Reasoning Ability

Chapter 2

Odd One Out

Classification means to define groups of people or things, arrange by class or category and then find out different things or odd one out.

In this part out of a group, one people or things differ from remaining other words, they are having some common properties. They may like as a international, national level information history, science, alphabet and numerical analogy, Classification having 3 types which are below :

(a) Classify among words and people (TYPE-1)

(b) Classify among pair of word (TYPE-2)

(c) Odd one out among set. (TYPE-3)

Solved Examples

TYPE – 1 :

In this type, among four options three objects or things having same properties.

1. (a) Lawyer (b) Legislator
   (c) Mayor (d) Governor

Sol. Last 3 options are related to the politics and first option does not follow. So, Lawyer is the odd one.

2. (a) Acute (b) Parallel
   (c) Right (d) Obtuse

Sol. Acute, Right, obtuse are types of triangle - angle rather parallel is a property of line

3. (a) 50 (b) 120
   (c) 145 (d) 37

Sol. 37 is not divisible by 5 and rest numbers are divisible by 5.

4. (a) Kanpur (b) Allahabad
   (c) Varanasi (d) Mathura

Sol. All except Mathura, are situated on the bank of river Ganga.

Type – 2 :

In previous type, there is a single word or thing is given which follow same type of properties. In this type we have a pair in it, 1st object related to another object with any specific properties, we have found that pair which doesn't follow it.

1. (a) Painter : Gallery (b) Actor : Stage
   (c) Worker : Factory (d) Student : Stage

Sol. Clearly, (d) is the odd one. In all other pairs, 2nd is the working place of the first.

2. (a) Ornithology : Birds (b) Mycology : Fungi
   (c) Phycology : Algae (d) Biology : Botany

Sol. Clearly, answer is (d). If all other pairs, 1st is study of second field.

3. (a) 8 – 64 (b) 9 – 81
   (c) 10 – 100 (d) 11 – 131

Sol. (d); is the answer.

$8^2 = 64$, $9^2 = 81$, $10^2 = 100$, $11^2 = 121$

Type – 3 :

In this type, pairs are given with minimum 3 digit or object which are correlated to each other with any specific property

1. (a) (3, 9, 27) (b) (5, 25, 125)
   (c) (6, 36, 216) (d) (9, 81, 728)

Sol. Clearly, (d) is the odd one, which does not follow continue powers of 9.

2. (a) 5, 10, 15, 20 (b) 6, 12, 18, 24
   (c) 8, 60, 10, 40 (d) 15, 30, 45, 60

Sol. Option (c) does not follow the multiples of digit 8 rather remaining have 1 : 2 : 3 : 4 ratio.

Practice Set

1. (a) CFIL (b) PSVX (c) JMPS (d) ORUX
2. (a) XW (b) PO (c) FG (d) ML
3. (a) EBD (b) QNO (c) IFH (d) YVX
4. (a) xXYA (b) hHIK (c) bBCE (d) iIMP
5. (a) Sun (b) Moon (c) Mars (d) Universe
6. (a) Faraday (b) Beethoven (c) Newton (d) Edison
7. (a) Inch (b) Foot (c) Yard (d) Quart
8. (a) Peak (b) Mountain (c) Hillock (d) Valley
9. (a) N M O L (b) PK QI (c) RISH (d) TGUF
10. (a) Reader (b) Writer (c) Publisher (d) Reporter
11. (a) Island (b) Coast (c) Harbour (d) Oasis
12. (a) Carrot (b) Potato (c) Ginger (d) Cabbage
13. (a) AUgPZ (b) YGLHT (c) MXiDV (d) KFeC
14. (a) Cheras (b) Chandelas (c) Pallavas (d) Cholas
15. (a) 66-56 (b) 101-90 (c) 41-30 (d) 33-22
16. (a) Stamp : letter (b) Ticket : Train (c) Ink : Pen (d) Car : Engine
17. (a) Army : General (b) Team : Captain (c) Creche : Infant (d) Meeting : Chairman
18. (a) Wolf (b) Cat (c) Dog (d) Fox
19. (a) 12 : 14 (b) 24 : 7 (c) 37 : 4 (d) 42 : 4
20. (a) 1 (5) 2 (b) 5 (61) 4 (c) 3 (17) 24 (d) 3 (17) 4
21. (a) 6348 (b) 5745 (c) 9309 (d) 8452
22. (a) Cuba-Havana (b) Cannada : Otty (c) France : Paris (d) Austria : Vienna
23. (a) Dollar : USA (b) Won : Korea (c) Euro : UK (d) Euro : france
24. (a) Sumo (b) Maldives (c) Cricket (d) Baseball
25. (a) Wheat (b) Rice (c) Jowar (d) Beans
26. (a) BDW (b) DFU (c) FHS (d) EVE
27. (a) TOY (b) MOB (c) DEL (d) LTO
28. (a) NOON (b) NET (c) LEVEL (d) TEA
29. (a) M 14 O (b) T 21 V (c) J 12 L (d) R 19 T
30. (a) 63 (b) 81 (c) 121 (d) 225
31. (a) TSOL (b) NUR (c) NRUT (d) MEHB
32. (a) 24 (b) 35 (c) 50 (d) 63
33. (a) 9763 (b) 8648 (c) 4721 (d) 5630
34. (a) 6481 (b) 1625 (c) 2536 (d) 1211
35. (a) 462 (b) 730 (c) 531 (d) 894
36. (a) 31 (b) 13 (c) 49 (d) 19
37. (a) 1024 (b) 2916 (c) 3969 (d) 7206
38. (a) $\frac{M}{Q} : 3$ (b) $\frac{J}{N} : 3$ (c) $\frac{E}{I} : 2$ (d) $\frac{R}{X} : 5$
39. (a) July (b) August (c) December (d) June
40. (a) 4-11-70 (b) 3-27-39 (c) 15-85-5 (d) 21-7-35
41. (a) Agni (b) Prithvi (c) INS (d) Nag
42. (a) CRPF (b) NIA (c) RAW (d) IB
43. (a) Saraswati (b) Yamuna (c) Charmanwati (d) Asikni
44. (a) 101–90 (b) 201–190 (c) 301–291 (d) 401–390
45. (a) 55–55 (b) 26–61 (c) 13–31 (d) 46–64

46. (a) $9\frac{1}{11}$ (b) $7\frac{9}{13}$
(c) $5\frac{15}{17}$ (d) $5\frac{6}{19}$
47. (a) Diesel-Bus (b) Oil- Earther light
(c) Smoke-Fire (d) Petrol-Car
48. (a) Pistol (b) Sword
(c) Gun (d) Rifle
49. (a) 55×5 (b) 15×15
(c) 5×45 (d) 9×25
50. (a) R (b) W
(c) V (d) A
51. (a) Gupta dynasty (b) Nanda dynasty
(c) Maurya dynasty (d) Chola dynasty
52. (a) Vayudoot (b) Pushkar
(c) Indian Airlines (d) Air India
53. (a) Andaman-Nicobar (b) Pondi Cherry
(c) Delhi (d) Goa
54. (a) Violet (b) Blue
(c) Green (d) White
55. (a) C R D T (b) A P B Q
(c) E U F V (d) G W H X
56. (a) Harmless (b) Guilty
(c) Innocent (d) Fearless
57. (a) 2 (b) 5
(c) 8 (d) 11
58. (a) Garden-Gardener (b) Song-Singer
(c) Art-Artist (d) Dance-Dancer
59. (a) Tabla (b) Veena
(c) Sitar (d) Ektara
60. (a) Light (b) Wave
(c) Heat (d) Sound
61. (a) Distinguish (b) Scatter
(c) Differentiate (d) Classification
62. (a) POT (b) TAB
(c) HOLDS (d) LEVEL
63. (a) ZX (b) TR
(c) IF (d) OM
64. (a) 94–7 (b) 42–6
(c) 35–5 (d) 56–8
65. (a) Pond-Lake (b) Pistol-Gun
(c) Car-Bus (d) Church-Monument
66. (a) Diligent (b) Dignified
(c) Dissident (d) Devoted
67. (a) A D G J (b) N Q T V
(c) P S V X (d) C F I K
68. (a) 64 (b) 900
(c) 343 (d) 1000
69. (a) DI (b) KQ
(c) OU (d) AG
70. (a) Long-Short (b) Black-White
(c) Head-Cap (d) Friend-Foe
71. (a) Ink (b) Paper
(c) Office (d) Pen
72. (a) dc ba (b) hg fe
(c) pq rs (d) rq po
73. (a) BF JN (b) DH LP
(c) GIMQ (d) HL PT
74. (a) (37-74) (b) (52-26)
(c) (47-84) (d) (88-44)
75. (a) Hindi (b) Tamil
(c) Punjabi (d) Urdu
76. (a) Insurance (b) Provident fund
(c) Salary (d) Shares
77. (a) Play-Actor (b) Building-Architect
(c) Craft-Artisan (d) Cloth-Skirt
78. (a) BADC (b) JILK
(c) NMPO (d) VUWX
79. (a) 357 (b) 581
(c) 698 (d) 784
80. (a) 206 (b) 125
(c) 27 (d) 8

Distinct Questions

81. (a) 325 (b) 256
(c) 369 (d) 224
82. (a) Aravali Hills (b) Mole Hills
(c) Shivalik hills (d) Nilgiri Hills
83. (a) 27 (b) 57
(c) 67 (d) 87
84. (a) 5-8 (b) 17-32
(c) 19-38 (d) 21-40
85. (a) DW (b) XC
(c) UF (d) NM
86. (a) 10.5 (b) 7.5
(c) 9 (d) 11.5
87. (a) Stethoscope (b) Microscope
(c) Telescope (d) Binocular
88. (a) Cotton (b) Terene
(c) Silk (d) Wool
89. (a) R G T F (b) M L O K
(c) C T E S (d) V D Z C
90. (a) U Z D G I (b) J O S V X
(c) R W A C E (d) F K O R T
91. (a) Confluence (b) Concourse
(c) Radiation (d) Concentration
92. (a) Carpenter (b) Goldsmith
(c) Blacksmith (d) Driver

93. (a) MSWCH (b) NSWAH
(c) GMRVY (d) UZEIL
94. (a) E G K Q (b) C E I O
(c) L N Q W (d) P R V B
95. (a) 392-21 (b) 483-15
(c) 602-42 (d) 917-35
96. (a) Mendicant (b) Ascetic
(c) Hermit (d) Pious
97. (a) Cotton (b) Ore
(c) Latex (d) Fabrics
98. (a) Diptheria (b) Cataract
(c) Whooping Cough (d) Encephalitis
99. (a) 81-45 (b) 72-91
(c) 117-99 (d) 135-126
100. (a) 20, 16, 18 (b) 18, 14, 16
(c) 16, 12, 14 (d) 14, 11, 13

Previous year Questions (Memory Based)

In below questions find out the odd numbers/letters/ number pairs from the given alternatives.

1. (a) 3 (b) 15
(c) 12 (d) 19
2. (a) Widow (b) Spinster
(c) Wife (d) Bachelor
3. (a) E (b) B
(c) O (d) I
4. (a) SPPG (b) EPOF
(c) HBJO (d) KVNM
5. (a) Enzyme (b) Anode
(c) Motion (d) Pressure
6. (a) 1857 (b) 1919
(c) 1909 (d) 1943
7. (a) ABCD (b) EFGH
(c) WXYZ (d) PRSQ
8. (a) Divergent Production
(b) Cognition
(c) Forgetting
(d) Possessive
9. (a) Fantasy (b) Disgust
(c) Distress (d) Sorrow
10. (a) 217 (b) 730
(c) 567 (d) 126
11. (a) Shimla (b) Darjeeling
(c) Ooty (d) Agra
12. (a) Foal (b) Hen
(c) Lamb (d) Leveret
13. (a) BADC (b) XWZY
(c) VUST (d) NMPO
14. (a) DCFG (b) FEHI
(c) JILM (d) HGJL
15. (a) (5,64) (b) (2,3)
(c) (3,8) (d) (4,27)
16. (a) (96,24) (b) (39,18)
(c) (81,54) (d) (82,64)
17. (a) Purple (b) Rosy
(c) Blue (d) Red
18. (a) Scurvy (b) Rickets
(c) Night-blindness (d) Influenza
19. (a) Rain (b) Shower
(c) Sleet (d) Raisin
20. (a) 9 (b) 12
(c) 4 (d) 25
21. (a) 36 (b) 61
(c) 18 (d) 52
22. (a) Rival (b) Opponet
(c) Foe (d) Ally
23. (a) 27 (b) 35
(c) 18 (d) 9
24. (a) 9-72 (b) 8-56
(c) 11-115 (d) 10-90
25. (a) TUVX (b) OPRS
(c) BCDF (d) HIJL
26. (a) Bay (b) Cape
(c) Peninsula (d) Island
27. (a) Arabic (b) Malayalam
(c) Intelligence (d) Chinese
28. (a) Square (b) Trapezium
(c) Cylinder (d) Parallelogram
29. (a) Yacht (b) Submarine
(c) Boat (d) Ship
30. (a) 2012 (b) 1998
(c) 2005 (d) 1997
31. (a) MIGE (b) XTQO
(c) RNKI (d) HDAY
32. (a) 42 : 4 (b) 48 : 6
(c) 32 : 2 (d) 15 : 5
33. (a) VWY (b) QRT
(c) LMO (d) JKL
34. (a) B E (b) G J
(c) N Q (d) Q R

35. (a) 400 (b) 484 (c) 625 (d) 728
36. (a) 1000 (b) 1725 (c) 2744 (d) 4125
37. (a) 12-16 (b) 45-80 (c) 30-40 (d) 36-48
38. (a) CX (b) DW (c) JQ (d) LR
39. (a) Cyclotron (b) Basic (c) Pascal (d) Fortran
40. (a) Rooster (b) Buck (c) Gander (d) Peahen
41. (a) PNB (b) OBC (c) Dena Bank (d) RBI
42. (a) Teaching (b) Counselling (c) Instruction (d) Guidance
43. (a) (25,49) (b) (121,169) (c) (7,169) (d) (9,25)
44. (a) HEAT (b) MEAT (c) MEET (d) BEAT
45. (a) 8395 (b) 7245 (c) 6322 (d) 8246
46. (a) FhjL (b) PrtV (c) KnpR (d) Cegi
47. (a) Table Tennis (b) Cricket (c) Volleyball (d) Football
48. (a) Andhra pradesh (b) Maharashtra (c) Kerala (d) Rajasthan
49. (a) 284 (b) 263 (c) 195 (d) 242
50. (a) 7 : 98 (b) 9 : 162 (c) 12 : 288 (d) 17 : 572
51. (a) 3 : 00 (b) 9 : 00 (c) 12 : 30 (d) 6 : 15
52. (a) Nana Shahib (b) Bakht Khan (c) Tatya tope (d) Bahadur Shah III
53. (a) mmmqqqttt (b) bbbfffjjj (c) cccgggkkk (d) kkkooosss
54. (a) brass (b) steel (c) bronze (d) tin
55. (a) Ears (b) Eyes (c) Legs (d) throat
56. (a) Sparrow (b) Kingfisher (c) Nightingle (d) Bat
57. (a) (1,2,4,5) (b) (6,7,14,15) (c) (4,5,10,15) (d) (3,4,8,9)
58. (a) Shirt : Dress (b) Boy : Girl (c) Mango : Fruit (d) Table : Furniture
59. (a) Downing Street (b) White House (c) Kremlin (d) Kirribilli House
60. (a) Race course road (b) Akbar Bhavan (c) Hyderabad house (d) Raj Bhawan

Practice Set Solutions

1. (b); Except option second PSVX doesn't follows increment of letters by 3 place.
2. (c); The second alphabet is immediate previous letter of 1st alphabet. In option (c) it is just reverse.
3. (b); IFH, YVX and EBD are follow same format, that from first alphabet decrement of 3 place value and from second alphabet increment of 2 place value.
4. (d); IIMP does not follow second alphabet to third alphabet consecutive sequence.
5. (d); All three options sun, moon, mars, are present in universe.
6. (b); Faraday, Newton and Edison are scientist and Beethoven is a singer.
7. (d); Inch, foot and yard are measurement unit of length but quart is unit of volume.
8. (d); All except valley is related to hill field or elevated feature.
9. (b); Except in P K Q I, in all others there are two Pairs of opposite letters.

   $N \rightarrow M$ $O \rightarrow L$

   $R \rightarrow I$ $S \rightarrow H$

   $T \rightarrow G$ $U \rightarrow F$
10. (a); Writer, publisher and reporter are related to publication field and reader is used for a person.
11. (d); All except Oasis related to sea and oasis is related to desert.
12. (d); Carrot, potato, ginger grow underground but cabbage grow above the ground.
13. (b); Except in YGLHT, in all others the third letter is written in small letter
14. (b); Cheras, pallaras and cholas related to southern part of India and chandelas are related to northern India.

15. (a); 66 – 56 = 10 101 – 90 = 11
41 – 30 = 11 33 – 22 = 11
16. (d); All except option (d), 1st object is part of 2nd object. But engine related to car, not car related to engine.
17. (c); All except option (c), 2nd object is head or main officer of the group.
18. (b); Except cat, all others belong to dog family.
19. (c); In each of pairs except (c), the product of the number is 168. Hence the answer is (c).
20. (c); In each of the alternatives except (c), the number inside it is greater than other two. Hence the answer is (c).
21. (d); All except option (d), the sum of all digit is 21.
22. (b); In each of the alternatives except (b), 2nd one is capital of first one.
23. (c); All except (c), first object is currency of second object.
24. (b); In each of alternative except (b), are name of games.
25. (d); Except Beans, all others are grains (cereals and coarse cereals)
26. (d); In each of alternatives except (d), from first letter to second letter increase by two of place value and 3rd letter is opposite of 2nd letter.
27. (d); All except (d), having middle letter a vowel.
28. (d); In each of alternatives except (d), reverse of given word also a meaningful word.
29. (c); All except option (c), middle digits is the average of place values of first and last letter.
30. (a); Except the number 63, all other numbers are perfect squares.
31. (d); All except option (d) are meaningful words in reverse order.
32. (c); In each of alternative except (c), are on digit less forming a square.
33. (c); All except option (c), the multiplication of first and second digit is third digit.
34. (d); In each of alternatives except option (d) the combination of 2-2 digit are perfect square in given number.
35. (b); All except 730, every number is divisible by digit 3.
36. (c); All except 49, every number is prime No.
37. (d); All except 7206, every number is a perfect square.
38. (c); In each of all alternative except option (c), the number is shown the number of alphabets present between given two alphabets.
39. (d); Except June, every month contain 31 days.
40. (a); Except 4-11-70, in all others the small number is a factor of the other two numbers.
41. (c); Agni Prithvi and Nag are name of Indian missile and INS term used for Naval Army.
42. (a); NIA, RAW and IB are investigation agency of India and CRPF is a part of police force.
43. (b); All except option (b), all rivers belong to the ancient India.
44. (c); All except option '3' the difference of both pair is 11.
45. (b); $55 - 55$ $13 - 31$ $46 - 64$ $26 - 61$
Odd one
46. (d); $9\frac{1}{11} = \frac{100}{11}$, $7\frac{9}{13} = \frac{100}{13}$, $5\frac{5}{17} = \frac{100}{17}$
$5\frac{6}{19} = \frac{101}{19}$ odd one.
47. (c); In the given option except 'C' first there are fuel and then are vehicles run with them but fire produces smoke.
48. (b); All except sword are related to bullet.
49. (a); 55×5=275, 15×15=225, 5×45=225, 9×25=225
50. (d); 'A' is odd because all others are consonant while 'A' is vowel.
51. (d); The other three dynasties belonged to North India, while Cholas were the rulers in south India.
52. (d); The other three are internal air ways, while Air India flies abroad also.
53. (c); The other three states / UTs are near sea beach or an island(s) in the sea.
54. (d); 'The other three are the colours of rainbow.
55. (a); Here in the three options, the first and the third and the socond and the fouth letters of alphabet are in a consecutive order.
56. (b); All the rest reflect the positive qualities of human being while Guilty reflects his negative quality.
57. (c); The other 3 numbers are prime numbers.
58. (a); One who works in garden is called gardener. All other are Artforms
59. (a); Except Tabla, all others are stringed musical-instruments.
60. (b); Except wave, all others are different forms of energy
61. (d); Classification denotes grouping
62. (c); Except HOLDS, if letters of all others words are written in reverse order, we will get another meaningful words.
POT → TOP ; TAB → BAT ; LEVEL → LEVEL
63. (c); $Z \xrightarrow{-2} X$; $T \xrightarrow{-2} R$; $I \xrightarrow{-3} F$; $O \xrightarrow{-2} M$
64. (a); Except in the number pair 94-7 in all other we get the second number by dividing the first number by 7.

65. (d); Except church - Monument, in all other pairs of words two related terms are give.

66. (c); Except Dissident, all other words imply positive attitude.

67. (a); $A \xrightarrow{+3} D \xrightarrow{+3} G \xrightarrow{+3} J$
$P \xrightarrow{+3} S \xrightarrow{+3} V \xrightarrow{+2} X$
$N \xrightarrow{+3} Q \xrightarrow{+3} T \xrightarrow{+2} V$
$C \xrightarrow{+3} F \xrightarrow{+3} I \xrightarrow{+2} K$

68. (b); $64 = 4^3$, $343 = 7^3$, $1000 = 10^3$

69. (a); $D \xrightarrow{+5} I$; $K \xrightarrow{+6} Q$
$O \xrightarrow{+6} U$; $A \xrightarrow{+6} G$

70. (c); Except in the pair of words Head-cap, in all others the two words are antonym to each other

71. (c); Except office, all others are stationery items

72. (c); $d \xrightarrow{-1} c \xrightarrow{-1} b \xrightarrow{-1} a$
$h \xrightarrow{-1} g \xrightarrow{-1} f \xrightarrow{-1} e$
$p \xrightarrow{+1} q \xrightarrow{+1} r \xrightarrow{+1} s$
$r \xrightarrow{-1} q \xrightarrow{-1} p \xrightarrow{-1} o$

73. (c); $B \xrightarrow{+4} F \xrightarrow{+4} J \xrightarrow{+4} N$
$D \xrightarrow{+4} H \xrightarrow{+4} L \xrightarrow{+4} P$
$G \xrightarrow{+2} I \xrightarrow{+4} M \xrightarrow{+4} Q$
$H \xrightarrow{+4} L \xrightarrow{+4} P \xrightarrow{+4} T$

74. (c); $37 \times 2 = 74$, $26 \times 2 = 52$, $44 \times 2 = 88$
But $47 \times 2 = 94$

75. (d); Except Urdu, all others are indigenous languages, Urdu was developed from Persian (a foreign language).

76. (c); Salary is given in lieu of work. All others are types of investment.

77. (d); Except in cloth-skirt, in all others work and worker relationship has been shown.

78. (d); $B \xrightarrow{-1} A \xrightarrow{+3} D \xrightarrow{-1} C$
$J \xrightarrow{-1} I \xrightarrow{+3} L \xrightarrow{-1} K$`
$N \xrightarrow{-1} M \xrightarrow{+3} P \xrightarrow{-1} O$
$V \xrightarrow{-1} U \xrightarrow{+2} W \xrightarrow{+1} X$

79. (c); Except 698, others are multiples of 7

$$\frac{357}{7} = 51 \; ; \; \frac{581}{7} = 83 \; ; \; \frac{784}{7} = 112$$

But $\frac{698}{7} = 99.71$

80. (a); Except the number 206, all other numbers are perfect cubes.
$5^3=125$, $3^3=27$; $2^3 = 8$

Distinct Solutions

81. (b); Except 256 all digit's last digit is sum of first two digit.

82. (b); Aravali, Shivalik and Nilgiri Hills are present in India and Mole Hills is a conical mound of loose soil.

83. (a); The number 27 is a perfect cube $3 \times 3 \times 3 = 27$

Note :- The number 67 may also be odd as it is a prime Number.

84. (c); $5 \times 2 - 2 = 10 - 2 = 8$
$17 \times 2 - 2 = 34 - 2 = 32$
$21 \times 2 - 2 = 42 - 2 = 40$
But $19 \times 2 - 2 = 38 - 2 = 36$

85 (a); In each of alternatives except (a), first letter is big letter as compared to second and they are opposite to each other.

86. (d); All except 11.5 number every alternatives follow a rule that is (number × 1.5 + 1.5) for example
$5 \times 1.5 + 1.5 = 9$

87. (a); Except Stethoscope all others are such scientific instruments that are used to view distant or small objects.

88. (b); Except Terene, all others are natural fibres.

89. (d); R G T F (+2, −1) M L O K (+2, −1)
C T E S (+2, −1) V D Z C (+4, −1)

90. (c); U Z D G J (+5 +4 +3 +2) , J O S V X (+5 +4 +3 +2)
R W A C E (+5 +4 +2 +2) F K O R T (+5 +4 +3 +2)

91. (c); Radiation is different from the other three All other words show convergence.

92. (d); Except driver, all others are artisans who make something.

93. (c); $M \xrightarrow{+6} S \xrightarrow{+4} W \xrightarrow{+6} C \xrightarrow{+5} H$
$N \xrightarrow{+5} S \xrightarrow{+4} W \xrightarrow{+4} A \xrightarrow{+7} H$
$G \xrightarrow{+6} M \xrightarrow{+5} R \xrightarrow{+4} V \xrightarrow{+3} Y$
$U \xrightarrow{+5} Z \xrightarrow{+5} E \xrightarrow{+4} I \xrightarrow{+3} L$

94. (c); $E \xrightarrow{+2} G \xrightarrow{+4} K \xrightarrow{+6} Q$
$C \xrightarrow{+2} E \xrightarrow{+4} I \xrightarrow{+6} O$
$L \xrightarrow{+2} N \xrightarrow{+3} Q \xrightarrow{+6} W$
$P \xrightarrow{+2} R \xrightarrow{+4} V \xrightarrow{+6} B$

95. (b); In the number pair 483-15, both the number are multiples of 3

$$\frac{483}{3} = 161 \; ; \; \frac{15}{3} = 5$$

96. (d); Mendicant, Ascetic and Hermit are synonyms given the meaning of a beggar, and pious related to devoutly religious.

97. (d); Cotton, ore and Latex are used to manufacture other things and fabrics is last stage of manufacturing process.

98. (b); All the rest affect nerves while cataract affects eyes.

99. (b); 8 + 1 = 9 ; 4 + 5 = 9
1 + 1 + 7 = 9 ; 9 + 9 = 18 → 1 + 8 = 9
1 + 3 + 5 = 9 ; 1 + 2 + 6 = 9
But, 7 + 2 = 9 ; 9 + 1 = 10

100. (d); $20 \xrightarrow{-4} 16 \xrightarrow{+2} 18$
$18 \xrightarrow{-4} 14 \xrightarrow{+2} 16$
$16 \xrightarrow{-4} 12 \xrightarrow{+2} 14$
$14 \xrightarrow{-3} 11 \xrightarrow{+2} 13$

Previous year Solutions (Memory Based)

1. (d); All alternatives except (d) are divisible by 3.
2. (d); All alternatives except (d) are used for a female candidate.
3. (b); B is not a vowel and remain option are vowel.
4. (d); All except option (d), each alternatives words decrease by 1 place value then it will be a meaningful word.
5. (a); All except option (a), are used in physics.
6. (d); All except 1943, every year shown a movement of Indian history.
7. (d); Each of alternatives option follow consecutive letter except PRSQ.
8. (a); Cognition, forgetting and possessive are part of human feeling rather divergent production is type of production.
9. (a); Disgust, distress and sorrow are part of difficult time and fantasy is imagination. Hence the answer is (a).
10. (c); In each alternatives are one digit extra from a perfect cube except 567. Hence, answer is (c).
11. (d); All except option (d) are hill station.
12. (b); All except option (b) is young one of a mammal.
13. (c); Each alternatives, except option (c) are follow a particular sequence of –1, +3, –1 in each alphabet.
14. (d); All except option (d) doesn't follow the sequence from first alphabet as –1, +3, +1.
15. (b); In each of alternatives except option (b) every second number is cube of previous digit from first number.
16. (d); All except option (d), each set number's sum is divisible by 3.
17. (b); Rosy is not the part of the spectrum.
18. (d); All except option (d), are disease due to deficiency of vitamins.
19. (d); All except option (d) are related to rain.
20. (b); Except 12, all numbers are square.
21. (a); 36 is a perfect square of 6.
22. (d); All except ally, each option, are synonyms of enemy.
23. (b); All except 35, are multipliers of digit 9.
24. (c); In each of alternatives except of (c), every second number is multiplication of first number and their previous number.
25. (b); All except OPRS, each alternatives follow increment sequence as +1, +1, +1 and +2
26. (b); All except cape, are places which are surrounded with water and related to sea.
27. (c); All except option (c) are the languages.
28. (c); Square, trapezium parallelogram are having 4 sides. Hence, option (c) is a 3-D figure.
29. (b); Except submarine, all moves in upper surface of water but submarine can move under the water also.
30. (a); All except option (a), every year is a general year and 2012 is a leap year.
31. (a); In each of alternatives except option (a), follow a sequence of –4, –3, –2.
32. (a); All except option (a), the first digit is exactly divisible by second digit.
33. (d); In each of alternatives except (d) are follow a sequence of +1 and +2.
34. (d); All except (d) are having increment of digit 3 in their place value.
35. (d); All except 728 are perfect square.
36. (c); All except 2744 number. All numbers are divisible by 25.
37. (b); In each of alternatives except (b), are having exact 3rd and 4th multiplier of a fixed number. for example.

$4 \times 3 = 12$, $4 \times 4 = 16$
$10 \times 3 = 30$ $10 \times 4 = 40$
$12 \times 3 = 36$, $12 \times 4 = 48$.

38. (d); All option (d), alphabets are opposite to each other.

39. (a); Basic pascal and Fortran are computer language rather cyclotron not a language. Hence answer is (a).

40. (b); Rooster, gander and Peathen all are related as a male Bird but buck is a mammal.

41. (d); RBI is the central bank.

42. (a); In each of alternatives except teaching, are connected to a same field.

43. (c); All except option (c), every set numbers are exact squares.

44. (c); In option (c), two letter are repeated.

45. (d); All except option (d), each alternatives have difference of 1st and last digit's square in the middle.

46. (c); All except option (c), there is common semantics follow as a sequence of +2, in all alphabets.

47. (a); All except Table Tennis, games are outdoor games. So answer is (a).

48. (d); Andra Pradesh Maharashtra and Kerala are coastal states but Rajasthan doesn't have any boundary with sea.

49. (c); In each of alternatives except option (c), middle digit is multiplication of first and last number.

50. (d); All except option (d) alternatives second number is totally divisible by first number.

51. (c); All expect 12 : 30, the angle between minute hand and hour hand is right angle. Hence, answer is (c).

52. (d); All except Bahadur shah III, these all are related to 1857 Revolution.

53. (a); In each of alternatives every main letter having only four alphabetic place value difference, except option (a). Doesnot follow it.

54. (d); All except tin other are combination of two metals. Hence, option (d) is answer.

55. (d); All except throat are outer parts of our body. Throat is inner part of our body.

56. (d); Bat is a mammal.

57. (c); All except option (c), each alternatives second digit is one extra from first digit, third digit is just double of second digit and last digit is one extra from third digit.

58. (b); In each of alternatives first object is a part of second object which is shown the field of first one. except option (b).

59. (d); In except kirribilli house, are name of president house of the country, rather than kirribilli house of Australian prime minister.

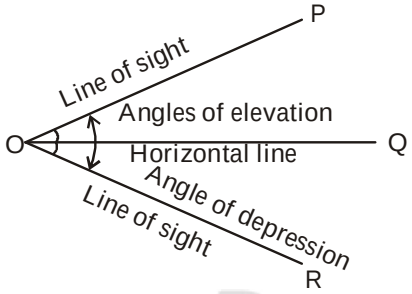
60. (d); Raj Bhawan is situated in west Bengal and race course road, Akbar Bhavan and hyderabad house are situated in new delhi.

Quantitative Aptitude

Chapter 7

Height and Distance

Height and distance is one of the important application of trigonometry. It is a technique used to find the distance and height of the object. We can find them with the help of trigonometric ratios.

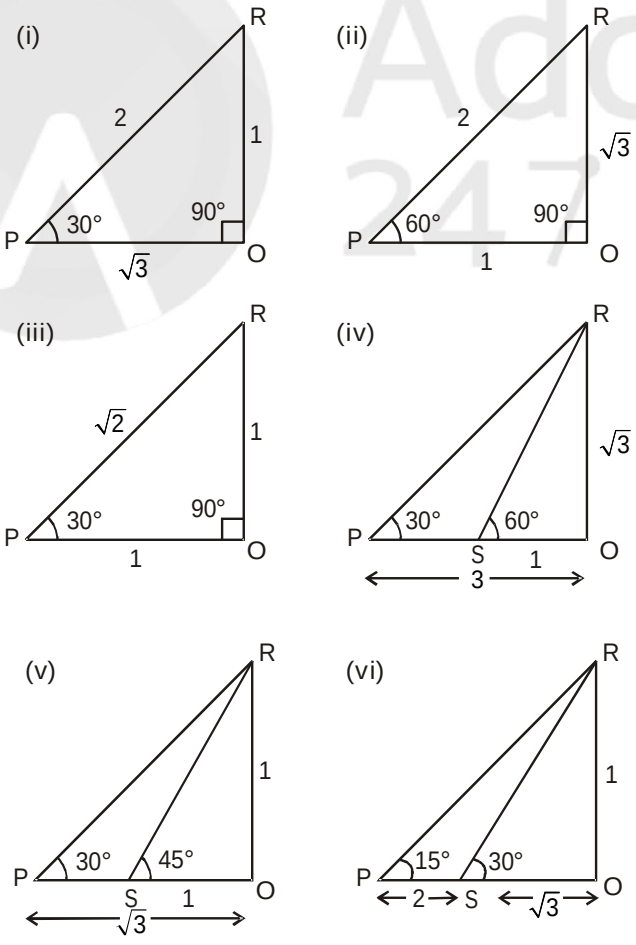


Line of Sight : The line of sight is the line drawn from the eye of an observer to the object.

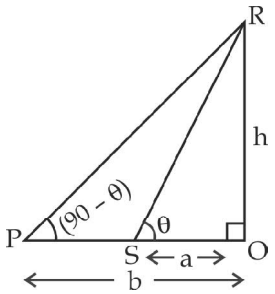
Angle of Elevation : When the object is above the horizontal level of our eye, we have to turn our head upwards to see an object. Here ∠POQ is the angle of elevation.

Angle of Depression : When the object is below the horizontal level of our eye, we have to turn our head downwards to see an object. Here ∠QOR is the angle of depression.

Some Important Points : In this chapter we solve all the questions with the help of ratio.



Concept 1 : If the angle of elevation of the top of a tower at two points which are at a distance of 'a' and 'b' metres from the foot of tower and on the same side of the tower are complementary. Then height of the tower is $\sqrt{ab}$.



Example : If the angle of elevation of the top of a tower at two points which are at a distance of '9' and '4' metres from the foot of the tower and on the same side of the tower are complementary. Find the height of the tower?

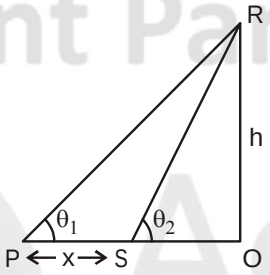
Sol. Height of tower $= \sqrt{ab} = \sqrt{9\times4}$

$= \sqrt{36} = 6$ m

Concept 2 : If a man wishes to find the height of a tower which stands on a horizontal plane. The angle of elevation of top of the tower is θ_1. On walking x units towards the tower. He find the angle of elevation becomes θ_2. Then the height of the tower is

$$h = \left[\frac{x\tan\theta_1\tan\theta_2}{\tan\theta_2 - \tan\theta_1}\right]$$

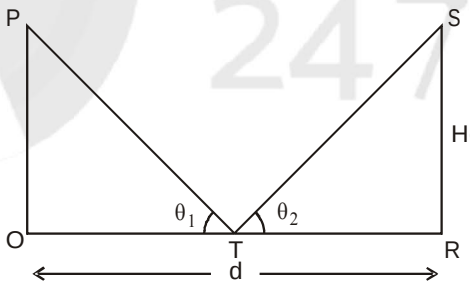
$$h = \frac{x}{\cot\theta_1 - \cot\theta_2}$$



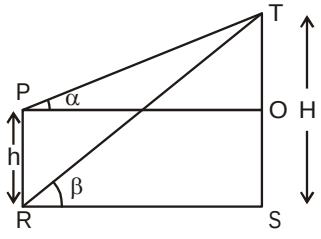
Concept 3 : If two poles of equal heights stand on either sides of a road which is 'd' units wide. At a point on the road between the poles, the elevation of the top of the poles are θ1 and θ2, then height of the poles is

$$h = \left[\frac{d\tan\theta_1\tan\theta_2}{\tan\theta_1 + \tan\theta_2}\right]$$

$$h = \frac{d}{\cot\theta_1 + \cot\theta_2}$$



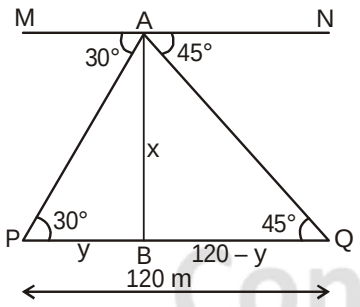
Concept 4 : From the top and bottom of the building of height 'h' units, the angle of elevation of the top of a tower are 'α' and 'β' respectively, then the height of the tower is $\left[\frac{h\tan\beta}{\tan\beta - \tan\alpha}\right]$



Types of Questions

1. The angles of depression of two ships from the top of a lighthouse are 45° and 30°. If the ships are 120 m apart, find the height of the lighthouse? (Ships are on both side of light house)

Sol. Let AB, the height of the lighthouse = x m



Since MN || PQ

∴ angle MAP = angle APB = 30° and angle NAQ = angle AQB = 45°

Let the length between P and B be y m.

So, the length between B and Q is (120 – y) m.

In ΔABP

$$\tan 30° = \frac{AB}{BP} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{y}$$

$$\Rightarrow y = x\sqrt{3} \quad ...(i)$$

Again, in ΔABQ

$$\tan 45° = \frac{AB}{BQ} \Rightarrow 1 = \frac{x}{120 - y}$$

$$\Rightarrow x = 120 - y \quad ...(ii)$$

Combining equations (i) and (ii), we get

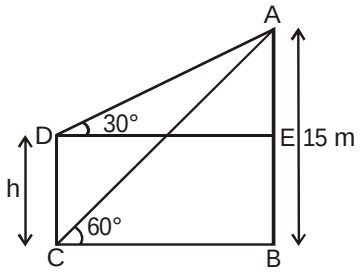
$$x = 120 - x\sqrt{3}$$

$$\text{or, } x\left(1 + \sqrt{3}\right) = 120$$

$$\therefore x = \frac{120}{1 + \sqrt{3}} \approx 44 \text{ m}$$

2. The top of a 15 metre-high tower makes an angle of depression of 60° with the bottom of an electric pole and an angle of depression of 30° with the top of the pole. What is the height of the electric pole?

Sol. $15 = \dfrac{h(\tan 60°)}{\tan 60° - \tan 30°}$

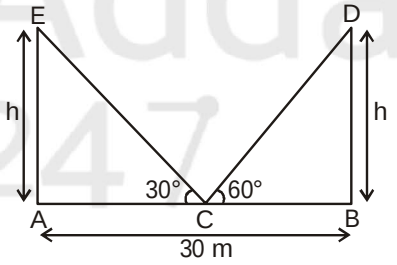


$$\therefore h = \frac{15 \times (\tan 60° - \tan 30°)}{\tan 60°} = \frac{15 \times \left(\sqrt{3} - \frac{1}{\sqrt{3}}\right)}{\sqrt{3}}$$

$$= \frac{30}{\sqrt{3} \times \sqrt{3}} = 10 \text{ m}$$

3. Two poles of equal heights are standing opposite to each other on either side of a road, which is 30 m wide. From a point between them on the road, the angles of elevation of the tops are 30° and 60°. The height of each pole is _____?

Sol. Required height (h) = $\dfrac{30 \times \tan 30° \times \tan 60°}{\tan 60° + \tan 30°}$



$$= \frac{30 \times \frac{1}{\sqrt{3}} \times \sqrt{3}}{\sqrt{3} + \frac{1}{\sqrt{3}}} = \frac{15\sqrt{3}}{2} = 7.5 \times 1.732$$

$$= 12.975 \text{ m} \approx 13 \text{ m}$$

4. The angle of elevation of a lamppost changes from 30° to 60° when a man walks towards it. If the height of the lamppost is $10\sqrt{3}$ metres, find the distance travelled by men?

Sol. Height of tower = $\dfrac{\text{Distance travelled}}{\cot\theta_1 - \cot\theta_2}$

$$h = \frac{x}{\cot\theta_1 - \cot\theta_2}, \quad 10\sqrt{3} = \frac{x}{\cot 30° - \cot 60°}$$

$$x = 10\sqrt{3}\left(\frac{2}{\sqrt{3}}\right) = 20\text{m}$$

Foundation

1. The height of a pole and the shadow cast by it have equal lengths. The angle of elevation of the sun is:
(a) 30° (b) 60°
(c) 45° (d) 75°

2. A ladder of length 20 m is resting against a wall 10 m high such that the top of the ladder touches the top edge of the wall. Find the distance of the foot of the ladder from the foot of the wall?
(a) $\frac{10}{\sqrt{3}}$ m (b) 10 m
(c) $10\sqrt{3}$ m (d) 30 m

3. A ladder is resting against a wall such that the top of the ladder and that of the wall touch each other. The height of the wall is $\sqrt{3}$ times the distance of the foot of the ladder from the foot of the wall. The angle which the ladder makes with the ground is:
(a) 30° (b) 60°
(c) 45° (d) 75°

4. The angle of elevation of a moon when the length of the shadow of a pole is equal to its height, is:
(a) 30° (b) 45°
(c) 60° (d) 90°

5. If the length of shadow of a pole on a level ground it's $\sqrt{3}$ times the length of that pole, the angle of elevation of the sun is:
(a) 30° (b) 45°
(c) 60° (d) None of these

6. The angle of elevation of a tower from a distance 100 m from its foot is 30°. Height of the tower is:
(a) $100\sqrt{3}$ m (b) $\frac{100}{\sqrt{3}}$ m
(c) $50\sqrt{3}$ m (d) $\frac{200}{\sqrt{3}}$ m

7. When the length of the shadow of a pillar on the ground is same as the height of the pillar then the angle of elevation of the sun is:
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{4}$

8. The length of a shadow of a vertical tower is $\frac{1}{\sqrt{3}}$ times its height. The angle of elevation of the sun is:
(a) 30° (b) 45°
(c) 60° (d) 90°

9. The length of the shadow of a vertical pole 9 m high, when the sun's altitude is 30°, is (in cm):
(a) $3\sqrt{3}$ (b) 9
(c) $9\sqrt{3}$ (d) $18\sqrt{3}$

10. P and Q are two points observed from the top of a building $10\sqrt{3}$ m high. If the angles of depression of the points are complementary and PQ = 20m, then the distance of P from the building is: (P being the farther point)
(a) 25 m (b) 45 m
(c) 30 m (d) 40 m

11. If angle of elevation of top of a tower AB from a point P on the ground 15 meter away from the foot is 60°, find the height of the tower?
(a) $\frac{15}{\sqrt{3}}$ m (b) 15 m
(c) $15\sqrt{3}$ m (d) 30 m

12. Length of the tight thread of a kite from a point on the ground is 85 m. If thread subtends an angle θ with the ground such that $\tan\theta = \frac{8}{15}$ then find the height at which kite is flying?
(a) 20 m (b) 40 m
(c) 35 m (d) 50 m

13. To cross a river a person covers a straight forward distance of 325 m along a bridge over the river. If bridge substends 30° angle with edge of the river, find the width of the river?
(a) 152.5 (b) 155
(c) 165 (d) 162.5

14. In a storm, a tree got broken by the wind whose top meets the ground at an angle of 30°, at a distance of 30 meters from the root. What was the height of the tree before breaking?
(a) 30 m (b) $30\sqrt{3}$ m
(c) 60 m (d) $60\sqrt{3}$ m

15. The height of a tower is 50 meter. When the Sun's altitude increases from 30° to 45°, the length of the shadow of the tower is decreased by x meter. Find the approximate value of x in meter?
(a) 36.6 m (b) 35.6 m
(c) 86.6 m (d) 36 m

16. The shadow of a tree is 16 meter when elevation of Sun is 60°. What is the height of the tree?
(a) 8 m (b) 16 m
(c) $16\sqrt{3}$ m (d) $\frac{16}{\sqrt{3}}$ m

17. A national highway is in north-south direction. From a point on the highway a school is situated in the north-east direction and is at a distance of $600\sqrt{2}$ m from the point. What is the perpendicular distance between school and the highway?

(a) 600 m (b) $\frac{600}{\sqrt{3}}$ m

(c) $600\sqrt{3}$ m (d) 300 m

18. When Sun's altitude is 30°, the shadow of a tower is 15 meter. What is the length of shadow when Sun's altitude is 60°?

(a) 3 m (b) 4 m

(c) 5 m (d) 6 m

19. The shadow of a 6 m high tower is 15 m and at the same point of time length of shadow of a tree is 25 m. What is the height of the tree?

(a) 21 m (b) 10 m

(c) 35 m (d) None of these

20. A tower stands vertically on the ground. From a point on the ground which is 30 m away from the foot of a tower, the angle of elevation of the top of the tower is found to be 45°. Find the height of the tower.

(a) 15 (b) 40

(c) 30 (d) 20

21. A tower is $50\sqrt{3}$ meters high. Find the angle of elevation of its top from a point 50 meters away from its foot?

(a) $\theta = 60°$ (b) $\theta = 45°$

(c) $\theta = 30°$ (d) $\theta = 22\frac{1}{2}°$

22. The angle of elevation of the top of a tower at a distance of 30 m from its foot is 60°. The height of the tower is:

(a) 20 m (b) $30\sqrt{3}$ m

(c) $15\sqrt{2}$ m (d) $\frac{15}{\sqrt{2}}$ m

23. If the ratio of the length of a pen to its shadow is $1:\sqrt{3}$, the angle of elevation of the source of light is:

(a) 40° (b) 30°

(c) 60° (d) 90°

24. The angle of elevation of the top of a tower at a distance of 500 m from its foot is 30°. The height of the tower is:

(a) $\frac{500\left(\sqrt{3}-1\right)}{3}$ m (b) 500 m

(c) $\frac{500\sqrt{3}}{3}$ m (d) $\frac{500\left(\sqrt{3}+1\right)}{3}$

25. If the angle of elevation of the top of a building from a point 50 m away from its base is 60°, the height of the building is:

(a) $100\sqrt{3}$ m (b) $50\left(\sqrt{3}-1\right)$ m

(c) $\frac{50}{\sqrt{3}}$ m (d) $50\sqrt{3}$ m

26. If the angle of elevation of sun is θ and the length of the shadow of a pole of length P is S, then:

(a) $P = S\cos\theta$ (b) $P = S\sin\theta$

(c) $P = \frac{S}{\cot\theta}$ (d) $P = S\cot\theta$

27. Determine the length of a ladder, if it is leaning against a vertical wall making an angle of inclination of 30° with the ground and its foot is 15 m from the wall?

(a) 15.77 m (b) 10 m

(c) $10\sqrt{3}$ m (d) 12.71 m

28. The foot of a ladder leaning against a wall of length 5 metre rest on a level ground $5\sqrt{3}$ metre from the base of the wall. The angle of inclination of the ladder with the ground is:

(a) 60° (b) 50°

(c) 40° (d) 30°

29. A balloon is connected to a meteorological station by a cable of length 200 m, inclined at 60° to the horizontal. Find the height of the balloon from the ground. Assume that there is no slack in the cable?

(a) 173.2 m (b) 17.35 m

(c) 123.2 m (d) None of these

30. The length of a string between a kite and a point on the ground is 50 m. The string makes an angle of 60° with the level ground. If there is no slack in the string, the height of the kite is:

(a) $50\sqrt{3}$ m (b) $25\sqrt{3}$ m

(c) 25 m (d) $\frac{25}{\sqrt{3}}$ m

Moderate

1. The angle of elevation of the top of a tower from two points situated at distances 36 m and 64 m from its base and in the same straight line with it are complementary. What is the height of the tower?
   (a) 50 m (b) 48 m
   (c) 25 m (d) 24 m
2. The angle of elevation of the top of a tower standing on a horizontal plane from two points on a line passing through the foot of the tower at a distance 9 ft and 16 ft respectively are complementary angles. Then the height of the tower is:
   (a) 9 ft (b) 12 ft
   (c) 16 ft (d) 144 ft
3. At a point on a horizontal line through the base of a monument the angle of elevation of the top of the monument is found to be such that its tangent is $\frac{1}{5}$. On walking 138 metres towards the monument the secant of the angle of elevation is found to be $\frac{\sqrt{193}}{12}$. The height of the monument (in metre) is:
   (a) 35 (b) 49
   (c) 42 (d) 56
4. The angles of elevation of the top of a tower from two points A and B lying on the horizontal through the foot of the tower are respectively 15° and 30°. If A and B are on the same side of the tower and AB = 48m, then the height of the tower is:
   (a) $24\sqrt{3}$ m (b) 24 m
   (c) $24\sqrt{2}$ m (d) 96 m
5. The angles of depression, from the top of a light-house, of two boats are 45° and 30° towards the west. If the two boats are 6m apart, then the height of the light-house is:
   (a) $3\left(\sqrt{3}+1\right)$m (b) $\left(\sqrt{3}+1\right)$ m
   (c) $3\left(\sqrt{3}-1\right)$ m (d) $\left(\sqrt{3}-1\right)$m
6. The angle of elevation of the top of an incomplete vertical pillar at a horizontal distance of 100 m from its base is 45°. If the angle of elevation of the top of complete pillar at the same point is to be 60°, then the height of the incomplete pillar is to be increased by:
   (a) $50\sqrt{2}$ (b) 100 m
   (c) $100\left(\sqrt{3}-1\right)$ m (d) $100\left(\sqrt{3}+1\right)$ m
7. A flag staff 5 mt. high stands on a building 25 mt. high. An observer is at the height of 30 m. The flag staff and the building subtend equal angles. The distance of the observer from the top of the flag staff is:
   (a) $\frac{5\sqrt{3}}{\sqrt{8}}$ (b) $\frac{5\sqrt{3}}{\sqrt{2}}$
   (c) $\frac{4\sqrt{3}}{\sqrt{2}}$ (d) $\frac{7\sqrt{3}}{\sqrt{2}}$
8. If from the top of a tower 50 m high, the angles of depression of two objects are respectively 60° and 45°, then the approximate distance between the objects, is: (objects are on same side of tower)
   (a) 11 m (b) 21 m
   (c) 31 m (d) 41 m
9. From the top of a pillar of height 20 m, the angles of elevation and depression of the top and bottom of another pillar are 30° and 45° respectively. The height of the second pillar (in meters) is:
   (a) $\frac{20\left(\sqrt{3}+1\right)}{\sqrt{3}}$ (b) 10
   (c) $10\sqrt{3}$ (d) $\frac{10}{\sqrt{3}}\left(\sqrt{3}+1\right)$
10. A straight tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with the ground. The distance from the foot of the tree to the point where the top touches the ground is 10 metres. The height of the tree is:
    (a) $10\left(\sqrt{3}+1\right)$ m (b) $10\sqrt{3}$ m
    (c) $10\left(\sqrt{3}-1\right)$ m (d) $\frac{10}{\sqrt{3}}$ m
11. If the angles of elevation of a tower from two points distant a and b (a > b) from its foot and in the same straight line from it are 30° and 60°, then the height of the tower is:
    (a) $\sqrt{a+b}$ (b) $\sqrt{ab}$
    (c) $\sqrt{a-b}$ (d) $\sqrt{\frac{a}{b}}$

12. A person of height 2 m wants to get a fruit which is on a pole of height $\left(\frac{10}{3}\right)$ m. If he stands at a distance of $\left(\frac{4}{\sqrt{3}}\right)$ m from the foot of the pole, then the angle at which he should throw the stone, so that it hits the fruit, is:
(a) 15° (b) 30°
(c) 45° (d) 60°

13. A landmark on a river bank is observed from two points A and B on the opposite bank of the river. The lines of sight make equal angles with the bank of the river. If AB = 1 km, then the width of the river is:
(a) 2 km (b) $\frac{1}{2}$ km
(c) $\frac{3\sqrt{2}}{2}$ km (d) $\frac{\sqrt{3}}{2}$ kms

14. A, B, C are three collinear points on the ground such that B lies between A and C and AB = 10 m. If the angles of elevation of the top of a vertical tower standing at C are respectively 30° and 60° as seen from A and B, then the height of the tower is:
(a) $5\sqrt{3}$ m (b) 5 m
(c) $\frac{10\sqrt{3}}{3}$ m (d) $\frac{20\sqrt{3}}{3}$ m

15. The angles of elevation of the top of a tower from two points A and B lying on the horizontal plane through the foot of the tower are respectively 45° and 30°. If A and B are on the same side of the tower and AB = 48 metre, then the height of the tower is:
(a) $24\left(\sqrt{3}+1\right)$ metre (b) 24 metre
(c) $14\sqrt{2}$ metre (d) 96 metre

16. There are two vertical posts, one on each side of a road, just opposite to each other. One post is 108 metre high. From the top of this post, the angles of depression of the top and foot of the other post are 30° and 60° respectively. The height of the other post, in metre, is:
(a) 36 (b) 72
(c) 108 (d) 110

17. The angles of elevation of the top of a building and the top of the chimney on the roof of the building from a point on the ground are x and 45° respectively. The height of building is h metre. Then the height of the chimney, in metre, is:
(a) h cotx + h (b) h cotx – h
(c) h tanx – h (d) h tanx + h

18. The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower is:
(a) $\sqrt{3}$ m (b) $5\sqrt{3}$ m
(c) $10\sqrt{3}$ m (d) $20\sqrt{3}$ m

19. A telegraph post is bent at a point above the ground due to storm. Its top just meets the ground at a distance of $8\sqrt{3}$ metres from its foot and makes an angle of 30°, then the height of the post is:
(a) 16 metres (b) 23 metres
(c) 24 metres (d) 10 metres

20. A ladder is resting against a wall at a height of 10 m. If the ladder is inclined with the ground at an angle of 30°, then the distance of the foot of the ladder from the wall is:
(a) $\frac{10}{\sqrt{3}}$ m (b) $\frac{20}{\sqrt{3}}$ m
(c) $10\sqrt{3}$ m (d) $20\sqrt{3}$ m

Difficult

1. At the base of a mountain the elevation of its summit is 45°. After ascending 600 meter towards the mountain upon an incline of 30°, the elevation changes to 60°. Find the height of the mountain?
(a) 300 m (b) $300\sqrt{3}$ m
(c) $300\left(1+\sqrt{3}\right)$ m (d) $300\left(\sqrt{3}-1\right)$ m

2. The angle of elevation of an aeroplane from a point on the ground is 60°. After flying for 15 seconds, the elevation changes to 30°. If the aeroplane is flying at a speed of 720 kmph, then find the constant height at which aeroplane is flying?
(a) 2958 m (b) 3850 m
(c) 2598 m (d) 3598 m

3. From a point on the ground the angle of elevation of top of a tower is α. On moving 'a' meters towards the tower, the elevation changes to β. The height of the tower is:
(a) $\frac{\tan\beta-\tan\alpha}{a\tan\alpha\tan\beta}$ (b) $\frac{a\left(\tan\beta-\tan\alpha\right)}{\tan\alpha\tan\beta}$
(c) $\frac{a\tan\alpha\ \tan\beta}{\tan\alpha-\tan\beta}$ (d) $\frac{a\tan\alpha\ \tan\beta}{\tan\beta-\tan\alpha}$

4. An aeroplane is flying above a horizontal plane. The angles of depression of two consecutive mile stones from plane in opposite directions are α and β. The aeroplane is flying at a height of:

(a) $\frac{\tan\alpha\ \tan\beta}{\tan\alpha-\tan\beta}$ (b) $\frac{\tan\alpha-\tan\beta}{\tan\alpha\ \tan\beta}$

(c) $\frac{\tan\alpha\ \tan\beta}{\tan\alpha+\tan\beta}$ (d) $\frac{\tan\alpha+\tan\beta}{\tan\alpha\ \tan\beta}$

5. The angle of elevation of a stationary cloud from a point h meter above a lake is α and angle of depression of its reflection in the lake is β. The height of the cloud above the lake is:

(a) $\frac{h(\tan\beta+\tan\alpha)}{\tan\alpha-\tan\beta}$ (b) $\frac{h(\tan\beta-\tan\alpha)}{\tan\beta+\tan\alpha}$

(c) $\frac{h(\tan\alpha-\tan\beta)}{\tan\alpha+\tan\beta}$ (d) $\frac{h(\tan\beta+\tan\alpha)}{\tan\beta-\tan\alpha}$

6. A spherical balloon of radius a units subtends an angle θ, at an observer's eye. The angle of elevation of centre of the balloon is ϕ. The height of the centre of the ball is:

(a) $a\sin\theta\ \text{cosec}\frac{\phi}{2}$ (b) $a\sin\frac{\theta}{2}\ \text{cosec}\ \phi$

(c) $a\sin\phi\ \text{cosec}\frac{\theta}{2}$ (d) $a\sin\frac{\phi}{2}\ \text{cosec}\ \theta$

7. From vertically situated aeroplane to the straight horizontal road, the angle of depression of two consecutive km stones are α and β. If an aeroplane is in vertical plane in between two stones, then the height of the aeroplane from the road (in km) will be:

(a) $\frac{\tan\alpha\tan\beta}{\tan\alpha+\tan\beta}$ (b) $\frac{\tan\alpha\tan\beta}{\tan\alpha-\tan\beta}$

(c) $\frac{\tan\alpha+\tan\beta}{\tan\alpha-\tan\beta}$ (d) $\frac{\tan\alpha-\tan\beta}{\tan\alpha+\tan\beta}$

8. Each side of an equilateral triangle subtends an angle of 60° at the top of a tower h m high located at the centre of the triangle. If a is the length of each side of the triangle, then:

(a) $3a^2 = 2h^2$ (b) $2a^2 = 3h^2$

(c) $a^2 = 3h^2$ (d) $3a^2 = h^2$

9. A round balloon of radius 10m subtends an angle $60°$ at the eye of an observer while the angle of elevation of its centre is $45°$. The height of the centre of the balloon is:

(a) $20\sqrt{2}$ (b) $20\sqrt{3}$

(c) $10\sqrt{2}$ (d) $10\sqrt{3}$

10. A tower on horizontal ground leans towards the north. At two points due south at distance a and b respectively from the foot, the angular elevations of the top of the tower are α and β. Find the inclination θ of the tower to the horizontal?

(a) $\frac{b\cot\alpha+a\cot\beta}{a-b}$ (b) $\frac{b\sin\alpha+b\cos\beta}{b-a}$

(c) $\frac{b\cot\alpha-a\cot\beta}{b-a}$ (d) None of these

11. At the foot of the mountain the elevation of its summit is 45°; after ascending 4 km towards the mountain up a slope of 30° inclination, the elevation is found to be 60°. Find the height of the mountain?

(a) $2\left(\sqrt{3}+1\right)$ km (b) $4\left(\sqrt{3}+1\right)$ km

(c) $2\left(\sqrt{3}-1\right)$ km (d) $4\left(\sqrt{3}-1\right)$ km

12. A boy standing in the middle of a field, observes a flying bird in the north at an angle of elevation of 30° and after 2 minutes, he observes the same bird in the south at an angle of elevation of 60°. If the bird flies all along in a straight line at a height of $50\sqrt{3}$ m, then its speed in km / h is:

(a) 4.5 (b) 3

(c) 9 (d) 6

13. A pole broken by the storm of wind and its top struck the ground at an angle of 30° and at a distance of 20 m from the foot of the pole, the height of the pole before it was broken:

(a) $20\sqrt{3}$ m (b) $\frac{40\sqrt{3}}{3}$ m

(c) $60\sqrt{3}$ m (d) $\frac{100\sqrt{3}}{3}$ m

14. The angle of depression of vertices of a regular hexagon lying in a plane from the top of a 75 m high tower standing at the centre of the hexagon is 60°. What is the length of each side of the hexagon?

(a) $50\sqrt{3}$ m (b) 75 m

(c) $25\sqrt{3}$ m (d) 25 m

15. Two vertical pillars stand on either side of a road. One of them is 108 meter height. From the top of this pillar angle of depression of top and bottom of the other pillar are respectively 30° and 60°. What is the height of the second pillar.

(a) 36 m (b) 72 m

(c) 108 m (d) 110 m

16. A shperical balloon of radius 10 feet is in the open air. If angle of elevation of centre of the balloon from a point on the ground is 45° and spherical balloon subtends an angle of 45° on that point then how high is the centre of the balloon from the ground?
(a) 10 feet (b) 15 feet
(c) $20\sqrt{2}$ feet (d) $10\sqrt{2}$ feet

17. The angle of elevation of an aeroplane from a point on the ground is 45°. After flying for 15 second, the elevation changes to 30°. If the aeroplane is flying at a height of 2500 meters, then approximate speed of the aeroplane in kmph is:
(a) 440 kmph (b) 400 kmph
(c) 360 kmph (d) 480 kmph

18. A boy standing in the middle of a field, observes a flying bird in the north at an angle of elevation of 30° and after 2 minutes, he observes the same bird in the south at an angle of elevation of 60°. If the bird flies all along in a straight line at a height of $50\sqrt{3}$ m, then its speed in km/h is:
(a) 4.5 (b) 3
(c) 9 (d) 6

19. The angle of elevation of an aeroplane from a point on the ground is 60°. After 15 seconds flight, the elevation changes to 30°. If the aeroplane is flying at a height of $1500\sqrt{3}$ m, then the speed of the plane is:
(a) 300 m/sec (b) 200 m/sec
(c) 100 m/sec (d) 150 m/sec

20. There are two temples, one on each bank of a river, just opposite to each other. One temple is 54 m high. From the top of this temple, the angles of depression of top and bottom of another temple are 30° and 60° respectively. The height of the other temple is:
(a) 18 m (b) 36 m
(c) $36\sqrt{3}$ m (d) $18\sqrt{3}$ m

Previous Year (Memory Based)

1. If the angle of elevation of the Sun changes from 30° to 45°, the length of the shadow of a pillar decreases by 20 metres. The height of the pillar is:
(a) $20\left(\sqrt{3}-1\right)$ m (b) $20\left(\sqrt{3}+1\right)$ m
(c) $10\left(\sqrt{3}-1\right)$ m (d) $10\left(\sqrt{3}+1\right)$ m

2. One flies a kite with a thread 150 metre long. If the thread of the kite makes an angle of 60° with the horizontal line, then the height of the kite from the ground (assuming the thread to be in a straight line) is:
(a) 50 metre (b) $75\sqrt{3}$ metre
(c) $25\sqrt{3}$ metre (d) 80 metre

3. The distance between two pillars of length 16 metres and 9 metres is x metres. If two angles of elevation of their respective top from the bottom of the other are complementary to each other, then the value of x (in metres) is:
(a) 15 (b) 16
(c) 12 (d) 9

4. The angles of elevation of the top of a building from the top and bottom of a tree are x and y respectively. If the height of the tree is h metre then, in metre, the height of the building is:
(a) $\frac{h\cot x}{\cot x+\cot y}$ (b) $\frac{h\cot y}{\cot x+\cot y}$
(c) $\frac{h\cot x}{\cot x-\cot y}$ (d) $\frac{h\cot y}{\cot x-\cot y}$

5. Two poles of equal heights are standing opposite to each other on either side of a road which is 100m wide. From a point between them on road, angles of elevation of their tops are 30° and 60°. The height of each pole in metre, is:
(a) $25\sqrt{3}$ (b) $20\sqrt{3}$
(c) $28\sqrt{3}$ (d) $30\sqrt{3}$

6. An aeroplane when flying at a height of 5000 m from the ground passes vertically above another aeroplane at an instant, when the angles of elevation of the two aeroplanes from the same point on the ground are 60° and 45° respectively. The vertical distance between the aeroplanes at that instant is:
(a) $5000\left(\sqrt{3}-1\right)$ m (b) $5000\left(3-\sqrt{3}\right)$ m
(c) $5000\left(1-\frac{1}{\sqrt{3}}\right)$ m (d) 4500 m

7. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30°. The man walks some distance towards the tower and then his angle of elevation of the top of the tower is 60°. If the height of the tower is 30 m, then the distance he moves is:
(a) 22 m (b) $22\sqrt{3}$ m
(c) 20 m (d) $20\sqrt{3}$ m

8. The distance between two vertical poles is 60 m. The height of one of the poles is double the height of the other. The angles of elevation of the top of the poles from the middle point of the line segment joining their feet are complementary to each other. The heights of the poles are:

(a) 10 m and 20 m (b) 20 m and 40 m

(c) 20.9 m and 41.8 m (d) $15\sqrt{2}$ m and $30\sqrt{2}$ m

9. The shadow of the tower becomes 60 metres longer when the altitude of the sun changes from 45° to 30°. Then the height of the tower is:

(a) $20\left(\sqrt{3}+1\right)$ m (b) $24\left(\sqrt{3}+1\right)$ m

(c) $30\left(\sqrt{3}+1\right)$ m (d) $30\left(\sqrt{3}-1\right)$ m

10. A vertical post 15 ft high is broken at a certain height and its upper part, not completely separated, meets the ground at an angle of 30°. Find the height at which the post is broken?

(a) 10 ft (b) 5 ft

(c) $15\sqrt{3}\left(2-\sqrt{3}\right)$ ft (d) $5\sqrt{3}$ ft

11. A man 6 ft tall casts a shadow 4 ft. long at the same time when a flag pole casts a shadow 50 ft long. The height of the flag pole is:

(a) 80 ft (b) 75 ft

(c) 60 ft (d) 70 ft

12. The angle of elevation of an aeroplane from a point on the ground is 60°. After 15 seconds flight, the elevation changes to 30°. If the aeroplane is flying at a height of $1500\sqrt{3}$ m, find the speed of the plane?

(a) 300 m/sec (b) 200 m/sec

(c) 100 m/sec (d) 150 m/sec

13. The angles of elevation of the top of a tower from the points P and Q at distances of 'a' and 'b' respectively from the base of the tower and in the same straight line with it are complementary. The height of the tower is:

(a) $\sqrt{ab}$ (b) $\frac{a}{b}$

(c) ab (d) a^2b^2

14. A pole stands vertically, inside a scalene triangular park ABC. If the angle of elevation of the top of the pole from each corner of the park is same, then in ΔABC, the foot of the pole is at the?

(a) centroid (b) circumcentre

(c) incentre (d) orthocentre

15. If the angles of elevation of a balloon from two consecutive kilometre-stones along a road are 30° and 60° respectively, then the height of the balloon above the ground will be:

(a) $\frac{\sqrt{3}}{2}$ km (b) $\frac{1}{2}$ km

(c) $\frac{2}{\sqrt{3}}$ km (d) $3\sqrt{3}$ km

16. A vertical stick 12 cm long casts a shadow 8 cm long on the ground. At the same time, a tower casts a shadow 40 m long on the ground. The height of the tower is:

(a) 72 m (b) 60 m

(c) 65 m (d) 70 m

17. The length of the shadow of a vertical tower on level ground increases by 10 meters when the altitude of the sun changes from 45° to 30°. Then the height of the tower is:

(a) $5\sqrt{3}$ metre (b) $10\left(\sqrt{3}+1\right)$ metre

(c) $5\left(\sqrt{3}+1\right)$ metre (d) $10\sqrt{3}$ metre

18. The elevation of the top of a tower from a point on the ground is 45°. On travelling 60 m from the point towards the tower, the elevation of the top becomes 60°. The height of the tower, in metres, is:

(a) 30 (b) $30\left(3-\sqrt{3}\right)$

(c) $30\left(3+\sqrt{3}\right)$ (d) $30\sqrt{3}$

19. The tops of two poles of height 24 m and 36 m are connected by a wire. If the wire makes an angle of 60° with the horizontal, then the length of the wire is:

(a) 6 m (b) $8\sqrt{3}$ m

(c) 8 m (d) $6\sqrt{3}$ m

20. From a tower 125 metres high, the angles of depression of two objects, which are in horizontal line through the base of the tower, are 45° and 30° and they are on the same side of the tower. The distance (in metres) between the objects is:

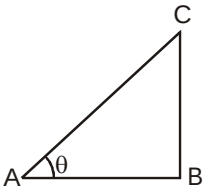
(a) $125\sqrt{3}$ (b) $125\left(\sqrt{3}-1\right)$

(c) $\frac{125}{\left(\sqrt{3}-1\right)}$ (d) $125\left(\sqrt{3}+1\right)$

Foundation

Solutions

1. (c);



Let BC be the height of the pole and let AB be the length of its shodow.
According to th question:
BC = AB

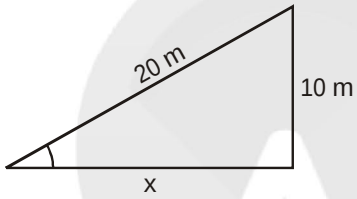
$\Rightarrow \frac{BC}{AB}$

$\Rightarrow \tan\theta = \frac{BC}{AB} = 1$

$\Rightarrow \theta = 45°$

So, the angle of elevation of the sun is 45°.

2. (c);



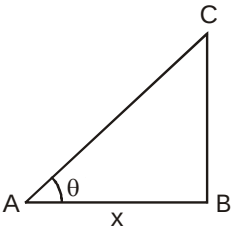
Let the required distance be x.

$\sin\theta = \frac{10}{20} = \frac{1}{2}$

$\Rightarrow \theta = 30°$

$\tan 30° = \frac{10}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{x}$, $x = 10\sqrt{3}$

3. (b);



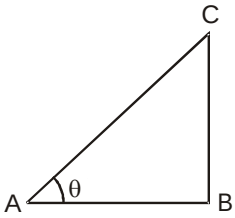
AB = distance between the foot of the ladder and the foot of the wall.
Let AB = x

$\Rightarrow$ BC = $\sqrt{3}$ x.

$\tan\theta = \frac{\sqrt{3}x}{x} = \sqrt{3}$

$\Rightarrow \theta = 60°$

4. (b);

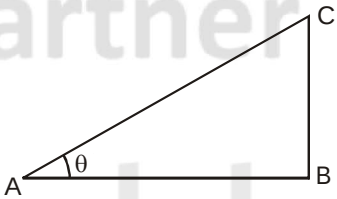


Let BC be the height of the pole and AB be the length of its shodow.
According to the question:
AB = BC

$\Rightarrow \tan\theta = \frac{BC}{AB} = 1$

$\Rightarrow \theta = 45°$

5. (a);



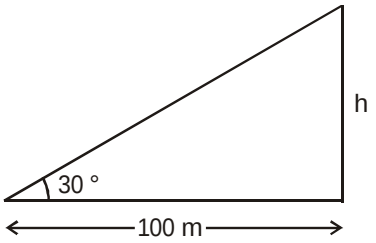
Let BC be the length of the pole and let AB be the length of its shadow.
According to the question:

AB = $\sqrt{3}$ BC

$\tan\theta = \frac{BC}{AB} = \frac{1}{\sqrt{3}}$

$\Rightarrow \theta = 30°$

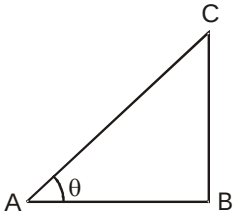
6. (b);



Let the h be the height of the tower.
h = 100 tan 30°

$= \frac{100}{\sqrt{3}}$ m.

7. (d);

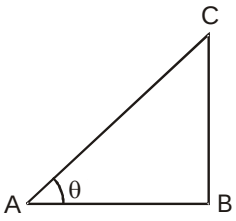


BC is the height of the pillar and AB is the length of the shadow.

$\tan\theta = \frac{BC}{AB} = 1$

$\Rightarrow \quad \theta = 45° = \frac{\pi}{4}$ radians.

8. (c);



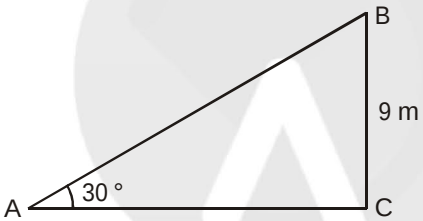
BC = height of the tower
AB = length of its shadow
According to the question:

$AB = \frac{1}{\sqrt{3}} BC$

$\tan\theta = \frac{BC}{AB} = \sqrt{3}$

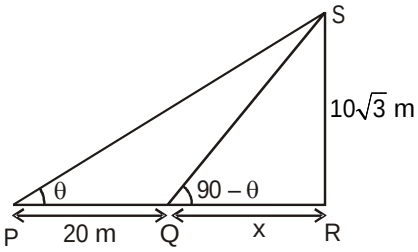
$\Rightarrow \quad \theta = 60°$

9. (c);



$AC = 9 \cot 30° = 9\sqrt{3}$ m.

10. (c);



Let QR = x m.

$\tan\theta = \frac{RS}{PR} = \frac{10\sqrt{3}}{20 + x}$

$\tan(90 - \theta) = \cot\theta = \frac{10\sqrt{3}}{x}$

$\tan\theta \cdot \cot\theta = 1$

$\Rightarrow \quad \frac{10\sqrt{3}}{20 + x} \cdot \frac{10\sqrt{3}}{x} = 1$

$\Rightarrow \quad x(20 + x) = 300$

$x^2 + 20x - 300 = 0$

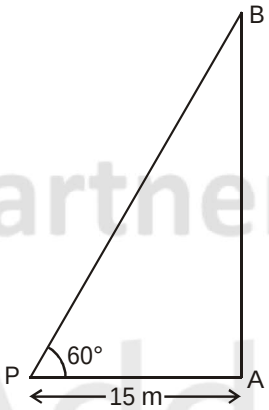
$\Rightarrow \quad x^2 + 30x - 10x - 300 = 0$

$\Rightarrow \quad (x - 10)(x + 30) = 0$

$\Rightarrow \quad x = 10$ m.

So, distance of P from the building = 20 + x = 30m.

11. (c);

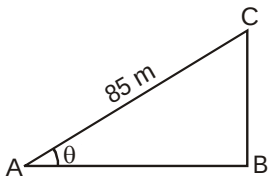


Let the height of the tower be h.

$\frac{h}{15} = \tan 60°$

$\Rightarrow \quad h = 15\sqrt{3}$ m.

12. (b);



$\tan\theta = \frac{8}{15}$

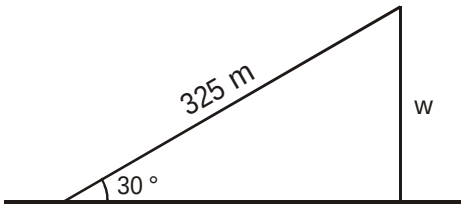
$\sec\theta = \sqrt{1 + \tan^2\theta} = \sqrt{1 + \frac{64}{225}} = \sqrt{\frac{225 + 64}{225}} = \frac{17}{15}$

$\Rightarrow \quad \cos\theta = \frac{15}{17}$

$\Rightarrow \quad \sin\theta = \sqrt{1 - \frac{225}{289}} = \sqrt{\frac{64}{289}} = \frac{8}{17} = \frac{BC}{85}$

$\Rightarrow \quad BC = 40$ m.

13. (d);

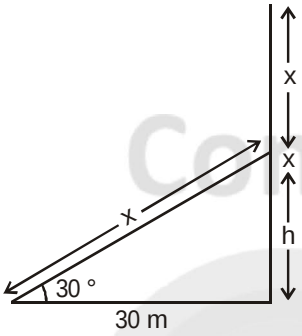


Let the width of the river be w.

$\frac{w}{325} = \sin 30° = \frac{1}{2}$

$\Rightarrow \quad w = \frac{325}{2} = 162.5 \text{ m}$

14. (b);



$\frac{h}{30} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad h = \frac{30}{\sqrt{3}} \text{ m}$

$\frac{h}{x} = \sin 30° = \frac{1}{2}$

$\Rightarrow \quad x = 2h$

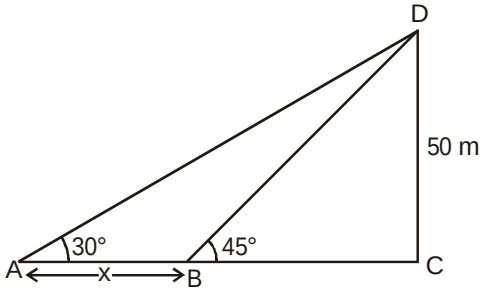
So, height of the tree

$= h + x = h + 2h = 3h$

$= 3 \times \frac{30}{\sqrt{3}}$

$= 30\sqrt{3} \text{ m.}$

15. (a);

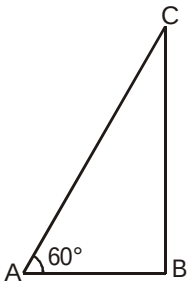


AC = 50 cot 30° = $50\sqrt{3}$ m

BC = 50 cot 45° = 50m

x = AC – BC = $50\left(\sqrt{3}-1\right) = 50 \times 0.732 = 36.6$ m.

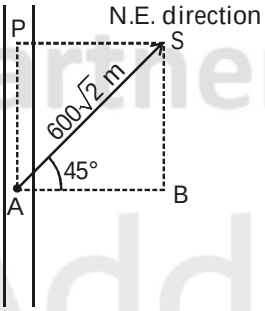
16. (c);



$\frac{BC}{16} = \tan 60° = \sqrt{3}$

$\Rightarrow \quad BC = 16\sqrt{3} \text{ m.}$

17. (a);



Perpendicular distance between the school and the highway

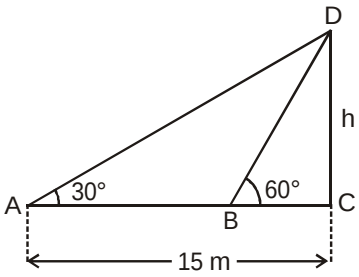
PS = AB

AB = $600\sqrt{2} \cos 45°$

$= 600\sqrt{2} \times \frac{1}{\sqrt{2}} = 600 \text{ m.}$

So, PS = 600 m.

18. (c);



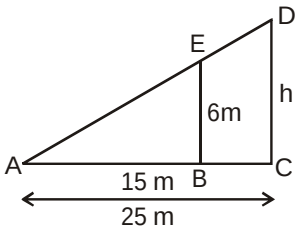
h = 15 tan 30°

$= \frac{15}{\sqrt{3}} \text{m.}$

BC = h cot 60°

$= \frac{15}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = 5 \text{ m.}$

19. (b);

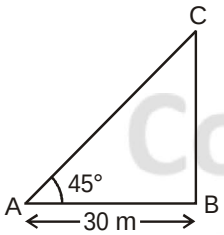


According to the question:

$\frac{6}{15} = \frac{h}{25}$

$\Rightarrow$ h = 10 m.

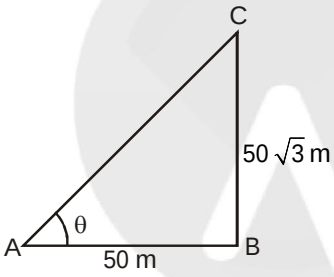
20. (c);



h = 30 tan 45°

= 30 × 1 = 30 m.

21. (a);

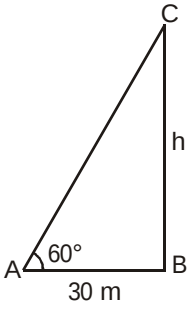


Let the angle of elevation be θ

$\tan\theta = \frac{50\sqrt{3}}{50} = \sqrt{3}$

$\Rightarrow$ θ = 60°.

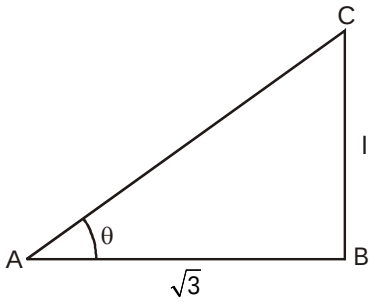
22. (b);



$\frac{h}{30} = \tan 60° = \sqrt{3}$

$\Rightarrow$ h = $30\sqrt{3}$ m.

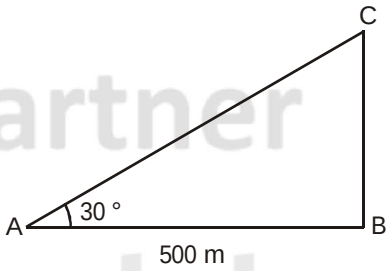
23. (b);



$\tan\theta = \frac{1}{\sqrt{3}}$

$\Rightarrow$ θ = 30°

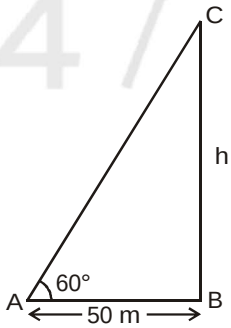
24. (c);



$\frac{BC}{AB} = \tan 30°$

BC = 500 tan 30° = $\frac{500}{\sqrt{3}}$ m.

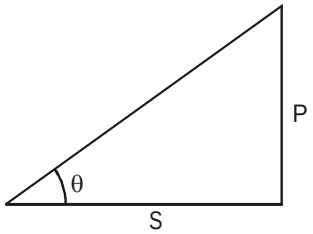
25. (d);



Height of the building = BC

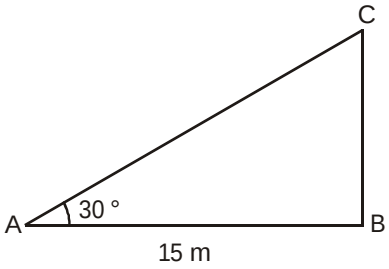
BC = 50 tan 60° = $50\sqrt{3}$ m.

26. (c);



$P = S\tan\theta = \frac{S}{\cot\theta}$

27. (c);

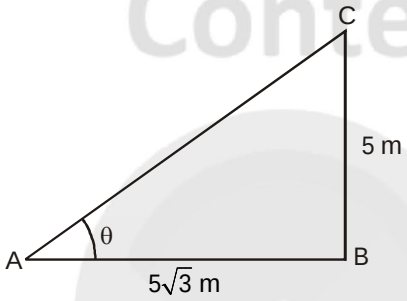


Length of the ladder = AC

$\frac{AB}{AC} = \cos 30° = \frac{\sqrt{3}}{2}$

$AC = \frac{2AB}{\sqrt{3}} m = \frac{2 \times 15}{\sqrt{3}} m. = 10\sqrt{3}$ m

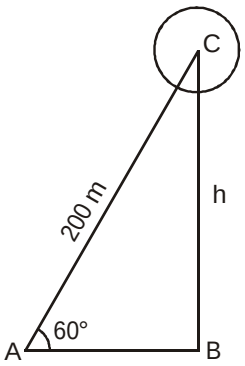
28. (d);



$\tan \theta = \frac{BC}{AB} = \frac{5}{5\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad \theta = 30°$

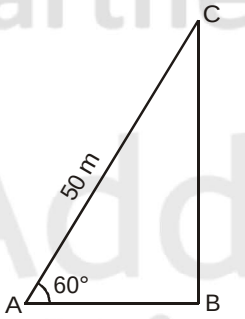
29. (a);



Height of the ballon from the ground = BC.

$BC = 200 \sin 60° = 200 \times \frac{\sqrt{3}}{2} = 100\sqrt{3}$ m = 173.2 m.

30. (b);



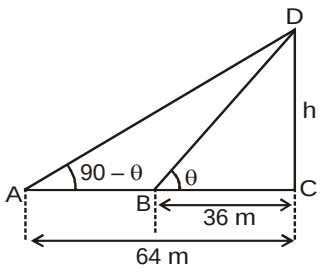
Height of the kite = BC = 50 sin 60°

$= \frac{50\sqrt{3}}{2} = 25\sqrt{3}$ m.

Moderate

Moderate

1. (b);



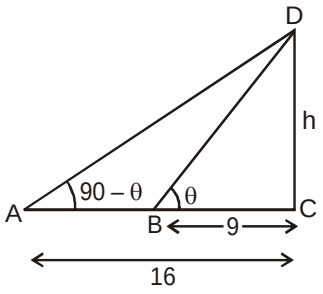
$\tan \theta = \frac{h}{36}$

$\tan (90 - \theta) = \cot \theta = \frac{h}{64}$

$\tan \theta \times \cot \theta = 1$

$\Rightarrow \quad \frac{h}{36} \times \frac{h}{64} = 1 \qquad \Rightarrow \quad h = 6 \times 8 = 48$ cm

2. (b);

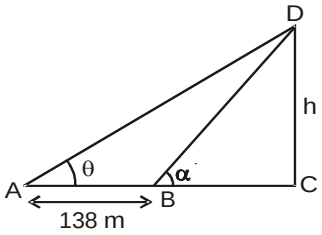


$\frac{h}{9} = \tan \theta, \frac{h}{16} = \tan (90 - \theta) = \cot \theta$

$\tan \theta \times \cot \theta = 1$

$\Rightarrow \quad \frac{h}{9} \times \frac{h}{16} = 1 \qquad \Rightarrow \quad h = 3 \times 4 = 12$ ft.

3. (c);



$\tan\theta = \frac{CD}{AC} = \frac{1}{5}$

$\Rightarrow$ AC = 5 CD

$\tan\alpha = \frac{CD}{BC} = \sqrt{\sec^2\alpha - 1}$

$\Rightarrow \frac{CD}{AC - 138} = \sqrt{\frac{193}{144} - 1} = \frac{7}{12}$

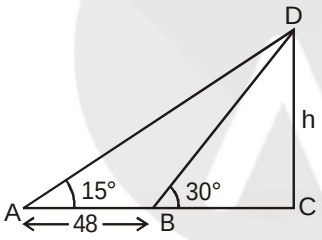
$\Rightarrow AC = \frac{12}{7}CD + 138$ ... (ii)

From (i) and (ii)

$\frac{12}{7}CD + 138 = 5\,CD$

$\Rightarrow$ CD = 42 m

4. (b);



Let the height of the tower be h.

BC = CD Cot 30°

$= \sqrt{3}\,h$

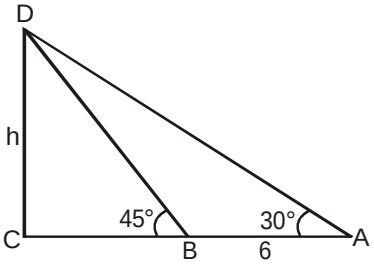
$AC = CD \cot 15° = h\left(2 + \sqrt{3}\right)$

AC – BC = 48 m

$\Rightarrow$ 2h = 48 m

$\Rightarrow$ h = 24 m.

5. (a);



Let the height of the light-house is h.

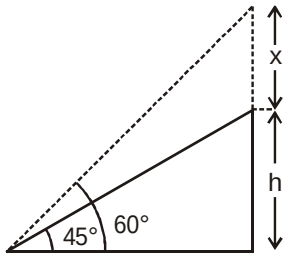
BC = h cot 45° = h

$AC = h \cot 30° = \sqrt{3}\,h$

AB = AC – BC = 6 m

$\Rightarrow \left(\sqrt{3} - 1\right)h = 6 \Rightarrow h = 3\left(\sqrt{3} + 1\right)$ m

6. (c);



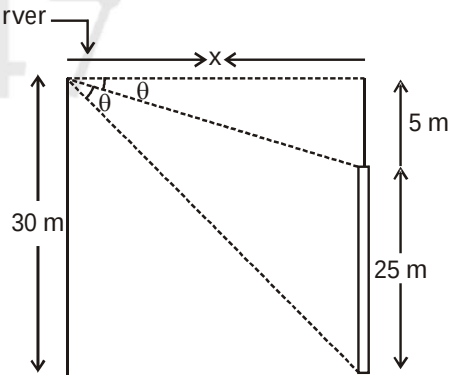
Let the height of the incomplete pillar be h and assume that it has to be increased by x m to complete it.

$\tan 45° = \frac{h}{100} = 1 \Rightarrow$ h = 100 m.

$\frac{h + x}{100} = \tan 60° = \sqrt{3}$

$\Rightarrow h + x = 100\sqrt{3}$ m $\Rightarrow x = 100\left(\sqrt{3} - 1\right)$ m

7. (b);



Let the distance of the observer from the top of the flag staff be x.

According to the question:

$\tan\theta = \frac{5}{x}$

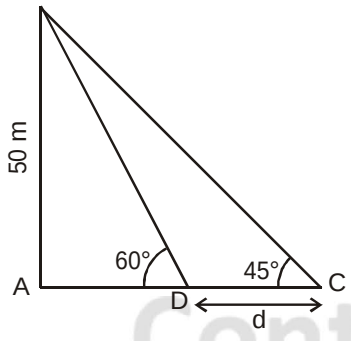
$\tan 2\theta = \frac{30}{x}$

$\Rightarrow \tan 2\theta = 6\tan\theta \Rightarrow \frac{2\tan\theta}{(1 - \tan^2\theta)} = 6\tan\theta$

$\Rightarrow \quad 1 - \tan^2\theta = \frac{1}{3} \quad \Rightarrow \quad \tan\theta = \frac{\sqrt{2}}{\sqrt{3}} = \frac{5}{x}$

$\Rightarrow \quad x = \frac{5\sqrt{3}}{\sqrt{2}}.$

8. (b);



Let the distance between the objects be d.

$\frac{AB}{AC} = \tan 45° = 1$

$\Rightarrow \quad AC = 50$ m.

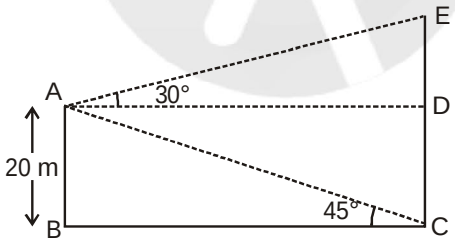
$AD = AB \cot 60° = \frac{AB}{\sqrt{3}}.$

The distance between the objects

$= d = AC - AD = 50 - \frac{50}{\sqrt{3}}$

$\Rightarrow \quad d = 21$m (approx).

9. (a);



$\frac{AB}{BC} = \tan 45° = 1$

$\Rightarrow \quad BC = 20$ m $\Rightarrow \quad AD = 20$ m

$\Rightarrow \quad \tan 30° = \frac{1}{\sqrt{3}} = \frac{DE}{20}$

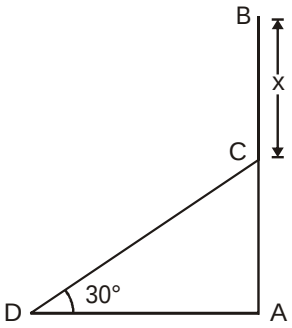
$\Rightarrow \quad DE = \frac{20}{\sqrt{3}}$ m

$CD = AB = 20$ m

$\Rightarrow$ The height of the second pillar = CD + DE

$= 20 + \frac{20}{\sqrt{3}} = \frac{20(\sqrt{3}+1)}{\sqrt{3}}$

10. (b);



Let CB be the part of the tree which breaks and takes the position CD.

Let CB = CD = x

AD = 10 m

$\angle ADC = 30°$

$\frac{10}{x} = \cos 30° = \frac{\sqrt{3}}{2} \quad \Rightarrow \quad x = \frac{20}{\sqrt{3}}$ m

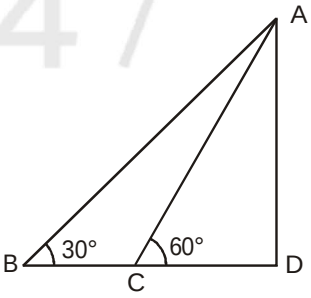
$\frac{AC}{AD} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad AC = \frac{10}{\sqrt{3}}$ m.

Height of the tree = AC + CB

$= \frac{10}{\sqrt{3}} + \frac{20}{\sqrt{3}} = 10\sqrt{3}$ m.

11. (b);



BD = a, CD = b

$\frac{AD}{BD} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad \frac{AD}{a} = \frac{1}{\sqrt{3}}$

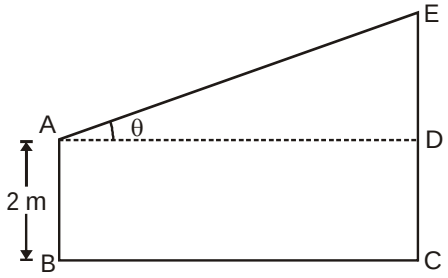
$\frac{AD}{CD} = \tan 60° = \sqrt{3}$

$\frac{AD}{b} = \sqrt{3}$

$\Rightarrow \frac{AD}{a} \times \frac{AD}{b} = \frac{1}{\sqrt{3}} \times \sqrt{3} = 1$

$\Rightarrow AD = \sqrt{ab}$

12. (b);

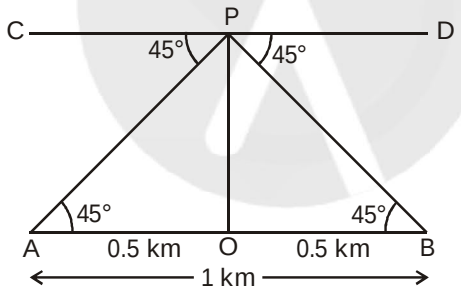


$AD = BC = \frac{4}{\sqrt{3}} m$

$DE = \frac{10}{3} - 2 = \frac{4}{3} m$

$\tan\theta = \frac{DE}{AD} = \frac{\frac{4}{3}}{\frac{4}{\sqrt{3}}} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$

13. (b);



Let OP be the width of the river as shown in the diagram.

$\because \angle OAP = \angle APC = 45°$

$\angle OBP = \angle BPD = 45°$

$\therefore \angle OAP = \angle OBP,$

$\therefore AP = BP$

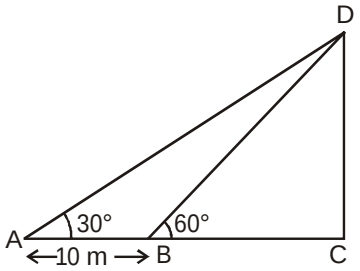
$\Rightarrow$ ΔAPB is an isosceles triangle OP is the distance between the two banks.

$\Rightarrow OP \perp AB$

New, $\frac{OP}{OB} = \tan 45° = 1$

$\Rightarrow OP = 1 \times 0.5 = 0.5$ km.

14. (a);



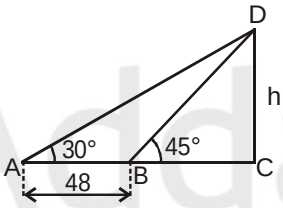
$BC = h \cot 60° = \frac{h}{\sqrt{3}}$

$AC = h \cot 30° = \sqrt{3}h$

$AB = AC - BC = \sqrt{3}h - \frac{h}{\sqrt{3}} = 10 m$

$\Rightarrow h = 5\sqrt{3}$ m.

15. (a);



Let the height of the tower be h.

$BC = h \cot 45° = h$

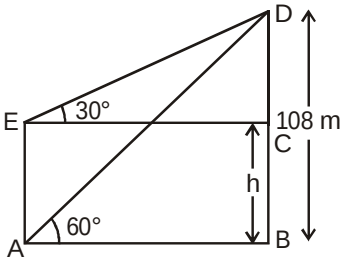
$AC = h \cot 30° = \sqrt{3}h$

$AB = (\sqrt{3} - 1)h = 48 m$

$h = \frac{48(\sqrt{3}+1)}{2}$

$h = 24(1 + \sqrt{3})$ m.

16. (b);



Let the height of the other post be h m.

$\Rightarrow$ BC = h m.

$\Rightarrow$ CD = (108 – h) m.

$AB = BD \cot 60° = \frac{BD}{\sqrt{3}} = \frac{108}{\sqrt{3}}$

$EC = AB = \frac{108}{\sqrt{3}}$ m

$\frac{CD}{EC} = \tan 30° = \frac{1}{\sqrt{3}}$

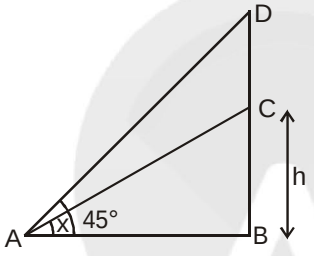
$\frac{108 - h}{\frac{108}{\sqrt{3}}} = \frac{1}{\sqrt{3}}$

$\frac{\sqrt{3}(108 - h)}{108} = \frac{1}{\sqrt{3}}$

$108 - h = \frac{108}{3}$

$h = 108 - \frac{108}{3} = \frac{2 \times 108}{3} = 72$ m.

17. (b);



$AB = h \cot x$

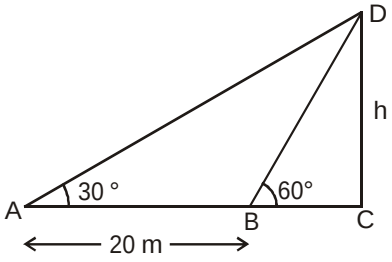
$\frac{BD}{AB} = \tan 45° = 1$

$\Rightarrow$ $BD = h \cot x$

The height of the chimney = $CD = BD - h$

$= h \cot x - h$.

18. (c);



Let the height of the tower be h.

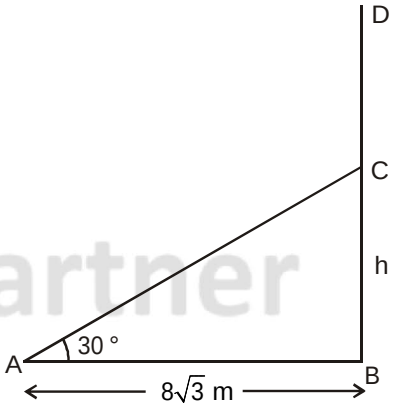
$AC = h \cot 30° = \sqrt{3}h$

$BC = h \cot 60° = \frac{h}{\sqrt{3}}$

$AB = AC - BC = \left(\sqrt{3} - \frac{1}{\sqrt{3}}\right)h = 20$ m.

$\Rightarrow$ $h = 10\sqrt{3}$ m.

19. (c);



$BC = AB \tan 30° = 8\sqrt{3} \times \frac{1}{\sqrt{3}}$

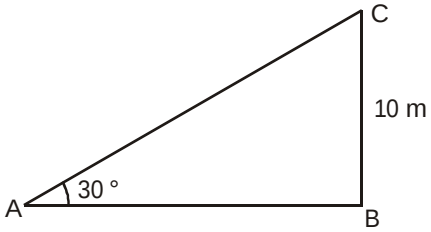
$\frac{BC}{AC} = \sin 30° = \frac{1}{2}$

$AC = 2\ BC = 16 = CD$

Height of the post = $BD = BC + CD$

$= 8 + 16 = 24$ m

20. (c);



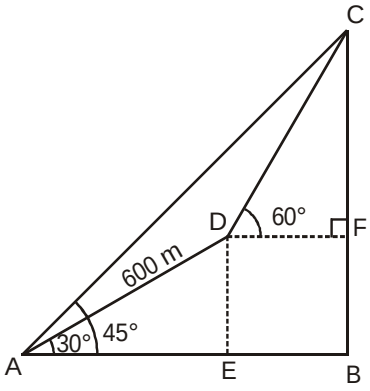
$\frac{AB}{BC} = \cot 30° = \sqrt{3}$

$AB = 10\sqrt{3}$ m

So, the distance of the foot of the ladder from the wall is $10\sqrt{3}$ m

Difficult

1. (c);



$\angle DCF = 180° - (90° + 60°)$
$= 180° - 150° = 30°$
$\angle ACB = 180° - (90° + 45°) = 45°$
$\angle ACD = \angle ACB - \angle DCF = 45° - 30° = 15°$
$\angle DAC = 45° - 30° = 15°$
In Δ ACD: $\angle ACD = \angle DAC = 15°$
$\Rightarrow$ DC = AD = 600 m.
In Δ ADE:

$DE = 600 \sin 30° = 600 \times \frac{1}{2} = 300$ m.

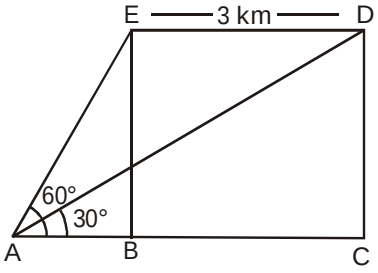
BF = DE = 300 m.
in ΔDFC:
$CF = CD \sin 60°$

$CF = 600 \times \frac{\sqrt{3}}{2} = 300\sqrt{3}$ m.

Height of the mountain =

$BC = BF + FC = 300 + 300\sqrt{3} = 300(1 + \sqrt{3})$ m.

2. (c);



Distance covered in 15 seconds at

$720 \text{ kmph} = 720 \times \frac{5}{18} \times 15 = 3000 \text{ m} = 3 \text{ km}.$

$AC = h \cot 30° = \sqrt{3}h$

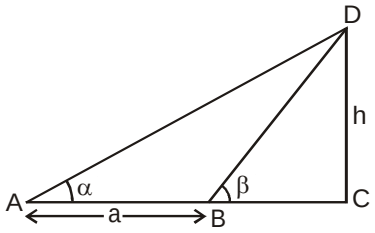
$AB = h \cot 60° = \frac{h}{\sqrt{3}}.$

BC = AC – AB = 3 km.

$\sqrt{3}h - \frac{h}{\sqrt{3}} = 3$

$\Rightarrow \quad h = \frac{3}{2}\sqrt{3} \text{ km} = \frac{3000}{2} \times 1.732 \text{ m} = 2598 \text{ m}.$

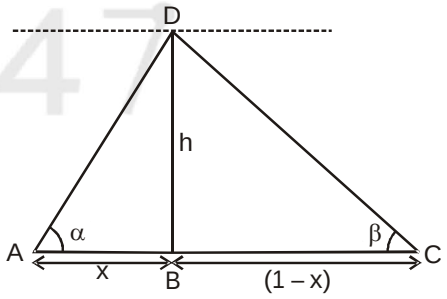
3. (d);



Let the height of the tower be h. $AC = h \cot \alpha$
$AC = h \cot \alpha$
$BC = h \cot \beta$
$AB = AC - BC = a$
$\Rightarrow \quad h(\cot \alpha - \cot \beta) = a$

$\Rightarrow \quad h = \frac{a}{\cot \alpha - \cot \beta} = \frac{a \tan \alpha \tan \beta}{\tan \beta - \tan \alpha}$

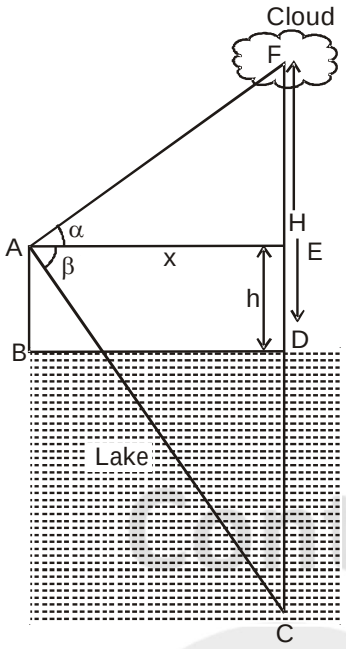
4. (c);



Let A and C be positions of two consecutive milestones
$\Rightarrow \quad AC = 1$ km.
Let AB = x $\Rightarrow$ BC = (1 – x)
Let the height of the aeroplane be h.
$x = h \cot \alpha$
$1 - x = h \cot \beta$
$h(\cot \alpha + \cot \beta) = 1$

$h = \frac{1}{\cot \alpha + \cot \beta} = \frac{\tan \alpha \tan \beta}{\tan \beta + \tan \alpha}.$

5. (d);



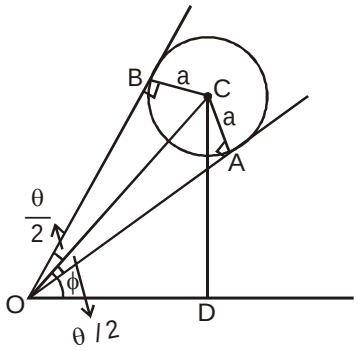
Let the height of the cloud above the lake be H m.
Let AE = x m.
$x = (H - h)\cot\alpha$ (From ΔAEF).
in ΔACE:
$x = (H + h)\cot\beta$

$$\Rightarrow \frac{H-h}{\tan\alpha} = \frac{H+h}{\tan\beta}$$

$H\tan\alpha + h\tan\alpha = H\tan\beta - h\tan\beta$
$h(\tan\alpha + \tan\beta) = H(\tan\beta - \tan\alpha)$

$$\Rightarrow H = \frac{h(\tan\alpha + \tan\beta)}{\tan\beta - \tan\alpha}.$$

6. (c);



OA and OB are tangents to the spherical balloon.
$\Rightarrow$ CA $\perp$ OA i.e., $\angle OAC = 90°$.
Similarly, CB $\perp$ OB i.e., $\angle OBC = 90°$
in ΔOAC,

$$\text{cosec}\frac{\theta}{2} = \frac{OC}{a}$$

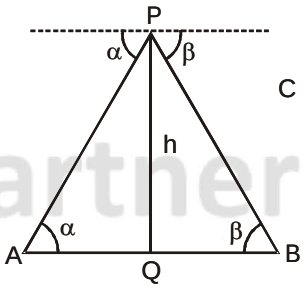
$$\Rightarrow \quad OC = a\,\text{cosec}\frac{\theta}{2}$$

in ΔODC,

$$CD = OC\sin\phi, \quad CD = a\,\text{cosec}\frac{\theta}{2}\sin\phi$$

So, height of the centre of ball is: $a\sin\phi\,\text{cosec}\frac{\theta}{2}$.

7. (a);



The height of the aeroplane as shown in the figure = PQ = h km.

$$\frac{h}{AQ} = \tan\alpha$$

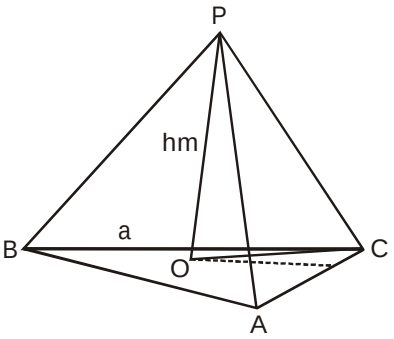
$$\Rightarrow AQ = \frac{h}{\tan\alpha} \quad \Rightarrow \quad \frac{h}{BQ} = \tan\beta$$

$$\Rightarrow BQ = \frac{h}{\tan\beta}$$

AQ + BQ = 1

$$\Rightarrow \frac{h}{\tan\alpha} + \frac{h}{\tan\beta} = 1 \quad \Rightarrow \quad h = \frac{\tan\alpha\tan\beta}{\tan\alpha + \tan\beta}$$

8. (b);



Let ABC be the equilateral triangle Let O be the centre of ΔABC and let OP be the h m high tower. Now, each side of the equilateral triangle ABC subtends an angle of 60° at the top of the tower.

$\Rightarrow$ Each of ΔABP, ΔACP and ΔBCP is equilateral.

$\Rightarrow$ AP = BP = CP = a

$OB = \frac{a}{2}\sec 30°$

In ΔOBP :

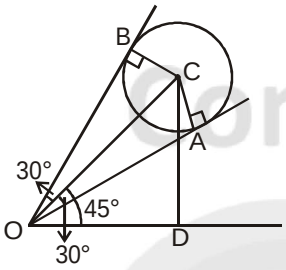
$\Rightarrow h^2 + \left(\frac{a}{2}\sec 30°\right)^2 = a^2$

$\Rightarrow h^2 + \frac{a^2}{3} = a^2$

$\Rightarrow h^2 = \frac{2a^2}{3}$

$\Rightarrow 2a^2 = 3h^2$.

9. (c);



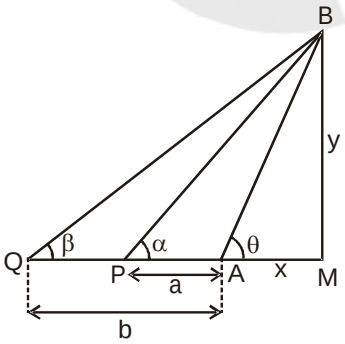
OA and OB are tangents to the spherical balloon.
similarly, CB $\perp$ OB, i.e., $\angle OBC = 90°$.
in ΔOAC :

$\frac{OC}{10} = \text{Cosec } 30°$

OC = 20 m.
in ΔODC:

$CD = OC \sin 45° = \frac{20}{\sqrt{2}} m = 10\sqrt{2}$ m .

10. (c);



Let AB be the tower inclined at an angle θ to the horizontal.
Let AM = x and BM = y.

$\cot \alpha = \frac{a + x}{y}$

$\Rightarrow a + x = y \cot \alpha$ ... (i)

$\cot \beta = \frac{b + x}{y}$

$\Rightarrow b + x = y \cot \beta$ ... (ii)

Subtract (ii) from (i):
$a - b = y(\cot \alpha - \cot \beta)$.

$\Rightarrow y = \frac{a - b}{\cot \alpha - \cot \beta}$.

From (i):
$x = y \cot \alpha - a$

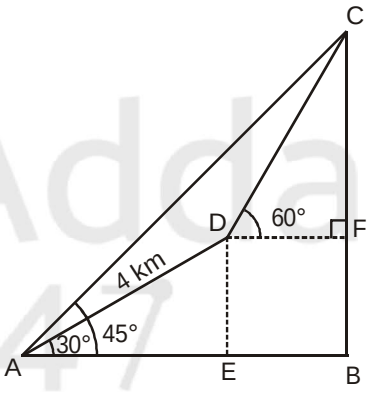
$= \frac{(a - b)\cot \alpha}{\cot \alpha - \cot \beta} - a = \frac{a \cot \beta - b \cot \alpha}{\cot \alpha - \cot \beta}$

in Δ ABM:

$\cot \theta = \frac{x}{y} = \frac{\frac{a \cot \beta - b \cot \alpha}{\cot \alpha - \cot \beta}}{\frac{a - b}{\cot \alpha - \cot \beta}}$

$\Rightarrow \cot \theta = \frac{b \cot \alpha - a \cot \beta}{b - a}$

11. (a);



In ΔABC : $\angle ACB = 180° - (90° + 45°) = 45°$
In ΔDCF : $\angle DCF = 180° - (90° + 60°) = 30°$
$\Rightarrow \angle ACD = \angle ACB - \angle DCF = 45° - 30° = 15°$
$\angle CAD = \angle CAB - \angle DAE = 45° - 30° = 15°$.
$\Rightarrow \angle ACD = \angle CAD$
$\Rightarrow$ DC = AD = 4 km [isosceles triangle]

$CF = CD \sin 60° = \frac{\sqrt{3}}{2}.4 = 2\sqrt{3}$ km

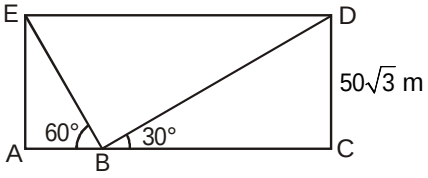
in ΔAED:

$DE = AD \sin 30° = \frac{4}{2} = 2$ km.

Height of the mountain = CF + FB

$= 2\sqrt{3} + 2 = 2\left(1 + \sqrt{3}\right)$ km.

12. (d);



$BC = 50\sqrt{3} \cot 30° = 50\sqrt{3} \times \sqrt{3} = 150$ m

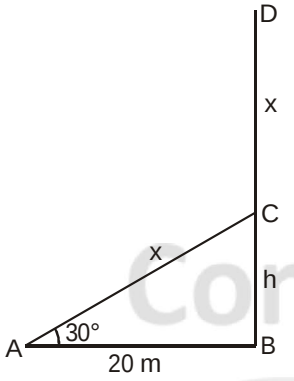
$AB = 50\sqrt{3} \cot 60° = 50$ m.

$AC = AB + BC = 50 + 150 = 200$ m.

So, the bird covers 200 m in 2 minutes speed =

$= \frac{200}{2 \times 60}$ m / sec $= \frac{200}{120} \times \frac{18}{5}$ km / h $= 6$ km / h.

13. (a);



According to the figure :

$h = 20 \tan 30° = \frac{20}{\sqrt{3}}$ m

$\frac{h}{x} = \sin 30° = \frac{1}{2}$

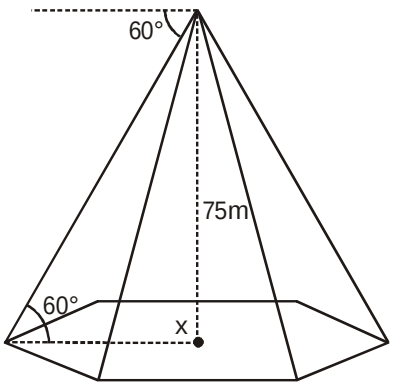
$\frac{20}{\sqrt{3}x} = \frac{1}{2}$

$\Rightarrow \quad x = \frac{40}{\sqrt{3}}$ m.

Height of the pole befere it was broken = h + x

$= \frac{20}{\sqrt{3}} + \frac{40}{\sqrt{3}} = \frac{60}{\sqrt{3}} = 20\sqrt{3}$ m.

14. (c);



Angle of elevation = Angle of depression

So, each slant edge makes an angle of 60° with the horizontal. Let the distance between a vertex and centre of te hexagon be x.

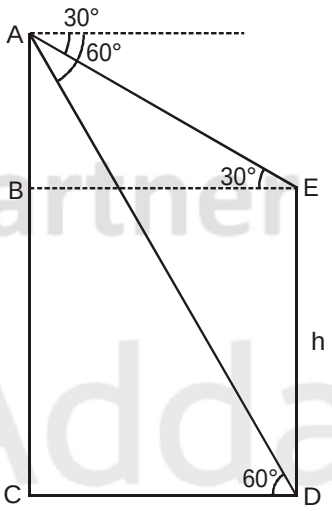
$\tan 60° = \frac{75°}{x} = \sqrt{3}$

$x = 25\sqrt{3}$ m.

$\because$ distance between the centre and the vertices of a hexagon is equal to the length of the edges,

$\therefore$ Length of each side of the hexagon = $25\sqrt{3}$ m.

15. (b);



$\frac{108}{CD} = \tan 60° = \sqrt{3}$

$CD = \frac{108}{\sqrt{3}} = \frac{108\sqrt{3}}{3} = 36\sqrt{3}$ m.

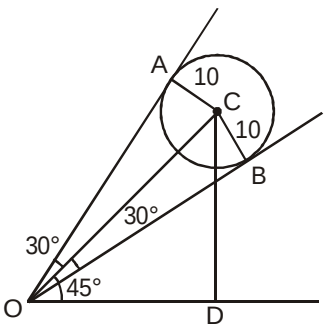
$BE = CD = 36\sqrt{3}$ m.

$AB = BE \tan 30° = 36\sqrt{3} \times \frac{1}{\sqrt{3}} = 36$ m.

$\Rightarrow$ Height of the second pillar

$= DE = BC = AC - AB = 108 - 36 = 72$ m.

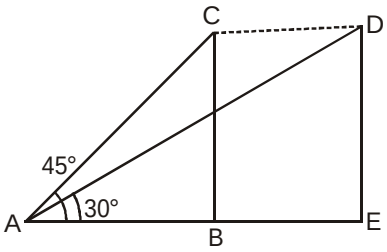
16. (d);



Let the height of the centre of the balloon be h.
According to the figure:
OC = 10 cosec 30° = 10 × 2 = 20

$h = OC \sin 45° = \frac{20}{\sqrt{2}} = 10\sqrt{2}$ ft.

17. (a);



CB = DE = 2500 m

$\frac{CB}{AB} = \tan 45° = 1$

$\Rightarrow$ AB = CB = 2500 m
In ΔADE:

$\frac{AE}{DE} = \cot 30° = \sqrt{3}$

$\Rightarrow$ $AE = 2500\sqrt{3}$ m.

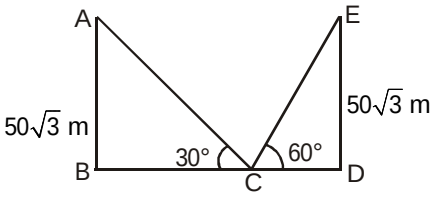
$BE = AE - AB = 2500\sqrt{3} - 2500 = 2500\left(\sqrt{3}-1\right)$ m

So the aeroplane covers $2500\left(\sqrt{3}-1\right)$ meters in 15 seconds.

$\Rightarrow$ speed $= \frac{2500}{15}\left(\sqrt{3}-1\right)$ m / s.

$= \frac{2500}{15}\left(\sqrt{3}-1\right) \times \frac{18}{5}$ km / h = 440kmph (approx).

18. (d);



BC = $50\sqrt{3}$ cot 30°

= $50\sqrt{3} \times \sqrt{3} = 150$ m

CD = $50\sqrt{3}$ cot 60°

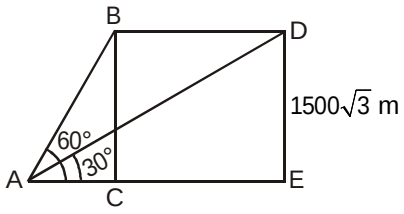
= $50\sqrt{3} \times \frac{1}{\sqrt{3}} = 50$ m

BD = BC + CD = 200 m..
So, the bird covers a distance of 200 m in 2 minute i.e., 120 seconds

Speed = $\frac{200}{120}$ m / s = $\frac{200}{120} \times \frac{18}{5}$ km / h

= 6 km / h.

19. (b);



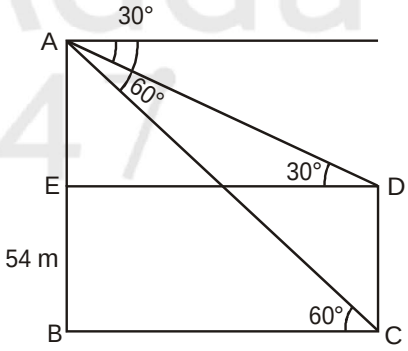
AC = $1500\sqrt{3} \times \frac{1}{\sqrt{3}}$ = 1500 m.

$AE = 1500\sqrt{3}$ cot 30° = $1500\sqrt{3} \times \sqrt{3}$ = 4500 m.

CE = AE – AC = 4500 – 1500 = 3000 m.
So, the aeroplane cover 3000 m in 15 seconds.

speed = $\frac{3000}{15} = 200$ m / s

20. (b);



In ΔABC
BC = AB Cot 60°

= $54 \times \frac{1}{\sqrt{3}} = \frac{54\sqrt{3}}{3}$ = $18\sqrt{3}$ m

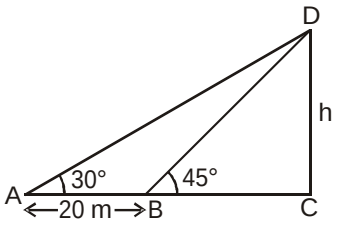
DE = BC = $18\sqrt{3}$ m

AE = DE tan 30° = $18\sqrt{3} \times \frac{1}{\sqrt{3}} = 18$ m

The height of the other temple = CD = BE = AB – AE
= (54 – 18) m = 36 m

Previous Year (Memory Based)

1. (d);



Let the height of the pillar be h.

$AC = h \cot 30° = \sqrt{3}\, h$

$BC = h \cot 45° = h$

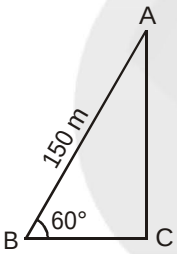
$AB = AC - BC = 20$ m

$\Rightarrow \quad (\sqrt{3} - 1)h = 20$ m

$h = \dfrac{20}{\sqrt{3}-1} \times \dfrac{\sqrt{3}+1}{\sqrt{3}+1}$

$= 10(\sqrt{3}+1)$ m.

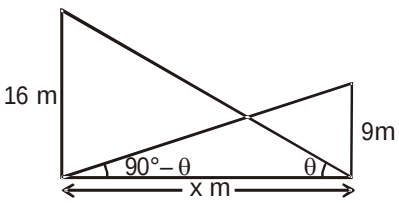
2. (b);



Height of the kite from the ground = AC = 150 sin 60°

$= 75\sqrt{3}$ m.

3. (c);



$x = 16 \cot \theta$

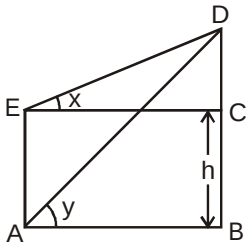
$x = 9 \cot (90 - \theta) = 9 \tan \theta$

$x = 9 \times \dfrac{16}{x}$

$x^2 = 144$

$x = 12$

4. (c);



$BD = AB \tan y.$

$DC = EC \tan x = AB \tan x$

$BC = h = BD - CD$

$h = AB \tan y - AB \tan x$

$\Rightarrow \quad AB = \dfrac{h}{\tan y - \tan x}$

$\Rightarrow \quad DC = \dfrac{h \tan x}{\tan y - \tan x}$

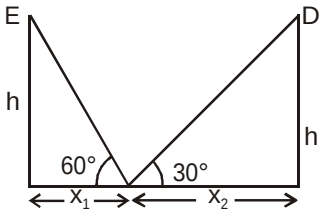
So, the height of the building

$= BD = BC + CD = h + CD$

$= h + \dfrac{h \tan x}{\tan y - \tan x} = \dfrac{h \tan y}{\tan y - \tan x}$

$= \dfrac{h \cot x}{\cot x - \cot y}$

5. (a);



$x_1 = h \cot 60° = \dfrac{h}{\sqrt{3}}.$

$x_2 = h \cot 30° = \sqrt{3}\, h$

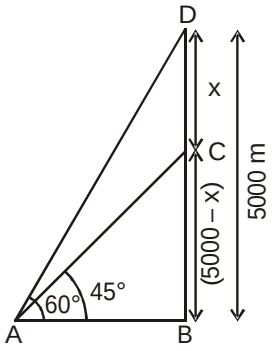
$x_1 + x_2 = 100$ m

$\Rightarrow \quad \dfrac{h}{\sqrt{3}} + \sqrt{3}\, h = 100$

$\Rightarrow \quad 4h = 100\sqrt{3}.$

$\Rightarrow \quad h = 25\sqrt{3}$ m.

6. (C);



$\tan 45° = 1 = \frac{(5000 - x)}{AB}$

$\Rightarrow$ AB = (5000 – x).

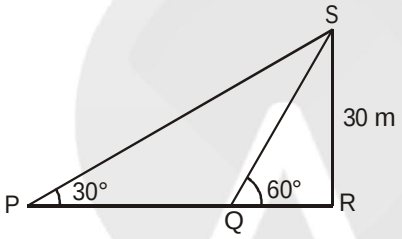
In ΔABD

$\tan 60° = \sqrt{3} = \frac{5000}{5000 - x}$

$\Rightarrow \quad 5000\sqrt{3} - \sqrt{3}\,x = 5000$

$\Rightarrow \quad x = 5000\left(1 - \frac{1}{\sqrt{3}}\right)$ m.

7. (d);



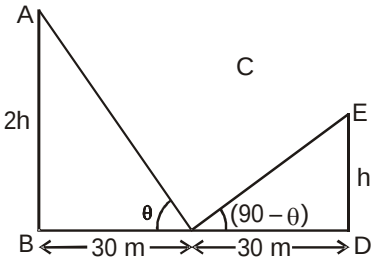
$QR = 30 \cot 60° = \frac{30}{\sqrt{3}}$ m

$PR = 30 \cot 30° = 30\sqrt{3}$ m.

The distance he moves = PR – QR

$= \left(30\sqrt{3} - \frac{30}{\sqrt{3}}\right)$ m $= 30\left(\frac{2}{\sqrt{3}}\right) = 20\sqrt{3}$ m.

8. (d);



Let the height of one of the poles be h.

So, height of the other pole = 2h

$\tan \theta = \frac{2h}{30}$

$\tan (90 - \theta) = \cot \theta = \frac{h}{30}$

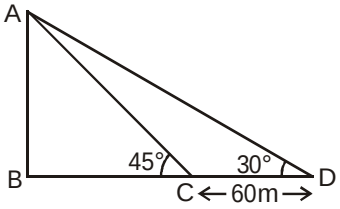
$\Rightarrow \quad \frac{2h}{30} \times \frac{h}{30} = 1$

$\Rightarrow \quad h^2 = 15 \times 30$

$\Rightarrow \quad h = 15\sqrt{2}$ m

So, $2h = 30\sqrt{2}$ m.

9. (c);



BD = AB cot 30°

$BD = \sqrt{3}$ AB

BC = AB cot 45° = AB

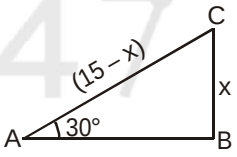
CD = BD – BC

$= \sqrt{3}$ AB – AB = $AB\left(\sqrt{3} - 1\right) = 60$

$\Rightarrow$ Height of the tower = $AB = \frac{60}{\sqrt{3} - 1}$

$= 30\left(1 + \sqrt{3}\right)$ m.

10. (b);



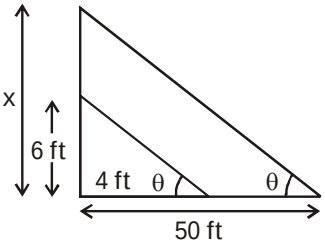
$\sin 30° = \frac{1}{2} = \frac{x}{15 - x}$.

$\Rightarrow \quad 2x = 15 - x$

$\Rightarrow \quad x = 5$

So, the post is broken at a height of 5 ft.

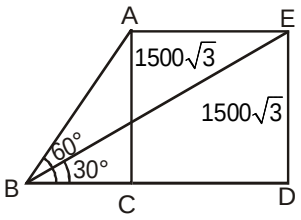
11. (b);



$\tan \theta = \frac{6}{4} = \frac{3}{2} = \frac{x}{50}$

$\Rightarrow \quad x = 75$ ft

12. (b);



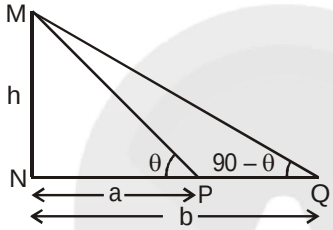
BC = $1500\sqrt{3}\cot 60°$

$= 1500\sqrt{3} \times \frac{1}{\sqrt{3}} = 1500$

BD = $1500\sqrt{3}\cot 30°$
= 4500 m.
CD = BD – BC
= 4500 – 1500 = 3000 m.
So, the aeroplane covers 3000 m in 15 seconds.

Speed = $\frac{3000}{15} = 200$ m / sec.

13. (a);



Let the height of the tower be h.

$\tan\theta = \frac{h}{a}$

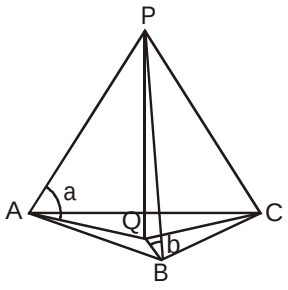
$\tan(90 - \theta) = \cot\theta = \frac{h}{b}$

$\Rightarrow \frac{h}{a} \times \frac{h}{b} = \tan\theta \times \cot\theta = 1$

$\Rightarrow h^2 = ab$

$\Rightarrow h = \sqrt{ab}$.

14. (b);



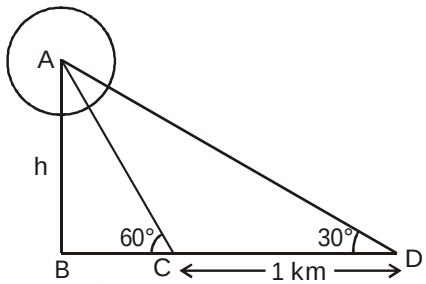
According to the questions:
$\angle a = \angle b = \angle c$

$\Rightarrow$ tan a = tan b = tan c

$\Rightarrow \frac{PQ}{AQ} = \frac{PQ}{BQ} = \frac{PQ}{CQ}$.

$\Rightarrow$ AQ = BQ = CQ
$\Rightarrow$ the foot of the pole (Q) is at the circumcentre of ΔABC

15. (a);



Let the height of the balloon above the ground be h.

BC = h cot 60° = $\frac{h}{\sqrt{3}}$

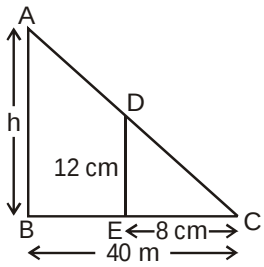
BD = h cot 30° = $\sqrt{3}$ h
CD = BD – BC = 1 km.

$\Rightarrow \sqrt{3}h - \frac{h}{\sqrt{3}} = 1$

$\Rightarrow h\left(\sqrt{3} - \frac{1}{\sqrt{3}}\right) = 1$

$\Rightarrow h = \frac{\sqrt{3}}{2}$ km.

16. (b);

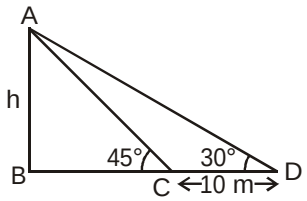


Let the height of the tower be h. According to the question:

$\frac{12}{8} = \frac{h}{4000}$

$\Rightarrow h = \frac{12 \times 4000}{8}$ cm = 60 m

17. (c);



Let the height of the tower be h.

BC = h cot 45°

$\Rightarrow$ BC = h

BD = h cot 30° = $\sqrt{3}$ h

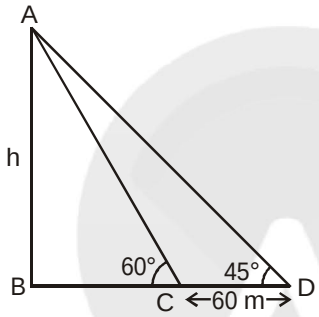
CD = 10m = BD – BC

$\Rightarrow$ $\sqrt{3}\,h - h = 10$

$\Rightarrow$ $h = \frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$\Rightarrow$ $5(1+\sqrt{3})\,m$

18. (c);



Let the height of the tower be h m.

BC = h cot 60° = $\frac{h}{\sqrt{3}}$

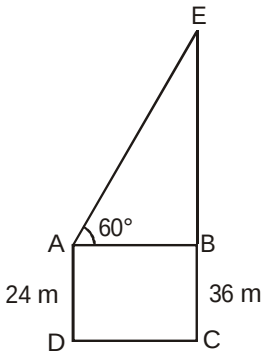
BD = h cot 45° = h

CD = BD – BC = 60 m.

$\Rightarrow$ $h - \frac{h}{\sqrt{3}} = 60$

$\Rightarrow$ $h = 30\left(3+\sqrt{3}\right)$

19. (b);



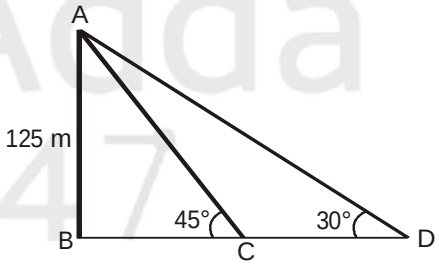
BE = 36 – 24 = 12 m

$\frac{AE}{BE} = \text{cosec } 60° = \frac{2}{\sqrt{3}}$.

= AE = $12 \times \frac{2}{\sqrt{3}}\,m = 8\sqrt{3}\,m$.

So, length of the wire is $8\sqrt{3}$ m.

20. (b);



BC = 125 cot 45° = 125 m.

BD = 125 cot 30° = $125\sqrt{3}$ m

So, the distance between the objects

= CD = BD – BC = $125\left(\sqrt{3}-1\right)$ m.

English Language

Chapter 3

One Word Substitution

One Word Substitution (अनेक शब्दों के लिए एक शब्द)

Abbreviation – A shortened form of a word or phrase
Acrimonious – Angry and bitter (typically of speech or discussion)
Addict – One who has become dependent on something or drugs
Adolescence – The period between childhood and adulthood
Advocacy – Public support or recommendation for a policy
Agnostic – One who doubts the existence of god
Agnosticism – The belief that nothing can be known about God
Alienate – To turn friends enemies
Alimony – Allowance due to a wife from her husband on separation
Allegory – A story etc containing a hidden moral lesson
Amateur – A person who does something for pleasure rather than for payment
Amazon – A notably tall, physically strong, or strong-willed woman
Ambassador/Diplomat/Envoy – A diplomatic minister of the higher order sent by a country to another
Ambidextrous – A person who is able to use both hands with equal skill
Ambiguous – A statement open to more than one interpretation, A sentence whose meaning is unclear
Ambivalent – Having opposing feelings
Ambivert – Both introvert and extrovert
Amnesty – A general pardon granted by a government
Amphibian – Animals that can live on land and in water
Amphitheatre – An open, circular or oval building with a central space for the presentation of dramatic or sporting events surrounded by tiers of seats for spectators
Amputee – A person whose limb has been amputated
Analgesia – The inability to feel pain
Anecdote – A short, amusing story about something
Annal – A record of the events of one year
Annihilate – To destroy completely
Anonymous – A letter, poem etc., whose author is unknown
Antedate – To be of an earlier date
Antibody – A blood protein produced in response to and counteracting a specific antigen
Antidote – A medicine that counteracts the effect of another medicine
Antigen – A toxin or other foreign substance which induces an immune response in the body
Apathy – Lack of interest, enthusiasm, or concern
Appraisal – An act of assessing something or someone
Apprentice – A person who works for a skilled employer in order to learn a skill
Aquatic – Of animals living in water
Arbitrator – A person appointed to settle dispute
Architect – A person who designs building
Archive – A place where government/public records are kept

Arena – A level area surrounded by seating, in which sports, entertainments, and other public events are held
Arid – Having little or no rain
Arsonist – A person who commits the criminal act of deliberately setting fire to property
Artisan – Expert in any skill of hand
Ascetic – A religious person with strict way of life
Assertive – One who expresses one's opinion firmly but politely
Assiduous – Showing great care and perseverance
Astrophysicist – An expert in the branch of astronomy concerned with the physical nature of stars and other celestial bodies
Asylum – A place of refuge and safety
Auctioneer – A person who conducts auction
Audacious – Showing a willingness to take surprisingly bold risks
Auditor – A person who conducts official inspection of a company's account
Auditorium – A building where an audience sits
Autobiography – Life story of a man written by himself
Autopsy – Examination of the dead body
Avaricious – One who is greedy for money
Axiom – A statement or proposition of truth
Bachelor – A man who is not and has never been married
Ballad – Long song or poem
Behead – To cut off the head
Belligerents – Nations engaged in war
Bibliography – Collection of names of books useful for the purpose
Bifurcate – To cut something into two pieces
Bigamy – Practice of having two wives or husbands
Bigot – One who has narrow and prejudiced religious views
Bilingual – A person who speaks two languages
Biography – An account of somebody's life written by another person
Biopsy – Examination of the tissue of a diseased person
Blizzard – A severe snowstorm with high winds and low visibility
Bohemian – One who does not follow the usual rules of social life
Bottleneck – A situation that stops an activity from progressing
Boulevard – A broad road bordered with trees
Bouquet – An attractively arranged bunch of flowers
Brittle – Hard but liable to be easily broken
Bully – A person who uses his strength or power to frighten or hurt others
Burglar – A person who breaks into a house in order to steal
Callous – Showing or having an insensitive and cruel disregard for others
Canine – Of, relating to, or resembling a dog or dogs
Cannibal – Somebody who eats human flesh
Capsize – To sink boat or ship
Caricature – A picture of a person or a thing drawn in such a highly exaggerated manner as to cause laughter
Carnivorous – Flesh eating animals
Cascade – A small waterfall or group of waterfalls flowing down a rocky hill side
Cataclysm – Sudden and violent change
Catalogue – A list of books
Cathedral – A very big church
Cavalry – Soldiers who fight on horseback

Ceasefire – An agreement between two countries or groups to stop fighting
Cemetery – Place of burial
Centenary – Celebration of a hundredth year, once a century
Centurion – The commander of a century in the ancient Roman army
Ceramics – Art of making pots etc. from clay
Chant – Say a prayer in singing voice
Chaotic – Situation in which everything is happening in a confused way
Chauffeur – A person employed to drive a private car
Circumstantial – Clues available at a scene
Cocktail – An alcoholic drink consisting of a spirit or several spirits mixed with other ingredients, such as fruit juice, lemonade, or cream
Colleague – A co-worker or a fellow-worker in the same institution
Colony – A group of people of one nationality or ethnic group living in a foreign city or country
Compositor – A person who arranges typing keys or printing text in a printing machine
Concubinage – Living together of a man and women without being married to each other
Concurrent/Coincident/Concomitant – Happening at the same time
Congenital – Belonging or pertaining to an individual from birth
Congregation – A group of people gathered for religious worship
Connoisseur – A person who can appreciate art, music etc.,
Conservatory – A greenhouse, esp. one attached to a house
Consolidate – To combine into a single stronger and more effective whole
Constellation – Group of stars
Constipated – Repressed or inhibited
Contemporary – Men living in the same age
Contingency – A future event or circumstance that is possible but cannot be predicted with certainty
Convalescence – The gradual return to good health after a period or illness or medical treatment
Convent – A place where nuns live
Convoy – A group of vehicles travelling together
Cosmetician – A person who sells or applies cosmetics as an occupation
Credential – A qualification, achievement, personal quality, or aspect of a person's background, typically when used to indicate that they are suitable for something
Credible – That which can be believed
Credulous – A person who believes easily whatever he is told
Criterion – A principle or standard by which something may be judged or decided
Crude – Not processed or refined, Rude
Crusade – A war of religions
Cuisine – A style or method of cooking, especially as characteristic of a particular country or region
Cynic – One who questions everything
Debonair– Confident, good looking and charming
Debut – A person's first appearance or performance
Defamation – The action of damaging the good reputation of someone
Defection – The abandonment of one's country or cause
Delegate – To transfer one's authority to another
Demagogue – A politician who rouses people's feeling for own benefit
Despicable – Deserving hatred or contempt
Dessert – The sweet course eaten at the end of a meal
Destitute – The state of being miserable bereft of all possessions
Deteriorate – To go from bad to worse
Dexterous – Skilful at handling things

Diplomacy – Art of dealing with people in a tactful way
Directory – A book of names and addresses
Diva – A famous female singer of popular music
Documentary – A television or radio programme providing factual report on a subject
Dominion – An area controlled by a ruler
Downpour – A heavy rainfall
Drought – Dry weather with no rainfall
Dynasty – Succession of rulers belonging to one family
Eccentric – One who has strange habits
Economical – Avoding wastage, Careful in the spending of money, time etc.
Edible – A thing that is fit to be eaten
Effeminate – Of manners more like those of a woman than a man
Egoist (also Egotist) – A person who is selfish, self absorbed and self centred, One who thinks only for oneself
Elegy – A song sung at the death of a person
Eligible – One who is qualified for selection
Elucidate – To explain something mysterious or difficult
Emancipation – The process of being set free from political or social restrictions
Emigrant – One who goes to settle in another country
Empathy – The ability to understand and share the feelings of another
Encyclopedia– Book that gives information about every branch of knowledge
Endemic – A disease that occurs within a specified area, region or locale
Entrepreneur – A person who organizes and operates a business or businesses, taking on greater than normal financial risks in order to do so
Epicure/Epicurean – One who is given to pleasures of the flesh
Epidemic – An outbreak of a disease that spreads among a large group of people quickly and extensively
Epilogue– A short poem or speech addressed to the spectators after the conclusion of a drama, concluding part of a literary work
Epitaph – Words written on the tomb of a person
Equilibrium – A state of perfect balance
Equivocal – Of doubtful character or sincerity; dubious
Espionage – Practice of employing spies in war
Eternal – Lasting or existing forever; without end or beginning
Evacuate – To shift people from a place of danger to a safer place
Exonerate – Free somebody from blame or guilt; free somebody from an obligation
Extempore/Impromptu – A speech or a presentation made without previous preparation
Fable – A story in which animals or objects speak and give wholesome moral lesson
Facsimile – An exact copy
Famine – Extreme scarcity of food
Fanatic – Somebody who has extreme and sometimes irrational enthusiasms or beliefs, especially in religion or politics
Fancy – Created from the imagination rather than from life
Fastidious – A person who is concerned that even the smallest details should be just right, A person difficult to please
Fauna – The animals of a particular region
Feint – Pretended Attack
Feminist– One who believes in giving equal opportunity to women in all fields
Fidelity – Faithfulness in behavior
Fling – A short period of enjoyment or wild behavior

Flip-flop – An abrupt reversal of policy
Flora – Plants of a particular region
Forerunner – A person or thing that precedes the coming or development of someone or something else
Fossils – Remains of prehistoric animal or plant preserved by being buried in earth
Fraud – Act of deceiving somebody in order to make money
Fugitive – One who runs away from justice or the law
Futurist – One who can predict future
Garrison – A group of soldiers living in a town or a fort, and defending it
Geek – An unfashionable or socially inept person
Germicide – A medicine that kills germs
Gesture – Movement of body to express something
Gimcrack – Flimsy or poorly made but deceptively attractive
Gimmick – A trick or device intended to attract attention, publicity, or business
Gladiator – One who fights with another person or animals
Glutton – One who eats too much
Gourmand – One who likes eating a lot
Gourmet – One who likes or knows about good food
Gracious – Courteous, kind, and pleasant
Granary – A storehouse for threshed grain
Gregarious – Of animals which live in flocks/herds
Gullible – One who is easily deceived
Hag – An ugly woman
Haggard – Looking exhausted and unwell, especially from fatigue, worry, or suffering
Hallucination – Seeing something that is not actually present
Hamlet – A small village or group of houses
Haphazard – With no particular order or plan
Haunt – Visit a place often
Hedonist – One who believes that gaining pleasure is the most important thing in life
Herbivorous – An animal that eats only grass or other plants
Heresy – Opinion contrary to accepted doctrines
Hierarchy – A system or organization in which people or groups are ranked one above the other according to status or authority
Hijack – To forcibly take control of a vehicle
Homophones – Two words different in spelling and meaning but pronounced alike
Honorarium – An emolument over and above fixed income or salary
Honorary – One who offers his services without charging for it
Hostility – Intense aggression or anger; state of antagonism
Humanist – An advocate or follower of the principles of attaching prime importance to human rather than divine or supernatural matters
Humanitarian – One who feels sympathetic towards human beings
Hurricane – Violent storm
Hyperbole – An exaggerated statement
Iconoclast – One who breaks the established traditions and image
Idolatry – The worship of idols or images
Illegal – That which is against law
Illegible – A handwriting that cannot be read
Illicit – A trade that is prohibited by law or prevailing social standards
Illiterate – A person who cannot read or write
Illustrious – Well-known and respected for past achievements

Imminent – That is sure to happen
Immune – Free from infection
Impostor/Hypocrite – One who pretends to be what he is not
Impracticable – That which cannot be practiced
Imprudent – Not showing care for consequence of the action
Impunity – Exemption from punishment, Without risk of punishment
Inaccessible – That which cannot be reached
Inaudible – A sound that cannot be heard
Incognito – Travelling under the name other than one's own
Incorrigible – One who cannot be corrected
Incredible – That which cannot be believed
Indefatigable – One incapable of being tired
Indefensible – That which cannot be defended
Indelible – That which cannot be effaced
Indifferent – Having no particular interest
Indispensable – Something that is essential and cannot be dispensed with
Inedible – Not suitable for eating
Ineligible – Someone not fit to be chosen
Inevitable – That which cannot be avoided
Inexplicable – That which cannot be explained
Infallible – One who does not make mistakes, A remedy which never fails
Infantry – Soldiers who fight on foot
Inflammable – Something that is quickly and easily set on fire and burned
Inflammable – That which burns easily
Ingenious – Skilful in inventing
Ingenuous – Innocent and unsuspecting
Insatiable – That which cannot be satisfied
Insolvent – One who is unable to pay his debts
Insomnia – Inability to sleep
Intangible–That cannot be touched
Intermediary – One who mediates to settle disputes
Intermission – An interval between parts of a play or film, Interval
Intestate – One who dies without a will
Introspection – The action of looking within or into one's own mind
Introvert – One person who enters without any invitation
Intuition – Immediate response by the mind without reasoning
Investigation – Careful and thorough enquiry
Invincible – That which cannot be conquered
Invisible – That which cannot be seen
Invocation – Call upon God or any other power (like law) etc. for help or protection
Invulnerable – That which cannot be hurt
Irrelevant – Not connected with the main point
Irreparable – A loss of damage that cannot be compensated
Irritable – A man who is easily irritated
Iterate – To perform or utter repeatedly
Itinerant – One who journeys from place to place
Jibe – An insulting remark
Jovial – Cheerful and friendly
Juggler – A person who tosses a number of objects in air and balances them
Jurisdiction – A fixed territory in which authority can be exercised

Jury – A body of persons appointed to hear evidence and give their verdict in trials
Juxtapose – Placing a thing beside another
Knell – Sound of the funeral bell
Landscape – The complete view of a place
Lapidist – One who cuts precious stones
Laudable – A person who deserves all praise
Laxative – A medicine used to loosen the stuff in the bowels
Lease – A legal agreement allowing the use of something
Ledger – A book of accounts showing debits and credits
Legacy – The property left to someone by a will
Legend – A traditional popular but unconfirmed story
Lexical – Relating to words or vocabulary
Liar – An underground living place for big animals
Ligament – Tough tissues in joints
Linguist – One who is good at foreign language
Logic – Science of reasoning
Loyalty – Firm in one's support and friendship
Lunatic – A mad person
Luxuriant – Thick and profuse in growth
Lyric – Expressing the writer's emotions in brief and stanza
Maiden – The first speech made by a person
Male chauvinist – One who believes in the dominance of man over woman
Mammal – An animal of a class that is distinguished by the possession of hair or fur, the secretion of milk by females for the nourishment of the young, and (typically) the birth of live young
Mandatory – Required by law
Manifesto – A written declaration of government or a political party
Manoeuvre – Use of trick for personal benefit
Materialism – Giving importance to money and material things
Matinee – A cinema show held in the afternoon
Matrilineal – Of or based on kinship with the mother or the female line
Maze – A complex network of paths or passages
Mediate – To try to settle a dispute between two other parties
Medieval – Belonging to the Middle Ages
Meditation – Deep in thought
Memoirs–Memorable recollection of the experiences of one's life
Mercenary – Somebody who works or serves only for personal profit. Also, a professional soldier paid to fight for an army.
Metallurgy – The branch of science concerned with the properties of metals and their production and purification
Metaphysics – The branch of philosophy dealing with abstract concepts
Mimicry – A humorous imitation of a person's activity
Mint – A place where money is coined
Mocktail – A non-alcoholic drink consisting of a mixture of fruit juices or other soft drinks
Momentous – An occasion of great importance
Monastery – A building in which monks live
Monk – A member of a religious community of men typically living under vows of poverty, chastity, and obedience
Monologue – A long speech by one person in a play or film
Monopoly – Sole right to make and sell some invention
Monotheist – One who believes in a single God

Monumental – Great in importance, extent or size
Moot – Subject to debate or uncertainty
Mortal – Subject to death
Mortgage – A legal agreement by which a person borrows money from a bank usually to buy a house
Mummy – Body of a human being or animal embalmed for burial
Mystic – One who seeks oneness with God
Namesake – Somebody or something with the same name as somebody or something else
Narcissism – Excessive indulgence to self
Narcotic/Opiate – A medicine for producing sleep
Nepotism – The practice of giving undue favour to one's relatives
Neurotic – A person suffering from nervous breakdown
Niche – A hollow place in a wall for a statue
Nimble – Quick and light in movement or action; agile
Nomad – Member of tribe that wanders from place to place
Nomenclature – A system of naming things
Nostalgia – Home sickness or sentimental longing for the past
Notorious – One who is known widely but usually unfavourably
Novice/Tyro/Neophyte – One who is new to a profession
Numb – To cause to feel no pain
Numismatic – Collection of coins
Obligatory – Required by a moral or legal rule
Obsolete – One which is not in use, outdated
Omnipotent – One who is all-powerful
Omnipresent – One who is present everything
Omniscient – One who knows everything
Omnivorous – An animal or a human being that eats any kind of food
Opaque – That through which light cannot pass
Optimist – One who looks at the bright side of things; somebody positive
Orphan – A child whose parents are dead
Orphanage – A place where orphans are housed
Orthopaedics – The area of medicine that treats illnesses of bones
Pacifist – A person who opposes war or use of military force, A person who believes in the total abolition of war
Panacea – A supposed cure for all diseases or problems
Pandemonium – Wild and noisy disorder
Pantheism – Belief of God in nature
Pantry – A place where food is kept
Parable – A story (in Bible) intended to teach moral lesson
Paranoia – A mental disease when people are afraid of others
Parasite – A person supported by another and giving him/her nothing return
Parole – A temporary release allowed on certain conditions
Parsimony– Extreme unwillingness to spend money or use resources
Patrilineal – Inheriting or determining descent through the male line
Patrimony – Property inherited from one's father or ancestor
Pedagogue – One who likes teaching
Pedant – One who emphasizes greatly on rules in study
Pedestrian – One who goes on foot
Perennial – That which is everlasting
Periphery – Boundary of an area

Perpetual – Continuing for a long period of time without interruption
Philately – Collection of stamps
Philistine – One who does not care for art, literature etc.
Pioneer – The first man to research and develop a new knowledge or activity
Pious – Deeply religious
Plagiarist – One who copies from other writers
Podium – A small platform on which a person may stand to be seen by an audience, as when making a speech etc.
Polyglot – One who knows many languages
Polygyny – Marrying more than two females
Posthumous – A child born after the death of his father or a book published after the death of its author
Potable – Water fit for drinking
Predator – An animal which preys on other animals
Preface – An introduction to a book
Prejudiced – To be biased against
Premiere – The first performance of a play or film
Preoccupation – The state or condition of being preoccupied or engrossed with something
Priest – A person who performs religious ceremonies
Proclaim – Say publicly that something important is true
Prognosis – A forecast of the result of a disease or illness
Propensity – An inclination or natural tendency to behave in a particular way
Prophecy – A prediction of what will happen in the future
Prophet – One who foretells events correctly
Prosecute – Take legal action against somebody
Pseudonym – An imaginary name assumed by an author for disguise
Psyche – Innermost feeling
Psychic – One who has strong mental power
Psychosis – A severe mental disease
Pugnacity – Inclined to fight or be aggressive
Pyrotechnics – The art of making fireworks
Rabble – A disorderly crowd
Ransom – Money paid to get a person freed from captivity
Rattle – To make or cause to make a rapid succession of short, sharp knocking sounds
Recall – To bring (a fact, event, or situation) back into one's mind; remember
Reciprocate – To give and receive mutually
Recluse – A person who withdraws from the world to live in seclusion and often in solitude
Reconnaissance – Information gathering activity
Red-tapism – Too much official formality
Referendum – Asking everyone for an opinion
Reformatory – An institution for reforming young offenders
Refrain – A comment often repeated
Refuge – The state of being safe or sheltered from pursuit, danger, or difficulty
Regicide – Murder of the king
Remind – To cause (someone) to remember someone or something
Renegade – One who deserts a belief or party
Repatriate – To send back a person to his own country
Replica – An exact copy or model of something
Resort – A place for improving one's health
Retaliate – Give tit for tat

Review – A formal assessment of something
Revolutionary – A person who advocates or engages in political revolution
Sabotage – Intentional damage to arrest production
Sacrilege – Violation of something holy or sacred
Samaritan – One who helps others
Sanatorium – an establishment for the medical treatment of people who are convalescing or have a chronic illness.
Sanctuary – A reserve for animals, birds etc their natural habitat
Sanctum– or Sanctorium – A very private place
Satire – Full of criticism and mockery
Sceptical – Having doubt over something
Scrupulous– Diligent, thorough, and extremely attentive to details (of a person or process)
Secular – A government in which all religions are honoured
Sedative – A drug taken for its calming or sleep-inducing effect
Sheath – A case in which sword is kept
Sinecure – An office with high salary but no work
Siren – A woman who is considered to be alluring or fascinating but also dangerous in some way
Slippery – That which cannot be captured
Somnambulist– One who walks in sleep
Somniloquist – Someone who talks while asleep.
Sonnet – A poem of fourteen
Soothing – Giving comfort
Soporific – A drug or other substance that induces sleep
Soprano – A singer with a high-pitched voice
Sot– One who is a habitual drunker
Souvenir – Something that reminds an event
Sporadic – Occurring at irregular intervals in time
Stable – A place where horses are kept
Stack – A pile of objects, typically one that is neatly arranged
Steam – To cook (food) by heating it in steam from boiling water
Stimulant – A substance that raises levels of physiological or nervous activity in the body
Stoic – A person who is indifferent to pleasure or pain, a person who is unaffected by emotions
Subjugate – To bring under dominion or control
Sublimate – To transform into a purer or idealized form
Subservient – Too willing to obey other people
Superfluous – More than what is needed
Sycophant – A servile self seeker who attempts to win favour by flattering influential people
Synagogue – A place of worship of the Jews
Tariff – A list or table or duties payable on exports or imports
Tautology – A statement in which you say the same thing twice in different words
Teetotaller – A person who abstains from alcoholic drinks
Teller – A person in a bank dealing with customers' transaction
Temperate – A climate that is neither extremely hot nor cold
Tempo – The speed of music
Theism – Belief in the existence of a god or gods, specifically of a creator who intervenes in the universe

Theist – One who believe in God
Theocracy – Rule by priest
Theology – Study of religion
Thesaurus – Dictionary of synonyms
Tomboy – A girl who enjoys violent games
Toxic – Something that is poisonous or unhealthy
Transitory/Momentary – That which lasts for a short time
Translucent – That through which light can partly pass
Transparent – A substance that allows light to pass through with little or no interruption so that objects on the other side can be clearly seen
Trek – Long hard journey especially on foot
Tribute – A statement made in acknowledgment, gratitude, or admiration
Triennial – Taking place once every three years
Troop – A group of artists
Truant – One who remains absent without permission
Tycoon – A wealthy, powerful person in business or industry
Unanimous – Done without opposition, complete agreement
Usurer – Somebody who loans money to other people and charges them exorbitant or unlawful interest on it
Usurper – A person who seizes something without the right to do so
Utopia – An imaginary ideal state
Uxorious – One extremely fond of one's wife
Vagabond – Moving from place to place without a fixed home
Vampire – A corpse that rises nightly from its grave to drink the blood of the living
Vandal – One who damages public property
Vegetarian – Somebody who doesn't eat meat or fish
Venal – Showing or motivated by susceptibility to bribery
Venerable – Given a lot of respect
Venial – A pardonable offense
Verbatim – Corresponding word for word translation
Versatile – Able to adopt oneself readily to many situations
Veteran – Somebody who is considerably experienced in something
Virtuoso – A person highly skilled in music or another artistic pursuit
Visionary – One who realizes the future situation wisely
Vocalist – A singer
Voluntary – Of one's own free will
Volunteer – One who offers one's services
Voracious – One who is very eager for knowledge and reads a lot
Vulnerable – To be affected easily by something
Vulpine – Of or relating to a fox or foxes
Wag – A jocular person who is full of amusing anecdotes
Waif – A thin and homeless child
Wardrobe – A place where clothes are kept
Widow – A woman whose husband has died
Widower – A man whose wife has died
Windfall – An unexpected piece of good fortune

Witty – Amusingly clever in perception and expression
Wrath – Extreme anger
Zealous – Having enthusiasm and a sense of purpose
Zymology – Study of enzymes

(A)PHOBIAS RELATED WORDS:

Phobia	unreasonable, unrealistic and excessive fear to a particular object, objects or situation
achluophobia	fear of darkness
acousticophobia	fear of noise
acrophobia	fear of heights
agliophobia	fear of pain
ailyrophobia	fear of cats
androphobia	fear of men
anthophobia	fear of flowers
arachnophobia	fear of spiders
arithmophobia	fear of numbers
atychiphobia	fear of failure
aurophobia	fear of gold
bibliophobia	fear of books
cacophobia	fear of ugliness
carcinophobia	fear of cancer
ceraunophobia	fear of thunder
chaetophobia	fear of hair
chrometophobia	fear of money
cibophobia	fear of money
cibophobia	fear of food
dentophobia	fear of dentists
dipsophobia	fear of drinking
domatophobia	fear of houses
electrophobia	fear of vomiting
enochlophobia	fear of crowds
febriphobia	fear of fever
gerascophobia	fear of growing old
heliophobia	fear of the sun
iatrophobia	fear of doctors
insectophobia	fear of insects
kenophobia	fear of empty spaces
lachanophobia	fear of vegetables
lockiophobia	fear of childbirth
methyphobia	fear of alcohol
motorphobia	fear of automobiles
noctiphobia	fear of night
nosocomephobia	fear of hospitals
ombrophobia	fear of rain
ophidiophobia	fear of snakes
pharmacophobia	fear of medicines
plutophobia	fear of wealth
rhytiphobia	fear of getting wrinkles

siderodromophobia	fear of trains
tachophobia	fear of speed
trypanophobia	fear of injections
venustraphobia	fear of beautiful women
xenophobia	fear of strangers
zoophobia	fear of animals

(B)SPECIFIC PLACES RELATED WORDS:

Aerodrome	where aeroplanes are kept
Altar	An elevated place where religious rites are performed or sacrifices offered to gods
Apiary	where bees are kept
Aquarium	A glass-sided tank in which fish and other living aquatic plants or animals are kept
Archives	A place where documents and other materials of public or historical importance are preserved
Arsenal	where arms and weapons are stored/kept
Asylum	An institution for the care or relief of the unfortunate–the blind, mentally ill, etc
Aviary	A large cage or house in which birds are kept
Barracks	A building or group of buildings for lodging soldiers
Bakery	where bread/biscuits are manufactured
Billet	A lodging for a student or soldier in a private home or a public non-military building
Brewery	where wine is produced
Byre	A cow shed
Cache	A hiding place for ammunition, food, treasures, etc
Cage	enclosure for domestic animals/birds
Casino	A building or large room used for professional gambling, meetings and dancing
Cemetery	where dead bodies are burried
Cloakroom	luggage storing place at a railway station
Confectionery	where confections or sweets are prepared
Creche	A nursery for brief or day-long care of young children
Crematorium	where dead bodies are cremated
Dockyard	where ships are built
Distillary	where liquor/spirits/whiskey is produced
Dispensary	out-patient department where medicines are dispensed
Garage	where cars/vehicles are kept
Granary	storage place of grains
Guestannexe	special room in a house for guests
Graveyard	where dead bodies are burried
Hosiery	where knitted-wear is manufactured
Hatchery	where eggs/chickens are produced
Insectarium	An artificial enclosure for keeping or raising insects
Kiln	where bricks are baked
Mint	where coins are made
Morgue	A place where dead bodies are kept pending identification or cremation or burial
Mortuary	where dead bodies are kept temporarily
Museum	a building in which objects of historical, artistic, or cultural interest are stored
Orphanage	A house for orphans
Pharmacy	where medicines are prepared
Reformatory	An institution for reforming young offenders

Sanatorium	Established for treatment of invalids, especially of convalescents and the chronically sick
Scullery	A room for rough kitchen work, such as for cleaning utensils
Studio	where films are produced and processed
Tannery	where leather is processed and produced
Treasury	where treasure (wealth) is kept
Wardrobe	an almirah in which clothes are kept
Zoo	where animals/birds are kept
Convent	where nuns live
Monastery	where monks live
Barracks	where soldiers live
Palace	where king lives
Hive	where bees live
Nest	where birds live
Byre	where cows live
Kennel	where dogs live
Stable	where horses live
Den	where lions live
Burrow	where rabbits live
Pen	where sheep live
Web	where spiders live
Lair	where tigers live

(C)FIELDS OF STUDY:

Acoustics: science of sound
Aerostatics: study of ballooning
Agronomy: study of scientific farming
Agrostology: study of grasses
Anthropology: the development of man
Archaeology: excavation and study of physical remains of early civilizations
Astronautics: science of space flight
Calisthenics: science of exercises for promoting beauty and strength.
Cosmography: description and mapping of the universe
Cryogenics: science of very low temperatures
Demography: science of vital and social statistics
Ecology: science of environment
Entomology: scientific study of insects
Ethnology: science of origin of races
Etiology: study of causes of diseases
Etymology: study of derivation of words
Eugenics: study of production of better offsprings
Genealogy: a record of family descent
Genetics: study of heredity of individuals
Geology: study or rocks, soils and minerals
Ichthyology: study of fishes
Meteorology: scientific study of weather conditions
Numismatics: study of coins and metals
Ornithology: study of birds.
Orthography: the science of spellings

Paleontology: study of past life forms through fossils
Philology: study of words or literature
Seismology: science of earthquakes and earth's movements
Sericulture: study of silk-worm breeding
Theology: study of religion
Toxicology: science and medical study of dealing with poisons

(D)WORDS RELATED WITH PHYSICAL CARE:

Anaesthetist: person trained to administer anaesthetics, during an operation
Cardiologist: doctor who specialises in the study of the heart and its functioning
Chiropodist, podiatrist: specialist in the minor ailments of the foot including bunions, corns etc.
Dermatologist: Physician who specialises in treating diseases of the skin
Gynaecologist: doctor who specialises in the cure of women, especially in matters concerning the reproductive organs
Internist: doctor who specialises in the large, general branch of medicine called internal medicine
Intern: medical graduate receiving clinical training in a hospital before being licensed to practice medicine
Neurologist: doctor who specialises in delivering babies and in medical problems related to childbirth
Obstetrician: doctor who specialises in preventing and correcting irregularities of the teeth
Orthopedist: doctor who specialises in correcting deformities of the skeletal system and treating diseases of the bones
Pediatrician: doctor who specialises in the care and treatment of babies and young children
Podiatrist: therapist who specialises in treating ailments of the feet
Otologist: doctor who specialises in ear
Nephrologist: kidney specialist
Oncologist: specialist in tumors and cancer

(E)TYPES OF PEOPLE:

Aesthete: Persons who is devoted to beauty in nature, art, painting, music etc.
Altruist: person who is selflessly concerned with the welfare of others
Ascetic: person who leads a simple, austere life, avoiding luxury and pleasure
Conservative: person who wants to preserve the existing order of things, feeling content or safe with things as they are
Exhibitionist: showoff, or person who tries to attract attention to himself by exaggerated or inappropriate behavior
Hypochondriac: person who worries constantly, usually without any real reason about the state of his health
Kleptomaniac: person who has an irresistible desire to steal and shoplift
Megalomaniac: person who suffers from delusions of greatness
Optimist: person who tends to look on the bright side of things
Paranoid: person who believes that other people are always planning against him, cheating and persecuting him
Pessimist: person who tends to look at the darker side of things
Pragmatist: person who believes that ideas have values only in terms of their practical consequence
Realist: person who believes in facts and who dislikes anything that seems imaginary, impractical, theoretical, or utopian

Romantic: person who approaches everything in life emotionally and who enjoys adventures, falling in love etc.

(F)TYPES OF ANIMALS:

Aquatic: animals living in or near water, such as fish, whales, ducks etc
Arboreal: animal living on trees, as most birds, monkeys, etc
Biped: an animal having only two feet, such as man, apes and birds
Carnivorus: an animal that feeds chiefly or exclusively on meat, like dogs, wolves, lions, tigers
Herbivorous: an animal that feeds mainly on vegetable matter, plant eating
Marsupial: order of mammals whose females nourish their new born in a pouch in the abdomen like kangaroos
Monotreme: a member of mammals, whose females lay and hatch eggs, like the duck
Nocturnal: animals that are more active during the night than in the day time like bats, certain birds etc
Oviparous: animals belonging to a class whose females lay and hatch eggs like birds, most fish, and reptiles
Pachyderm: any of certain thick-skinned animals like elephant, hippopotamus and rhinoceros etc
Prehensile: animals in the limbs capable of or adapted for grasping or holding

(G)FIGURES OF SPEECH RELATED WORDS:

Alliteration: The use of several words together, all beginning with the same sound in order to make a special effect
Circumlocution: The practice of using too many words to express an idea, instead of saying it directly
Ellipsis: Practice of deliberately not including one or more words in a sentence that can still be understood by a reader
Euphemism: A polite word or expression that you use instead of a more direct one to avoid shocking
Hyperbole: A way of describing something by saying it is much bigger, smaller or worse than it actually is
Irony: the use of words that are opposite to what you really mean, often in order to be amusing
Metaphor: A way of describing something as something different and suggesting that it has similar qualities to that thing
Oxymoron: A deliberate combination of two words that seem to be the opposite of each other
Paradox: The use of statements that seem strange because they involve two ideas or qualities that are very different
Personification: The representation of a thing or a quality as a person, in literature or art
Pun: Amusing use of a word or phrase that has two meanings
Rhetorical question: a question that you may ask as a way of making a statement, without expecting an answer
Simile: An expression that describes something by comparing it with something else
Tautology: Statement in which you say the same thing twice using different words in a way which is not necessary

(H)AREAS OF MEDICINE RELATED WORK:

Gynaecology: The area of medicine that deals with conditions and illnesses that affect only women
Obstetrics: The area of medicine that deals with the birth of children

Paediatrics: The area of medicine that deals with children and their illness
Geriatrics: The area of medicine that deals with old people and their illnesses
Oncology: The area of medicine that deals with cancer and tumors
Cardiology: The area of medicine that deals with the heart
Orthopedics: The area of medicine that deals with illnesses or injuries that affect people's bones and muscles
Ophthalmology: The area of medicine that deals with the eyes
Dentistry: The study of mouth and teeth, or the treatment of diseases of the teeth
Orthodontics: The skill or job of helping the teeth grow straight when they have not been growing correctly
Chiropody: The treatment and prevention of foot injuries and diseases
Psychiatry: The study and treatment of mental illness

(I)MANIARELATEDWORDS:

mania an excessive enthusiasm or desire; an obsession

anthomania	an obsession of flowers
bibliomania	an obsession of book collection
cynomania	an obsession of dogs
demomania	an obsession of crowd
dipsomania	an obsession of alcohol
dromomania	an obsession of travelling
ergomania	an obsession of work
erotomania	an obsession of sex (in female)
hedomania	an obsession of pleasure
hippomania	an obsession of horses
hodomania	an obsession of travelling
kleptomania	an obsession of stealing things
logomania	an obsession of talking
megalomania	an obsession of controlling other's life
mythomania	an obsession of telling lies
narcomania	an obsession of drugs
necromania	an obsession of death/dead bodies
nymphomania	an obsession of sex(in female)
ochlomania	an obsession of mob
plutomania	an obsession of wealth
poriomania	an obsession of travelling
pyromania	an obsession of burning things
satyromania	an obsession of sex(in male)
sitomania	an obsession of eating
thanatomania	an obsession of death/dead bodies
theomania	an obsession of religion
verbomania	an obsession of talking
xenomania	an obsession of foreigners/foreign things

(J)PHILOSOPHY RELATED WORDS:

Activism	vigorous action
adventurism	taking risks
altruism	selflessness

animatism	a belief in a generalized, impersonal power
antagonism	opposition
anthropomorphism	giving human form to god
antitheism	opposition to existence of god
archaism	retaining the old-fashioned
atheism	disbelief in god
benthamism	utilitarianism
dadaism	going against tradition
determinism	human action being determined by motives
erotism	sexual arousement
escapism	escaping from reality
euphemism	saying the harsh in a milder way
euphuism	artificial writing
fatalism	fate ruling supreme
favourism	favouring someone unfairly
hedonism	pleasure being the last aim
humanism	devotion to human good
incivism	disloyalty to the nation
individualism	giving importance only to self
mercantilism	money being the real wealth
monotheism	belief in one god
narcissism	self-worship
nepotism	favouring unduly one's relative
non-conformism	not obeying any traditional doctrine
objectivism	impartial assessment
opportunitism	taking advantage of the opportunity duly or unduly
pacifism	abolishing war
parochialism	narrow views
pessimism	hopelessness
plagiarism	using other's ideas without permission
pragmatism	actuality/matter-of-factness
probabiliorism	ethical living
probabilism	uncertainty
rationalism	supremacy of reason
stoicism	doing virtue being the only aim of man
transendentalism	reality being beyond human experience

(K)OTHER WORDS RELATED TO CONDITIONS:

astigmatism	structural defect in eyes
daltonism	colour blindness
melanism	colour darkness
neologism	coining/using new words
parachronism	chronological error
paralogism	illogical reasoning
pelmanism	memory training
reductionism	breaking complex things into simpler parts

(L)SYSTEM OF GOVERNANCE RELATED WORDS:

autocracy	government by one person who holds all power
aristocracy	government by a privileged, wealthy small group
diarchy	government by two persons/bodies/rulers
gerontocracy	government by elderly men
hierocracy/ theocracy	government by clergy class
matriarchy	government by only women
meritocracy	government by meritorious people
ochlocracy	government by mob
oligarchy	government by a small group
pantisocracy	rule of all equally
patriarchy	government by only men
plutocracy	government by the rich people
stratocracy	government by the army
technocracy	government by technological experts

(M)THERAPY RELATED WORDS:

acupuncture	curing by puncturing/inserting needles in body
aromatherapy	therapy using fragrant oils
chemotherapy	therapy using chemicals (in esp. cancer)
chiropractic	therapy by manipulating spine
herbotherapy	therapy using plants and herbs
hydrotherapy	therapy using water
hypnotherapy	therapy using hypnosis
naturopathy	therapy using natural things
osteopathy	therapy manipulating bones
phototherapy	therapy using light (ultraviolet, X-RAY etc.)
physiotherapy	therapy using exercise, massage
zonetherapy	therapy using foot massage

(N)LOVERS RELATED WORDS:

bibliophile	lover of books
bibliologist	lover of knowledge
cheirophile	lover of hands
carnivore	one who eats meat
cannibal	one who eats human flesh
connoisseur	lover of art and artistic creations
dendrophile	lover of trees
gourmet	lover of good food
globe-trotter	lover of travelling
hippophile	lover of horses
megalomaniac	lover of grandeur
mercenary	lover of money
materialist	lover of material things
narcissist	lover of self
paedophile	lover of children
padogphile	lover of feet
philologist	lover of words

pacifist	lover of peace
philanthropist	lover of mankind
warmonger	lover of war
zoophile	lover of animals

(O)PERSONALITIES/BELIFFS RELATED WORDS:

Amateur A person who practices something for the love of it, not as a profession
Amazon A tall, powerful, forceful woman
Anarchist A person who believes that abolition of government or governmental restraint is the indispensable condition for full social and political liberty
Arrogant Claiming too much; overbearing
Atheist one who does not believe in God
Apostate a person who renounces a religious or political belief or principle
Bankrupt One who is unable to pay off one's debt
Bigot one who is devoted to a particular creed intolerantly
Cannibal A person who eats human flesh
Centenarian A person who has reached hundred years of age
Charlatan Someone who pretends to have special knowledge or ability
Conceited Having an excessively favourable opinion of oneself
Connoisseur One who has special skill and well-informed knowledge especially of the arts or fine food and wine
Coquette A woman who flirts with men to win their attention and admiration
Cynic Disinclined to believe in or recognize goodness or selflessness
Dastard A mean, sneaking coward
Diffident Lacking confidence in one's own ability, worth or fitness
Dilettante A person who loves the fine arts but in a superficial way and without serious purpose
Effervescent Bubbling; lively
Egocentric Self-centered
Egoist A self-centered or selfish person
Egotist A conceited, boastful person
Epicure A person of refined and fastidious taste, especially in food and wine
Fanatic A person excessively enthusiastic, as in religion or politics
Fastidious excessively particular, critical or demanding
Fatalist A person who believes that all events are subject to fate, and happen by unavoidable necessity
Feminist An advocate of women's rights, or of the movement for the advancement and emancipation of women
Garrulous Talking too much
Gregarious Fond of the company of others
Gullible Easily deceived or cheated
Hedonist One with a lifestyle devoted to seeking pleasure and self-gratification
Heretic One who maintains religious opinions contrary to those accepted by his church
Humanitarian One who has concern for the welfare and happiness of the people
Hypocrite A person who falsely professes desirable or publicly approved qualities, beliefs or feelings
Iconoclast A destroyer of images especially those set up for religious veneration
Ignoramus An ignorant person
Illiterate A person who cannot read and write
ImmigrantA person who comes to live permanently in a foreign country

Introvert A person interested mainly in his or her own inner state and processes rather than the outside world
Jockey A person who rides horses professionally in races
Loquacious A person fond of talking
Martyr A person who willingly suffers death rather than renounce his or her religious beliefs
Maverick An unbranded animal, especially a motherless calf
Mimic One who imitates the voice or gestures of another
Misanthrope A hater of humankind
Misogamist A hater of marriage
Misogynist A woman-hater
Neurotic A person suffering from nervous breakdown or a personality disorder typified by anxiety
Novice A beginner
Paedophile A person affected with sexual desire for children
Pantheist A person with the belief that the universe is identical with divinity
Pedant A person who makes an excessive or inappropriate display of learning
Pedestrian A person who goes or travels on foot
Philanthropic Doing good to others; benevolent
Philistine A person who lacks in or is smugly indifferent to culture, aesthetic refinement
Phlegmatic Not easily excited to action or' display of emotion
Polyglot Able to speak or write many languages
Precocious Early in developing or reaching some stage of development
Quixotic Extravagantly romantic in ideals or chivalrous in action
Recluse A person who lives in seclusion or apart from society
Sadist A person who derives pleasure, especially sexual, from inflicting pain, suffering or cruelty
Saturnine Grave or gloomy
Sceptic A person who questions the validity, authenticity or truth of something purporting to be factual
Snob A person who imitates or slavishly admires his/her social superiors and is condescending to others
Sociable Inclined to associate with or be in the company of others
Spendthrift A person who spends money or wealth extravagantly and wastefully
Stoic indifferent to pleasure or pain
Suave Smoothly agreeable or polite
Teetotaler A person who never drinks alcohol
Theist one who believes in God
Truculent Aggressive and discourteous
Vagabond A person who wanders without settled habitation
Virago A loud-voiced, ill-tempered woman
Virtuoso A person with a good deal of knowledge of or interest in works of art, antiquities, curiosities
Volunteer A person who voluntarily offers himself for an undertaking or a service

(P)PROFESSIONS/OCCUPATIONS RELATED WORDS:

Acrobat A performer of gymnastic feats that require agility, balance and coordination
Agronomist: an expert in soil management and production of field crops
Anthropologist: one who studies the origin, development and structure of people and their societies
Antiquary: a student of antiquities
Archaeologist: one who uncovers and studies the remains of early human cultures

Astrologer One who interprets the influence of the heavenly bodies on human life
Astronomer An expert in the science that deals with the material universe beyond the earth's atmosphere
Cartographer one who is skilled in making maps and charts
Chandler A person who makes or sells items of tallow or wax, as candles and soap
Charwoman A woman hired to do general cleaning, as in an office
Choreographer: one who devices dance movements and patterns
Collier A coal miner
Confectioner A person who makes or sells candies, ice-creams, cakes etc
Cooper A person who makes or repairs casks, barrels and tubes
Costermonger A hawker of fruits, vegetables and fish
Croupier The attendant who collects or pays money at a gaming table
Cutler A person who produces, sells or repairs cutting instruments like knives
Etymologist: an expert in the derivation of words
Entomologist: one who studies insects
Florist A person who grows or sells flowers and ornamental plant
Furrier One who buys and sells, makes, repairs or cleans fur and fur garments
Glazier A person who fits windows or the like with glass panes
Haberdasher A seller of small sewing articles such as ribbons and tape
Ichthyologist: an expert in fishes
Janitor An attendant, caretaker or doorkeeper
Juggler One who performs juggling feats, as with balls and knives
Lapidary A cutter of stones, especially gemstones
Lexicographer A writer, editor or compiler of a dictionary
Mercer A dealer in fine textiles and fabrics
Milliner A person who creates or sells hats for women
Oculist A specialist in diseases and defects of the eye
Ornithologist: study of birds
Ostler A person who looks after horses at an inn
Pawnbroker A broker who lends money on something deposited as security for repayment
Philatelist One who collects or studies postage and revenue stamps and other materials relating to postal history
Philologist: a student of words and languages
Plagiarist: one who copies without acknowledgement
Poulterer A dealer in poultry
Psychiatrist one who studies, diagnoses and treats mental disorders
Scavenger One who gathers something usable from discarded material like rubbish
Stevedore A person or company engaged in loading or unloading of ships
Stoker A labourer engaged to tend or fuel a furnace, especially one that generates steam
Tinker A mender of pots and cans, usually travelling from place to place
Undertaker One who manages funerals
Usurer A person who lends money and charges interest especially at an exorbitant rate
Vintner A person who makes or sells wines
Zoologist: one who studies the development and structure of animals

(Q)MEDICAL PROFESSION RELATED WORDS:

Anaesthetist One who administers anaesthetic or agents producing insensibility in the body
Cardiologist One who treats diseases of the heart

Chiropractor One who treats diseases by manipulating the joints of the body, especially those of the spinal cord
Dermatologist One who treats diseases of the skin
Gerontologist One who treats illness of old people
Gynaecologist A physician specializing in health maintenance and diseases related to the reproductive organs of women
Nephrologist A specialist who deals with diseases of the kidney
Neurologist One who deals with the diseases of the nervous system
Orthopaedist A specialist in curing deformities arising from disease or injury of bones
Ophthalmologist A physician specializing in the anatomy, functions and diseases of the eye
Optician A person who examines the eyes and prescribes, makes or sells spectacles or contact lenses for the eye
Optometrist A professional who examines eyes for defects of vision and eye disorders to prescribe corrective lenses or other treatment
Orthodontist One who specializes in straightening and adjusting teeth
Paediatrician A physician who specializes in development, care and diseases of children
Pathologist A person who studies the causes and effects of diseases
Periodontist One who specializes in treating diseases of the gums
Urologist A specialist in diseases and abnormalities of the urinary tract and in their treatment

(R)GOVERNMENT RELATED WORDS:

Anarchy A political and social disorder due to absence of governmental control
Bureaucracy A government by a rigid hierarchy of administrators and petty officials
Coalition An alliance, especially a temporary one, between factions, parties or states
Condominium Joint sovereignty over a territory by several states
Democracy A government by the people
Episcopacy A government of the church by bishops
Fascism The authoritarian form of government characterized by extreme nationalism, militarism, anti-communism and restrictions on individual freedom
Hegemony Predominant influence or domination exercised by one nation over others
Hierarchy Any system of persons or things ranked one above another
Isocracy A government in which all individuals have equal political power
Kakistocracy A government by the worst, least qualified, or most unscrupulous citizens
Polyarchy A government in which power is invested in multiple people.
Republic A state in which the supreme power rests in the body of citizens entitled to vote and is exercised by representatives chosen directly or indirectly by them
Stratocracy A government by the military
Technocracy A system of government in which technological experts manage and control the economy, government and social system

(S)MILITARY AND WARFARE RELATED WORDS:

Amnesty A general pardon
Armistice A suspension of hostilities
Arsenal A storehouse or factory for naval and military weapons and ammunition
Battery A number of cannons or other offensive weapons with their equipment
Belligerent A country waging war
Bivouac A makeshift camp or camping place for soldiers
Conscription A compulsory enrolment for service

Convoy A ship or ships of war, or a supply of stores, under escort
Demobilise To discharge from the army
Embargo A temporary order issued by the admiralty to stop the arrival or departure of ships
Espionage Spying
Guerilla War warfare or harassment of the army by an irregular force, which operates in small bands and is often politically motivated
Munitions Fortification
Reconnaissance A preliminary survey of an area to locate the enemy forces, etc
Reveille The sound of the drum or the bugle at daybreak in order to awaken soldiers
Salvo A simultaneous discharge of bombs, etc., in salute or for other purpose

(T)MARRIAGE RELATED WORDS:
Alimony A periodic allowance paid to a spouse or a former spouse for maintenance following a legal separation or divorce
Bigamy Marriage with one person while being legally wedded to another
Celibate A person who abstains from sexual relations
Monogamy The condition of having only one spouse at a time
Polyandry The practice condition of having more than one husband at one time
Polygamy The condition of having more than one spouse, especially a wife, at a time

(U)KILLING RELATED WORDS:

Foeticide Getting rid of/killing of foetus
Fratricide Killing of one's own brother
Genocide Systematic killing of a cultural or racial group
Homicide Killing of one human being by another
Infanticide Killing of a child
Matricide Killing of one's mother
Parricide Killing of a parent or other near relative
Patricide Killing of one's father
Regicide Killing of a king
Sororicide Killing of one's sister
Suicide Killing of oneself
Uxoricide Killing of one's wife

(V)LITERARY RELATED WORDS:

Anecdote A narrative, short in length, of an incident concerning the private life of a person
Autobiography The story of a person's life written by the person himself
Biography An account or history of the life of a person
Elegy A serious or pensive poem
Epilogue The concluding section of a book
Epitome The abstract of a literary work
Eulogy A speech or writing in praise of a person or thing
Hyperbole An extravagant statement or figure of speech not meant to be taken in a literal sense
Parody A satirical or humorous imitation of a serious piece of writing

Protagonist The leading character of a literary work
Thesaurus A dictionary of synonyms and antonyms

(W)BRANCHES OF SCIENCE:

Anatomy Science of the physical structure of an animal or plant learned by dissection
Ballistics Science or study of the motion of projectiles such as bullets, shells or bombs
Biochemistry Discipline involving study of the chemistry of living things
Biology Study of physical life
Botany Science of plants
Cryptology The science and study of cryptanalysis (procedures, processes, methods, etc. used to translate or interpret secret writings such as codes and ciphers) and cryptography (application of techniques of secret writing)
Hydrology Science dealing with the occurrence, circulation, distribution, and properties of water on earth and in atmosphere
Morphology Branch of biology dealing with the from and structure of organisms
Mycology Branch of biology dealing with fungi
OologyScience or study of birds' eggs
Orology The scientific study of mountains
Pedagogy Science or art of teaching
Penology Study of punishment in its relation to crime
Phonology Study of sounds of a language, their history and changes
Photometry Branch of physics dealing with measurements of the intensity of light, light distribution, illumination and luminous flux
Phycology Branch of biology dealing with algae
Pomology Study of fruit growing
Selenology Science dealing with the moon, especially its astronomical features
Zoology Scientific study of animals

(X)MEDICINE AND DISEASE RELATED WORDS:

Aetiology The medical study of the causation of disease
Anaesthesia General or local insensibility
Anaesthetic Producing insensibility; (n.) an anaesthetic agent
Analgesic (Anodyne) A medicine that relieves pain
Antibiotic Inhibiting the growth of another organism, especially micro-organisms causing infectious diseases
Antidote Something that counteracts a poison
Antiseptic Relating to inhibition or destruction of bacteria by a chemical agent
Chemotherapy Treatment of cancer and infectious diseases by using chemical compounds that act against the cancerous tissue or invading micro-organisms
Cicatrice Scar over a wound that has healed convalescence Gradual recovery of one's health and strength
Emetic Causing vomiting
Endemic A disease prevalent or regularly found among a certain set of people or in an area
Geriatrics Medical care of old people
Immunity The condition of being protected against an infection or disease owing to the presence of antibodies in the body that act against the antigens
Narcotic Inducing sleep or dulling sensation, physical or mental
Prognosis Forecasting the course of a disease

Quarantine A period of compulsory isolation for preventing the spread of an infection
Vaccination Innoculate with vaccine of a disease in order to produce it in mild form and so prevent serious attack

(Y)GROUP RELATED TERMS:

Army of soldiers
Assembly of people
Band of singers
Bevy of girls
Bouquet of flowers
Bunch of keys
Bundle of hay/sticks
Brood of chickens
Chain of mountains
Choir of singers
Cloud of locusts
Cluster of stars
Collection of stamps
Company of soldiers
Congregation of worshippers
Constellation of stars
Convey of partridges
Crew of sailors
Crowd of people
Drove of cattle
Fleet of ships
Flight of steps
Flock of birds/geese
Gang of robbers
Garland of flowers
Ground of islands
Heap of stones/ruins
Herd of cattle
Litter of pigs/pups
Mob of rioters
Pack of hounds/playing-cards
Panel of Jurymen
Pile of arms
Regiment of soldiers
Sheaf of arrows
Shoal of fish
Stud of horses
Suite of clothes
Swarm of bees
Team of horses/oxen/players
Train of followers
Throng of people
Troop of horsemen
Troupe of actors

Tribe of natives

(Z)SOME OTHER WORDS:

Booklet: a small book
Capsule: a small box, a small detachable compartment of an airplane or spacecraft, a small soluble container for enclosing a dose of medicine
Darling : little dear, a person tenderly loved
Duckling: a young duck
Islet: a small island
Leaflet: a small leaf, as a leaf of folded paper
Molecule: a small mass; smallest particle of an element or compound
Morsel: a small bite; a small piece of anything
Particle: a small part of piece of matter
Linguistics: science and study of language

EXERCISE

Direction: In the following questions, out of the four alternatives choose the one which can be substituted for the given words/sentence.

1. A person with a long experience of any occupation
   (a) Veteran (b) Genius
   (c) Seasoned (d) Ambidextrous
2. Words written on a tomb
   (a) Epithet (b) Epigraph
   (c) Soliloquy (d) Epitaph
3. Stealthily done
   (a) Devious (b) Nefarious
   (c) Surreptitious (d) Villainous
4. Something no longer in use
   (a) Desolate (b) Absolute
   (c) Obsolete (d) Primitive
5. One not concerned with right or wrong
   (a) Moral (b) Amoral
   (c) Immoral (d) Immortal
6. A person who opposes war or use of military force
   (a) Fascist (b) Pacifist
   (c) Narcissist (d) Fatalist
7. Severely abusive writing in journals
   (a) Imaginary (b) Speculative
   (c) Scurrilous (d) Sarcastic
8. Call upon God or any other power (like law) etc. for help or protection
   (a) Invocation (b) Involution
   (c) Inundation (d) Revocation
9. Fear of being enclosed in a small closed space
   (a) Agoraphobia (b) Claustrophobia
   (c) Xenophobia (d) Paranoia

10. One who has become dependent on something or drugs is
    (a) Adamant (b) Edict
    (c) Addict (d) Derelict
11. Succession of rulers belonging to one family
    (a) Dynasty (b) Lineage
    (c) Ancestry (d) Progeny
12. To cut something into two pieces
    (a) Severe (b) Sever
    (c) Sewer (d) Sow
13. Flat metal or Porcelain plate fixed on a wall as an ornament or memorial
    (a) Tabloid (b) Poster
    (c) Board (d) Plaque
14. Act of deceiving somebody in order to make money
    (a) Fraud (b) Robbery
    (c) Pickpocket (d) Theft
15. A short poem or speech addressed to the spectators after the conclusion of a drama
    (a) Prologue (b) Dialogue
    (c) Epilogue (d) Monologue
16. Capable of being understood in either of two or more possible senses, and therefore not definite
    (a) Amphibious (b) Ambiguous
    (c) Amorphous (d) Confusing
17. A person who is unable to pay his debts
    (a) Solvent (b) Banker
    (c) Insolvent (d) Lender
18. Anything which is no longer in use
    (a) Obscure (b) Obsolete
    (c) Pristine (d) Lapsed
19. A person coming to a foreign land to settle there
    (a) Immigrant (b) Emigrant
    (c) Tourist (d) Settler
20. Something capable of being done
    (a) Probable (b) Feasible
    (c) Tenable (d) Explicable
21. One who goes to settle in another country
    (a) Immigrant (b) Alien
    (c) Citizen (d) Emigrant
22. One who hates mankind
    (a) Philanthropist (b) Terrorist
    (c) Misanthrope (d) Misogynist
23. Belonging to all parts of the world
    (a) Versatile (b) Universal
    (c) Cosmopolitan (d) Secular
24. One who walks on ropes
    (a) Funambulist (b) Upholsterer
    (c) Acrobat (d) Aviator
25. The study of the origin and history of words
    (a) Linguistics (b) Etymology
    (c) Verbose (d) Anthology
26. A person who breaks into a house in order to steal
    (a) Poacher (b) Bandit

(c) Intruder (d) Burglar

27. The study of maps
(a) Cartography (b) Geography
(c) Geology (d) Atlas

28. Tough tissues in joints
(a) Ligaments (b) Endoderm
(c) Muscles (d) Fibre

29. The first model of a new device
(a) Prototype (b) Sculpture
(c) Icon (d) Photography

30. A building where an audience site
(a) Aquarium (b) Gymnasium
(c) Auditorium (d) Stadium

31. Give and receive mutually
(a) Present (b) Reciprocate
(c) Compromise (d) Approve

32. One who can think about the future with imagination and wisdom
(a) Dreamer (b) Seer
(c) Idealist (d) Visionary

33. A doctor who treats children
(a) Pediatrician (b) Pedagogue
(c) Pedestrian (d) Paedophile

34. One who studies election trends by means of opinion polls
(a) Entomologist (b) Psephologist
(c) Demagogue (d) Eugenist

35. One who believes in offering equal opportunities to women in all spheres
(a) Male chauvinist (b) Feminist
(c) Fatalist (d) Futurist

36. Killing of a child
(a) Homicide (b) Genocide
(c) Infanticide (d) Suicide

37. The art of good eating
(a) Gastronomy (b) Astronomy
(c) Vegetarianism (d) Gourmet

38. One who is indifferent to pleasure or pain
(a) Stoic (b) Stylist
(c) Cynic (d) Psychic

39. Lasting only for a moment
(a) Momentous (b) Momentary
(c) Trivial (d) Petty

40. To seize control of a vehicle in order to force it to go to a new destination, or demand something
(a) Attack (b) Contract
(c) Hijack (d) Detour

41. That which lasts for a short time
(a) Regular (b) Transitory
(c) Rotatory (d) Repository

42. Ready to believe anything
(a) Credible (b) Incredible
(c) Credulous (d) Incredulous

43. A four footed animal

(a) Tetraped (b) Quadruped
(c) Polyped (d) Double-paired

44. A person who believes in the total abolition of war
(a) Socialist (b) Communist
(c) Fascist (d) Pacifist

45. Constant efforts to achieve something
(a) Patience (b) Vigour
(c) Attempt (d) Perseverance

46. Of unknown and unadmitted authorship
(a) Gullible (b) Anonymous
(c) Unanimous (d) Vexation

47. Member of a band of robbers
(a)Fratricide (b) Brigand
(c)Thief (d) Pirate

48. A person who is made to bear the blame due to others
(a) Innocent (b) Scapegoat
(c) Ignoramus (d) Nincompoop

49. A person who brings goods illegally into the country
(a) Exporter (b) Importer
(c) Smuggler (d) Deporter

50. Cutting of stone in the bladder
(a) Dichotomy (b) Tubectomy
(c) Vasectomy (d) Lithotomy

Solutions

Solutions									
1.	a	2.	d	3.	c	4.	c	5.	b
6.	b	7.	c	8.	a	9.	b	10.	C
11.	a	12.	b	13.	d	14.	a	15.	c
16.	b	17.	c	18.	b	19.	a	20.	b
21.	d	22.	c	23.	c	24.	c	25.	b
26.	d	27.	a	28.	a	29.	a	30.	c
31.	c	32.	d	33.	a	34.	b	35.	b
36.	c	37.	a	38.	a	39.	b	40.	c
41.	b	42.	c	43.	b	44.	d	45.	d
46.	b	47.	b	48.	b	49.	c	50.	d

General Studies

Chapter 2

Cytology

INTRODUCTION

- Study which deals with the cell, its structure and functions of cell organ is called cytology.
- The structural and functional unit of all the organism or living beings is called cell.
- The shape & size of the cell are different, not only for the various organisms but the cells are also different in the same organism of the different organs.
- Cell was first discovered by Robert Hook in 1665.
- Protoplasm, the physical base of the life was discovered by J.E. Purkinje.
- The Cell Theory was jointly propounded by Schleden & Schwann in 1838 – 39. It states that:
  a) The cell is a self independent unit.
  b) All living things are composed of cells and their products.
  c) All cells arise from pre-existing cells.
  d) All cells are basically alike in chemical composition and metabolic activities.
  e) The function of an organism as a whole is the outcome of the activities and interaction of the constituent cells.

2. TYPES OF CELLS

In a typical cell, the protoplasm consists of nucleus and cytoplasm.

A. Depending on the type of nucleus present, the cells are of two types:

(i)Prokaryotic cell: Found in blue-green algae, bacteria and Pleuropneumonia like organisms (PPLO).

(ii)Eukaryotic cell: Found in developed organism

Prokaryotic Cell	Eukaryotic cell
1. It is simple and primitive in nature.	1. It is developed and comparatively complex in nature.
2. The nucleus is not well organized. It has no nuclear membrane and nucleolus.	2. The nucleus is well organized. Nuclear membrane and nucleolus are present.
3. The cell has no membrane bound organelles except ribosomal granules.	3. The cell contains almost all the membrane bound organelles.
4. Chromosomes are not formed in this cell during cell division.	4. Chromosomes are formed in the nucleus during cell division.
5. Single DNA thread remains freely in the nuclear material.	5. DNA is present in the nuclear reticulum or chromosomes.

B. On the basis of number of cells, the organisms are classified as Unicellular and Multi-cellular organisms.

C. DIFFERENCE BETWEEN PLANT CELLS AND ANIMAL CELLS

Plant Cell	Animal Cell
A plant cell has a rigid wall on the outside.	Cell wall is absent.
It is usually larger in size.	An animal cell is comparatively smaller in size.
It cannot change its shape.	An animal cell can often change its shape.
Plastids ore found in plant cells.	Plastids are usually absent.
Plant cells exposed to sunlight possess chlorophyll containing plastids called chloroplasts.	Chlorophyll is absent.
A mature plant cell contains a large central vacuole.	An animal cell often possesses many small vacuoles.
Nucleus lies on one side in the peripheral cytoplasm. Mitochondria ore comparatively fewer.	Nucleus usually lies in the centre. Mitochondria are generally more numerous.
Cristae are tubular in plant mitochondria.	Cristae are plate-like in animal mitochondria.

Plant cells do not burst if placed in hypotonic solution due to the presence of cell wall.	Animal cells usually burst if placed in hypotonic solution unless arid until they possess contractile vacuoles.
Centrioles are usually absent except in lower plants. Golgi apparatus consists of a number of distinct or unconnected units called dictyosomes	Centrioles are found in animal cells. Golgi apparatus is either localized or consists of a well connected single complex.
Lysosomes are rare. Their activity is performed by specialized vacuoles.	Typical lysbsomes occur in animal cell.
Glyoxysomes may be present.	They are absent.
Crystals of inorganic substances may occur inside the cell.	Crystals usually do not occur in animal cells.
Reserve food is generally starch and fat.	Reserve food is usually glycogen and fat.
Adjacent cells may be connected through plasmodesmata.	Adjacent cells are connected through a number of junctions.

3. CELL STRUCTURE

Every cell has three main components – Cell membrane, Nucleus and Nucleoplasm

A. CELL MEMBRANE

- The cell membrane of the cell is the outer layer of the cell and it is basically a semi permeable membrane.
- The main function of the cell membrane is to control the molecular activities between the cell & its outer medium which interact with the cell.
- Cells are enclosed by a thin film like membrane called plasma membrane, cytoplasmic membrane or plasma lemma.

B. CYTOPLASM

- It is a part of protoplasm lying between plasma membrane and nucleus, Jelly-like fluid.
- Participates in the intracellular distribution of nutrients, metabolites and enzymes.

C. CELL WALL

- Cells of most fungi, prokaryotes (bacteria and blue-green algae) and plants (except gametes) are surrounded by the cell wall. It is absent in animals.
- In true bacteria and cyanobacteria, cell wall is of peptidoglycan, in some fungi it is of chitin and in most of the algae and higher green plants it is of cellulose.

D. NUCLEUS

- Discovered by Robert Brown.
- Every eukaryotic cell consists of at least one, almost spherical, dense, highly specialized structure called nucleus. Although, sieve tube element of mature phloem and RBCs of mammals don't have nucleus.
- Contains nucleoplasm (nuclear sap) which contains chromatin. (Chromatin is composed of DNA mainly)
- Chromatin organizes itself into thread like structures called Chromosomes. The function of chromosomes is to carry genetic information from one cell generation to another.
- Nucleolus is also present which helps in the production of ribosome.
- Nucleus controls the metabolic activities of the cell by controlling the synthesis of enzymes.

E. CHROMOSOMES

- Waldeyer coined the term chromosome.
- Sutton and Boveri proved that chromosome is the physical basis of hereditary.
- Each chromosome is made up of DNA and this DNA by replication gives rise to messenger RNA which carry the genetic information in the form of code. This -RNA comes out of the nuclear wall into the cytoplasm where it helps to form a particular kind of protein needed by the cell or body.
- Number is constant for a particular species.
- In humans, the diploid number is **46.** Of these, 23 are from egg cell and 23 from sperm cell.

F. MITOCHONDRIA

- **Powerhouse of the cell** or energy converting organelles, as oxidation of 'fuel' occurs stepwise in these, resulting in the release of chemical energy. This energy is stored as ATP
- From mitochondria, ATP molecules are shifted to cytoplasm, which is the chief site of their utilization.
- They are semi-autonomous organelles. They contain DNA, m-RNA, ribosome and can synthesize some of their own proteins.
- Each mitochondria is enclosed by a double-membraned envelope, outer and inner. Fluid (called matrix) is there between these 2 layers

G. ENDOPLASMIC RETICULUM

- Provides an increased surface area for various metabolic activities within the cell:
- Provides mechanical support to the cytoplasm.
- 2 types: Rough and smooth.
- Both Smooth Endoplasmic Reticulum and Rough Endoplasmic Reticulum form passages for transport of secretary proteins, lipids and sterols.
- Rough Endoplasmic Reticulum collects and **stores the proteins synthesized by its surface bound, ribosome**

H. GOLGI COMPLEX

- Main function is **secretion**.).

I. LYSOSOMES

- Also called **Suicidal bags.**
- Contain powerful enzymes (acid hydrolyses), rupture of lissome membrane releases these enzymes.
- Digest worn-out or unnecessary parts of the cell, or even whole cells by process called 'Autophagy'.

J. RIBOSOMES

- Found on Endoplasmic Reticulum. Made of RNA and proteins in equal amounts.
- **Sites of protein synthesis** (Ribosome are inactive for protein synthesis, but after combining with mRNA form polyribosome which play important role in protein synthesis).

K. VACUOLES

- **Found in plant cells only.**
- Membrane surrounding the vacuole is tonoplast.
- Function: Regulation of water, in osmoregulation, in storage and indigestion.

L. PLASTIDS

- **Found in plant cells only.**
- Are of different types:
  (i)Chloroplast: Green contains the pigment **chlorophyll.** Contains the matrix (fluid), stroma which has many flat membranous structures called thylakoids
  (ii)Leucoplasts: Colorless, occur in large no in cells of fruits, seeds, etc. They **store nutrients** (eg, amyloplasts of potato store starch).
  (iii)Chromoplasts: Colored, containing fat soluble yellow, orange and red pigments (chiefly carotinoids). Found in flowers and fruits.

M. CENTROSOME

- Found in animal cells and cells of lower plants (eg, Algae) only.
- The first indication that the cell is about to divide is generally given by the centrosome.

SUMMARY OF FUNCTIONS OF DIFFERENT CELL ORGANELLES

	Cell Organelles		Functions
1.	Plasma membrane	(i)	Protection of cell cytoplasm.
		(ii)	Control of substances entering and coming out of the cell.
2.	Cytoplasm (a) Endoplasmic reticulum	(i)	Provides an increased surface area for the metabolic activities.
		(ii)	Synthesis of steroids.
	(b) Mitochondria		Act as power houses of cell, release energy by the oxidation of food.
	(c) Golgi complex	(i)	Produce secretions.
		(ii)	Forms lysosome.
	(d) Centro some		Plays an important role in the formation of spindle during cell-division.
	(e) Lysosomes	(i)	Store enzymes for the digestion of cellular components and bring about digestion of proteins and carbohydrates etc.
		(ii)	Bring about digestion of foreign substances entering the cell.
	(f) Ribosomes		Act as factories of the cell and synthesize proteins from amino acids.
	(g) Plastids	(i)	In presence of light, green plastids or chloroplasts manufacture carbohydrates from water and carbon dioxide.
		(ii)	Chromoplosts give different colours to the structures in which these are present.
3.	Nucleus (a) Nuclear membrane	(i)	Protects the nucleus.
		(ii)	Regulates the passage of substances entering and leaving the nucleus.
	(b) Nucleolous		Stores ribosomol RNA and controls synthesis of ribosomes and proteins.
		(i)	Controls nuclear metabolism and cell metabolism.
		(ii)	Stores hereditary information.
		(iii)	Inherits characters from parents to offsprings.

N. DNA and RNA

- **Wilkins, Watson and Crick (1953)—Noble Prize for DNA Structure**.
- DNA stands for **Deoxyribose Nucleic Acid** while RNA stands for **Ribose Nucleic Acid.**
- Compounds of carbon, hydrogen, oxygen nitrogen and phosphorus.

DNA	RNA
It usually occurs inside nucleus and some cell organelles.	Very little RNA occurs inside nucleus. Most of it is found in the cytoplasm.
DNA is the genetic material.	RNA is not the genetic material except in certain viruses, e.g., TNIV, Reovirus.
It is double stranded with the exception of some viruses.	RNA is single stranded with the exception of some viruses (e.g., double stranded in Reovirus).
DNA shows regular helical coiling.	There is no regular coiling except in parts of RNA.
DNA forms chromosomes of similar structures.	rRNA form, ribosomes.
DNA contains several million nucleotides.	Depending upon the type, RNA contains 10-12000 nucleotides.
DNA is of only two types, nuclear and extra nuclear.	There are at least three types of RNA—rRNA, mRNA and tRNA.
It contains deoxyribose sugar.	It contains ribose sugar.
Nitrogen base thymine occurs in DNA alongwith three other-odenine, cytosine and guanine.	Thymine is replaced by uracil in RNA. The other three are adenine, cytosine and guanine.
Renaturation after melting is slow.	It is quite fast.
Hydrogen bonds tire formed between complementary nitrogen bases of the opposite strands of DNA (A : T, C : G)	Base pairing through hydrogen bonds occurs only in the coiled parts.

It replicates to form new DNA molecules.	It cannot replicate itself except in RNA-RNA viruses.
DNA transcribes genetic information to RNA.	RNA translates the transcribed message for forming polypeptides.
DNA controls heredity, evolution, metabolism, structure and differentiation.	RNA controls only protein synthesis.
Its quantity is fixed for cell.	The quantity of RNA of a cell is variable.
DNA controls metabolism and genetics including variations.	It only controls metabolism under instructions from DNA.
Purine and pyrimidine bases are in equal nmber.	There is no proportionality between number of purine and pyrimidine bases.
It can be hydrolyzed by enzyme DNA-ase.	RNA is hydrolysed by RNA-ase.

- Made up of Nucleotide monomers (Polynucleotides)
- A nucleotide consists of **a nitrogenous base, a pentose sugar & phosphate group.**
- Nucleotide: Nitrogenous base + Sugar.
- 5 Nitrogenous Bases :
  (i)Cytosine (ii)Uracil (iii)Thymine (iv)Adenine (v)Guanine
- Cytosine, Uracil and Thymine are the Pyrimidine Derivatives with a single ring structure.
- Adenine and Guanine are the Purine Derivatives with a double ring structure.
- The pentose sugars are of 2 types :-
  (i)Deoxyribose (ii)Ribose
- Long and highly complex, spirally twisted, right-handed double helix, Ladder like structure formed by 2 polynucleotjdes strands
- Base thymine is present, but never uracil.
- **Adenine links with Thymine** by two hydrogen bonds.
- **Guanine with cytosine** by three hydrogen bonds.
- A single DNA molecule has millions of pairs of nucleotide monomers.
- DNA contains "BLUE PRINT" of life.
- With RNA's help, it directs the synthesis of all structural and functional proteins of protoplasm.

DIFFERENCE BETWEEN DNA AND RNA

MISCELLANEOUS FACTS

1. Human nerve cell is the longest animal cell.
2. In human beings, cells of kidney are the smallest.
3. Ostrich egg is the largest cell in size.
4. The smallest cell is Mycoplasma gallisepticum.
5. Largest a cellular plant Acetabularia and animal is Amoeba.