble** vitamin-B and C	• Required in small quantities and essential for proper working of the body. • If lacking in food, cause deficiency diseases.	• Vitamin-A–Night blindness orange, carrot, spinach. • Vitamin-D (Rickets)–Fish, egg, liver. • Vitamin-E (infertility)–Many fruits and vegetables. • Vitamin-K (non-clotting of blood)–Green vegetables. • Vitamin-B (Beri-beri)–Vegetables, rice, brococoli, etc. • Vitamin-C (Scurvy)–peppers, citrus fruits.
5.	Minerals	• Required for proper functioning, normal growth and good heath.	• Spinach (Fe), salt (NaCl).
6.	Roughage	• Reduces the risk of heart disease and bowel cancer.	• Whole grain, pulses, potatoes, fresh fruits, salads etc.

PRACTICE EXERCISE

1. Kharif crops are grown in
   (a) winter season (b) rainy season
   (c) summer season (d) Both (a) and (b)

2. Identify the kharif crop from the following.
   (a) Groundnut (b) Wheat
   (c) Pea (d) Mustard

3. Rabi crops are grown during
   (a) June – July
   (b) January – February
   (c) August – September
   (d) October – November

4. Among the following rabi crop is
   (a) wheat (b) cotton
   (c) millet (d) maize

5. Identify the correct set of rabi crops.
   (a) Wheat, gram, pea
   (b) Groundnut, mustard, soybean
   (c) Millet, paddy, pea
   (d) Mustard, linseed, cotton

6. Ploughing is a method of preparing soil. It is beneficial as
   (a) it removes weeds
   (b) helps roots of penetrate deeper
   (c) helps roots to breathe easily
   (d) All of the above

7. Ploughing is the process of
   (a) loosening and turning the soil
   (b) levelling of soil
   (c) watering the crop
   (d) None of the above

8. The process of scattering or putting seeds into the soil is called
   (a) irrigation (b) ploughing
   (c) sowing (d) levelling

9. The modern method of sowing seeds is
   (a) funnel (b) seed-drill
   (c) plough (d) tilling

10. In seed-drill, sowing is done with the help of
    (a) funnel (b) plough
    (c) tractor (d) leveller

11. Manures all
    (a) organic substances
    (b) inorganic substances
    (c) salts
    (d) Both (a) and (b)

12. Manures are derived from the decomposition of
    (a) cow dung (b) wine
    (c) dead leaves (d) All of these

13. The chemical substances rich in particular nutrients are called
    (a) manures
    (b) fertilisers
    (c) decomposed matter
    (d) None of the above

14. Which of the following is not true for fertilisers?
    (a) They increase the yield
    (b) Their excessive use disturbs the balance of nutrients in soil
    (c) They are generally used in small quantity
    (d) They are environment friendly

15. Watering the crops is called
    (a) sowing (b) manuring
    (c) tilling (d) irrigation

16. The system of irrigation where water is supplied drop by drop near the roots of plants, is called
    (a) pulley system (b) drip system
    (c) sprinkler system (d) lever system

17. Weeds are the
    (a) main crop plants
    (b) insects and pests
    (c) unwanted plants growing along the crop
    (d) chemical substances

18. Which of the following tools would a farmer use to remove weeds from the field?
(a) Leveller (b) Plough
(c) Trowel (d) Cultivator

19. 2,4-D is a
(a) pesticides (b) insecticides
(c) fungicides (d) weedicides

20. The term used for the process of separation of grains from chaff is
(a) sieving (b) winnowing
(c) threshing (d) hand picking

21. Threshing is carried out with the help of a machine called
(a) thresher (b) harvester
(c) combine (d) plough

22. The big containers that are used for the storage of grains in large quantities are called
(a) silos (b) bags
(c) cold house (d) None of these

23. Milk yielding animals are called
(a) milch animals
(b) drought animals
(c) broilers
(d) layers

24. The main source of energy in our food is
(a) protein (b) carbohydrate
(c) fats (d) vitamin

25. Food component essential for the growth and repair of the body tissues is
(a) carbohydrate (b) protein
(c) roughage (d) minerals

26. Food component that provides energy is
(a) carbohydrate
(b) fat
(c) protein
(d) Both (a) and (b)

27. Deficiency of vitamin-C causes
(a) anaemia (b) rickets
(c) scurvy (d) xeropthalmia

28. Water soluble vitamins are
(a) vitamin-A and D (b) vitamin-E and K
(c) vitamin-B and C (d) None of these

29. A good source of vitamins of B group is
(a) carrot
(b) fish oil
(c) germinated seeds
(d) egg yold

30. Tocopherol is the chemical name of
(a) vitamin-B (b) vitamin-E
(c) vitamin-C (d) None of these

Answers

1	(b)	2	(a)	3	(d)	4	(a)	5	(a)	6	(d)	7	(a)	8	(c)	9	(b)	10	(c)
11	(a)	12	(d)	13	(b)	14	(d)	15	(d)	16	(b)	17	(c)	18	(c)	19	(d)	20	(b)
21	(c)	22	(a)	23	(a)	24	(b)	25	(b)	26	(d)	27	(c)	28	(c)	29	(c)	30	(b)

CHAPTER

12

MICROORGANISMS AND FOOD PRESERVATION

This chapter deals with microorganisms like be Bacteria, fungi, protozoa, algae, viruses and desires caused by these in plants and animals. The benefits are derive from microorganisms are also discussed which are important from examination points of view.

Microorganisms

- Organisms that cannot be seen with the unaided eyes are called microorganisms or microbes.
- These microorganisms are as small as 10^{-6} nm in size.
- Some of these such as fungus grown on moist bread can be seen with magnifying glass while others need a microscope for their presence.

Habitat of Microorganisms

- Microorganisms are spread over the entire biosphere. They are found in soil, water, air, inside the bodies of plants and animals.
- They show a high degree of adaptability and can be found in harsh conditions like hotsprings, deserts, marshy areas, etc.

Major Groups of Microorganisms

SN	Micro organisms	Characteristics
1.	Bacteria	• These are simplest unicellular organisms having rigid cell wall like plant cells. • Based on their shapes, bacteria are of four types, i.e. bacillus (rod-shaped), coccus (spherical-shaped), spirillum (spiral-shaped) and vibrio (comma-shaped), e.g. *Lactobacieeus, Rhizobium*.
2.	Fungi	• It is a large group of organisms which do not have chlorophyll and do not photosynthesise, thus are heterotrophs, e.g. yeast, *Penicillium, Aspergillus* and *Rhizopus* (bread mould). • Fungi may be unicellular (yeast) or multicellular. (*Aspergillus*)
3.	Protozoa	• It is a group of single-celled microorganisms that have animal-like characteristics. • They can move from place to place, e.g. *Amoeba* and *Paramecium*.
4.	Algae	• It is a large group of simple, plant-like organisms. But they have no roots, stems or leaves. • They can be unicellular or multicellular. They are photoautotrophs, e.g. *Chlamydomonas* and *Spirogyra*.
5.	Viruses	• These are also microscopic disease causing entities which reproduce only inside the cells of the host organisms (plants, animals, humans).

Beneficial Microorganisms

Use	Comment
1. **In household products**	
• Curd	The bacterium *Lactobacillus* converts milk into curd. It is added to idlis and bhaturas to make them soft and spongy.
• Dough	Yeast when added in dough produces carbon dioxide during cellular respiration. The bubbles of the gas fill the dough and increase its volume. This dough is used for making breads, pastries and cakes, etc.
• Cheese	It is produced by the curdling of milk. Cottage cheese is prepared by using *Streptococcus lactis*.
2. **In Industries**	
• Fermentation	The microbes are used for the large scale production of alcohols, wine and acetic acid. The process of conversion of sugar into alcohol is called **fermentation**. It was discovered by **Louis Pasteur** in 1857.

3. **In Medicines**	
• Antibiotics	These are chemicals produced by microbos and are used to kill or stop the growth of disease causing microorganisms in human beings and animals, e.g. penicillin (discovered by Alexander fleming).
• Vaccines	These provide immunity against a particular disease. It consists of a dead or weakend microbes which when introduced in a healthy body, produce suitable antibodies to fight and kill themselves.
4. Increasing soil fertility	Some bacteria and blue-green algae can fix atmospheric nitrogen and thus increase the soil fertility, e.g. *Rhizobium, Anabaen, Nostoc*.
5. Cleaning of environment	Some microbes decompose the harmful and smelly dead remains of plants and animals. They convert them into simple substances and thus clean the environment. These are called (decomposers), e.g. fungi, bacteria, etc.

Harmful Microorganisms

Some microorganisms are harmful for us. Some of diseases caused by microorganism are described below

Disease Causing Microorganisms in Humans

Some of the microorganisms cause diseases in human beings. Such disease causing microorganisms are called **pathogens**. The table given below depicts certain facts about some common human diseases.

Name of Disease	Causal Microorganism	Mode of Transmission	Preventive measure (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation.
Measles	Virus	Air	Keep the personal belongings of the patient away from those of the healthy persons.
Chickenpox	Virus	Air/contact	Vaccination to be given at suitable age.
Polio	Virus	Air/water	Vaccination
Cholera	Bacteria	Water/food	Consume properly cooked food and boiled drinking water.
Typhoid	Bacteria	Water	Maintain personal hygiene and good sanitary habits.

Disease Causing Microorganisms in Plants and Animals

Some of disease causing organisms are tabulated below

Disease Animals	Micro Organisms	Animal/Plant Affected
Anthrax	Bacteria (*Bacillus anthracis*) discovered by Robert Koch (1876)	Cattle
Foot and mouth disease	Virus	Cattle
Swine flu	Virus	Pigs
Bird flu	Virus	Birds

Disease Animals	Micro Organisms	Animal/Plant Affected
Plants Citrus canker	Bacteria	Lemon
Rust of wheat	Fungi	Wheat
Yellow vein mosaic of bhindi (okra)	Virus	Bhindi

Food Poisoning

- It occurs due to the consumption of food spoilt by some microorganisms.
- It's symptoms include vomiting, diarrhoea, headache, fever, etc. It is caused by bacteria (like *Salmonella*, *Clostridium*), fungus (like *Aspergillus*), etc.

Food Preservation

The process by which spoilage of food is prevented using suitable chemical or physical methods is called food preservation. Some of these methods are given below

(i) **Drying or dehydration** It means removal of water from food materials. In the absence of moisture, the food microorganisms stop growing. Vegetables (spinach, peas, etc), pulses, spices and dry-fruits are preserved by this method.

(ii) **Special preservatives** Sodium benzoate and sodium metabisulphite are common preservatives used to check the growth of microbes. They are added to pickles and also used in jams and squashes to check their spoilage.

(iii) **Preservation by common salt** Common salt has been used to preserve meat and fish for ages. Salting is also used to preserve amla, raw mangoes, tamarind, etc.

(iv) **Preservation by sugar** Jams, jellies and squashes are preserved by sugar. Sugar reduces the moisture content which inhibits the growth of bacteria which spoil food.

(v) **Preservation by oil and vinegar** Use of oil and vinegar prevents spoilage of pickles because bacteria cannot live in such an environment.

(vi) **Hot and cold treatments** Boiling kills many microorganisms. Similarly, we keep our food in the refrigerator, low temperature inhibits the growth of microbes.

(vii) **Pasteurisation** It is used for the preservation of milk. It involves the process of heating milk to about 70°C for 15-30 seconds (killing most of bacteria) and then cooling quickly to a very low temperature.

(viii) **Proper storage and packing** Dry-fruits and vegetables are sold in sealed and air tight packets to prevent the attack of microbes.

Nitrogen-Fixation

- It is the process of conversion of atmospheric nitrogen into nitrogenous compounds.
- It occurs by lightening, certain nitrogen fixing bacteria (e.g., *Azotobacter*), blue-green algae (e.g., *Anabaena*, *Nostoc*) and *Rhizobium* (symbiotic bacteria).

Nitrogen Cycle

- The atmospheric nitrogen remains constant, although it is continuously used by plants and animals. This happens through a cycle of processes grouped together called **nitrogen cycle**.
- Certain microbes fix atmospheric nitrogen. It is utilised by plants and animals feeding on plants.
- After their death certain bacteria and fungi change nitrogenous compounds into simple compounds and nitrogen gas is liberated into the atmosphere.

PRACTICE EXERCISE

1. The simplest unicellular organisms having rigid cell wall like plant cells are
   (a) virus (b) bacteria
   (c) protozoans (d) fungi
2. The spiral-shaped bacteria are called
   (a) bacillus (b) coccus
   (c) spirillum (d) vibrio
3. The vibrio bacteria are
   (a) rod - shaped
   (b) spiral - shaped
   (c) comma - shaped
   (d) spherical - shaped
4. The organisms which do not have chlorophyll and are mostly heterotrophs are
   (a) bacteria (b) algae
   (c) viruses (d) fungi
5. *Amoeba* and *Paramecium* are
   (a) protozoans (b) bacteria
   (c) virus (d) fungi
6. The simple plant-like organs that lack roots, stems or leaves are
   (a) protozoans (b) algae
   (c) virus (d) fungi
7. The organisms that can be stored as crystals are
   (a) virus (b) bacteria
   (c) algae (d) fungi
8. Microorganisms found in
   (a) deserts (b) marshy lands
   (c) hotsprings (d) All of these
9. Which of these do not have a regular cell strucutre?
   (a) Bacteria (b) Viruses
   (c) Protozoa (d) Algae
10. The bread of idli dough rises because of
    (a) heat
    (b) grinding
    (c) growth of yeast cells
    (d) kneading
11. The process of conversion of sugar into alcohol is called
    (a) nitrogen fixation (b) moulding
    (c) fermentation (d) infection
12. Curd is formed due to the presence of bacterium
    (a) *Lactobacillus* (b) *Streptococcus*
    (c) *Bacillus* (d) None of these
13. Cottage cheese is prepared by using
    (a) *Lactobacillus* (b) *Streptococcus lactis*
    (c) *Saccharomyces* (d) *Penicillium*
14. Fermentation was discovered by
    (a) Louis Pasteur (b) Robert Hooke
    (c) Robert Brown (d) Charles Darwin
15. The first antibiotic was
    (a) penicillin (b) streptomycin
    (c) tetracycline (d) erythromycin
16. The following is an antibiotic
    (a) sodium bicarbonate (b) streptomycin
    (c) alcohol (d) yeast
17. Vaccine contains
    (a) live microbes (b) dead microbes
    (c) weakend microbes (d) Both (b) and (c)
18. Vaccines provide immunity by producing
    (a) antigens (b) antibodies
    (c) pathogens (d) None of these
19. The microbe that increases soil fertility is
    (a) *Rhizobium* (b) *Lactobacillus*
    (c) yeast (d) *Streptococcus*
20. The bacterium, found in root nodules of leguminous plants is
    (a) *Anabaena* (b) *Nostoc*
    (c) *Azotobacter* (d) *Rhizobium*
21. The nitrogen-fixing blue-green algae is/are
    (a) *Azotobacter* (b) *Nostoc*
    (c) Anabaena (d) Both (b) and (c)
22. Typhoid is caused by
    (a) bacteria (b) virus
    (c) protozoa (d) fungus

23. Which of the following is a viral disease?
(a) Typhoid (b) Polio
(c) TB (d) Leprosy

24. Cholera is an infectious digestive disorder in which patients have loose motions and vomiting. It is caused by.....
(a) virus (b) fungi
(c) Bacteria (d) None of these

25. Foot and mouth disease of cattle is caused by
(a) virus (b) bacteria
(c) protozoan (d) fungi

26. Citrus canker is caused by
(a) bacteria (b) fungi
(c) virus (d) protozoan

27. Food poisoning is caused by
(a) *Salmonella* (b) *Clostridium*
(c) *Aspergillus* (d) All of these

28. The spoiling of food is a
(a) physical change
(b) chemical change
(c) Both (a) and (b)
(d) None of these

29. Common food preservative is
(a) sodium benzoate
(b) sodium metabisulphate
(c) mercuric chloride
(d) Both (a) and (b)

30. Pasteurisation was discovered by
(a) Louis Pasteur (b) Darwin
(c) Khurana (d) Hooke

31. Jams are preserved by
(a) salts (b) sugars
(c) pasteurisation (d) irradiation

32. Dryfruits are prevented by spoiling through
(a) storage and packing (b) pasteurisation
(c) oil (d) salt

33. Common salt is used to preserve
(a) meat (b) fish
(c) tamarind (d) All of theseabove

34. Vinegar prevents spoilage of
(a) jams (b) jellies
(c) pickles (d) None of these

35. Pasteurisation is done at
(a) 100° C (b) 30° C (c) 70° C (d) 45° C

Answers

1	(b)	2	(c)	3	(c)	4	(d)	5	(a)	6	(b)	7	(a)	8	(d)	9	(a)	10	(c)
11	(c)	12	(a)	13	(b)	14	(a)	15	(a)	16	(b)	17	(d)	18	(b)	19	(a)	20	(d)
21	(d)	22	(a)	23	(b)	24	(c)	25	(a)	26	(a)	27	(d)	28	(b)	29	(d)	30	(a)
31	(b)	32	(a)	33	(d)	34	(c)	35	(c)										

CHAPTER

13

THE LIVING AND NON-LIVING

The term living thing refers to things that are now or once were alive. A Non-living thing is anything that was never alive. In order for something to be classified as living, it must grow and develop, use energy, reproduce and is made up of cells. Living and Non-living things interact with each other all the time.

The characteristics of living and non-living things are discussed within chapter.

Cell

- The cell is the basic structural and functional unit of all living organisms.
- It is the smallest unit of life and is the building block of the body organisms.
- **Robert Hooke** coined the term cell, when he saw honey-comb-like structure in the section of cork with his primitive microscopes.

Structure of and Function of cell

It deals with the shape, size and parts and their function of cell.

Shape and Size of Cells

- The cell may vary in their shapes. They are round or spherical, (*zq.* RBCs) spindle-shaped, (in muscle cells), long branched, (in nerve cells, etc.
- WBC's or White Blood Cells and *Amoeba* are able to change their shape.
- Size of cell is related to its function.

- The largest known cells are unfertilised **ostrich egg** cells (size 6 inch diameter).
- The smallest cell is of Pleuro Pneumonia Like Organisms (**PPLO**) also called Mycoplasma gallisepticum. It measures about 0.1-0.3 µm.
- **Human nerve cell** is the longest animal cell.
- Largest unicellular plant is *Acetabularia* (10 cm) and animal is *Amoeba* (1 mm).
- The largest human cell is the **female ovum** (1mm) and the smallest human cell is the **red blood cell**.

Parts of Cell

The various components of plant and animal cells are described below

Cell Wall

- It is a characteristic feature of only plant cells and fungi.
- It is an outer thick additional layer surrounding the plasma membrane.
- It protects the cell against wind, temperature, variation, moisture conditions and also provides shape and rigidity to cells.

Cell Membrane

- It is the outer boundary of the cell enclosing the cytoplasm and nucleus.
- It is also called plasma membrane.
- It is semi-permeable, i.e. allows certain substances to move inward and outward.
- It helps to separate cells from each other and their surrounding medium.

Cytoplasm

It is a jelly-like substance present between cell membrane and nucleus containing various cell organelles.

Nucleus

- It was discovered by **Robert Brown** (1831).
- It contains nucleoplasm, nucleolus and chromatin material.
- All this material is covered up by a nuclear membrane.
- Chromatin is the **controlling centre of cell** as it forms chromosomes.

Chromosome

- It is thread-like structure, found in the nucleus of the cell.
- Bead-like structures found on chromosome are called **genes**, which are made up of DNA and are the carrier of genetic information from generation to generation.
- Chromosomes are units of inheritance.

Cell Organelles

A cell performs different functions with the help of various small highly specialised structures called organelles present in the cytoplasm. Some of these are as given below

Vacuoles

- These are sac-like structures, containing a solution of mineral salts and sugars (i.e. cell sap). In **plant cells,** the vacuoles are large distinct and permanent, occupying most of the volume of the cell.
- On the contrary, an **animal cell** has small and temporary vacuoles or it may be absent.

Plastids

They occur in most plant cells and are absent in animal cells. They are of different colours and types as given below

- **Chromoplasts** These are the coloured plastids(except green), give fruit and flower their colour.
- **Leucoplasts** These are the colourless plastids, store food.
- **Chloroplasts** These are the green coloured plastids also called kitchen of the cell.
  They contain the green pigment, chlorophyll that is essential for photosynthesis and provides green colour to the leaves.

Comparison of Plant Cells and Animal Cells

There are certain features that distinguish a plant cell from animal cell as listed below is the table

Plant Cell	Animal Cell
A plant cell has rigid wall on the outside.	A cell wall is absent.
It cannot change its shape.	An animal cell can often change its shape.
Plastids are found in plant cells.	Plastids are usually absent.
A mature cell has large central vacuoles.	An animal cell may have many small vacuoles.
Reserve food is generally starch and fat.	Reserve food is usually glycogen and fat.

Prokaryotic and Eukaryotic Cell

On the basis of type of nucleus, cells are classified into two types

(i) **Prokaryotes** (*Pro*-primitive, *karyon*-nucleus) The cells having nuclear material without nuclear membrane are called prokaryotic cells, e.g. bacteria and blue-green algae.

(ii) **Eukaryotes** (*Eu*-true, *karyon*-nucleus) The cells having well-organised nucleus with nuclear membrane are called eukaryotic cells, e.g. all the organisms except bacteria and blue-green algae.

Cellular Composition in Different Organisms

Depending on the number of cells, organisms can be

(i) Unicellular organisms (having single cell, e.g. *Amoeba*, *Paramecium*, etc.)

(ii) Multicellular organisms (having many cells, e.g., plants, animals, man, etc.)

Thus, cells are the basic unit of life. All the vital process are performed in the cells. These make a characteristic difference between livings and non-livings.

The living beings are different from non-livings in many ways. These differences can be understand by the given table

Character	Living beings	Non-livings
Cell	Made up of cells.	Lack cells.
Organisation levels	Same type of cells performing same function form tissue which in turn form organ and organ system.	Lack organisational levels.
Growth	Growth occurs from inside.	Growth occurs from outside.
Life cycle	All organisms follow a life cycle of birth, growth, reproduction, ageing and death.	Lack a life cycle.
Reproduction	Reproduce to produce offspring of their own kind.	Do not the proses of reproduction.
Nutrition	Living beings require proper nourishment. They may be autotrophic or heterotrophic.	They do not require nourishment.
Respiration	Respire to produce energy by the break down of food.	Do not respire.
Excretion	It is the process of throwing out waste from the body.	Lack excretion.
Response to stimulus	Response to stimulus, i.e. temperature, light, water, sound, touch, etc.	Do not show any response to stimuli
Movement	Show movement	Do not show movement

PRACTICE EXERCISE

1. In living beings, growth occurs from
   (a) inside
   (b) outside
   (c) does not occur
   (d) Both (a) and (b)

2. Same type of cells performing same functions are called
   (a) organ (b) tissue
   (c) organ system (d) None of these

3. Who lacks a life cycle?
   (a) Non-livings (b) Living beings
   (c) Both (a) and (b) (d) *Amoeba*

4. The process of producing offspring of their own kind is known as
   (a) excretion (b) nutrition
   (c) reproduction (d) respiration

5. Living beings respire to produce
   (a) offspring of their own kind
   (b) energy by the break down of food
   (c) food for the nutrition
   (d) None of the above

6. Through which process living beings throw out waste from their body
   (a) respiration (b) reproduction
   (c) excretion (d) growth

7. The characteristic feature(s) of living beings is/are
   (a) organisation level
   (b) excretion
   (c) respiration
   (d) All of the above

8. In which terms, growth of living beings is different from growth of non-livings?
   (a) Outside growth (b) Inside growth
   (c) Both (a) and (b) (d) No growth

9. Among the following who shows response to stimulus?
   (a) Earthworm (b) Man
   (c) Knife (d) Both (a) and (b)

10. Which of the following objects shows movement?
    (a) *Amoeba* (b) Rock
    (c) Knife (d) Pen

11. Who coined the term cell
    (a) Robert Brown (b) Darwin
    (c) Robert Hooke (d) Lamarck

12. The smallest unit of life is
    (a) tissue (b) cell
    (c) organ (d) None of these

13. Among the following which cell can change its shape?
    (a) White blood cell (b) *Amoeba*
    (c) Nerve cell (d) Both (a) and (b)

14. The largest known cell is
    (a) *Amoeba* (b) human egg
    (c) Ostrich egg (d) WBC

15. The smallest cell is
    (a) *Amoeba* (b) PPLO
    (c) Ostrich egg (d) RBC

16. The longest animal cell is
    (a) Nerve cell (Human)
    (b) PPLO
    (c) Red blood cell
    (d) None of the above

17. The largest unicellular plant is
    (a) *Acetabularia* (b) *Ectocarpus*
    (c) mint (d) None of these

18. The smallest human cell is
    (a) white blood cell (b) red blood cell
    (c) nerve cell (d) ovum

19. Cell wall is the characteristic feature of
    (a) *Amoeba* (b) animal cell
    (c) *Euglena* (d) plant cell

20. The outer thick additional layer surrounding the plasma membrane in plants is
    (a) cell membrane (b) cell wall
    (c) envelope (d) cyst

21. The cell wall protects the cell against
(a) wind
(b) temperature
(c) moisture conditions
(d) All of the above

22. The cell membrane allows
(a) all substances to move
(b) only water to move
(c) only certain substances to move
(d) does not allow any movement

23. The membrane that helps to separate cells from, each other and their surrounding medium is
(a) cell wall
(b) cell membrane
(c) nuclear membrane
(d) None of the above

24. The jelly-like substance-between cell membrane and nucleus is
(a) cytoplasm
(b) plasma membrane
(c) cell wall
(d) None of the above

25. Who discovered nucleus?
(a) Robert Hooke (b) Robert Brown
(c) Leeuwenhoek (d) Khurana

26. The nucleus contains
(a) nucleoplasm (b) nucleolus
(c) chromatin (d) All of these

27. Which one is known as the controlling centre of the cell?
(a) cytoplasm (b) chromatin
(c) cell membrane (d) None of these

28. The bead-like structures found on chromosomes are
(a) chromasm (b) genes
(c) nucleolus (d) vacuole

29. The unit of inheritance is
(a) chromosome (b) nucleus
(c) cytoplasm (d) nucleolus

30. The large, distinct and permanent vacuoles are found in
(a) animal cells (b) sex cells
(c) plant cells (d) All of these

31. The plastid that gives colour to fruits is
(a) chloroplast
(b) chromoplast
(c) leucoplast
(d) None of the above

32. The colourless plastids that store food are
(a) Leucoplasts
(b) Chloroplasts
(c) Chromoplasts
(d) Both (a) and (b)

33. The kitchen of the cell is
(a) mitochondria (b) chloroplast
(c) leucoplast (d) chromoplast

34. The plant cell differs from animal cell in
(a) having rigid cell wall
(b) presence of plastids
(c) presence of large vacuole
(d) All of the above

35. Identify the prokaryotic cell from the following
(a) bacteria (b) blue-green algae
(c) *Amoeba* (d) Both (a) and (b)

Answers

1	(a)	2	(b)	3	(a)	4	(c)	5	(b)	6	(c)	7	(d)	8	(b)	9	(d)	10	(a)
11	(c)	12	(b)	13	(d)	14	(c)	15	(b)	16	(a)	17	(a)	18	(b)	19	(d)	20	(b)
21	(d)	22	(c)	23	(b)	24	(a)	25	(b)	26	(d)	27	(b)	28	(b)	29	(a)	30	(c)
31	(b)	32	(a)	33	(b)	34	(d)	35	(d)										

CHAPTER

14

CONSERVATION OF PLANTS AND ANIMALS

In this chapter, we will discuss carbon, its various forms, its compounds, fuels and petroleum and their types.

Conservation

It is a term used to describe the prudent (careful and sensible) use of natural resources like air, water, soil, minerals, fuels, forests, plants and animals.

Forest

A forest is a large area covered with trees and plants. It provides habitats for animals and plants.

Deforestation and its Causes

The process of clearing away forests by cutting them down or burning them is called deforestation. People clear forests to use the wood or to make way for farming or development.
The various causes of deforestation are

(i) **Procuring land for cultivation** Forest trees are cut down to obtain more agricultural land for cultivation of crops to feed the increasing population.

(ii) **Building houses and factories** The trees are cut down to build homes, factories, roads, dams, etc.

(iii) **Making various products** These such as paper or wood for making doors, windows, etc., are obtained from trees.

(iv) **Natural causes** It includes forest fires, severe droughts, etc.

Consequences of Deforestation

Deforestation has the following adverse effects on the environment.

1. **Global warming** Plants use carbon dioxide for photosynthesis (preparation of food). When fewer trees will be left due to deforestation, less carbon dioxide will be used up. This will result in its increased amount in the atmosphere. A possible consequence is global warming as carbon dioxide traps the heat rays reflected by the surface of the earth.
2. **Disturbance in water cycle** The consequent increase in temperature on the earth disturbs the water cycle. This leads to decrease in rainfall that lowers the groundwater level and could cause **droughts.**
3. **Soil Erosion and desertification** When the forest trees are cut, there are no roots and the bare topsoil becomes loose quickly and erodes rapidly. This results in more **soil erosion,** exposing the lower layer that has less humus and is less fertile.
4. **Desertification** The properties like nutrient content, texture, etc., of soil also changes. Overtime continued soil erosion can thus convert the land into a desert. This is called desertification.
5. **Floods** The roots of forest trees help in absorbing the rainwater and make it percolate into the ground. Due to deforestation, there is decrease in the water-holding capacity of the soil. The movement of water from the soil surface into the ground is reduced. This results in floods (excess water overflowing from the banks of the river into the adjoining areas).

Reforestation

It is restocking of the destroyed forests by planting new trees (generally of the same species.

In India, there are following conservation acts to save forests:

(i) The Government of India has enacted a **Forest Conservation Act (1980)** to save forests. It aims at preservation and conservation of natural forests, while meeting the basic needs of the people living in or near the forests at the same time.

(ii) The **Chipko Andolan,** a people's movement to save trees, started in a couple of villages in Uttarakhand and spread over the Himalayan region under the leadership of activists like Sunderlal Bahuguna and Chandi Prasad Bhatt.

(iii) The **Joint Forest Management Programme** launched by the government aims at regenerating and protecting degraded forests with the people's participation.

Conservation of Forests and Wildlife

The efforts to protect and preserve forests and wildlife are directed generally along the following lines:

(i) **Protection by law** It is very necessary to have strict laws and their enforcement for the protection and preservation of wildlife, e.g. hunting regulation, rules for unauthorised felling of trees, etc.

(ii) **Afforestation** It is the act of planting more trees to replace the ones that are cut. It also takes place naturally if the area is left undisturbed.

(iii) **Protection from forest fires** It can be done by spraying fire extinguishing solutions from aircrafts or by changing the direction of wind by using strong blowers.

(iv) **Personal and society efforts** Some organisations help in conservation of forests through their projects, programmes and joint efforts with the government, e.g. Van Mahotsava programme is celebrated every year during the first week of July in India (initiated in 1950).

(v) **Habitat preservation** In this method, protected areas such as wildlife sanctuaries, national parks, biosphere reserve, etc are established. These areas are large enough to protect the diverse and whole set of ecosystems. Plantation, cultivation, grazing, cutting of trees, hunting and poaching are prohibited in these protected areas.

Biodiversity

It refers to the variety of organisms existing on the earth, their inter-relationships and relationships with the environment.India is sixth on the list of 12 mega-biodiversity countries in the world. It contains two of the 34 biodiversity hotspots of the world— Eastern Himalayas and the Western Ghats. These areas are very rich in biodiversity.

India contains 172 species of animals considered globally threatened or 2.9% of the world's total number of threatened species. Eastern Himalayas hotspot has merely 163 globally threatened species including several animal and plant species. India contains globally important population of some of Asia's rarest animals such as the Bengal fox, Marbled cat, Asiatic lion, Indian elephant, Asiatic wild ass, Indian rhinoceros, gaur, wild Asiatic water buffalo, etc.

Wildlife Sanctuary

A wildlife sanctuary is a protected area for animals in their natural environment like forests. There is no disturbance to animals and their habitat. Killing (poaching) and capturing of wild animals is strictly prohibited.

Some of the threatened wild animals like black buck, white-eyed buck, elephant, golden cat, pink-headed duck, gharial, marsh crocodile, python, rhinoceros, etc are protected and preserved in our wildlife sanctuaries.

It is important to take a note of zoos or zoological parks, it is a large area where many types of wild animals and birds brought from different parts of the world are kept in cages or enclosures, so that people can see them.

National Park

It is a relatively large protected area and is maintained by the government to preserve flora and fauna, landscape, historic objects of the area and places of scientific interest. People are allowed to enter these areas but exploitation of natural resources is strictly prohibited.

India has more than 105 national parks. Many of these national parks were initially wildlife sanctuaries, e.g. Keoladeo national park.

A national park has a large species of wild animals in it, e.g. **Satpura national park** in Pachmarhi Reserve has tiger, gaur (Indian bison), leopard, Indian giant squirrel, sambar, sloth bear, cheetal, barking deer, wild boar, Rhesus monkey, langur, nilgai, hyena, wild dog, porcupine, marsh crocodile and four-horned antelope.

Project Tiger

It is a wildlife conservation project which was launched by the Government of India in 1973 to protect the tigers in the country. The objective of this project was to ensure the survival and maintenance of the tiger population in the country.

From 9 tiger reserves in its formative years, the Project Tiger coverage has increased to 47 at present. There is a 'Satpura Tiger Reserve' in the Satpura national park which is a part of Project Tiger.

Species

It is a group of population which is capable of interbreeding. This means that the members of a species can reproduce fertile offspring (one which can reproduce its own kind) only with the members of their own species and not with members of other species. Members of a species have common characteristics, e.g. human, tiger. There are about 6,00,000 species of animals and 4,00,000 species of plants in the world.

Endemic Species

These are the species of plants and animals which are found exclusively in a particular area, e.g. sal and wild mango are examples of endemic flora of the Pachmarhi biosphere reserve. Bison, Indian giant squirrel and flying squirrel are endemic fauna of this area.

Endangered Animals and Extinct Animals

The species which no longer exist anywhere on the earth are called **extinct animals**. These have died out completely. A species becomes extinct when the last living member of that species dies, e.g. dodo, dinosaurs, iris deer, etc.

Animals whose numbers are diminishing to a level that they might face extinction are called **endangered animals**. These are on the verge of vanishing from the earth and if appropriate actions to save them are not taken, they may become extinct, e.g. lion-tailed macaque, tiger, snow leopard, Asiatic lion, etc.

The small animals are much more in danger of becoming extinct than the bigger animals.

Red Data Book

- A Red Data Book contains list of species whose continued existence is threatened, i.e. endangered animals and plants. Species are classified into different categories of perceived risk such as 'critically endangered', 'endangered' and 'vulnerable'.
- Some of the endangered species in Red Data Book of India are black buck, great Indian rhinoceros, Himalayan musk deer, etc.

Migration

The process of an animal (or bird) to move from one place to another on the basis of season is called migration. It is an adaptation to escape the harsh and cold conditions of their normal habitat, so as to survive and reproduce, e.g. Siberian crane, one of the most common migratory bird which comes to India every year from Siberia (when it is winters there). It comes to warmer places in India such as Bharatpur (Rajasthan).

PRACTICE EXERCISE

1. Which of the following does a forest prevent?
   (a) Floods
   (b) Soil erosion
   (c) Water table from going down
   (d) All of the above

2. Forests are not responsible for
   (a) providing medicinal plants
   (b) maintaining the flow of water into the streams
   (c) creating flood conditions
   (d) absorbing rainwater and maintaining water table

3. Which of the following products is not obtained from a forest?
   (a) Honey (b) Catechu
   (c) Gum (d) Ginger

4. Which of the following is not a correct statement?
   (a) Forest trees are cut done to obtain timber
   (b) Forest trees are cut down to obtain paper
   (c) Forest trees are cut down to obtain honey
   (d) Forest trees are cut down to obtain firewood

5. Which one of the following is a role of forests?
   (a) Provide food, shelter, water and medicines
   (b) Prevent soil erosion
   (c) Prevent flood
   (d) All of the above

6. Which one of the following is an animal product?
   (a) Gum (b) Catechu (c) Honey (d) Rubber

7. Trees help in reducing the pollution of our environment. Lakhs of trees are planted by people in the month of July every year. This occasion is called, as
   (a) Forest conservation Day
   (b) Plantation month
   (c) Van Mahotsav
   (d) Wildlife week

8. Which of the following is not done in a wildlife sanctuary?
   (a) Fauna is conserved
   (b) Flora is conserved
   (c) Soil and flora is utilised
   (d) Hunting is prohibited

9. Endemic plants are those, which are
   (a) Cosmopolitan in distribution
   (b) restricted to grow over certain areas
   (c) found in Arctic region
   (d) gregarious in habit

10. Which animal is the symbol of WWF?
    (a) Tiger (b) Hornbill
    (c) Giant Panda (d) White bear

11. Animals whose numbers are diminishing to a level that they might face extinction are known as
    (a) endangered (b) endemic
    (c) flora (d) fauna

12. Among the following the threatened wild animal is
    (a) black buck
    (b) white eyed buck
    (c) golden cat
    (d) All of the above

13. Dudhwa national park is in
    (a) Odisha
    (b) Gujarat
    (c) Uttar Pradesh
    (d) Himachal Pradesh

14. Siberian cranes are regular visitors of
    (a) Bharatpur sanctuary, Rajasthan
    (b) Lalbagh, Bengaluru
    (c) Vedanthgol Sanctuary, Tamil Nadu
    (d) Jim Corbett National Park, Uttarakhand

15. The book which helps a record of all the endangered animals and plants is
    (a) Pink Data Book
    (b) Red Data Book
    (c) Black Data Book
    (d) None of these

16. The species, which is going to become extinct due to the lack of proper care would be celled
(a) flora (b) endangered
(c) fauna (d) extinct

17. Wildlife is
(a) any living organism in any habitat
(b) predatory animals in their natural habitat
(c) any living organism in its natural habitat
(d) economically important animals and plants

18. Which amongst the following birds are migratory birds?
(a) Siberian crane (b) Parrot
(c) Kite (d) Swan

19. Number of wildlife is continuously decreasing. What is the main reason of this?
(a) Predation
(b) Cutting down of forests
(c) Destruction of habitats
(d) Hunting

20. Manas sanctuary is located at
(a) Rajasthan (b) Asom
(c) Bihar (d) Gujarat

21. The place where animals receive protection is
(a) Botanical garden (b) Museum
(c) Zoo (d) Both (a) and (c)

22. Ranthambor national park is situated in
(a) Asom (b) Jharkhand
(c) Uttarakhand (d) Rajasthan

23. Rajaji national park is situated in
(a) Tamil Nadu (b) Karnataka
(c) Uttarakhand (d) Rajasthan

24. Indian rhinoceros are protected in
(a) Gir forest
(b) Kaziranga national park
(c) Bandipur national park
(d) Ranthambor national park

25. Which one of the following is the first national park in India
(a) Kanha national park
(b) Periyar national park
(c) Corbett national park
(d) Bandipur national park

26. In your opinion which is the most effective way to conserve the plant diversity of an area?
(a) By tissue culture method
(b) By creating biosphere reserve
(c) By creating botanical garden
(d) By developing seed bank

27. The species which is slowly disappering from our forests
(a) Tiger (b) Monkey
(c) Dog (d) None of these

28. An animal which became extinct a long time ago is
(a) black buck
(b) tiger
(c) dinosaurs
(d) python

Answers

1	(d)	2	(c)	3	(d)	4	(c)	5	(d)	6	(c)	7	(c)	8	(c)	9	(b)	10	(c)
11	(a)	12	(d)	13	(c)	14	(a)	15	(b)	16	(b)	17	(c)	18	(a)	19	(c)	20	(b)
21	(c)	22	(d)	23	(c)	24	(b)	25	(c)	26	(b)	27	(a)	28	(c)				

CHAPTER

15

REPRODUCTION IN PLANTS AND ANIMALS

Reproduction is a biological process in which organisms produce offsprings. It is essential for the continuity of species in all living organisms. Broadly, the process of reproduction can be divided into following two types

1. Reproduction in Plants

The plants can reproduce by both ways, i.e. asexually and sexually.

Asexual Reproduction in Plants

The asexual reproduction in plants takes place by the following methods.

Reproduction in plants and animals as well as their vegetative Reproduction, Budding, Fragmentation etc.

(i) Vegetative Propagation

- New plants are produced from vegetative parts of the plants.
- Vegetative parts include roots, stems, leaves, etc.
- The vegetative units are called propagules.

Vegetative Propagule	Examples
Stems (by cutting)	Rose, sugarcane, cacti
Stems (by layering)	*Jasmine*
Leaves	*Bryophyllum*
Buds (eye)	Potato, ginger
Roots	Sweet potato, *Dahlia*

(ii) Budding

- New individual is formed from a small projection on parent body and forms bud.
- The bud grows and gets detached from the parent body.
- The detached part further grows, matures and forms new daughter cells, e.g. yeast.

(iii) Fragmentation

- The body of the parent breaks into small pieces called fragments. Each fragment grows up to become a new plant, *e.g.* Some algae (*Spirogyra*)

(iv) Spore Formation

The spores are asexual reproductive bodies where, under favourable conditions, spores germinate and develop a new individual, e.g. mosses, ferns, bread moulds, etc.

Sexual Reproduction in Plants

- **Flowers** are the reproductive part of a plant. They are considered as modified shoots.
- **Stamens** are the male reproductive organ. It is made up of-filament and anther.
- **Anther** contains pollen grains that contain male sex cells (male gamete).
- **Pistil** is the female reproductive part of flower. It is made up of three parts-stigma (top), style (middle) and ovary (lower).
- **Ovary** makes ovules that contain female sex cells (egg cells).

Types of Flower

On the basis of the type of reproductive organs present in a flower, the flowers are of following types

- **Unisexual flower** The flower which contains only one reproductive organ (i.e either male or female) is called unisexual flower. This is also called as incomplete flower, e.g. papaya, watermelon, cucumber, etc.
- **Bisexual flower** The flower that contains both reproductive parts (i.e. male and female) in a single flower is called a bisexual flower. This is also termed as hermaphrodite or complete flower, e.g. rose, mustard, *Hibiscus*, etc.

Various events occurring in plants during sexual reproduction are described below

Pollination

- The transfer of pollen grains from the anther of a stamen to the stigma of a pistil is called pollination.
- The process of pollination is carried out by external agencies like wind, water, insects, etc.
- Pollination takes place in two different ways
  - (i) **Self-Pollination** The pollen grain from the anther of one flower reaches to the stigma of the same flower. It generally occurs in a bisexual flower.
  - (ii) **Cross-Pollination** The pollen grains from the anther of a flower or of a plant are transferred to the stigma of a flower of the same plant or that of a different plant of the same kind. This transfer to another plant is mediated by insects, wind, water, animals, birds, etc.

Fertilisation

- The process in which the male gamete fuses with female gamete to form a new cell (called zygote) is called fertilisation.
- The zygote inside the ovary derives its food from the ovule.
- After the fertilisation, the ovary grows into the fruit and the ovule develops into the seeds.
- The seed contains an embryo enclosed by protective seed coat.

2. Sexual Reproduction In Animals

In animals, males and females have different reproductive parts or organs.

- (i) **The male reproductive organs** These organs include a pair of testis, two sperm ducts and a penis (external genital organ).
- (ii) **The female reproductive organs** These organs are a pair of ovaries, oviducts (Fallopian tube) and the uterus. Ovaries produce the female gamete called ova (or egg).

Fertilisation

The male and female gametes fuses to form a new cell called zygote.

- After fertilisation, the zygote begins to develop into an embryo. The embryo gets embedded in the walls of the uterus for further development.
- Various body parts begin to develop due to repeated divisions of cells.
- The stage of embryo in which all the body parts can be identified is called a **foetus**.
- When foetus develop completely, mother gives birth to the baby.

Types of Fertilisation

These are as follows

Internal Fertilisation

- The process of fusion of gametes taking place inside the female body is called internal fertilisation.
- It occurs in humans, cows, dogs, etc. Internal fertilisation takes place in hens also but hens do not give birth to babies like human beings and cows.

External Fertilisation

- The process of fusion of male and female gametes takes place outside the body of a female is called external fertilisation.
- It is commonly found in aquatic animals like frog, fish, starfish, etc.

Development of Embryo

- Fertilisation results in the formation of zygote which begins to develop into an embyo.
- The embryos continues to develop in the uterus.
- The stages of the embryo in which all the body parts can be identified is called a foetus.
- When the development of the foetus is complete, the mother gives birth to the baby.

Test Tube Baby

- In such cases, doctors collect freshly released egg and sperms and keep them together for a few hours for IVF or In Vitro Fertilisation (fertilisation outside the body). In case fertilisation occurs, the zygote is allowed to develop for about a week and then it is placed in mother's uterus. Babies born through this technique are called test tube babies.

Dolly, the Clone

- Cloning is the production of an exact copy of a cell, any other living part, or a complete organism. Cloning of an animal was successfully performed for the first time by Ian Wilmut and his colleagues at the Roslin Institute in Edinburgh, Scotland. They successfully cloned a sheep named Dolly. (Dolly was born on 5th July 1996 and was the first mammal to be cloned.

Viviparous and Oviparous Animals

- The animals in which females give birth to young ones are called **viviparous animals**, e.g. humans, cows, cats, etc.
- The animals in which females lay eggs are called **oviparous animals**, e.g. frogs, hens, etc.
- The new individuals which are born or hatched from the eggs continue to grow till they become adults.
- In some animals, the young ones may look very different from the adults, e.g. the life cycle of the silkworm
  Egg → Larva or caterpillar → Pupa → Adult
- The process of transformation of larva to an adult through a series of drastic changes is referred to as **metamorphosis** such as in frog, silkworm, butterfly, etc.

Reaching the Age of Adolescence

- The stage of growth of a baby from birth to about 2 years of age is called **infancy.** During this period, a baby learns to sit, stand, walk, etc. The stage of growth of a child from 2-12 years of age is called **childhood.**
- On crossing the age of 11-12, there is a sudden increase in growth which becomes noticeable.

This period of transition from childhood to adulthood is called **adolescence**.

- In this period of life, the body undergoes changes leading to **reproductive maturity**.
- Growth of the body is an important character during puberty. The rapid growth is due to the two main types of hormones, i.e. **sex hormones** and **growth hormones**.
- Some of the conspicuous changes which take place during puberty are given below:
  1. Increase in height.
  2. Change in voice of boys.
  3. Increased activity of sweat and sebaceous glands.
  4. Attainment of mental, intellectual and emotional maturity.
  5. Development of secondary sexual characters in boys and girls.
- The male hormone (testosterone) and female hormones (oestrogen) play important role in the puberty and adolescence. The maturation of sex organs and appearance of secondary sexual characters in both (boys and girls) occur under the influence of these sex hormones.

Role of Hormones in Completing the Life History of Insects and Frogs

- We have studied the life cycle of a silk moth and the frog. The caterpillar has to go through various stages to become an adult. Similarly, the tadpole passes through certain stages to become a frog. These changes from larva to adult is called **metamorphosis.** The process of metamorphosis in insects is controlled by **insect hormones.**
- In a frog, the process is regulated by **thyroxine** hormone produced by **thyroid** gland. A tadpole cannot become an adult if there is deficiency of iodine in the water where it is growing.

PRACTICE EXERCISE

1. Reproduction is
(a) biological process of producing young ones
(b) non-biological process of producing young ones
(c) biological process of producing mature ones
(d) None of the above

2. Asexual reproduction is common in
(a) single-celled organisms
(b) plants with relatively simple organisation
(c) animals with relatively simple organisation
(d) All of the above

3. Which type of reproduction amongst the following involves single parent?
(a) Sexual reproduction
(b) Asexual reproduction
(c) Both (a) and (b)
(d) None of the above

4. The production of an exact copy of an animal by asexual reproduction is known as
(a) budding (b) mating
(c) cloning (d) hatching

5. Onion is propagated throught its
(a) tubers (b) bulbs
(c) seeds (d) rhizomes

6. The eyes of potato are
(a) flower buds (b) shoot buds
(c) vegetative structure (d) None of these

7. Layering is the most common method of reproduction in which of the following plants?
(a) *Jasmine* (b) Rose
(c) Guava (d) None of these

8. Examples of vegetative propagation are
(a) rhizome (b) tuber
(c) offset (d) All of these

9. The reproduction in *Bryophyllum* takes place
(a) buds on leaves (b) buds on stem
(c) roots (d) flower

10. The vegetative reproduction in rose takes place by
(a) eyes (b) cutting
(c) leaves (d) grafting

11. Which amongst the following is the reproductive part of the plant?
(a) Leaf (b) Flower
(c) Stem (d) Root

12. Pollen grains are found in
(a) carpel (b) stigma
(c) anther (d) None of these

13. Male gametes are also called
(a) antherozoid (b) sperm
(c) egg (d) Both (a) and (b)

14. Female gametes are also called
(a) egg (b) ovum
(c) Both (a) and (b) (d) antherozoid

15. The reproductive part of a plant is the
(a) leaf (b) stem
(c) root (d) flower

16. Pollen grains are
(a) male reproductive structure
(b) spore mother cell
(c) male sperm cell
(d) female structure

17. In human beings, the correct sequence of events during reproduction is
(a) gamete formation, fertilisation, zygote formation, embryo
(b) embryo, zygote formation, fertilisation, gamete formation
(c) fertilisation, gamete formation, embryo, zygote formation
(d) gamete formation, fertilisation, embryo, zygote formation

18. In the list of animals given below, hen is the odd one out.
Human being, cow, dog, hen. The reason for this is
(a) it undergoes internal fertilisation
(b) it is oviparous
(c) it is viviparous
(d) it undergoes external fertilisation

19. Which of the following is not a part of the human male reproductive system?
(a) Testes (b) Oviducts
(c) Seminal vesicles (c) Epididymis

20. After fertilisation, the resulting cell which gives rise to a new individual is the
(a) embryo (b) ovum
(c) foetus (d) zygote

21. The egg laying mammals are
(a) Platypus
(b) Echidna
(c) Both (a) and (b)
(d) None of the above

22. The belief that the mother is completely responsible for the sex of the child is wrong because the child
(a) gets sex chromosome only from the mother
(b) develops in the body of the mother
(c) gets one sex chromosome from the mother and the other from the father
(d) gets sex chromosome only from the father

23. The faulty functioning of an endocrine gland can make a person very short or very tall. This gland is
(a) thyroid (b) pituitary
(c) adrenal (d) pancreas

24. The beginning of menstruation at puberty is called
(a) ovulation (b) menstruation
(c) menarche (d) menopause

25. The male hormone is
(a) oestrogen (b) progesterone
(c) testosterone (d) All of these

26. The most conspicuous visible change that occurs in boys during puberty is
(a) development in voice box
(b) increase in height
(c) production of sperms
(d) increased sweating

27. Given below are events that lead to pregnancy and development of embryo.
(i) Fertilisation of egg
(ii) Maturation of egg
(iii) Release of egg
(iv) Embedding of embryo in uterus

Which of the following options gives the correct order of sequence in which they occur?
(a) (i), (ii), (iii), (iv)
(b) (ii), (i), (iii), (iv)
(c) (i), (iv), (ii), (iii)
(d) (ii), (iii), (i), (iv)

28. The dramatic changes in body features associated with puberty are mainly because of the secretions of
(i) Thyroxine (ii) Oestrogen
(iii) Adrenaline (iv) Testosterone
(a) (i) and (ii) (b) (ii) and (iii)
(c) (i) and (iii) (d) (ii) and (iv)

29. Pimples and acne are formed due to the increased activity of
(i) Adrenal glands (ii) Sebaceous glands
(iii) Thyroid gland (iv) Sweat glands
(a) (i) and (ii) (b) (ii) and (iii)
(c) (i) and (iii) (d) (ii) and (iv)

30. Adolescents should be careful about what they eat, because
(a) proper diet develops their brains
(b) proper diet is needed for the rapid growth taking place in their body
(c) adolescents feel hungry all the time
(d) taste buds are well-developed in teenagers

Answers

1	(a)	2	(d)	3	(b)	4	(c)	5	(b)	6	(c)	7	(a)	8	(d)	9	(a)	10	(b)
11	(b)	12	(c)	13	(d)	14	(c)	15	(d)	16	(a)	17	(a)	18	(b)	19	(b)	20	(d)
21	(c)	22	(c)	23	(b)	24	(c)	25	(c)	26	(a)	27	(d)	28	(d)	29	(d)	30	(b)

CHAPTER

16

POLLUTION (AIR AND WATER)

This chapter deals with the pollution of air and water as well as their ill effects on plants and animals. The methods that can be used to prevent the pollution has also been discussed.

Pollution

Pollution can be defined as undesirable change in physical, chemical and biological properties of air, water and soil, which directly or indirectly affect human beings and other forms of life. Pollution causing agents or substances are called pollutants. Various Types of Pollution are

Air Pollution

- The air present in the atmosphere is mixture of gases. The major components of gases of air are oxygen (20%), nitrogen (70%) and carbon dioxide (0.32%).
- The pollution of air may be caused by natural process or by human activities.
  - (i) **Air Pollution Due to Natural Processes** The dust raised from ground during strong winds and storms, smoke from fire and fog, the decomposition of plant and animal remains and the pollen grains also contribute to air pollution.
  - (ii) **Air Pollution Due to Human Activities** Man burns fuels which produces smoke and industries release harmful gases in the atmosphere.

- **Smog** It is fog like thick layer present in atmosphere. It is made up of smoke and fog. It contains oxides of nitrogen combined with other air pollutants and cause respiratory problems.
- **CFCs** These are a kind of air pollutants known as chlorofluorocarbons (CFCs). These arise from refrigerators, air conditioners and aerosol sprays.
- **SPM** These are Suspended Particulate Matter present in the air (particles smaller than 2.5 micron size).

Effects of Air Pollution

Due to the two main acidic gases (sulphur dioxide and nitrogen dioxide) damage the historical monuments.

(i) **ACID Rain** (a cause of damage to Taj Mahal) The pollutant like So_2 and No_2 when combine with rain water form H_2SO_4 and HNO_3 acids. They cause the damage to the marble of Taj Mahal. Thus causing its corrosion.

(ii) **Ozone Hole** CFCs present in air go up in the atmosphere and seat with O_3 gases and this causes hole there. This way protective ozone layer gets destroyed.

(iii) **Effect on health** Many respiratory problems are caused due to air polluted with CO_2, CO, SO_2, NO_2 etc e.g. Asthma, Allergy etc.

Green House effect and global warming

The climate of earth facing regular changes due to the presence of green house gases and other air pollutants.

Geen House Effect

The trapping of solar radiation by gases (CO_2, No_2, water vapour, CH_4 etc.) present in earth's atmosphere which leads to increase the average temperature of earth is called green house effect.
It can be prevented by planting more trees, reducing air pollution, less use of fossil fuels etc.

Global Warming

Increase in green house gas concentration is atmosphere trap more solar radiation. Because of this there is airfare in average global temperature (2.5° every year). This is called global warming. It causes polar ice melt and rise in sea level water in coastal areas.

Water Pollution

- Water is made up of two elements hydrogen and oxygen. A molecule of water contains two hydrogen atoms and one oxygen atom. The chemical formula of water is H_2O.
- Water exists in all the three physical states i.e. solid, liquid and gas.
- Water occurs in nature in the free state as well as in the combined state as a part of several salts and minerals. Water occurs in the oceans, lakes, rivers, springs and wells.
- Water occurs in the tissues of plants and animals.
- Rainwater, well water, river water, sea water are sources of water. The contamination of water by the addition of unwanted and harmful substances, is called water pollution. Whenever harmful substances such as sewage, toxic chemicals, silt, etc get mixed with water, the water becomes polluted. The substances that pollute water are called water pollutants.

Effects of Water Pollution

- The polluted water adversely affects plant and animal life. In humans it causes various infectious diseases like typhoid, dysentery, cholera, etc.
- The water pollution can be prevented by sewage treatment, less use of chemicals in agricultural practices preventing the throw of industrial effluent into water bodies.

Ganga Action Plan

- This action plan to recover the Ganga river came into existence in 1985 by Government of India. It is one of the ten most endangered rivers of the world. Cleaning works done under Ganga Action Plan (GAP) has improved the quality of water as well as plant and animal life existing in it.
- **Potable Water** Water which is suitable for drinking is called potable water.
- **Three R's** Reduce, Reuse and Recycle are the three concepts to reduce water pollution.

PRACTICE EXERCISE

1. Air is a mixture of various gases. One of the gases is 21% part of the air and is essential for the survival of human beings. This gas is
(a) nitrogen (b) oxygen
(c) ozone (d) argon

2. The components of air which are harmful to living beings are
(a) nitrogen and carbon dioxide
(b) dust and water vapour
(c) dust and smoke
(d) smoke and water vapour

3. Major pollution is caused by are
(a) animals (b) man
(c) hydrogen gases (d) None of these

4. At present, the concentration of CO_2 in the atmosphere is about
(a) 100 ppm (b) 240 ppm
(c) 380 ppm (d) 520 ppm

5. The main cause of pollution in metrocities is
(a) burning of fossil fuels
(b) water plants
(c) domestic products
(d) None of these

6. CFCs are responsible for
(a) ozone layer depletion
(b) deforestation
(c) acid rain
(d) None of these

7. Which of the following is not a greenhouse gas?
(a) Water vapour
(b) Carbon monoxide
(c) Methane
(d) Oxygen

8. Acid rain contains
(a) SO_2 and NO_2 (b) NO_3
(c) O_3 (d) CO

9. Which of the following gases does not cause acid rain?
(a) Sulphur dioxide (b) Methane
(c) Nitrous oxide (d) None of these

10. Taj Mahal marble is affected by
(a) SO_2 (b) O_2
(c) O_3 (d) None of these

11. Ozone hole rain is due to
(a) CO_2
(b) CO
(c) CFCS
(d) SO_2

12. Greenhouse effect is due to the presence of
(a) ozone layer in the atmosphere
(b) infrared light reaching the earth
(c) moisture layer in the atmosphere
(d) CO_2 layer in the atmosphere

13. A gradual increase in the average temperature of earth's atmosphere is known as
(a) acid rain
(b) global warming
(c) deforestation
(d) None of the above

14. Which one of the following is mainly responsible for greenhouse effect?
(a) SO_2 (b) CO_2 (c) CO (d) O_2

15. Which one of the following pairs of gases are the major cause of greenhouse effect?
(a) CO_2 and CO
(b) CFCs and SO_2
(c) CO_2 and N_2O
(d) CO_2 and O_3

16. Greenhouse effect with respect to global climate refers to
(a) cooling and moist condition
(b) warming effect
(c) increase rainfall and greenery
(d) desertification

17. Biological pollution in water is caused by
(a) coal mines
(b) domestic sewage and animal excreta
(c) oil spills
(d) chemicals like paint

18. A pond contains clean water. Which of the following activities will produce least pollution of water?
(a) Washing clothes in the pond
(b) Bathing animals in the pond
(c) Washing motor vehicles in the pond
(d) Swimming in the pond

19. The Ganga Action Plan was launched in the year
(a) 1985
(b) 1981
(c) 2000
(d) 1958

20. The cause(s) of water pollution is/are througling of
(a) garbage in river
(b) untreated rewage in river
(c) dead bodies in river
(d) All of the above

Answers

1	(b)	2	(c)	3	(b)	4	(c)	5	(a)	6	(a)	7	(d)	8	(a)	9	(b)	10	(a)
11	(c)	12	(d)	13	(b)	14	(b)	15	(c)	16	(b)	17	(b)	18	(d)	19	(a)	20	(d)

JAWAHAR
NAVODAYA
VIDYALAYA

MATHEMATICS

CHAPTER

01

NUMBER SYSTEM

(RATIONAL NUMBERS)

In this chapter, we study the various types of numbers, properties of rational numbers, simplification and test for divisibility.

Digits The symbols 0,1, 2, 3, 4, 5, 6, 7, 8, 9 are known as digits in Hindu Arabic System.

Numbers or Numerals A mathematical symbol which represent the digits, are known as numbers or numerals.

Types of Numbers There are some types of numbers, which are given below

(i) **Natural Numbers** Those numbers which are used for counting, are known as natural numbers. These are denoted by N.

e.g. $N = 1, 2, 3, \ldots$

Here 1 is the first and smallest natural number.

(ii) **Whole Numbers** If 0 is included in natural numbers, then these numbers are known as whole numbers. These numbers are denoted by W.

e.g. $W = 0, 1, 2, 3, \ldots$

(iii) **Integers** All whole numbers and their negative numbers are known as integers. These numbers are denoted by I.

$\therefore\ I = 0, \pm 1, \pm 2, \pm 3, \ldots$

Here, 1, 2, 3, ... are positive integers, denoted by I^+, and

$-1, -2, -3, \ldots$ are negative integers, denoted by I^-.

Here 0 is neither positive nor negative integer.

(iv) **Rational Numbers** Numbers in the form of $\frac{p}{q}$, where $p, q \in I$ and $q \neq 0$, are known as rational numbers. It is denoted by Q.

e.g. $\frac{2}{3}, \frac{5}{6}, 6, \frac{-4}{5}$, etc.

(v) **Irrational Numbers** Numbers which can not be expressed in the form of $\frac{p}{q}$, where $p, q \in I$ and $q \neq 0$, are known as irrational numbers.

e.g. $\pi, \sqrt{2}, \sqrt{6}, \sqrt[3]{11}$, etc.

(vi) **Real Numbers** Those numbers which are either rational or irrational, are known real numbers. It is denoted by R.

All natural, whole, integer, rational and irrational numbers are real numbers.

e.g. 2, 0, –5, $\frac{1}{2}, \sqrt{6}$, etc.

(vii) **Even Numbers** Those numbers which are divisible by 2, are known as even numbers.

e.g., 2, 4, 6, ...

Note 2 is smallest even number.

(viii) **Odd Numbers** Those numbers, which are not divisible by 2, are known as odd numbers.

e.g. 1, 3, 5, 7, ...

(ix) **Prime Numbers** Those numbers which are divisible by 1 and the number itself, are known as prime numbers.

e.g. 2, 3, 5, 7, 11, 13, ...

Here 2 is the only even prime number.

(x) **Composite Numbers** Those numbers which are divisible by at least one number except 1 and the number itself, are known as composite numbers.

e.g. 12, 8 and 15 etc, are composite numbers.

Example 1 Which of the following is not true?

(a) 11 is prime number

(b) 2/5 is rational number

(c) ± 8 is the real number

(d) $\frac{6}{0}$ is rational number

Sol. *(d)* $\frac{6}{0}$ is not true, because $\frac{6}{0}$ is not rational number, as in its denominator, (p/q form) $q = 0$, which is wrong.

Example 2 Sum of first five prime numbers is

(a) 25 (b) 26 (c) 27 (d) 28

Sol. *(d)* We know that, first five prime numbers are 2, 3, 5, 7, 11

$\therefore$ Their sum $= 2 + 3 + 5 + 7 + 11 = 28$

Properties of Rational Numbers

(i) **Closure Property** The sum and multiplication of two rational numbers are rational numbers.

(a) $2 + \frac{2}{7} = \frac{16}{7}$ [rational number]

(b) $2 \times \frac{2}{7} = \frac{4}{7}$ [rational number]

(ii) **Commutative Property** If a and b are any rational numbers, then we have

(a) $a + b = b + a$ [for addition]

(b) $a \times b = b \times a$ [for multiplication]

(iii) **Associative Property** If a, b and c are three any rational numbers, then we have,

(a) $(a + b) + c = a + (b + c)$ [for addition]

(b) $(a \times b) \times c = a \times (b \times c)$ [for multiplication]

(iv) **Distributive Property** If a, b, c are any rational numbers, then we have

$$a(b + c) = ab + ac,$$

which is called distributive property of multiplication over addition.

(v) **Additive Identity** If a is any rational number, then we have

$$a + 0 = a,$$

i.e. adding a number 0 to any number, is equal to the number itself. Therefore, '0' is called additive identity.

(vi) **Multiplicative Identity** If a is any rational number, then we have

$$a \times 1 = a$$

i.e. multiplying a number 1 to any number, is equal to the number itself. Therefore, 1 is called multiplicative identity.

Rational Numbers Between any Two Given Rational Numbers

Between any two given rational numbers, there are countless or infinite rational numbers.

To find rational numbers between any two given rational numbers, we can use the idea of mean.

Thus, we can say that, 'if a and b are two rational numbers, then $\frac{a+b}{2}$ will be a rational number, such that $a < \frac{a+b}{2} < b$.

e.g. A rational number between 2 and 3 is $\frac{2+3}{2} = \frac{5}{2}$.

Here, we find that, $2 < \frac{5}{2} < 3$.

Example 3 A rational number between $\frac{2}{3}$ and $\frac{3}{4}$ is

(a) 15/24 (b) 17/24 (c) 13/24 (d) 5/24

Sol. *(b)* We find the mean of $\frac{2}{3}$ and $\frac{3}{4}$.

i.e. $$\left(\frac{2}{3}+\frac{3}{4}\right)\div 2 = \left(\frac{8+9}{12}\right)\div 2$$
$$= \frac{17}{12}\div 2 = \frac{17}{12}\times\frac{1}{2} = \frac{17}{24}$$

Simplification

To solve any expression or to simplify, we have many operations, i.e. Brackets, Addition, Subtraction, Multiplication, Division, etc.

We follow the rule of VBODMAS, i.e.

V → Vinculum or bar '–'
B → Brackets, i.e. ( ), { }, [ ]
O → Of
D → Division, i.e. ÷
M → Multiplication, i.e. '×'
A → Addition, i.e. '+'
S → Subtraction, i.e. '–'

To solve brackets, we follow the order
(i) ( ), circular or small bracket
(ii) { }, curly or middle bracket
(iii) [ ], square or big bracket

Note In the absence of any bracket or operation, their is no change in order to solve the expression.

Example 4 $\frac{3}{4}$ of $\frac{2}{7}$ of $\frac{1}{5}$ of $560 = ?$

(a) 28 (b) 24 (c) 32 (d) 36

Sol. *(b)* We have, $\frac{3}{4}$ of $\frac{2}{7}$ of $\frac{1}{5}$ of 560
$$= \frac{3}{4}\times\frac{2}{7}\times\frac{1}{5}\times 560 = 24$$

Example 5 The value of
$$1 \div [1 + 1 \div \{1 + 1 \div (1 + 1 \div 2)\}] \text{ is}$$

(a) $\frac{5}{8}$ (b) $\frac{8}{5}$ (c) $\frac{2}{5}$ (d) $\frac{3}{8}$

Sol. *(a)* We have,
$$1 \div [1 + 1 \div \{1 + 1 \div (1 + 1 \div 2)\}]$$
$$= 1 \div \left[1 + 1 \div \left\{1 + 1 \div \left(1 + \frac{1}{2}\right)\right\}\right]$$
$$= 1 \div \left[1 + 1 \div \left\{1 + 1 \div \frac{3}{2}\right\}\right]$$
$$= 1 \div \left[1 + 1 \div \left\{1 + \frac{2}{3}\right\}\right]$$
$$= 1 \div \left[1 + 1 \div \frac{5}{3}\right] = 1 \div \left[1 + \frac{3}{5}\right] = 1 \div \frac{8}{5} = \frac{5}{8}$$

Test for Divisibility

Generally, to check the divisibility of one number by another, we normally do actual division and see whether remainder is zero or not. But sometimes we use direct condition for divisibility, which is as shown below

- **Divisible by 2** When the last digit of a number is either 0 or even, then the number is divisible by 2.

  e.g. 12, 86, 472, 520, 1000 etc. are divisible by 2.

- **Divisible by 3** When the sum of the digits of a number is divisible by 3, then the number is divisible by 3.

  e.g. 1233 as sum of digits

  $1 + 2 + 3 + 3 = 9$, which is divisible by 3, so 1233 must be divisible by 3.

- **Divisible by 4** When the number made by last two digits of a number is divisible by 4, then that particular number is divisible by 4. Apart from this, the number having two or more zeros at the end, is also divisible by 4.

  e.g. 6428 is divisible by 4 as the number made by its last two digits i.e., 28 is divisible by 4.

- **Divisible by 5** Numbers having 0 or 5 at the end are divisible by 5.

  e.g. 45, 4350, 135, 14850 etc. are divisible by 5 as they have 0 or 5 at the end.

- **Divisible by 6** When a number is divisible by both 3 and 2, then that particular number is divisible by 6 also.

  e.g. 18, 36, 720, 1440 etc. are divisible by 6 as they are divisible by both 3 and 2.

- **Divisible by 7** A number is divisible by 7 when the difference between twice the digit at ones place and the number formed by other digits is either zero or a multiple of 7.

  e.g. 658 is divisible by 7 because
  $65 - 2 \times 8 = 65 - 16 = 49$. As 49 is divisible by 7, the number 658 is also divisible by 7.

- **Divisible by 8** When the number made by last three digits of a number is divisible by 8, then the number is also divisible by 8. Apart from this, if the last three or more digits of a number are zeros, then the number is divisible by 8.

  e.g. 2256. As 256 (the last three digits of 2256) is divisible by 8, therefore 2256 is also divisible by 8.

- **Divisible by 9** When the sum of all the digits of a number is divisible by 9, then the number is also divisible by 9.

  e.g. 936819 as sum of digits
  $9 + 3 + 6 + 8 + 1 + 9 = 36$, which is divisible by 9. Therefore, 936819 is also divisible by 9.

- **Divisible by 10** When a number ends with zero, then it is divisible by 10.

  e.g. 20, 40, 150, 123450, 478970 etc. are divisible by 10 as these all end with zero.

- **Divisible by 11** When the sums of digits at odd and even places are equal or differ by a number divisible by 11, then the number is also divisible by 11.

  e.g. 217382 Let us see

  Sum of digits at odd places $= 2 + 7 + 8 = 17$

  Sum of digits at even places $= 1 + 3 + 2 = 6$

  Difference $= 17 - 6 = 11$

  Clearly, 217382 is divisible by 11.

- **Divisible by 12** A number which is divisible by both 4 and 3 is also divisible by 12.

  e.g. 2244 is divisible by both 3 and 4. Therefore, it is also divisible by 12.

- **Divisible by 25** A number is divisible by 25 when its last 2 digits are divisible by 25.

  e.g. 500, 1275, 13550 are divisible by 25 as last 2 digits of these numbers are divisible by 25.

Example 6 Which of the following number is not divisible by 3?

(a) 75 (b) 52 (c) 63 (d) 42

Sol. *(b)* $\because$ Sum of digits, we have

$75 = 7 + 5 = 12$ (divisible by 3)

$52 = 5 + 2 = 7$ (not divisible by 3)

$63 = 6 + 3 = 9$ (divisible by 3)

$42 = 4 + 2 = 6$ (divisible by 3)

$\therefore$ 52 is not divisible by 3, since its sum is not divisible by 3.

PRACTICE EXERCISE

1. A number in the form $\frac{p}{q}$ is said to be a rational number, if

(a) p, q are integers
(b) p, q are integers and $q \neq 0$
(c) p, q are integers and $p \neq 0$
(d) p, q are integers and $p \neq 0$, also $q \neq 0$

2. The numerical expression $\frac{3}{8} + \frac{(-5)}{7} = \frac{-19}{56}$ shows that

(a) rational numbers are closed under addition
(b) rational numbers are not closed under addition
(c) rational numbers are closed under multiplication
(d) addition of rational numbers is not commutative

3. Which of the following is not true?

(a) rational numbers are closed under addition
(b) rational numbers are not closed under subtraction
(c) rational numbers are closed under multiplication
(d) rational numbers are closed under division

4. Between two given rational numbers, we can find

(a) one and only one rational number
(b) only two rational numbers
(c) only ten rational numbers
(d) infinitely rational numbers

5. The product $\frac{3}{4}, \frac{2}{5}$ and $\frac{25}{3}$ is

(a) 5/2 (b) 2/5 (c) 3/5 (d) 5/3

6. Smallest 3-digit prime number is

(a) 103 (b) 107 (c) 101 (d) 109

7. What should be added to $-\frac{5}{7}$ to get $-\frac{3}{2}$?

(a) $-\frac{11}{14}$ (b) $\frac{11}{14}$
(c) $\frac{14}{11}$ (d) $-\frac{14}{11}$

8. Find the additive identity for the rational number

(a) 0 (b) 1 (c) 2 (d) 3

9. Which statement is true?

(a) $-5 + 3 \neq 3 + (-5)$
(b) $\frac{-8}{12} = \frac{10}{-15}$
(c) 2 is not natural number
(d) 17 is not prime number

10. What should be subtracted from $-\frac{3}{4}$ to make $\frac{2}{3}$?

(a) $\frac{-17}{12}$ (b) $\frac{17}{12}$
(c) $\frac{12}{9}$ (d) $\frac{11}{12}$

11. A rational number between $-\frac{3}{5}$ and $\frac{1}{4}$ is

(a) $\frac{7}{40}$ (b) $-\frac{7}{40}$
(c) $\frac{9}{40}$ (d) $-\frac{9}{40}$

12. The value of $\frac{3}{5} + \frac{3}{5} + \ldots$ upto 25 times is

(a) 25 (b) 10 (c) 15 (d) 35

13. $8\frac{1}{4} + 8\frac{1}{2} + ? = 20\frac{1}{8}$

(a) $8\frac{1}{4}$ (b) $3\frac{5}{8}$
(c) $3\frac{3}{8}$ (d) $8\frac{5}{9}$

14. Which of the following is correct?

(a) $a + 0 = b$ (b) $-a \times b = b \times (-a)$
(c) $a - b = b - a$ (d) $\frac{a}{b} = \frac{b}{a}$

15. The value of $2\frac{4}{5} \div 3\frac{1}{2}$ of $\frac{4}{5}$ is

(a) 0 (b) 1
(c) 2 (d) 3

16. By division algorithm, which of the following is correct?
(a) $41 = 7 \times 5 + 6$ (b) $56 = 5 \times 11 + 2$
(c) $30 = 5 \times 8 - 5$ (d) $25 = 5 \times 4 + 4$

17. If $157x234$ is divisible by 3, then the digit at the place of x is
(a) 0 (b) 1 (c) 2 (d) 4

18. By which number, 91476 is not divisible?
(a) 11 (b) 7 (c) 3 (d) 8

19. If a number $573xy$ is divisible by 90, then the value of $x + y$ is
(a) 13 (b) 3 (c) 8 (d) 6

20. Which number is divisible by 5 and 9 both?
(a) 585 (b) 285 (c) 389 (d) 560

21. Which number is not divisible by 6?
(a) 270 (b) 385
(c) 312 (d) 432

22. Which number is divisible by 5 and 25 both?
(a) 2170 (b) 5125
(c) 3107 (d) 4115

23. What least number should be subtracted from 1365 to get a number exactly divisible by 25?
(a) 15 (b) 5 (c) 10 (d) 20

24. Which of the following number is divisible by 9?
(a) 4621 (b) 2834 (c) 9216 (d) 1560

25. By how much $\frac{3}{4}$th of 52 is lesser than $\frac{2}{3}$rd of 99?
(a) 27 (b) 33 (c) 39 (d) 66

26. The value of K, where $31K2$ is divisible by 6, is
(a) 1 (b) 2
(c) 3 (d) 7

Answers

1	(b)	2	(a)	3	(d)	4	(d)	5	(a)	6	(c)	7	(a)	8	(a)	9	(b)	10	(a)
11	(b)	12	(c)	13	(c)	14	(b)	15	(b)	16	(a)	17	(c)	18	(d)	19	(b)	20	(a)
21	(b)	22	(b)	23	(a)	24	(c)	25	(a)	26	(c)								

Hints and Solutions

1. A number in the form $\frac{p}{q}$ is said to be a rational number, if p and q are integers and $q \neq 0$.

2. We have, $\frac{3}{8} + \left(\frac{-5}{7}\right) = \frac{-19}{56}$

$\because \frac{3}{8}$ and $\frac{-5}{7}$ are rational numbers and their addition is $\frac{-19}{56}$, which is also a rational number.

Hence, the rational numbers are closed under addition.

3. Rational numbers are not closed under division.

As, 1 and 0 are the rational numbers but $\frac{1}{0}$ is not defined.

4. We can find infinite rational numbers between any two given rational numbers.

5. We have, $\frac{3}{4} \times \frac{2}{5} \times \frac{25}{3} = \frac{1}{2} \times \frac{1}{5} \times 25 = \frac{5}{2}$

6. 101 is not divisible by any of the prime numbers 2, 3, 5, 7, 11.

$\therefore$ 101 is smallest three-digit prime number.

7. Let x should be added to $-\frac{5}{7}$ to get $-\frac{3}{2}$.

Then, $\frac{-5}{7} + x = \frac{-3}{2}$

$\Rightarrow \quad x = \frac{-3}{2} + \frac{5}{7} = \frac{-21 + 10}{14} = -\frac{11}{14}$

Hence, $-\frac{11}{14}$ should be added.

8. The additive identity for the rational number is 0.

9. By options,

(a) $-5+3=-2$

and $3+(-5)=-2$, which are equal.

(b) $\frac{-8}{12}=\frac{10}{-15} \Rightarrow \frac{-2}{3}=\frac{-2}{3}$, which is true.

(c) 2 is a natural number

(d) 17 is also a prime number.

10. Let x be subtracted.

Then, $\frac{-3}{4}-x=\frac{2}{3}$

$\Rightarrow \frac{-3}{4}-\frac{2}{3}=x$

$\Rightarrow x=\frac{-9-8}{12}=\frac{-17}{12}$

Hence, $-\frac{17}{12}$ should be subtracted.

11. The rational number between $-\frac{3}{5}$ and $\frac{1}{4}$

is $\frac{\frac{-3}{5}+\frac{1}{4}}{2}=\frac{-12+5}{20\times 2}=-\frac{7}{40}$

$\left[\because \text{ A rational number between two rational number} = \frac{\text{Sum of rational number}}{2}\right]$

12. $\frac{3}{5}+\frac{3}{5}+\ldots\ldots$ upto 25 times

$=\frac{3}{5}\times 25=3\times 5=15$

13. $8\frac{1}{4}+8\frac{1}{2}+?=20\frac{1}{8}$

$\Rightarrow ?=20\frac{1}{8}-8\frac{1}{4}-8\frac{1}{2}$

$=(20-8-8)+\left(\frac{1}{8}-\frac{1}{4}-\frac{1}{2}\right)$

$=4+\frac{1-2-4}{8}$

$=4+\frac{-5}{8}=\frac{27}{8}=3\frac{3}{8}$

14. $-a\times b=b\times(-a)$

Because multiplication of two numbers in any order are same.

15. We have, $2\frac{4}{5}\div 3\frac{1}{2}$ of $\frac{4}{5}$

$=\frac{14}{5}\div\frac{7}{2}\times\frac{4}{5}$

$=\frac{14}{5}\div 7\times\frac{2}{5}$

$=\frac{14}{5}\div\frac{14}{5}=1$

16. By option (a),

RHS $=7\times 5+6=35+6=41=$ LHS

$\therefore$ $41=7\times 5+6$ is correct.

17. $\because$ Sum of digits $=1+5+7+x+2+3+4$

$=22+x$

This addition is divisible by 3, if 2 is at the place of x,

i.e. $22+x=22+2=24$, divisible by 3.

So, $x=2$.

18. $\because$ We have, to check

divisible by 11 91476 = Sum of odd places digits − Sum of even places digits

$=(9+4+6)-(1+7)$

$=19-8=11$, which is divisible by 11.

Divisible by 7 $=19476=194-2(76)=194-152$

$=42$, which is divisible by 7.

Divisible by 2 given number is even number, hence it is divisible by 2.

Divisible by 8 $91476\rightarrow 476$ is not divisible by 8.

Hence, 91476 is not divisible by 8.

19. We know that, if any number divisible by 90, i.e. divisible by 9 and 10.

So, to make number $573xy$ divisible by 10, we have to put $y=0$ to make unit digit 0, (i.e. 0 unit digit number divisible by 10), i.e. $y=0$.

Now, to also make $573x0$ divisible by 9,

$5+7+3+x+10=15+x=15+\underline{3}=18$,

i.e. divisible by 3.

So, $x=3$

$\therefore$ $x+y=3+0=3$

20. By option (a),

We have, 585, divisible by 5 because unit digit is 5, and sum of digits $=5+8+5=18=1+8=9$ which is also divisible by 9.

21. We know that, if any number divisible by 2 and 3, it is also divisible by 6.

$\therefore$ By option (b), 385 is not divisible by 2. Hence, it is also not divisible by 6.

22. We know that,

Number is divisible by 5, if last digit is 5 or 0.

And divisible by 25, if last two digits is divisible by 25.

Hence, 5125 is only number divisible by 5 and 25 both.

23. 25)1365(54

125

115

100

15

$\therefore$ Required number is 15.

24. We have, $4621 = 4 + 6 + 2 + 1 = 13$, not divisible by 9

$2834 = 2 + 8 + 3 + 4 = 17$, not divisible by 9

$9216 = 9 + 2 + 1 + 6 = 18$, divisible by 9

$1560 = 1 + 5 + 6 + 0 = 12$, not divisible by 9

Hence, 9216 is only number divisible by 9.

25. $\therefore$ Required answer

$$= \frac{2}{3} \times 99 - \frac{3}{4} \times 52$$

$$= 2 \times 33 - 3 \times 13$$

$$= 66 - 39 = 27$$

26. The number $31K2$ is divisible by 6, it mean it is divisible by 2 and 3 both.

Here, unit digit is 2 (even), so this number is divisible by 2.

Now, for 3, first we have to add all the digits.

$\therefore \quad 3 + 1 + K + 2 = 6 + K$

$= 6 + 3 = 9,$

for $K = 3$, it is divisible by 3.

Hence, $K = 3$

CHAPTER

02

SQUARE AND SQUARE ROOTS

In this chapter, we study the squares of number and their properties. Also finding the square root of numbers and decimal numbers by prime factorisation and long division method.

Square

The square of a number is the product of the number itself, i.e. $a \times a = a^2$.

Perfect Square

A given number is said to be a perfect square, if it can be expressed as the product of two equal factors. A natural number 'n' is a perfect square if $n = m^2$ for any natural number m.

e.g. $4 = 2^2$ or 2×2 and $25 = 5^2$ is a perfect square.

Squares from 1 to 20 numbers

Numbers	Squares	Numbers	Squares
1	1	11	121
2	4	12	144
3	9	13	169
4	16	14	196
5	25	15	225
6	36	16	256
7	49	17	289
8	64	18	324
9	81	19	361
10	100	20	400

Properties of Square

(i) The number of zeroes at the end of a perfect square is always even.

(ii) A perfect square leaves a remainder 0 or 1 on division by 3.

(iii) The number ending with an odd number of zeroes is never a perfect square.

(iv) Squares of even numbers are always even.

(v) Squares of odd numbers are always odd.

Example 1 Which are of the following will have odd unit digit?

(a) $(32)^2$ (b) $(35)^2$ (c) $(64)^2$ (d) $(68)^2$

Sol. (b) We know that that square of odd number in an odd number

The number $(35)^2$ have odd unit digit.

Pythagorean Triplet

In a triplet (m, n, p) of three natural numbers m, n and p is called a Pythagorean triplet, if $m^2 + n^2 = p^2$. It is easy to prove that for any natural number m greater than 1, $(2m, m^2 - 1, m^2 + 1)$ is a Pythagorean triplet.

Example 2 Find the value of $(13)^2 + 3 \times 7$.

(a) 190 (b) 189 (c) 191 (d) 192

Sol. (a) $(13)^2 + 3 \times 7 = 169 + 21 = 190$

Square Root

The square root of the number x is the number which multiplied by itself gives x as the product. It is denoted by the symbol $\sqrt[2]{\ }$ or $\sqrt{\ }$.

e.g. If $y = x^2$, then we call, x is a square root of y,

i.e. $x = \pm\sqrt{y}$.

Properties of Square Root

(i) If the unit digit of a number is 2, 3, 7 or 8, then it does not have a square root.

(ii) Square root of even number is even.

(iii) Square root of odd number is odd.

Square Root of a Perfect Square by the Prime Factorisation Method

The following steps are given below.

I. Resolve the given number into prime factors.

II. Make pairs of similar factors.

III. Choose one prime from each pair and multiply all primes.

Thus, the product obtained is the square root of given number.

Example 3 The square root of 1764 is

(a) 41 (b) 43 (c) 42 (d) 40

Sol. (c) By prime factorisation method,

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$$\therefore \quad \sqrt{1764} = \sqrt{\overline{2 \times 2} \times \overline{3 \times 3} \times \overline{7 \times 7}}$$
$$= 2 \times 3 \times 7 = 42$$

Square Root of a Perfect Square by Long Division Method

If it is not easy to evaluate square root using prime factorisation method, then we use division method.

The steps of this method can be easily understood with the help of following examples.

e.g. Find the square root of 18769.

Step **I** In the given number, mark off the digits in pairs starting from the unit digit. Each pair and the remaining one digit (if any) is called a period.

Step **II** Choose a number whose square is less than or equal to 1. Here, $1^2 = 1$, on subtracting, we get 0 (zero) as remainder.

Step **III** Bring down the next period, i.e. 87. Now, the trial divisor is $1 \times 2 = 2$ and trial dividend is 87. So, we take 23 as divisor and put 3 as quotient. The remainder is 18 now.

	137
1	$\overline{1}\,\overline{87}\,\overline{69}$
	1
23	87
	69
267	1869
	1869
	×

Step **IV** Bring down the next period, which is 69. Now, trial divisor is $13 \times 2 = 26$ and trial dividend is 1869. So, we take 267 as dividend and 7 as quotient. The remainder is 0.

Step **V** The process (processes like III and IV) goes on till all the periods (pairs) come to an end and we get remainder as 0 (zero) now.

Hence, the required square root = 137

Example 4 2025 plants are to be planted in a garden in such a way that each row contains as many plants as the number of rows. Find the number of rows and the number of plants in each now.

(a) 55, 45 (b) 45, 45 (c) 35, 35 (d) 36, 36

Sol. *(b)* Let the number of rows be x.

Then, number of plants in a row = x

So, number of plants to be planted in a garden

$$x \times x = x^2$$

According to the question,

Total number of plants to be planted = 2025

$\therefore \quad x^2 = 2025$

3	2025
3	675
3	225
3	75
5	25
5	2
	1

$\Rightarrow \quad x = \sqrt{2025} = \sqrt{3 \times 3 \times 3 \times 3 \times 5 \times 5}$

$= 3 \times 3 \times 5 = 45$

Hence, the number of rows is 45 and the number of plants in each row is 45.

Formula for Finding the Number of Digits in the Square Root of a Perfect Square

If any perfect square number contains 'n' digits. then, its square root will contain $\frac{n}{2}$ digits, when n is even and $\frac{n+1}{2}$ digits, when n is odd.

e.g. Square root of 64 is 8. [$\because n = 2$ i.e. even]

Also, square root of 144 is 12. [$\because n = 3$ i.e. odd]

Square Root of Product of Numbers and Rational Number

(i) The square root of product of integers is the square root of integer by taking separately, for any integer a and b, we have

$$\sqrt[2]{ab} = \sqrt[2]{a}\ \sqrt[2]{b}$$

(ii) The square root of rational number $\frac{a}{b}$ is

$$\sqrt[2]{\frac{a}{b}} = \frac{\sqrt[2]{a}}{\sqrt[2]{b}}$$

Square Root of Number in Decimal Form

Make the number of decimal places even by affixing zero, if necessary. Now, mark bars and find out the square root by the long division method. Put the decimal point in the square root as soon as the integral part is completed.

Example 5 Find the square root of 176.252176.

(a) 13.276 (b) 13.801 (c) 13.295 (d) 13.218

Sol. *(a)* By long division method,

	13.276
1	$\overline{1}\,\overline{76}.\overline{25}\,\overline{21}\,\overline{76}$
	1
23	76
	69
262	725
	524
2647	20121
	18529
26546	159276
	159276
	×

$\therefore \quad \sqrt{176.252176} = 13.276$

PRACTICE EXERCISE

1. The value of $(15)^2 + (8)^2 + 2$ is
(a) 289 (b) 291 (c) 293 (d) 295

2. Which of the following cannot be a perfect square?
(a) 841 (b) 529
(c) 198 (d) All of these

3. Which of the following cannot be a digit in the unit place of a perfect square ?
(a) 0 (b) 1 (c) 5 (d) 7

4. The square root of 73.96 is
(a) 8.6 (b) 86
(c) 0.86 (d) None of these

5. If $x = \sqrt{3018 + \sqrt{36 + \sqrt{169}}}$, then the value of x is
(a) 55 (b) 44 (c) 63 (d) 42

6. $\sqrt{12} + \sqrt{24}$ is equal to
(a) $2\sqrt{3} + 3\sqrt{2}$ (b) $4\sqrt{3} + \sqrt{6}$
(c) $\sqrt{7} + 2\sqrt{3}$ (d) $2\sqrt{6} + 2\sqrt{3}$

7. Which one of the following will have even unit digit?
(a) $(43)^2$ (b) $(37)^2$
(c) $(63)^2$ (d) $(34)^2$

8. If the area of an equilateral triangle is $24\sqrt{3}\ m^2$, then its perimeter is
(a) $12\sqrt{6}$ m (b) $9\sqrt{6}$ m
(c) $8\sqrt{3}$ m (d) $4\sqrt{3}$ m

9. The value of $(301)^2 - (300)^2$ is
(a) 1 (b) 601
(c) 106 (d) 100

10. A General arranges his soldiers in rows to form a perfect square. He finds that in doing so, 60 soldiers are left out. If the total number of soldiers be 8160. Then, the number of soldiers in each row is
(a) 90 (b) 91
(c) 92 (d) 80

11. The greatest six digit number which is a perfect square is
(a) 998004 (b) 998006
(c) 998049 (d) 998001

12. What is that fraction which when multiplied by itself gives 227.798649 ?
(a) 15.093 (b) 15.099
(c) 14.093 (d) 9.0019

13. In a triplet $(6, a, 10)$ what value of 'a' will make it a Pythagorean triplet ?
(a) 4 (b) 16
(c) 8 (d) 5

14. If a number is increased by two times, then the square of the number will increase
(a) two times (b) three times
(c) four times (d) five times

15. Two numbers are in the ratio of 9 : 7. If the difference of their square is 288, then the smaller of the number is
(a) 21 (b) 24
(c) 27 (d) 28

16. The number of digits in the square root of 298116 is
(a) 4 (b) 5
(c) 3 (d) 6

17. If $\sqrt{2401} = \sqrt{7^x}$, then the value of x is
(a) 3 (b) 4
(c) 5 (d) 6

18. The least number to be added to 269 to make it a perfect square is
(a) 31 (b) 16
(c) 17 (d) 20

19. If $\sqrt{18225} = 135$, then the value of $\sqrt{18225} + \sqrt{182.25} + \sqrt{1.8225} + \sqrt{0.018225}$ is
(a) 1.49985 (b) 14.985
(c) 149.985 (d) 1499.85

20. The expression
$$\sqrt{\frac{0.85\times(0.105+0.024-0.008)}{0.022\times 0.25\times 1.7}}$$
simplifies to

(a) $\sqrt{11}$ (b) $\sqrt{1.1}$
(c) 11 (d) $\sqrt{0.011}$

21. The value of $\sqrt{\frac{16}{36}+\frac{1}{4}}$ is

(a) $\frac{2}{5}$ (b) $\frac{1}{3}$ (c) $\frac{5}{3}$ (d) $\frac{5}{6}$

22. If $\frac{52}{x}=\sqrt{\frac{169}{289}}$, then the value of x is

(a) 52 (b) 58 (c) 62 (d) 68

23. A square board has an area of 144 sq units. How long is each side of the board?

(a) 11 units (b) 12 units
(c) 13 units (d) 14 units

24. If $\sqrt{1+\frac{25}{144}}=1+\frac{x}{12}$, then x is equal to

(a) 1 (b) 2 (c) 5 (d) 9

25. The value of $\frac{\sqrt{80}-\sqrt{112}}{\sqrt{45}-\sqrt{63}}$ is

(a) $\frac{3}{4}$ (b) $1\frac{3}{4}$
(c) $1\frac{1}{3}$ (d) $1\frac{7}{9}$

26. The least number which is added to 17420 will make it a perfect square is

(a) 3 (b) 5 (c) 9 (d) 4

27. If $\sqrt{0.09\times 0.09\times x}=0.09\times 0.09\times\sqrt{z}$, then the value of $\frac{x}{z}$

(a) 0.0081 (b) 0.810
(c) 0.801 (d) 8.09

Answers

1	(b)	2	(c)	3	(d)	4	(a)	5	(a)	6	(d)	7	(d)	8	(a)	9	(b)	10	(a)
11	(d)	12	(a)	13	(c)	14	(c)	15	(a)	16	(c)	17	(b)	18	(d)	19	(c)	20	(a)
21	(d)	22	(d)	23	(b)	24	(a)	25	(c)	26	(d)	27	(a)						

Hints and Solutions

1. $(15)^2+(8)^2+2=225+64+2=291$

2. We know that, a number ending with digits 2, 3, 7 or 8 can never be a perfect square. So, 198 cannot be written in the form of a perfect square.

3. Digit 7 cannot be a place of a perfect square.

4. By using long division method,

	8.6
8	$\overline{73}.\overline{96}$
+8	64
166	996
	996
	×

Hence, $\sqrt{73.96}=8.6$

5. According to question,
$$\sqrt{3018+\sqrt{36+\sqrt{169}}}=\sqrt{3018+\sqrt{36+13}}$$
$$=\sqrt{3018+7}=\sqrt{3025}=55$$

6. $\sqrt{12}+\sqrt{24}=\sqrt{2\times2\times3}+\sqrt{2\times2\times6}$
$$=2\sqrt{3}+2\sqrt{6}$$

7. We know that, the square of even number is even.

$\therefore$ The number $(34)^2$ has even unit digit.

8. Let the side of an equilateral triangle be a m.

Since, the area of an equilateral triangle
$$=24\sqrt{3}\,\text{m}^2$$

$\Rightarrow \quad \frac{\sqrt{3}}{4}a^2 = 24\sqrt{3} \Rightarrow a^2 = 96$

$\Rightarrow \quad a = 4\sqrt{6}$ m

9. $(301)^2 - (300)^2$

$= (301 + 300)(301 - 300)$

$[\because a^2 - b^2 = (a+b)(a-b)]$

$= (601) \times 1$

$= 601$

10. Total number of soldiers arranged

$= 8160 - 60 = 8100$

Since, the number of soldiers in each row is equal to number of rows.

$\therefore$ Number of soldiers in each row

$= \sqrt{8100}$

$= \sqrt{9 \times 9 \times 10 \times 10} = 90$

11. The greatest six digit number = 999999

	999
9	99 99 99
	81
189	1899
	1701
1989	19899
	17901
	1998
	×

$\therefore$ The greatest number of six digit which is a perfect square

$= 999999 - 1998$

$= 998001$

12. Let the fraction be x.

Then, $\quad x^2 = 227.798649$

$\therefore \quad x = \sqrt{227.798649} = 15.093$

[$\because$ using long divison method]

13. $6^2 = 36,\ a^2 = a^2, 10^2 = 100$

By Pythagoraem triplet, $6^2 + a^2 = 10^2$

$\Rightarrow \quad a^2 = 10^2 - 6^2$

$\Rightarrow \quad a^2 = 100 - 36 = 64$

$\Rightarrow \quad a = \sqrt{64} = 8$

14. Let the number be y.

If the number is increased by two times it becomes $2y$.

Square of the number $= (2y)^2 = 4y^2$

$\therefore$ The number will be increased by four times.

15. Let the number be $9x$ and $7x$.

According to the question,

$81x^2 - 49x^2 = 288$

$\Rightarrow \quad x^2 = \frac{288}{32} \Rightarrow x^2 = 9 \Rightarrow x = 3$

$\therefore$ The smaller number is 21.

16.

2	298116
2	149058
3	74529
3	24843
7	8281
7	1183
13	169
13	13
	1

$\Rightarrow \quad \sqrt{298116} = 2 \times 3 \times 7 \times 13$

$= 546$

$\therefore$ Number of digits = 3

17. $\sqrt{2401} = \sqrt{7^x}$

$\Rightarrow \quad 2401 = 7^x$

$\Rightarrow \quad 7^4 = 7^x$

$\therefore \quad x = 4$

18. We know, $256 < 269 < 289$

$\Rightarrow (16)^2 < 269 < (17)^2$

$\therefore$ Number to be added $= (17)^2 - 269$

$= 289 - 269 = 20$

19. $\sqrt{18225} + \sqrt{182.25} + \sqrt{1.8225} + \sqrt{0.018225}$

$= \sqrt{18225} + \sqrt{\frac{18225}{100}} + \sqrt{\frac{18225}{10000}} + \sqrt{\frac{18225}{1000000}}$

$= 135 + \frac{135}{10} + \frac{135}{100} + \frac{135}{1000}$

$= 135 + 13.5 + 1.35 + 0.135$

$= 149.985$

20. $\sqrt{\dfrac{0.85\times(0.105+0.024-0.008)}{0.022\times0.25\times1.7}}$

$$=\sqrt{\frac{0.85\times0.121}{0.022\times0.25\times1.7}}$$

$$=\sqrt{\frac{85\times121\times10}{22\times25\times17}}=\sqrt{11}$$

21. $\sqrt{\dfrac{16}{36}+\dfrac{1}{4}}=\sqrt{\dfrac{16+9}{36}}$

$$=\sqrt{\frac{25}{36}}=\frac{5}{6}$$

22. Given, $\dfrac{52}{x}=\sqrt{\dfrac{169}{289}}$

$\Rightarrow \quad x=\dfrac{52\times17}{13}=68$

23. Given, area of square board = 144 sq units

$\therefore \quad (\text{side})^2=144 \quad [\because \text{area of square}=(\text{side})^2]$

$\Rightarrow \quad (\text{side})^2=12$

$\Rightarrow \quad \text{side}=12 \text{ units}$

Hence, the length of each side of the board is 12 units.

24. Given, $\sqrt{1+\dfrac{25}{144}}=1+\dfrac{x}{12}$

$\Rightarrow \quad \sqrt{\dfrac{169}{144}}=1+\dfrac{x}{12}$

$\Rightarrow \quad \dfrac{13}{12}=1+\dfrac{x}{12}$

$\Rightarrow \quad \dfrac{x}{12}=\dfrac{1}{12}\Rightarrow x=1$

25. $\dfrac{4\sqrt{5}-4\sqrt{7}}{3\sqrt{5}-3\sqrt{7}}=\dfrac{4(\sqrt{5}-\sqrt{7})}{3(\sqrt{5}-\sqrt{7})}=\dfrac{4}{3}=1\dfrac{1}{3}$

26. Since, 17420 lies between 131^2 and 132^2.

Now, $(132)^2=17424$

Hence, it should be 4 added.

27. $\sqrt{0.09\times0.09\times x}=0.09\times0.09\times\sqrt{z}$

$\Rightarrow \quad 0.09\times\sqrt{x}=0.09\times0.09\times\sqrt{z}$

$\Rightarrow \quad \dfrac{\sqrt{x}}{\sqrt{z}}=0.09$

$\Rightarrow \quad \dfrac{x}{z}=(0.09)^2$ (squaring both sides)

$\Rightarrow \quad \dfrac{x}{z}=0.0081$

CHAPTER

03

CUBE AND CUBE ROOTS

In this chapter, we study the cubes of numbers and their properties, and cube roots by prime factorisation method.

Cube

The cube of a number is the product of the number itself thricely.

e.g. If x is a non-zero number, then $x \times x \times x = x^3$ is called cube of x.

The cube of rational number is the cube of the numerator divided by the cube of denominator. e.g. Cube of $\frac{4}{5}$ is $\frac{64}{125}$.

Perfect Cube

A natural number n is said to be a perfect cube if there is an integer m such that $n = m \times m \times m$.

Cubes from 1 to 15 numbers

Numbers	Cubes	Numbers	Cubes
1	1	9	729
2	8	10	1000
3	27	11	1331
4	64	12	1728
5	125	13	2197
6	216	14	2744
7	343	15	3375
8	512		

Properties of Cube of Numbers

(i) Cubes of all even natural numbers are always even.

(ii) Cubes of all odd natural numbers are always odd.

(iii) Cubes of negative integers are always negative.

(iv) For any rational number $\frac{a}{b}$, we have

$$\left(\frac{a}{b}\right)^3 = \frac{a^3}{b^3}$$

Example 1 Find the value of $(11)^3 + 4(7)^3 - 5$.

(a) 2697 (b) 2698 (c) 2699 (d) 3000

Sol. *(b)* $(11)^3 + 4(7)^3 - 5 = 1331 + 4(343) - 5$

$= 1331 + 1372 - 5 = 2698$

Example 2 Which one of the following will have odd unit digit

(a) $(24)^3$ (b) $(64)^3$

(c) $(27)^3$ (d) $(52)^3$

Sol. *(c)* We knwo cube of odd number is odd number.

$\therefore$ Number $(27)^3$ have odd unit digit

Cube Root

If n is perfect cube for any integer m i.e. $n = m^3$, then m is called the cube root of n and it is denoted by $m = \sqrt[3]{n}$.

Cube Root of a Perfect Cube by Prime Factorisation

The following steps are given below.

I. Factorise the given number into prime factors.

II. Make triples of similar factors or arrange them in group of three equal factors at a time.

III. Choose one prime from each pair and multiply all primes.

Example 3 Find the cube root of 74088.

(a) 40 (b) 47 (c) 42 (d) 45

Sol. *(c)* Resolving the given number, we get

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$$74088 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7}$$

$$\therefore \quad \sqrt[3]{74088} = 2 \times 3 \times 7 = 42$$

Cube Root of a Negative Cube

If a is a positive integer, then $-a$ is a negative integer.

We know that, $(-a)^3 = -a^3$

So, $\sqrt[3]{-a^3} = -a$

In general, we have $\sqrt[3]{-x} = -\sqrt[3]{x}$

Cube Root of Product of Numbers and Rational Number

(i) The cube root of product of integers is the cube root of integer by taking separately.

For any two integer a and b, we have

$$\sqrt[3]{ab} = \sqrt[3]{a} \times \sqrt[3]{b}$$

(ii) Cube Root of Rational Number $\frac{a}{b}$ is $\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$

Example 4 The simplified form of $\sqrt[3]{125 \times 64}$ is

(a) 20 (b) 40 (c) 60 (d) 80

Sol. *(a)* $125 \times 64 = \underline{5 \times 5 \times 5} \times \underline{4 \times 4 \times 4}$

$\therefore$ LHS $= \sqrt[3]{125 \times 64} = \sqrt[3]{(5 \times 4)^3} = (5 \times 4) = 20$

Now, $\sqrt[3]{125} = \sqrt[3]{5 \times 5 \times 5} = 5$

and $\sqrt[3]{64} = \sqrt[3]{4 \times 4 \times 4} = 4$

$\therefore$ RHS $= \sqrt[3]{125} \times \sqrt[3]{64} = (5 \times 4) = 20$

$\Rightarrow$ LHS = RHS

Hence, $\sqrt[3]{125 \times 64} = \sqrt[3]{125} \times \sqrt[3]{64}$

Example 5 Find the cube root of 4.096.

(a) 1.6 (b) 165
(c) 1.75 (d) None of these

Sol. (a) $\sqrt[3]{4.096} = \sqrt[3]{\frac{4096}{1000}} = \frac{\sqrt[3]{4096}}{\sqrt[3]{1000}}$

$\therefore \quad 4096 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$

$\therefore \quad \sqrt[3]{4096} = 2\times2\times2\times2 = 16$

Also, $\sqrt[3]{1000} = \sqrt[3]{10\times10\times10} = 10$

So, $\frac{\sqrt[3]{4096}}{\sqrt[3]{1000}} = \frac{16}{10} = 1.6$

Hence, $\sqrt[3]{4.096} = 1.6$

Important Points

(i) If 1, 4, 5, 6 and 9 in the unit place, then cube of that number given the same digit in the unit place.

(ii) 3 in the unit place have cube with 7 in the unit place.

(iii) 7 in the unit place have cube with 3 in the unit place.

(iv) 2 in the unit place have cube with 8 in the unit place.

(v) 8 in the unit place have cube with 2 in the unit place.

Example 6 Difference of two perfect cubes is 189. If the cube root of the smaller of the two numbers is 3, then find the cube root of the larger number.

(a) 5 (b) 6 (c) 7 (d) 8

Sol. (b) Given difference of two perfect cube = 189 and cube root of the smaller number = 3

$\therefore$ Cube of smaller number $= (3)^3 = 27$

Let cube root of the larger number be x.

Then, cube of larger number $= x^3$

According to the question,

$$x^3 - 27 = 189$$

$\Rightarrow \quad x^3 = 189 + 27 \Rightarrow x^3 = 216$

$\Rightarrow \quad x = \sqrt[3]{216} = \sqrt[3]{6\times6\times6}$

$\therefore \quad x = 6$

Hence, the cube root of the larger number is 6.

PRACTICE EXERCISE

1. Which of the following is not a perfect cube ?
(a) 1000000
(b) 216
(c) 10000
(d) None of the above

2. Which of the following perfect cube is the cube of an even number ?
(a) 343 (b) 2197
(c) 216 (d) 1331

3. Which of the following perfect cube is the cube of an odd number ?
(a) 1728 (b) 512
(c) 729 (d) 1000

4. If a number is increased by four times, then cube of the number will increase
(a) 64 times (b) 69 times
(c) 729 times (d) 1000 times

5. The value of $\sqrt[3]{\frac{27}{125}}$ is
(a) $\frac{3}{5}$ (b) $\frac{3}{25}$
(c) $\frac{9}{25}$ (d) not appropriate data

6. The unit place of cube roots of 117649 is
(a) 4 (b) 9
(c) 49 (d) None of these

7. The smallest number by which 3087 may be multiplied so that the product is a perfect cube, is
(a) 6 (b) 5
(c) 4 (d) 3

8. The smallest by which 392 may be divided so that the quotient is a perfect cube, is
(a) 50 (b) 51
(c) 49 (d) 62

9. In a number pattern, 8, 27, 64, x, the value of x will be
(a) 125 (b) 216 (c) 100 (d) 115

10. The cube of 31.2 is
(a) 3037.1328 (b) 3037.1381
(c) 30371.328 (d) 30371328

11. The sum of the cubes of first three natural number is equal to
(a) $(1 + 2 + 3)^3$ (b) $(1 + 2 + 3)^2$
(c) 3^3 (d) 3^2

12. The cube root of $\frac{-343}{1331}$ is
(a) $\frac{7}{11}$ (b) $\frac{-7}{11}$ (c) $\frac{11}{7}$ (d) $\frac{-11}{7}$

13. If one side of a cube is 33 m, then the volume of the cube is
(a) 35937 (b) 35936
(c) 3934 (d) None of these

14. Three numbers are in the ratio of 1 : 2 : 3. The sum of their cubes is 121500. The numbers are
(a) 15, 30, 45 (b) 30, 45, 15
(c) 7, 14, 21 (d) None of these

15. If the volume of a cubical box is 35.937 m^3, what is the length of its one side ?
(a) 3.3 m (b) 6.6 m
(c) 3.6 m (d) None of these

16. $(-216 \times 729)^{1/3}$
(a) 54 (b) –54 (c) –45 (d) 45

17. The value of $\sqrt[3]{0.064} + \sqrt[3]{27} - \sqrt[3]{729}$ is
(a) 12.4 (b) –2 (c) 5.6 (d) –5.6

18. The value of $\frac{\sqrt[3]{8}}{\sqrt{16}} \div \sqrt{\frac{100}{49}} \times \sqrt[3]{125}$ is
(a) 7 (b) $1\frac{3}{4}$ (c) $\frac{7}{100}$ (d) $\frac{4}{7}$

19. The value of $\sqrt{\sqrt[3]{0.004096}}$ is
(a) 0.4 (b) 0.04
(c) 0.16 (d) 4

20. The value of $(27 \times -2744)^{1/3}$ is
(a) – 40 (b) – 42
(c) – 22 (d) – 32

21. The value of $\frac{(73)^3 + (53)^3}{73 \times 73 - 73 \times 53 + 53 \times 53}$ is
(a) 126 (b) 216 (c) 162 (d) – 126

22. What is the smallest number in which we multiply by 392, we get the factors in the form of cube ?
(a) 5 (b) 6
(c) 7 (d) 8

23. The value of $\sqrt[3]{\frac{27}{64}}$ is
(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{5}{4}$ (d) $\frac{5}{3}$

24. If $\sqrt{\frac{x}{0.0064}} = \sqrt[3]{0.008}$, then the value of x is
(a) 0.256 (b) 0.0256
(c) 0.000256 (d) 0.00256

25. The smallest number in which we multiply by 1800, we get the cube. Then, the sum of digit is
(a) 2 (b) 3 (c) 6 (d) 8

26. If cube root of 175616 is 56, then the value of $\sqrt[3]{175.616} + \sqrt[3]{0.175616} + \sqrt[3]{0.000175616}$ is
(a) 0.168 (b) 6.216
(c) 6.116 (d) 62.16

27. The cube root of 0.000001 is
(a) 0.1 (b) 0.01
(c) 0.316 (d) 0.031

Answers

1	(c)	2	(c)	3	(c)	4	(a)	5	(a)	6	(b)	7	(d)	8	(c)	9	(a)	10	(c)
11	(b)	12	(b)	13	(a)	14	(a)	15	(a)	16	(b)	17	(d)	18	(b)	19	(a)	20	(b)
21	(a)	22	(c)	23	(a)	24	(c)	25	(c)	26	(b)	27	(b)						

Hints and Solutions

1. $\sqrt[3]{1000000} = 100$ is a perfect cube.

$\sqrt[3]{216} = 6$ is a perfect cube.

$\sqrt[3]{10000}$ = not a perfect cube.

2. 216 is the cube of an even number because cube of an even number is always even.

3. 729 is the cube of an odd number because the cube of odd number is always odd.

4. Let the number be x.

After increasing 4 times the number $= 4x$

Cube of the number $= (4x)^3 = 64x^3$

$\therefore$ The cube of a number increases by 64 times.

5. $\sqrt[3]{\frac{27}{125}} = \sqrt[3]{\frac{3 \times 3 \times 3}{5 \times 5 \times 5}} = \frac{3}{5}$

6. $\sqrt[3]{117649} = 49$

$\therefore$ Unit place is 9.

7. Writing 3087 as a product of a prime factors, we have

3	3087
3	1029
7	343
7	49
7	7
	1

$\therefore \quad 3087 = 3 \times 3 \times \underline{7 \times 7 \times 7}$

Clearly, to make it a perfect cube it must be multiplied by 3.

8. Writing 392 as a product of prime factors, we have

2	392
2	196
2	98
7	49
7	7
	1

$\therefore \quad 392 = 2 \times 2 \times 2 \times 7 \times 7$

Clearly, to make it perfect cube it must be divided by (7×7) i.e., 49.

9. Here, we see that $8 = 2^3$, $27 = 3^3$, $64 = 4^3$.

It means given pattern is a cube of consecutive natural number.

$\therefore \quad x = 5^3 = 125$

10. $31.2 \times 31.2 \times 31.2 = 30371.328$

11. $1^3 + 2^3 + 3^3 = 1 + 8 + 27$

$= 36 = (6)^2 = (1 + 2 + 3)^2$

12. $\sqrt[3]{\frac{-343}{1331}} = \frac{\sqrt[3]{-343}}{\sqrt[3]{1331}} = \frac{\sqrt[3]{-7 \times -7 \times -7}}{\sqrt[3]{11 \times 11 \times 11}} = \frac{-7}{11}$

13. Volume of cube $= (33)^3 = 35937$

14. Let the number be x, $2x$ and $3x$.

$\therefore \quad (x)^3 + (2x)^3 + (3x)^3 = 121500$

$\Rightarrow \quad 1x^3 + 8x^3 + 27x^3 = 121500$

$\Rightarrow \quad 36x^3 = 121500$

$\Rightarrow \quad x^3 = \frac{121500}{36}$

$\Rightarrow \quad x^3 = 3375$

$\Rightarrow \quad x = \sqrt[3]{3375}$

$\Rightarrow \quad x = \sqrt[3]{15 \times 15 \times 15}$

$\Rightarrow \quad x = 15$

$\therefore$ The numbers are $x = 15$, $2x = 30$, $3x = 45$.

15. $\because$ Volume of a cube $= (\text{side})^3$

$(\text{side})^3 = 35.937$

$\Rightarrow \quad \text{side} = \sqrt[3]{35.937}$

$\Rightarrow \quad \text{side} = \sqrt[3]{3.3 \times 3.3 \times 3.3}$

$\Rightarrow \quad \text{side} = 3.3\text{ m}$

16. $(-216 \times 729)^{1/3} = (-216)^{1/3} \times (729)^{1/3}$

$= -(\underline{6 \times 6 \times 6})^{1/3} \times (\underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3})^{1/3}$

$= -6 \times 3 \times 3 = -54$

17. $\sqrt[3]{0.064} + \sqrt[3]{27} - \sqrt[3]{729}$

$\because \quad \sqrt[3]{0.064} = \sqrt[3]{0.4 \times 0.4 \times 0.4} = 0.4$

$\sqrt[3]{27} = \sqrt[3]{3 \times 3 \times 3} = 3$

$\sqrt[3]{729} = \sqrt[3]{\underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3}}$

$= 3 \times 3 = 9$

$\therefore \quad \sqrt[3]{0.064} + \sqrt[3]{27} - \sqrt[3]{729} = 0.4 + 3 - 9 = -5.6$

18. $\dfrac{\sqrt[3]{8}}{\sqrt{16}} \div \sqrt{\dfrac{100}{49}} \times \sqrt[3]{125} = \dfrac{2}{4} \times \dfrac{7}{10} \times 5$

$= \dfrac{7}{4} = 1\dfrac{3}{4}$

19. $\sqrt{\sqrt[3]{0.004096}} = \sqrt{\sqrt[3]{(0.16)^3}} = \sqrt{0.16} = 0.4$

20. $(27 \times -2744)^{1/3} = (27)^{1/3} \times (-2744)^{1/3}$

$= 3 \times -14 = -42$

21. $\dfrac{(73)^3 + (53)^3}{73 \times 73 - 73 \times 53 + 53 \times 53}$

$= \dfrac{(73 + 53)(73 \times 73 - 73 \times 53 + 53 \times 53)}{73 \times 73 - 73 \times 53 + 53 \times 53}$

$= 73 + 53 = 126$

22.

2	392
2	196
2	98
7	49
7	7
	1

The divisible number of $392 = 2 \times 2 \times 2 \times 7 \times 7$. It is clear that on multiplying by 7, we get 392 cube number.

23. $\sqrt[3]{\dfrac{27}{64}} = \sqrt[3]{\left(\dfrac{3}{4}\right)^3} = \dfrac{3}{4}$

24. $\sqrt{x} = \sqrt{0.0064} \times \sqrt[3]{0.008}$

$\Rightarrow \sqrt{x} = 0.08 \times 0.2 = 0.016$

$\Rightarrow \quad x = 0.000256$

25. $1800 = 2^3 \times 3^2 \times 5^2$

It is clear that we have to multiply by 15 to get the sum of digit is 6.

26. $\sqrt[3]{175.616} + \sqrt[3]{0.175616} + \sqrt[3]{0.000175616}$

$= 5.6 + 0.56 + 0.056 = 6.216$

27. $(0.000001)^{1/3} = \sqrt[3]{0.000001}$

$= \sqrt[3]{\dfrac{1}{1000000}} = \dfrac{1}{100}$

$= 0.01$

CHAPTER

04

EXPONENTS /POWERS AND SURD

In this chapter, we study the positive and negative exponents with their laws of exponents and also surds with their laws of exponent.

Exponential Form

The repeated multiplication of the same non-zero rational number a with itself in the form of a^n {i.e., $a \times a \times \ldots\ldots\ldots\ldots \times a \times (n \text{ times}) = a^n$}, where a is called the base and n is an integer called the exponent or index. This type of representation of a number is called the exponential form of the given number. e.g. $6 \times 6 \times 6 = 6^3$

Here, 6 is the base and 3 is the exponent and we read it as "6 raised to the power of 3".

Rational Exponents

A rational exponents represent both an integer exponent and nth root.

e.g. $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

Negative Integral Exponents

For any non-zero integer a, we have

$$a^{-n} = \frac{1}{n} \text{ or } a^{-n} \times a^n = 1$$

So, a^{-n} is the multiplicative inverse or reciprocal of a^n and *vice-versa*.

e.g. $(5)^{-2} = \frac{1}{5^2}$

Example 1 Find the multiplicative inverse of 10^{-5}.

(a) 10^4 (b) 10^5

(c) 10^6 (d) None of these

Sol. *(b)* We have, $10^{-5} = \frac{1}{10^5}$

Reciprocal of $\frac{1}{10^5} = 10^5$

$\therefore$ Multiplicative inverse of 10^{-5} is 10^5

$[\because \ 10^{-5} \times 10^5 = 10^0 = 1]$

Laws of Exponent

I. If a and b be any real numbers and m, n be positive integers, then

(i) $a^m \times a^n = a^{m+n}$

(ii) $a^m \div a^n = a^{m-n}, a \neq 0$

(iii) $(a^m)^n = a^{mn}$ (iv) $(ab)^n = a^n b^n$

(v) $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ (vi) $(a)^0 = 1, \ a \neq 0$

II. If a and b be any real numbers and m, n be negative integers, then

(i) $a^{-m} \times a^{-n} = \frac{1}{a^m} \times \frac{1}{a^n}$

$= \frac{1}{a^m \times a^n} = \frac{1}{a^{m+n}} = a^{-(m+n)}$

(ii) $a^{-m} \div a^{-n} = \frac{1}{a^m} \div \frac{1}{a^n} = \left(\frac{1}{a^m} \times \frac{a^n}{1}\right)$

$= \frac{a^n}{a^m} = a^{n-m} = a^{-m-(-n)}$

(iii) $(a^{-m})^{-n} = \left[\frac{1}{(a^{-m})}\right]^n$

$= (a^m)^n = a^{mn} = a^{(-m)(-n)}$

(iv) $(ab)^{-n} = \frac{1}{(ab)^n} = \frac{1}{a^n \times b^n}$

$= \frac{1}{a^n} \times \frac{1}{b^n} = a^{-n} \times b^{-n}$

(v) $\left(\frac{a}{b}\right)^{-n} = \frac{1}{\left(\frac{a}{b}\right)^n} = \frac{1}{\frac{a^n}{b^n}} = \frac{b^n}{a^n} = \frac{a^{-n}}{b^{-n}}$

Example 2 $\left(\frac{5}{7}\right)^8 \div \left(\frac{4}{5}\right)^8$ is equal to

(a) $\left(\frac{5}{7} / \frac{4}{5}\right)^8$ (b) $\left(\frac{5}{7} \times \frac{4}{5}\right)^8$

(c) $\left(\frac{5}{7} / \frac{4}{5}\right)^0$ (d) None of these

Sol. *(a)* $\frac{(5/7)^8}{(4/5)^8} = \left(\frac{5/7}{4/5}\right)^8$ $\left[\because \frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m\right]$

$= \left(\frac{5}{7} / \frac{4}{5}\right)^8$

Example 3 The value of

$(7^{-1} - 8^{-1})^{-1} - (3^{-1} - 4^{-1})^{-1}$ is

(a) 44 (b) 56 (c) 68 (d) 12

Sol. *(a)* Using law of exponents, $a^{-m} = \frac{1}{a^m}$

$[\because a$ is non-zero integer$]$

$\therefore \quad (7^{-1} - 8^{-1})^{-1} - (3^{-1} - 4^{-1})^{-1}$

$= \left(\frac{1}{7} - \frac{1}{8}\right)^{-1} - \left(\frac{1}{3} - \frac{1}{4}\right)^{-1} = \left(\frac{1}{56}\right)^{-1} - \left(\frac{1}{12}\right)^{-1}$

$= 56 - 12 = 44$

Example 4 Evaluate $\left(\frac{625}{81}\right)^{-1/4}$

(a) $\frac{3}{5}$ (b) $\frac{5}{3}$ (c) $\frac{1}{5}$ (d) $\frac{5}{2}$

Sol. *(a)* $\left(\frac{625}{81}\right)^{-1/4} = \left(\frac{81}{625}\right)^{1/4} = \left(\frac{3^4}{5^4}\right)^{1/4}$

$= \left[\left(\frac{3}{5}\right)^4\right]^{1/4} = \frac{3}{5}$

Example 5 Simplify $\left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b \times \left(\frac{x^a}{x^b}\right)^c$

(a) 0 (b) 1 (c) –1 (d) 2

Sol. *(b)* Given expression

$= (x^{b-c})^a \times (x^{c-a})^b \times (x^{a-b})^c$

$= x^{a(b-c) + b(c-a) + c(a-b)}$

$= x^0 = 1$

Surd or Radicals

If $\sqrt[n]{a}$ is irrational, where a is a rational number and n is a positive integer, then $\sqrt[n]{a}$ or $a^{1/n}$ is called a surd or radical of order n and a is called the radicand.

- A surd of order 2 is called a quadratic or square surd.
- A surd of order 3 is called a cubic surd.
- A surd of order 4 is called a biquadratic surd.

Surd in Simplest Form

A surd in its simplest form has

(i) the smallest possible index of this radical.

(ii) no fraction under the radical sign.

(iii) no factor of the form b^n, where b is rational, under the radical sign of index n.

Note Let n be a positive integer and a be a real number.

(i) If a is irrational, then $\sqrt[n]{a}$ is not a surd.

(ii) If a is rational, then $\sqrt[n]{a}$ is a surd.

Laws of Surd

As surds can be expressed with fractional exponent, the laws of indices are therefore, applicable to surd.

(i) $(\sqrt[n]{a})^n = a$ (ii) $\sqrt[n]{ab} = \sqrt[n]{a}\,\sqrt[n]{b}$

(iii) $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a} = \sqrt[n]{\sqrt[m]{a}}$

(iv) $\sqrt[n]{\dfrac{a}{b}} = \dfrac{\sqrt[n]{a}}{\sqrt[n]{b}}$

(v) $(\sqrt[n]{a})^m = \sqrt[n]{a^m}$

Example 6 The index form of $\sqrt[9]{\left(\frac{4}{5}\right)^3}$ is

(a) $\left(\frac{4}{5}\right)^{1/3}$ (b) $\left(\frac{4}{5}\right)^{3}$ (c) $\left(\frac{4}{5}\right)^{1/2}$ (d) $\left(\frac{4}{5}\right)^{1/27}$

Sol. *(a)* $\sqrt[9]{\left(\frac{4}{5}\right)^3} = \left[\left(\frac{4}{5}\right)^3\right]^{1/9} = \left(\frac{4}{5}\right)^{3/9} = \left(\frac{4}{5}\right)^{1/3}$

$[\because (a^m)^n] = a^{mn}$

Example 7 If $3^x = 5^y = 75^z$, then the value of z is

(a) $\dfrac{xy}{(2x+y)}$ (b) $\dfrac{xy}{x+2y}$

(c) $\dfrac{xy}{x-y}$ (d) $\dfrac{xy}{x-2y}$

Sol. *(a)* Let $3^x = 5^y = (75)^z = k$

Then, $3 = k^{1/x}, 5 = k^{1/y}$ and $75 = k^{1/z}$

Now, $75 = 3 \times 5^2$

$\Rightarrow \quad k^{1/z} = k^{1/x} \cdot k^{2/y}$

$\Rightarrow \quad k^{1/z} = k^{\left(\frac{1}{x}+\frac{2}{y}\right)}$

$\therefore \quad \dfrac{1}{z} = \dfrac{1}{x} + \dfrac{2}{y}$

$\Rightarrow \quad z = \dfrac{xy}{(2x+y)}$

PRACTICE EXERCISE

1. The value of $\dfrac{5^0+2^1}{3^2+8^0}$ is

(a) $\dfrac{3}{10}$ (b) $\dfrac{5}{3}$

(c) $\dfrac{2}{5}$ (d) $\dfrac{3}{5}$

2. The multiplicative inverse of 10^{-100} is

(a) 10 (b) 100

(c) 10^{100} (d) 10^{-100}

3. The value of $\dfrac{5}{(121)^{-1/2}}$ is

(a) -55 (b) $\dfrac{1}{55}$ (c) $-\dfrac{1}{55}$ (d) 55

4. The value of $3 \times 9^{-3/2} \times 9^{1/2}$ is

(a) $\dfrac{1}{3}$ (b) 3

(c) 27 (d) $-\dfrac{1}{3}$

5. The simplified form of $(-4)^5 \div (-4)^8$ is

(a) $\frac{1}{4^3}$ (b) $\frac{1}{(-4)^3}$

(c) $\frac{1}{4^4}$ (d) None of these

6. The value of $\left(\frac{1}{2^3}\right)^2$ is

(a) $\frac{1}{62}$ (b) $\frac{1}{64}$

(c) $\frac{1}{32}$ (d) None of these

7. Evaluate $(-3)^4 \times \left(\frac{5}{3}\right)^4$

(a) 5^7 (b) 5^6

(c) 5^3 (d) 5^4

8. Evaluate, $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$

(a) -1 (b) -2

(c) -3 (d) -4

9. If $5^a = 3125$, then the value of 5^{a-3} is

(a) 625 (b) 25

(c) 5 (d) 225

10. The standard form of 0.0000078 is

(a) 78×10^{-6} (b) 78×10^{6}

(c) 78×10^{-5} (d) None of these

11. If $3^x = \frac{1}{9}$, the value of x is

(a) 2 (b) -2 (c) 1/2 (d) 1

12. The value of $(12^2 + 5^2)^{1/2}$ is

(a) 11 (b) 13 (c) 12 (d) 15

13. The value of $(0.000064)^{5/6}$ is

(a) $\frac{32}{100000}$ (b) $\frac{16}{10000}$

(c) $\frac{16}{100000}$ (d) None of these

14. The value of $\left[\left(\frac{25}{9}\right)^{5/2}\right]^{3/5}$ is

(a) $\frac{25}{27}$ (b) $\frac{125}{27}$

(c) $\frac{25}{9}$ (d) None of these

15. The value of $\left(-\frac{1}{125}\right)^{-2/3}$ is

(a) 5 (b) 25

(c) -25 (d) None of these

16. The value of $\frac{(81)^{1/3} \times (576)^{1/3}}{(64)^{2/3} \times (27)^{2/3}}$ is

(a) $\frac{1}{4}$ (b) $\frac{3}{4}$

(c) $\frac{5}{8}$ (d) None of these

17. The value of $\frac{2^{10+n} \times 4^{3n-5}}{2^{4n+1} \times 2^{3n-1}}$ is

(a) 0 (b) 1

(c) 3 (d) 4

18. If $9\sqrt{x} = \sqrt{12} + \sqrt{147}$, then the value of x is

(a) 1 (b) 2

(c) 3 (d) 4

Answers

1	(a)	2	(c)	3	(d)	4	(a)	5	(b)	6	(b)	7	(d)	8	(a)	9	(b)	10	(a)
11	(b)	12	(b)	13	(a)	14	(b)	15	(b)	16	(a)	17	(b)	18	(c)				

Hints and Solutions

1. $\frac{5^0 + 2^1}{3^2 + 8^0} = \frac{1+2}{9+1} = \frac{3}{10}$

2. For multiplicative inverse, let a be the multiplicative inverse of 10^{-100}.

[$\because$ If a is multiplicative inverse of b then $a \times b = 1$]

$\therefore\ a \times 10^{-100} = 1$

$\Rightarrow \quad a = \frac{1}{10^{-100}} \frac{1}{\frac{1}{10^{100}}} = 10^{100} \quad \left[\because a^{-m} = \frac{1}{a^m}\right]$

3. $\frac{5}{(121)^{-1/2}} = 5 \times 121^{1/2}$

$= 5 \times (11^2)^{1/2} = 5 \times 11 = 55$

4. $3 \times 9^{-3/2} \times 9^{1/2} = 3 \times \left(3^{2 \times -\frac{3}{2}}\right) \times \left(3^{2 \times \frac{1}{2}}\right)$

$= 3 \times (3)^{-3} \times 3 = 3 \times \left(\frac{1}{3}\right)^3 \times 3$

$= 3 \times \frac{1}{27} \times 3 = \frac{1}{3}$

5. We have, $(-4)^5 \div (-4)^8$

$= \frac{(-4)^5}{(-4)^8} = \frac{1}{(-4)^8 \times (-4)^{-5}} \quad \left[\because a^m = \frac{1}{a^{-m}}\right]$

$= \frac{1}{(-4)^{8-5}} = \frac{1}{(-4)^3} \quad [\because a^m \times a^n = a^{m+n}]$

which is the required form.

6. We have, $\left(\frac{1}{2^3}\right)^2$

$= \frac{(1)^2}{(2^3)^2} \quad \left[\because \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}\right]$

$= \frac{1}{2^6} = \frac{1}{64} \quad [\because (a^m)^n = a^{m \times n}]$

7. We have, $(-3)^4 \times \left(\frac{5}{3}\right)^4$

$= (-1 \times 3)^4 \times \left(\frac{5}{3}\right)^4 \quad [\because -a = -1 \times a]$

$= (-1)^4 \times 3^4 \times \frac{5^4}{3^4}$

$[\because (a \times b)^m = a^m \times b^m, \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}]$

$= 1 \times 5^4 = (5)^4 \quad [\because (-1)^4 = 1]$

which is the required form.

8. We have, $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$

$= \left\{\frac{(1)^{-1}}{(3)^{-1}} - \frac{(1)^{-1}}{(4)^{-1}}\right\}^{-1} \quad \left[\because \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}\right]$

$= \left\{\frac{3}{1} - \frac{4}{1}\right\}^{-1} \quad \left[\because a^{-m} = \frac{1}{a^m}\right]$

$= (3-4)^{-1} = (-1)^{-1} \quad \left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{(-1)^1}$

$= \frac{1}{-1} = -1$

9. Given, $5^a = 3125$

$\Rightarrow \quad 5^a = 5^5$

On comparing, we get

$a = 5$

$\therefore \quad 5^{a-3} = 5^{5-3} = 25$

10. According to question,

$0.000078 = \frac{78}{1000000} = 78 \times 10^{-6}$

11. $\because \quad 3^x = \frac{1}{9}$

$\therefore \quad 3^x = \left(\frac{1}{3}\right)^2$

or $\quad 3^x = 3^{-2}$

On comparing both sides, we get $x = -2$

12. $(12^2 + 5^2)^{1/2} = (144 + 25)^{1/2}$

$= (169)^{1/2}$

$= (13^2)^{1/2} = 13$

13. $(0.000064)^{5/6} = \left(\frac{64}{1000000}\right)^{5/6}$

$$= \left[\left\{\left(\frac{2}{10}\right)^6\right\}^{1/6}\right]^5 = \left(\frac{2}{10}\right)^5 = \frac{32}{100000}$$

14. $\left[\left(\frac{25}{9}\right)^{5/2}\right]^{3/5} = \left[\left\{\left(\frac{5}{3}\right)^2\right\}^{5/2}\right]^{3/5}$

$$= \left[\left(\frac{5}{3}\right)^5\right]^{3/5} = \left(\frac{5}{3}\right)^3 = \frac{125}{27}$$

15. $\left(-\frac{1}{125}\right)^{-2/3} = \left[\left(-\frac{1}{5} \times -\frac{1}{5} \times -\frac{1}{5}\right)^{-1/3}\right]^2$

$$= (-5)^2 = 25$$

16. $\frac{(81)^{1/3} \times (576)^{1/3}}{(64)^{2/3} \times (27)^{2/3}} = \frac{(3^4)^{1/3} \times (2^6 \times 3^2)^{1/3}}{(4^3)^{2/3} \times (3^3)^{2/3}}$

$$= \frac{3^{4/3} \times 2^2 \times 3^{2/3}}{4^2 \times 3^2} = \frac{3^2 \times 2^2}{4^2 \times 3^2} = \frac{9 \times 4}{16 \times 9} = \frac{1}{4}$$

17. $\frac{2^{10+n} \times 4^{3n-5}}{2^{4n+1} \times 2^{3n-1}} = \frac{2^{10+n} \times 2^{6n-10}}{2^{4n+1} \times 2^{3n-1}}$

$$= \frac{2^{10+n+6n-10}}{2^{4n+1+3n-1}} = \frac{2^{7n}}{2^{7n}} = 1$$

18. $9\sqrt{x} = \sqrt{12} + \sqrt{147}$

$$= \sqrt{2 \times 2 \times 3} + \sqrt{3 \times 7 \times 7}$$

$$= 2\sqrt{3} + 7\sqrt{3}$$

$\Rightarrow \quad 9\sqrt{x} = 9\sqrt{3} \quad \Rightarrow \quad x^{1/2} = 3^{1/2}$

On comparing both sides, we get $x = 3$

CHAPTER

05

RATIO AND PROPORTION

In this chapter, we study the ratio and proportion with their properties and also proportion.

Ratio

The ratio of two quantities of the same kind and in the same unit is the fraction that one quantity is of the other.

Note : In the ratio $a : b$, the first term a is antecedent and second term b is consequent.

Properties of Ratios

(i) The value of a ratio remains unchanged, if each one of its terms is multiplied or divided by a same non-zero number.

(ii) If $a : b$ and $c : d$ are two ratios, then the compounded ratio is $ac : bd$.

Example 1 If $a : b = 2 : 5$, the value of $(3a + 4b) : (4a + 5b)$ is

(a) $\frac{26}{33}$ (b) $\frac{33}{26}$ (c) $\frac{44}{23}$ (d) $\frac{33}{25}$

Sol. *(a)* We have, $\frac{3a+4b}{4a+5b} = \frac{3\left(\frac{a}{b}\right)+4}{4\left(\frac{a}{b}\right)+5} = \frac{3\times\frac{2}{5}+4}{4\times\frac{2}{5}+5} = \frac{26}{33}$ $\left[\because \frac{a}{b} = \frac{2}{5} \text{ given}\right]$

Proportion

If two ratio are equal, then we can say that both ratio are in proportion .

Direct Proportion

If the values of two quantities depend on each other in such a way that, a change in one, results in a corresponding change in the other and *vice-versa*, then the two quantities are said to be in direct proportion.

In other words, if two quantities a and b vary with each other in such a manner that the ratio $\frac{a}{b}$ (or $a : b$) remains constant, i.e. $\frac{a}{b} = k$ or $a = kb$ (where, k is any positive constant), then we say that a and b vary directly with each other or a and b are in direct proportion or a and b have a direct variation.

Example 2 The variable x varies directly as y and $x = 80$ when y is 160. What is y when x is 64?

(a) 127 (b) 128 (c) 129 (d) 130

Sol. *(b)* If x varies directly as y.

$\therefore$ $x / y = k$ (constant) ...(i)

If $x = 80$ and $y = 160$

$\therefore$ $\frac{x}{y} = \frac{80}{160} = \frac{1}{2} \Rightarrow k = \frac{1}{2}$

When $x = 64$, then from Eq. (i),

$\frac{64}{y} = \frac{1}{2}$ [putting the value of k]

$\Rightarrow$ $y = 64 \times 2 = 128$

Inverse Proportion

The two quantities may vary in such a way that if one increases, the other decreases and *vice-versa*, then the two quantities are said to be inverse proportion. In other words if two quantities a and b vary with each other in such a manner that the product ab remains constant and is positive, then we say that a varies inversely with b and b varies inversely with a. Thus, two quantities a and b are said to vary in inverse proportion, if there exists a relation of the type $ab = k$ between them, where k is a positive constant.

Let a, b, c and d are four quantities, then the proportional are $a : b :: c : d$.

where a, b, c, d are known as first proportional, second proportional, third proportional and fourth proportional respectively.

Note (i) In the proportion $a : b :: c : d$, a and d are extreme values and b and c are mean values. i.e. Product of means = Product of extreme.

(ii) If x is the third proportional to a, b, then $a : b :: b : x$.

Example 3 If x varies inversely as y and $y = 60$ when $x = 1.5$. Find x, when $y = 4.5$.

(a) 20 (b) 21 (c) 22 (d) 23

Sol. *(a)* If x varies inversely as y.

$\therefore$ $xy = k$ (constant) ...(i)

If $x = 1.5$ and $y = 60$

$\therefore$ $xy = 1.5 \times 60 = 90$

$\Rightarrow$ $k = 90$

When $y = 4.5$, then from Eq. (i),

$4.5 \times x = k$

$\Rightarrow$ $4.5 \times x = 90$ [putting the value of k]

$\Rightarrow$ $x = \frac{90}{4.5} = 20$

Example 4 In a camp, there is enough flour for 300 persons for 42 days. How long will the flour last, if 20 more persons join the camp?

(a) $\frac{315}{7}$ day (b) $\frac{315}{8}$ day

(c) $\frac{126}{8}$ day (d) None of these

Sol. *(b)* $\because$ For 300 persons flour is enough for 42 days.

$\therefore$ For 1 person flour enough

$= 300 \times 42 = 12600$ days

Now, 20 more persons join the camp.

So, total persons = 300 + 20 = 320

$\therefore$ For 320 persons flour enough

$= \frac{12600}{320} = \frac{315}{8}$ day

Example 5 The fourth proportional of 6, 11 and 12 is

(a) 29 (b) 23

(c) 72 (d) 22

Sol. *(d)* Let fourth proportional be x, then

$6 : 11 :: 12 : x$

[$\because$ Product of means = Product of extreme]

$\Rightarrow$ $6 \times x = 11 \times 12$

$\Rightarrow$ $x = \frac{11 \times 12}{6} = 22$

PRACTICE EXERCISE

1. The number of teeth and the age of a person vary
(a) directly with each other
(b) inversely with each other
(c) neither directly nor inversely with each other
(d) sometimes directly and sometimes inversely with each other

2. Which of the following vary inversely with each other?
(a) Speed and distance covered
(b) Distance covered and taxi fare
(c) Distance travelled and time taken
(d) Speed and time taken

3. Both x and y are in direct proportion, then $\frac{1}{x}$ and $\frac{1}{y}$ are
(a) in indirect proportion
(b) in direct proportion
(c) neither in direct nor in inverse proportion
(d) sometimes in direct and sometimes in inverse proportion

4. If two quantities p and q vary inversely with each other, then
(a) $\frac{p}{q}$ remains constant
(b) $p + q$ remains constant
(c) $p \times q$ remains constant
(d) $p - q$ remains constant

5. The variable x is inversely proportional to y. If x increases by $p\%$, then by what per cent will y decrease?
(a) $p\%$ (b) $2p\%$
(c) $3p\%$ (d) None of these

6. l varies directly as m and $l = 5$, when $m = \frac{2}{3}$.
Find l when $m = \frac{16}{3}$.
(a) 38 (b) 39
(c) 40 (d) 41

7. The fourth proportional to 3, 5 and 21 is
(a) 35 (b) $\frac{5}{7}$
(c) $\frac{7}{5}$ (d) None of these

8. What must be added to each term of the ratio 49 : 68, so that it becomes 3 : 4?
(a) 11 (b) 10 (c) 7 (d) 8

9. A bag contains ₹600 in the form of one rupee, 50 paise and 25 paise coins in the ratio 3 : 4 : 12. The number of 25 paise coins is
(a) 800 (b) 900
(c) 1205 (d) None of these

10. The cost of making an article is divided between materials, labour and overheads in the ratio 5 : 3 : 1. If the materials cost ₹6.90, then cost of the article is
(a) ₹12.42 (b) ₹13.20
(c) ₹14.00 (d) None of these

11. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, then $\frac{a+b+c}{c}$ is equal to
(a) $\frac{1}{7}$ (b) $\frac{1}{2}$ (c) 7 (d) 2

12. Out of the ratios 7 : 20; 13 : 25; 17 : 30 and 11 : 15, the smallest one is
(a) 10 : 7 (b) 7 : 20
(c) 17 : 20 (d) None of these

13. ₹770 have been divided among A, B, C in such a way that A receives $\frac{2}{9}$th of what B and C together receive. Then, A's share is
(a) ₹140 (b) ₹154
(c) ₹165 (d) ₹ 170

14. If x varies inversely as y and $x = 20$ when $y = 600$, find y when $x = 400$.
(a) 30 (b) 40
(c) 32 (d) 35

15. If $2x = 3y = 4z$, then $x : y : z$ is
(a) $6:4:3$ (b) $5:4:2$
(c) $2:3:4$ (d) None of these

16. The ratio of number of boys and girls in a school of 720 students is $7:5$. How many more girls should be admitted to make the ratio $1:1$?
(a) 160 (b) 145 (c) 120 (d) 170

17. The incomes of A and B are in the ratio $3:2$ and their expenditures in the ratio $5:3$. If each saves ₹1500, then B's income is
(a) ₹6000 (b) ₹4700
(c) ₹3000 (d) ₹7500

18. Third proportional to 9 and 12 is
(a) 16 (b) 10.5
(c) $6\sqrt{3}$ (d) None of these

19. If $a : b = 3:4$, then $(6a + b) : (4a + 5b)$ is
(a) $1:2$
(b) $3:5$
(c) $7:9$
(d) None of the above

20. The ratio of zinc and copper in a brass piece is $13:7$. How much zinc will be there in 100 kg of such a piece ?
(a) 65 kg (b) 40 kg
(c) 45 kg (d) 50 kg

Answers

1	(d)	2	(d)	3	(b)	4	(c)	5	(a)	6	(c)	7	(a)	8	(d)	9	(b)	10	(a)
11	(d)	12	(b)	13	(a)	14	(a)	15	(a)	16	(c)	17	(a)	18	(a)	19	(d)	20	(a)

Hints and Solutions

1. The number of teeth and the age of a person vary sometimes directly and sometimes inversely with each other, we cannot predict about the number of teeth with exactly the age of a person. It change with person-to-person.

Hence, option (d) is correct.

2. We know that, when we increases the speed, then the time taken by vehicle decreases.

Hence, speed and time taken vary inversely with each other.

So, option (d) is correct.

3. If both x and y are in directly proportion, then $\frac{1}{x}$ and $\frac{1}{y}$ are in direct proportion.

Hence, option (b) is correct.

4. If two quantities p and q vary inversely with each other, then $p \times q$ remains constant. Since, in inverse proportion, an increase in p cause a proportional decrease in q and vice-versa.

Hence, option (c) is correct.

5. The variable x is inversely proportionls to y.

$\therefore \quad xy = k$ (constant)

Since, we know that two quantities x and y are said to be in inverse proportion, if an increase in x cause a proportional decrease in y and *vice-versa*.

So, we can say y decrease by $p\%$.

6. If l varies directly as m.

$\therefore \quad l/m = k$ (constant) ...(i)

If $\quad l = 5$ and $m = \frac{2}{3}$

$\therefore \quad \frac{l}{m} = \frac{5}{2/3} = \frac{5}{1} \times \frac{3}{2} = \frac{15}{2}$

$\Rightarrow \quad k = \frac{15}{2}$

When, $m = \frac{16}{3}$, then from Eq. (i),

$\frac{l}{16/3} = \frac{15}{2}$ [putting the value of k]

$\Rightarrow \quad l = \frac{15}{2} \times \frac{16}{3} = 40$

7. Let the fourth proportional be x.

$\therefore \quad 3:5::21:x$

$\Rightarrow \quad x = \frac{5 \times 21}{3} = 35$

8. Let the number be x added in the given ratio.

$\therefore \quad \frac{49+x}{68+x} = \frac{3}{4}$

$\Rightarrow \quad 4(49+x) = 3(68+x)$

$\Rightarrow \quad x = 8$

9. Given ratio is $3:4:12$.

The ratio of values in coins $= \frac{3}{1}:\frac{4}{2}:\frac{12}{4} = 3:2:3$

Value of 25 paise coins $= ₹\left(600 \times \frac{3}{8}\right) = ₹\,225$

$\therefore$ Number of these coins $= 225 \times 4 = 900$

10. If material cost be ₹5, then cost of article be ₹9.

$\therefore \quad 5:9 :: 6.90 : x$

$\Rightarrow \quad x = \frac{9 \times 6.90}{5}$

$\Rightarrow \quad x = ₹\,12.42$

11. Let $\frac{a}{3} = \frac{b}{4} = \frac{c}{7} = k$.

Then, $a = 3k$, $b = 4k$ and $c = 7k$.

$\therefore \quad \frac{a+b+c}{c} = \frac{3k+4k+7k}{7k} = 2$

12. Now, $\frac{7}{20} = 0.35$, $\frac{13}{25} = 0.52$, $\frac{17}{30} = 0.56$ and $\frac{11}{15} = 0.73$.

$\therefore$ The smallest value is 0.35 i.e. ratio $7:20$.

13. $\therefore \quad A:(B+C) = 2:9$

$\therefore \quad A$'s part $= ₹\left(770 \times \frac{2}{11}\right) = ₹\,140$

14. If x varies inversely as y.

$\therefore \quad xy = k$ (constant) ...(i)

If $\quad x = 20$ and $y = 600$

$\therefore \quad xy = 20 \times 600 = 12000$

$\Rightarrow \quad k = 12000$

When $x = 400$, then from Eq. (i),

$y \times 400 = k$

$\Rightarrow \quad y \times 400 = 12000$ [putting the value of k]

$\Rightarrow \quad y = \frac{12000}{400} = 30$

15. Let $2x = 3y = 4z = k$

Then, $x = \frac{k}{2}$, $y = \frac{k}{3}$ and $z = \frac{k}{4}$

$\therefore \quad x:y:z = \frac{k}{2}:\frac{k}{3}:\frac{k}{4} = \frac{1}{2}:\frac{1}{3}:\frac{1}{4} = 6:4:3$

16. Number of boys $= 720 \times \frac{7}{12} = 420$

Number of girls $= 720 - 420 = 300$

$\therefore$ Number of girls to be admitted

$= 420 - 300 = 120$

17. Let their incomes be $3x$ and $2x$ and their corresponding expenditure be $5y$ and $3y$.

According to the given conditions,

$3x - 5y = 1500$ and $2x - 3y = 1500$

On solving, we get

$x = 3000$ and $y = 1500$

Hence, B's income $= 2x = ₹\,6000$

18. Let third proportion be x.

$\therefore \quad 9:12 :: 12:x$

$\Rightarrow \quad 9x = 12 \times 12$

$\Rightarrow \quad x = 16$

19. Now, $\frac{6a+b}{4a+5b} = \frac{6\left(\frac{a}{b}\right)+1}{4\left(\frac{a}{b}\right)+5}$

$= \frac{6 \times \frac{3}{4}+1}{4 \times \frac{3}{4}+5} = \frac{11}{16}$

20. Amount of zinc $= \left(100 \times \frac{13}{20}\right)$ kg

$= 65$ kg

CHAPTER

06

COMPARING QUANTITIES

In this chapter, we study about the percentage and its important rules, profit, loss and discount with their important rules. Apart from this we will also study Simple and Compound Interest.

Sometimes, we have to measure and compare our daily life quantities such as height, distance, price of commodity, rate of interest etc. The best measure of these compare quantities in the percentage.

Percentage

The meaning of term per cent is per hundred or hundred part.

e.g. Meaning of 38% is $\frac{38}{100}$ i.e. 38 parts out of 100 parts.

e.g. $\frac{30}{100} = 30\%$

Important Rules

(i) For expressing 'x' % as a fraction, then $x\% = \frac{x}{100}$.

(ii) For expressing a fraction $\frac{x}{y}$ as a per cent. Then, $\frac{x}{y} = \left(\frac{x}{y} \times 100\right)\%$

(iii) If A's income is x% more than that of B, then B's income is less than that of A by $\left[\frac{x}{100 + x} \times 100\right]\%$.

(iv) If A's income is x% less than that of B, then B's income is more than that of A by $\left[\frac{x}{100 - x} \times 100\right]\%$.

Example 1 What per cent of $\frac{2}{7}$ is $\frac{1}{35}$?

(a) 10% (b) 11% (c) 12% (d) 13%

Sol. (*a*) Required per cent $= \left[\frac{\frac{1}{35}}{\frac{2}{7}} \times 100\right]\%$

$= \left(\frac{1}{35} \times \frac{7}{2} \times 100\right)\%$

$= 10\%$

Example 2 The salary of a worker is first increased by 10% and thereafter it was reduced by 10%. What was the change in his salary ?

(a) 4% (b) 2% (c) 3% (d) 1%

Sol. (*d*) Let the salary of the worker be ₹ 100. After increase, it becomes ₹100 + 10% of 100 = ₹ 110

After decrease, it becomes ₹110 − 10% of ₹110 = ₹99

The percentage reduction = 100 − 99 = 1%

Example 3 The length of a rectangle is increased by 60%. By what per cent would the breadth be decreased to maintain the same area?

(a) $37\frac{1}{2}\%$ (b) 38% (c) 39% (d) 40%

Sol. (*a*) Let the length be 100 m and breadth be 100 m, then

New length = 160 m, new breadth = x,

then $160 \times x = 100 \times 100$

$\Rightarrow \quad x = \frac{100 \times 100}{160} \Rightarrow x = \frac{125}{2}$

$\therefore$ Decrease in breadth $= \left(100 - \frac{125}{2}\right)\%$

$= 37\frac{1}{2}\%$

Profit and Loss

- The price at which an article or item is bought is called its **cost price** and it is denoted by CP.
- And if the price at which an article is sold is called its **selling price** and it is denoted by SP.
- If the selling price of an article is greater than cost price, then it is **profit** (SP > CP) otherwise it is **loss** (CP > SP).
- The list price of an item is known as its **marked price**. It is the price that appers on the item's tag.
- If the shopkeeper given a some rebate on an article is called **discount.**

Note : Discount is always given on a marked price.

Important Formulae

(i) Profit = SP − CP

(ii) Loss = CP − SP

(iii) Profit per cent $= \frac{\text{Profit}}{\text{CP}} \times 100$

$= \frac{\text{SP} - \text{CP}}{\text{CP}} \times 100$

(iv) Loss per cent $= \frac{\text{Loss}}{\text{CP}} \times 100$

$= \frac{\text{CP} - \text{SP}}{\text{CP}} \times 100$

(v) If there is a profit of r%, then

$\text{SP} = \frac{100 + r}{100} \times \text{CP}$

(vi) If there is a loss of r%, then

$\text{SP} = \frac{100 - r}{100} \times \text{CP}$

(vii) Discount = Marked price − Sale price

(viii) Rate of discount = Discount%

$= \frac{\text{Discount}}{\text{MP}} \times 100$

(ix) $\text{SP} = \text{MP}\frac{(100 - \text{Discount\%})}{100}$

or $\text{MP} = \frac{100 \times \text{SP}}{100 - \text{Discount\%}}$

Example 4 A boy buys a pen for ₹ 25 and sells it for ₹ 20. Find his loss per cent.

(a) 10% (b) 20% (c) 22% (d) 23%

Sol. (*b*) Loss per cent $= \frac{\text{Loss}}{\text{CP}} \times 100$

$= \frac{5}{25} \times 100$

$= 20\%$

Example 5 A shopkeeper sells a pen set at 30% profit to another shopkeeper who sells it at a loss of 30%. If price of pen set ₹ 150, what is net profit or loss on total transaction?

(a) profit 9% (b) loss 9%
(c) profit 10% (d) loss 10%

Sol. (*b*) Cost price of pen is ₹ 150.

Initially shopkeeper sells a pen in 30% profit.

$\therefore$ SP of a pen $= 150 + 30\%$ of 150

$= 150 + \frac{30}{100} \times 150$

$= 150 + 45 =$ ₹ 195

Now, shopkeeper sells a pen to another shopkeeper at an loss of 30%. Then,

SP of a pen $= 195 - \frac{30}{100} \times 195$

$= 195 - 58.5 =$ ₹ 136.5

Now, loss % in transaction $= \frac{150 - 136.5}{150} \times 100$

$= \frac{13.5}{150} \times 100 = \frac{1350}{150} = 9\%$

Example 6 The marked price of a ceiling fan is ₹ 1250 and the shopkeeper allows a discount of 6% on it. Find the selling price of the fan.

(a) ₹ 1190 (b) ₹ 1175
(c) ₹ 1200 (d) ₹ 1180

Sol. (*b*) Marked price = ₹ 1250 and discount = 6%

Discount = 6% of MP

= (6% of ₹ 1250)

$= ₹\left(1250 \times \frac{6}{100}\right) = ₹\ 75$

Selling price = (MP) − (discount)

= ₹ (1250 − 75) = ₹ 1175

Hence, the selling price of the fan is ₹ 1175.

Example 7 Two successive profits of 50% and 50% is equivalent to

(a) 100% (b) 75% (c) 50% (d) 125%

Sol. (*d*) Let the cost price of an item be x. Then

After profit of 50%, SP of an item

$= x + 50\%$ of x

$= x + \frac{50}{100} \times x = x + \frac{x}{2} = \frac{3x}{2}$

Again profit of 50%, SP of an item

$= \frac{3x}{2} + 50\%$ of $\frac{3x}{2}$

$= \frac{3x}{2} + \frac{50}{100} \times \frac{3x}{2}$

$= \frac{3x}{2} + \frac{3x}{4} = \frac{9x}{4}$

Now, total profit % in whole transaction

$= \frac{\frac{9x}{4} - x}{x} \times 100\%$

$= \frac{5x}{4 \times x} \times 100 = 125\%$

Simple Interest

If the interest is paid to the lender regularly every year or half year on the same principal, then it is called simple interest.

Or The interest is said to be simple, if it is calculated on the original principal throughout the loan period.

i.e. $\text{SI} = \frac{PRT}{100}$

where, P is the principal amount
R is the rate of interest
T is the time period

Compound Interest

If the borrower and the lender agree to fix up a certain interval of time (say, a year or half year or a quarter of a year, etc), so that the amount at the end of an interval becomes the principal for the next interval, then the total interest over all the intervals calculated in this way is called the compound interest.

$$CI = P\left[\left(1+\frac{R}{100}\right)^T - 1\right]$$

where, P is the principal amount
T is the time period
R is the rate of interest

Note The simple interest and compound interest for one year will be same, if the rate of interest is annually.

Important Rules

- **Rule 1.** When interest is compounded annually

  Then, Amount $= P\left(1+\frac{R}{100}\right)^n$

  where, n is number of time for which interest is calculated,

- **Rule 2.** When interest is compounded half-yearly then, interest would be calculated after every six months,

  So, $n = T \times 2$ and rate $= \frac{R}{2}$

  $\therefore$ Amount $= P\left(1+\frac{R/2}{100}\right)^n$

- **Rule 3.** When interest is compounded quarterly. Then, interest would be calculated after every three months, So

  $n = T \times 4$

  and Rate of interest $= \frac{R}{4}$

  $\therefore$ Amount $= P\left(1+\frac{R/4}{100}\right)^n$.

- **Rule 4.** When rate of interest are different for different years say R_1, R_2, R_3% for first, second and third year respectively, then

  Amount $= P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$.

Note If the difference between the simple interest and compound interest on the same sum ₹ P at r % per annum for 2 yr is ₹ d, then

$$d = P\left(\frac{r}{100}\right)^2$$

When interest is compounded yearly, then on the same sum and at the same rate, then

Compound interest for the first year
= Simple interest for the first year

If A and B are the amounts of a certain sum for two consecutive year, then

Simple interest for 1 yr $= B - A$.

Example 8 The sum required to earn a monthly interest of ₹ 400 at 10% per annum at simple interest.

(a) ₹ 47000 (b) ₹ 48000 (c) ₹ 49000 (d) ₹ 50000

Sol. (*b*) Total interest amount needed in a year

$= ₹\,400 \times 12 = ₹\,4800$

$$\therefore \quad P = \frac{100 \times SI}{R \times T}$$

$$= \frac{4800 \times 100}{10 \times 1} = ₹\,48000$$

Example 9 Find CI on a sum ₹ 8000 for 2 yr at 5% per annum compounded annually.

(a) ₹ 821 (b) ₹ 820
(c) ₹ 822 (d) None of these

Sol. (*b*) Given, principal $(P) = ₹\,8000$,
time $(n) = 2$ yr, rate $(R) = 5\%$

$$\therefore \quad \text{Amount}(A) = P\left(1+\frac{R}{100}\right)^n$$

$$= 8000\left(1+\frac{5}{100}\right)^2$$

$$= 8000\left(\frac{105}{100}\right)^2$$

$$= 8000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹\,8820$$

$\therefore$ Compound Interest (AI)

= Amount (A) − Principal (P)
$= ₹(8820 - 8000)$
$= ₹\,820$

Example 10 Find the compound interest on ₹ 5000 for 4 yr if the rate of interest is 10% per annum for the first two years and 15% for the next two years.

(a) ₹ 3001 (b) ₹ 3003
(c) ₹ 3008 (d) ₹ 3009

Sol. (*a*) Let $R_1 = 10\%$, $T_1 = 2$ yr

and $R_2 = 15\%$, $T_2 = 2$ yr

and $P =$ ₹ 5000

$$\therefore \text{ Amount} = 5000\left(1+\frac{10}{100}\right)^2\left(1+\frac{15}{100}\right)^2$$

$$= 5000 \times \left(\frac{110}{100}\right)^2\left(\frac{115}{100}\right)^2$$

$$= 5000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{23}{20} \times \frac{23}{20}$$

= ₹ 8001 (approx)

$\therefore$ Compound interest = 8001 − 5000

= ₹ 3001

PRACTICE EXERCISE

1. If 90% of x is 315 km, then the value of x is
(a) 325 km (b) 350 km (c) 350 m (d) 325m

2. A toy is purchased at ₹ 1500 including 5% SGST and 5% CGST. Find the actual price of the toy without GST.
(a) ₹ 14500 (b) ₹ 1350 (c) ₹ 1500 (d) ₹ 1400

3. If 11% of a number exceeds 7% of the same by 18, the number is
(a) 300 (b) 450 (c) 350 (d) 370

4. If A's income is 30% less than B's, then how much per cent is B's income more than A's?
(a) $42\frac{6}{7}\%$ (b) $32\frac{1}{10}\%$ (c) 30% (d) 40%

5. A man spent 20% of his monthly earning on house rent. Out of the balance, he spent 75% on the other house expenses. If he had a balance of ₹ 250 at the end of the month, the monthly earning of the man is
(a) ₹ 1250 (b) ₹ 1200
(c) ₹ 1150 (d) None of these

6. If the numerator of a fraction is increased by 20% and its denominator is diminished by 10%, the value of the fraction is $\frac{16}{21}$. The original fraction is
(a) $\frac{3}{5}$ (b) $\frac{4}{5}$
(c) $\frac{4}{7}$ (d) None of these

7. In an examination, it is required to get 36% of maximum marks to pass. A student got 113 marks and was declared failed by 85 marks. The maximum marks are
(a) 500 (b) 1008 (c) 640 (d) 550

8. The price of cooking oil has increased by 25%. The percentage of reduction that a family should affect in the use of cooking oil so as not to increase the expenditure on this account is
(a) 20% (b) 15% (c) 22% (d) 25%

9. A boy who asked to find $3\frac{1}{2}\%$ of a sum of money misread the question and found $5\frac{1}{2}\%$ of it. His answer was ₹220, what would have been the correct answer ?
(a) ₹ 140 (b) ₹ 150 (c) ₹ 157 (d) ₹ 160

10. A's salary increased by 12% over last year and has become ₹ 6720. If it increased by 20% over last year's salary, then the next salary will be
(a) ₹ 8000 (b) ₹ 8064
(c) ₹ 7500 (d) ₹ 7200

11. The ratio of the number of boys and girls in a school is 3 : 2. If 20% of the boys and 30% of the girls are scholarship holders, the percentage of the students who are not scholarship holder is
(a) 50% (b) 72% (c) 75% (d) 76%

12. If 50% of $(x - y) = 30\%$ of $(x + y)$, then what per cent of x is y ?
(a) 25% (b) $33\frac{1}{3}\%$ (c) 40% (d) 400%

13. If 15% of 40 is greater than 25% of a number by 2, then the number is
(a) 12 (b) 16 (c) 24 (d) 32

14. If 35% of a number is 12 less than 50% of that number, then the number is
(a) 80 (b) 60 (c) 50 (d) 40

15. 60% of that the students in a school are boys. If the number of girls in the school is 300, then the number of boys is
(a) 300 (b) 450 (c) 500 (d) 750

16. Profit after selling an article for ₹ 425 is the same as loss after selling it for ₹ 355. The cost of the article is
(a) ₹ 390 (b) ₹ 405
(c) ₹ 380 (d) None of these

17. The difference between a discount of 40% on ₹ 500 and two successive discounts of 36% and 4% on the same amount is
(a) ₹ 0 (b) ₹ 2 (c) ₹ 5 (d) ₹ 7.20

18. The marked price of an article is 10% higher than the cost price. A discount of 10% is given on the marked price. In this kind of sale, the seller
(a) bears no loss, no gain
(b) gains 1%
(c) loses 1%
(d) None of the above

19. On selling an article for ₹ 240, a trader loses 4%. In order to gain 10%, he must sell that article for
(a) ₹ 264 (b) ₹ 275
(c) ₹ 250 (d) ₹ 280

20. A sweet seller declares that he sells sweets at the cost price. However, he uses a weight of 450 g instead of 500 g. His percentage profit is
(a) $11\frac{1}{9}\%$ (b) 12%
(c) 13% (d) None of these

21. A radio is sold at a gain of 16%. If it had been sold for ₹ 20 more, 20% would have been gained. The cost price of the radio is
(a) ₹ 420 (b) ₹ 410 (c) ₹ 485 (d) ₹ 500

22. A dealer sold a radio at a loss of 2.5%. Had he sold it for ₹ 100 more, he would have gained $7\frac{1}{2}\%$. In order to gain $12\frac{1}{2}\%$, he should sell it for
(a) ₹ 850 (b) ₹ 925 (c) ₹ 1000 (d) ₹ 1125

23. By selling sugar at ₹ 11.16 per kg, a man loses 7%. To gain 7%, it must be sold (per kg) at
(a) ₹ 11.24 (b) ₹ 12.84 (c) ₹ 14.64 (d) ₹ 13.24

24. If a commission of 10% is given to the marked price of a book, the publisher gains 20%. If the commission is increased to 15%, the gain is
(a) $16\frac{2}{3}\%$ (b) $13\frac{1}{3}\%$
(c) $15\frac{1}{6}\%$ (d) 15%

25. Oranges are bought at 7 for ₹ 3. At what rate per hundred must they be sold to gain 33% ?
(a) ₹ 56 (b) ₹ 60
(c) ₹ 58 (d) ₹ 57

26. A reduction of 20% in the price of oranges enables a man to buy 5 oranges more for ₹ 10. The price of an orange before reduction was
(a) 20 paise (b) 40 paise
(c) 50 paise (d) 60 paise

27. Kiran buys an article with 25% discount on the marked price. She makes a profit of 10% by selling it at ₹ 660. What was the marked price ?
(a) ₹ 900 (b) ₹ 600
(c) ₹ 700 (d) ₹ 800

28. If a shirt cost ₹ 64 after a 20% discount, what was its original price ?
(a) ₹ 76.80 (b) ₹ 80
(c) ₹ 88 (d) ₹ 86.80

29. The cost price of 19 chairs is equal to the selling price of 16 chairs. Then the gain is
(a) $3\frac{9}{17}\%$ (b) $15\frac{15}{19}\%$
(c) $18\frac{3}{4}\%$ (d) None of these

30. The ratio between the sales price and the cost price of an article is 7 : 5. What is the ratio between the profit and the cost price of that article ?
(a) 2 : 5 (b) 7 : 2
(c) 2 : 7 (d) Data inadequate

31. By selling a table for ₹ 350 instead of ₹ 400, loss percent increased by 5%. The cost price of the table is
(a) ₹ 1050 (b) ₹ 417.50 (c) ₹ 435 (d) ₹ 1000

32. A house worth ₹150000 is sold by X at 5% profit to Y. Y sells the house back to X at a 2% loss. Then, in the entire transaction
(a) X gains ₹ 4350 (b) X loses ₹ 4350
(c) X gains ₹ 3150 (d) X loses ₹ 3150

33. Find interest and amount to be paid on ₹ 15000 at 5% per annum after 2 yr.
(a) ₹ 1500, ₹ 16600 (b) ₹ 1500, ₹ 16500
(c) ₹ 1600, ₹ 16500 (d) None of the above

34. A sum of money at simple interest amount to be ₹ 1260 in 2 yr and ₹ 1350 in 5 yr, then the rate per cent per annum is
(a) 30% (b) 10% (c) 2.5% (d) 5%

35. The difference of 13% per annum and 12% of a sum in one year is ₹ 110. Then, the sum is
(a) ₹ 12000 (b) ₹ 13000 (c) ₹ 11000 (d) ₹ 16000

36. The amount of a certain sum at compound interest for 2 yr at 5% is ₹ 4410. The sum is
(a) ₹ 4000 (b) ₹ 4200 (c) ₹ 3900 (d) ₹ 3800

37. Two equal amounts of money are deposited in two banks, each at 15% per annum, for $3\frac{1}{2}$ yr and 5 yr. If the difference between their interest is ₹ 144, each sum is
(a) ₹ 460 (b) ₹ 500 (c) ₹ 640 (d) ₹ 720

38. If the simple interest on ₹ 1500 increases by ₹ 30, when the time increases by 8 yr. The rate per cent per annum is
(a) 0.5% (b) 0.25% (c) 0.75% (d) 1.25%

39. What annual payment will discharge a debt of ₹ 19350 due 4 yr hence at the rate of 5% simple interest ?
(a) ₹ 4500 (b) ₹ 5400
(c) ₹ 4000 (d) None of these

40. The simple interest on a sum of money for 3 yr at $6\frac{2}{3}\%$ per annum is ₹ 6750. The compound interest on the same sum at the same rate of interest for the same period will be
(a) ₹ 7200 (b) ₹ 7210
(c) ₹ 7120 (d) ₹ 7012

41. The difference of the compound interest and the simple interest on ₹ 60000 at 6% annually for 2 yr will be
(a) ₹ 215 (b) ₹ 216 (c) ₹ 220 (d) ₹ 250

42. The compound interest on ₹ 350 for 1 year at 4% per annum, the interest being payable half yearly, will be
(a) ₹ 364.14 (b) ₹ 365.15
(c) ₹ 14.14 (d) ₹ 15.15

43. The compound interest on ₹ 2000 for $1\frac{1}{4}$ yr is 10% per annum, the interest being payable quarterly will be
(a) ₹ 2262.81 (b) ₹ 262.81
(c) ₹ 261.81 (d) None of these

44. A sum of money doubles itself at compound interest in 15 yr. In how many years will it become eight times ?
(a) 20 yr (b) 40 yr
(c) 35 yr (d) 45 yr

45. A certain sum amounts to ₹ 7350 in 2 yr and to ₹ 8575 in 3 yr. The the rate per cent and sum are
(a) $16\frac{2}{3}\%$, ₹ 5400 (b) $16\frac{2}{3}\%$, ₹ 2400
(c) $12\frac{1}{2}\%$, ₹ 5400 (d) None of these

Answers

1	(b)	2	(b)	3	(b)	4	(a)	5	(a)	6	(c)	7	(d)	8	(a)	9	(a)	10	(d)
11	(d)	12	(a)	13	(b)	14	(a)	15	(b)	16	(a)	17	(d)	18	(c)	19	(b)	20	(a)
21	(d)	22	(c)	23	(b)	24	(b)	25	(d)	26	(c)	27	(d)	28	(b)	29	(c)	30	(a)
31	(d)	32	(a)	33	(b)	34	(c)	35	(c)	36	(a)	37	(c)	38	(b)	39	(a)	40	(b)
41	(b)	42	(c)	43	(b)	44	(d)	45	(a)										

Hints and Solutions

1. We have, 90% of $x = 315$

$\Rightarrow \quad \frac{90}{100} \times x = 315$

$\Rightarrow \quad x = \frac{315 \times 100}{90}$

$= \frac{315 \times 10}{9} = 350$

$\Rightarrow \quad x = 350$ km

2. Now, SGST = 5% of 1500

$\therefore \quad = \frac{5}{100} \times 1500 = ₹\ 75$

Similarly, CGST = 5% of 1500 = ₹ 75

$\therefore$ Actual price of toy = 1500 − SGST − CGST

= 1500 − 75 − 75 = 1500 − 150

= ₹ 1350

3. Let x be the given number.

Then, according to the question,

11% of x − 7% of x = 18

$\Rightarrow \quad$ 4% of x = 18

$\Rightarrow \quad x = \frac{18 \times 100}{4}$

$\Rightarrow \quad x = 450$

4. $\therefore$ Required percentage

$= \left[\frac{30}{(100-30)} \times 100\right]\%$

$= 42\frac{6}{7}\%$

5. Let total income be ₹ x.

Then, 25% of (80% of x) = 250

$\Rightarrow \quad \frac{25}{100} \times \frac{80}{100} \times x = 250$

$\Rightarrow \quad x = 250 \times 5 =$ ₹ 1250

6. Let the fraction be $\frac{x}{y}$.

New fraction $= \frac{120\% \text{ of } x}{90\% \text{ of } y} \Rightarrow \frac{4x}{3y} = \frac{16}{21}$

$\therefore \quad \frac{x}{y} = \frac{16}{21} \times \frac{3}{4} = \frac{4}{7}$

7. Let maximum marks be x.

Then, 36% of x = 113 + 85 = 198

$\therefore \quad x = \frac{198 \times 100}{36} = 550$

8. Reduction in consumption $= \left[\frac{25}{100+25} \times 100\right]\%$

= 20%

9. Since, $5\frac{1}{2}\% \equiv 220 \Rightarrow 3\frac{1}{2}\% \equiv \frac{220 \times (7/2)}{11/2} =$ ₹ 140

10. Last year's salary $= \frac{6720 \times 100}{100+12} =$ ₹ 6000

$\therefore$ The next year's salary $= \frac{6000 \times 120}{100} =$ ₹ 7200

11. Let the number of boys and girls be $3x$ and $2x$.

Number of those who are not scholarship holder

= (80% of $3x$ + 70% of $2x$)

$= \frac{12x}{5} + \frac{7x}{5} = \frac{19x}{5}$

$\therefore$ Required percentage $= \left(\frac{19x}{5} \times \frac{1}{5x} \times 100\right)\%$

= 76%

12. Since, $\frac{50}{100}(x-y) = \frac{30}{100}(x+y)$

$\Rightarrow \quad 5(x-y) = 3(x+y) \quad 2x = 8y$

$\Rightarrow \quad \frac{y}{x} \times 100 = \frac{20}{80} \times 100 = 25\%$

13. According to the given condition,

$$\frac{15}{100} \times 40 - \frac{25}{100} x = 2 \Rightarrow x = 16$$

14. Since, $(50 - 35)\%$ of $x = 12$

$$\Rightarrow \quad x = \frac{12 \times 100}{15} = 80$$

15. Here, 40% are girls in a school.

$\therefore \quad 40\% = 300$

$$\Rightarrow \quad 60\% = \frac{300 \times 60}{40} = 450$$

16. Let cost price of an article be ₹ x.

According to the given condition,

$$425 - x = x - 355$$

$$\Rightarrow \quad 2x = 780 \Rightarrow x = ₹\ 390$$

17. SP at 40% discount = 60% of ₹ 500 = ₹ 300

SP after two successive discounts of 36% and 4%

$$= 96\% \text{ of } (64\% \text{ of } 500)$$

$$= \frac{96}{100} \times \frac{64}{100} \times 500 = ₹\ 307.20$$

$\therefore$ Required difference = ₹ 7.20

18. Let CP of article be Rs 100, then marked price be Rs 110.

$\therefore \quad$ SP = 90% of Rs 110

$$= \frac{90}{100} \times 110 = \text{Rs } 99$$

$\therefore \quad$ Loss per cent $= 100 - 99 = 1\%$

19. $\text{CP} = \frac{100}{96} \times 240 = ₹\ 250$

Now, $\quad$ CP = ₹ 250, Gain = 10%

$$\therefore \quad \text{SP} = \frac{110}{100} \times 250 = ₹\ 275$$

20. Let CP of each gram be ₹ 1.

Then, CP of 450 g = ₹ 450, SP of 450 g = ₹ 500

$$\therefore \quad \text{Profit per cent} = \left(\frac{50}{450} \times 100\right)\% = 11\frac{1}{9}\%$$

21. Let CP of radio be ₹ x. Then,

120% of $x - 116\%$ of $x = 20$

$\Rightarrow \quad 4\%$ of $x = 20$

$$\Rightarrow \quad x = \frac{20 \times 100}{4} = ₹\ 500$$

22. Let CP of radio be ₹ x. Then,

$107\frac{1}{2}\%$ of $x - 97\frac{1}{2}\%$ of $x = 100$

$\Rightarrow \quad 10\%$ of $x = 100$

$$\Rightarrow \quad x = \frac{100 \times 100}{10}$$

$\Rightarrow \quad x = ₹\ 1000$

23. Let CP of sugar per kg be ₹ x.

$\therefore \quad 93\%$ of $x = 11.16$

$$\Rightarrow \quad x = \frac{11.16 \times 100}{93} = 12$$

So, $\quad$ CP = ₹ 12 per kg

$\therefore \quad$ SP = 107% of ₹ 12

$$= \frac{107}{100} \times 12 = ₹\ 12.84$$

24. Let CP be ₹ 100, then SP be ₹ 120.

Now, SP = ₹ 120, commission = 10%

$$\therefore \quad \text{Marked price} = \frac{100}{90} \times 120 = ₹\ \frac{400}{3}$$

Now, marked price $= \frac{400}{3}$, commission = 15%

$$\therefore \quad \text{SP} = 85\% \text{ of } \frac{400}{3} = \frac{85}{100} \times \frac{400}{3} = \frac{340}{3}$$

$$\therefore \quad \text{Gain per cent} = \frac{340}{3} - 100 = 13\frac{1}{3}\%$$

25. CP of an orange $= \frac{3}{7}$

$$\therefore \quad \text{CP of 100 orange} = \frac{300}{7}$$

$$\Rightarrow \quad \text{SP of 100 oranges} = \frac{300}{7} \times \frac{(100 + 33)}{100} = ₹\ 57$$

$$\left[\because \text{SP} = \text{CP}\left(\frac{100 + r}{100}\right)\right]$$

26. Reduced price $= \frac{10 \times 20}{5 \times 100} = ₹\ \frac{2}{5}$ per orange

$$\therefore \quad \text{Original price} = \frac{2 \times 100}{5 \times 80} = \frac{1}{2} = 50 \text{ paise}$$

27. $\because \quad$ SP = ₹ 660, Profit % = 10%

$\Rightarrow$ CP = ₹ 600

$$\therefore \quad \text{MP} = \frac{600 \times 100}{75} = ₹\ 800$$

28. Let the original CP be ₹ x.

$\therefore \quad x \times \frac{80}{100} = 64 \quad \Rightarrow \quad x = ₹\ 80$

29. $\therefore$ Gain % $= \frac{19-16}{16} \times 100$

$= \frac{3 \times 100}{16} = \frac{75}{4} = 18\frac{3}{4}\%$

30. Let SP = $7x$ and CP = $5x$

$\therefore$ Profit = $7x - 5x = 2x$

$\therefore \frac{\text{Profit}}{\text{CP}} = \frac{2x}{5x} = \frac{2}{5}$

31. Given, 5% = ₹ 50

$\Rightarrow \quad 100\% = \frac{50}{5} \times 100 = ₹\ 1000$

32. Final cost of the house

$= 150000 \times \frac{100+5}{100} \times \frac{(100-2)}{100}$

$= ₹\ 154350$

$\therefore$ X gains ₹ 4350.

33. $\because$ Interest $= \frac{P \times R \times T}{100}$

$= \frac{15000 \times 5 \times 2}{100} = ₹\ 1500$

$\therefore$ Amount = Principal + Interest

$= ₹\ (15000 + 1500) = ₹\ 16500$

34. Interest in three years $= 1350 - 1260 = ₹\ 90$

$\therefore$ Interest in one year $= ₹\ \frac{90}{3} = ₹\ 30$

and interest for two years = ₹ 60

and Principal = ₹ (1260 − 60)

= ₹ 1200

Hence, rate of interest $= \frac{100 \times 60}{1200 \times 2} = 2.5\%$

35. Let sum = ₹ x

Then, according to given condition

$\frac{x \times 13 \times 1}{100} - \frac{x \times 12 \times 1}{100} = 110$

$\Rightarrow \quad \frac{x}{100} = 110$

$\Rightarrow \quad x = ₹\ 11000$

36. According to given condition,

$4410 = P\left(1 + \frac{5}{100}\right)^2$

$\Rightarrow \quad P = \frac{4410}{(21/20)^2}$

$= \frac{4410 \times 400}{441} = ₹\ 4000$

37. Let the sum be ₹ x. Then,

$\frac{x \times 5 \times 15}{100} - \frac{x \times 15}{100} \times \frac{7}{2} = 144$

$\Rightarrow \quad \frac{x}{100}\left(75 - \frac{105}{2}\right) = 144$

$\Rightarrow \quad x = \frac{144 \times 100 \times 2}{45} \Rightarrow x = ₹\ 640$

38. $t = 8$ yr

SI increase by ₹ 30 in 8 yr

$\therefore$ SI increases in 1 yr $= \frac{30}{8} = 3.75$

Let the rate be x% per annum

$3.75 = \frac{1500 \times 1 \times x}{100}$

$x = 0.25\%$

39. Let the annual instalment be ₹ x, then

$4x$ + {interest on x for (3 + 2 + 1) yr} = 19350

$\Rightarrow \quad 4x + \frac{x \times 6 \times 5}{100} = 19350$

$\therefore \quad x = ₹\ 4500$

40. Since, SI $= \frac{PRT}{100}$

$\therefore \quad 6750 = \frac{P \times \frac{20}{3} \times 3}{100}$

$\Rightarrow \quad P = 33750$

Now, $\quad \text{CP} = 33750\left[\left(1 + \frac{20}{300}\right)^3 - 1\right]$

$= 33750\left[\frac{4096}{3375} - 1\right] = ₹\ 7210$

41. Now, simple interest for two years, SI $= \frac{PRT}{100}$

$= \frac{60000 \times 6 \times 2}{100} = ₹\ 7200$

and compound interest for two years CI $= A - P$

$$= P\left(1+\frac{R}{100}\right)^n - P = 60000\left(1+\frac{6}{100}\right)^2 - 60000$$

$$= 60000\left(\frac{53}{50}\right)^2 - 60000$$

$$= 67416 - 60000 = ₹7416$$

$\therefore$ Required difference = CI − SI

$$= 7416 - 7200 = ₹216$$

42. $$A = P\left(1+\frac{R/2}{100}\right)^{2n}$$

$$= 350 \times \frac{102}{100} \times \frac{102}{100}$$

$$= ₹\ 364.14$$

$\therefore$ Compound interest = ₹ 364.14 − ₹ 350

= ₹ 14.14

43. $$A = 2000\left(1+\frac{10}{400}\right)^{4\times\frac{5}{4}}$$

$$= 2000\left(\frac{41}{40}\right)^5 = ₹\ 2262.81$$

$\therefore$ Compound interest = 2262.81 − 2000

= ₹ 262.81

44. $$P\left(1+\frac{R}{100}\right)^{15} = 2P$$

or $$\left(1+\frac{R}{100}\right)^{15} = 2 \quad \text{...(i)}$$

Now, $$P\left(1+\frac{R}{100}\right)^n = 8P$$

$$\Rightarrow \left(1+\frac{R}{100}\right)^n = 8 = (2)^3 = \left\{\left(1+\frac{R}{100}\right)^{15}\right\}^3$$

[from Eq. (i)]

$$\Rightarrow \left(1+\frac{R}{100}\right)^n = \left(1+\frac{R}{100}\right)^{45}$$

$$\Rightarrow n = 45$$

45. SI on ₹ 7350 for 1 yr

= ₹ (8575 − 7350) = ₹1225

$$\therefore \quad \text{Rate} = \left(\frac{100\times1225}{7350\times1}\right)\% = 16\frac{2}{3}\%$$

Let the sum be ₹ x.

Then, $$x\left(1+\frac{50}{3\times100}\right)^2 = 7350$$

$$\Rightarrow x\times\frac{7}{6}\times\frac{7}{6} = 7350$$

$$\Rightarrow x = 7350\times\frac{36}{49} = 5400$$

or Sum = ₹ 5400

CHAPTER

07

SPEED, TIME AND DISTANCE

In this chapter, we study speed of a person / object / train to cover a distance from a point to another point in certain time.

Speed

The rate at which a body or an object travels to cover a certain distance is called speed of body. The unit of speed is km/h and m/s.

Time

The duration in hours, minutes or seconds spent to cover a certain distance is called the time. The unit of time is hours, minute and seconds.

Distance

The length of the path travelled by any object or any person between two places is known as distance. The unit of distance is m, km, etc.

Relationship between Time, Speed and Distance

Relationship between time, distance and speed is expressed by

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \text{ or Distance} = \text{Speed} \times \text{Time}$$

This expression shown that

1. Speed is directly proportional to distance.
2. Distance and time are directly proportional.
3. Time is inversely proportional to speed.

Average Speed

When a certain distance is covered at speed A and the same distance is covered at speed B, then the average speed during the whole journey is given by $\frac{2AB}{A+B}$.

Note If a body covers a distance D_1 at S_1 km/h, D_2 at S_2 km/h, D_3 at S_3 km/h and so on upto D_n at S_n km/h then

Average speed

$$= \frac{D_1 + D_2 + D_3 + D_4 + \ldots + D_n}{\frac{D_1}{S_1} + \frac{D_2}{S_1} + \frac{D_3}{S_3} + \frac{D_4}{S_4} + \ldots + \frac{D_n}{S_n}}$$

$$\text{Average speed} \neq \frac{S_1 + S_2 + S_3 + S_4 \ldots S_n}{n}$$

Example 1 A person goes to Delhi from Mumbai at the speed of 60 km/h and comes back at the speed of 50 km/h. Calculate the average speed of the person for the entire trip.

(a) 54.75 km/h (b) 54.54 km/h
(c) 57.57 km/h (d) 75.57 km/h

Sol. *(b)* Average Speed $= \frac{2 \times 60 \times 50}{60 + 50}$

[$\because A = 60$ km/h, $B = 50$ km/h]

$$= \frac{6000}{110} = 54.54 \text{ km/h}$$

Example 2 A teacher reaches the school in 30 min with average speed of 15km/h. If they want to reach school in 10 minute earlier, their speed should be

(a) 80 km/h (b) 90 km/h
(c) 50 km/h (d) 75 km/h

Sol. *(b)* Let the distance covered by the teacher to reach to the school in d km with time t.

$\because$ Speed $= \frac{\text{Distance}}{\text{Time}}$

$$15 = \frac{d}{\frac{30}{60}} \Rightarrow d = \frac{15 \times 60}{30} = 30\text{km}$$

Again using formula,

$$S = \frac{30}{\frac{(30-10)}{60}} = \frac{30 \times 60}{20} = 90 \text{ km/h}$$

Some Another Formulae

1. To convert a m/s into km/h, multiply by $\frac{18}{5}$, i.e. $a \times \frac{18}{5}$ km/h. e.g. Convert 25 m/s to km/h.

$$25 \text{ m/s} = \left(25 \times \frac{18}{5}\right) = 5 \times 18 = 90 \text{ km/h}$$

2. To convert a km/h into m/sec, multiply by $\frac{5}{18}$, i.e. $a \times \frac{5}{18}$ m/s. e.g. Convert 72 km/h into m/s

$$\therefore 72 \text{ km/h} = \left(72 \times \frac{5}{18}\right) \text{ m/s} = 4 \times 5 = 20 \text{ m/s}$$

3. When two bodies A and B are moving with speed a km/h and b km/h respectively, then the relative speed of two bodies is
   (i) $(a + b)$ km/h (if they are moving in opposite direction)
   (ii) $(a - b)$ km/h (if they are moving in same direction)
4. If a man changes his speed in the ratio $a : b$, then the ratio of time taken becomes $b : a$.
5. The distance covered by train in passing a pole or a standing man or a signal post or any other object (of negligible length) is equal to the length of the train.
6. If a train passes a stationary object (bridge, platform etc) having some length, then the distance covered by train is equal to the sum of the lengths of train and that particular stationary object which it is passing.
7. (i) If two trains of lengths x and y km are moving in opposite directions with speeds of u and v respectively, then time taken by the trains to cross each other

$$= \frac{\text{Sum of lengths}}{\text{Sum of speeds}} = \frac{(x + y)}{(u + v)}$$

   (ii) If trains are moving in same directions, then time taken by faster train to cross slower train

$$= \frac{\text{Sum of lengths}}{\text{Difference of speed}} = \frac{x + y}{u - v}$$

   Here, $u > v$.

Example 3 The speed of a bus is 72 km/h. The distance covered by the bus in 5 s is
(a) 50 m (b) 74.5 m (c) 100 m (d) 60 m

Sol. *(c)* Speed of bus in m/s $= 72 \times \frac{5}{18} = 20$ m/s

$\therefore$ Distance travelled in 5 s $= 20 \times 5$ (Speed × Time)
$= 100$ m

Example 4 Two trains are running in the same direction. The speeds of two trains are 5 km/h and 15 km/h, respectively. What will be the relative speed of second train with respect to first?
(a) 10 km/h (b) 15 km/h (c) 20 km/h (d) 5 km/h

Sol. *(a)* We know that, if two trains are running in same direction, then difference in speeds is the required relative speed.

$\therefore$ Required relative speed $= 15 - 5 = 10$ km/h

Example 5 Two trains of lengths 75 m and 95 m are moving in the same direction at 9 m/s and 8 m/s, respectively. Find the time taken by the faster train to cross the slower train.
(a) 120 s (b) 170 s
(c) 140 s (d) 190 s

Sol. *(b)* According to the formula,

$$\text{Required time} = \frac{x + y}{u - v}$$

where, $x = 75$ m,
$y = 95$ m,
$u = 9$ m/s
and $v = 8$ m/s

$$\therefore \text{Required time} = \frac{75 + 95}{9 - 8}$$
$$= 170 \text{ s}$$

PRACTICE EXERCISE

1. A train runs at the rate of 120 km/s. The speed is m/s is
(a) $66\frac{2}{3}$ (b) 25 (c) 30 (d) $33\frac{1}{3}$

2. An Athlete runs 200 m race in 24 s his speed (in km/h) is
(a) 20 (b) 24 (c) 30 (d) 28.5

3. A person crosses a 600 m long street in 5 min. What is his speed in km per hour?
(a) 3.6 (b) 7.2
(c) 8.4 (d) 10

4. A train is 125 m long. If the train takes 30 s to cross a tree by the railway line, then the speed of the train is
(a) 14 km/h (b) 15 km/h
(c) 16 km/h (d) 12 km/h

5. A man riding on a bicycle at a speed of 15 km/h crosses a bridge in 5 min. Find the length of the bridge.
(a) 1 km (b) 2 km
(c) $2\frac{1}{2}$ km (d) $1\frac{1}{4}$ km

6. A train 110 m long is running at the speed of 72 km/h to pass a 132 m long platform in how many times?
(a) 9.8 s (b) 12.1 s (c) 12.42 s (d) 14.3 s

7. If a man covers $10\frac{1}{5}$ km in 3 h, the distance covered by him in 5 h is
(a) 16 km (b) 15 km (c) 18 km (d) 17 km

8. A train 700 m long is running at the speed of 72 km/h. If it crosses a tunnel in 1 min, then the length of the tunnel is
(a) 650 m (b) 500 m (c) 550 m (d) 700 m

9. A car does a journey in 10 h, the first half at 21 km per hour, and the rest at 24 km per hour.The distance travelled by the car is
(a) 264 km (b) 244 km (c) 254 km (d) 224 km

10. Sunita reaches the coaching in 25 min with an average speed of 14 km/h. She want to reach school 5 min later, then her speed should be
(a) 11.67 km/h (b) 12 km/h
(c) 13 km/h (d) 13.5 kn/h

11. A man travels first 50 km at 25 km/h next 40 km at 20 km/h and then 90 km at 15 km/h. His average speed for the whole journey in (m/s)is
(a) 18 (b) 5
(c) 10 (d) 36

12. A car is ahead of a scooter by 30 km, car goes at the rate of 50 km/h and the scooter goes at the rate of 60 km/h. The scooter overtake the car after
(a) 3 h (b) 3.5 h
(c) 4 h (d) $3\frac{1}{4}$ h

13. A train passes two bridges of lengths 800 m and 400 m in 100 s and 60 s respectively. The length of the train is
(a) 80 m (b) 90 m
(c) 200 m (d) 150 m

14. Two runners cover the same distance at the rate of 15 km and 16 km per hour respectively. The distance travelled when one takes 16 min longer than the other is
(a) 64 km (b) 60 km
(c) 52 km (d) 58 km

15. Excluding stoppages, the speed of a bus is 54 km/h and including stoppages, it is 45 km/h. For how many minutes does the bus stop per hour?
(a) 9 (b) 10
(c) 12 (d) 20

16. Two persons are moving in the directions opposite to each other. The speeds of the both persons are 5 km/h and 3 km/h, respectively. Find the relative speed of the two persons in respect of each other
(a) 7 km/h (b) 3 km/h (c) 8 km/h (d) 5 km/h

17. A train 240 m long passes a pole in 24 s. How long will it take to pass a platform 650 m long?
(a) 65 sec (b) 89 sec (c) 100 sec (d) 150 sec

18. Distance between two towns P and Q is 240 km. A motor cycle rider starts from P towards Q at 8 pm at a speed of 40 km/h. At the same time another motor cycle rider starts from Q towards P at 50 km/h. At what time will they meet?
(a) 9 : 45 pm (b) 10 : 40 pm
(c) 11 pm (d) 10 : 30 pm

19. A car travels 25 km an hour faster than a bus a takes 10 hours less journey of 500 kms. The speed of the car and bus are given by respectively.
(a) 60 and 35 (b) 45 and 70
(c) 80 and 55 (d) 50 and 55

20. Two trains running in opposite directions cross a man standing on the platform in 54s and 34s respectively and they cross each other in 46 s. Find the ratio of their speeds.
(a) 3 : 2 (b) 2 : 3 (c) 5 : 3 (d) 3 : 5

Answers

1	(d)	2	(c)	3	(b)	4	(b)	5	(d)	6	(b)	7	(d)	8	(b)	9	(d)	10	(a)
11	(b)	12	(a)	13	(c)	14	(a)	15	(b)	16	(c)	17	(b)	18	(b)	19	(b)	20	(a)

Hints and Solutions

1. $120 \text{ km/h} = 120 \times \frac{5}{18} = 33\frac{1}{3} \text{ m/s}$

2. Distance = 200 m, Time = 24 s

$$\text{Speed} = \frac{200}{24} \times \frac{18}{5} \text{ km/h} = 30 \text{ km/h}$$

3. $\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{600}{5 \times 60} \text{ m/s} = 2 \text{ m/sec}$

$$= 2 \times \frac{18}{5} \text{ km/hr} = 7.2 \text{ km/hr}$$

4. $\text{Speed of train} = \frac{\text{Distance}}{\text{Time}} = \frac{125}{30} \times \frac{18}{5}$

$$= 15 \text{ km/h}$$

5. Length of bridge

= Speed × time taken to cross the bridge

$$= \frac{15 \times 5}{60} = 1\frac{1}{4} \text{ km}$$

6. Speed of the train = 72 km/h

$$= 72 \times \frac{5}{18} \text{ m/s} = 20 \text{ m/s}$$

$$\therefore \quad \text{Required time} = \frac{110 + 132}{20}$$

$$= \frac{242}{20} = 12.1 \text{ s}$$

7. Distance covered by man in 3h

$$= 10\frac{1}{5} \text{ km}$$

Distance covered by man in 1 h

$$= \frac{51}{5 \times 3} = \frac{17}{5} \text{ km}$$

Distance covered by man in 5 h will be

$$= \frac{17}{5} \times 5 = 17 \text{ km}$$

8. $\text{Speed} = 72 \times \frac{5}{18} = 20 \text{ m/s}$

Let the length of tunnel be x m.

Then, $\frac{700 + x}{20} = 60$

$$\Rightarrow \quad x = 500 \text{ m}$$

9. Average speed

$$= \frac{2 \times 21 \times 24}{21 + 24} = \frac{2 \times 21 \times 24}{45}$$

$$= \frac{2 \times 21 \times 24}{45} \times \frac{112}{5} \text{ km/hr}$$

$$\therefore \quad \text{Distance} = \frac{112}{5} \times 10 = 224 \text{ km}$$

10. Let the distanve covered by Sunita to reach the school in d km withe time t. Then

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$14 = \frac{d}{\frac{25}{60}}$$

$$\Rightarrow \quad d = \frac{14 \times 25}{60} = \frac{350}{60} = \frac{35}{6}$$

Again using formula,

$$\text{require speed} = \frac{\frac{35}{6}}{\frac{(25+5)}{60}} = \frac{35 \times 10}{30}$$

$$= \frac{35}{3} = 11.67 \text{ km/h}$$

11. Total distance covered

$$= 50 + 40 + 90 = 180 \text{ km}$$

$$\text{Total time taken} = \frac{50}{25} + \frac{40}{20} + \frac{90}{15} = 10 \text{ h}$$

$\therefore$ Average speed for the whole journey

$$= \frac{180}{10} = 18 = 18 \times \frac{5}{18} = 5 \text{ m/s}$$

12. Distance between car and scooter = 30 km

Difference of velocity

$$= 60 - 50 = 10 \text{ km/h}$$

So, time taken by scooter to travel 30 km extra than a car when its speed 10 km/h more

$$= \frac{30}{10} = 3 \text{ h}$$

13. Let train is x m long.

According to the question,

$$\frac{800+x}{100}=\frac{400+x}{60}$$

$$4800+6x=4000+10x \Rightarrow 4x=800$$

$\therefore \quad x = 200\,\text{m}$

14. Let distance covered by runners = x km

Then, according to the question,
difference time in both runner = 6 min

$$\Rightarrow \quad \frac{x}{15}-\frac{x}{16}=\frac{6}{60} \quad [\because 1 \text{ hour} = 60 \text{ min}]$$

$$\Rightarrow \quad \frac{x}{15\times16}=\frac{6}{60}$$

$$\Rightarrow \quad x=\frac{15\times16}{10}=64 \text{ km}$$

Hennce, distance covered by runners = 64 km

15. Speed = 54 km/hr

After stopage = 45 km/hr

$\Rightarrow$ Difference = 54 − 45 = 9 km/hr

$\therefore$ Required time $=\frac{9}{54}\times 60=10$ min

16. We know that, the two speeds will be added, if the motions of two objects are in opposite directions.

$\therefore$ Required relative speed

$$= 5 + 3 = 8 \text{ km/h}$$

17. Speed of train $=\frac{240}{24}$ m/s $=10$ m/s

$$\text{Time} = \frac{650+240}{10} = 89 \text{ s}$$

18. Suppose, they meet x h after 8 pm. Then, sum of distance covered by them in hours = 240 km.

$\therefore \quad 40x + 50x = 240$

$$\Rightarrow \quad x=\frac{240}{90}=2 \text{ h } 40 \text{ min}$$

$$= 8 \text{ pm} + 2 \text{ h } 40 \text{ min}$$

Hence, they will meet = 10:40 pm

19. Let speed of bus = x km/hr

Speed of car = $(x + 25)$ km/hr

According to the question,

$$\frac{500}{x}-\frac{500}{x+25}=10$$

$\therefore$ Car $x = 45$ km/hr.

Bus = 45 + 25 = 70 km/hr.

20. Let the speed of two trains be x and y, respectively.

$\therefore$ Length of 1st train = $54x$

Length of the 2nd train = $34y$

According to the question,

$$\frac{54x+34y}{x+y}=46$$

$\Rightarrow \quad 54x + 34y = 46x + 46y$

$\Rightarrow \quad 27x + 17y = 23x + 23y$

$\Rightarrow \quad 4x = 6y \Rightarrow 2x = 3y$

$\Rightarrow \quad \frac{x}{y}=\frac{3}{2}$

$\therefore \quad x : y = 3 : 2$

CHAPTER

08

ALGEBRAIC EXPRESSION AND IDENTITIES

In this chapter, we study the various terms of Algebraic expression, operations on polynomials, various identities, factorisation by various method.

Constant A symbol having a fixed numerical value is called a constant.

Variable A symbol which takes various numerical values is called a variable.

e.g., $P=2(l+b)$

Here, 2 is a constant and l and b are variables.

Algebraic Expression

An algebraic expression is a combination of constants and variables connected by fundamental operations $(+, -, \times, \div)$. e.g. $2x + 3$, $8a^2b + a^3b^3 - 5a$ etc .

Terms

The separated parts of an algebraic expression are called its term.

e.g. $2x$ and 3 are the terms of expression $2x + 3$.

Like and Unlike Terms

The terms having same variable and the same exponents are like terms, otherwise it has, unlike terms.

e.g. In $x^2 - xy + 2x^2 + y$, x^2 and $2x^2$ are like terms and $-xy$ and y are unlike terms.

Factors

Each term in an algebraic expression is a product of one or more numbers and variables. These numbers and variables are known as the factors of that term.

e.g. $7x$ is the product of number 7 and variable x. So, 7 and x are factors of $7x$.

Coefficients

In a term of an algebraic expression, the numerical value of a term is called coefficient and any of the factors with the sign of the term is called the coefficient of the product of the other factors.

e.g. In $3xy$, the coefficient of y is $3x$, the coefficient of x is $3y$ and the coefficient of xy is 3.

Polynomial

An algebraic expression that contains one or more terms with non-zero coefficients, is called a polynomial.

e.g. $a + b + c + d$, $3xy$ and $7xy - 10$, etc. are all polynomials.

Note (i) An expression may contain a term involving rational power of a variable but in a polynomial, the power of each variable must be a non-negative integer.

(ii) The highest power of the variable (or in more than one variable, the sum of the highest power of the variable) is the degree of the polynomial.

Monomial

An algebraic expression that contains only one term, is called a monomial.

e.g. 3, $-6abc$ and $5x^2y$, etc., are all monomials.

Binomial

An algebraic expression that contains two terms, is called a binomial.
e.g. $x + 5$, $x^3 + 7$ and $a^2 - 2abc$, etc. are all binomials.

Trinomial

An algebraic expression that contains three terms, is called a trinomial.

e.g. $2x - y + 3$ and $3 + xyz + x^3$, etc. are all trinomials.

Quadrinomial

An algebraic expression that contains four terms, is called a quadrinomial. e.g. $a^3 + b^3 + c^3 + 3abc$ and $ab + bc + ca + abc$, etc., are all quadrinomials.

Example 1 The example of binomial is

(a) $5+2x$ (b) $2x^2$
(c) $-2x-5y-1$ (d) $3+xy+2y^2$

Sol. *(a)* We have, $5+2x$, only this algebraic contains two terms. Hence, $5+2x$ is the example of binomial.

Fundamental Operations on Polynomials

Some operations based on polynomials are discussed below

I. **Addition of Polynomials** Polynomials can be added by arranging their like terms and combining them.

II. **Subtraction of Polynomials** Polynomials can be subtracted by arranging their like terms and by changing sign of each term of the polynomial to be subtracted and then added.

III. **Multiplication of Polynomials** We know that,

(a) The product of two factors with like signs is positive and product of unlike signs is negative.

(b) If x is any variable and m, n are positive integers, then $x^m \times x^n = x^{m+n}$

Thus, $x^3 \times x^6 = x^{(3+6)} = x^9$.

IV. (a) **Division of a Monomial by a Monomial**
We have, quotient of two monomials
=(quotient of their coefficients)
× (quotients of two monomials)

(b) **Division of a Polynomial by a Monomial**

To dividing a polynomial by a monomial, we can divide each term of the polynomial by the monomial.

e.g. $\frac{2x^2+6x+8}{2} = \frac{2x^2}{2} + \frac{6x}{2} + \frac{8}{2}$

$= x^2 + 3x + 4$

(c) **Division of a Polynomial by a Polynomial**

The following steps are given below

(i) Firstly, arrange the terms of the dividend and divisor in descending order of their degrees.

(ii) Divide the first term of the dividend by the first term of the divisor to obtain the first term of the quotient.

(iii) Multiply all the terms of the divisor by the first term of the quotient and subtract the result from the dividend.

(iv) Consider the remainder (if any) as a new dividend and proceed as before.

(v) Repeat this process till we obtain a remainder which is either 0 or a polynomial of degree less than the degree of the divisor.

Note In polynomials, we have dividend = (divisor × quotient) + remainder

Example 2 The sum of $3x^2 - 4x + 5$ and $9x - 10$ is

(a) $3x^2 + 5x$ (b) $3x^2 + 5x - 5$

(c) $5x - 5$ (d) $3x^2 - 5x + 5$

Sol. *(b)* The sum of $3x^2 - 4x + 5$ and $9x - 10$, is

$$\begin{array}{r} 3x^2 - 4x + 5 \\ +9x - 10 \\ \hline 3x^2 + 5x - 5 \end{array}$$

Example 3 The product of $(3x + 7y)$ and $(3x - 7y)$ is

(a) $9x^2 - 49y^2$ (b) $39x^2 - 49y^2$

(c) $9x^2 + 49y^2$ (d) $9x^2 - 49y$

Sol. *(a)* $(3x + 7y) \times (3x - 7y)$

$= 3x(3x - 7y) + 7y(3x - 7y)$

$= 9x^2 - 21xy + 21xy - 49y^2 = 9x^2 - 49y^2$

Example 4 Find the quotient and the remainder when $x^4 + 1$ is divided by $x - 1$.

(a) $x^3 + x^2 + x + 1, 2$ (b) $x^3 + x^2 - x + 1, 2$

(c) $x^3 + x^2 + x + 1, 3$ (d) None of these

Sol. *(a)* Using long division method,

$$\begin{array}{r|l} & x^3 + x^2 + x + 1 \\ \hline x - 1 & x^4 + 1 \\ & \underline{-x^4 \mp x^3} \\ & x^3 + 1 \\ & \underline{-x^3 \mp x^2} \\ & x^2 + 1 \\ & \underline{-x^2 \mp x} \\ & x + 1 \\ & \underline{-x \mp 1} \\ & 2 \end{array}$$

Hence, quotient $= x^3 + x^2 + x + 1$ and remainder $= 2$.

Identity

An identity is an equality which is true for all values of the variables.

e.g. $(a + b)^2 = (a)^2 + 2ab + (b)^2$

Some Important Identities

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $(a + b)(a - b) = a^2 - b^2$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
  $= a^2 + b^2 + c^2 + 2(ab + bc + ca)$
- $(a + b - c)^2 = a^2 + b^2 + c^2 + 2ab - 2bc - 2ca$
- $(a - b + c)^2 = a^2 + b^2 + c^2 - 2ab - 2bc + 2ca$
- $(-a + b + c)^2 = a^2 + b^2 + c^2 - 2ab + 2bc - 2ca$
- $(a - b - c)^2 = a^2 + b^2 + c^2 - 2ab + 2bc - 2ca$
- $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
- $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
- $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$
- $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$

- $a^3 - b^3 = (a - b)^3 + 3ab(a - b)$
- $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$
- $(x + a)(x + b) = x^2 + (a + b)x + ab$

Example 5 If $p+q=12$ and $pq=22$, then the value of p^2+q^2 is

(a) 95 (b) 105 (c) 100 (d) 110

Sol. (*c*) We know that,

$$(p+q)^2 = p^2+2pq+q^2$$

$$\Rightarrow \quad (12)^2 = p^2 + 2\times 22 + q^2 \quad [\because p+q=12 \text{ and } pq=22]$$

$$\Rightarrow \quad 144 = p^2 + 44 + q^2$$

$$\therefore \quad p^2+q^2 = 144 - 44 = 100$$

Example 6 If $x+\frac{1}{x}=3$, then the value of $x-\frac{1}{x}$ is

(a) $+\sqrt{5}$ (b) $-\sqrt{5}$ (c) $\pm\sqrt{5}$ (d) ± 5

Sol. (*c*) Given, $x+\frac{1}{x}=3$

$$\Rightarrow \quad \left(x+\frac{1}{x}\right)^2 = 3^2 \quad \text{[on squaring]}$$

$$\Rightarrow \quad \left(x^2+\frac{1}{x^2}+2\right)=9$$

$$\Rightarrow \quad x^2+\frac{1}{x^2}=7$$

$$\Rightarrow \quad x^2+\frac{1}{x^2}-2=7-2$$

[subtracting 2 on both sides]

$$\Rightarrow \quad x^2+\frac{1}{x^2}-2=5 \quad \Rightarrow \left(x-\frac{1}{x}\right)^2=5$$

$$\Rightarrow \quad \left(x-\frac{1}{x}\right)=\pm\sqrt{5}$$

Example 7 If $4x-5z=16$ and $zx=12$, then the value of $64x^3-125z^3$ is

(a) 15600 (b) 1561
(c) 15616 (d) 15618

Sol. (*c*) $64x^2-125z^3=(4x)^3-(5z)^3$

$$=(4x-5z)[(4x)^2+4x\cdot 5z+(5z)^2]$$
$$=16[(4x-5z)^2+40zx+20zx]$$
$$=16[16^2+60\times 12]$$
$$=16\times 976=15616$$

Factor and Factorisation

A polynomial $g(x)$ is called **a factor** of polynomial $p(x)$, if $g(x)$ divides $p(x)$ exactly. To express polynomial as the product of polynomial of degree less than that of the given polynomial is called as **factorisation**.

Factorisation by Common Factors

A factor which occurs in each term, is called the common factor. e.g. Factorise $16x^2y+4xy$

We have, $16x^2y=2\times2\times2\times2\times x\times x\times y$

and $4xy=2\times2\times x\times y$

Here, $2\times2\times x\times y$ is common in these two terms.

Factorisation by Splitting Middle Term

Let factors of the quadratic polynomial ax^2+bx+c be $(px+q)$ and $(rx+s)$. Then,

$$ax^2+bx+c=(px+q)(rx+s)$$
$$=prx^2+(ps+qr)x+qs$$

On comparing the coefficients of x^2, x and constant terms from both sides, we get

$$a=pr,\ b=ps+qr \text{ and } c=qs$$

Here, b is the sum of two numbers ps and qr, whose product is $(ps)(qr)=(pr)(qs)=ac$.

Thus, to factorise ax^2+bx+c, write b as the sum of two numbers, whose product is ac.

Note To factorise ax^2+bx-c and ax^2-bx-c, write b as the difference of two numbers whose product is $(-ac)$.

Example 8 Factors of $2x^2+7x+3$ are

(a) $(x+2)(x+1)$ (b) $(2x+1)(x+3)$
(c) $(x+3)(2x-1)$ (d) $(2x-2)(x-3)$

Sol. (*b*) Given polynomial is $2x^2+7x+3$

On comparing with ax^2+bx+c, we get

$$a=2,\ b=7 \text{ and } c=3$$

Now, $ac=2\times3=6$

So, all possible pairs of factors of 6 are 1 and 6, 2 and 3.

Clearly, pair 1 and 6 gives

$$1+6=7=b$$

$$\therefore \quad 2x^2+7x+3=2x^2+(1+6)x+3$$
$$=2x^2+x+6x+3$$
$$=x(2x+1)+3(2x+1)$$
$$=(2x+1)(x+3)$$

Factorisation by Algebraic Identities

To solve these types of question, we have to use some algebraic identities.

e.g. $x^2-(2y)^2=(x+2y)(x-2y)$

Here, we use $a^2-b^2=(a+b)(a-b)$ identity.

Example 9 Factors of $x^3+27y^3+8z^3-18xyz$ are

(a) $(x+3y+2z)(x^2+9y^2+4z^2-3xy-6yz-2xz)$
(b) $(x-3y-2z)(x^2-9y^2+4z^2+3xy+6yz+2xz)$
(c) $(x+3y-3z)(x^2-9y^2+4z^2-3xy-6yz-2xz)$
(d) None of the above

Sol. (*a*) We have, $x^3+27y^3+8z^3-18xyz$

$=x^3+(3y)^3+(2z)^3-3(x)(3y)(2z)$
$=(x+3y+2z)[x^2+9y^2+4z^2-x(3y)-3y(2z)-x(2z)]$
$=(x+3y+2z)(x^2+9y^2+4z^2-3xy-6yz-2xz)$

Example 10 The value of $x^4-3x^3+2x^2+x-1$ at $x=2$ is

(a) 0 (b) 1 (c) 2 (d) 3

Sol. (*b*) Let $p(x)=x^4-3x^3+2x^2+x-1$ ...(i)

On putting $x=2$ in Eq. (i), we get

$$p(2)=2^4-3\times(2)^3+2\times(2)^2+2-1$$
$$=16-24+8+1=1$$

Example 11 The value of p, if $(2x-1)$ is a factor of $2x^3+px^2+11x+p+3$ is

(a) -7 (b) 7 (c) -6 (d) 5

Sol. (*a*) Let $q(x)=2x^3+px^2+11x+p+3$

If $q(x)$ is divisible by $2x-1$, then $(2x-1)$ is a factor of $q(x)$.

$$\therefore \quad 2x-1=0$$
$$\Rightarrow \quad x=\frac{1}{2}$$

On putting $x=\frac{1}{2}$ in $q(x)$, we have

$$q\left(\frac{1}{2}\right)=2\times\left(\frac{1}{2}\right)^3+p\left(\frac{1}{2}\right)^2+11\left(\frac{1}{2}\right)+p+3=0$$
$$\Rightarrow \quad 2\times\frac{1}{8}+p\times\frac{1}{4}+\frac{11}{2}+p+3=0$$
$$\Rightarrow \quad \frac{1}{4}+\frac{p}{4}+\frac{11}{2}+p+3=0$$
$$\Rightarrow \quad \frac{1+p+22+4p+12}{4}=0$$
$$\Rightarrow \quad 5p+35=0$$
$$\Rightarrow \quad 5p=-35$$
$$\therefore \quad p=-7$$

PRACTICE EXERCISE

1. In the expression $3a^2-4ab+5b^2+7ba$ the like terms are

(a) $-4ab, 7ba$ (b) $3a^2, 5b^2$
(c) $4ab, 7ba$ (d) $-4ab, -7ba$

2. The value of the expression

$$8y^2+\frac{1}{3}x^2+\frac{1}{5}z^2-3xy+4yz$$

at $x=1, y=-2$ and $z=-3$ is

(a) $64\frac{2}{15}$ (b) $64\frac{1}{15}$
(c) $64\frac{3}{15}$ (d) None of these

3. $-6x^2y^2+4x^2y^2-3x^2y^2$ is equal to

(a) $6x^2y^2$ (b) $-5x^2y^2$
(c) $-6x^2y^2$ (d) $5x^2y^2$

4. The difference of $x^3 - x^2 + 2x - 19$ and $2x^3 - x^2 + 4x - 6$ is
(a) $x^3 - 2x + 13$ (b) $-x^3 + 6x^2 - 8x + 12$
(c) $-x^3 - 2x - 13$ (d) None of the above

5. What must be added to $x^2 + 4x - 6$ to get $x^3 - x^2 + 2x - 2$?
(a) $x^3 + 6x - 8$ (b) $x^3 - 2x^2 + 2x - 4$
(c) $x^3 + 2x^2 + 2x - 4$ (d) $x^3 - 2x^2 - 2x + 4$

6. What must be subtracted from $x^4 + 2x^2 - 3x + 7$ to get $x^3 + x^2 + x - 1$?
(a) $x^4 - x^3 + x^2 - 4x + 8$
(b) $x^3 + x^4 + x^2 + 4x + 8$
(c) $x^4 + x^3 - x^2 + 4x - 8$
(d) None of the above

7. The product of $2x^2 + x - 5$ and $x^2 - 2x + 3$ is
(a) $2x^4 + 3x^3 + x^2 + 13x + 15$
(b) $2x^4 - 3x^3 + x^2 - 13x - 15$
(c) $2x^3 - 3x^2 - x - 15$
(d) $2x^4 - 3x^3 - x^2 + 13x - 15$

8. The value of $(29x - 6x^2 - 28) \div (3x - 4)$ is
(a) $(2x - 7)$ (b) $(-2x + 7)$
(c) $(2x + 7)$ (d) $(7 + 2x)$

9. What should be subtracted from $p^2 - 6p + 7$ so that it may exactly be divisible by $(p - 1)$?
(a) 4 (b) -4 (c) 2 (d) -2

10. Divide $3y^4 - 3y^3 - 4y^2 - 4y$ by $y^2 - 2y$, then remainder is
(a) $4y^2$ (b) $4y$
(c) $2y$ (d) 0

11. If $P = a^4 + a^3 + a^2 - 6$,
$Q = a^2 - 2a^3 - 2 + 3a$
and $R = 8 - 3a - 2a^2 + a^3$,
then the value of $P + Q + R$ is
(a) a^4 (b) a^3
(c) $2a^4$ (d) $3a^4$

12. If the expression $px^3 + 3x^2 - 3$ and $2x^3 - 5x + p$ when divided by $x - 4$ leave the same remainder, then the value of p is
(a) 0 (b) 1
(c) 2 (d) 3

13. The value of p and q when $px^3 + x^2 - 2x - q$ is exactly divisible by $(x - 1)$ and $(x + 1)$, is
(a) 2, 1 (b) 2, 2
(c) 1, 1 (d) 1, 0

14. The expansion of $\left(\frac{x}{5} - \frac{y}{6}\right)^2$ is
(a) $\frac{x^2}{25} - \frac{y^2}{36} - \frac{xy}{15}$ (b) $\frac{x^2}{25} + \frac{y^2}{36} + \frac{xy}{15}$
(c) $\frac{x^2}{10} + \frac{y^2}{12} - \frac{xy}{15}$ (d) $\frac{x^2}{25} + \frac{y^2}{36} - \frac{xy}{15}$

15. The irreducible factorisation $(25x^2 - 9y^2)$ is
(a) $(5x - 3y)(5x + 3y)$
(b) $(5x^2 - 3y^2)$
(c) $(5x - 3y)^2$
(d) None of the above

16. If $(a + b) = 4$ and $a^2 + b^2 = 7$, then the value of ab is
(a) $-\frac{9}{2}$ (b) $\frac{9}{2}$ (c) $\frac{9}{4}$ (d) $\frac{7}{4}$

17. If $(2x - 3)(? + 6x + 9) = 8x^3 - 27$, then ? will be replaced by
(a) $-4x^2$ (b) $4x^2$
(c) $5x^2$ (d)None of these

18. If $a^2 + b^2 + c^2 = ab + bc + ca$, then the value of $a^3 + b^3 + c^3$ is
(a) $3abc$ (b) $3a^2b^2c^2$
(c) $3(abc)^3$ (d) None of these

19. If $(x + y + z) = 10$ and $x^2 + y^2 + z^2 = 40$, then $(xy + yz + zx)$ is equal to
(a) 60 (b) 30
(c) 40 (d) 20

20. If $(x - y) = 6$ and $xy = 1$, then the value of $x^3 - y^3$ is
(a) 324 (b) 432 (c) 234 (d) 322

21. Common factors between $3x^2y^3$, $10x^3y^2$ and $-6x^2y^2z$ terms is
(a) $3x^2y$ (b) $3xz$
(c) x^2y^2 (d) $-x^2y^2$

22. Factors of $x^2yz + xy^2z + xyz^2$ are
(a) $xyz(x + y + z)$ (b) $xyz(x - y - z)$
(c) $xy(x + y + z)$ (d) $xz(x^2 + y + z)$

23. The factor form of $5x^2 - 20xy$ is
(a) $5x(x-4y)$
(b) $10x(x-2y)$
(c) $5(x^2-2y)$
(d) None of the above

24. The factor of form $8-4x-2x^3+x^4$ is
(a) $(2-x)(4-x^3)$ (b) $(2+x)(4-x^3)$
(c) $(2+x)(4+x^3)$ (d) $(2-x)(4+x^3)$

25. Factorise $3x^2+7x-6$
(a) $(x+3)(3x-2)$ (b) $(x-3)(3x+2)$
(c) $(x+3)(3x-3)$ (d) $(x+3)(3x-4)$

26. Factorise $8x^2-9x-14$
(a) $(x+2)(8x-7)$ (b) $(x-2)(8x-7)$
(c) $(x-2)(8x+7)$ (d) $(x+2)(8x+7)$

27. Factors of $1-8x^3$ are
(a) $(1-2x)(1+2x-4x^2)$
(b) $(1-2x)(1+2x+4x^2)$
(c) $(1-2x)(1-4x+4x^2)$
(d) $(1-2x)(1+4x-4x^2)$

28. Factors of x^6-y^6 are
(a) $(x^2-y^2)(x^4+y^4)$
(b) $(x^2+y^2)(x^4-x^2y^2+x^4)$
(c) $(x+y)(x-y)(x^2+xy+y^2)$
(d) $(x+y)(x-y)(x^2-xy+y^2)(x^2+xy+y^2)$

29. The factor form of $z^2+\frac{1}{z^2}+2-2z-\frac{2}{z}$ is
(a) $\left(z+\frac{1}{z}+2\right)\left(z-\frac{1}{z}\right)$ (b) $\left(z+\frac{1}{z}\right)\left(z+\frac{1}{z}-2\right)$
(c) $\left(z-\frac{1}{z}+2\right)\left(z+\frac{1}{z}\right)$ (d) $\left(z-\frac{1}{z}\right)\left(z-\frac{1}{z}-2\right)$

30. The factor form of $(a^4b^4-16c^4)$ is
(a) $4(a^2b^2+c^2)(ab-2c)(ab+2c)$
(b) $(a^2b^2-4c^2)(ab+2c)^2$
(c) $(a^2b^2+4c^2)(ab+2c)(ab-2c)$
(d) $(a^2b^2-4c^2)^2(ab+2c)(ab+4c)$

31. The factor form of $x^2-2\sqrt{3x}+3$ is
(a) $(x+\sqrt{3})^2$ (b) $(x-\sqrt{3})^2$
(c) $(x+\sqrt{3})(x-\sqrt{3})$ (d) $(x+2)(x+\sqrt{3})$

32. If $p(x)=x^3-5x^2+x-5$, then the remainder, when $p(x)$ is divided by $(x+1)$, is
(a) -11 (b) -12
(c) 11 (d) 12

33. Polynomial $x^{11}+1$ has factor
(a) $(x+1)$ (b) $(x-1)$
(c) $(x-2)$ (d) $(x-3)$

34. The factor of the polynomial $4x^3+3x^2-4x-3$ is
(a) $(x-2)$ (b) $(x-1)$
(c) $(x+1)$ (d) $(x-3)$

Answers

1	(a)	2	(a)	3	(b)	4	(c)	5	(d)	6	(a)	7	(d)	8	(b)	9	(c)	10	(d)
11	(a)	12	(b)	13	(a)	14	(d)	15	(a)	16	(b)	17	(b)	18	(a)	19	(b)	20	(c)
21	(c)	22	(a)	23	(a)	24	(a)	25	(a)	26	(c)	27	(b)	28	(d)	29	(b)	30	(c)
31	(b)	32	(b)	33	(a)	34	(b)												

Hints and Solutions

1. $-4ab$ and $7ba$ are like terms because variable parts are same in both side.

2. Let $E = 8y^2 + \frac{1}{3}x^2 + \frac{1}{5}z^2 - 3xy + 4yz$.

At $x = 1$, $y = -2$ and $z = -3$ is

$$E = 8(-2)^2 + \frac{1}{3}(1)^2 + \frac{1}{5}(-3)^2 - 3 \times 1(-2) + 4 \times (-2) \times (-3)$$

$$= 8 \times 4 + \frac{1}{3} + \frac{1}{5} \times 9 + 6 + 24$$

$$= 32 + \frac{1}{3} + \frac{9}{5} + 30$$

$$= \frac{32 \times 15 + 5 + 9 \times 3 + 30 \times 15}{15}$$

$$= \frac{480 + 5 + 27 + 450}{15} = \frac{962}{15} = 64\frac{2}{15}$$

3. $-6x^2y^2 + 4x^2y^2 - 3x^2y^2 = -5x^2y^2$.

4. Rearranging the terms of the given polynomials, changing the sign of each term of the polynomial which is to be subtracted and adding the two polynomials, we get

$$\begin{array}{rrrr} x^3 & -x^2 & +2x & -19 \\ 2x^3 & -x^2 & +4x & -6 \\ - & + & - & + \\ \hline -x^3 & & -2x & -13 \\ \hline \end{array}$$

5.

$$\begin{array}{rrrr} x^3 & -x^2 & +2x & -2 \\ & x^2 & +4x & -6 \\ & - & - & + \\ \hline x^3 & -2x^2 & -2x & +4 \\ \hline \end{array}$$

6.

$$\begin{array}{rrrrr} x^4 & +0x^3 & +2x^2 & -3x & +7 \\ & x^3 & +x^2 & +x & -1 \\ & - & - & - & + \\ \hline x^4 & -x^3 & +x^2 & -4x & +8 \\ \hline \end{array}$$

7. Now, $(2x^2 + x - 5) \times (x^2 - 2x + 3)$

$= 2x^2(x^2 - 2x + 3) + x(x^2 - 2x + 3) - 5(x^2 - 2x + 3)$

$= 2x^4 - 4x^3 + 6x^2 + x^3 - 2x^2 + 3x - 5x^2 + 10x - 15$

$= 2x^4 - x^3(4 - 1) + x^2(6 - 5 - 2) + x(3 + 10) - 15$ [arranging like terms]

$= 2x^4 - 3x^3 - x^2 + 13x - 15$

8. Arranging the terms of the dividend and the divisor in descending power and then dividing, we get

$$\begin{array}{r|l} & -2x + 7 \\ \hline 3x - 4 & -6x^2 + 29x - 28 \\ & -6x^2 + 8x \\ & + \quad - \\ \hline & 21x - 28 \\ & 21x - 28 \\ & - \quad + \\ \hline & \times \\ \hline \end{array}$$

$\therefore (29x - 6x^2 - 28) \div (3x - 4) = (-2x + 7)$

9.

$$\begin{array}{r|l} & p - 5 \\ \hline p - 1 & p^2 - 6p + 7 \\ & p^2 - p \\ & - \quad + \\ \hline & -5p + 7 \\ & -5p + 5 \\ & + \quad - \\ \hline & 2 \end{array}$$

Remainder = 2

Hence, 2 is subtracted from it.

10.

$$\begin{array}{r|l} & 3y^2 + 3y + 2 \\ \hline y^2 - 2y & 3y^4 - 3y^3 - 4y^2 - 4y \\ & 3y^4 - 6y^3 \\ & - \quad + \\ \hline & 3y^3 - 4y^2 - 4y \\ & 3y^3 - 6y^2 \\ & - \quad + \\ \hline & 2y^2 - 4y \\ & 2y^2 - 4y \\ & - \quad + \\ \hline & 0 \\ \hline \end{array}$$

$\therefore$ Remainder is 0.

11. $P + Q + R = (a^4 + a^3 + a^2 - 6) + (a^2 - 2a^3 - 2 + 3a) + (8 - 3a - 2a^2 + a^3)$

$= a^4 + 0 + 0 + 0 + 0$

$= a^4$

12. Let $f(x)=px^3+3x^2-3$ and $g(x)=2x^3-5x+p$

$\therefore \quad f(4)=p(4)^3+3(4)^2-3$

and $\quad g(4)=2(4)^3-5(4)+p$

$\Rightarrow \quad f(4)=64p+45$ and $g(4)=p+108$

Since, $f(4)=g(4) \Rightarrow 64p+45=p+108$

$\Rightarrow \quad p=1$

13. Let $f(x)=px^3+x^2-2x-q=0$

$f(1)=p+1-2-q=0$

$\Rightarrow \quad p-q=1 \quad \ldots(i)$

$f(-1)=p(-1)^3+(-1)^2-2(-1)-q=0$

$\Rightarrow \quad p+q=3 \quad \ldots(ii)$

On solving Eqs. (i) and (ii), we get

$p=2, q=1$

14. $\left(\frac{x}{5}-\frac{y}{6}\right)^2=\left(\frac{x}{5}\right)^2-2\times\frac{x}{5}\times\frac{y}{6}+\left(\frac{y}{6}\right)^2$

[by using identity $(a-b)^2=a^2-2ab+b^2$]

$=\frac{x^2}{25}-\frac{xy}{15}+\frac{y^2}{36}$

$=\frac{x^2}{25}+\frac{y^2}{36}-\frac{xy}{15}$

15. $(25x^2-9y^2)=[(5x)^2-(3y)^2]$

$=(5x-3y)(5x+3y) \quad [\because (a^2-b^2)=(a-b)(a+b)]$

16. We have, $a+b=4$ and $a^2+b^2=7$

$\therefore \quad (a+b)^2=(4)^2$

$\Rightarrow \quad a^2+b^2+2ab=16$

$\Rightarrow \quad 7+2ab=16$

$\Rightarrow \quad 2ab=16-7=9$

$\therefore \quad ab=\frac{9}{2}$

17. Now, $\quad 8x^3-27=(2x)^3-(3)^3$

$=(2x-3)[(2x)^2+2x\times3+3^2]$

$[\because a^3-b^3=(a-b)(a^2+ab+b^2)]$

$=(2x-3)(4x^2+6x+9)$

So, ? will be replaced by $4x^2$.

18. $\because a^3+b^3+c^3-3abc$

$=(a^2+b^2+c^2-ab-bc-ca)(a+b+c)$

$=[(a^2+b^2+c^2)-(ab+bc+ca)](a+b+c)$

But, $a^2+b^2+c^2=ab+bc+ca$ [given]

$\therefore a^3+b^3+c^3-3abc=(a+b+c)\times0=0$

$\therefore \quad a^3+b^3+c^3=3abc$

19. $\because (x+y+z)=10$

On squaring both sides, we get

$(x+y+z)^2=(10)^2$

$\Rightarrow x^2+y^2+z^2+2xy+2yz+2zx=100$

$\Rightarrow \quad 40+2(xy+yz+zx)=100$

$\Rightarrow \quad 2(xy+yz+zx)=100-40$

$\Rightarrow \quad 2(xy+yz+zx)=60$

$\therefore \quad (xy+yz+zx)=\frac{60}{2}=30$

20. $\because (x-y)=6$

On squaring both sides, we get

$(x-y)^2=(6)^2$

$\Rightarrow \quad x^2+y^2-2xy=36$

$\Rightarrow \quad x^2+y^2-2\times1=36$

$\Rightarrow \quad x^2+y^2=36+2=38$

$\because \quad x^3-y^3=(x-y)(x^2+y^2+xy)$

$\therefore \quad x^3-y^3=(6)(38+1)=6\times39=234$

21. We have,

$3x^2y^3=3\times x\times x\times y\times y\times y,$

$10x^3y^2=2\times5\times x\times x\times x\times y\times y$

and $\quad -6x^2y^2z=-2\times3\times x\times x\times y\times y\times z$

Here, x, x, y, y are common factors.

Hence, x^2y^2 is common factor.

22. We have, $x^2yz+xy^2z+xyz^2$

$=x\times x\times y\times z+x\times y\times y\times z+x\times y\times z\times z$

$=xyz(x+y+z)$

23. We have, $5x^2-20xy=5x(x-4y)$

24. $8-4x-2x^3+x^4$

$=4(2-x)-x^3(2-x)=(2-x)(4-x^3)$

25. We have, $3x^2+7x-6$

$=3x^2+9x-2x-6$

$=3x(x+3)-2(x+3)$

$=(3x-2)(x+3)$

26. We have, $8x^2-9x-14$

$=8x^2-16x+7x-14$

$=8x(x-2)+7(x-2)$

$=(8x+7)(x-2)$

27. We have, $1-8x^3=1^3-(2x)^3$

$=(1-2x)(1+2x+4x^2)$

$[\because a^3-y^3=(a-b)(a^2+ab+b^2)]$

28. $x^6 - y^6 = (x^3)^2 - (y^3)^2 = (x^3 + y^3)(x^3 - y^3)$

$[\because a^2 - b^2 = (a+b)(a-b)]$

$= (x+y)(x^2 - xy + y^2)(x-y)(x^2 + xy + y^2)$

$\left[\begin{array}{l} \because \quad a^3 + b^3 = (a+b)(a^2 - ab + b^2) \\ \text{and } a^3 - b^3 = (a-b)(a^2 + ab + b^2) \end{array}\right]$

$= (x+y)(x-y)(x^2 - xy + y^2)(x^2 + xy + y^2)$

29. We have, $z^2 + \frac{1}{z^2} + 2 - 2z - \frac{2}{z}$

$= \left(z + \frac{1}{z}\right)^2 - 2\left(z + \frac{1}{z}\right) \quad \left[\because z^2 + \frac{1}{z^2} + 2 = \left(z + \frac{1}{z}\right)^2\right]$

$= \left(z + \frac{1}{z}\right)\left(z + \frac{1}{z} - 2\right)$

30. $(a^4 b^4 - 16c^4) = [(a^2b^2) - (4c^2)^2]$

$= (a^2b^2 + 4c^2)(a^2b^2 - 4c^2)$

$= (a^2b^2 + 4c^2)[(ab)^2 - (ac)^2]$

$= (a^2b^2 + 4c^2)(ab + 2c)(ab - 2c)$

31. $x^2 - 2\sqrt{3x} + 3$

$= x^2 - \sqrt{3}x - \sqrt{3}x + 3$

$= x(x - \sqrt{3}) - \sqrt{3}(x - \sqrt{3})$

$= (x - \sqrt{3})(x - \sqrt{3}) = (x - \sqrt{3})^2$

32. Given, that

$p(x) = x^3 - 5x^2 + x - 5$

$\therefore \quad p(-1) = (-1)^3 - 5(-1)^2 + (-1) - 5$

$= -1 - 5 - 1 - 5 = -12$

33. Let $p(x) = x^{11} + 1$

$\therefore \quad p(-1) = (-1)^{11} + 1 = -1 + 1 = 0$

Here, $\quad x = -1$

i.e. $\quad x + 1 = 0$

So, $(x+1)$ is factor of given polynomial.

34. We have, $p(x) = 4x^3 + 3x^2 - 4x - 3$

By options,

(a) $p(2) = 4 \times 2^3 + 3 \times 2^2 - 4 \times 2 - 3$

$= 32 + 12 - 8 - 3 = 33$

(b) $p(1) = 4 \times 1^3 + 3 \times 1^2 - 4 \times 1 - 3$

$= 4 + 3 - 4 - 3 = 0$

Here, by $p(1)$, i.e. $x = 1 \Rightarrow (x-1) = 0$

So, $(x-1)$ is a factor of given polynomial.

CHAPTER

09

LINEAR EQUATIONS IN ONE VARIABLE

In this chapter, we study one and two variable types linear equations and various word problems by using linear equations.

Equation

An equation is an equality involving variables and it has an equality sign (=). The expression on the left of the equality sign is the Left Hand Side (LHS) and expression on the right of the equality sign is the Right Hand Side (RHS).

Linear Equations

The equations, in which the highest power of the variable appearing in the expression is 1, are called linear equations.

Linear Equations in One Variable

The expression, which form the equation contains only one variable and the highest power of the variable appearing in the equation is 1, are called linear equations in one variable.

e.g. $2x - 5 = 3$ and $\frac{5}{3}x + 3 = \frac{1}{2}$

Note The graph of the linear equation is always a straight line.

Properties of Linear Equations

(i) If same number is added or subtracted to both the sides of an equation, the equality remains the same.

(ii) If same number is multiplied to both the sides of an equation, the equality remains the same.

(iii) If both sides are divided by a same non-zero number, the equality remains the same.

Example 1 Solve $2(x-3)-(5-3x) = 3(x+1)-4(2+x)$

(a) 2 (b) 1
(c) 3 (d) 0

Sol. *(b)* Given,

$$2(x-3)-(5-3x)=3(x+1)-4(2+x)$$

$\Rightarrow$ $2x-6-5+3x=3x+3-8-4x$

$\Rightarrow$ $5x-11=-x-5 \Rightarrow 6x=6$

$\Rightarrow$ $x=1$

Example 2 If $\frac{2x+1}{3x-1}=\frac{2x+1}{3x+2}$, the value of x is

(a) $-\frac{1}{2}$ (b) 0
(c) $\frac{1}{3}$ (d) $-\frac{2}{3}$

Sol. *(a)* We have, $\frac{2x+1}{3x-1}=\frac{2x+1}{3x+2}$

$\Rightarrow$ $(2x+1)(3x+2)=(2x+1)(3x-1)$

$\Rightarrow$ $6x^2+4x+3x+2=6x^2-2x+3x-1$

$\Rightarrow$ $6x^2+7x+2=6x^2+x-1$

$\Rightarrow$ $7x-x=-1-2 \Rightarrow 6x=-3$

$\therefore$ $x=-\frac{3}{6}=-\frac{1}{2}$

Solving Word Problems by Using Linear Equation

I. Firstly, denote the unknown quantity by any letters, say x, y, z, etc.

II. Translate the statements of the problem into mathematical statements.

III. Using the conditions given in the problem, form the equation.

IV. Solve the equation for the unknown quantity.

Example 3 The digit in the ten's place of a two-digit number is 3 more than the digit in the unit's place. Let the digit at unit's place be b. Then, the number is

(a) $11b+30$ (b) $10b+30$
(c) $11b+3$ (d) $10b+3$

Sol. *(a)* Let digit at unit's place be b.

Then, digit at ten's place $=(3+b)$

$\therefore$ Number $=10(3+b)+b$

$=30+10b+b=11b+30$

Example 4 Thirty one is added 63 to twice a whole number gives. The number is

(a) 15 (b) 16 (c) 17 (d) 18

Sol. *(b)* Let whole number be x.

Then, $31+2x=63$

$\Rightarrow$ $2x=32 \Rightarrow x=16$

Example 5 A boy is now one-third as old as his father. Twelve years hence, he will be half as old as his father. The present age of the boy is

(a) 12 yr (b) 20 yr (c) 36 yr (d) 25 yr

Sol. *(a)* Let the present age of the father be x yr and that of the son be $\frac{1}{3}x$ yr.

After twelve years,

Age of father $=(x+12)$ yr

and age of son $=\left(\frac{1}{3}x+12\right)$ yr

According to given condition,

$$\frac{1}{3}x+12=\frac{1}{2}(x+12)$$

$\Rightarrow$ $\frac{x+36}{3}=\frac{x+12}{2}$

$\Rightarrow$ $2x+72=3x+36 \Rightarrow x=36$

$\therefore$ Age of the boy $=\frac{x}{3}=\frac{36}{3}=12$ yr.

PRACTICE EXERCISE

1. Linear equation in one variable has
(a) only one variable with any power
(b) only one term with a variable
(c) only one variable with power 1
(d) only constant term

2. Which of the following is a linear expression?
(a) x^2+1 (b) $y+y^2$
(c) 4 (d) $1+z$

3. A linear equation in one variable has
(a) only one solution
(b) two solutions
(c) more than two solutions
(d) no solution

4. If $8x-3=25+17x$, then x is
(a) a fraction
(b) an integer
(c) a rational number
(d) cannot be solved

5. If $7x:63=1:9$, then x is equal to
(a) 1 (b) 2
(c) 3 (d) -1

6. If $\frac{3x+6}{8}-\frac{11x-8}{24}+\frac{x}{3}=\frac{3x}{4}-\frac{x+7}{24}$, then the value of x is
(a) -3 (b) 3/2
(c) 3 (d) 1/3

7. If $\sqrt{3}x-2=2\sqrt{3}+4$, then the value of x is
(a) $2(1-\sqrt{3})$ (b) $2(1+\sqrt{3})$
(c) $1+\sqrt{3}$ (d) $1-\sqrt{3}$

8. If $a(x-a^2)-b(x-b^2)=0$, then x is equal to
(a) $\frac{(-a+b)(a^2+ab+b^2)}{(a+b)}$ (b) $\frac{a^3+b^3}{(a-b)}$
(c) $\frac{a^3-b^3}{a+b}$ (d) a^2+ab+b^2

9. If one number is thrice the other and their sum is 20, then the numbers are
(a) 5, 15 (b) 4, 12
(c) 3, 9 (d) 6, 18

10. If the sum of five consecutive even numbers is 340, then the smallest numbers will be
(a) 62 (b) 64 (c) 66 (d) 68

11. The sum of 4 consecutive odd numbers is 56. The smallest number is
(a) 12 (b) 11 (c) 13 (d) 14

12. The sum of the two numbers is 11 and their product is 30, then the numbers are
(a) 8, 3 (b) 9, 2 (c) 7, 4 (d) 6, 5

13. Divide 60 into two parts, so that three times the greater may be exceed 100 by as much as 8 times the less falls short of 200. What is the greater part ?
(a) 36 (b) 24 (c) 20 (d) 25

14. The ages of two persons differ by 20 yr. If 5 yr ago, the elder one be 5 times as old as the younger one, their present ages are
(a) 50 yr, 30 yr (b) 28 yr, 5 yr
(c) 20 yr, 10 yr (d) 30 yr, 10 yr

15. Given that $\frac{4p+9q}{p}=\frac{5q}{p-q}$ and p and q are both positive. The value of $\frac{p}{q}$ is
(a) $\frac{5}{3}$ (b) $\frac{2}{3}$ (c) $\frac{3}{2}$ (d) $\frac{3}{5}$

16. A fraction becomes 4/5 when 5 is added to its numerator and 1 is subtracted from its denominator. It becomes 1/2 when 3 and 5 are subtracted from its numerator and denominator. The numerator of the fraction will be
(a) 4 (b) 11 (c) 10 (d) 9

17. The total cost of 6 books and 4 pencils is ₹ 34 and that of 5 books and 5 pencils is ₹ 30. The cost of each book and pencil (in ₹) respectively is
(a) 1 and 5 (b) 5 and 1
(c) 6 and 1 (d) 1 and 6

18. The age of a man is 4 times that of his son. Five years ago, the man was nine times as old as his son was at that time. The present age of the man is
(a) 28 yr (b) 45 yr (c) 32 yr (d) 48 yr

19. In a class $\frac{3}{5}$ of the students are girls and rest are boys. If $\frac{2}{9}$ of the girls and $\frac{1}{4}$ of the boys are absent. What part of the total number of students are present ?
(a) $\frac{23}{30}$ (b) $\frac{23}{36}$ (c) $\frac{18}{49}$ (d) $\frac{17}{25}$

20. If a sum of ₹ 275 is to be divided between Ram and Shyam so that Ram gets more than 3/4th of what Shyam gets, then the share of Ram will be
(a) ₹ 200 (b) ₹ 175 (c) ₹ 160 (d) ₹ 100

21. Find a number such that if 5,15 and 35 are added to it, the product of the first and third results may be equal to the square of the second.
(a) 10 (b) 7 (c) 6 (d) 5

22. The length of a rectangle is 8 cm more than its breadth. If the perimeter of the rectangle is 68 cm, its length and breadth are respectively.
(a) 21 cm, 13 cm (b) 21 cm, 32 cm
(c) 20 cm, 10 cm (d) 13 cm, 15 cm

23. In a two digit number, the tens digit is twice the unit digit. When the digits are reversed, the new number formed is 18 less than the original number. The original number is
(a) 45 (b) 42
(c) 43 (d) 41

24. A man has a certain number of chickens and goats. Their head count is 30. If the total number of their legs is 84, what is the ratio between the number of chickens and goats ?
(a) 1 : 2 (b) 2 : 3
(c) 3 : 2 (d) 3 : 4

Answers

1	(c)	2	(d)	3	(a)	4	(c)	5	(a)	6	(c)	7	(b)	8	(d)	9	(a)	10	(b)
11	(b)	12	(d)	13	(a)	14	(d)	15	(c)	16	(b)	17	(b)	18	(c)	19	(a)	20	(b)
21	(d)	22	(a)	23	(b)	24	(c)												

Hints and Solutions

1. Linear equation in one variable has only one variable with power 1.

2. We know that, the algebraic expression in one variable having the highest power of the variable as 1, is known as the linear expression.
Here, $1 + z$ is the only linear expression, as the power of the variable z is 1.

3. A linear equation in one variable has only one solution.

4. Given, $8x - 3 = 25 + 17x$
$\Rightarrow \quad 8x - 17x = 25 + 3$
$\Rightarrow \quad -9x = 28$
$\therefore \quad x = \frac{-28}{9}$
Hence, x is a rational number.

5. $\frac{7x}{63} = \frac{1}{9} \Rightarrow x = \frac{63}{9 \times 7} = 1$

6. Given, $\frac{3x+6}{8} - \frac{11x-8}{24} + \frac{x}{3} = \frac{3x}{4} - \frac{x+7}{24}$
$\Rightarrow \quad \frac{3(3x+6) - (11x-8) + 8x}{24} = \frac{6(3x) - (x+7)}{24}$
$\Rightarrow \quad 9x + 18 - 11x + 8 + 8x = 18x - x - 7$

$\Rightarrow \quad 26 + 6x = 17x - 7$

$\Rightarrow \quad 11x = 33$

$\Rightarrow \quad x = 3$

7. Given, $\sqrt{3}x - 2 = 2\sqrt{3} + 4$

$\therefore \quad \sqrt{3}x = 2\sqrt{3} + 6$

$\Rightarrow \quad x = \frac{2\sqrt{3}+6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 2(1+\sqrt{3})$

8. Since, $\quad ax - a^3 - bx + b^3 = 0$

$\therefore \quad (a-b)x - (a^3 - b^3) = 0$

$\Rightarrow (a-b)[x - (a^2 + b^2 + ab)] = 0$

$\Rightarrow \quad x = a^2 + b^2 + ab$

9. Let the one number be x and number be $3x$.

According to the given condition,

$x + 3x = 20 \Rightarrow x = 5$

$\therefore$ Other number is $(3x) = 3 \times 5 = 15$

10. Let the smallest number be x.

Then,

$x + (x+2) + (x+4) + (x+6) + (x+8) = 340$

$\Rightarrow \quad 5x + 20 = 340$

$\Rightarrow \quad 5x = 320$

$\therefore \quad x = 64$

11. Let four consecutive odd number be

$x+1, x+3, x+5, x+7.$

Then, $(x+1) + (x+3) + (x+5) + (x+7) = 56$

$4x = 40 \Rightarrow x = 10$

$\therefore$ The smaller odd number is $x+1 = 10+1 = 11$

12. Let numbers be x and $11 - x$.

Since, product $\quad x(11-x) = 30 \quad$ [given]

$\Rightarrow \quad x^2 - 11x + 30 = 0$

$\Rightarrow \quad (x-5)(x-6) = 0$

$\Rightarrow \quad x = 5, 6$

13. Let two parts be x and $60 - x$.

Then, $\quad 3x - 100 = 200 - 8(60 - x)$

$\Rightarrow \quad 3x - 100 = 200 - 480 + 8x$

$\Rightarrow \quad 8x - 3x = 480 - 200 - 100$

$\Rightarrow \quad 5x = 180$

$\therefore \quad x = \frac{180}{5} = 36$

Thus, another number $60 - 36 = 24$.

$\therefore$ Greater number $= 36$

14. Let their ages be x and $(x - 20)$ yr.

5 yr ago, their ages are $(x - 5)$ and $(x - 20 - 5)$ yr.

According to the given condition,

$5(x - 20 - 5) = (x - 5)$

$\Rightarrow \quad 5x - 125 = x - 5$

$\Rightarrow \quad 4x = 120 \Rightarrow x = 30$

Hence, their present ages are 30 yr and 10 yr.

15. Given, $\quad \frac{4p + 9q}{p} = \frac{5q}{p - q}$

$\Rightarrow \quad \frac{4\left(\frac{p}{q}\right) + 9}{\left(\frac{p}{q}\right)} = \frac{5}{\left(\frac{p}{q}\right) - 1}$

[on dividing by q in numerator and denominator]

$\Rightarrow 4\left(\frac{p}{q}\right)^2 + 9\left(\frac{p}{q}\right) - 4\left(\frac{p}{q}\right) - 9 = 5\left(\frac{p}{q}\right)$

$\Rightarrow \quad 4\left(\frac{p}{q}\right)^2 - 9 = 0 \Rightarrow \left(\frac{p}{q}\right)^2 = \left(\frac{3}{2}\right)^2$

$\therefore \quad \frac{p}{q} = \frac{3}{2}$

16. Let the fraction be $\frac{x}{y}$.

Then, $\frac{x+5}{y-1} = \frac{4}{5} \Rightarrow 5x - 4y = 29 \quad$ ...(i)

and $\frac{x-3}{y-5} = \frac{1}{2} \quad \Rightarrow \quad 2x - y = 1 \quad$ ...(ii)

On solving Eqs. (i) and (ii), we get $x = 11$

17. Let CP of a book be ₹ x and CP of pencil be ₹y.

Then, $\quad 6x + 4y = 34 \quad$ ...(i)

and $\quad 5x + 5y = 30 \quad$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x = 5$ and $y = 1$.

18. Let the son's age be x yr, then man age's be $4x$.

Five years ago, their ages are $(x - 5)$ yr and $(4x - 5)$ yr respectively.

According to the given condition,

$(4x - 5) = 9(x - 5)$

$\Rightarrow \quad 5x = 40 \quad \Rightarrow \quad x = 8$ yr

Hence, the man's age $= 4x = 4 \times 8 = 32$ yr.

19. Let the number of students be x.

Then, number of girls $= \frac{3}{5}x$ and number of boys

$= \frac{2}{5}x$

Number of girls present $= \frac{7}{9} \times \frac{3}{5}x = \frac{7x}{15}$ and

Number of boys present $= \frac{3}{4} \times \frac{2}{5}x = \frac{3x}{10}$

$\therefore$ Total students present $= \left(\frac{7x}{15} + \frac{3x}{10}\right) = \frac{23}{30}x$

20. Let Shyam's share be ₹ x.

Then, Ram's share $= \left(x + \frac{3x}{4}\right) =$ ₹ $\frac{7x}{4}$

$\therefore \quad x + \frac{7x}{4} = 275 \Rightarrow x = 100$

$\therefore$ Ram's share $= \frac{7}{4} \times 100 =$ ₹ 175

21. Let the number be x.

Then, first number $= (x+5)$

second number $= (x + 15)$

and third number $= (x+35)$

According to the question,

$(x + 5)(x + 35) = (x + 15)^2$

$\Rightarrow \quad 175 + 40x = 225 + 30x$

$\Rightarrow \quad 10x = 50$

$\therefore \quad x = 5$

22. Let breadth of rectangle be x.

Then, its length $= (x + 8)$ cm

$\therefore$ Perimeter of rectangle $= 2[x + (x + 8)]$

$= 2(2x + 8) = 4x + 16$

$\therefore \quad 4x + 16 = 68$ [given]

$\Rightarrow \quad 4x = 52$

$\Rightarrow \quad x = 13$

So, breadth of rectangle $= 13$ cm

and length $= 13 + 8 = 21$ cm

23. Let unit digit $= x$

Then, tens digit $= 2x$

$\therefore$ Original number $= 10 \times 2x + x = 20x + x = 21x$

New Number $= 10 \times x + 2x$

$= 10x + 2x = 12x$

Now, $21x - 12x = 18$

$\Rightarrow \quad 9x = 18$

$\Rightarrow \quad x = 2$

$\therefore$ Unit digit $= 2$ and Tens digit $= 2 \times 2 = 4$

Thus, required number $= 10 \times 4 + 2 = 42$

24. Let the number of chickens and goat be x and

According to the question,

$x + y = 30$ ...(i)

and $2x + 4y = 84$

$\Rightarrow \quad x + 2y = 42$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x = 18$ and $y = 12$

$\therefore$ Required ratio $= 18 : 12 = 3 : 2$

CHAPTER

10

LINES AND TRIANGLES

In this chapter, we study the Line, Triangle their types and properties etc.

Lines and Triangles are the branch of plane geometry. In which we study the two intersecting lines forms different types of angles and three intersecting lines forms a different types of triangles.

Definitions Related to Lines and Angles

Line Segment

A line segment is a portion (or part) of a line. It has two end points.

It has a definite length. Distance between P and Q is called length of the line segment PQ.

Ray

A ray extends indefinitely in one direction. This is shown by an arrow *ie*,

P is called initial point. It has no definite length.

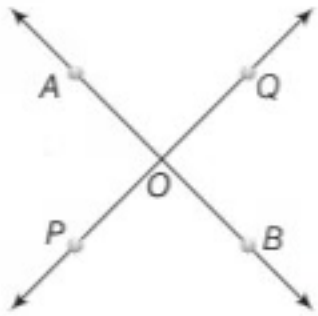
Line

A line segment PQ when extended indefinitely in both the directions is called a line.

- Line has no end point.
- Line has no definite length.
- Line is a set of infinite points.

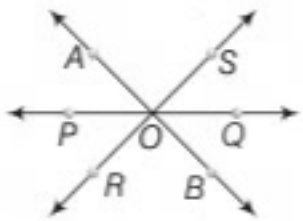
Intersecting Lines

Two lines having a common point, are called intersecting lines. This common point is called point of intersection. In the figure, 'O' is the common point.



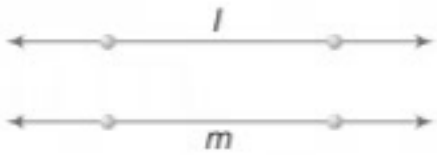
Concurrent Lines

Three or more lines in a plane which are intersecting at the same point, are called concurrent lines.



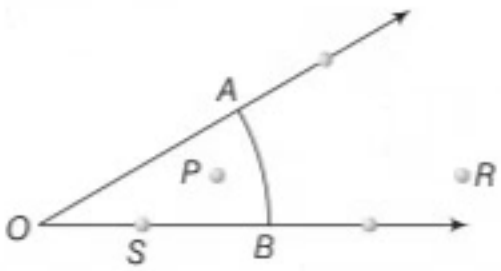
Parallel Lines

Two lines in a plane which do not intersect anywhere in a plane are called parallel lines.



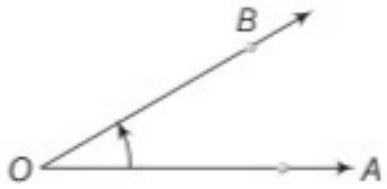
Angles

A figure consisting of two rays join with end points is called an angle. In the figure, $\angle AOB$ is a angle with rays OA and OB.

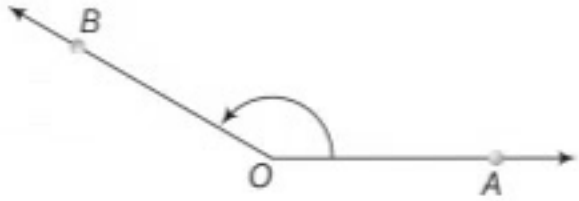


Classification of Angles

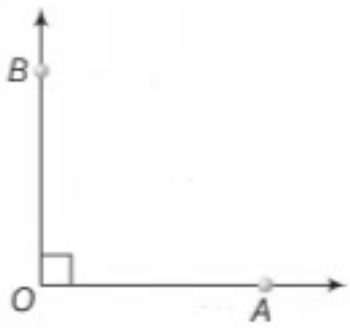
(i) **Acute Angle** An angle between 0° and 90° (less than 90°) is called acute angle.



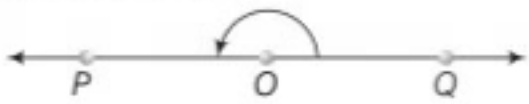
(ii) **Obtuse Angle** An angle between 90° and 180° (greater than 90°) is called obtuse angle.



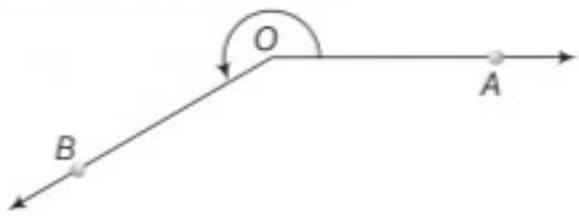
(iii) **Right Angle** An angle equal to 90° is called right angle.



(iv) **Straight Angle** An angle equal to 180° is called straight angle.



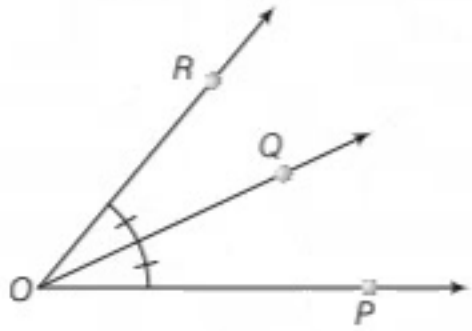
(v) **Reflex Angle** An angle between 180° and 360° is called reflex angle.



(vi) **Complete Angle** An angle equal to 360° is called complete angle.

(vii) **Bisector of an Angle** A ray OQ is called the bisector of $\angle POR$, if

$$\angle POQ = \angle ROQ.$$



$$\therefore \quad \angle POQ = \angle QOR = \frac{1}{2}\angle POR$$

(viii) **Complementary Angles** Two angles are said to be complementary, if their sum is 90°.

Complementary angles are complement of each other.

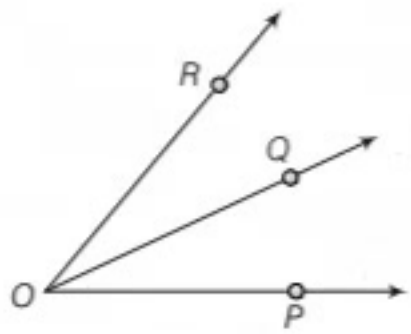
Complement of θ is (90° − θ).

(ix) **Supplementary Angles** Two angles are said to be supplementary, if their sum is 180°.

Supplementary angles are supplement of each other.

Supplement of θ is (180° − θ).

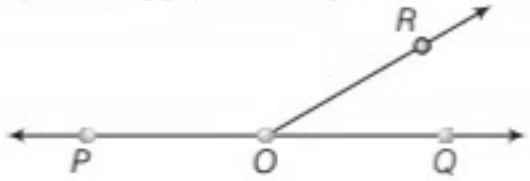
(x) **Adjacent Angles** Two angles are said to be adjacent, if they have a common vertex.



They have a common arm and their non-common arms are on either side of the common arm.

Here, $\angle POQ$ and $\angle ROQ$ are adjacent angles and have the same vertex O, a common arm OQ, the non- common arms OP, OR on either side of OQ.

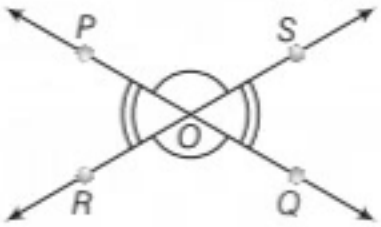
(xi) **Linear Pair** Two angles are said to form a linear pair of angles, if they are adjacent angles and they are supplementary.



$$\therefore \quad \angle POR + \angle QOR = 180°$$

If a ray stands on a line, then the sum of the adjacent angles so formed is 180°.

(xii) **Vertically Opposite Angles** If two lines PQ and RS intersects at a point O, then the pair of $\angle POR$ and $\angle QOS$ or pair of $\angle POS$ and $\angle ROQ$ is said to be a pair of vertically opposite angles.



Vertically opposite angles are always equal.

i.e. $\angle POR = \angle QOS$ and $\angle POS = \angle ROQ$

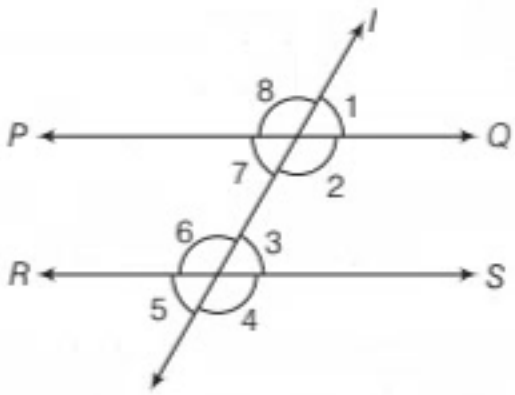
Properties of Parallel Lines

Let PQ and RS be two parallel lines, cut by a transversal l.

Then,

- Angles $\angle 1$, $\angle 8$, $\angle 5$ and $\angle 4$ are the exterior angles and $\angle 2$, $\angle 3$, $\angle 6$ and $\angle 7$ are the interior angles.
- Pairs of corresponding angles are equal

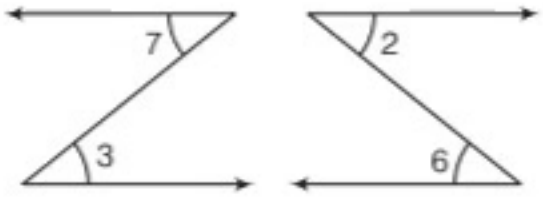
  i.e. $\angle 1 = \angle 3$, $\angle 2 = \angle 4$, $\angle 7 = \angle 5$, $\angle 8 = \angle 6$



- The sum of co-interior angles on the same side of transversal is 180°.

  i.e., $\angle 2 + \angle 3 = 180°$ and $\angle 7 + \angle 6 = 180°$

- The pairs of opposite angles of transversal line is said to be alternate angles.



i.e., $\angle 7 = \angle 3$

$\angle 2 = \angle 6$

- The vertical opposite angles are equal, i.e.

$\angle 1 = \angle 7$; $\angle 2 = \angle 8$

and $\angle 3 = \angle 5$; $\angle 4 = \angle 6$

Example 1 Find the measure of an angle which is 28° more than its complement.

(a) 58° (b) 59°
(c) 60° (d) 61°

Sol. (*b*) Let measure of the required angle be $x°$.

Then, measure of its complement $= 90° - x$

$\therefore \quad x - (90° - x) = 28°$

$\Rightarrow \quad 2x = 118°$

$\Rightarrow \quad x = 59°$

Hence, the measure of the required angle is 59°.

Example 2 Find the measure of an angle, which is 32° less than its supplement.

(a) 74° (b) 73°
(c) 72° (d) 71°

Sol. (*a*) Let the measure of the required angle be x.

Then, measure of its supplement $= (180° - x)$

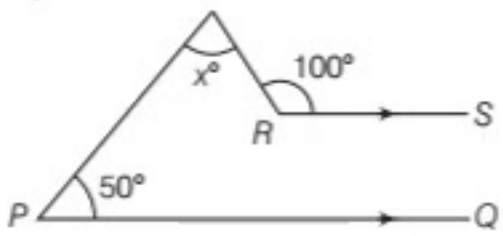
$\therefore \quad (180° - x) - x = 32°$

$\Rightarrow \quad 180° - 32° = 2x$

$\Rightarrow \quad 2x = 148°$

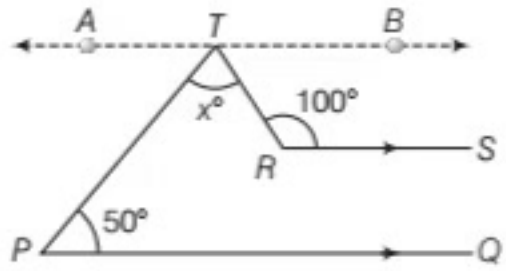
$\Rightarrow \quad x = 74°$

Example 3 In the given figure, $PQ \parallel RS$. The value of $x°$, is



(a) 120° (b) 50°
(c) 135° (d) 140°

Sol. (*b*) Draw $AB \parallel PQ$



$\angle ATP = \angle TPQ = 50°$

[$\because$ alternate interior angles]

$\angle BTR + \angle TRS = 180°$

[$\because$ sum of interior angles]

$\Rightarrow \quad \angle BTR = 80°$ and $\angle ATP + x + \angle BTR = 180°$

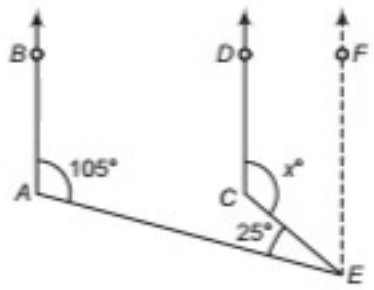
[$\because$ AB is the straight line]

$\Rightarrow \quad 50° + x + 80° = 180°$

$\therefore \quad x = 50°$

Example 4 In the given figure, $AB \parallel CD$, the value of x is

(a) 120° (b) 130° (c) 132° (d) 134°



Sol. (*b*) Let $CD \parallel EF$. Then, $x + \angle CEF = 180°$

[$\because$ sum of interior angles]

$\Rightarrow \quad \angle CEF = 180° - x$

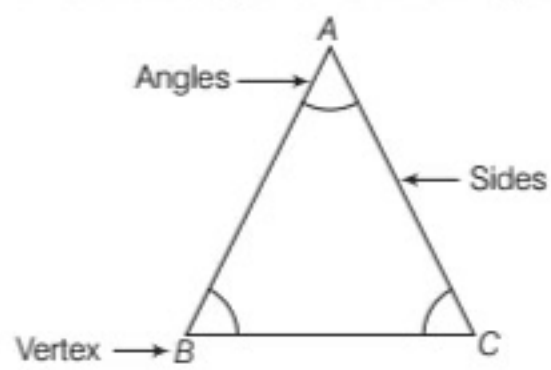
But $\quad \angle BAE + \angle AEF = 180°$

$\Rightarrow 105° + 25° + (180° - x) = 180°$

$\therefore \quad x = 130°$

Triangle

A closed figure which has three sides, three angles and three vertices, is called a triangle.



Properties of Triangle

- The sum of three angles of a triangle is equal to 180°.
- The sum of lengths of any two sides of triangle is greater than the length of third side.
- In a triangle, an exterior angle is equal to the sum of the two interior opposite angles.

Types of Triangle

Different types of triangle, according to their sides and angles are given below

I. According to their Sides

(i) **Scalene Triangle** If all sides are different in lengths called scalene triangle. In which all angles are different.

(ii) **Isosceles Triangle** If any two sides are equal in length called isosceles triangle. In which opposite angles of equal sides are also equal.

(iii) **Equilateral Triangle** If all three sides are equal in length called equilateral triangle. In which all three angles of triangles are equal to 60°.

II. According to their Angles

(i) **Acute Angled Triangle :** If each angle of triangle is less than 90°. It is called an acute angled triangle.

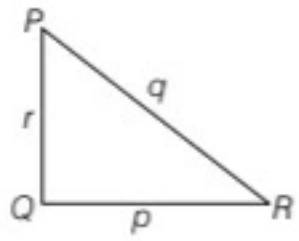
(ii) **Right Angled Triangle :** If any one angle of a triangle is 90°. It is called right angled triangle.

(iii) **Obtuse Angled Triangle :** If any one angle of triangle is greater than 90°. It is called an obtuse angled triangle.

Pythagoras Theorem

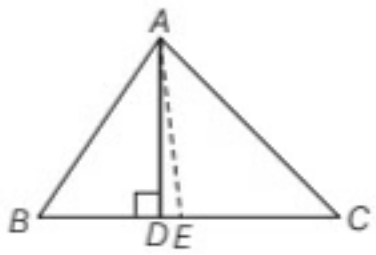
In a right angle triangle, the square of the hypotenuse equals the sum of the square of its other sides.

i.e., $q^2 = p^2 + r^2$



Altitude and Median of a Triangle

A line segment from a vertex of triangle, perpendicular to the line containing the opposite side is called an **altitude** of a triangle. In the figure AD is the altitude of a triangle.



A line segment that joins a vertex of a triangle to the mid-point of the opposite side is called median of triangle. In a figure, AE is the **median** of a triangle.

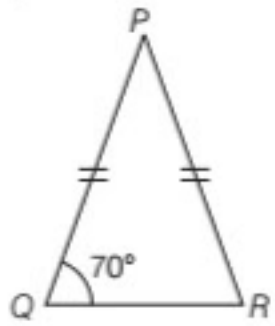
Note : Every triangle has three altitudes and three medians, which are drawn from each vertex.

Example 5 ΔPQR is an isosceles triangle with $PQ = PR$. If $\angle Q = 70°$, then the other angles of a triangle, are

(a) 40°, 70° (b) 35°, 75°
(c) 55°, 55° (d) None of these

Sol. (*a*) In ΔPQR, we have,

$$PQ = PR$$



i.e., $\angle Q = \angle R = 70°$

Since, $\angle P + \angle Q + \angle R = 180°$

[the sum of three angles of triangle]

$\therefore$ $\angle P + 140° = 180°$

$\Rightarrow$ $\angle P = 180° - 140° = 40°$

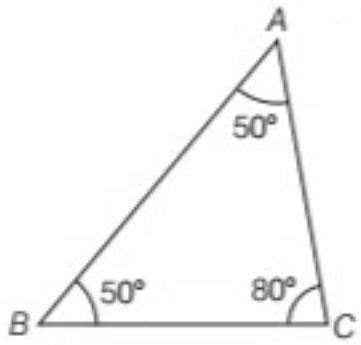
Hence, the required angles of triangle are

$\angle P = 40°$ and $\angle R = 70°$.

Example 6 In ΔABC, $\angle A = 50°$, $\angle B = 50°$, $\angle C = 80°$, which two sides of this triangle are equal.

(a) $AB = AC$ (b) $AC = BC$
(c) $AB = BC$ (d) None of these

Sol. (*b*) Since, $\angle A = \angle B = 50°$



Therefore, the sides opposite these angles must be equal.
The side opposite $\angle A$ is BC and the side opposite $\angle B$ is AC

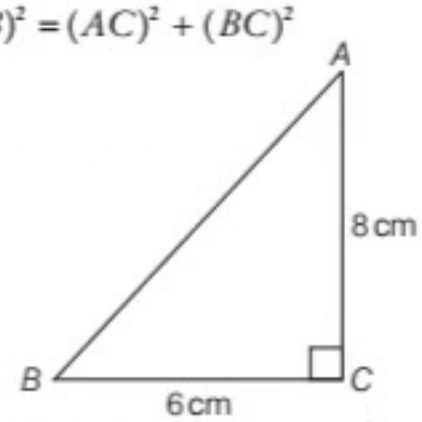
$\therefore$ In $\Delta ABC, AC = BC$

Example 7. The length of the sides of a right angle triangle are 6 cm and 8 cm. What is the length of the hypotenuse ?

(a) 11 cm (b) 10 cm (c) 9 cm (d) 8 cm

Sol. (*b*) Using Pythagoras theorem in ΔABC

$\therefore \quad (AB)^2 = (AC)^2 + (BC)^2$



$\Rightarrow \quad (AB)^2 = (8)^2 + (6)^2$

$\Rightarrow \quad (AB)^2 = 64 + 36$

$= 100$

$\Rightarrow \quad AB = 10$ cm

Hence, the length of the hypotenuse is 10 cm.

PRACTICE EXERCISE

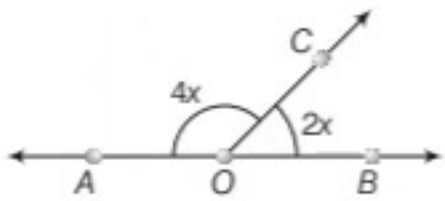
1. An angle is 14° more than its complement. Then, its measure is
(a) 166° (b) 86° (c) 76° (d) 52°

2. The measure of an angle is twice the measure of its supplementary angle. Then, its measure is
(a) 120° (b) 60° (c) 100° (d) 90°

3. How many least number of distinct points required to determine a unique line ?
(a) One (b) Two (c) Three (d) Infinite

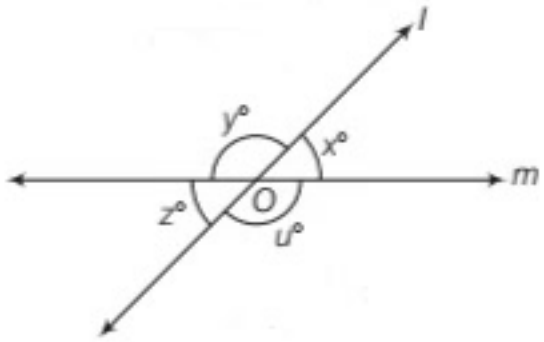
4. If OA and OB are opposite rays; a ray OC inclined. If one of the angle is 75°, then the measurement of the second angle is
(a) 105° (b) 70°
(c) 15° (d) None of these

5. In figure, $\angle AOC$ and $\angle BOC$ form a linear pair. Then, the value of x is



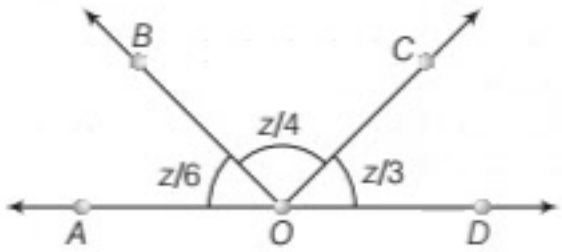
(a) 15° (b) 40° (c) 25° (d) 30°

6. Lines l and m intersect at O, forming angles as shown in figure. If $x = 45°$, then values of y, z and u are respectively



(a) 45°, 135°, 135°
(b) 135°, 135°, 45°
(c) 135°, 45°, 135°
(d) 115°, 45°, 115°

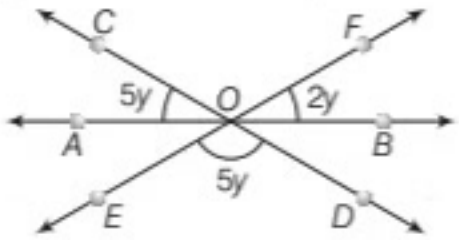
7. The value of z (in degrees), in the given figure is



(a) 180° (b) 216° (c) 240° (d) 40°

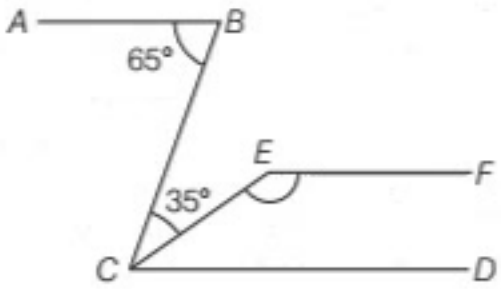
8. Which of the following statements is false?
(a) A line segment can be produced to any desired length
(b) Through a given point, only one straight line can be drawn
(c) Through two given points, it is possible to draw one and only one straight line
(d) Two straight lines can intersect in only one point

9. In the figure, the value of y is



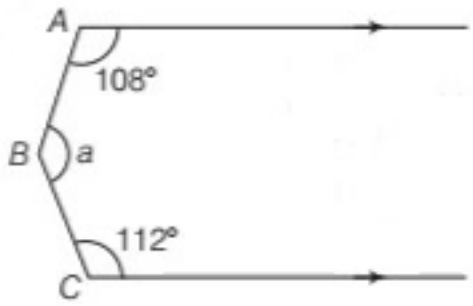
(a) 25° (b) 35°
(c) 15° (d) 40°

10. AB and CD are two parallel lines. The points B and C are joined such that $\angle ABC = 65°$. A line CE is drawn making angle of 35° with the line CB, EF is drawn parallel to AB, as shown in figure, then $\angle CEF$ is



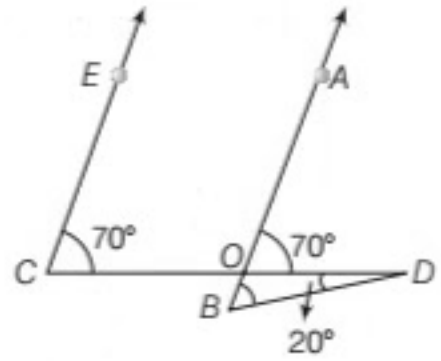
(a) 160° (b) 155°
(c) 150° (d) 145°

11. In the given figure, ray $A \parallel$ ray C, the value of 'a' is



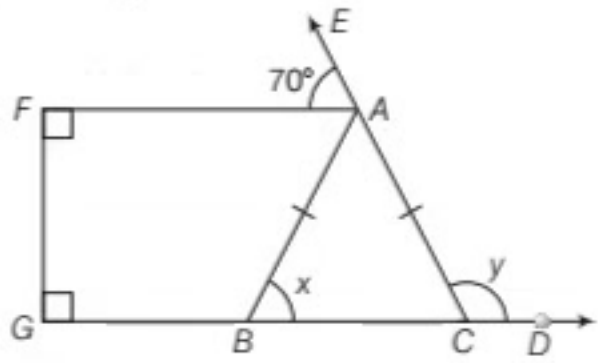
(a) 120° (b) 140°
(c) 90° (d) 150°

12. In the given figure, if $EC \parallel AB$, $\angle ECD = 70°$, $\angle BDO = 20°$, then $\angle OBD$ is



(a) 70° (b) 60° (c) 50° (d) 20°

13. In the given figure, the value of x and y are respectively

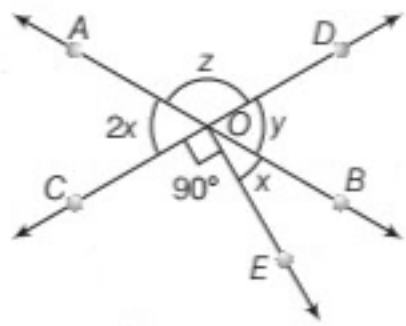


(a) 70°, 110° (b) 110°, 70°
(c) 120°, 60° (d) 70°, 90°

14. The earth makes a complete rotation about its axis in 24 h. Through what angle will it turn in 3 h 20 min?
(a) 60° (b) 50°
(c) 70° (d) 90°

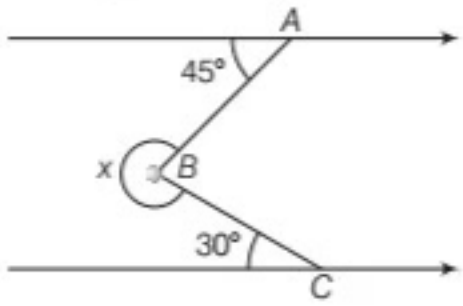
15. An angle is $\frac{2}{3}$rd of its complement and $\frac{1}{4}$th of its supplement, then the angle is
(a) 46° (b) 56°
(c) 36° (d) 40°

16. In the given figure, if $\angle COE = 90°$, then the value of x is



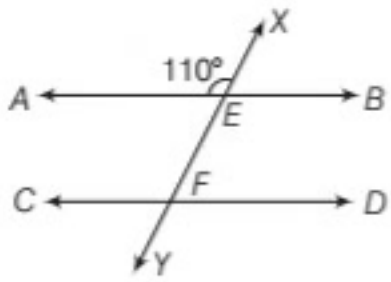
(a) 120° (b) 60°
(c) 45° (d) 30°

17. The value of x, in the figure is



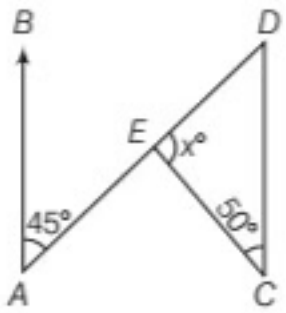
(a) 75° (b) 185° (c) 285° (d) 245°

18. In the given figure, AB and CD are two parallel lines. A line XY meets the lines AB and CD at E and F respectively. If $\angle XEA = 110°$, then $\angle EFD$ is



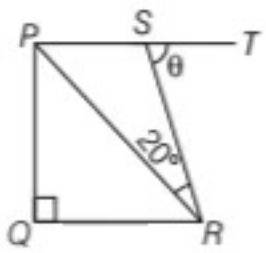
(a) 110° (b) 70° (c) 80° (d) 45°

19. In the given figure,
$AB || CD$, $\angle BAE = 45°$, $\angle DCE = 50°$ and $\angle CED = x°$, then the value of x is



(a) 85° (b) 95°
(c) 130° (d) 135°

20. In the trapezium $PQRS$, $QR || PS$, $\angle Q = 90°$, $PQ = QR$ and $\angle PRS = 20°$. If $\angle TSR = \theta$, then value of θ is

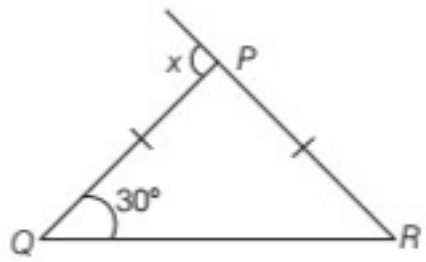


(a) 75° (b) 55°
(c) 65° (d) 45°

21. If ΔABC is an isosceles with $AB = AC$, if $\angle A = 80°$, then $\angle ABC$ will be
(a) 100° (b) 80°
(c) 50° (d) 40°

22. In ΔABC, $BC = CA$, its two equal angles are
(a) $\angle B = \angle C$
(b) $\angle A = \angle B$
(c) $\angle A = \angle C$
(d) $\angle A = \angle B = \angle C$

23. The value of x in figure, where ΔPQR is an isosceles with $PQ = PR$ will be



(a) 30° (b) 60°
(c) 90° (d) 150°

24. The length of the sides BC and AC of a right angled ΔABC are 3 cm and 4 cm, the length of hypotenuse will be
(a) 5 cm (b) 6 cm
(c) 14 cm (d) 10 cm

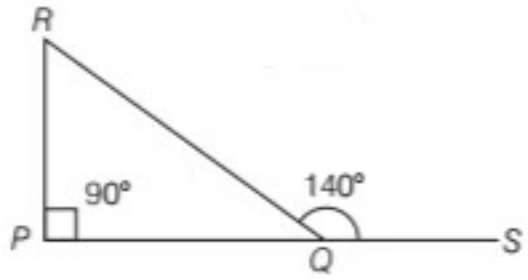
25. If the square of the hypotenuse (in cm) of an isosceles right triangle is 200 then the length of each side will be
(a) 15 cm (b) 200 cm
(c) 10 cm (d) None of these

26. In ΔABC all sides are of same length, then each angle will be
(a) 50° (b) 90°
(c) 60° (d) 180°

27. In a ΔABC, $AB = 11$ cm, $BC = 60$ cm and $AC = 61$ cm. What type of ΔABC ?
(a) Acute angled triangle
(b) Right angled triangle
(c) Obtuse angled triangle
(d) None of the above

28. The total number of triangles formed in a rectangle are
(a) 4 (b) 8
(c) 6 (d) 3

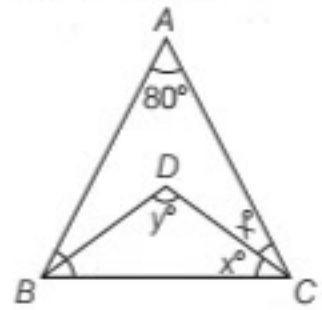
29. The value of $\angle PRQ$ in the given triangle is



(a) 50°
(b) 140°
(c) 90°
(d) 60°

30. ABC is a triangle such that $AB = 10$ and $AC = 3$. The side BC is
(a) equal to 7
(b) less than 7
(c) greater than 7
(d) None of the above

31. In the given figure, $\angle A = 80°$, $\angle B = 60°$, $\angle C = 2x°$ and $\angle BDC = y°$. BD and CD bisect angles B and C respectively. The value of x and y are respectively



(a) 10°, 160° (b) 15°, 70°
(c) 20°, 130° (d) 20°, 125°

32. If one of the angles of a triangle is greater than each of the two remaining angles by 30°, then the angles of the triangle are
(a) 40°, 40°, 100° (b) 50°, 50°, 80°
(c) 30°, 30°, 120° (d) 35°, 35°, 110°

Answers

1	(d)	2	(a)	3	(b)	4	(a)	5	(d)	6	(c)	7	(c)	8	(b)	9	(c)	10	(c)
11	(b)	12	(c)	13	(a)	14	(b)	15	(c)	16	(d)	17	(c)	18	(b)	19	(a)	20	(c)
21	(c)	22	(b)	23	(b)	24	(a)	25	(c)	26	(c)	27	(b)	28	(b)	29	(a)	30	(c)
31	(c)	32	(b)																

Hints and Solutions

1. Let the angle be x, then its complement be $(90° - x)$.

$\therefore \quad x = (90° - x) + 14° \Rightarrow 2x = 104°$

$\therefore \quad x = \frac{104°}{2} = 52°$

2. Let the angle be x, then its supplementary be $(180° - x)$.

$\therefore \quad x = 2(180° - x) \Rightarrow x = 360° - 2x$

$\Rightarrow \quad 3x = 360°$

$\therefore \quad x = 120°$

3. One and only one straight line passes through two distinct points.

4. Since, OA and OB are opposite rays.
So, AB is a line.
Sum of the two angles $= 180°$

$\therefore$ Second angle $= 180° - 75° = 105°$

5. Since, $\angle AOC + \angle BOC = 180°$ [linear pair]

$\Rightarrow \quad 4x + 2x = 180°$

$\Rightarrow \quad 6x = 180°$

$\therefore \quad x = 30°$

6. $\because \quad x = z$ [vertically opposite angles]

$\Rightarrow \quad x = 45° \Rightarrow z = 45°$

and $y + x = 180°$ [linear pair]

$\Rightarrow \quad y = 180° - 45°$

$\therefore \quad y = 135°$

Also, $y = u$ [$\because$ vertically opposite angles]

$\Rightarrow \quad u = 135°$

$\therefore \quad y = 135°,$
$z = 45°,$
$u = 135°$

7. We have, $\frac{z}{6}+\frac{z}{4}+\frac{z}{3}=180°$ [$\because$ AOD is a line]

$\Rightarrow \quad \frac{2z+3z+4z}{12}=180°$

$\Rightarrow \quad \frac{9z}{12}=180°$

$\therefore \quad z=\frac{180°\times 12}{9}=240°$

8. Since, an infinite number of straight lines can be drawn through a given point.
Hence, (b) is false statement.

9. Since, OA, OB are opposite rays.

$\therefore \angle AOC+\angle COF+\angle FOB=180°$

$\Rightarrow \quad 5y+5y+2y=180°$

[$\because$ $\angle COF=\angle EOD$ vertical opposite angle]

$\Rightarrow \quad 12y=180° \Rightarrow y=\frac{180°}{12°}=15°$

10. Since, $AB \parallel CD$

$\Rightarrow \quad \angle BCD=\angle ABC=65°$

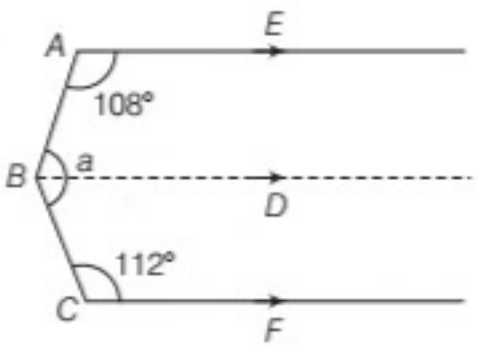
But, $\angle ECD=65°-\angle BCE$

$=65°-35°=30°$

Now, $\angle CEF+\angle ECD=180°$ [sum of co-interior angles is 180°; since $CD \parallel EF$]

$\therefore \quad \angle CEF=180°-30°=150°$

11.



Draw ray $AE \parallel$ ray $BD \parallel$ ray CF

Then, $\angle EAB+\angle ABD=180°$

[the sum of co-interior angles is 180°]

$\Rightarrow \quad 180°+\angle ABD=180°$

$\Rightarrow \quad \angle ABC=180°-108°$

$=72°$ ...(i)

and $\angle FCB+\angle CBD=180°$

$\Rightarrow \quad 112°+\angle CBD=180°$

$\Rightarrow \quad \angle CBD=180°-112°$

$=68°$ ...(ii)

Now, adding Eqs, (i) and (ii), we have

$\angle ABD+\angle CBD=72°+68°$

$\therefore \quad \angle ABC=140°$

Hence, $a=140°$

12. $\because \quad \angle AOD=\angle ECO$ [$\because EC \parallel AB$]

$\Rightarrow \quad \angle AOD=70°$

So, $\angle BOD=110°$ [$\because$ AOB is the line]

In ΔBOD, $\angle OBD+\angle BOD+\angle ODB=180°$

$\Rightarrow \quad \angle OBD=180°-(110°+20°)$

$\therefore \quad \angle OBD=50°$

13. In ΔABC, $\angle ABC=\angle ACB=x$

[Angles opposite to equal sides are equal]

and $x+y=180°$

Now, $\angle EAF=\angle ACB=70°$

[corresponding angles]

$\therefore \quad x=70°$

$\Rightarrow \quad y=180°-70°$ [$\because$ linear pair]

$\therefore \quad y=110°$

14. In 24 h, earth covers an angle = 360°

In 1 h, earth covers an angle $=\frac{360°}{24}$

In 3 h, 20 min earth will cover an angle

$=\frac{360°}{24}\times(3 \text{ h } 20 \text{ min})$

$=\frac{360°}{24}\times\left(3+\frac{20}{60}\right)=\frac{360°}{24}\times\frac{10}{3}=50°$

15. Let angle be x, then its complement be $(90°-x)$.

$\therefore \quad \frac{2}{3}(90°-x)=x \Rightarrow 180°-2x=3x$

$\therefore \quad x=36°$

16. Since, $\angle BOD=\angle AOC$

[$\because$ vertically opposite angles]

$\Rightarrow \quad 2x=y$

Now, $\angle COE+\angle EOB+\angle BOD=180°$

[$\because$ COD is line or linear pair]

$\Rightarrow \quad 90°+x+2x=180°$

$\Rightarrow \quad 3x=90°$

$\therefore \quad x=30°$

17. Here, $\angle ABC = 45° + 30° = 75°$

[let ray $A \parallel$ ray C]

$\Rightarrow \quad x = 360° - \angle ABC = 360° - 75°$

$\therefore \quad x = 285°$

18. $\because \angle XEA = \angle BEF = 110°$

[vertically opposite angles]

$\therefore \quad \angle BEF + \angle EFD = 180°$ [co-interior angles]

$\Rightarrow \quad \angle EFD = 180° - 110° = 70°$

19. In a given figure, $AB \parallel CD$

$\therefore \quad \angle BAD = \angle ADC = 45°$ [alternate angle]

In ΔECD, $x° + 50° + 45° = 180° \Rightarrow x = 85°$

20. $\because PQ = QR \Rightarrow \angle QPR = \angle QRP = 45°$

and $PS \parallel QR$, $\angle SPR = \angle QRP = 45°$

[alternate angles]

$\therefore \theta = \angle PRS + \angle SPR = 20° + 45°$

$= 65°$ [by exterior angle theorem of ΔPSR]

21. Given, $\angle A = 80°$ and $AB = AC$

Therefore, $\angle B = \angle C = x$

[Opposite angles to equal sides are equal]

In ΔABC, $\angle A + \angle B + \angle C = 180°$

$\Rightarrow \quad 80° + x + x = 180°$

$\Rightarrow \quad 2x = 100°$

$\therefore \quad x = 50°$

22. Since in a ΔABC, $BC = CA$, therefore $\angle A = \angle B$

23. Since, $PQ = PR$

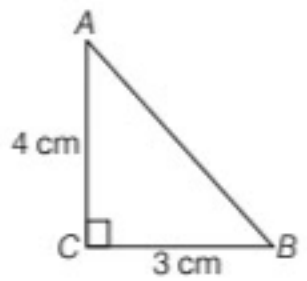
i.e., $\angle Q = \angle R = 30°$

Now, $\angle P = 180° - (30° + 30°) = 120°$

$\therefore \quad x = 180° - CP$ [linear pair]

$x = 180° - 120° = 60°$

24. Given $AC = 4$ cm, $BC = 3$ cm, $AB = ?$



By pythagoras theorem,

$(AB)^2 = (AC)^2 + (BC)^2$

$= 4^2 + 3^2 = 16 + 9 = 25$

$\therefore \quad AB = \sqrt{25} = 5$ cm

25. Let the sides of a right isosceles triangle be x and x.

$\therefore \quad H^2 = x^2 + x^2 \Rightarrow 200 = 2x^2$

$\Rightarrow \quad x^2 = 100 \Rightarrow x = 10$ cm

26. Since, all sides of a triangle are of same length, therefore all angles are of equal, say x.

$\therefore \quad 3x = 180°$

$\Rightarrow \quad x = 60°$

27. Now, $AB^2 + BC^2 = 11^2 + 60^2$

$= 121 + 3600 = 3721$

and $AC^2 = (61)^2 = 3721$

$\because \quad AC^2 = AB^2 + BC^2$

Hence, ΔABC is right angled triangle.

28. The total number of triangle formed in a rectangle are 8.

29. $\because PQR$ is a line.

$\therefore \quad \angle PQR = 180° - 140° = 40°$

and in ΔPQR, $\angle RPQ + \angle PQR + \angle PRQ = 180°$

$\angle PRQ = 180° - (90° + 40°)$

$= 180° - 130° = 50°$

30. Since, the sum of any two sides of a triangle is greater than the third side, so BC must be greater than 7, then $AC + BC > AB$.

31. In the given figure,

$\angle C = 180° - \angle A - \angle B$

$\Rightarrow 2x = 180° - 80° - 60° = 40°$

$\therefore \quad x = 20°$

Also, $\angle B = 60° \Rightarrow \angle DBC = \frac{1}{2} \times 60° = 30°$

In ΔBDC, $\angle DBC + y + x = 180°$

$\Rightarrow 30° + y + 20° = 180° \Rightarrow y = 130°$

32. Since, $(x + 30°) + x + x = 180°$

$\Rightarrow \quad 3x = 150° \Rightarrow x = 50°$

$\therefore$ Angles are $50°, 50°, 80°$.

CHAPTER

11

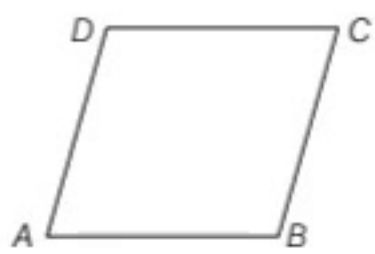
QUADRILATERALS

(PARALLELOGRAM, RHOMBUS, RECTANGLE, SQUARE, KITE)

In this chapter, we study the quadrilateral and their types. Also study the circle and cyclic quadrilaterals with their important results.

Quadrilateral

A plane figure which is made up of joining any four non-collinear points, is called quadrilateral.



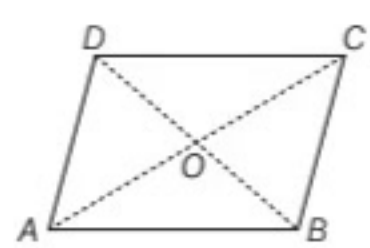
The sum of all angles of a quadrilateral is 360°.
i.e. $\angle A + \angle B + \angle C + \angle D = 360°$.

Types of Quadrilateral

Some types of quadrilateral are as given below

(i) Parallelogram

A quadrilateral is a parallelogram, if its both pairs of opposite sides are parallel.



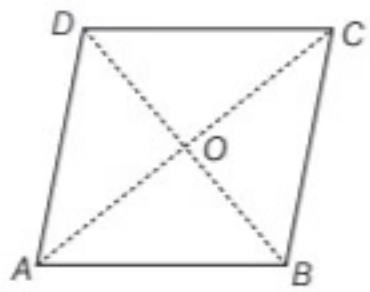
In figure, quadrilateral $ABCD$ is a parallelogram because $AB \parallel DC$ and $AD \parallel BC$.

- Opposite sides are equal, i.e. $AB = CD$ and $AD = BC$.

- Opposite angles are equal i.e. $\angle A = \angle C$ and $\angle B = \angle D$.
- Diagonals bisect each other, i.e. $AO = OC$, $OD = OB$.

(ii) Rhombus

A parallelogram in which all the sides are equal is called a rhombus.

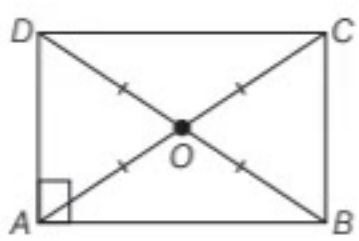


In figure, $ABCD$ is rhombus in which $AB \parallel DC$ and $AD \parallel BC$ and $AB = BC = CD = DA$.

- In rhombus diagonal bisects each other but they are not equal.

(iii) Rectangle

A parallelogram in which each angle is a right angle and opposite sides are equal is called rectangle.

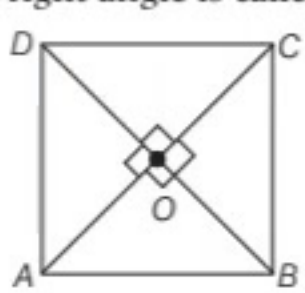


In figure, $ABCD$ is a rectangle in which $AB = DC$ and $AD = BC$, also $\angle A = \angle B = \angle C = \angle D = 90°$.

- In rectangle diagonals bisect each other and they are equal, i.e. $AO = OB = OC = OD$

(iv) Square

A parallelogram having all sides equal and each angle equal to a right angle is called a square.



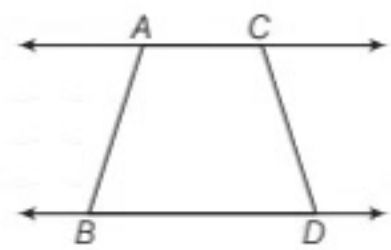
In figure, $ABCD$ is a square in which $AB = BC = CD = DA$ and $\angle A = \angle B = \angle C = \angle D = 90°$.

- In a square diagonals bisect each other at 90°and they are equal, i.e. $AO = OB = OC = OD$.

(v) Trapezium

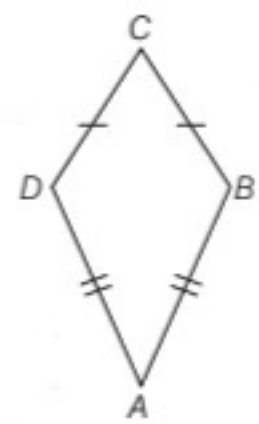
A quadrilateral in which one pair of opposite sides is parallel, is called a trapezium.

In trapezium $ABCD$, sides AC and BD are parallel to each other, but AB and CD neither parallel nor equal.



(vi) Kite

A quadrilateral which has two pairs of equal adjacent sides but unequal opposite sides, is a kite.

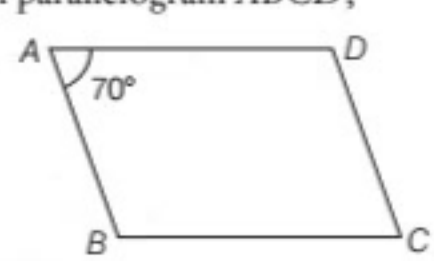


In figure, $ABCD$ is a kite in which $AB = AD$ and $BC = CD$ but $AD \neq BC$ and $AB \neq CD$.

Example 1 $ABCD$ is a parallelogram in which $\angle A = 70°$, the remaining angles of parallelogram are

(a) 110°, 65°, 115° (b) 110°, 70°, 110°
(c) 110°, 50°, 130° (d) None of these

Sol. *(b)* In parallelogram $ABCD$,



$$AD \parallel BC$$

$\therefore \quad \angle A + \angle B = 180°$

$\Rightarrow \quad \angle B = 180° - 70° = 110°$

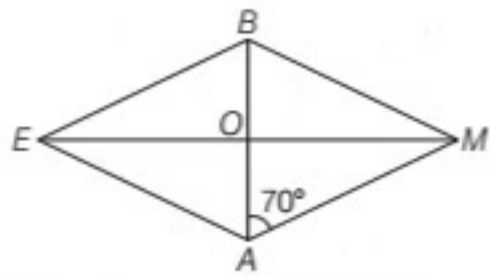
and $\angle C = \angle A$ [opposite angles]

$\therefore$ $\angle C = 70°$

and $\angle D = \angle B = 110°$ [opposite angles]

Hence, the angles B, C, D are $110°, 70°, 110°$ respectively.

Example 2 In rhombus $BEAM$, $\angle AME$ and $\angle AEM$ are



(a) 20°, 20° (b) 30°, 30°
(c) 35°, 35° (d) 40°, 40°

Sol. *(a)* Given, $\angle BAM = 70°$

We know that, in rhombus, diagonals bisect each other at right angles.

$\therefore$ $\angle BOM = \angle BOE = \angle AOM = \angle AOE = 90°$

Now, in ΔAOM,

$\angle AOM + \angle AMO + \angle OAM = 180°$

[angle sum property of triangle]

$\Rightarrow$ $90° + \angle AMO + 70° = 180°$

$\Rightarrow$ $\angle AMO = 180° - 90° - 70°$

$\Rightarrow$ $\angle AMO = 20° = \angle AME$

Also, $AM = BM = BE = EA$

In ΔAME, we have,

$AM = EA$

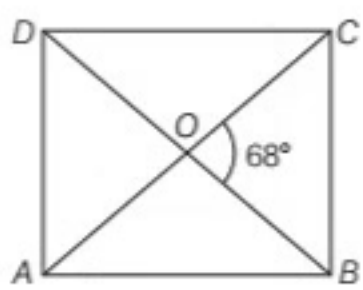
$\therefore$ $\angle AME = \angle AEM = 20°$

[$\because$ equal sides make equal angles]

Example 3 The diagonals of a rectangle $ABCD$ intersect in O, if $\angle BOC = 68°$, find $\angle ODA$.

(a) 55° (b) 56°
(c) 57° (d) 58°

Sol. *(b)* Given, $\angle BOC = 68°$ [given]



Then, $\angle AOD = 68°$ [vertically opposite angles]

$\because$ $OA = OD$

[$\because$ diagonals bisects each other]

$\therefore$ $\angle ODA = \angle OAD$

$\angle ODA + \angle OAD + \angle AOD = 180°$

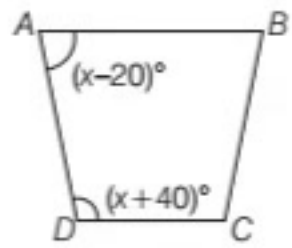
[sum of angles of a ΔAOD]

$2\angle ODA + 68° = 180°$

$\Rightarrow$ $2\angle ODA = 180° - 68° = 112°$

$\Rightarrow$ $\angle ODA = 56°$

Example 4 The value of x in the trapezium $ABCD$ given below is



(a) 80° (b) 82°
(c) 84° (d) 85°

Sol. *(a)* Given, a trapezium $ABCD$ in which

$\angle A = (x - 20)°$, $\angle D = (x + 40)°$

Since, in a trapezium, the angles on either side of the base are supplementary, therefore

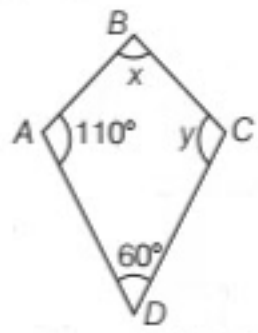
$(x - 20°) + (x + 40°) = 180°$

$\Rightarrow$ $2x + 20° = 180°$

$\Rightarrow$ $2x = (180° - 20°) = 160°$

$\therefore$ $x = 80°$

Example 5 The values of x and y in the following kite, are



(a) 80° (b) 70°
(c) 82° (d) 84°

Sol. *(a)* In a kite, one pair of opposite angles are equal.

$\therefore$ $y = 110°$

Now, by the angle sum property of a quadrilateral, we have

$\angle A + \angle B + \angle C + \angle D = 360°$

$$110° + x + 110° + 60° = 360°$$
$$\Rightarrow \quad x = 360° - 280°$$
$$\therefore \quad x = 80°$$

Polygons

A polygon is a closed plane figure bounded by straight lines.

Types of Polygons

Polygons are as following four types

1. **Convex polygon** A polygon in which none of its interior angles is more than 180°, is called convex polygon.
2. **Concave polygon** A polygon in which atleast one angle is more than 180°, is called concave polygon.
3. **Irregular polygon** A polygon in which all the sides or angles are not of the same measure, is called an irregular polygon.
4. **Regular polygon** A regular polygon has all its sides and angles equal.

   (i) Each exterior angle of a regular polygon
   $$= \frac{360°}{\text{Number of sides}}$$
   (ii) Each interior angle = 180° − Exterior angle

   (iii) Sum of all interior angles $= (2n - 4) \times 90°$
   $$= (n-2) \times 180°$$
   (iv) Sum of all exterior angles = 360°

   (v) Number of diagonals of polygon of n sides
   $$= \frac{n(n-3)}{2}$$

Example 6 Each interior angle of a regular polygon is 144°. Find the interior angle of a regular polygon which has double the number of sides as the first polygon.

(a) 170° (b) 160°
(c) 162° (d) 180°

Sol. *(c)* ∵ Each interior angle of polygon = 144°

$$\Rightarrow \quad \frac{(2n-1)90°}{n} = 144°$$
$$\Rightarrow \quad 180n - 360° = 144n$$
$$\Rightarrow \quad 36n = 360°$$
$$\Rightarrow n = 10°$$

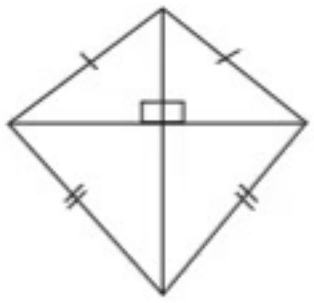
According to the given condition,

Total sides of a new polygon $= 2 \times 10 = 20$

Each interior angle of new polygon
$$= \frac{(2 \times 20 - 4) \times 90°}{20}$$
$$= \frac{36 \times 9}{2} = 162°$$

Kite

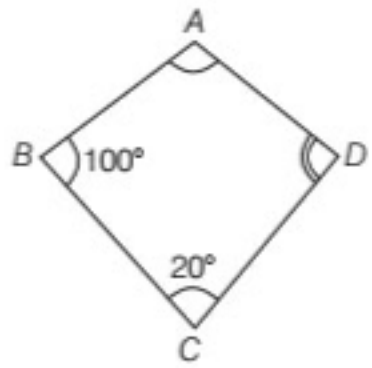
A kite is a quadrilateral whose four sides can be grouped into two pairs of equal- length sides that are adjacent to each other



Properties of Kite

- Its two diagonals are at right angles to each other.
- There is a pair of equal opposite angles.

Example 7 Calculate the measures of the unmarked angles of the kite ABCD.



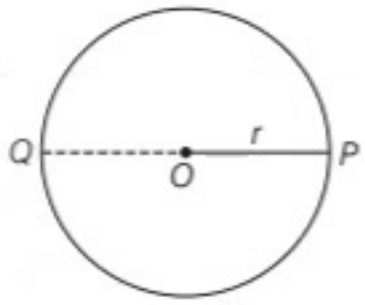
(a) 170° and 120° (b) 100° and 100°
(c) 100° and 140° (d) 110° and 130°

Sol. *(c)* We know that, $\angle ABC = \angle ADC = 100°$

∵ Sum of four angles of kite = 360°
$$\angle ABC + \angle BCD + \angle ADC + \angle BAD = 360°$$
$$100° + 20° + 100° + \angle BAD = 360°$$
$$\angle BAD = 360° - 220°$$
$$\angle BAD = 140°$$

Circle

A circle is a set of those points in a plane, which are at a given constant distance from a given fixed point in the plane.



- The fixed point O is called the centre of the circle.
- The constant distance r is called the radius of the circle.
- A circle can have many radii measure and all the radii of a circle are of equal length.
- The line PQ is a diameter (d) of a circle and

$$d = PQ = 2 \times \text{Radius} = 2r$$

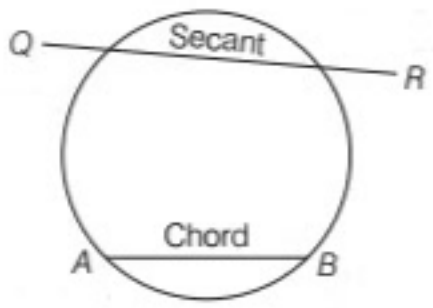
(i) Arc of the Circle

A continuous part of a circle is called an arc of the circle.

(ii) Chord

A line segment joining any two points on the circle is called its chord.

In a figure, AB is a chord.



Note Biggest chord of a circle is its diameters.

(iii) Secant

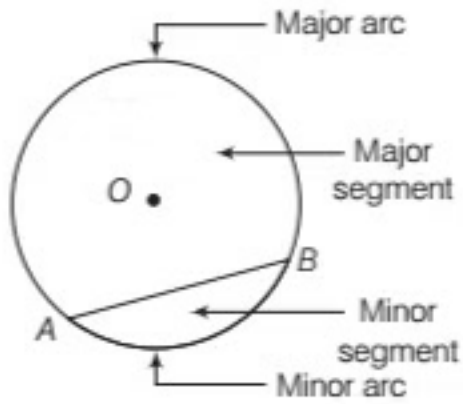
A line which intersect a circle in two distinct points is called a secant of the circle.

In above figure, QR is a secant.

(iv) Semicircle

A diameter divides the circle into two equal arcs, each of these two arcs is called a semicircle.

An arc whose length is less than the arc of a semicircle is called a minor arc, otherwise it is called a major arc.



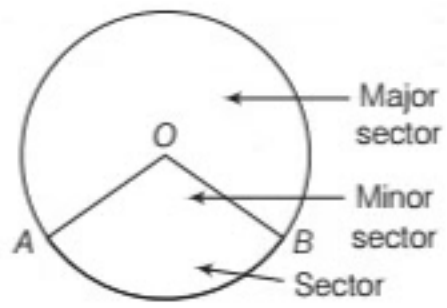
(v) Segment

If AB be a chord of the circle then AB divides the circular region into two parts, each part is called a segment of the circle.

The segment containing the minor arc is called the minor segment and the segment containing the major arc is called the major segment.

(vi) Central Angle

If $C\ (O, r)$ be any circle, then any angle whose vertex is centre of circle is called a central angle.



The degree measure of an arc is the measure of the central angle containing the arc.

(vii) Sector

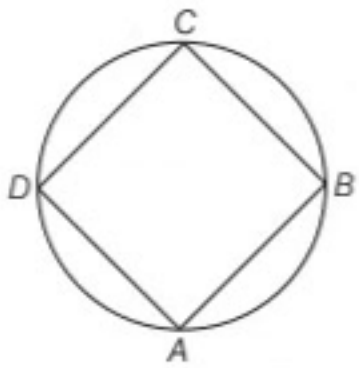
A sector is that region of a circle $C\ (O, r)$ which lies between an arc and the two radii joining the extremities of the arc to the centre.

(viii) Quadrant

One fourth of a circular region is called a quadrant.

(ix) Cyclic Quadrilateral

If all four vertices of a quadrilateral lie on a circle, then such a quadrilateral is called a cyclic quadrilateral.



The sum of opposite angles of a cyclic quadrilateral is 180°, i.e.,

$$\angle A + \angle C = 180°$$

and $$\angle B + \angle D = 180°$$

Some Important Results Related to Circles

(i) An infinite number of circles can pass through the two points.

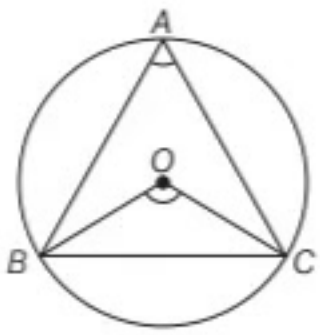
(ii) There is one and only one circle passing through three non-collinear points.

(iii) Angles in the same segment of a circle are equal.

(iv) The perpendicular from the centre to any chord bisects the chord.

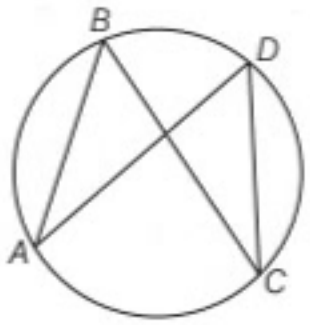
(v) The line joining the centre of the circle to the mid-point of any chord of a circle, is perpendicular to the chord.

(vi) The angle subtended by an arc at the centre of a circle is double the angle subtended by it at any point on the remaining part of the circle.



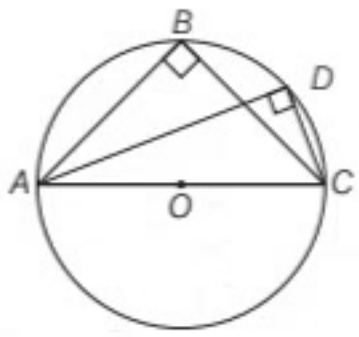
i.e. $$\angle BOC = 2\angle BAC$$

(vi) Angles in the same segment of a circle are equal.



Here, $$\angle ABC = \angle ADC$$

(vii) The angle made in a semicircle is always a right angle.

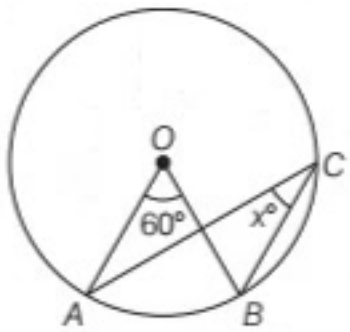


Here, $$\angle ABC = 90°$$

and $$\angle ADC = 90°$$

(viii) If the sum of any pair of opposite angles of a quadrilateral is 180°, then the quadrilateral is cyclic.

Example 6 The value of $x°$ in the figure is



(a) 20° (b) 100°
(c) 60° (d) 30°

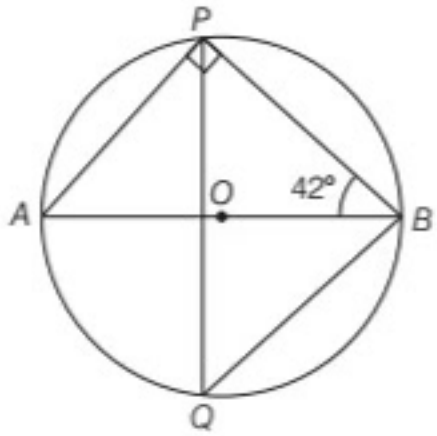
Sol. *(d)* We know that, the angle subtended by an arc at the centre of a circle is double the angle subtended by it any point of the remaining part of the circle.

$\therefore$ $$\angle AOB = 2(\angle ACB)$$

$\Rightarrow$ $$60° = 2\angle ACB$$

$\Rightarrow$ $$\angle ACB = 30°$$

Example 7 In figure, the value $\angle PQB$, where O is the centre of the circle, is



(a) 47° (b) 48° (c) 49° (d) 50°

Sol. *(b)* In ΔAPB,

$\angle APB = 90°$ [angle in a semi-circle]

$\angle PBA = 42°$ [given]

Now, $\angle PAB + \angle APB + \angle PBA = 180°$

$\Rightarrow \quad \angle PAB + 90° + 42° = 180°$

$\Rightarrow \quad \angle PAB = 180° - 132° = 48°$

Since, we know that the angle subtended by an arc in the same segment are equal.

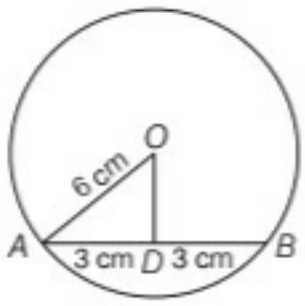
$\therefore \quad \angle PQB = \angle PAB = 48°$

Example 8 The radius of a circle is 6 cm and the length of one of its chords is 6 cm. The distance of the chord from the centre is

(a) $3\sqrt{5}$ cm (b) $3\sqrt{2}$ cm

(c) $3\sqrt{3}$ cm (d) $3\sqrt{6}$ cm

Sol. *(c)* Let AB be a chord of a circle with centre O and radius 6 cm such that $AB = 6$ cm.



From O, draw $OD \perp AB$. Join OA

Clearly,

$$AD = \frac{1}{2} AB = 3 \text{ cm and } OA = 6 \text{ cm.}$$

Now, in right angle ΔODA,

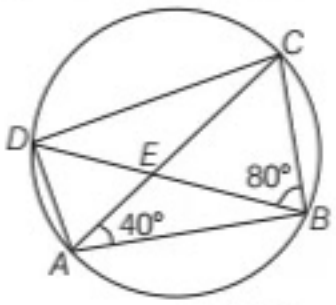
$$OD = \sqrt{OA^2 - AD^2}$$

[using Pythagoras theorem]

$$= \sqrt{6^2 - 3^2} = \sqrt{27} = 3\sqrt{3} \text{ cm}$$

Hence, the distance of the chord from the centre is $3\sqrt{3}$ cm.

Example 9 In figure, if $\angle DBC = 80°$ and $\angle BAC = 40°$, then the value of $\angle BCD$ is



(a) 50° (b) 60°

(c) 70° (d) 80°

Sol. *(b)* Given,

$\angle DBC = 80°$ and $\angle BAC = 40°$

Consider the chord CD, we find that $\angle CBD$ and $\angle CAD$ are angles in the same segment of the circle.

$\therefore \quad \angle CBD = \angle CAD$

$\Rightarrow \quad 80° = \angle CAD$

$\Rightarrow \quad \angle CAD = 80°$

Now, $\angle BAD = \angle BAC + \angle CAD$

$\Rightarrow \quad \angle BAD = 40° + 80° = 120°$ ...(i)

Since, $ABCD$ is a cyclic quadrilateral.

$\therefore \quad \angle BAD + \angle BCD = 180°$

$\Rightarrow \quad 120° + \angle BCD = 180°$ [using Eq. (i)]

$\Rightarrow \quad \angle BCD = 60°$

PRACTICE EXERCISE

1. A quadrilateral has three acute angles each measuring $75°$, the measure of fourth angle is

(a) $145°$ (b) $135°$ (c) $125°$ (d) $130°$

2. The measures of the four angles of a quadrilateral are in the ratio of $1:2:3:4$. What is the measure of fourth angle?

(a) $144°$ (b) $135°$ (c) $125°$ (d) $150°$

3. The diagonals of a rectangle $ABCD$ cut at O. OAL is an equilateral triangle drawn so that B and L are on the same side of AC. If $\angle ACD = 30°$, then the angles of ΔALB are

(a) $60°$, $60°$ and $60°$
(b) $30°$, $30°$ and $120°$
(c) $30°$, $60°$ and $120°$
(d) Cannot be determined

4. The sum of two opposite angles of a parallelogram is $130°$. All the angles of parallelogram are

(a) $65°, 65°, 115°, 115°$ (b) $145°, 135°, 35°, 45°$
(c) $90°, 130°, 80°, 60°$ (d) $40°, 140°, 80°, 110°$

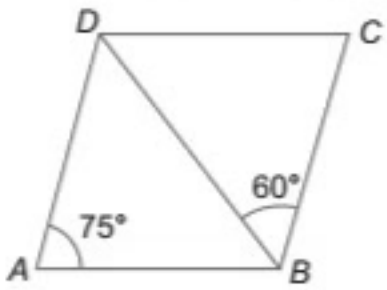
5. The length of the diagonal of a rectangle whose sides are 12 cm and 5 cm, is

(a) 17 cm (b) 13 cm (c) 25 cm (d) 14 cm

6. In a quadrilateral $ABCD$, if AO and BO be the bisectors of $\angle A$ and $\angle B$ respectively, $\angle C = 70°$ and $\angle D = 30°$, then $\angle AOB$ is

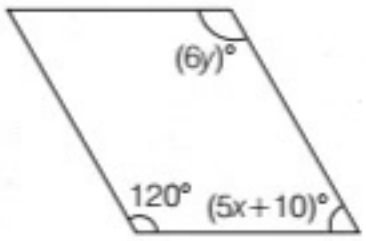
(a) $40°$ (b) $50°$ (c) $80°$ (d) $100°$

7. In the given figure, $ABCD$ is a parallelogram in which $\angle DAB = 75°$ and $\angle DBC = 60°$. Then, $\angle BDC$ is equal to



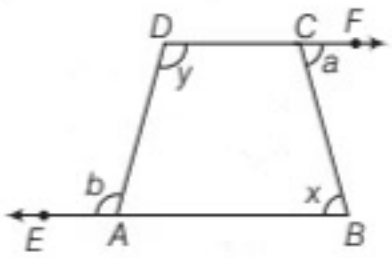
(a) $75°$ (b) $45°$
(c) $60°$ (d) $55°$

8. The values of x and y in the following parallelogram is



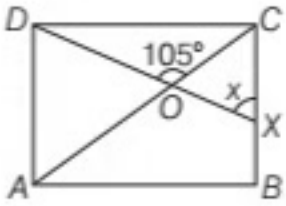
(a) $10°, 20°$ (b) $60°\ 80°$
(c) $90°, 110°$ (d) None of these

9. The sides BA and DC of quadrilateral $ABCD$ are produced as shown in figure. Then, which of the following statement is correct?



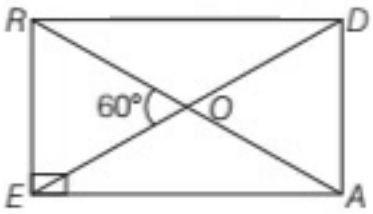
(a) $2x + y = a + b$ (b) $x + \frac{y}{2} = \frac{a+b}{2}$
(c) $x + y = a + b$ (d) $x + a = y + b$

10. In the given figure, $ABCD$ is a square. A line segment DX cuts the side BC at X and the diagonal AC at O such that $\angle COD = 105°$, $\angle OCX = 45°$ and $\angle OXC = x$. The value of x is



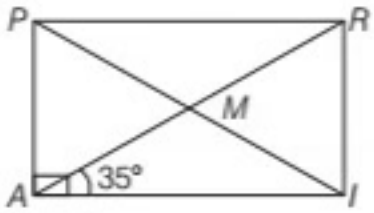
(a) $40°$ (b) $60°$ (c) $80°$ (d) $85°$

11. In rectangle $READ$, the values of $\angle EAR$, $\angle RAD$ and $\angle ROD$ are respectively



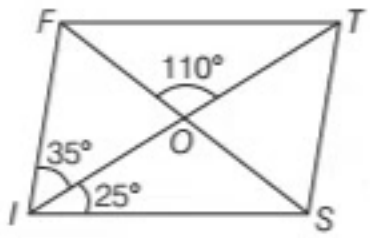
(a) $30°, 60°, 120°$ (b) $40°, 60°, 110°$
(c) $30°, 40°, 110$ (d) None of these

12. In rectangle *PAIR*, the values of $\angle ARI$, $\angle RMI$ and $\angle PMA$ are



(a) 60°, 70°, 70°
(b) 55°, 70°, 70°
(c) 60°, 80°, 80°
(d) None of these

13. In parallelogram *FIST*, the value of $\angle OST$ is

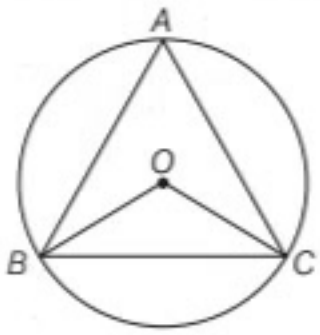


(a) 70° (b) 72°
(c) 75° (d) 80°

14. The external angle of a regular polygon is 45°. Find the sum of all the internal angles of it.
(a) 1082°
(b) 1080°
(c) 1085°
(d) 1090°

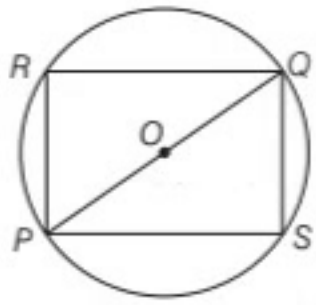
15. Find the number of non overlapping triangles can be formed in 9 sided polygon by joining the vertices.
(a) 5 (b) 7
(c) 6 (d) 4

16. An equilateral ΔABC is inscribed in a circle with centre *O*. Then, $\angle BOC$ is equal to



(a) 120° (b) 75°
(c) 180° (d) 160°

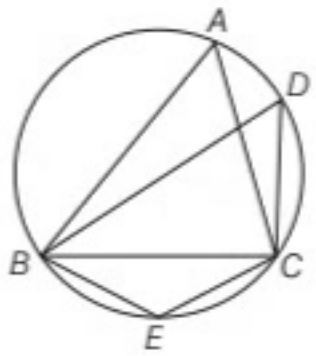
17. In the adjoining figure, *POQ* is the diameter of the circle, *R* and *S* are any two points on the circle. Then,



(a) $\angle PRQ > \angle PSQ$ (b) $\angle PRQ < \angle PSQ$
(c) $\angle PRQ = \angle PSQ$ (d) $\angle PRQ = \frac{1}{2}\angle PSQ$

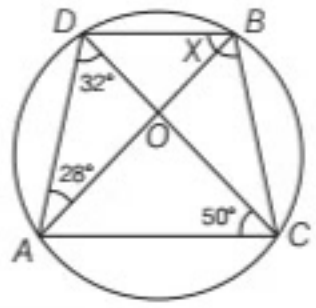
18. In a circle with centre *O* and radius 5 cm, *AB* is a chord of length 8 cm. If $OM \perp AB$, then the length of *OM* is
(a) 4 cm (b) 5 cm
(c) 3 cm (d) 2 cm

19. In the adjoining figure, ΔABC is an isosceles triangle with $AB = AC$ and $\angle ABC = 50°$. Then, $\angle BDC$ is



(a) 110° (b) 90° (c) 80° (d) 70°

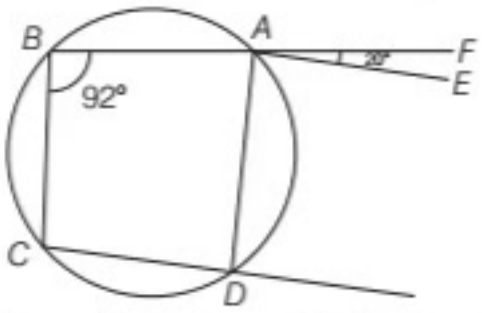
20. If *O* is the centre of the circle, then *x* is



(a) 72° (b) 62° (c) 82° (d) 52°

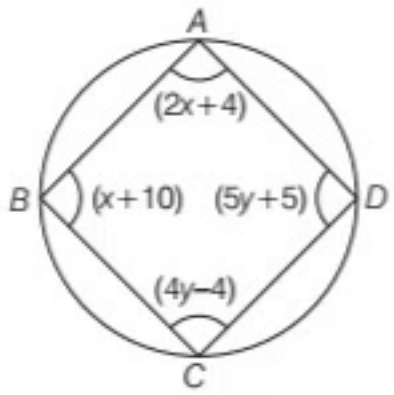
21. In a cyclic quadrilateral *ABCD*, if $\angle B - \angle D = 60°$, then the measure of the smaller of the two is
(a) 60° (b) 40° (c) 38° (d) 30°

22. In the given figure, $ABCD$ is a cyclic quadrilateral. AE is drawn parallel to CD and BA is produced. If $\angle ABC = 92°$ and $\angle FAE = 20°$, then $\angle BCD$ is equal to



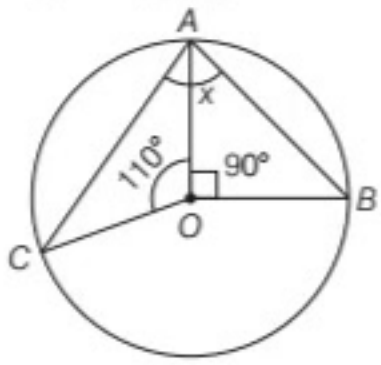
(a) 88° (b) 98° (c) 108° (d) 72°

23. The values of x and y in the figure are measure of angles, then $x + y$ is equal to



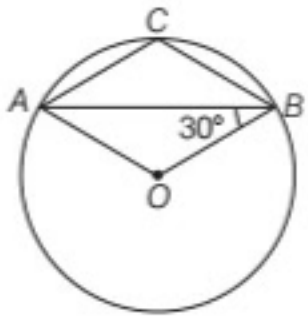
(a) 90° (b) 85° (c) 75° (d) 65°

24. If O is the centre of the circle, the value of x in the adjoining figure, is



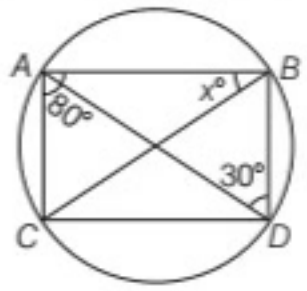
(a) 80° (b) 70° (c) 60° (d) 50°

25. In the given figure, O is centre, then $\angle ACB$ is



(a) 60° (b) 120°
(c) 75° (d) 90°

26. In the following figure, the value of $x°$ is



(a) 60° (b) 90°
(c) 70° (d) 40°

27. In the figure, O is the centre and AOC is the diameter of the circle. BD is chord and OB and CD are joined D is joined to A. If $\angle AOB = 120°$, then the value of x is

(a) 30° (b) 40°
(c) 50° (d) 60°

Answers

1	(b)	2	(a)	3	(b)	4	(a)	5	(b)	6	(d)	7	(b)	8	(a)	9	(c)	10	(b)
11	(a)	12	(b)	13	(c)	14	(b)	15	(b)	16	(a)	17	(c)	18	(c)	19	(c)	20	(c)
21	(a)	22	(c)	23	(d)	24	(a)	25	(b)	26	(c)	27	(a)						

Hints and Solutions

1. Since, $\angle A + \angle B + \angle C + \angle D = 360°$

$\therefore \quad 75° + 75° + 75° + \angle D$

$\Rightarrow \quad 225° + \angle D = 360°$

$\Rightarrow \quad \angle D = 360° - 225° = 135°$

2. Let the angles be x, $2x$, $3x$ and $4x$.

$\because \quad x + 2x + 3x + 4x = 360°$

$\Rightarrow \quad 10x = 360°$

$\Rightarrow \quad x = 36°$

$\therefore$ Fourth angle $= 4 \times 36° = 144°$

3. $\because OA = OB$

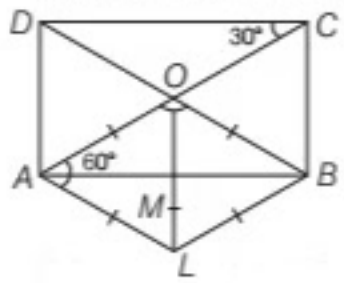
[$\because$ the diagonals of a rectangle bisect each other]

Also, $OA = OL \Rightarrow AOBL$ is a rhombus.

Since, $\Delta\, AOL$ is an equilateral triangle.

$\therefore \quad \angle AOL = 60°$

$\Rightarrow \quad \angle AOB = 2\angle AOL = 120°$



Since, $CD \parallel AB$

$\Rightarrow \quad \angle DCA = \angle CAB = 30°$

and $\quad \angle OAL = 60°$

$\Rightarrow \quad \angle BAL = 60° - 30° = 30° = \angle ABL$

$\therefore$ In $\Delta\, ALB$,

$\angle ALB = 120°$, $\angle ABL = 30°$, $\angle LAB = 30°$

4. Let $\quad \angle A + \angle C = 130°$, then

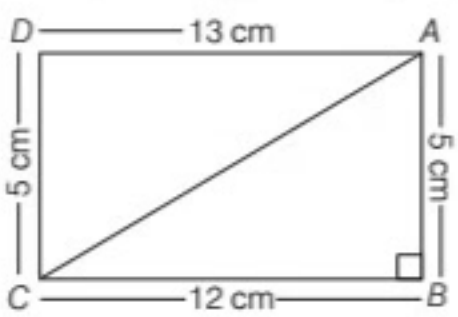
$\angle B + \angle D = 360° - 130°$

$= 230°$

$\therefore$ Angles $= \dfrac{130°}{2}, \dfrac{230°}{2} = 65°, 115°$

Hence, all angles are 65°, 65°, 115°, 115°.

5.



Since, here $\angle ABC = 90°$

So, by pythagoras theorem,

diagonal $AC = \sqrt{AB^2 + BC^2}$

$= \sqrt{5^2 + 12^2}$

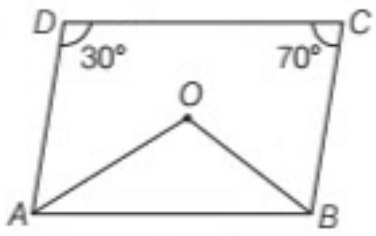
$= \sqrt{25 + 44}$

$= \sqrt{169} = 13$ cm

6. Since, $\quad \angle A + \angle B + \angle C + \angle D = 360°$

$\therefore \quad \angle A + \angle B = 360° - (130° + 70°)$

$= 360° - 200° = 160°$



$\Rightarrow \quad \dfrac{1}{2}(\angle A + \angle B) = 80°$

So, $\quad \angle OAB + \angle ABO = 80°$

$\therefore \quad \angle AOB = 180° - (\angle OAB + \angle ABO)$

$= (180° - 80°) = 100°$

7. $\angle C = \angle A = 75°$

[opposite angles of a parallelogram are equal]

$\therefore \quad \angle BDC = 180° - (60° + 75°)$

$= 180° - 135° = 45°$

8. In a parallelogram, adjacent angles are supplementary.

$\therefore \quad 120° + (5x + 10)° = 180°$

$\Rightarrow \quad 5x + 10° + 120° = 180°$

$\Rightarrow \quad 5x = 180° - 130°$

$\Rightarrow \quad 5x = 50°$

$\Rightarrow \quad x = 10°$

Also, opposite angles are equal in a parallelogram.

Therefore, $\quad 6y = 120° \Rightarrow y = 20°$

9. Since, $\quad \angle A + b = 180° \Rightarrow \angle A = 180° - b$

Also, $\quad \angle C + a = 180°$ [linear pair]

$\Rightarrow \quad \angle C = 180° - a$

But $\quad \angle A + \angle B + \angle C + \angle D = 360°$

$\Rightarrow \quad (180° - b) + x + (180° - a) + y = 360°$

$\therefore \quad x + y = a + b$

10. Given, $\angle COD = 105°$ and $\angle OCX = 45°$

$$\angle COD + \angle COX = 180°$$

$$\Rightarrow \quad \angle COX = 180° - \angle COD$$

$$= 180° - 105° = 75°$$

In ΔOCX, $\angle OCX + \angle COX + \angle OXC = 180°$

$$\Rightarrow \quad 45° + 75° + x = 180°$$

$$\therefore \quad x = 180° - 120° = 60°$$

11. Given, a rectangle *READ*, in which

$$\angle ROE = 60°$$

$\therefore \quad \angle EOA = 180° - 60° = 120°$ [linear pair]

Now, in ΔEOA, $\angle OEA = \angle OAE = 30°$

[$\because$ $OE = OA$ and equal sides make equal angles]

$\therefore \quad \angle EAR = 30°$, $\angle RAD = 90° - \angle EAR = 60°$

and $\angle ROD = \angle EOA = 120°$

12. Given, $\angle RAI = 35°$

$\therefore \quad \angle PRA = 35°$

[$PR \parallel AI$ and AR is transversal]

Now, $\angle ARI = 90° - \angle PRA = 90° - 35° = 55°$

$\because \quad AM = IM$, $\angle MIA = \angle MAI = 35°$

In ΔAMI, $\angle RMI = \angle MAI + \angle MIA = 70°$

[exterior angle]

Also, $\angle RMI = \angle PMA$

$\Rightarrow \quad \angle PMA = 70°$ [vertically opposite angles]

13. Given, $\angle FIS = 60°$

Now, $\angle FTS = \angle FIS = 60°$

[$\because$ opposite angles of a parallelogram are equal]

Now, $FT \parallel IS$ and TI is a transversal, therefore

$\angle FTO = \angle SIO = 25°$ [alternate angles]

$\therefore \quad \angle STO = \angle FTS - \angle FTO = 60° - 25° = 35°$

Also, $\angle FOT + \angle SOT = 180°$ [linear pair]

$\Rightarrow \quad 110° + \angle SOT = 180°$

$\Rightarrow \quad \angle SOT = 180° - 110° = 70°$

In ΔTOS, $\angle TSO + \angle OTS + \angle TOS = 180°$

[angle sum property of triangle]

$\therefore \quad \angle OST = 180° - (70° + 35°) = 75°$

14. External angle of any polygen

$$\frac{360°}{n} = 45° \Rightarrow n = \frac{360°}{45°} \Rightarrow n = 8°$$

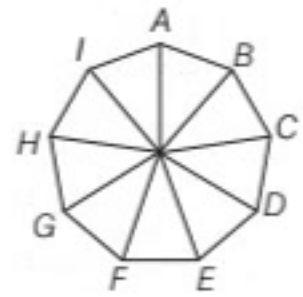
$\therefore$ Every interior angle of regular polygon

$= 180° -$ External angle

$= 180° - 45° = 135°$

$\therefore$ Sum of interior angles of it $= 8 \times 135° = 1080°$

15. Hence total number of non overlapping triangles can be formed in 9 sided polygon is 7.



16. We know that, the angle subtended by an arc at the centre of a circle is double the angle subtended by it any point on the remaning part of the circle.

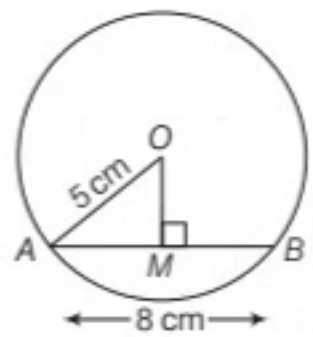
$$\angle BOC = 2\angle A$$

$$= 2 \times 60°$$

$$\therefore \quad \angle BOC = 120°$$

17. $\angle PRQ = \angle PSQ = 90°$ [each angle in semi-circle]

18. $\because OA = 5$ cm



and $\quad AM = \frac{1}{2}AB = \frac{1}{2} \times 8 = 4$ cm

$$\therefore \quad OM = \sqrt{OA^2 - AM^2}$$

$$= \sqrt{5^2 - 4^2} = 3 \text{ cm}$$

19. Since, $\quad AB = AC$

$$\Rightarrow \quad \angle ACB = \angle ABC = 50°$$

In ΔABC,

$$\angle BAC = 180° - (50° + 50°)$$

$$= 80°$$

$$\therefore \quad \angle BDC = \angle BAC = 80°$$

[angle in the same segment]

20. In ΔDAC, $\angle ADC + \angle DCA + \angle CAD = 180°$

$$\Rightarrow \quad \angle CAD = 180° - 32° - 50° = 98°$$

Now, $\angle CAD + \angle CBD = 180°$

[opposite angles of a quadrilateral]

$$\therefore \quad x = 180° - 98° = 82°$$

21. Since, $\angle B + \angle D = 180°$

[sum of opposite angles of a cyclic quadrilateral]

$\angle B - \angle D = 60°$ [given]

$\Rightarrow$ $\angle B = 120°$ and $\angle D = 60°$

$\therefore$ Required smaller angle $\angle D = 60°$

22. $\angle B + \angle D = 180°$

$\Rightarrow$ $\angle D = 180° - 92° = 88°$

Now, $\angle DAE = \angle D = 88°$ [$\because AE \parallel CD$]

$\Rightarrow$ $\angle FAD = 88° + 20° = 108°$

$\therefore$ $\angle BCD = \angle FAD = 108°$

23. Since, $ABCD$ is a cyclic quadrilateral.

$\angle B + \angle D = 180°$

and $\angle A + \angle C = 180°$

$\Rightarrow$ $x + 10 + 5y + 5 = 180°$

$x + 5y = 165°$ ...(i)

and $2x + 4 + 4y - 4 = 180°$

$\Rightarrow$ $2x + 4y = 180°$ ...(ii)

Solving Eqs.(i) and (ii), we get

$x = 40°$ and $y = 25°$

$\therefore$ $x + y = 40° + 25° = 65°$

24. $\angle COB = 360° - (\angle COA + \angle BOA)$

$= 360° - (110° + 90°)$

$= 160°$

$\therefore$ $x = \frac{1}{2} \times \angle COB$ [by theorem]

$= \frac{1}{2} \times 160° = 80°$

25. In the given figure, $OA = OB$ (radius of circle)

$\Rightarrow$ $\angle OAB = \angle OBA = 30°$

$\therefore$ $\angle AOB = 180° - 60° = 120°$

$\therefore$ Major $\angle AOB = 360° - 120° = 240°$

$\Rightarrow$ $\angle ACB = \frac{1}{2} \times 240° = 120°$

[angle subtended in the arc is half of that subtended at the centre.]

26. In a given figure,

$\angle ADB = \angle ACB = 30°$

[angle subtended in the same segment]

In ΔABC, $\angle x° = 180° - (\angle ACB + \angle CAB)$

$= 180° - (30° + 80°) = 70°$

27. In a given figure,

$\angle COB = 180° - 120° = 60°$ [$\because COA$ is a line]

$\therefore$ $x = \frac{1}{2} \angle COB$

[angle subtended in the arc is half of that subtended at the centre.]

$= \frac{1}{2} \times 60° = 30°$

CHAPTER

12

AREA OF PLANE FIGURES

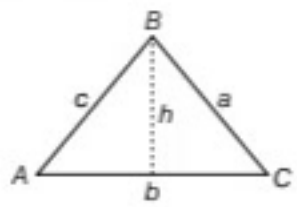
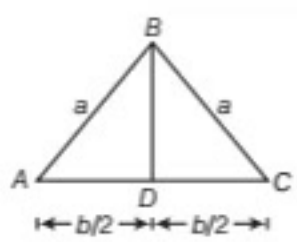
In this chapter, we study the Area of Plane Figures, triangle and its type Square, circle, semi-circle, Trapezium, Hexagon etc.

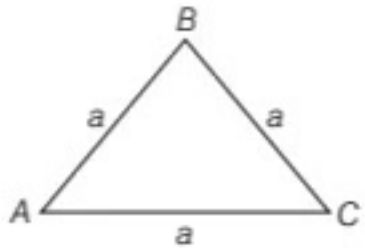
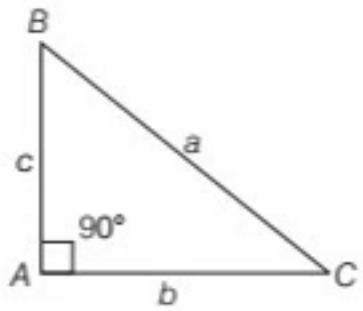
Plane figures are the flat shape in two dimensions, having length and width (breadth).

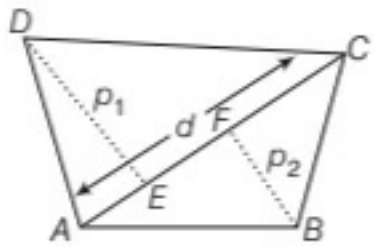
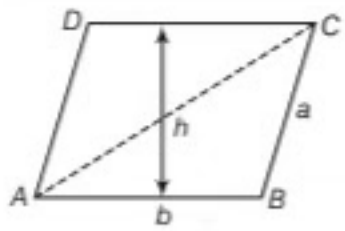
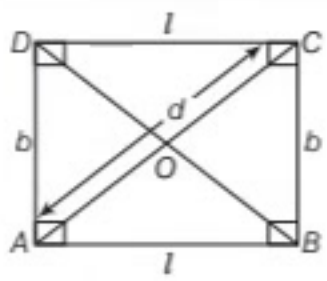
Perimeter The length of boundary of a simple closed figure is known as perimeter.

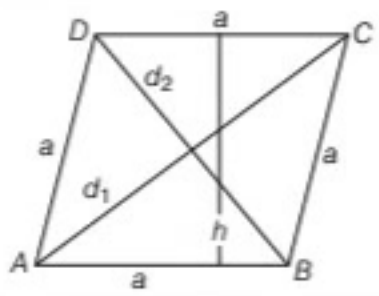
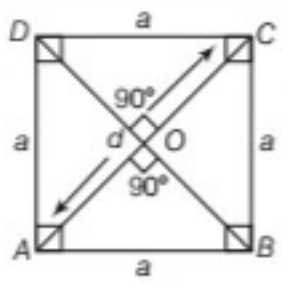
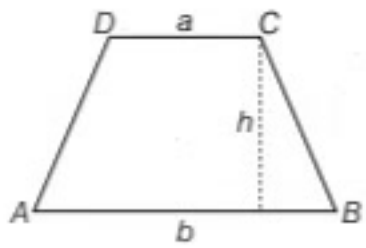
Area The measure of region enclosed in a simple closed curve is called area of closed curve.

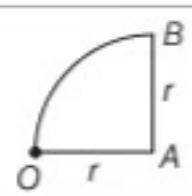
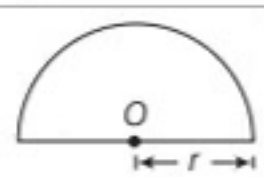
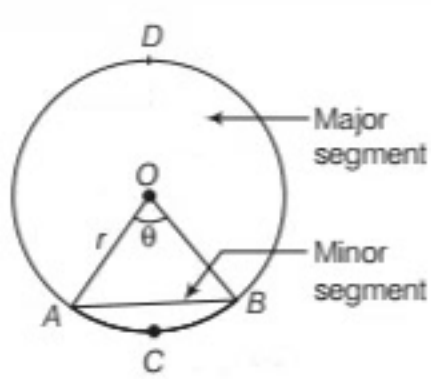
Perimeter and Area of Plane Figures

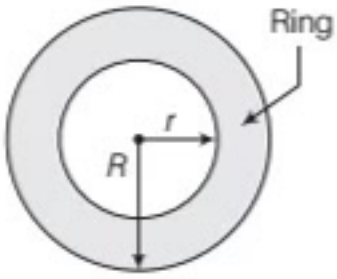
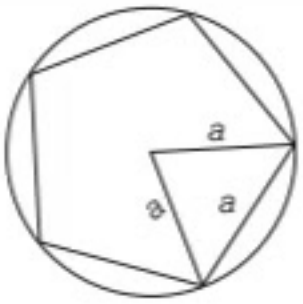
	Type	Figure	Perimeter (P)	Area (A)
1	Triangle		$P = a + b + c$ $= 2s$	$A = \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} bh$ $= \sqrt{s(s-a)(s-b)(s-c)}$
2	Isosceles Triangle		$P = 2a + b$	$A = \frac{b}{4}\sqrt{4a^2 - b^2}$

	Type	Figure	Perimeter (P)	Area (A)
3	Equilateral Triangle		$P = 3a$	$A = \frac{\sqrt{3}}{4}a^2$
4	Right Angled Triangle		$P = a + b + c = 2s$	$A = \frac{1}{2}bc$

	Type	Figure	Diagonal	Perimeter (P)	Area (A)
5	Quadrilateral	 Diagonal $AC = d$; DE, BF are two perpendiculars drawn on the diagonal (AC) and p_1, p_2 are lengths of the two perpendiculars	$BD \neq AC$	$P = AB + BC + CD + DA$	$A = \frac{1}{2} \times d \times (p_1 + p_2)$
6	Parallelogram	 b = base, h = perpendicular distance between the base and its opposite side	$BD \neq AC$	$P = 2(a + b)$	$A = b \times h = 2\times$ (area of $\Delta\, ABD$) (or $\Delta\, BCD$)
7	Rectangle	 l = length, b = breadth d = diagonal	$BD = AC$ Also, $AO = OC$ $= OD = OB$ and $d^2 = l^2 + b^2$	$P = 2(l + b)$	$A = l \times b$ $= l \times \sqrt{d^2 - l^2}$ $= b \times \sqrt{d^2 - b^2}$

	Type	Figure	Diagonal	Perimeter (P)	Area (A)
8	Rhombus		$BD \neq AC$ and $d_1^2 + d_2^2 = 4a^2$	$P = 4a = 2\sqrt{d_1^2 + d_2^2}$	$A = \frac{1}{2} \times d_1 \; x d_2$ $= a \times h$
9	Square	 a = length of side d = diagonal	$BD = AC$ and $OA = OB$ $= OC = OD$ and $d = a\sqrt{2}$	$P = 4a = 2d\sqrt{2}$	$A = a^2 = \frac{d^2}{2}$
10	Trapezium			P = sum of all sides	$A = \frac{1}{2}(a + b) \times h$

	Type	Figure	Perimeter (or Circumference)	Area
11	Quadrant		$P = 2r + \frac{\pi r}{2}$	$A = \frac{1}{4}\pi r^2$
12	Semi-circle		$P = (\pi r + 2r)$	$A = \frac{1}{2}\pi r^2$
13	Circle		Circumference of circle, $P = 2\pi r = \pi d$ Length of arc $AB = 2\pi r \times \frac{\theta}{360°}$	$A = \pi r^2$

	Type	Figure	Perimeter (or Circumference)	Area
14	Ring		$P = 2\pi R + 2\pi r$	$A = \pi R^2 - \pi r^2$ $= \pi(R^2 - r^2)$
15	Hexagon inscribed in a circle		$P = 6(a)$	$A = 6 \times \frac{\sqrt{3}a^2}{4}$

Conversion of Units

$100 \text{ mm}^2 = 1 \text{ cm}^2$ $\quad$ $100 \text{ cm}^2 = 1 \text{ dm}^2$

$100 \text{ dm}^2 = 1 \text{ m}^2$ $\quad$ $10000 \text{ cm}^2 = 1 \text{ m}^2$

$1 \text{ acre} = 100 \text{ m}^2$ $\quad$ $1 \text{ hectare} = 10000 \text{ m}^2$

$1 \text{ hectare} = 100 \text{ acres}$ $\quad$ $100 \text{ hectare} = 1 \text{ km}^2$

Example 1 The base of a triangular field is three times its altitude. If the cost of cultivating the field at ₹ 240 per hectare ₹ 3240, find its base and height.

(a) 900 m, 300 m (b) 910 m, 310 m
(c) 905 m, 315 m (d) None of these

Sol. (a) Area of the field $= \frac{\text{Total cost}}{\text{Rate}}$

$= \frac{3240}{240}$ hectare

$= 13.5 \times 10000 \text{ m}^2$

$= 135000 \text{ m}^2$

Let the height be x metre.

Then, base = $3x$ metre

$\therefore \quad \frac{1}{2} \times x \times 3x = 135000$

$\Rightarrow \quad x^2 = 90000$

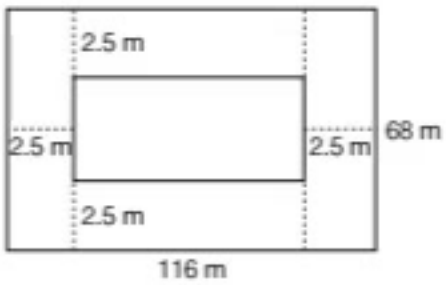
$\Rightarrow \quad x = 300 \text{ m}$

Hence, base is 900 and height is 300 m.

Example 2 A rectangular grassy plot is 116 m by 68 m. It has a gravel path 2.5 m wide all round it on the inside. Find the area of the path.

(a) 895 m^2 (b) 900 m^2
(c) 910 m^2 (d) 890 m^2

Sol. (*a*) Area of the plot $= (116 \times 68) = 7888 \text{ m}^2$



Area of the plot excluding the path

$= (116 - 5) \times (68 - 5)$

$= 111 \times 63 = 6993 \text{ m}^2$

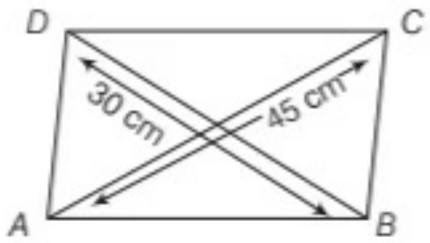
$\therefore$ Required area of path $= 7888 - 6993 = 895 \text{ m}^2$

Example 3 The floor of a building consists of 3000 tiles, which are rhombus shaped and each of its diagonals are 45 cm and 30 cm in length. Find the total cost of polishing the floor, if the cost per sq metre is ₹ 4.

(a) ₹ 800 (b) ₹ 810 (c) ₹ 820 (d) ₹ 850

Sol. (b) Area of one rhombus shaped tile $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 45 \times 30 = 45 \times 15 = 675 \text{ cm}^2$



Now, floor of a building consists of 3000 tiles of such kind.

$\therefore$ Area of floor = Number of tiles × Area of one tile

$$= 3000 \times 675$$

$$= 2025000\,\text{cm}^2 = \frac{2025000}{10000}\,\text{m}^2$$

$$= 2025\,\text{m}^2 \quad \left[\begin{array}{l}\because 1\text{ m} = 100\text{ cm} \\ \therefore\ 1\text{m}^2 = 10000\text{ cm}^2\end{array}\right]$$

$\because$ Rate of polishing the floor = ₹4 per m^2

$\therefore$ Total cost of polishing the floor = ₹ 4×202.5

= ₹810

Hence, the total cost of polishing the floor is ₹810.

Example 4 The area of trapezium is $450\,\text{m}^2$ and the distance between two parallel sides is 10 m and one of the parallel side 15 m. Find the other parallel side.

(a) 75 m (b) 80 m
(c) 85 m (d) 90 m

Sol. (*a*) Given, one of the parallel sides of the trapezium, a=15 m and height (h) = 10 m

Let another side be b m.

Then, area of trapezium = 450 m^2

$\therefore$ Area of trapezium $= \frac{1}{2}h(a+b)$

$$\Rightarrow \quad 450 = \frac{1}{2} \times 10 \times (15+b)$$

$$\Rightarrow \quad \frac{450 \times 2}{10} = 15 + b$$

$$\Rightarrow \quad 90 = 15 + b$$

$$\therefore \quad b = 90 - 15 = 75$$

Hence, the other parallel side of trapezium is 75m.

Example 5 If the area of a semi-circular field is $30800\,\text{m}^2$, then find the perimeter of the field.

(a) 705 m (b) 710 m
(c) 700 m (d) 720 m

Sol. (*d*) Let the radius of the field be r.

Then, $\frac{1}{2}\pi r^2 = 30800$

$$\Rightarrow \quad \frac{1}{2} \times \frac{22}{7} \times r^2 = 30800$$

$$\Rightarrow \quad r^2 = 30800 \times 2 \times \frac{7}{22} = 19600$$

$$\Rightarrow \quad r = 140\text{ m}$$

$\therefore$ The perimeter of the field $= \pi r + 2r$

$$= \frac{22}{7} \times 140 + 2 \times 140$$

$$= 440 + 280 = 720\text{m}$$

Example 6. In a circle of radius 35 cm, an arc subtends an angle of 72° at the centre. Find the length of the arc and the area of the sector.

(a) 660 cm^2 (b) 700 cm^2 (c) 770 cm^2 (d) 750 cm^2

Sol. (c) Length of the arc $= \frac{2\pi r\theta}{360°}$

$$= 2 \times \frac{22}{7} \times 35 \times \frac{72}{360} = 44\text{ cm}$$

Area of the sector $= \frac{\pi r^2\theta}{360°}$

$$= \frac{22}{7} \times 35 \times 35 \times \frac{72}{360} = 770\text{ cm}^2$$

Example 7. A regular hexagon is inscribed in a circle of radius 5 cm. The area of regular hexagon inscribed in a circle is

(a) $\frac{75}{2}\text{ cm}^2$ (b) $75\sqrt{3}\text{ cm}^2$
(c) $\frac{75\sqrt{3}}{2}\text{ cm}^2$ (d) None of these

Sol. (c) Area of hexagon inscribed in a circle

$$6 \times \frac{\sqrt{3}}{4}(a)^2 = 6\frac{\sqrt{3}}{4} \times (5)^2 = \frac{75}{2}\sqrt{3}\text{ cm}^2$$

PRACTICE EXERCISE

1. The area of an equilateral triangle with side 10 cm is

(a) $15\sqrt{3}$ cm^2 (b) $25\sqrt{3}$ cm^2
(c) $5\sqrt{3}$ cm^2 (d) $35\sqrt{3}$ cm^2

2. An isosceles right angled triangle has area 200 cm^2. The length of its hypotenuse is

(a) $15\sqrt{2}$ cm (b) $\frac{10}{\sqrt{2}}$ cm
(c) $10\sqrt{2}$ cm (d) $20\sqrt{2}$ cm

3. The diagonal of a square field measures 50 m. The area of square field is

(a) 1250 m^2 (b) 1200 m^2
(c) 1205 m^2 (d) 1025 m^2

4. The sum of the length of two diagonals of a square is 144 cm, then the perimeter of square is

(a) 144 cm (b) $72\sqrt{2}$ cm
(c) $144\sqrt{2}$ cm (d) None of these

5. The circumference of a circle is 176 m. Then, its area is

(a) 2464 m^2 (b) 2164 m^2
(c) 2346 m^2 (d) 2246 m^2

6. The area of a rhombus whose one side and one diagonal measure 20 cm and 24 cm respectively, is

(a) 364 cm^2 (b) 374 cm^2
(c) 384 cm^2 (d) 394 cm^2

7. The area of the largest circle that can be drawn inside a square of side 14 cm in length, is

(a) 84 cm^2 (b) 96 cm^2
(c) 104 cm^2 (d) 154 cm^2

8. The least number of square slabs that can be fitted in a room 10.5 m long and 3 m wide, is

(a) 12 (b) 13
(c) 14 (d) 15

9. The length of a rectangle is 2 cm more than its breadth and the perimeter is 48 cm. The area of the rectangle (in cm^2) is

(a) 96 (b) 28
(c) 143 (d) 144

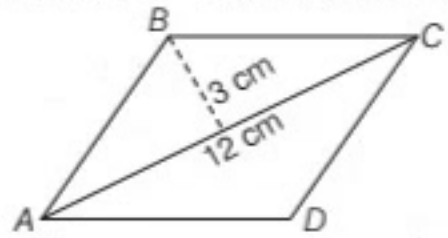
10. In a circle of radius 42 cm, an arc subtends an angle of 72° at the centre. The length of the arc is

(a) 52.8 cm (b) 53.8 cm
(c) 72.8 cm (d) 79.8 cm

11. If the side of a square be increased by 50%, then the per cent increase in area is

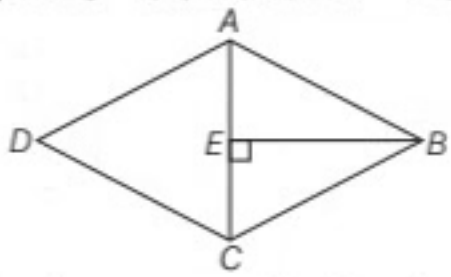
(a) 50 (b) 100 (c) 125 (d) 150

12. The figure $ABCD$ is a quadrilateral, in which $AB = CD$ and $BC = AD$. Its area is



(a) 72 cm^2 (b) 36 cm^2
(c) 24 cm^2 (d) 18 cm^2

13. What is the area of the rhombus $ABCD$ below, if $AC = 6$ cm and $BE = 4$ cm?



(a) 36 cm^2 (b) 16 cm^2
(c) 24 cm^2 (d) 13 cm^2

14. The area of a parallelogram is 60 cm^2 and one of its altitude is 5 cm. The length of its corresponding side is

(a) 12 cm (b) 6 cm (c) 4 cm (d) 2 cm

15. If the ratio of the areas of two square is 4 : 1, then the ratio of their perimeter is

(a) 2 : 1 (b) 1 : 2
(c) 1 : 4 (d) 4 : 1

16. The inner circumference of a circular park is 440 m. The track is 14 m wide. The diameter of the outer circle of the track is

(a) 168 m (b) 169 m (c) 144 m (d) 108 m

17. A wire is in the form of a circle of radius 42 cm. It is bent into a square. The side of the square is

(a) 33 cm (b) 66 cm
(c) 78 cm (d) 112 cm

18. The perimeter of a trapezium is 52 cm and its each non-parallel side is equal to 10 cm with its height 8 cm. It area is

(a) 124 cm^2 (b) 118 cm^2
(c) 128 cm^2 (d) 112 cm^2

19. The areas of two circles are in the ratio 49 : 64. Find the ratio of their circumferences.

(a) 7 : 8 (b) 5 : 8 (c) 5 : 3 (d) 5 : 9

20. The diameter of the wheels of a bus is 140 cm. How many revolutions per minute must a wheel make in order to move at a speed of 66 km/h ?

(a) 200 (b) 250 (c) 300 (d) 350

21. The length of the sides of a triangle are in the ratio 3 : 4 : 5 and its perimeter is 144 cm. The area of the triangle is

(a) 684 cm^2 (b) 664 cm^2
(c) 764 cm^2 (d) 864 cm^2

22. The difference between the sides at right angles in a right angled triangle is 14 cm. The area of the triangle is 120 cm^2. The perimeter of the triangle is

(a) 68 cm (b) 64 cm
(c) 60 cm (d) 58 cm

23. The area of the quadrilateral whose sides measures 9 cm, 40 cm, 28 cm and 15 cm and in which the angle between the first two sides is a right angle, is

(a) 206 cm^2 (b) 306 cm^2
(c) 356 cm^2 (d) 380 cm^2

24. If three sides of a triangle are 6 cm, 8 cm and 10 cm, then the altitude of the triangle using the largest side as base will be

(a) 8 cm (b) 6 cm
(c) 4.8 cm (d) 4.4 cm

25. The area of a circle is 13.86 hectares. The cost of fencing it at the rate of 60 paise per metre is

(a) ₹ 784.00 (b) ₹ 788.00
(c) ₹ 792.00 (d) ₹ 796.00

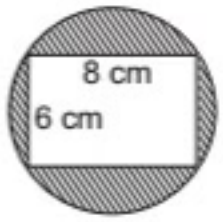
26. If the diagonal of a rectangle is 13 cm and its perimeter is 34 cm, then its area will be

(a) 442 cm^2 (b) 260 cm^2
(c) 60 cm^2 (d) 20 cm^2

27. The cross-section of a canal is in the shape of a trapezium. The canal is 15 m wide at the top and 9 m wide at the bottom. The area of cross-section is 720 m^2, the depth of the canal is

(a) 58.4 m (b) 58.6 m
(c) 58.8 m (d) 60 m

28. In the adjacent figure, find the area of the shaded region.

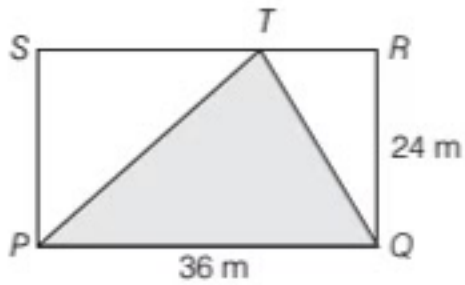


(a) 15.28 cm^2
(b) 61.14 cm^2
(c) 30.57 cm^2
(d) 40.76 cm^2

29. A square and an equilateral triangle have equal perimeters. If the area of the equilateral triangle is $16\sqrt{3}$ cm^2, then the side of the square is

(a) 4 cm (b) $4\sqrt{2}$ cm
(c) $6\sqrt{2}$ cm (d) 6 cm

30. find the figure area of the shaded portion. In the following figure,



(a) 433m^2 (b) 432 m^2
(c) 434 m^2 (d) None of these

31. A regular hexagon is inscribed in a circle of radius 8 cm. The perimeter of the regular hexagon is

(a) 48 cm (b) 50 cm
(c) 52 cm (d) 54 cm

32. Find the area of regular hexagon inscribed in a circle of radius 10 cm.

(a) $140\sqrt{3}$ cm^2 (b) $150\sqrt{3}$ cm^2
(c) $120\sqrt{3}$ cm^2 (d) None of these

Answers

1	(b)	2	(d)	3	(a)	4	(c)	5	(a)	6	(c)	7	(d)	8	(c)	9	(c)	10	(a)
11	(c)	12	(b)	13	(c)	14	(a)	15	(a)	16	(a)	17	(b)	18	(c)	19	(a)	20	(b)
21	(d)	22	(c)	23	(b)	24	(c)	25	(c)	26	(c)	27	(d)	28	(c)	29	(d)	30	(b)

Hints and Solutions

1. Area of equilateral triangle $= \frac{\sqrt{3}}{4}(\text{side})^2$

$$= \frac{\sqrt{3}}{4} \times 10 \times 10 = 25\sqrt{3} \text{ cm}^2$$

2. Area of an isosceles right angled triangle

$$= \frac{1}{2}(\text{side})^2 = 200 \text{ cm}^2$$

$\therefore$ side = 20 cm

$\therefore$ Hypotenuse $= \sqrt{a^2 + a^2} = \sqrt{2}a = 20\sqrt{2}$ cm

3. Area of square $= \frac{1}{2} \times (\text{diagonal})^2$

$$= \frac{1}{2} \times 50 \times 50 = 1250 \text{ m}^2$$

4. Length of a diagonal of square $= \frac{144}{2} = 72$ cm

Side of square $= \frac{\text{length of diagonal}}{\sqrt{2}} = \frac{72}{\sqrt{2}}$ cm

$\therefore$ The perimeter of square $= 4a = 4 \times \frac{72}{\sqrt{2}}$

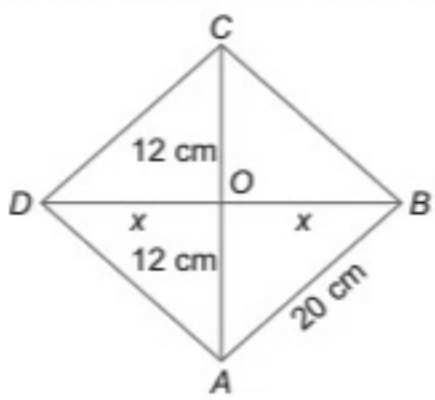
$$= 144\sqrt{2} \text{ cm}$$

5. Circumference of circle $= 2\pi r = 176$ m

$\Rightarrow$ $r = \frac{176 \times 7}{2 \times 22} = 28$ m

$\therefore$ Area $= \pi r^2 = \frac{22}{7} \times 28 \times 28 = 2464 \text{ m}^2$

6. Let the other diagonal be $2x$. In ΔAOB,



$$(20)^2 = (12)^2 + x^2$$

$\Rightarrow$ $x^2 = 256$

$\Rightarrow$ $x = 16$ cm

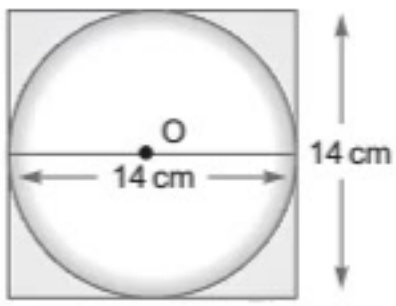
$\therefore$ Other diagonal $= 2x = 32$ cm

$\therefore$ Area $= \frac{1}{2} \times d_1 d_2$

$$= \frac{1}{2} \times 24 \times 32$$

$$= 384 \text{ cm}^2$$

7. Diameter of circle = side of square = 14 cm



$\Rightarrow$ $r = 7$ cm

$\therefore$ Area of circle, $\pi r^2 = \frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$

8. Side of the greatest square tile = GCM of the length and breadth of the room

GCM of 10.5 and 3 = 1.5 m.

$\therefore$ Area of room $= 10.5 \times 3 \text{ m}^2$

$\therefore$ Number of tiles needed $= \frac{10.5 \times 3}{1.5 \times 1.5} = 14$ tiles

9. Let length = x cm and breadth = $(x - 2)$ cm

$\therefore$ $2[x + (x - 2)] = 48$

$\Rightarrow$ $4x - 4 = 48$

$\Rightarrow$ $x = \frac{52}{4} = 13$ cm

$\therefore$ Length = 13 cm and breadth = 11 cm

Hence, area $= l \times b$

$$= 13 \times 11 = 143 \text{ cm}^2$$

10. Length of an arc

$$= 2\pi r \times \frac{\theta}{360°} = \frac{2 \times 22 \times 42 \times 72°}{7 \times 360°}$$

$$= \frac{264}{5} = 52.8 \text{ cm}$$

11. Let the original side of a square be 'a'.

$\therefore$ Area of square $= a^2$

Now, new side $= a + \frac{a}{2} = \frac{3a}{2}$

$\Rightarrow$ New area $= \frac{9a^2}{4}$

$\therefore$ Increase in area $= \frac{9a^2}{4} - a^2 = \frac{5a^2}{4}$

$\therefore$ Percent increase in area

$$= \frac{5a^2}{4a^2} \times 100 = 125\%$$

12. It is clear from the figure that, quadrilateral $ABCD$ is a parallelogram. The diagonal AC of the given parallelogram $ABCD$ divides it into two triangles of equal areas.

Area of the $\Delta ABC = \frac{1}{2} \times \text{Base} \times \text{Height}$

$$= \frac{1}{2} \times 12 \times 3 = 18 \text{ cm}^2$$

$\therefore$ Area of the parallelogram $ABCD$

$$= 2 \times \text{Area of } \Delta ABC$$

$$= 2 \times 18 = 36 \text{ cm}^2$$

13. The diagonal AC of the rhombus $ABCD$ divides it into two triangles of equal areas.

Now, area of $\Delta ABC = \frac{1}{2} \times \text{Base} \times \text{Height}$

$$= \frac{1}{2} \times 4 \times 6 = 12 \text{ cm}^2$$

$\therefore$ Area of the rhombus $ABCD = 2 \times$ Area of ΔABC

$$= 2 \times 12 = 24 \text{ cm}^2$$

14. We know that,

Area of a parallelogram = Side × Altitude

$\Rightarrow$ $a \times h = 60 \Rightarrow a \times 5 = 60$

$\Rightarrow$ $a = \frac{60}{5}$

$\therefore$ $a = 12$ cm

15. Let the sides of the two square be a and b.

$\therefore$ Ratio of their areas

$$\frac{a^2}{b^2} = \frac{4}{1}$$

or $\left(\frac{a}{b}\right)^2 = \left(\frac{2}{1}\right)^2$

$\Rightarrow$ $\frac{a}{b} = \frac{2}{1}$

$\therefore$ $a : b = 2 : 1$

16. Inner circumference of a park

$$= 2\pi r = 440 \text{ m}$$

$\Rightarrow$ $r = \frac{440}{2 \times 22} \times 7 = 70$ m

Width of track = 14 m

$\Rightarrow$ Radius of outer circle

$$= (70 + 14) = 84 \text{ m}$$

$\therefore$ Diameter of outer circle $= 2 \times 84 = 168$ m

17. Circumference of circle $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 42 = 264 \text{ cm}$$

$\therefore$ Length of wire = 264 cm

Now, wire is bent into a square.

$\therefore$ Perimeter of square = length of wire = 264 cm

$\Rightarrow$ $4 \times$ side of square = 264

$\therefore$ Side of square $= \frac{264}{4} = 66$ cm

18. Given, perimeter of a trapezium is 52 cm and each non-parallel side is of 10 cm.

Then, sum of its parallel sides

$$= 52 - (10 + 10)$$

$= 52 - 20 = 32$ cm

$\therefore$ Area of the trapezium $= \frac{1}{2}(a + b) \times h$

$$= \frac{1}{2} \times 32 \times 8$$

$[\because h = 8 \text{ cm and } a + b = 32 \text{ cm}]$

$$= 128 \text{ cm}^2$$

19. Given, the area of two circles are in the ratio 49 : 64.

Area of a circle $= \pi r^2$

Let area of the first circle $= \pi r_1^2$

and area of the second circle $= \pi r_2^2$

According to the question, $\frac{49}{64} = \frac{\pi r_1^2}{\pi r_2^2}$

$\Rightarrow \quad \frac{49}{64} = \frac{r_1^2}{r_2^2}$

$\Rightarrow \quad \frac{(7)^2}{(8)^2} = \frac{r_1^2}{r_2^2} \Rightarrow \left(\frac{7}{8}\right)^2 = \left(\frac{r_1}{r_2}\right)^2$

$\therefore \quad r_1 = 7$ and $r_2 = 8$

The ratio of circumferences of these two circles

$$= \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2} = \frac{7}{8}$$

[$\because$ circumference of circle $= 2\pi r$]

Hence, required ratio is 7 : 8.

20. Distance covered by wheel in one minute

$$= \left(\frac{66 \times 1000 \times 100}{60}\right) = 110000 \text{ cm}$$

Circumference of wheel

$$= \left(2 \times \frac{22}{7} \times 70\right) = 440 \text{ cm}$$

$\therefore$ Number of revolutions in 1 min

$$= \left(\frac{110000}{440}\right) = 250$$

21. Given, perimeter of triangle = 144 cm

$\therefore$ Sides of triangle are

$$a = \frac{3}{3+4+5} \times 144 = 36 \text{ cm}$$

and $b = 48$ cm,

$c = 60$ cm

Now, $s = \frac{a+b+c}{2} = \frac{36+48+60}{2}$

$= 72$ cm

$\therefore$ Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{72 \times 36 \times 24 \times 12} = 72 \times 12$

$= 864 \text{ cm}^2$

22. Let the sides containing right angled be x cm and $(x - 14)$ cm.

$\therefore$ Area $= \left[\frac{1}{2} x \times (x - 14)\right] \text{cm}^2$

$\Rightarrow \quad \frac{1}{2} x(x - 14) = 120 \quad [\because \text{area} = 120 \text{ cm}^2]$

$\Rightarrow \quad x^2 - 14x - 240 = 0$

$\Rightarrow \quad (x - 24)(x + 10) = 0 \Rightarrow x = 24$

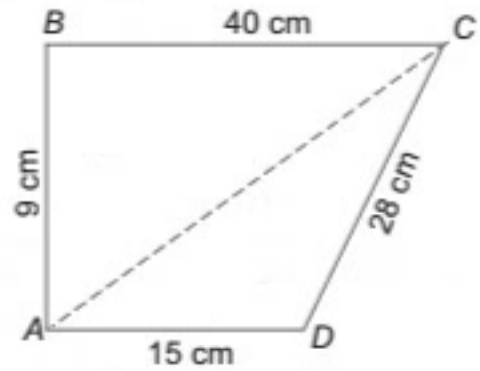
and $\quad x \neq -10$

Other side $= 24 - 14 = 10$ cm

$\Rightarrow$ Hypotenuse $= \sqrt{24^2 + 10^2} = \sqrt{676} = 26$ cm

$\therefore \quad$ Perimeter $= (24 + 10 + 26) = 60$ cm.

23. Applying Pythagoras theorem in ΔABC we get,



$$9^2 + 40^2 = AC^2$$

$\Rightarrow \quad AC = \sqrt{1681} = 41$ cm

$\therefore$ Area of quadrilateral

$=$ area of ΔABC + area of ΔADC

$= \frac{1}{2}(9 \times 40) + \sqrt{42 \times 1 \times 14 \times 27}$

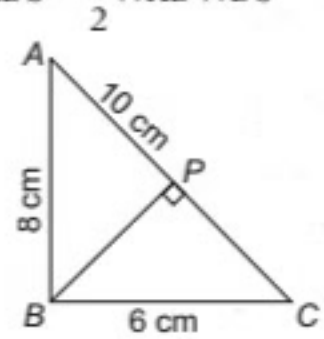
$[\because s = \frac{15 + 28 + 41}{2} = 42 \text{ cm}]$

and area $= \sqrt{s(s-a)(s-b)(s-c)}$

$= 180 + 14 \times 3 \times 3$

$= 180 + 126 = 306 \text{ cm}^2$

24. Area of $\Delta ABC = \frac{1}{2} \times AB \times BC$



$\Rightarrow \quad \frac{1}{2} \times 8 \times 6 = \frac{1}{2} \times AC \times BP$

$\Rightarrow \quad \frac{1}{2} \times 48 = \frac{1}{2} \times 10 \times BP$

$\Rightarrow \quad BP = 4.8 \text{ cm}$

25. Since, 1 hec $= 10000 \text{ m}^2$

Also, $\pi r^2 = 13.86 \times 10000$

$\Rightarrow \quad r = \sqrt{\frac{138600}{22} \times 7} = 210 \text{ m}$

Circumference of circle $= 2\pi r = 1320\text{m}$

$\therefore$ Total cost of fencing $= 1320 \times 0.60 =$ ₹792

26. Since, $2(l + b) = 34 \Rightarrow l + b = 17$

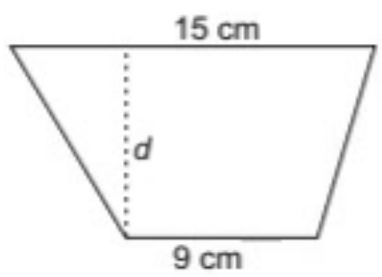
and $\sqrt{l^2 + b^2} = 13 \Rightarrow l^2 + b^2 = 169$

On solving, we get $l = 12$ and $b = 5$

$\therefore$ Area of rectangle $5 = l \times b$

$= 12 \times 5 = 60 \text{ cm}^2$

27. Area of cross-section of canal $= \frac{1}{2}(15 + 9) \times d$



$\Rightarrow \quad 720 = \frac{1}{2} \times 24 \times d$

$\Rightarrow \quad d = 60 \text{ m}$

28. Diameter of circle $= \sqrt{6^2 + 8^2} = 10$ cm

$\therefore$ Area of cricle $= \pi (5)^2 = 25\pi \text{ cm}^2$

$= 25 \times \frac{22}{7} = 78.57 \text{ cm}^2$

and area of rectangle $= 8 \times 6 = 48$ cm

$\therefore$ Shaded area $= 78.57 - 48$

$= 30.57 \text{ cm}^2$

29. Area of equilateral triangle $= \frac{\sqrt{3}}{4} a^2$

$\Rightarrow \quad \frac{\sqrt{3}}{4} a^2 = 16\sqrt{3} \Rightarrow a^2 = 64 \Rightarrow a = 8$ cm

Since, perimeter of square = perimeter of an equilateral triangle

$\Rightarrow \quad 4x = 3 \times 8 \quad \Rightarrow \quad x = 6$ cm

30. Area of the shaded portion = Area of ΔPTQ

$\because$ Area of a triangle $= \frac{1}{2} \times$ Base $\times$ Height

So, in ΔPTQ, RQ = Height

$\therefore$ Area of $\Delta PTQ = \frac{1}{2} \times 36 \times 24 = 18 \times 24 = 432 \text{ m}^2$

31. The perimeter of regular hexagon

$= 6 \times$ radius of a circle $= 6 \times 8 = 48$ cm

32. Area of regular hexagon inscribed in a circle

$= \frac{6\sqrt{3}}{4}(r)^2$

$= \frac{6\sqrt{3}}{4} \times (10)^2 = 150\sqrt{3} \text{ cm}^2$

CHAPTER

13

SURFACE AREA AND VOLUME

This chapter is very important for entrance. In this chapter, we study the surface area and volume of various solid figures such as cuboid, cube, cylinder, cone, sphere etc.

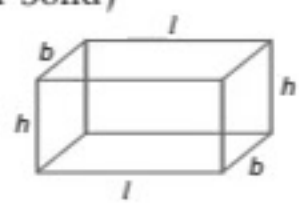
Any figure bounded by one or more surfaces is called a **solid figure**. Hence, a solid figure must have length, breadth (width) and thickness (depth or height).

Surface Area The surface area is the sum of all the areas of all the shapes that cover the surface of the object.

Volume The amount of space occupied by a solid is called its volume.

Surface Area and Volume of Plane Figures

Cuboid (Rectangular Solid)



Let length, breadth and height are respectively l, b and h.

Total number of faces = 6

Surface Area $(SA) = 2(bh + lh)$

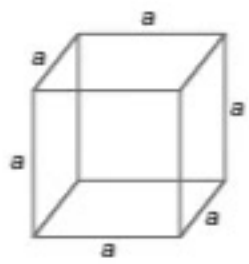
Base Area $(B) = lb$

Total $(C + 2B) = 2(bh + lh + lb)$

Volume $(V) = l \times b \times h = \sqrt{A_1 A_2 A_3}$

where, A_1, A_2 and A_3 are areas of base, side and end face respectively.

Cube



It has six equal faces of each side (edge) a.

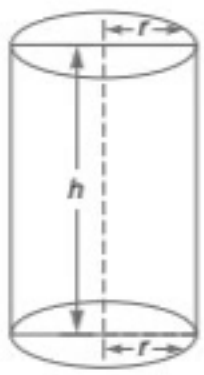
Surface Area $(SA) = 4a^2$

Base Area $(B) = a^2$

Total $(C + 2B) = 6a^2$

Volume $(V) = a^3$

Cylinder



Let the radius of base and height be respectively r and h.

Surface Area (SA)

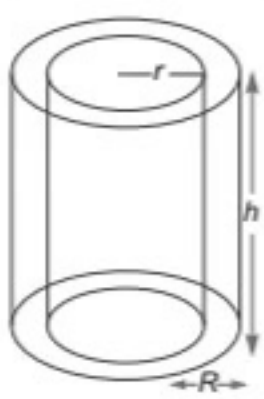
$= (\text{base perimeter}) \times (\text{height}) = 2\pi rh$

Base Area $(B) = \pi r^2$

Total $(C + 2B) = 2\pi r(h + r)$

Volume $(V) = \pi r^2 h$

Hollow cylinder



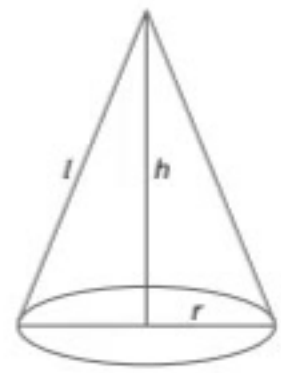
Surface Area $(SA) = 2\pi Rh + 2\pi rh$

Base Area $(B) = \pi(R^2 - r^2)$

Total $(C + 2B) = 2\pi h(R + r) + 2\pi(R^2 - r^2)$

Volume $(V) = \pi(R^2 - r^2)h$

Cone (Right Circular)



Let the radius of base, altitude and slant height be respectively r, h and l.

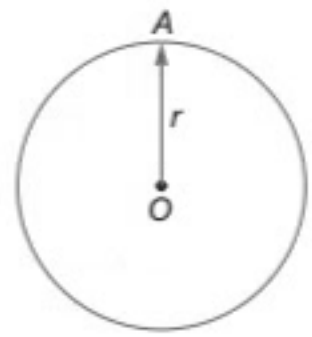
Surface Area $(SA) = \pi rl$, where $l = \sqrt{h^2 + r^2}$

Base Area $(B) = \pi r^2$

Total $(C + 2B) = \pi r(l + r)$

Volume $(V) = \frac{1}{3}$ (Base area) $\times$ Altitude $= \frac{1}{3}\pi r^2 \times h$

Sphere



Let radius of sphere be r.

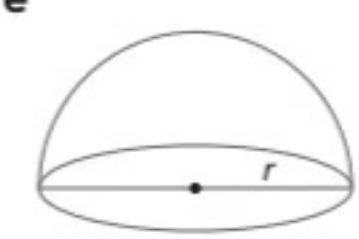
Surface Area $(SA) = 4\pi r^2$

Base Area $(B) =$ No Base

Total $(C + 2B) = 4\pi r^2$

Volume $(V) = \frac{4}{3}\pi r^3$

Hemisphere



Surface Area $(SA) = 2\pi r^2$

Base Area $(B) = \pi r^2$

Total $(C + 2B) = 3\pi r^2$

Volume $(V) = \frac{2}{3}\pi r^3$

Example 1 The volume and surface area of a cube sides measures 4 cm are respectively
(a) 64 cm^3, 96 cm^2 (b) 64 cm^3, 80 cm^2
(c) 64 cm^3, 90 cm^2 (d) 60 cm^3, 96 cm^2

Sol. *(a)* Volume $= a^3 = (4)^3 = 64\ cm^3$

and surface area $= 6a^2$

$$= 6 \times 4 \times 4 = 96\ cm^2$$

Example 2 How many bricks each measuring 25 cm × 11.5 cm × 6 cm will be needed to construct a wall 8 m long, 6 m high and 22.5 cm thick ?
(a) 6262 (b) 6260 (c) 6624 (d) 6520

Sol. *(b)* Number of bricks required

$$= \frac{\text{Volume of wall in cm}^3}{\text{Volume of 1 brick in cm}^3}$$

$$= \frac{800 \times 600 \times 22.5}{25 \times 11.5 \times 6} = 6260$$

Example 3 If the radius of a cylinder is increased from 6 cm to 14 cm and the surface area of it kept same. If its height is 5 cm, what will be its new height?
(a) $\frac{15}{7}$ cm (b) $\frac{15}{8}$ cm
(c) $\frac{17}{7}$ cm (d) None of these

Sol. *(a)* When $r = 6$ cm and $h = 5$ cm, then surface area of cylinder $S_1 = 2\pi rh$

$$= 2\pi \times 6 \times 5 = 60\pi\ cm^2$$

When $r_1 = 14$ cm and height h_1 cm, then the surface area of cylinder

$$S_2 = 2\pi r_1 h_1 = 2\pi \times 14 h_1$$

According to the given condition,

$$S_1 = S_2$$

$$\Rightarrow \quad 60\pi = 28\pi h_1$$

$$\Rightarrow \quad h_1 = \frac{60}{28} = \frac{15}{7}\ cm$$

Example 4 The volume and curved surface area of a cylinder of length 60 cm with diameter of the base 7 cm are respectively
(a) 2310 cm^3, 1320 cm^2 (b) 2410 cm^3, 1320 cm^2
(c) 2310 cm^3, 1350 cm^2 (d) 2410 cm^3, 1350 cm^2

Sol. *(a)* Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 3.5 \times 3.5 \times 60 = 2310\ cm^3$$

and curved surface area $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 3.5 \times 60 = 1320\ cm^2$$

Example 5 The slant height, volume and curved surface area of a cone of base radius 21 cm and height 28 cm are respectively
(a) 35 cm 12936 cm^3, 2310 cm^2
(b) 35 cm 12930 cm^3, 2320 cm^2
(c) 36 cm 12940 cm^3, 2325 cm^2
(d) None of the above

Sol. *(a)* Slant height, $l = \sqrt{r^2 + h^2} = \sqrt{(21)^2 + (28)^2}$

$$= \sqrt{1225} = 35\ cm$$

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 28 = 12936\ cm^3$$

and curved surface area of cone $= \pi rl$

$$= \frac{22}{7} \times 21 \times 35 = 2310\ cm^2$$

Example 6 A circus tent is cylindrical to a height of 4 m and conical above it. If its diameter is 105 m and its slant height is 40 m. The total area of the canvas required (in m^2) is
(a) 7928 m^2 (b) 7920 m^2
(c) 7923 m^2 (d) None of these

Sol. *(b)* Total area of canvas $= (2\pi rh + \pi rl)$

$$= \left(2 \times \frac{22}{7} \times \frac{105}{2} \times 4 + \frac{22}{7} \times \frac{105}{2} \times 40\right)$$

$$= 1320 + 6600 = 7920\ m^2$$

Example 7 The volume and total surface area of a hemisphere of diameter 21 cm are respectively
(a) 2420 cm^3, 1038 cm^2
(b) 2422 cm^3, 1039 cm^2
(c) 2425.5 cm^3, 1039.5 cm^2
(d) None of the above

Sol. (c) Volume of hemisphere $= \frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$$

$$= 2425.5 \text{ cm}^3$$

and total surface area of hemisphere

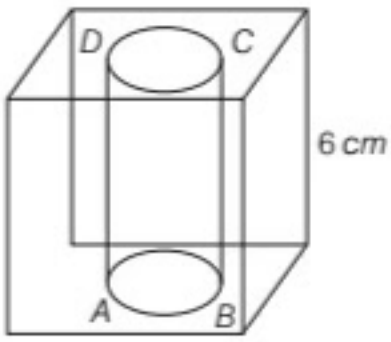
$$= 3\pi r^2 = 3 \times \frac{22}{7} \times 10.5 \times 10.5$$

$$= 1039.5 \text{ cm}^2$$

Example 8 Find the volume of cylinder which is exactly fit into a cube of side 6 cm.

(a) 171 cm^3 (b) 169.71 cm^3
(c) 173 cm^3 (d) None of the above

Sol. (*b*)



Here, height of cylinder = 6 cm

Radius of cylinder $= \frac{6}{2} = 3$ cm

Now, volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times (3)^2 \times 6$$

$$= \frac{1188}{7} = 169.71 \text{ cm}^3$$

PRACTICE EXERCISE

1. The volume of a cuboid is 440 cm^3, the area of its base is 88 cm^2, then its height is
(a) 5 cm (b) 10 cm (c) 11 cm (d) 6 cm

2. The surface area of a cube is 486 sq m, then its volume is
(a) 729 m^3 (b) 781 m^3 (c) 625 m^3 (d) 879 m^3

3. Rectangular sand box is 5 m wide and 2 m long. How many cubic metres of sand are needed to fill the box upto a depth of 10 cm?
(a) 1 m^3 (b) 10 m^3
(c) 100 m^3 (d) 1000 m^3

4. If the height of a cylinder becomes 1/4 of the original height and the radius is doubled, then which of the following will be true?
(a) Volume of the cylinder will be doubled
(b) Volume of the cylinder will remain unchanged
(c) Volume of the cylinder will be halved
(d) Volume of the cylinder will be $\frac{1}{4}$ of the original volume

5. A cube whose side is 5 cm will have surface area is equal to
(a) 125 cm^2 (b) 50 cm^2
(c) 100 cm^2 (d) None of these

6. The maximum length of a pencil that can be kept in a rectangular box of dimensions 8 cm × 6 cm × 2 cm is
(a) $2\sqrt{54}$ cm (b) $2\sqrt{26}$ cm
(c) $2\sqrt{14}$ cm (d) $2\sqrt{13}$ cm

7. The sum of the length, breadth and depth of a cuboid is 20 cm and its diagonal is $4\sqrt{5}$ cm, then its surface area is
(a) 400 cm^2 (b) 420 cm^2
(c) 300 cm^2 (d) 320 cm^2

8. How many 6 m cubes can be cut from a cuboid measuring 18 m × 15 m × 8 m ?
(a) 8 (b) 9 (c) 10 (d) 7

9. The ratio of radii of two cylinders is 1 : 2 and heights are in the ratio 2 : 3. The ratio of their volumes is
(a) 1 : 6 (b) 1 : 9 (c) 1 : 3 (d) 2 : 9

10. Two cubes have volumes in the ratio 1 : 64. The ratio of the areas of a face of first cube to that of the other is
(a) 1 : 4 (b) 1 : 8 (c) 1 : 16 (d) 1 : 32

11. If the volumes of two cubes are in the ratio 8 :1, then ratio of their edges is
(a) 2:1 (b) 4:1 (c) $2\sqrt{2}:1$ (d) 8:1

12. The total surface area of a right circular cylinder whose height is 15 cm and the radius of the base is 7 cm, is
(a) 968 cm^2 (b) 2310 cm^2
(c) 488 cm^2 (d) 1860 cm^2

13. The outer dimensions of a closed wooden box are 10 cm × 8 cm × 7 cm. Thickness of the wood is 1 cm. The total cost of wood required to make box, if 1 cm^3 of wood cost ₹ 2 is
(a) ₹ 540 (b) ₹ 640 (c) ₹ 740 (d) ₹ 780

14. The diameter of a right circular cone is 12 m and the slant height is 10 m. The total surface area of cone is
(a) $\frac{2412}{7}$ m^2 (b) $\frac{2312}{7}$ m^2
(c) $\frac{2112}{7}$ m^2 (d) $\frac{2012}{7}$ m^2

15. The dimensions of a field are 12 m × 10 m. A pit 5 m long, 4 m wide and 2 m deep is dug in one corner of the field and the earth removed has been evenly spread over the remaining area of the field. The level of the field is raised by
(a) 30 cm (b) 35 cm (c) 38 cm (d) 40 cm

16. A plate of metal 1 cm thick, 9 cm broad, 81 cm long is melted into a cube. The difference in the surface area of two solids is
(a) 1152 cm^2 (b) 1150 cm^2
(c) 1052 cm^2 (d) 1050 cm^2

17. The sum of the radius of the base and the height of a cylinder is 37 m. If the total surface area of the solid cylinder is 1628 m^2. The circumference of base of cylinder is
(a) 11 m (b) 22 m (c) 33 m (d) 44 m

18. The volume of a metallic cylindrical pipe is 770 cm^3. Its length is 14 cm and its external radius is 9 cm. Then, its thickness is
(a) 1 cm (b) 1.5 cm
(c) 2 cm (d) 2.5 cm

19. A 20 m deep well with diameter 14 m is dug up and the earth from digging is spread evenly to form a platform 22m ×14 m. The height of platform is
(a) 10 m (b) 15 m
(c) 20 m (d) 25 m

20. The circumference of the base of a 9 m high wooden solid cone is 44 m. The slant height of the cone is
(a) $\sqrt{120}$ m (b) $\sqrt{130}$ m
(c) $\sqrt{150}$ m (d) $7\sqrt{5}$ m

21. How many metres of cloth 50 m wide will be required to make a conical tent, the radius of whose base is 7 m and whose height is 24 m ?
(a) 9 m (b) 11 m (c) 12 m (d) 13 m

22. It is required to make a hollow cone 24 cm high whose base radius is 7 cm. The area of sheet required including the base is
(a) 700 cm^2 (b) 704 cm^2
(c) 708 cm^2 (d) 710 cm^2

23. The radius of a sphere whose surface area is 154 cm^2, is
(a) 3.5 cm (b) 3.6 cm
(c) 3.7 cm (d) None of these

24. A hemispherical bowl made of brass has inner diameter 10.5 cm. The cost of tin plating it on the inside at the rate of ₹ 16 per 100 cm^2 is
(a) ₹ 28 (b) ₹ 27.72
(c) ₹29.27 (d) ₹28.52

25. If the volume of a sphere is double that of the other sphere, then the ratio of their radii is
(a) $2\sqrt{2}:1$ (b) $\sqrt[3]{2}:1$
(c) $1:\sqrt[3]{2}$ (d) 2:1

26. The internal and external diameters of a hollow hemispherical vessel are 24 cm and 25 cm respectively. The total area to be painted is

(a) $\frac{13211}{7}$ cm^2 (b) $\frac{26961}{14}$ cm^2
(c) $\frac{6961}{14}$ cm^2 (d) $\frac{16951}{14}$ cm^2

27. Three cubes each of side 10 cm are joined end to end. The surface area of the resultant figure is

(a) 1400 cm^2 (b) 1500 cm^2
(c) 1450 cm^2 (d) 1550 cm^2

28. Height of a solid cylinder is 10 cm and diameter 8 cm. Two equal conical holes have been made from its both ends. If the diameter of the hole is 6 cm and height 4 cm. The volume of remaining portion is

(a) 24π cm^3 (b) 36π cm^3
(c) 72π cm^3 (d) 136π cm^3

29. The length, breadth and height of a room are in the ratio of 3 : 2 : 1. If its volume be 1296 m^3, its breadth is

(a) 12 m (b) 18 m
(c) 16 m (d) 24 m

30. The diameters of two cones are equal. If their slant height be in the ratio 5 : 7, the ratio of their curved surface areas is

(a) 25 : 7 (b) 25 : 49
(c) 5 : 49 (d) 5 : 7

31. A rectangular paper 11 cm by 8 cm can be exactly wrapped to cover the curved surface of a cylinder of height 8 cm. The volume of the cylinder is

(a) 66 cm^3 (b) 77 cm^3
(c) 88 cm^3 (d) 12 cm^3

32. A cylindrical tube open at both ends is made of metal. The internal diameter of the tube is 11.2 cm and its length is 21 cm. The metal everywhere is 0.8 cm thick. The volume of the metal is

(a) 316 cm^3 (b) 310 cm^3
(c) 306.24 cm^3 (d) 280.52 cm^3

33. A solid right circular cylinder of radius 8 cm and height 2 cm is melted into a right circular cone with radius of the base 8 cm. Its height is

(a) 5 cm (b) 6 cm
(c) 5.75 cm (d) 6.25 cm

34. A hemispherical bowl is made from a metal sheet having thickness 0.3 cm. The inner radius of the bowl is 24.7 cm. The cost of polishing its outer surface at the rate of ₹ 4 per 100cm^2 is (take $\pi = 3.14$)

(a) ₹ 159 (b) ₹ 157
(c) ₹ 160 (d) ₹ 165

35. If the radius of a cylinder is increased from 7 m to 10 m and the surface area of it kept same. If its height is 4 m, then new height will be

(a) 2.8 m (b) 3.1 m
(c) 3.6 m (d) 3.3 m

36. Find the volume of the cone which is exactly fit in the cube of side 8 cm.

(a) 133 cm^3 (b) 134 cm^3
(c) 135 cm^3 (d) None of these

Answers

1	(a)	2	(a)	3	(a)	4	(b)	5	(c)	6	(b)	7	(d)	8	(c)	9	(a)	10	(c)
11	(a)	12	(a)	13	(b)	14	(c)	15	(d)	16	(a)	17	(d)	18	(a)	19	(a)	20	(b)
21	(b)	22	(b)	23	(a)	24	(b)	25	(b)	26	(b)	27	(a)	28	(d)	29	(a)	30	(d)
31	(b)	32	(c)	33	(b)	34	(b)	35	(a)	36	(c)								

Hints and Solutions

1. Height $= \dfrac{\text{Volume of the cuboid}}{\text{Area of its base}}$

$= \dfrac{440}{88} = 5\text{ cm}$

2. Let edge of cube be a.

Surface area of the cube $= 6a^2$

$\therefore \quad 6a^2 = 486$

$\Rightarrow \quad a^2 = 81$

$\Rightarrow \quad a = 9$

$\therefore$ Volume of the cube $= (\text{edge})^3$

$= (9)^3 = 729\text{ m}^3$

3. Sand needed to fill the tank

$= \left(5 \times 2 \times \dfrac{10}{100}\right) = 1\text{ m}^3$

4. We know that, the volume of a cylinder having base radius r and height h is $V = \pi r^2 h$

Now, if new height is $\dfrac{1}{4}$th of the original height and the radius is doubled, i.e.

$h' = \dfrac{1}{4}h$ and $r' = 2r$, then

New volume, $V' = \pi(2r)^2 \times \dfrac{1}{4}h = 4\pi r^2 \times \dfrac{1}{4}h$

$= \pi r^2 h = V$

Hence, the new volume of cylinder is same as the original volume.

5. Now, surface area of cube $= 4(\text{side})^2$

$= 4 \times (5)^2 = 100\text{ cm}^2$

6. Length of longest pencil

= diagonal of the box

$= \sqrt{8^2 + 6^2 + 2^2} = \sqrt{104} = 2\sqrt{26}$ cm

7. Given, $\quad l + b + h = 20\text{ cm}$

and $\quad \sqrt{l^2 + b^2 + h^2} = 4\sqrt{5}$

$\therefore$ Surface area $= 2(lb + bh + hl)$

$= (l + b + h)^2 - (l^2 + b^2 + h^2)$

$= (20)^2 - (4\sqrt{5})^2$

$= 400 - 80 = 320\text{ cm}^2$

8. Volume of cube $= 6 \times 6 \times 6\text{ m}^3$

Volume of cuboid $= 18 \times 15 \times 8\text{ m}^3$

$\therefore$ Required number of cube

$= \dfrac{\text{Volume of cuboid}}{\text{Volume of cube}}$

$= \dfrac{18 \times 15 \times 8}{6 \times 6 \times 6} = 10$

9. Let r_1, r_2 be radii of two cylinders and h_1, h_2 be their heights.

Then, $\dfrac{r_1}{r_2} = \dfrac{1}{2}$ and $\dfrac{h_1}{h_2} = \dfrac{2}{3}$

$\therefore \quad \dfrac{V_1}{V_2} = \dfrac{\pi r_1^2 h_1}{\pi r_2^2 h_2} = \left(\dfrac{r_1}{r_2}\right)^2 \times \dfrac{h_1}{h_2} = \left(\dfrac{1}{2}\right)^2 \times \dfrac{2}{3}$

$= \dfrac{1}{4} \times \dfrac{2}{3} = \dfrac{1}{6} = 1:6 = \dfrac{1}{4} \times \dfrac{2}{3} = \dfrac{1}{6} = 1{:}6$

10. Let a and b be the edges of the two cubes, respectively.

Then, according to the question,

$a^3 : b^3 = 1 : 64 \qquad [\because \text{ volume of cube} = (\text{edge})^3]$

$\Rightarrow \quad \dfrac{a^3}{b^3} = \dfrac{1}{64}$

$\Rightarrow \quad \left(\dfrac{a}{b}\right)^3 = \left(\dfrac{1}{4}\right)^3$

$\Rightarrow \quad \dfrac{a}{b} = \dfrac{1}{4} \qquad$ [taking cube roots on both sides]

Now, ratio of areas, $\left(\dfrac{a}{b}\right)^2 = \left(\dfrac{1}{4}\right)^2$

$[\because \text{ surface area of cube} = 6 \times (\text{edge})^2]$

$\Rightarrow \quad \dfrac{a^2}{b^2} = \dfrac{1}{16}$

$\therefore \quad a^2 : b^2 = 1 : 16$

11. Let the edges of cubes be x and y, then volumes are x^3 and y^3 respectively.

$\therefore \quad \dfrac{x^3}{y^3} = \dfrac{8}{1}$

$\Rightarrow \quad \dfrac{x}{y} = \dfrac{2}{1}$

12. Total surface area of right circular cylinder

$$= 2\pi r\,(h + r) = 2 \times \frac{22}{7} \times 7\,(15 + 7)$$

$$= 2 \times 22 \times 22 = 968 \text{ cm}^2$$

13. External volume of the box

$$= 10 \times 8 \times 7 = 560 \text{ cm}^3$$

Internal dimensions as thickness of wood

$$= 1 \text{ cm}$$

Internal length $= 10 - 2 = 8$ cm,

breadth $= 8 - 2 = 6$ cm, height $= 7 - 2 = 5$ cm

$\therefore$ Internal volume $= 8 \times 6 \times 5 = 240 \text{ cm}^2$

$\Rightarrow$ Volume of wood

$$= \text{External volume} - \text{Internal volume}$$

$$= 560 - 240 = 320 \text{ cm}^3$$

$\therefore$ Total cost of wood required to make the box

$$= 320 \times 2 = ₹\ 640$$

14. Total surface area $= \pi r\,(l + r)$

$$= \frac{22}{7} \times 6 \times (10 + 6) = \frac{2112}{7} \text{ m}^2$$

15. Area of the field = Length × Breadth

$$= 12 \times 10 = 120 \text{ m}^2$$

Area of the pit's surface $= 5 \times 4 = 20 \text{ m}^2$

Area on which the earth is to be spread

$$= 120 - 20 = 100 \text{ cm}^2$$

Volume of earth dug out $= 5 \times 4 \times 2 = 40 \text{ m}^3$

$\therefore$ Level of field raised $= \dfrac{40}{100} = \dfrac{2}{5}$ m

$$= \frac{2}{5} \times 100 = 40 \text{ cm}$$

16. Let the edge of the cube be 'x'.

Then, volume of the cube is

$$x^3 = 9 \times 81 \times 1 \text{ cm}^3 = 729 \text{ cm}^3$$

$\therefore$ $x = \sqrt[3]{729} = 9$ cm

Surface area of metal plate

$$= 2\,(81 \times 9 + 9 \times 1 + 1 \times 81) = 2 \times (819)$$

$$= 1638 \text{ cm}^2$$

Total surface area of the cube

$$= 6\,(\text{edge})^2 = 6\,(9)^2 = 486 \text{ cm}^2$$

$\therefore$ Difference of surface area of two solids

$$= 1638 - 486 = 1152 \text{ cm}^2$$

17. Given, $r + h = 37$ m

and total surface area $= 1628 \text{ m}^2$

$= 2\pi r\,(h + r) = 1628 \text{ m}^2 \Rightarrow 2\pi r\,(37) = 1628$

$\Rightarrow$ $r = \dfrac{1628 \times 7}{2 \times 22 \times 37} = 7$

$\therefore$ Circumference of its base $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 7 = 44 \text{ m}$$

18. External radius, $R = 9$ cm

Internal radius, r cm.

Length of pipe $= 14$ cm

Since, volume of pipe $= 770 \text{ cm}^3$

$\Rightarrow$ Volume of hollow cylinder $= 770$

$\therefore$ $r(R^2 - r^2)h = 770$

$\Rightarrow$ $81 - r^2 = \dfrac{770 \times 7}{22 \times 14} = 17$

$\Rightarrow$ $r^2 = 64 \Rightarrow r = 8$ cm

$\therefore$ Thickness $= R - r = 9 - 8 = 1$ cm

19. Volume of earth dug out from the well

$$\pi r^2 h = \frac{22}{7} \times \left(\frac{14}{2}\right)^2 \times 20$$

$$= 22 \times 7 \times 20 \text{ m}^3$$

Let height of platform be h m.

$\therefore$ Volume of platform $= 22 \times 14 \times h$

$\Rightarrow$ $22 \times 14 \times h = 22 \times 7 \times 20$

$\Rightarrow$ $h = \dfrac{22 \times 7 \times 20}{22 \times 14} = 10$ m

20. Since, circumference of cone $= 44$ m

$\Rightarrow$ $2\pi r = 44 \Rightarrow r = \dfrac{44}{2\pi} = 7$m

$\therefore$ Slant height $= \sqrt{r^2 + h^2} = \sqrt{49 + 81}$

$$= \sqrt{130} \text{ m}^3$$

21. Slant height $= \sqrt{r^2 + h^2} = \sqrt{24^2 + 7^2}$

$$= \sqrt{576 + 49}$$

$$= \sqrt{625} = 25$$

Curved surface area $= \pi rl = \frac{22}{7} \times 7 \times 25 = 550 \text{ m}^2$

Since, width of cloth = 50 m

$\therefore$ Length of required cloth $= \frac{550}{50} = 11$ m

22. Given, $h = 24$ cm, $r = 7$ cm

Now, slant height

$$l = \sqrt{r^2 + h^2}$$
$$= \sqrt{24^2 + 7^2} = \sqrt{576 + 49}$$
$$= \sqrt{625} = 25 \text{ cm}$$

$\therefore$ Area of metal sheet required

= Total surface area of cone

$$= \pi r (l + r) = \frac{22}{7} \times 7 (7 + 25)$$
$$= 22 (32) = 704 \text{ cm}^2$$

23. Let the radius of the sphere be r cm.

Surface area of the sphere $= 154 \text{ cm}^2$

$\therefore \quad 4\pi r^2 = 154$

[$\because$ surface area of a sphere $= 4\pi r^2$]

$$\Rightarrow \quad 4 \times \frac{22}{7} \times r^2 = 154$$
$$\Rightarrow \quad r^2 = \frac{154 \times 7}{22 \times 4} = 12.25$$
$$\Rightarrow \quad r = \sqrt{12.25} = 3.5 \text{ cm}$$

Hence, the radius of the sphere is 3.5 cm.

24. We have, inner diameter = 10.5 cm

$\therefore$ Inner radius $(r) = \frac{10.5}{2} = 5.25$ cm

Curved surface area of hemispherical bowl of inner side $= 2\pi r^2 = 2 \times \frac{22}{7} \times (5.25)^2$

$$= 2 \times \frac{22}{7} \times 5.25 \times 5.25$$
$$= 173.25 \text{ cm}^2$$

$\because$ Cost of tin plating on inside for 100 cm^2

= ₹16

$\therefore$ Cost of tin plating on the inside for 173.25 cm^2

$$= \frac{16 \times 173.25}{100} = ₹\ 27.72$$

25. Let r_1 and r_2 be the radii and V_1, V_2 be its volume of spheres respectively.

Given, $V_1 = 2V_2 \Rightarrow \frac{V_1}{V_2} = 2$

$$\therefore \quad \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{2}{1} \Rightarrow \frac{r_1^3}{r_2^3} = \frac{2}{1}$$
$$\Rightarrow \quad \frac{r_1}{r_2} = \frac{\sqrt[3]{2}}{1}$$

26. Internal radius $(r) = 12$ cm

and external radius $(R) = \frac{25}{2}$ cm

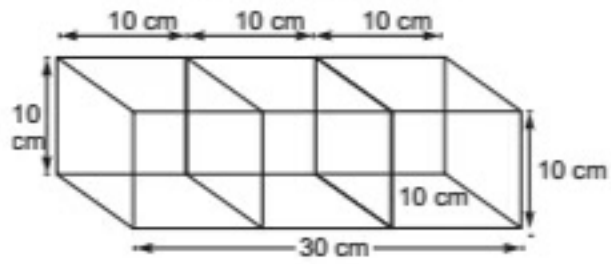
$\therefore$ Area to be painted

= Internal area + External area + Area of edge

$$2\pi r^2 + 2\pi R^2 + \pi (R^2 - r^2)$$
$$= 2 \times \frac{22}{7} \times 12 \times 12 + 2 \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2} + \frac{22}{7}\left(\frac{25}{2} \times \frac{25}{2} - 12 \times 12\right)$$
$$= \frac{6336}{7} + \frac{6875}{7} + \frac{539}{14}$$
$$= \frac{26422}{14} + \frac{539}{14} = \frac{26961}{14} \text{ cm}^2$$

27. If three cubes each of side 10 cm are joined, then a cuboid will be formed of dimensions

30 cm × 10 cm × 10 cm



$\therefore$ Surface area of the cuboid $= 2[lb + bh + hl]$

$$= 2[30 \times 10 + 10 \times 10 + 30 \times 10]$$
$$= 2[300 + 100 + 300] = 2[700] = 1400 \text{ cm}^2$$

28. Volume of cylinder $= \pi(4)^2 \times 10 = 160\pi \text{ cm}^3$

Volume of one cone $= \frac{1}{3} \times \pi \times 3^2 \times 4$

$= 12\pi \text{ cm}^3$

$\therefore$ Volume of both cones $= 24\pi \text{ cm}^3$

$\therefore$ Volume of remaining portion

$= 160\pi - 24\pi = 136\pi \text{ cm}^3$

29. Let the sides be $3x, 2x$ and $1x$.

$\therefore$ Volume $= l \times b \times h$

$\Rightarrow \quad 1296 = 3x \times 2x \times x$

$\Rightarrow \quad 6x^3 = 1296$

$\Rightarrow \quad x^3 = 216 \Rightarrow x = 6$

$\therefore$ Breadth $= 2 \times 6 = 12$ m

30. Ratios of two curved surface area

$= C_1 : C_2 = \pi r l_1 : \pi r l_2$

$= l_1 : l_2 = 5 : 7$

31. $\therefore$ Surface area of cylinder = Area of paper

$\Rightarrow \quad 2\pi rh = l \times b$

$\Rightarrow \quad 2\pi r \times 8 = 11 \times 8$

$\Rightarrow \quad 2\pi r = 11 \Rightarrow r = \frac{11 \times 7}{2 \times 22} = \frac{7}{4}$

$\therefore$ Volume $= \pi \left(\frac{7}{4}\right)^2 \times 8 = 77 \text{cm}^3$

32. Volume of metal $= \pi [R^2 - r^2] h$

$= \frac{22}{7} [6^2 - (5.6)^2] \times 21$

$= 66 \times 4.64$

$= 306.24 \text{ cm}^3$

33. Volume of circular cylinder $= \pi(8)^2(2) = 128\pi$ cm

Volume of right circular cone $= \frac{1}{3}\pi r^2 h$

$\therefore \quad \frac{1}{3}\pi r^2 h = 128\pi$

$\Rightarrow \quad \frac{1}{3} \times \pi \times (8)^2 \times h = 128\pi$

$\Rightarrow \quad h = 6$ cm

34. Given, inner radius of the hemispherical bowl

$= 24.7$ cm

Thickness of metal sheet $= 0.3$ cm

Now, outer radius of the hemispherical bowl

$= 24.7 + 0.3 = 25$ cm

$\therefore$ Outer surface area of the hemispherical bowl

$= 2\pi r^2$

$= 2 \times 3.14 \times (25)^2 = 157 \times 25 = 3925 \text{ cm}^2$

Now, cost of polishing $100 \text{ cm}^2 =$ ₹ 4

$\therefore$ Cost of polishing 3925 cm^2

$= \frac{4 \times 3925}{100} =$ ₹ 157

35. When radius $r = 7$ m and height $h = 4$ m,

then surface area of cylinder, $S_1 = 2\pi rh$

$= 2\pi \times 7 \times 4 = 56\pi \text{m}^2$

When radius $r_1 = 10$ m and height $= h_1$ m,

then surface area of new cylinder,

$S_2 = 2\pi r_1 h_1 = 2\pi \times 10 \times h_1$

$= 20\pi h_1$

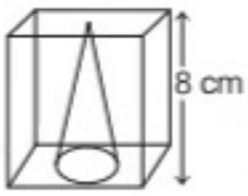
According to the given condition,

$S_1 = S_2$

$\Rightarrow \quad 56\pi = 20\pi \times h_1$

$\Rightarrow \quad h_1 = \frac{56}{20} = 2.8$ m

36. Here, height of cone $h = 8$ cm



and radius of cone $r = \frac{8}{2} = 4$ cm

Now, volume of cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times (4)^2 \times 8$

$= \frac{2816}{21} = 135 \text{ cm}^3$

CHAPTER

14

DATA HANDLING

In this chapter, we study the data in frequency distribution table, representation of there data in various types of graph such as Bar graph Pie chart, Line graph etc. and also study probability of event.

Data

A collection of numerical facts regarding a particular type of information is called data.

(i) **Primary Data** The data collected actually in the process of investigation by the investigator is known as primary data.

(ii) **Secondary Data** Data which is already collected by other persons is called secondary data.

e.g. As investigator collects data related to industries through the government publications.

Organising Data

The initial form of data is in unorganised form, i.e. raw data form. To organise the given data in systematic manner, we use a term frequency.

Frequency

The number of times a particular observation occurs is called frequency.
e.g. The frequency distribution table is shown below.

Subjects	Tally marks	Number of students
Art	卌 II	7
Mathematics	卌	5
Science	卌 I	6
English	IIII	4

Here we see that, the number of students corresponding to each subject are the frequencies.

Grouping Data

Sometimes, the given data is very large, so we make a group. The data arranged in each group is known as class-interval (or class).

Each of group 0-10, 10-20, 20-30, etc, is called class-interval. The upper value of a class-interval is called its upper class limit and the lower value of the class-interval is called its lower class limit.

Here, in the class interval 10-20,
the upper class limit =20

and the lower class limit =10.

Some more related terms of grouping data are given below.

(i) **Width** The difference between the upper class limit and lower class limit of a class is called the width or size of the class-interval.

(ii) **Tally marks** Frequency distribution table involves the tally marks for counting purpose. We use bar (i.e.| |) known as tally marks.

(iii) **Class Frequency** The frequency of a class in a continuous frequency distribution is called as class frequency.

(iv) **Class Marks** It is the mid-value of the class interval.

Class mark

$$= \frac{\text{Lower limit of class + Upper limit of class}}{2}$$

(v) **Range** It is the difference between the highest and the lowest values of the given observation on data.

Example 1 The first and second class interval of a grouped data are 6-12, 12-18. Its fifth class interval is

(a) 20-26 (b) 30-36 (c) 24-30 (d) 31-37

Sol. *(b)* Given, class intervals are 6-12 and 12-18

Here, width of the class is $12 - 6$ i.e. 6

$\therefore$ Then, next class intervals will be 18-24, 24-30, 30-36 etc.

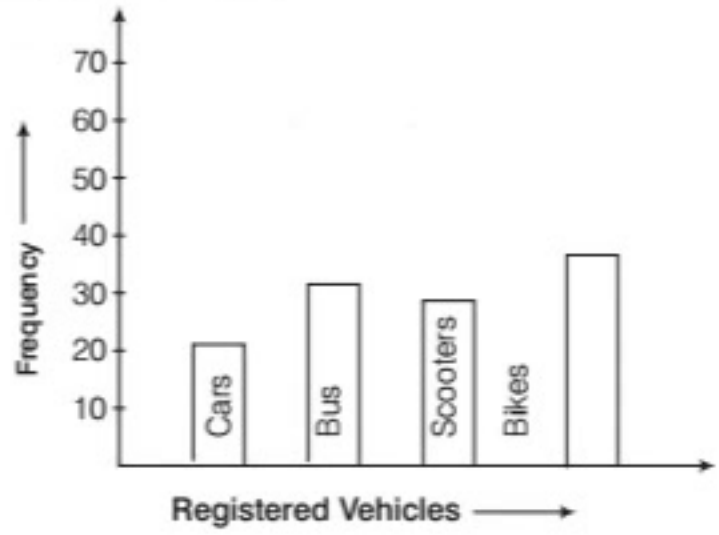
Hence, fifth class interval is 30-36.

Types of Graphical Data

The following types of groups are given below

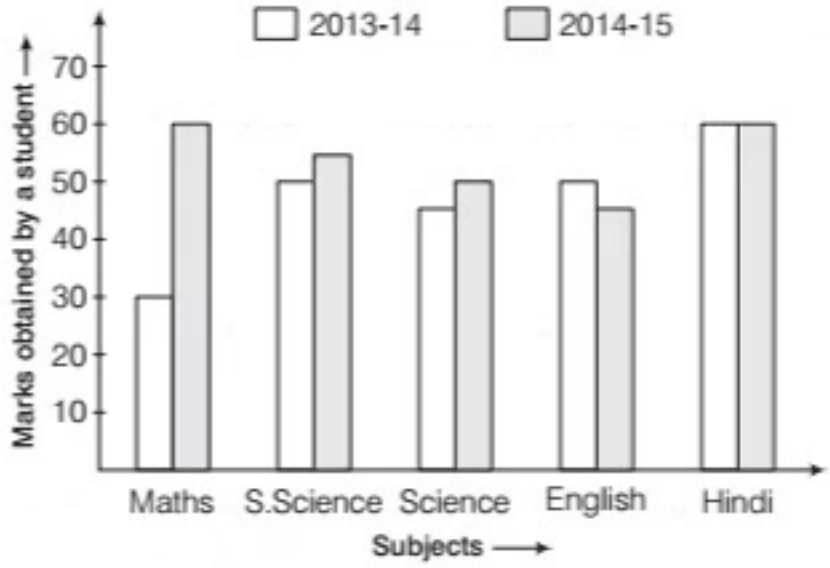
1. Bar Graph

A pictorial representation of numerical data in the form of rectangles (or bars) of uniform width and various heights is called a bar graph, where the commodity taken on the horizontal axis and the heights of the bars (rectangles) show the frequency of the commodity. e.g. The registration of vehicles versus number of vehicles shown through the bar graph.



2. Double Bar Graph

A bar graph showing two sets of data simultaneously is called a double bar graph. It is useful for the comparison of the data.

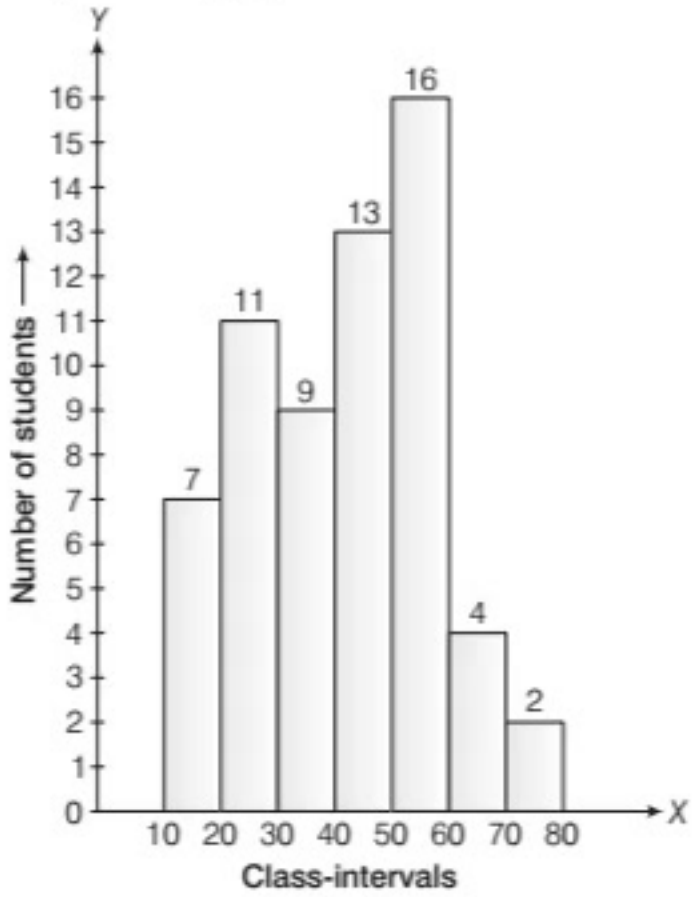


3. Histogram Graph

A histogram is the graphical representation of a grouped frequency distribution in exclusive form with continuous classes in the form of rectangles with class-intervals as bases and the corresponding frequencies as heights.

There is no gap between any two consecutive rectangles.

The shape of the graph is shown below.



4. Pie Chart

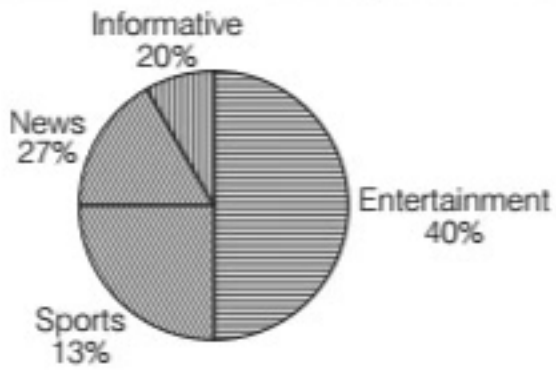
In a pie chart, the various observations or components are represented by the sectors of a circle and the whole circle represents the sum of the values of all components.

The central angle for a component is given by

Central angle for a component

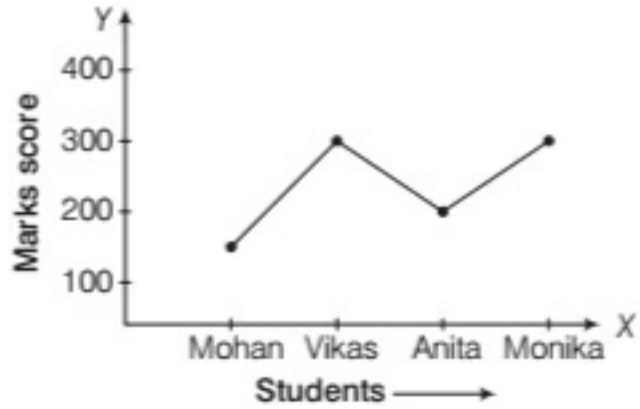
$$= \left(\frac{\text{Value of the component}}{\text{Sum of the values of all components}} \times 360° \right)$$

e.g. The following pie graph shows the percentage of viewers watching different types of TV channels.

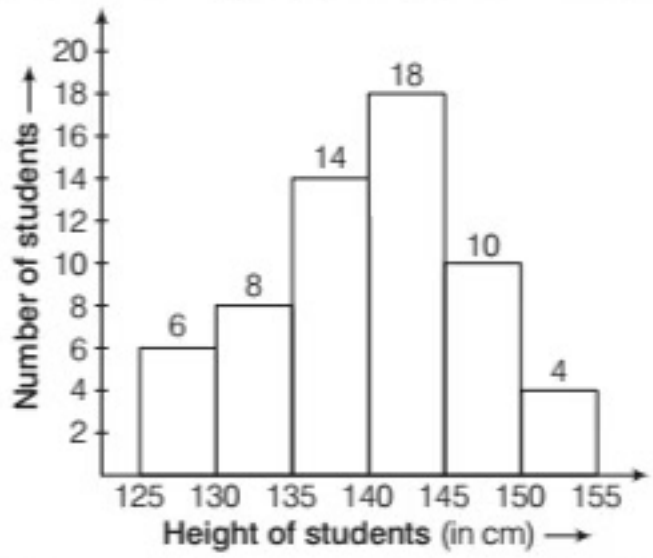


5. Line Graph

A line graph is a graph, which is used to display data that changes continuously over period of time. e.g. The marks score by the students shown through the line graph as given below.



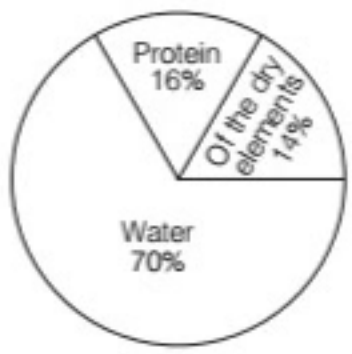
Example 2 In a histogram, the number of students having height less than 140 cm is



(a) 32 (b) 28 (c) 40 (d) 34

Sol. *(b)* Number of students who have height less than 140 cm = 6 + 8 + 14 = 28.

Example 3 The following pie chart gives the distribution of constituents in the human body. The central angle of the sector showing the distribution of protein and other constituents is



(a) 108° (b) 54°
(c) 30° (d) 216°

Sol. *(a)* Distribution of protein and other constituents in human body = 16 + 14 = 30%

Central angle of the sector showing the distribution of protein and other constituents

$$= \frac{30}{100} \times 360° = 108°$$

Experiment

An operation which can produce some well-defined outcomes is called an experiment.

Random Experiment

An experiment in which the outcomes cannot be predicted exactly in advance and all possible outcomes are known, is called random experiment. e.g. On tossing a coin, head or tail are the two outcomes, but you cannot predict, which outcome you will get.

Event

Each outcome of an experiment or a collection of outcomes make an event.

e.g.

(i) Throwing a die and getting each of the outcomes 1, 2, 3, 4, 5 or 6 is an event.

(ii) Tossing a coin and getting a head or a tail is an event.

Negation of an event Negation of an event A is 'not A', which occurs only when A does not occur. It is denoted by '$\overline{A}$'.

Probability of an Event

Let E be an event. Then, the probability of occurrence of E is defined as

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

Note The probability of any event lies between 0 to 1.

Important Points

(i) In tossing a coin, all possible outcomes are $\{H, T\}$.

(ii) In tossing 2 coins, all possible outcomes are $\{HH, HT, TH, TT\}$.

(iii) On rolling a dice, all possible outcomes are $\{1, 2, 3, 4, 5, 6\}$.

(iv) In drawing a card from a well-shuffled deck of 52 cards, it has 4 suits (spades, clubs, hearts and diamonds), each having 13 cards.

In out of 52 cards, 26 cards are black and 26 cards are red.

(a) Cards of spades and clubs are black cards.

(b) Cards of hearts and diamonds are red cards.

(c) Kings, queens and jacks (or knaves) are known as face cards.

Thus, there are in 12 face cards.

Example 4 The two coins are tossed together. The probability of getting two heads together is?

(a) $\frac{1}{4}$ (b) $\frac{2}{4}$ (c) $\frac{1}{2}$ (d) 1

Sol. *(a)* When two coins are tossed together, all possible outcomes are – $\{HH, HT, TH, TT\}$

$\therefore$ Number of all possible outcomes = 4

Possibility of getting two heads together $= \frac{1}{4}$

Example 5 A dice is thrown. What is the probability of getting a prime number?

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{1}{5}$

Sol. *(b)* In throwing a die, all possible outcomes are 1, 2, 3, 4, 5, 6.

$\therefore$ Number of all possible outcomes = 6

Prime numbers are 2, 3, 5.

Number of prime numbers = 3

$\therefore P(\text{getting a prime number}) = \frac{3}{6} = \frac{1}{2}$

Example 6 From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the card drawn is an ace?

(a) $\frac{2}{13}$ (b) $\frac{3}{13}$ (c) $\frac{1}{13}$ (d) $\frac{5}{13}$

Sol. *(c)* Total number of cards = 52

Total number of possible outcomes = 52.

Number of all aces = 4.

$\therefore \quad P(\text{getting an ace}) = \frac{4}{52} = \frac{1}{13}$

PRACTICE EXERCISE

1. A graph that displays data that changes continuously over periods of time is
   (a) bar graph (b) pie chart
   (c) histogram (d) line graph

2. The range of the data 30, 61, 55, 56, 60, 20, 26, 46, 28, 56 is
   (a) 26 (b) 30
   (c) 41 (d) 61

3. Which of the following is not a random experiment?
   (a) Tossing a coin
   (b) Rolling a die
   (c) Choosing a card from a deck of 52 cards
   (d) Throwing a stone to the roof of a building

4. Tally marks are used to find
   (a) class intervals
   (b) range
   (c) frequency
   (d) upper limit

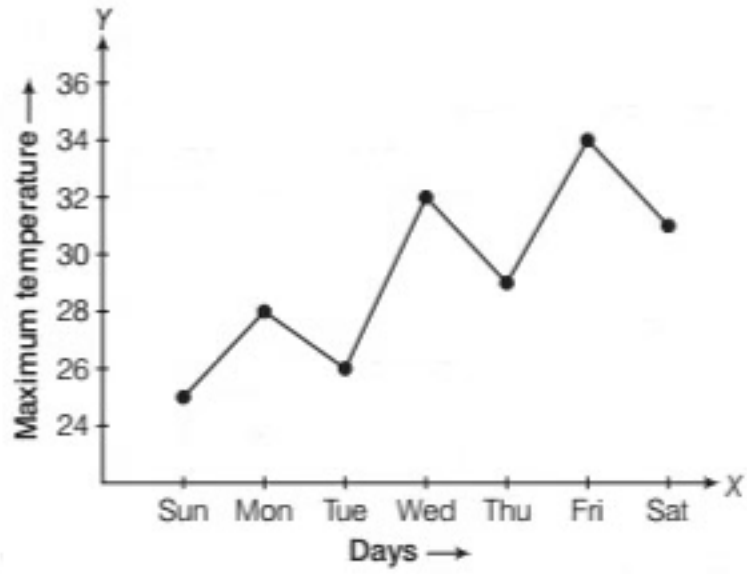
5. In a frequency distribution with classes 0-10, 10-20 etc., the size of the class intervals is 10. The lower limit of fourth class is
   (a) 40 (b) 50
   (c) 20 (d) 30

6. Monthly salary of a person is ₹ 15000. The central angle of the sector representing his expenses on food and house rent on a pie chart is 60°. The amount he spends on food and house rent, is
   (a) ₹ 5000 (b) ₹ 2500
   (c) ₹ 6000 (d) ₹ 9000

7. The first and second class interval of a grouped data are 5-15, 15-25, 25-35. Its sixth class interval is
   (a) 65-70 (b) 44-55
   (c) 45-50 (d) 55-65

8. The class mark of the interval 13.5-18.5 is
   (a) 15 (b) 16
   (c) 14 (d) 13

Directions (Q. Nos. 9-11) *Study the graph and answer the questions that follow.*

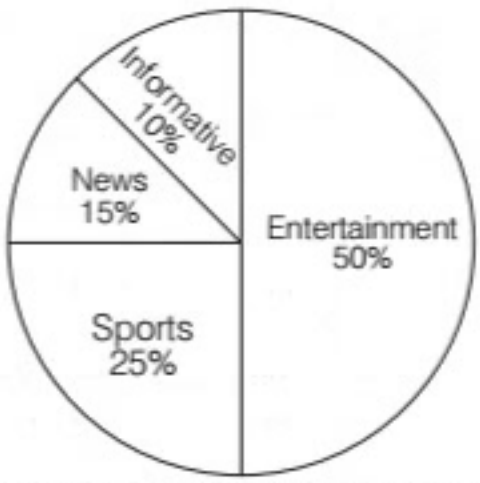


9. On which day the temperature was least?
   (a) Sunday
   (b) Monday
   (c) Friday
   (d) None of the above

10. On which day the temperature was 31°C?
    (a) Monday (b) Saturday
    (c) Tuesday (d) Friday

11. Which was the hottest day?
    (a) Monday (b) Friday
    (c) Tuesday (d) Saturday

Directions (Q.Nos. 12 and 13) *A pie chart is given below.*



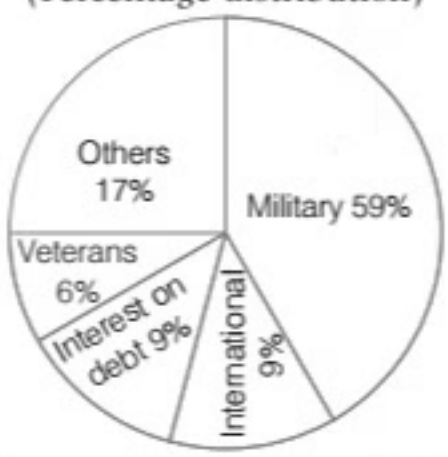
Viewers watching different types of channels on TV

12. Which type of programmes are viewed the most?
(a) Entertainment viewers
(b) Informative viewers
(c) Sports viewers
(d) None of the above

13. Which two types of programmes have number of viewers equal to those watching sports channels?
(a) News and Sports
(b) News and Informative
(c) News and Entertainment
(d) None of the above

Directions (Q. Nos. 14 and 15) *Study the following pie chart and answer the questions that follow.*

National budget expenditure in the year 2012
(Percentage distribution)

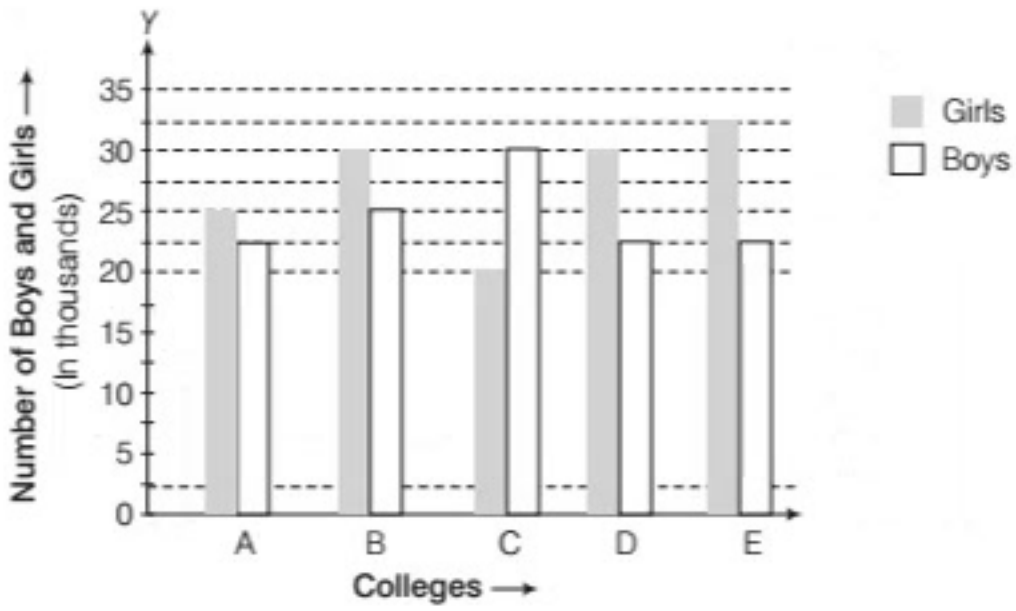


14. In year 2012, if India had a total expenditure of ₹ 120 billion, then how many billions did it spend on interest on debt?
(a) ₹ 10.8 billion
(b) ₹ 11.2 billion
(c) ₹ 11.50 billion
(d) ₹ 11.70 billion

15. If ₹ 9 billion were spent in year 2012 for veterans, then what would have been the total expenditure for that year (in billions)?
(a) ₹ 160 billion
(b) ₹ 165 billion
(c) ₹ 150 billion
(d) ₹ 170 billion

Directions (Q. Nos. 16 and 17) *Study the following graph carefully and answer the questions given below.*

Total Number of Boys and Girls in Various Colleges (Number in Thousands)



16. What is the average number of girls from all the colleges together?
(a) 25000 (b) 27500
(c) 27000 (d) 25500

17. What is the difference between the total number of girls and the total number of boys from all the colleges together?
(a) 13500 (b) 14000
(c) 15000 (d) 16000

18. A dice is throw, find the probability of getting not even number?
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{5}$ (d) $\frac{1}{3}$

19. What is the probability of choosing a vowel from the alphabets?
(a) $\frac{21}{26}$ (b) $\frac{5}{26}$ (c) $\frac{1}{26}$ (d) $\frac{3}{26}$

20. A coin is tossed 12 times and the outcomes are observed as shown below

The chance of occurrence of head is
(a) $\frac{1}{2}$ (b) $\frac{5}{12}$ (c) $\frac{7}{12}$ (d) $\frac{5}{7}$

21. Ram puts some buttons on the table. There were 4 blue, 7 red, 3 black and 6 white buttons in all. All of a sudden, a cat jumped on the table and knocked out one button on the floor. What is the probability that the button on the floor is blue?
(a) $\frac{7}{20}$ (b) $\frac{3}{5}$ (c) $\frac{1}{5}$ (d) $\frac{1}{4}$

22. Two coins are tossed simultaneously. What is the probability of getting one head and one tail?
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) $\frac{2}{3}$

23. A bag contains 3 white and 2 red balls. One ball is drawn at random. What is the probability that the ball drawn is red?
(a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{1}{5}$ (d) $\frac{2}{5}$

24. A dice is thrown. What is the probability of getting 6?
(a) 1 (b) $\frac{1}{6}$
(c) $\frac{5}{6}$ (d) None of these

25. A dice is thrown. What is the probability of getting an even number?
(a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{5}{6}$ (d) $\frac{1}{6}$

26. From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the drawn card is a queen?
(a) $\frac{1}{4}$ (b) $\frac{1}{52}$ (c) $\frac{1}{13}$ (d) $\frac{1}{26}$

27. From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the drawn card is a black 6?
(a) $\frac{3}{26}$ (b) $\frac{1}{26}$ (c) $\frac{1}{13}$ (d) $\frac{1}{52}$

28. Numbers 1 to 10 are written on ten separate slips (one slip of one number), kept in a box and mixed well. One slip is chosen from the box without looking into it. What is the probability of getting a number less than 6?
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{5}$

Answers

1	(d)	2	(c)	3	(d)	4	(c)	5	(d)	6	(b)	7	(d)	8	(b)	9	(a)	10	(b)
11	(b)	12	(a)	13	(b)	14	(a)	15	(c)	16	(b)	17	(c)	18	(b)	19	(b)	20	(b)
21	(c)	22	(b)	23	(d)	24	(b)	25	(a)	26	(c)	27	(b)	28	(a)				

Hints and Solutions

1. Line graph is an important way to represent and compare the data which varies continuously.

A line graph displays the relation between two varying quantities.

In a line graph, we connect all the points by a line segment while in bar graph and histogram, we use rectangles of uniform width.

2. Range of data

= Maximum value – Minimum value

= 61 – 20 = 41

3. Tossing a coin, rolling a die and choosing a card from a deck of 52 cards are the random experiments, as we don't have an idea about the output of these experiments. But if we throw a stone to the roof of a building, we know that output, it will fall on the ground.

4. Tally marks are used to find the frequency of the observations.

5. Given classes are 0-10 and 10-20.

As, the class of given classes is 10, so the next classes will be 20-30 and 30-40.

As, the fourth class is 30-40.

Hence, the lower limit of fourth class is 30.

6. Central angle of the sector representing his expenses on food and house rent on a pie chart

$= 60°$

Part of the monthly salary he is expending on food and house rent $= \frac{60°}{360°} = \frac{1}{6}$

Hence, the amount he spends on food and house rent $= \frac{1}{6} \times$ Monthly salary

$= \frac{1}{6} \times 15000 =$ ₹ 2500

7. Given class intervals are 5-15, 15-25 and 25-35

Here, width of the class is 15-5 i.e. 10.

∴ The next class intervals will be

35-45, 45-55, 55-65 etc

Hence, sixth class interval is 55-65.

8. Class mark $= \frac{\text{Lower limit} + \text{Upper limit}}{2}$

$= \frac{13.5+18.5}{2} = \frac{32.0}{2} = 16$

9. On Sunday, the temperature was 25°C. So, it is least temperature in the week.

10. On Saturday, the temperature was 31°C.

11. On Friday, the temperature was maximum i.e. 34°C. Hence, it is the hottest day of the week.

12. From the given pie chart, we have the following table :

Types of viewers	Percentage
Sports viewers	25
News viewers	15
Informative viewers	10
Entertainment viewers	50

Since, percentage of entertainment is highest, so entertainment programme are viewed the most.

13. Here, the number of viewers watching news = 15%

Number of viewers watching informative = 10%

∴ Sum of number of viewers watching news and informative = (15 + 10)% = 25%

= Number of viewers watching sports

Hence, news and informative programmes have number of viewers equal to those watching sports channel.

14. Total expenditure = ₹ 120 billion

∴ Expenditure of interest on debt = 9% of 120

$= \frac{9}{100} \times 120 =$ ₹ 10.8 billion

15. ₹ 9 billion were spent for veterans. 6% of the total expenditure was spent on veterans in the year 2012.

Hence, the total expenditure

$= \frac{9}{6} \times 100 =$ ₹ 150 billion

16. Total number of girls

= (25+ 30+ 20+ 30+ 32.5) thousands

= 137.5×1000=137500

Average number of girls $= \frac{137500}{5} = 27500.$

17. Total number of boys

$=(22.5+25+30+22.5+22.5)$ thousands

$=(122.5\times1000)=122500$

Total number of girls $=137500$

Required difference $=(137500-122500)=15000$.

18. The probability of getting not even number

= Probability of getting odd number

$=\frac{3}{6}=\frac{1}{2}$ [$\because$ Odd numbers in a die are 1, 3, 5]

19. Total number of alphabets = 26

Total number of vowels = 5

$\therefore$ Probability of choosing a vowel from the alphabets $=\frac{\text{Total number of vowels}}{\text{Total number of alphabets}}=\frac{5}{26}$

20. Total number of times a coin is tossed = 12

Total number of occurrence of head = 5

$\therefore$ The chance of occurrence of head

$=\frac{\text{Number of times head appeared}}{\text{Number of times a coin is tossed}}=\frac{5}{12}$

21. Total number of buttons $=4+7+3+6=20$

$\therefore$ Probability that button on the floor is blue

$=\frac{\text{Number of blue buttons}}{\text{Total number of buttons}}=\frac{4}{20}=\frac{1}{5}$

22. Total number of outcomes $=2\times2=4$

Number of favourable outcomes

$=2$ [i.e. (H, T), (T, H)]

$\therefore$ Probability of getting one head and one tail

$=\frac{2}{4}=\frac{1}{2}$

23. Total number of balls $=3+2=5$ balls

Number of favourable outcomes = Number of red balls = 2

$\therefore$ Probability of getting a red ball $=\frac{2}{5}$

24. Total number of outcomes in a die = 6

Number of favourable outcomes = 1

$\therefore$ P (getting 6) $=\frac{1}{6}$

25. Total number of outcomes in a die = 6

Number of favourable outcomes = 3

[$\because$ even numbers are 2, 4, 6]

$\therefore P$ (getting even number) $=\frac{3}{6}=\frac{1}{2}$

26. Total number of outcomes in a deck of cards

= 52

Number of favourable outcomes (queen) = 4

$\therefore P$ (getting queen) $=\frac{4}{52}=\frac{1}{13}$

27. Total number of outcomes = 52

Number of favourable outcomes = 2

$\therefore P$ (getting card of black 6) $=\frac{2}{52}=\frac{1}{26}$

28. Total number of outcomes = 10

Number of favourable outcomes = 5

$\therefore P$ (getting number less than 6) $=\frac{5}{10}=\frac{1}{2}$

JAWAHAR
NAVODAYA
VIDYALAYA

PRACTICE SETS

Jawahar Navodaya Vidyalaya
Entrance Exam (Class IX)
PRACTICE SET 01

Instructions

1. This question paper contains 100 questions, which is divided into following four sections
   Section I English (15 Questions); **Section II** Hindi (15 Questions) and
   Section III Mathematics (35 Questions); **Section IV** General Science (35 Questions).
2. Each question carries 1 Mark.
3. The candidate is expected to attempt all the questions.

Section I English

Directions (Q. Nos. 1-5) *Read the passage carefully and choose the best answer to each question out of the four alternatives.*

Passage

Chameleons can make their skin colour change, but not because they decide to. The colour changes to help the chameleon avoid its enemies. It is a form of camouflage, a disguise that lets it blend in with its surroundings. The changes are actually determined by environmental factors, such as light and temperature.

Bright sunlight causes the skin to get darken. On cool nights, the colour fades to a creamy colour. The colour also changes when chameleons are excited, angry or afraid. The colour change is rapid and increases when the chameleon is handled, injured, or approached by another chameleon.

There are many types of chameleons. Almost half of them are found on the African Island of Madagascar. The others mostly occur in the Sahara desert, with few in Western Asia and Southern Europe. Chameleons live in trees; where they usually eat insects. Very large chameleons may even use their sticky tongues to catch birds.

1. A chameleon's colour changes to help it
   (a) fly away
   (b) look beautiful
   (c) avoid its enemies
   (d) attract prey
2. Chameleons change colour when they are
   (a) excited, angry or hungry
   (b) afraid, excited or angry
   (c) angry, excited or happy
   (d) afraid, angry or hungry
3. The colour changing ability of a chameleon is a form of camouflage which is a
   (a) colour that fades
   (b) disguise that lets it blend in with its surroundings
   (c) dance done by chameleons
   (d) disease which affects chameleons
4. The colour changes are determined by
   (a) light and wind
   (b) light and pressure
   (c) light and temperature
   (d) pressure and temperature
5. Half of the world's chameleons are found
   (a) on the Asian Island of Madagascar
   (b) in the Sahara Desert
   (c) on the African Island of Madagascar
   (d) in the continent of Asia

Directions (Q. Nos. 6-8) *Fill in the blanks with the correct parts of speech from the given alternatives.*

6. How much did you spend ..... roses?
   (a) in (b) on
   (c) of (d) from
7. I could hardly recognise him ..... I saw him.
   (a) after (b) but
   (c) and (d) when

8. Our teacher encouraged ..... setting the poem to music.
(a) his (b) him (c) he (d) he's

9. Choose the correct passive form of the given sentence from the following
Don't subject the animals to cruelty
(a) The animals are not to be subjected to cruelty.
(b) The animals shall not be subjected to cruelty.
(c) The animals will not be subjected to cruelty.
(d) The animals should not be subjected to cruelty.

Directions (Q. Nos. 10-11) *Fill in the blanks with a suitable clause to complete the sentences*

10. No one knows..... .
(a) who he is (b) whom he is
(c) why he is (d) when he is

11. She will not let you go ..... .
(a) unless you will bless her.
(b) unless you do not bless her.
(c) unless you bless her. (d) if you bless her.

Directions (Q. Nos. 12-13) *In the following questions, choose the one which best expresses the meaning of the given word*

12. Humiliation
(a) Elimination (b) Dishonor
(c) Irritation (d) Damage

13. Valient
(a) Courageous (b) Quarrelsome
(c) Cheerful (d) Repulsive

Directions (Q. Nos. 14-15) *In the following questions choose the word opposite in meaning to the given word.*

14. Boisterous
(a) Naughty (b) Quiet
(c) Reserved (d) Bouncy

15. Veteran
(a) Activist (b) Enthusiast
(c) Novice (d) Master

Section II हिन्दी

निर्देश (प्र. सं. 16-20) *दिए गए अनुच्छेद को ध्यानपूर्वक पढ़िए और उससे सम्बन्धित प्रश्नों के उत्तर दीजिए।*

देश और जाति के उत्थान में शिक्षा पहला सोपान है। बिना शिक्षा के देश न तो कृषि सम्बन्धी उन्नति कर सकता है और न औद्योगिक। वैज्ञानिक शिक्षा का अभाव हमारे औद्योगिक पिछड़ेपन का मूल कारण है। हमारे लुहार-मजदूरों को सैद्धान्तिक ज्ञान का अभाव रहता है, इसलिए वे नए आविष्कार करने में असमर्थ रहते हैं। शिक्षा के बिना मनुष्य अपने प्रारम्भिक आविष्कारों की भी माँग नहीं कर सकता और न अपने स्वाभिमान को सुरक्षित रख सकता है। शिक्षा के बिना रहन-सहन का स्तर भी ऊँचा नहीं उठ सकता। बहुत से सम्पन्न लोग भी धन का सदुपयोग शिक्षा के अभाव के कारण नहीं कर सकते।

16. देश और जाति के उत्थान के लिए प्रथम चरण है
(a) औद्योगिक उन्नति (b) कृषि सम्बन्धी उन्नति
(c) शिक्षा (d) सैद्धान्तिक ज्ञान

17. औद्योगिक पिछड़ेपन का मूल कारण है
(a) वैज्ञानिक शिक्षा
(b) वैज्ञानिक शिक्षा का अभाव
(c) शिक्षा
(d) उपरोक्त में से कोई नहीं

18. अपने स्वाभिमान को सुरक्षित रख सकता है
(a) मजदूर (b) उच्च वर्ग
(c) शिक्षित वर्ग (d) निम्न वर्ग

19. 'सम्पन्न' का विलोम शब्द होगा
(a) विपत्ति (b) संपत्ति
(c) विपन्न (d) कृपण

20. शिक्षा के अभाव में क्या सम्भव नहीं होता
(a) धन का सदुपयोग (b) धन का दुरुपयोग
(c) व्यवसाय करना (d) इनमें से कोई नहीं

21. 'आँखों का तारा होगा' का उपयुक्त अर्थ है
(a) आँखों में पानी आना
(b) अधिक प्रिय होना
(c) अप्रिय होना
(d) तारे देखना

22. शुद्ध रूप छाँटिए
(a) व्यक्त (b) व्यकत
(c) तयक्त (d) तयक्त

23. 'आदि से उपरान्त अन्त तक' को कहते हैं
(a) अधोपन्त (b) अद्योपान्त
(c) समाप्त (d) छह

24. निम्न में कौन द्विगु समास नहीं है?
(a) नवरात्र (b) नवग्रह
(c) चतुर्भुज (d) त्रिलोक

25. 'यहीं बैठकर पढ़ो' ..... वाक्य का उदाहरण है।
(a) विधिवाचक (b) इच्छावाचक
(c) संकेतवाचक (d) आज्ञावाचक

26. 'नीलिमा रोती है' वाक्य में कौन-सी क्रिया है?
(a) सकर्मक (b) द्विकर्मक
(c) अकर्मक (d) सकारक

27. 'वृक्ष से पत्ता गिरा' वाक्य में रेखांकित शब्द में कारक है
(a) कर्ता (b) करण (c) कर्म (d) अपादान

28. 'वधू' का पर्यायवाची शब्द है
(a) इन्दिरा (b) दारा (c) भानु (d) अक्षर

29. 'उत्थान' का विलोम शब्द है
(a) पवन (b) प्रगति
(c) विपत्ति (d) उपरोक्त में से कोई नहीं

30. निम्न में से कौन-सा वाक्य शुद्ध है?
(a) ईश्वर के अनेक नामों हैं
(b) ईश्वर के अनेक नाम है
(c) ईश्वर के अनेकों नाम हैं
(d) ईश्वर के अनेक नाम हैं

Section III Mathematics

31. The difference in the measures of two complementary angles is 12°, then the measures of the angles, are
(a) $51^\circ, 39^\circ$ (b) $60^\circ, 30^\circ$
(c) $45^\circ, 45^\circ$ (d) $51^\circ, 51^\circ$

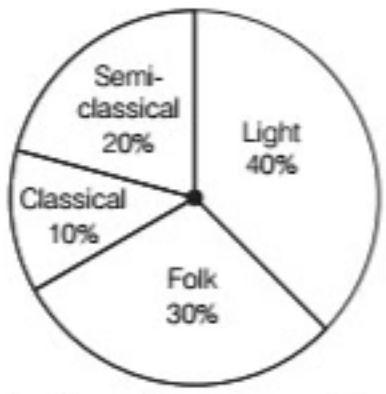
32. The surface area of a sphere of diameter 14 cm, is
(a) $166\ cm^2$ (b) $196\ cm^2$ (c) $661\ cm^2$ (d) $616\ cm^2$

33. The sum of three consecutive even numbers is 138, then the greatest of these numbers is
(a) 44 (b) 46 (c) 42 (d) 48

34. The factorisation of $84 - 2r - 2r^2$, is
(a) $(6 - r)(r + 7)$ (b) $(7 - r)(r + 6)$
(c) $2(6 - r)(r + 7)$ (d) $2(7 - r)(r + 7)$

35. If $\frac{x^2 + y^2}{x^2 - y^2} = \frac{17}{8}$, then the value of $x : y$, is
(a) 3:5 (b) 5:3
(c) 3:8 (d) 5:8

Directions (Q. Nos. 36-37) *A pie chart is given below*



Peoples like different type of music

36. Which type of music is liked by the maximum number of people ?
(a) Semi-Classical (b) Classical
(c) High (d) Folk

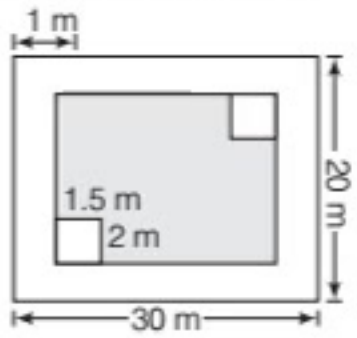
37. If a cassette company were to make 1000 CD'S, how many of semi-classical and folk would they make ?
(a) 200, 400 (b) 100, 300
(c) 200, 300 (d) 100, 400

38. The value of $\frac{\sqrt{24} + \sqrt{216}}{\sqrt{96}}$, is
(a) 8 (b) 6 (c) 4 (d) 2

39. Navin purchased a cellphone for ₹ 12000 and sold it for ₹ 8000, then his loss per cent, is
(a) 30% (b) 33% (c) $33\frac{1}{3}\%$ (d) $34\frac{1}{3}\%$

40. The value of $(3x + 2y)^2 + (3x - 2y)^2$, is
(a) $9x^2 + 4y^2$ (b) $18x^2 + 8y^2$
(c) $12xy$ (d) $24xy$

41. There are two rectangular flower beds of size 1.5 m × 2 m each in the park as shown in the given figure and the rest has grass on it, then the area covered by grass, is



(a) $498\ m^2$ (b) $948\ m^2$
(c) $894\ m^2$ (d) $849\ m^2$

42. Efficiency of Kanchan is four times to that of Hina. If they will complete the work is 24 days by working together, then in how many days can Hina alone complete the work ?
(a) 36 days (b) 24 days
(c) 144 days (d) 96 days

43. The sum required to earn a monthly interest of ₹ 1500 at 5% per annum at simple interest.
(a) ₹ 360000 (b) ₹ 36000
(c) ₹ 180000 (d) ₹ 18000

44. 30 persons can reap a field in 17 days. How many more persons should be engaged to reap the same field in 10 days ?
(a) 17 (b) 30 (c) 51 (d) 21

45. A negative integer and a positive integer whose difference is +2, are
(a) −1, 3 (b) −2, 4
(c) −1, 1 (d) −4, 6

46. Six bells begin to toll together at the interval of 10 s, 15sec, 20sec, 25sec, 30sec, 35sec respectively , then how many times will they toll together in the span of 7 h ?
(a) 12 (b) 10 (c) 8 (d) 6

47. Difference of two perfect cubes is 189. If the cube root of the smaller of the two numbers is 3, the cube root of the larger number, is
(a) 27 (b) 36
(c) 9 (d) 6

48. If $p(x) = x^3 - 4x^2 + x + 6$, then the value of $p(3)$ is
(a) 27 (b) 10 (c) 4 (d) 0

49. If $a : b = 5 : 3$, then the value of $(5a + 8b) : (6a - 7b)$, is
(a) 9 : 49 (b) 49 : 9
(c) 11 : 50 (d) 50 : 11

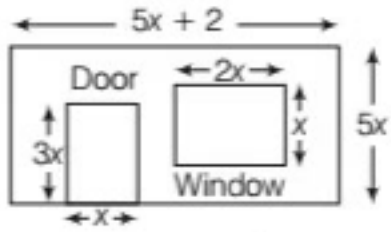
50. If you have a spinning wheel with 3 green sectors, 5 black sectors and 10 red sectors , then the probability of getting a non-black sector, is
(a) $\frac{1}{9}$ (b) $\frac{1}{6}$
(c) $\frac{5}{9}$ (d) $\frac{13}{18}$

51. The value of $\sqrt{248 + \sqrt{52 + \sqrt{144}}}$, is
(a) 17 (b) 16 (c) 15 (d) 14

52. Find the compound interest on ₹ 48000 for one year at 8% per annum, when compunded half-yearly.
(a) ₹ 51916 (b) ₹ 51916.80
(c) ₹ 3916.80 (d) ₹ 3910.80

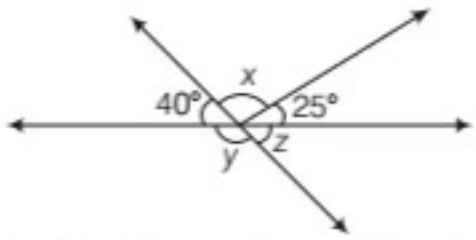
53. If lemons were bought at ₹ 48 per dozen and sold at the rate of ₹ 48 per 10, then the gain or loss per cent, is
(a) 40% profit (b) 40% loss
(c) 20% profit (d) 20% loss

54. The alongside figure shows the dimensions of a wall having a window and a door of a room. Then, the algebraic expression for the area of the wall to be painted, is



(a) $x(2x + 1)$ sq unit (b) $2x(x + 1)$ sq unit
(c) $10x(2x + 1)$ sq unit (d) $(x + 1)$ sq unit

55. The values of the angles x, y and z are respectively, (see figure)



(a) 115°, 140°, 40° (b) 40°, 140°, 115°
(c) 140°, 40°, 115° (d) 115°, 40°, 140°

56. If $5^{3x-1} \div 25 = 125$, then the value of x, is
(a) 4 (b) 3
(c) 2 (d) 1

57. If $x - \frac{1}{x} = 7$, then the value of $x^2 + \frac{1}{x^2}$, is
(a) 49 (b) 50 (c) 51 (d) 52

58. A pair of integers whose product is −36 and whose difference is 15, is
(a) −3, 12 (b) −12, 3 (c) 9, −4 (d) 4, −9

59. The HCF of $\frac{12}{7}, \frac{18}{7}, \frac{24}{7}$, is
(a) 12/7 (b) 6/7 (c) 4/7 (d) 3/7

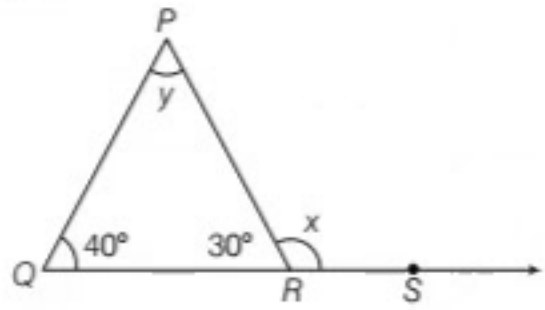
60. By prime factorisation , the value of the cube root of 5832, is
(a) 16 (b) 17 (c) 18 (d) 19

61. If two interior angles on the same side of a transversal intersecting two parallel lines are in the ratio 3 : 2 , then the greater of the two angles, is
(a) 72° (b) 36°
(c) 108° (d) 44°

62. The nature of $(-5 + 2\sqrt{5} - \sqrt{5})$ is
(a) natural (b) integer
(c) rational (d) irrational

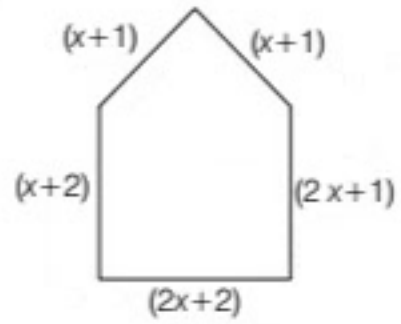
63. If the total surface area of a cube is 486 cm^2, then its lateral surface area.
(a) 243 cm^2 (b) 342 cm^2
(c) 324 cm^2 (d) 432 cm^2

64. In the following figure, then the value of $2x$, is



(a) 300° (b) 200° (c) 100° (d) 50°

65. For what value of x, the perimeter of shape is 77 cm?



(a) 14 cm (b) 12 cm (c) 10 cm (d) 8 cm

Section IV Science

66. The normal range of vocal cords in women is
(a) 20 mm (b) 10 mm (c) 15 mm (d) 40 mm

67. The loudness of sound is determined by its
(a) amplitude of vibration
(b) ratio of amplitude and frequence of vibration
(c) frequency of vibration
(d) product of amplitude and frequency of vibration

68. Galvanisation is a process used to prevent the rusting of which of the following?
(a) Iron (b) Zinc
(c) Aluminium (d) Copper

69. Silk fibre is obtained from
(a) Fleece of sheep (b) Cotton ball
(c) Cocoon (d) shiny jute stalk

70. During dry weather while combing hair, sometimes we experience hair flying apart. The force responsible for this is
(a) force of gravity (b) electrostatic force
(c) force of friction (d) magnetic force

71. On heating one end of iron rod, other end also gets heated. Such materials are called
(a) good conductor of heat (b) good insulator of heat
(c) bad conductor of heat (d) heater

72. Which one records the distance travelled by a vehicle?
(a) Speedometer (b) Manometer
(c) Motometer (d) Odometer

73. The pressure exerted by liquid due to increase in depth
(a) reduces
(b) increases
(c) remains same
(d) depends on the nature of liquid

74. Which of the following is not always necessary to observe a shadow?
(a) Sun (b) Screen
(c) Source of light (d) Opaque object

75. The objects which partially allow the light to pass through it are called
(a) transparent (b) luminous
(c) opaque (d) translucent

76. Which of the following can never form a circular shadow?
(a) A ball (b) A flat disc
(c) A shoe box (d) An icecream cone

77. Bouncing back of ray of light from shining surface on which it was incident is known as
(a) refraction (b) bending
(c) reflection (d) dispersion

78. Circuit breaker device which can be used in place of fuse in domestic electric wiring is called
(a) DCB (b) MCD (c) MCB (d) BCM

79. If the number of turns in the coil of an electromagnet is more, the strength of the electromagnet will be
(a) lesser (b) greater
(c) double (d) same

80. Which of the following characteristic is most suitable material for making the care of an electromagnet?
(a) Brass (b) Aluminium
(c) Iron (d) Steel

81. Amount of heat required to warm an object depends on
(a) mass of object
(b) temperature change
(c) nature of substance
(d) All of the above

82. At atmospheric pressure, water boils at 100° C. If pressure is reduced, then
(a) it still boils at same temperature
(b) it now boils at a lower temperature
(c) it now boils at a higher temperature
(d) it does not boil at all

83. An iron ball at 40°C is dropped in a mug containing water at 40°C. The heat will
(a) flow from iron ball to water
(b) not flow from iron ball to water or from water to iron ball
(c) flow from water to iron ball
(d) increase the temperature of both

84. Stainless steel pans are usually provided with copper bottoms. The reason for this could be that
(a) copper bottom makes the pan more durable
(b) such pans appear colourful
(c) copper is a better conductor of heat than the stainless steel
(d) copper is easier to clean than the stainless steel

85. Neutralisation reaction is a
(a) physical and reversible change
(b) physical change that cannot be reversed
(c) chemical and reversible change
(d) chemical change that cannot be reversed

86. Pick the synthetic fibre out of the following.
(a) Cotton (b) Nylon
(c) Jute (d) Wool

87. Wool fibre cannot be obtained from which of the following?
(a) Goat (b) Liama
(c) Alpaca (d) Moth

88. Turmeric is a natural indicator. On adding its paste to acid and base separately, which colours would be observed?
(a) Yellow in both acid and base
(b) Yellow in acid and red in base
(c) Pink in acid and yellow in base
(d) Red in acid and blue in base

89. Which of the following is not a plastid?
(a) Chloroplast (b) Chromoplast
(c) Leucoplast (d) Ribosome

90. Which of the following cells does not have a nucleus?
(a) White blood cell
(b) Red blood cell
(c) Nerve cell
(d) Muscle cell

91. A suitable term for the various components of cells is
(a) tissue (b) cell organelles
(c) chromosomes (d) genes

92. The mode of vegetative reproduction where scion and stock are used is called
(a) budding (b) grafting (c) cutting (d) layering

93. Which among the following have hairs on seed?
(a) Drumstick (b) Cotton
(c) Aak (d) Maple

94. Biological pollution in water is caused by
(a) coal mines
(b) domestic sewage and animal excreta
(c) oil spills
(d) chemicals like paint

95. Which of these does not prevent growth of bacteria?
(a) Salt (b) Oil (c) Sugar (d) Water

96. Potable water is the water which is
(a) obtained from a river
(b) obtained from a lake
(c) pure and fit for drinking
(d) used only for washing clothes

97. Scientist who discovered the fermentation
(a) Alexander Fleming (b) Louis Pasteur
(c) Johann Mendel (d) Charles Darwin

98. Given below is a list of edible plants.
(i) Banana (ii) Pumpkin
(iii) Lady finger (iv) Brinjal
Which pair of plants has two or more edible parts?
(a) (i) and (ii) (b) (ii) and (iii)
(c) (ii) and (iv) (d) (i) and (iv)

99. Which one of the following sources of protein is different from others?
(a) Peas (b) Grams
(c) Soybeans (d) Cottage cheese (paneer)

100. The buds at the tip of the stem or its branches are called
(a) axillary buds (b) nodal buds
(c) apical buds (d) growing buds

Answers

1	(c)	2	(b)	3	(b)	4	(c)	5	(c)	6	(b)	7	(d)	8	(b)	9	(d)	10	(a)
11	(c)	12	(b)	13	(a)	14	(b)	15	(c)	16	(c)	17	(b)	18	(c)	19	(c)	20	(a)
21	(b)	22	(a)	23	(b)	24	(c)	25	(d)	26	(c)	27	(d)	28	(b)	29	(a)	30	(d)
31	(a)	32	(d)	33	(b)	34	(c)	35	(b)	36	(c)	37	(c)	38	(d)	39	(c)	40	(b)
41	(a)	42	(c)	43	(a)	44	(d)	45	(c)	46	(a)	47	(d)	48	(d)	49	(b)	50	(d)
51	(b)	52	(c)	53	(c)	54	(c)	55	(a)	56	(c)	57	(c)	58	(a)	59	(b)	60	(c)
61	(c)	62	(d)	63	(c)	64	(a)	65	(c)	66	(c)	67	(a)	68	(a)	69	(c)	70	(b)
71	(a)	72	(d)	73	(b)	74	(a)	75	(d)	76	(c)	77	(c)	78	(c)	79	(b)	80	(c)
81	(d)	82	(b)	83	(b)	84	(c)	85	(d)	86	(b)	87	(d)	88	(b)	89	(d)	90	(b)
91	(b)	92	(b)	93	(b)	94	(d)	95	(d)	96	(c)	97	(b)	98	(c)	99	(d)	100	(c)

Jawahar Navodaya Vidyalaya
Entrance Exam (Class IX)
PRACTICE SET 02

Instructions

1. This question paper contains 100 questions, which is divided into following four sections.
   Section I English (15 Questions); **Section II** Hindi (15 Questions)and
   Section III Mathematics (35 Questions); **Section IV** General Science (35 Questions).
2. Each question carries 1 Mark.
3. The candidate is expected to attempt all the questions.

Section I English

Directions (Q. Nos. 1-5) *Read the passage and answer the questions that are given below.*

Hummingbirds are amazing little birds. They are the smallest of all birds and weigh less than even a penny. The bee hummingbird, barely more than two inches long, is the smallest bird in the world! Unlike most birds, hummingbirds have iridescent feathers. Iridescent feathers glitter and shine in the sun. Hummingbirds are often dazzling combinations of green and red or green and blue. Others are violet, orange, golden, silver or other combinations only Mother Nature could dream up. All hummingbirds have long bills to insert into flowers. Some hummingbirds have special bills to fit into specific flowers. Hummingbirds are the only birds that can fly backwards. Hummingbirds are also unique among bird species in that they drink nectar from flowers. You can attract hummingbirds to your yard with special feeders that are filled with sugar water. These feeders are usually bright red in colour because hummingbirds are attracted to red.

1. Hummingbirds are the only birds that ..... .
   (a) can fly backwards
   (b) are small
   (c) will come to bird feeders
   (d) are green
2. Compared to other birds, hummingbirds are .... .
   (a) about the same size (b) lighter
   (c) heavier (d) larger
3. To attract hummingbirds to your yard, put up feeders with ..... in them.
   (a) sugar water (b) flowers
   (c) berries (d) seeds
4. Of what colour are most hummingbird feeders?
   (a) white (b) green
   (c) red (d) golden
5. Hummingbirds drink ... .
   (a) insects
   (b) berries
   (c) not mentioned in the passage
   (d) flower nectar

Directions (Q. Nos. 6-7) *Select the word from the options for the given definition.*

6. Person who does not believe in the existence of God
   (a) Theist (b) Heretic
   (c) Atheist (d) Fanatic
7. One who eats everything
   (a) Cannibal (b) Herbivorous
   (c) Omnivorous (d) Carnivorous

Directions (Q. Nos. 8-11) *Fill in the blanks with the most appropriate option given against each question.*

8. Sapna ..... to dance every day.
   (a) loves (b) is loving
   (c) has been loving (d) has loved
9. This is one of the ..... novel I have ever read.
   (a) entertaining (b) more entertaining
   (c) most entertaining (d) very entertaining

10. Employees ..... attend the meeting in the office.
(a) may (b) can (c) must (d) shall

11. Swati jumped ..... the river to save her son.
(a) in (b) into
(c) within (d) on

Directions (Q. Nos. 12 and 13) *Mark the option with the correct spelling of the given words.*

12. (a) Orphanege (b) Orphannage
(c) Orphainage (d) Orphanage

13. (a) Caterpillar (b) Catrepillar
(c) Caterpilar (d) Catirpillar

Directions (Q. Nos. 14-15) *Choose the similar meaning word of the given word in the following questions.*

14. MASSIVE
(a) Strong (b) Little
(c) Gaping (d) Huge

15. DILIGENT
(a) Fool (b) Unhappy
(c) Hardworking (d) Disappointment

Section II Hindi

16. 'श्याम कल मुम्बई जाएगा' वाक्य में कौन-सा काल है?
(a) भूतकाल (b) भविष्यत् काल
(c) वर्तमान काल (d) उपरोक्त में से कोई नहीं

17. 'समुद्र अधिक गहरा है' इस वाक्य का शुद्ध रूप क्या है?
(a) समुद्र बड़ा गहरा है
(b) समुद्र अधिकांश गहरा है
(c) समुद्र बहुत गहरा है
(d) समुद्र की गहराई अधिक ज्यादा है

18. 'सजीव' का विलोम शब्द होगा
(a) निर्जीव (b) अजीव
(c) परजीव (d) इनमें से कोई नहीं

19. निम्न में द्वन्द्व समाज का उदाहरण नहीं है
(a) पाप-पुण्य (b) देश-विदेश
(c) धर्म-भ्रष्ट (d) राग-द्वेश

निर्देश (प्र. सं. 20-24) *दिए गए अनुच्छेद को ध्यानपूर्वक पढ़िए और उससे सम्बन्धित प्रश्नों के उत्तर दीजिए।*

सच्चे वीर अपने प्रेम के जोर से लोगों को सदा के लिए बाँध देते हैं। वीरता की अभिव्यक्ति कई प्रकार से कभी लड़ने-मरने से, खून बहाने से, तोप तलवार के सामने बलिदान करने से, तो कभी जीवन के गूढ़ तत्त्व और सत्य की तलाश में बुद्ध जैसे राजा विरक्त होकर वीर हो जाते हैं। वीरता एक प्रकार की अन्तः प्रेरणा है। जब कभी उसका विकास हुआ तभी एक रौनक, एक रंग, एक बहार संसार में छा गई। वीरता हमेशा निराली और नई होती है, वीरों को बनाने के कारखाने नहीं होते, वे तो देवदार के वृक्ष की भाँति जीवन रूपी वन में स्वयं पैदा होते हैं और बिना किसी के पानी दिए, बिना किसी के दूध पिलाए बढ़ते हैं। "जीवन के केन्द्र में निवास करो और सत्य की चट्टान पर दृढ़ता से खड़े हो जाओ। बाहर की सतह छोड़कर जीवन के अन्दर की तहों मे पहुँचे तब नए रंग खिलेंगे।" यही वीरता का सन्देश है।

20. वीरता कैसी प्रेरणा है?
(a) अन्त: (b) बाह्य
(c) फलित (d) उपरोक्त सभी

21. देवदार वृक्ष से किसकी तुलना की गई है
(a) खाने-पीने की (b) वीरों की
(c) मनुष्य की (d) वीरता की

22. निम्नलिखित में से कौन-सा रूप वीरता का नहीं है?
(a) क्रोध (b) युद्ध (c) त्याग (d) दान

23. वीरता का एक विशेष लक्षण है
(a) नयापन (b) नकल (c) हास्य (d) करुणा

24. 'विरक्त' का विलोम होगा
(a) विकल्प (b) रक्त (c) अनुरक्त (d) सशक्त

25. 'लोहे के चने चबाना' मुहावरे का अर्थ है।
(a) कठिन कार्य करना (b) अधिक परेशान करना
(c) चने चबाना (d) इनमें से कोई नहीं

26. 'अतिथि' का पर्यायवाची है
(a) भगवान (b) विकास (c) वसन (d) आगन्तुक

27. 'जिसके समान कोई दूसरा न हो' के लिए एक शब्द है
(a) अचल (b) अद्वितीय
(c) अनगिनत (d) अभिज्ञ

28. निम्न में कौन-सा शब्द शुद्ध है?
(a) अविषकार (b) आविषकार
(c) आविष्कार (d) अवनिषकार

29. 'रहीम' घर पर है में कौन-सा कारक है
(a) अपादान (b) अधिकरण (c) सम्प्रदान (d) करण

30. विशेषण जिस संज्ञा या सर्वनाम शब्द की विशेषता बताते हैं, उन्हें ..... कहते हैं।
(a) विशेष्य (b) गुणवाचक विशेषण
(c) संख्यावाचक विशेषण (d) परिमाणवाचक विशेषण

Section III Mathematics

31. The value of A and B, is

$$\begin{array}{r} 1\ A \\ \times\ B \\ \hline B\ 8 \end{array}$$

(a) 8 and 1 (b) 4 and 3
(c) 3 and 6 (d) 4 and 7

32. An exterior angle of a triangle is of measure 70° and one of the interior opposite angle is of measure 35°, then the measure of the other interior opposite angle.
(a) 70° (b) 35° (c) 45° (d) 25°

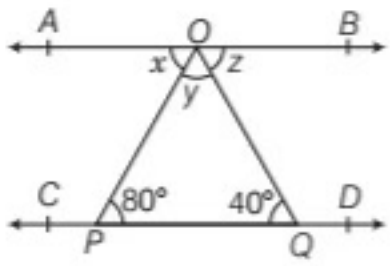
33. If the ratio between the curved surface area and the total surface area of a right circular cylinder is 1 : 3. Then, the ratio between the height and radius of the cylinder.
(a) 3:1 (b) 1:3
(c) 2:1 (d) 1 : 2

34. The smallest number by which 256 must be multiplied to obtain a perfect cube, is
(a) 2 (b) 3
(c) 5 (d) 7

35. Expression of 24 million in standard form, is
(a) 2.4×10^8 (b) 2.4×10^9
(c) 2.4×10^7 (d) 2.4×10^{11}

36. The cost of $\frac{19}{4}$ m of wire is ₹ $\frac{171}{2}$, then find the cost of one metre of wire.
(a) ₹ 9 (b) ₹ 18
(c) ₹ 19 (d) ₹ 20

37. In the given figure, $AB \| CD$, then the value of $x : y : z$ is



(a) 2: 3:4 (b) 3:4:2
(c) 4:3:2 (d) 2:4:3

38. The subtraction of $-3p^2 + 3pq + 3px$ from $3p\ (-p - a - r)$
(a) $3ap - 3pr + 3pq - 3px$ (b) $-3ap - 3pr - 3pq - 3px$
(c) $-3ap + 3pr - 3pq + 3px$ (d) $3ap + 3pr + 3pq + 3px$

39. By, selling an article for ₹ 112000, a girl gains 40%. Then, the cost price of the article.
(a) ₹ 112000 (b) ₹ 120000
(c) ₹ 80000 (d) ₹ 101200

40. A contractor estimates that 3 persons could rewire Jasminder's house in 4 days. If he uses 4 persons instead of three, how long should they take to complete the job ?
(a) 3 days (b) 4 days
(c) 5 days (d) 6 days

41. What number should be subtracted from each of the following numbers 23, 30, 57 and 78, so that the remainders are in proportion ?
(a) 6 (b) 8 (c) 10 (d) 12

42. The HCF of $5\ (x^3 + y^3)$ and $10(x^2 - y^2)$, is
(a) $(x + y)$ (b) $(x - y)$
(c) $5(x + y)$ (d) $5(x - y)$

43. The square root of 22 .09 is
(a) 2.7 (b) 4.7 (c) 5.7 (d) 6.7

Directions (Q. Nos. 44 and 45) *A group of 360 people were asked to vote for their favourite season from the three seasons rainy, winter and summer.*

Season	Number of votes
Summer	90
Rainy	120
Winter	150
Total	**360**

44. Which season got the most votes ?
(a) Summer
(b) Rainy
(c) Winter
(d) Both summer and winter

45. The central angle winter season's sector is
(a) 90° (b) 120° (c) 135° (d) 150°

46. If the sum of digits of a two-digit number is 17. On reversing its digits, the new number is 9 more than the original number, then the number, is
(a) 89 (b) 98 (c) 97 (d) 79

47. If the diameter of the Moon is approximately one-fourth of the diameter of the Earth, then the ratio of their surface areas is.
(a) 1 :16 (b) 16 :1
(c) 1 : 8 (d) 8 :1

48. If in a cricket match, a batswoman hits a boundary 6 times out of 30 balls she plays, then the probability that she did not hit a boundary, is
(a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{6}{5}$ (d) 1

49. If the area of trapezium is 450 m^2, the distance between two parallel sides is 10 m and one of the parallel side 15 m. Then the other parallel side, is

(a) 15 m (b) 90 m (c) 45 m (d) 75 m

50. The value of x, if $\frac{3x-5}{17}+\left[\frac{11-x}{76}-\frac{3}{4}\right]=\frac{4+x}{2}-13$, is

(a) 60 (b) 30 (c) 20 (d) 10

51. The least number which when divided by 14, 35 and 42 leaves remainder in each case , is

(a) 210 (b) 216 (c) 280 (d) 252

52. The value of $1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{3}{6}}}$, is

(a) $\frac{20}{15}$ (b) $\frac{22}{15}$ (c) $\frac{24}{15}$ (d) $\frac{26}{15}$

53. Two numbers are in the ratio of 3 : 5. If 8 is added to each number, then the ratio becomes 2 : 3 then, the largest number, is

(a) 16 (b) 24 (c) 40 (d) 42

54. The difference between compound interest and simple interest on ₹ 45000 at 12% per annum for 3 yr, is

(a) ₹ 2021 (b) ₹ 2021.76
(c) ₹ 2201 (d) ₹ 2201.76

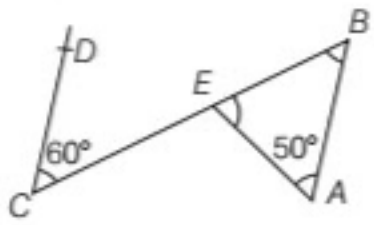
55. Divide 400 into two parts such that $\frac{1}{3}$rd of the first part is 40 less than the other. Then, the smallest part, is

(a) 270 (b) 360
(c) 130 (d) 100

56. The value of $\left(\left(\frac{-3}{2}\right)^{-2}\right)^{-3}$, is

(a) $\left(\frac{2}{3}\right)^{6}$ (b) $\left(\frac{2}{3}\right)^{-6}$
(c) $\left(\frac{-2}{3}\right)^{6}$ (d) $\left(\frac{-2}{3}\right)^{-6}$

57. In the given figure, $AB \parallel CD$, $\angle EAB = 50°$. If $\angle ECD = 60°$, then find $\angle AEB$.



(a) 70° (b) 60° (c) 50° (d) 110°

58. The value of $\sqrt[3]{27}-7\sqrt[3]{216}+10\sqrt[6]{64}+\sqrt[3]{121}$, is

(a) 8 (b) 4 (c) −8 (d) −4

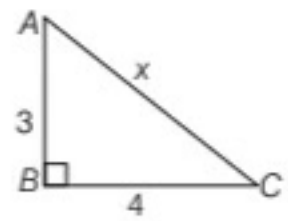
59. The value of $-\frac{3}{5}\times\left\{\frac{3}{7}+\left(\frac{-5}{6}\right)\right\}$, is

(a) $\frac{7}{10}$ (b) $\frac{54}{30}$ (c) $\frac{17}{70}$ (d) $\frac{1}{10}$

60. The value of $\frac{5^{-2}\times 3^{-3}\times (125)^{2/3}}{(27)^{-2/3}\times (32)^{-1/5}}$

(a) $\frac{3}{2}$ (b) $\frac{2}{3}$
(c) $\frac{1}{3}$ (d) 3

61. The value of x from the following figure, is

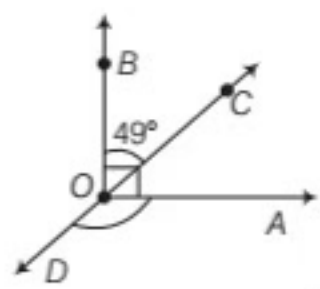


(a) 5 (b) 6
(c) 7 (d) 8

62. If one angle of a triangle is 60° and the other two angles are in the ratio 1 : 3. Then, the value of smallest angle, is

(a) 30° (b) 60°
(c) 90° (d) 100°

63. In the following figure, OB is perpendicular to OA and $\angle BOC = 49°$. Find $\angle AOD$



(a) 118° (b) 139°
(c) 151° (d) 110°

64. If the expression $(x^2+19x-20)$ shows the area of rectangle, then the possible length and breadth of this rectangle.

(a) $(x+10), (x-1)$ (b) $(x+20), (x-1)$
(c) $(x+10), (x+1)$ (d) $(x+20), (x+1)$

65. The length of the side of a square, whose area is 729 m^2, is

(a) 17 m (b) 27 m
(c) 37 m (d) 47 m

Section IV General Science

66. A characteristic of sound that depends on the amplitude is
(a) pitch (b) speed
(c) quality (d) loudness

67. In order to reduce the loudness of a sound, we have to
(a) decrease its frequency of vibration of the sound
(b) increase its frequency of vibration of the sound
(c) decrease its amplitude of vibration of the sound
(d) increase its amplitude of vibration of the sound

68. The ultrasound waves can penetrate into matter to a large extent because they have
(a) very high frequency
(b) very high speed
(c) very high quality
(d) very high amplitude

69. Heat always flows
(a) from a colder object to a hotter object
(b) from a hotter object to a colder object
(c) in both the directions
(d) None of the above

70. In coastal areas, cold air flows in the day from sea to land. It is called .....
(a) sea strom (b) sea breeze
(c) tsunami (d) None of these

71. Heat capacity of a substance depends on
(a) the mass of the substance
(b) the temperature of the substance
(c) Both (a) and (b)
(d) Neither (a) nor (b)

72. A girl is sitting on a merry-go-round which is moving with a constant speed of 10 m/s. This means that the girl is
(a) at rest
(b) moving with no acceleration
(c) in accelerated motion
(d) moving with uniform velocity

73. The distance-time graph for a vehicle standing on a road side will be
(a) straight line inclined by some angle to x- axis
(b) straight line parallel to x- axis
(c) straight line parallel to y- axis
(d) None of the above

74. Motion of an ant is a example of
(a) rectilinear motion
(b) circular motion
(c) rotational motion
(d) periodic motion

75. The correct symbol to represent the speed of an object is
(a) 5 m/s (b) 5 mp
(c) $5 m / s^{-1}$ (d) 5 s/m

76. Laws of reflection are valid in case of
(a) regular reflection
(b) irregular reflection
(c) reflection over a curved surface
(d) Both (a) and (c)

77. If lower half of a concave mirror is blackened, then
(a) image distance increases
(b) image distance decreases
(c) image intensity increases
(d) image intensity decreases

78. The material similar to silk in appearance is
(a) nylon (b) rayon
(c) polyester (d) terylene

79. Silkworms secrete fibre made of
(a) fat (b) cellulose (c) protein (d) nylon

80. The product(s) of combustion is/are
(a) only oxygen
(b) oxygen and water
(c) carbon dioxide and water
(d) only carbon dioxide

81. Hardest natural substance on earth is
(a) iron (b) plastic
(c) charcoal (d) diamond

82. Which of the following is not a combustible
(a) camphor (b) glass
(c) straw (d) alcohol

83. Which of the following is not a constituent of petroleum?
(a) Paraffin wax (b) Lubricating oil
(c) Petrol (d) Coke

84. Which of the following non-metals reacts and catches fire on exposure to air?
(a) Phosphorus (b) Nitrogen
(c) Sulphur (d) Hydrogen

85. Iron pillar near the Qutub Minar in Delhi is famous for the following facts. Which of these facts is responsible for its long stability?
(a) It is more than 7 m high
(b) It weighs about 6000 kg
(c) It was built more than 1600 years ago
(d) It has not rusted after such a long period

86. Which of the following reacts with cold water vigorously?
(a) Carbon (b) Sodium
(c) Magnesium (d) Sulphur

87. Coal is formed from the remains of
(a) vegetation only
(b) animals only
(c) Both vegetation and animals
(d) Neither vegetation nor animals

88. The metal which produces hydrogen gas on reaction with dilute hydrochloric acid as well as sodium hydroxide solution is
(a) copper (b) iron
(c) aluminium (d) sodium

89. Which of the following groups contains all synthetic substances?
(a) Nylon, terylene, wool
(b) Cotton, polycot, rayon
(c) PVC, polythene, bakelite
(d) Acrylic, silk, wool

90. The ovaries of different flowers may contain
(a) Only one ovule (b) many ovules
(c) one to many ovules (d) only two ovules

91. Pathogenic microorganisms present in host cells are killed by medicines called
(a) pain killer (b) antibodies
(c) antibiotics (d) vaccines

92. Which of the following reproduces only inside a host cell?
(a) Bacteria (b) Virus
(c) Amoeba (d) Fungus

93. A disease in human beings caused by virus is
(a) typhoid (b) influenza
(c) dysentery (d) cholera

94. Carrot and radish food obtained from plants are examples of
(a) stem (b) roots
(c) leaves (d) flowers

95. Diseases occurring due to the deficiency of one or other nutrients is called
(a) dietary disease
(b) chronic disease
(c) deficiency disease
(d) transmitted disease

96. Carbohydrates can be tested by using which of the following?
(a) Iodine
(b) Caustic soda
(c) Copper sulphate
(d) Fehling's solution

97. The bread or idli dough rises because of
(a) heat (b) grinding
(c) growth of yeast cells (d) kneading

98. Read the food items gives below.
(i) Wheat (ii) Ghee
(iii) Iodised salt (iv) Spinach (palak)
Which of the above food items are energy giving foods?
(a) (i)and (iv) (b) (ii) and (iv)
(c) (i) and (ii) (d) (iii) and (iv)

99. The male parts of the flower are called
(a) pistils (b) carpels
(c) stamens (d) styles

100. The swollen part at the base of a flower from which the whorls of the flower radiate is called the
(a) thalamus (b) pedicel
(c) pistil (d) carpel

Answers

1	(a)	2	(b)	3	(a)	4	(c)	5	(d)	6	(c)	7	(c)	8	(a)	9	(c)	10	(c)
11	(b)	12	(d)	13	(a)	14	(d)	15	(c)	16	(b)	17	(c)	18	(a)	19	(c)	20	(a)
21	(b)	22	(a)	23	(a)	24	(c)	25	(a)	26	(d)	27	(b)	28	(c)	29	(b)	30	(a)
31	(a)	32	(b)	33	(d)	34	(a)	35	(c)	36	(b)	37	(c)	38	(b)	39	(c)	40	(a)
41	(a)	42	(c)	43	(b)	44	(c)	45	(d)	46	(a)	47	(a)	48	(b)	49	(d)	50	(b)
51	(b)	52	(c)	53	(c)	54	(b)	55	(c)	56	(d)	57	(a)	58	(c)	59	(c)	60	(b)
61	(a)	62	(a)	63	(b)	64	(b)	65	(b)	66	(d)	67	(c)	68	(a)	69	(b)	70	(b)
71	(c)	72	(c)	73	(b)	74	(a)	75	(a)	76	(d)	77	(d)	78	(b)	79	(c)	80	(c)
81	(d)	82	(b)	83	(d)	84	(a)	85	(d)	86	(b)	87	(a)	88	(c)	89	(d)	90	(c)
91	(c)	92	(b)	93	(b)	94	(b)	95	(c)	96	(a)	97	(c)	98	(a)	99	(c)	100	(a)

Jawahar Navodaya Vidyalaya
Entrance Exam (Class IX)
PRACTICE SET 03

Instructions

1. This question paper contains 100 questions, which is divided into following four sections.
   Section I English (15 Questions); **Section II** Hindi (15 Questions)and
   Section III Mathematics (35 Questions); **Section IV** General Science (35 Questions).
2. Each question carries 1 Mark.
3. The candidate is expected to attempt all the questions.

Section I English

Directions (Q. Nos. 1-2) *Fill in the blanks with the most appropriate option given against each question.*

1. The stairs are wet and slippery. Walk .... .
   (a) carefuller (b) carefuls
   (c) careful (d) carefully
2. He .... at the seminar on Thursday because he was sick.
   (a) was not (b) is not
   (c) will not be (d) had not

Directions (Q. Nos. 3-4) *Fill in the blanks in the given sentence with the correct use of clause.*

3. My brother doesn't know ....
   (a) he is tall (b) how tall is he?
   (c) how tall he is. (d) how he is tall.
4. I couldn't believe .... it took them to process my application.
   (a) how much (b) how long
   (c) how many (d) where

Directions (Q. Nos. 5-9) *Read the passage and answer the questions that are given below.*

Fifty years ago people ate ice cream only in summer. Now it is eaten all the year round. It originated in the Orient, centuries before English schoolboys first tasted it. Marco Polo saw people eating ice cream there and brought back the idea to Italy. From Italy the idea was carried to France, It became very popular in France with the rich, and an effort was even made to keep the recipes a secret from the common people. But, of course, they soon learned about this **delicious** new food and ice cream became popular with everyone. Soon it spread all over the world. The first factory to manufacture ice cream was started in Baltimore, Maryland, in 1851. However, the real development of ice cream and the ice cream business didn't take place until after 1900 with new developments in refrigeration.

A small amount of gelatin is used in order to retain the smoothness of the ice cream by preventing the formation of ice crystals. When you eat a third of a pint of vanilla ice cream, you are getting about as much calcium, protein, and vitamin B as are in half a cup of whole milk, and as much vitamin A and calories as are in one cup of milk.

5. The major change towards ice cream is that
   (a) it is eaten throughout the year
   (b) it is eaten as a dessert
   (c) it is eaten in summer
   (d) it is eaten in winter
6. Ice cream became popular with everyone
   (a) when the idea was carried from Italy to France
   (b) when English schoolboys tasted it
   (c) when the rich in France started eating it
   (d) when the common people learned about its recipe
7. The introduction of refrigeration led to the
   (a) increased consumption of ice cream
   (b) development of the ice cream business
   (c) increase in the production of ice cream
   (d) improvement in the quality of ice cream

8. The smoothness of ice cream is retained by
(a) forming ice crystals
(b) using a small amount of gelatin
(c) using eggs
(d) using cream and milk

9. Choose the word from the option which means the same as 'delicious' as used in the passage.
(a) quality (b) bitter
(c) tasty (d) flavour

Directions (Q. Nos. 10-11) *Choose the most opposite meaning word of the given word in the following questions.*

10. DIVIDED
(a) United (b) Dignified
(c) Separated (d) Isolated

11. SUPERIORITY
(a) Seniority (b) Juniority
(c) Inferiority (d) Urbanity

Directions (Q. Nos. 12-13) *Change the following sentences into passive voice.*

12. Radha is singing a song.
(a) A song has been being sung by Radha.
(b) A song is sung by Radha.
(c) A song has being sung by Radha.
(d) A song is being sung by Radha.

13. He had written a poem.
(a) A poem has written by him.
(b) A poem had written by him.
(c) A poem had been written by him.
(d) A poem has been written by him.

Directions (Q. Nos. 14-15) *Choose the similar meaning word of the given word in the following questions.*

14. PACIFY
(a) Gather (b) Allot (c) Calm (d) Remit

15. SECURITY
(a) Boldness (b) Safety
(c) Fearlessness (d) Confidence

Section II Hindi

निर्देश (प्र. सं. 16-20) *दिए गए अनुच्छेद को ध्यानपूर्वक पढ़िए और उससे सम्बन्धित प्रश्नों के उत्तर दीजिए।*

सामान्यतः दुष्टों की वन्दना में या तो भय रहता है या व्यंग्य, परन्तु जहाँ हम हानि होने के पहले ही हानि के कारण की वन्दना करने लगते हैं, वहाँ हमारी वन्दना के मूल में भय नहीं, बल्कि उसकी स्थायी दशा की आशंका है। इस वन्दना में दुष्टों को थपकी देकर सुलाने की चाल है, जिसमें विघ्न बाधाओं से जान बच सके। आशंका से उत्पन्न यह नम्रता गोस्वामी जी को आश्रय से आलम्बन बना देती है। जब स्फुट अंशों के संचारी भावों तथा अनुभावों को छोड़कर वन्दना के पीछे निहित भावना की दृष्टि से देखते हैं, तो यह आश्रय से संक्रमित आलम्बन का उदाहरण बन जाता है। सन्तों, देवताओं तथा राम की वन्दना पर्याप्त नहीं इसलिए दुष्टों की भी वन्दना की जाती है। इससे दुष्टों के महत्त्व की भायिक सृष्टि होती है और वह उन्हें और भी उपहास्य बना देती है।

16. दुष्टों की वन्दना में क्या रहता है?
(a) भय, व्यंग्य
(b) हर्ष, क्रोध
(c) हानि, लाभ
(d) ये सभी

17. दुष्ट वन्दना के पीछे लेखक का उद्देश्य है
(a) दुष्टों को लज्जित करना
(b) दुष्टों को थपकी देकर सुलाना
(c) दुष्टों से अपना बचाव करना
(d) दुष्टों का सहयोग प्राप्त करना

18. रामचरितमानस एक भक्ति काव्य है। इसमें दुष्ट वन्दना का रहस्य है
(a) तुलसी को व्यापक दृष्टि
(b) तुलसी का सभी को राममय देखना
(c) तुलसी की उदारता
(d) तुलसी का शील-सौजन्य

19. देवताओं, महापुरुषों, सज्जनों के साथ दुष्टों की वन्दना इसलिए सार्थक कही जाएगी कि महाकवि तुलसीदास
(a) सन्त कवि थे (b) उदार नेता थे
(c) हित-अनहित और अपने-पराए की भावना से ऊपर उठ चुके थे
(d) निर्वरता चाहते थे

20. भय का विलोम शब्द है
(a) निर्भय (b) डरहीन (c) निर्बल (d) दुर्धर

21. किस समास का प्रथम पद संख्यावाचक विशेषण होता है?
(a) द्विगु (b) द्वन्द्व (c) अव्ययीभाव (d) तत्पुरुष

22. 'सोना' ..... संज्ञा का उदाहरण है।
(a) समूहवाचक (b) द्रव्यवाचक
(c) जातिवाचक (d) व्यक्तिवाचक

23. निम्न में अशुद्ध वाक्य है
(a) बेटी पराए घर का धन होती है
(b) बेटी पराए घर का धन होता है
(c) बेटी पराया घर का धन होता है
(d) बेटी पराया घर का धन होती है

24. 'में, पर' किस कारक के कारक चिह्न हैं?
(a) अधिकरण (b) अपादान
(c) सम्प्रदान (d) कर्म

25. प्रश्नवाचक सर्वनाम है
(a) मैं (b) कौन
(c) तुम (d) वह

26. 'श्र' संयुक्त व्यंजन किसके योग से बना है?
(a) स् + र (b) ष् + र
(c) श् + र (d) श्र + र

27. धृत का तद्भव शब्द है
(a) घी (b) घड़ा (c) घर (d) गृह

28. 'व्याल' किसका पर्यायवाची है?
(a) पक्षी (b) सिंह (c) सर्प (d) मोर

29. 'आ बैल! मुझे मार' का अर्थ है
(a) बैल से मरवाना
(b) बैल से पीटना
(c) जान-बूझकर मुसीबत मोल लेना
(d) ये सभी

30. निम्न में संयुक्त वाक्य का उदाहरण है
(a) वह घर आया और बाहर चला गया
(b) उन्हें याद था कि राधा घर ही है
(c) यदि राम आए तो मुझे बताना
(d) राजू घर पर ही है।

Section III Mathematics

31. The value of $[(16)^{1/2}]^{1/2}$ is
(a) 1 (b) 2 (c) 3 (d) 4

32. Simplify the expression $[\{(81)^{-1/2}\}^{-1/4}]^2$.
(a) 1 (b) 2 (c) 3 (d) 9

33. The value of x, if $\left(\frac{6}{5}\right)^x\left(\frac{5}{6}\right)^{2x} = \frac{125}{216}$ is
(a) 2 (b) 3 (c) 5 (d) 6

34. In ΔABC, if $BC = AB$ and $\angle B = 80°$, then $\angle A$ is equal to
(a) 40° (b) 50° (c) 60° (d) 70°

35. If $x = 1$, $y = 1$ and $z = -2$, then the value of expression $x^3 + y^3 + z^3 - 3xyz$ is
(a) 0 (b) 1 (c) 2 (d) 3

36. The degree of the polynomial $5x^3 - 2x^2 + 1$ is
(a) 3 (b) 2 (c) 0 (d) 4

37. Factors of $x^2 - 14x - 147$ are
(a) $(x - 21)(x + 14)$ (b) $(x - 21)(x + 7)$
(c) $(x + 21)(x - 7)$ (d) $(x + 14)(x - 7)$

38. The greatest number that will divide 445, 572 and 699, leaving remainders 4, 5 and 6 respectively, is
(a) 9 (b) 7 (c) 63 (d) 21

39. A merchant has 120 L of oil of one kind, 180 L of another kind and 240 L of a third kind. He wants to sell the oil by filling the three kinds of oil in tins of equal capacity. What should be the greatest capacity of such tin?
(a) 50 L (b) 55 L (c) 60 L (d) 70 L

40. The HCF of 513 and 783 is
(a) 9 (b) 12 (c) 18 (d) 27

41. Reshma prepared 18 kg of burfi by mixing khoya with sugar in the ratio of 7 : 2. How much khoya did she use?
(a) 14 kg (b) 4 kg (c) 10 kg (d) 8 kg

42. School starts at 7: 00 am and gets over at 12 : 30 pm. If the break time is from 9 : 50 am to 10 : 10 am, then the ratio of the break time to the total time for which the students spend at school, is
(a) 1 : 11 (b) 2 : 33 (c) 1 : 33 (d) 4 : 33

43. If $(x^2y + 2y^2 + 3)$ is subtracted from $(3x^2y + 2y^2 + 5)$, then, the coefficient of y in the result is
(a) x^2 (b) $2x^2$ (c) $3x^2$ (d) $-x^2$

44. The perimeter of a parallelogram is 32 cm. If the longer side measures 9.5 cm, then the measure of the shorter side is
(a) 6.5 cm (b) 6 cm (c) 5.5 cm (d) 5 cm

45. If the perimeter of an equilateral triangle is 60 m, then its area is
(a) $25\sqrt{3}\,m^2$ (b) $75\sqrt{3}\,m^2$
(c) $50\sqrt{3}\,m^2$ (d) $100\sqrt{3}\,m^2$

46. The area of an isosceles triangle having base 2 cm and the length of one of the equal sides 4 cm, is
(a) $2\sqrt{3}\,cm^2$ (b) $\sqrt{15}\,cm^2$
(c) $3\sqrt{2}\,cm^2$ (d) $\sqrt{21}\,cm^2$

47. The mean of 24 numbers is 12. If 2 is added to every number, then the new mean will be
(a) 12 (b) 14
(c) 16 (d) 18

48. Express 0.00323232..... in the form of $\frac{p}{q}$.

(a) $\frac{8}{2475}$ (b) $\frac{7}{2136}$ (c) $\frac{6}{1815}$ (d) $\frac{5}{1531}$

49. An irrational number between $\frac{1}{7}$ and $\frac{1}{3}$ is

(a) 0.4101001000..... (b) 0.1401001000 .....
(c) 0.3401001000 ..... (d) 0.2101001000 .....

50. The value of $\frac{\sqrt{24}+\sqrt{216}}{\sqrt{96}}$ is

(a) 2 (b) 3 (c) $4\sqrt{2}$ (d) 6

51. The length of each side of a cube, if its volume is 512 cm^3, is

(a) 7 cm (b) 8 cm (c) 9 cm (d) 10 cm

52. The cost of an article was ₹ 15500. ₹ 450 were spent on its repairs. If it is sold for a profit of 15%, the selling price of the article is

(a) ₹ 19412.50 (b) ₹ 18342.50
(c) ₹ 17401.50 (d) ₹ 16500.50

53. The interest and amount to be paid on ₹ 15000 at 5% per annum after 2 yr are

(a) ₹ 1500, ₹15000 (b) ₹ 1000, ₹16000
(c) ₹ 1500, ₹16500 (d) ₹ 1200, ₹16200

54. A machinery worth ₹ 10500 depreciated by 5%. Its value after one year is

(a) ₹ 6690 (b) ₹ 7750
(c) ₹ 8825 (d) ₹ 9975

55. The population of a city after 2 yr, which is at present 12 lakh, if the rate of increase is 4%, is

(a) 1264250 (b) 1245010
(c) 1297920 (d) 1310042

56. Two dice are thrown simultaneously. The probability of getting a multiple of 2 on one die and a multiple of 3 on the other die, is

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{19}{36}$ (d) $\frac{13}{36}$

57. $\{5^2 + (12^2)^{1/2}\}^3$ is equal to

(a) 40124 (b) 37011
(c) 50653 (d) 24614

58. 72% of 25 students are good in Mathematics. How many students are not good in Mathematics?

(a) 3 (b) 4 (c) 6 (d) 7

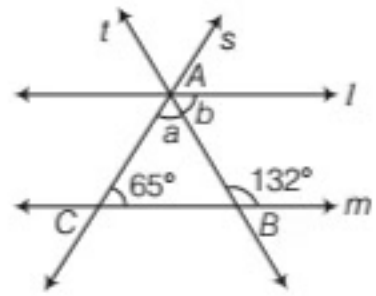
59. A football team won 10 matches out of the total number of matches they played their win percentage was 40, then how many matches did they play in all?

(a) 10 (b) 15
(c) 20 (d) 25

60. A VCR and TV were bought for ₹ 8000 each. The shopkeeper made a loss of 4% on the VCR and a profit of 8% on the TV. The gain or loss per cent on the whole transaction was

(a) 2% profit (b) 2% loss (c) 1% profit (d) 1% loss

61. In the given figure, if $l \| m$, then the values of a and b are

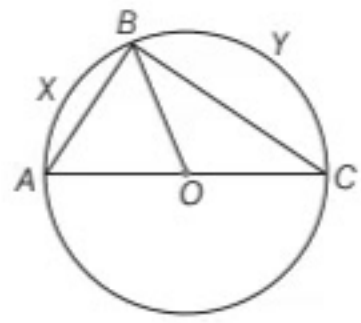


(a) $\angle a = 70°$ and $\angle b = 45°$ (b) $\angle a = 61°$ and $\angle b = 54°$
(c) $\angle a = 65°$ and $\angle b = 50°$ (d) $\angle a = 67°$ and $\angle b = 48°$

62. Find the length of a chord of a circle which is at a distance of 6 cm from the centre of the circle , if the radius of the circle is 10 cm.

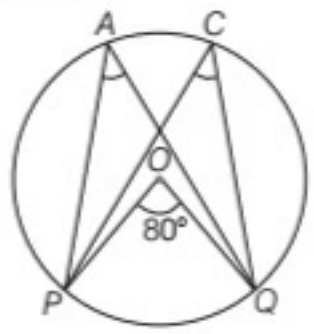
(a) 8 cm (b) 14 cm (c) 16 cm (d) 20 cm

63. In the given figure, AOC is a diameter of the circle and arc $AXB = \frac{1}{2}$ arc BYC. Then, $\angle BOC$ is equal to



(a) 100° (b) 120° (c) 130° (d) 115°

64. In the given figure, if $\angle POQ = 80°$, then $\angle PAQ$ and $\angle PCQ$ are



(a) $\angle PAQ = 30°$ and $\angle PCQ = 40°$
(b) $\angle PAQ = \angle PCQ = 30°$
(c) $\angle PAQ = \angle PCQ = 40°$
(d) $\angle PAQ = \angle PCQ = 35°$

65. If surface area of a sphere is $676\pi\ cm^2$, then its radius is

(a) 10 cm (b) 11 cm (c) 12 cm (d) 13 cm

Section IV General Science

66. Which one of the following force is a contact force?
(a) Force of gravity (b) Force of friction
(c) Magnetic force (d) Electrostatic force

67. The wear and tear in the machine part is due to
(a) electrostatic force .
(b) muscular force
(c) frictional force
(d) gravitational force

68. The basic unit of speed is
(a) km/min (b) m/min
(c) km/h (d) m/s

69. The process of depositing a thin layer of any superior metal over an object of a cheaper metal with the help of electricity is called
(a) electro refining (b) electro metallurgy
(c) electroplating (d) None of these

70. Plastic wire is
(a) an insulator (b) a conductor
(c) Both (a) and (b) (d) None of these

71. Vibrations in a body produce
(a) sound (b) pressure
(c) density (d) current

72. Loudness of sound is measured in units of
(a) decibel (dB)
(b) Hertz (Hz)
(c) metre (m)
(d) metre / second (m/s)

73. The loudness of sound is determined by is
(a) amplitude of vibration
(b) ratio of amplitude and frequency of vibration
(c) frequency of vibration
(d) product of amplitude and frequency of vibration

74. Which of the following are used to study the growth of foetus inside the mother's womb?
(a) Radiowaves (b) X-rays
(c) Infrared waves (d) Ultrasound

75. Which among the following in the given options is an example of a magnetic substance?
(a) Cobalt (b) Nickel
(c) Iron (d) All of these

76. When electric current is passed through a conducting solution, there is a change of colour of the solution. This indicates
(a) the chemical effect of current
(b) the heating effect of current
(c) the magnetic effect of current
(d) the lightning effect of current

77. A person cannot see the distant objects clearly (though) he can see the nearby object clearly. He is suffering from the defect of vision called
(a) myopia (b) hypermetropia
(c) cataract (d) night blindness

78. No medium is required for transfer of heat by the process of
(a) conduction (b) convection
(c) Both (a) and (b) (d) radiation

79. Which of the following is non - biodegradable?
(a) Paper (b) Cotton cloth
(c) Plastic (d) Wood

80. Metals are generally hard. Which of the following metals is an exception and can be cut with a knife?
(a) Iron (b) Sodium
(c) Gold (d) Magnesium

81. The substance that does not burn with flame is
(a) LPG (b) camphor
(c) dry grass (d) charcoal

82. The term sericulture is used for
(a) culture of bacteria
(b) rearing of silkworm
(c) making silk fabric from silk yarn
(d) production of sarees

83. Which of the following is an acid-base indicator ?
(a) Vinegar (b) Lime water
(c) Turmeric (d) Baking soda

84. Materials which can be drawn into wires are called ductile. Which of the following is not a ductile material?
(a) Silver (b) Copper
(c) Sulphur (d) Aluminium

85. The material which is commonly used for making electric iron sole?
(a) PVC (b) Acrylic (c) Teflon (d) PET

86. When coal burns in air,
(a) carbon monoxide is formed
(b) sulphur dioxide is formed
(c) oxygen is formed
(d) carbon dioxide is formed

87. PET is a
(a) polyester (b) nylon
(c) polyamide (d) thermosetting polymer

88. Which metal is present in haemoglobin?
(a) Magnesium (b) Iron
(c) Carbon (d) Zinc

89. The general process that takes place at a sheep shearing shed is
(a) removal of fleece
(b) separating hair of different textures
(c) washing of sheep fibre to remove grease
(d) rolling of sheep fibre into yarn

90. Which of the following is not a cell?
(a) Red Blood cell (RBC)
(b) Bacterium
(c) Spermatozoa
(d) Virus

91. Which one of the following terms is not a part of the nucleus?
(a) Ribosome (b) Chromosome
(c) Nucleolus (d) Gene

92. Which among the following do not reproduce by vegetative reproduction.
(a) Wheat (b) Sugarcane
(c) Rose (d) Jasmine

93. The fusion of male and female gametes is called
(a) ovulation (b) population
(c) pollinating (d) fertilization

94. The disease caused by a protozoan and spread by an insect is
(a) dengue (b) malariae
(c) polio (d) measles

95. Which of these do not have a regular cell structure?
(a) Bacteria (b) Viruses
(c) Protozoa (d) Algae

96. The phenomenon of 'marble cancer' is due to
(a) soot particles.
(b) CFCs
(c) log
(d) acid rain

97. Roughage component in our food is made up of
(a) glucose
(b) cellulose
(c) starch
(d) sugarcane

98. One of the following food is not obtained from animals. The food is
(a) honey (b) milk
(c) maize (d) mutton

99. A pond contains clean water. Which of the following activities will produce least pollution of water?
(a) Washing clothes in the pond
(b) Bathing animals in the pond
(c) Washing motor vehicles in the pond
(d) Swimming in the pond

100. Which of the following nutrients is not present in milk?
(a) Protein (b) Vitamin - C
(c) Calcium (d) Vitamin - D

Answers

1	(a)	2	(d)	3	(c)	4	(b)	5	(a)	6	(d)	7	(b)	8	(b)	9	(c)	10	(a)
11	(c)	12	(d)	13	(c)	14	(c)	15	(b)	16	(a)	17	(b)	18	(b)	19	(d)	20	(a)
21	(a)	22	(b)	23	(a)	24	(a)	25	(b)	26	(c)	27	(a)	28	(c)	29	(c)	30	(a)
31	(b)	32	(c)	33	(b)	34	(b)	35	(d)	36	(a)	37	(b)	38	(c)	39	(c)	40	(d)
41	(a)	42	(b)	43	(b)	44	(a)	45	(d)	46	(b)	47	(b)	48	(a)	49	(d)	50	(a)
51	(b)	52	(b)	53	(c)	54	(d)	55	(c)	56	(b)	57	(c)	58	(d)	59	(d)	60	(a)
61	(d)	62	(c)	63	(d)	64	(c)	65	(d)	66	(b)	67	(c)	68	(d)	69	(c)	70	(a)
71	(a)	72	(a)	73	(a)	74	(d)	75	(d)	76	(a)	77	(a)	78	(c)	79	(c)	80	(b)
81	(d)	82	(b)	83	(c)	84	(c)	85	(c)	86	(d)	87	(a)	88	(b)	89	(a)	90	(d)
91	(a)	92	(a)	93	(d)	94	(b)	95	(b)	96	(d)	97	(b)	98	(a)	99	(d)	100	(b)