clamphook

Shift 4

Tribhuvan University

2080

Full Marks: 140 **Time:** 2 hours **Pass Marks:** 56

1. The dimensional formula of pressure gradient is

a. $[ML^{-2}T^{-1}]$ b. $[M^{-1}L^{-2}T^{-2}]$

c. $[ML^{-2}T^{-2}]$ d. $[M^{-1}L^{-2}T^{-3}]$

2. A scooter of mass 120 kg is moving with a uniform velocity of 108 km/hr. The force required to stop the velocity in 10 sec is :

a. 360 N b. 720 N

c. 180 N d. $12 \times 10.8N$

3. At what height from earth, g becomes g/2?

a. R/2 b. 0.414R

c. 0.7R d. R

4. A force of $10^6 \frac{N}{m^2}$ is required for breaking a material. If the density of the material $3 \times 10^3 \frac{kg}{m^3}$ than what should be the length of the wire made of material so that it breaks by its own weight?

a. 30 m b. 34 m

c. 38 m d. 42 m

5. When a large bubble rises from the bottom of lake to the surface , its radius doubles . The atmospheric pressure is equal to the column of water of height 'H' . Then depth of the lake is

a. H b. $2H$

c. $7H$ d. $8H$

6. On a particular day, the relative humidity is $100^\circ c$ and the room temperature is $30^\circ c$, then the dew point is

a. $0^\circ C$ b. $50^\circ c$

c. $70^\circ c$ d. $80^\circ c$

7. A gas is initially at $27^\circ C$. It is compressed adiabatically from 27 liters to 8 liters. The rise in temperature is

a. $402^\circ C$ b. $375^\circ C$

c. $675^\circ C$ d. none

8. Time taken by sun light through a block 9.5 cm thick having refractive index 1.5 is [IOE 2076]

a. 0.21 ns
b. 0.21 μs
c. 0.47 ns
d. 0.47 μs

9. In a right sighted glass prism , light is normally incident through smaller face . Then deviation is

a. 90°
b. 45°
c. 30°
d. 60°

10. A spherical condenser has inner and outer spheres of radii a and b respectively . The space between the two is filled with air . The difference between the capacities of two condensers formed when outer sphere is earthed and then inner sphere is earthed will be :

a. zero
b. 4 $\pi\epsilon_o$ a
c. 4 $\pi\epsilon_o$ b
d. $\frac{4\pi\epsilon_o ab}{b-a}$

11. if 1.5 A current liberates x kg of ions, the ions liberated by 6.0 A current will be:

a. $\frac{x}{4}$ kg
b. $\frac{x}{2}$ kg
c. $2x$ kg
d. $4x$ kg

12. A compass needle is allowed to move horizontal plane is taken to a geomagnetic pole . It

a. Will stay in north - south direction only .
b. Will stay in east – west direction only
c. Will become rigid showing non movement .
d. Will stay in any position

13. A pure resistance and a pure inductance are connected in series across a 100 volt AC line . A voltmeter give the same reading whether connected across resistance or inductance . What does it read ?

a. 70 V
b. 70.7 V
c. 110 V
d. 220 V

14. In Young's experiment , one slit is covered with a blue filter and the other with a yellow filter . Then the interference pattern .

a. will be blue
b. will be yellow
c. will be green
d. will not be formed

15. A source of sound emits sound equally in all direction in a non – absorbing medium. Two points P and Q are at a distance of 9 m and 25 m respectively for point source then the ratio of their amplitude at P and Q is

a. $8:25$
b. $3:5$
c. $25:9$
d. $5:3$

16. The kinetic energy of a proton acceleration by 1V is

a. 1 eV
b. 1840 eV
c. $\frac{1}{1840}$ eV
d. $\sqrt{1840}$ eV

17. Who discovered nucleus? [IOE 2074]

a. Rutherford
b. Bohr
c. Heisenberg
d. Dalton

18. Let A and B be two sets such that $n(A) = 70, n(B) = 60$ and $n(A \cup B) = 10$. Then $n(A \cap B)$ is equal to

a. 240 b. 20

c. 160 d. 120

19. A matrix has 8 number of elements, the number of possible order of matrix is

a. 1 b. 2

c. 4 d. 8

20. $\left|\frac{(1+i)(2+i)}{(3+i)}\right| =$

a. $\frac{1}{\sqrt{5}}$ b. $\frac{2}{\sqrt{5}}$

c. $\frac{1}{2}$ d. 1

21. If the sum of all terms in this expansion of $\left(x + \frac{1}{x}\right)^n$ is 64 then value of n is [IOE 2077]

a. 4 b. 8

c. 6 d. 10

22. If $\sec^{-1} x = \operatorname{cosec}^{-1} y$, then $\cos^{-1}\frac{1}{x} + \cos^{-1}\frac{1}{y}$, is equal to:

a. π b. $\frac{\pi}{4}$

c. $\frac{\pi}{6}$ d. $\frac{\pi}{2}$

23. A solution of equation $\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$ is :

a. $x = 1$ b. $x = -1$

c. $x = 0$ d. $x = \pi$

24. If in a triangle ABC , $\frac{a}{\cos A} = \frac{b}{\cos B}$,then

a. $2\sin A \sin B \sin C = 1$ b. $\sin^2 A + \sin^2 B = \sin^2 C$

c. $2\sin A \cos B = \sin C$ d. None

25. $(\vec{a} \times \vec{b})^2 =$ [IOE 2075]

a. $ab + (\vec{a} \cdot \vec{b})$ b. $\sqrt{a^2b^2 - (\vec{a} \cdot \vec{b})^2}$

c. $\sqrt{a^2b^2 - (\vec{a} \times \vec{b})^2}$ d. $\sqrt{a^2b^2 + (\vec{a} \cdot \vec{b})^2}$

26. The length of the perpendicular from the point $(2, 3)$ top the line $8x + 15y + 24 = 0$ is

a. 5 b. 85

c. 17 d. $\frac{1}{5}$

27. The area of curve $x^2 + y^2 = 2ax$ is: [IOE 2075]

a. $\frac{\pi a^2}{2}$ b. $\frac{\pi a^2}{3}$

c. $\frac{\pi a^2}{4}$ d. πa^2

28. The equations $x = \mathrm{at}^2, y = 4at$ represent :

a. Circle b. Ellipse

c. Hyperbola d. Parabola

29. The foci of the hyperbola $x^2 - 4y^2 = 4$ is:

a. (±3, 0) b. (± 5, 0)

c. (0,± 3) d. (0,± 5)

30. The Y – coordinates of a point on line joining $(1, 3, -5)$ and $(9, 11, 7)$ is 5. The Z – coordinates of point is [IOE 2076]

a. 2 b. 4

c. -2 d. – 4

31. The value of $\lim_{x \to 0} \left(\frac{\sqrt{1 - \cos 2x}}{\sqrt{2}x} \right)$ is equal to

a. 1 b. 0

c. -1 d. Does not exist

32. If $f(x) = e^{\sin^{-1} x}$ then $f'(x) =$ [IOE 2077]

a. $-\frac{e^{\sin^{-1} x}}{\sqrt{1 - x^2}}$ b. $e^{\sin^{-1} x}$

c. $\frac{e^{\sin^{-1} x}}{\sqrt{1 - x^2}}$ d. $\frac{e^{\sin^{-1} x}}{1 - x^2}$

33. If $y = e^{x+b}$ then $(y_2)_0 =$

a. a^2e^2 b. a^be^2

c. a^2e^b d. ae^b

34. The minimum value of $\frac{a^2}{(\cos^2 x)} + \frac{b^2}{(\sin^2 x)}$ is

a. $a^2 - b^2$ b. $(a - b)^2$

c. $2(a + b)^2$ d. $ba^2 + b^2a$

35. If by dropping a stone in a quiet lake a wave moves in circle at speed of 3.5cm/sec , then the rate of increase of the enclosed circular region when the radius of the circular wave is 10cm , is

a. 350 sq. cm/sec , b. 35 sq. cm/sec

c. 220 sq. cm/sec d. 10 sq. cm/sec

36. $\int_1^2 \frac{dx}{x + 2}$ [IOE 2076]

a. 1 b. $\log_e 2$

c. $\log_e(3/4)$ d. $\log_e(4/3)$

37. The area bounded by the parabola $y^2 = 4x$ and its latus rectum is:

a. $\frac{4}{3}$ b. $\frac{8}{3}$

c. $\frac{2}{3}$ d. $\frac{1}{3}$

38. Electrolysis of cold concentrated aqueous solution of potassium succinate yields

a. ethane
b. ethyne
c. ethene
d. ethane- 1, 2-diol

39. Polymerisation of acetylene leads to the formation of

a. benzene
b. naphthalene
c. butane
d. propane

40. Catalyst used in the manufacture of sulphuric acid by contact process is

a. Finely divided iron
b. NO
c. N_2O
d. V_2O_5

41. The maximum possible number of hydrogen bonds a water molecule can form is

a. 1
b. 2
c. 3
d. 4

42. Alkali metal import colour to Bunsen burner flame due to

a. The presence of one electron in their outermost orbitals
b. Low ionization energy
c. Their softness
d. Their reducing nature

43. In which process blister copper is obtained? [IOE 2078]

a. Bessemer Process
b. Smelting
c. Electrical Process
d. Open Hearth Process

44. The formula of hematite is

a. Fe_3O_4
b. Fe_2O_3
c. $FeCO_3$
d. FeS_2

45. A metal ion M^{++} after losing two electrons in a reaction has an oxidation number

a. 0
b. +2
c. +4
d. -4

46. Boron compounds behaves as lewis acid because of their

a. Acidic nature
b. Covalent nature
c. Electron deficiency
d. Ionization property

47. It is not possible to determine simultaneously the exact position and momentum of a moving micro particle. It is known as

a. uncertainty principle
b. pauli's exclusion rule
c. hund's rule
d. Afbau's principle

48. The correct order of electropositive character of Li, Na and K is

a. $Li > Na > K$
b. $Li > K > Na$
c. $Na > K > Li$
d. $K > Na > Li$

49. Is ..... yours?

a. that
b. those
c. these
d. such

50. He as well as I ..... help.

a. need
b. needs
c. is needing
d. has needed

51. There are 1000 grams ____ one kilogram.

a. in
b. at
c. on
d. by

52. The sentence structure of ‚Äú She made him a good husband ,,Äô is [IOE 2076]

a. S + V + O + C
b. S + V + IO + DO
c. S + V + O+ Adverbial
d. S + V + O

53. Class ..... at 7 o'clock tomorrow.

a. Began
b. begin
c. begins
d. was beginning

54. Active form of 'The dog was run over by a car.' Is [IOE 2075]

a. A car run over the dog.
b. A car runs over the dog.
c. A car ran over the dog.
d. A car had run over the dog.

55. The phonemic transcription of the word 'stone' is [IOE 2077]

a. /stəʊn/
b. /stən/
c. /stəʊ:n/
d. /stə:n/

56. 'Shopping online , Daniel bought a book for entrance.' This sentence is [IOE 2076]

a. simple
b. compound
c. complex
d. none

57. Students drop out of school to take part time jobs.

a. resume
b. leave
c. admit
d. finish

58. The antonym of the word 'capacious' is [IOE 2075]

a. Squeezed
b. Abundant
c. Substantial
d. Distensible

59. Is she should win the race,___ her. [IOE 2074]

a. congratulated
b. congratulate
c. may congratulate
d. would congratulate

60. Building has been built ____ the new plan.

a. accordance to
b. in accordance with
c. for
d. about

61. The stone are projected with velocity u at an angle θ and $90^\circ - \theta$ whose maximum height reached is H_1 and H_2 then R is related as:

a. $R = \sqrt{H_1 H_2}$
b. $R = H_1 H_2$
c. $R = 4\sqrt{H_1 H_2}$
d. $R = 4H_1 H_2$

62. 250 J of energy is required to lift a body of mass 2 kg through a height 10 m. The acceleration with which a body is lifted is

a. $2.5m/s^2$ b. $5m/s^2$

c. $7.5m/s^2$ d. $10m/s^2$

63. A simple pendulum with a brass bob has a time period T. The bob is now immersed in a non – viscous liquid and oscillates in it, if the density of liquid is 1/10th that of brass. The time period of same pendulum in liquid will be:

a. T b. $\frac{10}{9}T$

c. $\sqrt{\frac{10}{9}}T$ d. $\sqrt{\frac{9}{10}}T$

64. A rectangular plate of dimensions 6 cm ×4 cm and thickness 2 mm is placed with its largest face flat on surface of water. What is the downward force on the plate due to surface tension ?
Surface tension of water $= 7.0 \times 10^{-2}$ N/m [IOE 2078]

a. 0.07 N b. 0.028 N

c. 0.14 N d. 0.014 N

65. The rms speed of certain gas at $27^{\circ}C$ is $1930m/s$ then gas is:

a. H_2 b. F_2

c. O_2 d. Cl_2

66. A lens produces real image 3 times the size of an object placed 10 cm away. The focal length of the lens will be: [IOE 2078]

a. 10 cm b. 7.5 cm

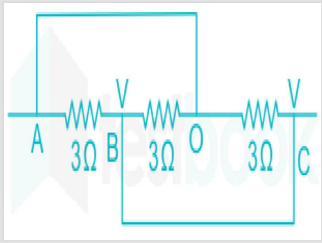
c. 15 cm d. 30 cm

67. An air filled parallel plate capacitor has a capacitance 1 PF. The separation of plates is doubled and wax is inserted between them which makes capacitance 2 PF. The dielectric constant of wax is:

a. 2 b. $\frac{4}{3}$

c. 4 d. 8

68. The effective resistance of network between point A and B is:



a. 9 Ω b. 6 Ω

c. 1 Ω d. zero

69. Magnetic field at axis 1.8m for from center of coil having 500 turns and radius 1.5 m such that it carries 7A current is [IOE 2074]

a. 2.6 gauss b. 3.8 gauss

c. 4.2 gauss d. 5.4 gauss

70. The magnetic field at a point at a large distance r at the axis of a current carrying circular coil of small radius is proportional to:

a. r^2 b. r^3

c. $\frac{1}{r^2}$ d. $\frac{1}{r^3}$

71. A piano string 1.5 m long is made of steel of density $7.7 \times 10^3 kgm^{-3}$ and Young's modulus $2 \times 10^{11} Nm^{-2}$. It is maintained at a tension that produces an elastic strain of 1% in the string. The fundamental frequency of transverse vibration of the string is :

a. 100 Hz
b. 170 Hz
c. 50 Hz
d. 200 Hz

72. Doppler's effect is not observed when velocity of sound source is [IOE 2075]

a. $>$ speed of sound
b. $<$ speed of sound
c. $=$ speed of sound
d. 0

73. Light of frequency 5×10^{14} Hz shown onto the metal surface, electron emitted out with maximum kinetic energy 1.2×10^{-19} J. If the same surface is illuminated by light of frequency 6.2×10^{14} Hz, in this case, electron emitted out from the surface with energy 2×10^{-19} J. Use this data, calculate Planck's constant

a. 6.64×10^{-34} Js
b. 6.65×10^{-34} Js
c. 6.67×10^{-34} Js
d. 6.68×10^{-34} Js

74. Let f_1 be the frequency of the series limit of the lyman series, f_2 be the frequency of the first line of the lyman series, and f_3 be the frequency of the series limit of the balmer series then [IOE 2078]

a. $f_1 > f_2 > f_3$
b. $f_1 < f_2 < f_3$
c. $f_1 > f_2 = f_3$
d. $f_1 = f_2 < f_3$

75. The domain and range of the function f(x)=x^2 are :

a. (-∞,∞) and (0,∞)
b. (0,∞) and (0,∞)
c. (-∞, ∞) and [0,∞)
d. (0,∞) and (-∞,∞)

76. $A = \begin{bmatrix} 4 & 6 & -1 \\ 3 & 0 & 2 \\ 1 & -2 & 5 \end{bmatrix}, B = \begin{bmatrix} 2 & 4 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}, C = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$ then the expression which is not defined is

a. $A^2 + 2B - 2A$
b. CC'
c. $B'C$
d. AB

77. The value of $k(k > 0)$ for which the equation $x^2 + kx + 64 = 0$ and $x^2 - 8x + k = 0$ both will have real roots is

a. 16
b. 8
c. 4
d. 15

78. The sum of the series $(1^2 + 1) + (2^2 + 2) + (3^2 + 3) + \ldots\ldots +$ up to n terms is:

a. $\frac{n^2(n+1)^2}{4}$
b. $\frac{n(n+1)(n+2)}{3}$
c. $\frac{n(n+2)(n+3)}{4}$
d. $\frac{n(n+1)(2n+1)}{6}$

79. $\frac{1}{2.3} + \frac{1}{4.5} + \frac{1}{6.7} + \ldots . + \infty =$

a. $\log_e 2$
b. $1 - \log_e 2$
c. $(\log_e 2 - 2)$
d. $-\log_e 2$

80. The general solution of $2\cos A\cos 3A + 1 = 0$ is [IOE 2076]

a. $n\pi \pm \frac{\pi}{3}$ b. $2n\pi \pm \frac{\pi}{3}$

c. $2n\pi \pm \frac{\pi}{4}$ d. $n\pi \pm \frac{\pi}{6}$

81. In ΔABC, $\frac{2\Delta}{bc} =$ [IOE 2078]

a. $\cos A$ b. $\cot A$

c. $\sin A$ d. $2\sin A$

82. If $\vec{a} = -2\vec{i} + \vec{j} - 3\vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} - \vec{k}$ and $\vec{c} = \vec{i} + \vec{j} + \vec{k}$ then the value of $(\vec{a} \times \vec{b}).\vec{c}$ will be [IOE 2075]

a. -7 b. -9

c. 1 d. – 15

83. If slope of one line represented by $ax^2 + 2hxy + by^2$ = 0 is five times the slope of another line then [IOE 2076]

a. $5h^2 = ab$ b. $5h^2 = 9ab$

c. $9h^2 = 5ab$ d. $h^2 = ab$

84. If an equation of circle given by $x^2 + y^2 + 2gx + 2fy + c = 0$ touches y-axis, then [IOE 2078]

a. $f^2 = c$ b. $g^2 = c$

c. $g^2 - f^2 = c$ d. $g^2 \pm f^2 = c$

85. The number of tangents drawn from (1,2) to parabola $y^2 = 4x$ is [IOE 2078]

a. 1 b. 2

c. 3 d. 4

86. If a plane passes through P(a ,a ,a) and is perpendicular to OP. The sum of intercepts made by plane on the coordinate axes is [IOE 2074]

a. 3a b. 9a

c. $\frac{1}{3a}$ d. $\frac{1}{9a}$

87. $\lim_{x\to\infty}(\frac{x-4}{x+5})^{2x}$ [IOE 2078]

a. e^{-4} b. e^{-6}

c. e^{-9} d. e^{-18}

88. $\frac{d}{dx}\left(\sec^{-1}\frac{1}{\sqrt{1-x^2}}\right) =$ [IOE 2075]

a. $\frac{1}{\sqrt{1-x^2}}$ b. $\frac{1}{1+x^2}$

c. $\frac{2}{\sqrt{1+x^2}}$ d. $\frac{1}{\sqrt{1+x^2}}$

89. $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx =$ [IOE 2075]

a. $\frac{\pi}{3}$ b. $\frac{\pi}{4}$

c. $\frac{\pi}{2}$ d. $\pi/6$

90. The correct structure of 4-bromo-3-methylbut-l-ene is

a. $Br - CH{=}C(CH_3)_2$ b. $CH_2{=}CH{-}CH\ (CH_3)\ CH_2Br$

c. $CH_2{=}C(CH_3)\ CH\ 2\ CH_2\ Br$ d. $CH_3{-}C\ (CH_3){=}CHCH_2Br$

91. Which of the following produces Cl_2 gas?

a. $NaCl + HNO_3$ b. $MnO_2 + NaCl$

c. $KMnO_4 + HCl$ d. $HCl + HNO_3$

92. Railway wagon axles are made by heating rods of iron embedded in charcoal powder. The correct process is known as

a. Case hardening b. Sherardizing

c. Annealing d. Tempering

93. The equivalent weight of an element is 4. Its chloride has a V.D. 59.25. Then the valency of the elements is

a. 4 b. 3

c. 2 d. 1

94. The mass of $CaCO_3$ produced when CO_2 is bubbled through 200 ml of 0.2 N $Ca(OH)_2$ will be [IOE 2075]

a. 1 gm b. 2 gm

c. 3 gm d. 4 gm

95. If the solubility of $Ca(OH)_2$ is $\sqrt{3}$, what will be solubility product?

a. $\sqrt{3}$ b. 3

c. 27 d. $12\sqrt{3}$

96. A certain current liberates 0.504 g of hydrogen in 2 hours. How many grams of oxygen can be liberated by the same current in same time?

a. 2 g b. 0.4 g

c. 4 g d. 8 g

Read the following passage and answer the questions below: *(Questions from 97 to 100)*

How can you best improve your English depends on where you live, and particularly on, whether or not you live in an English-speaking community? If you hear English spoken every day and mix freely with English speaking people, that is, on the whole, an advantage on the other hand, it is often confusing to have the whole language poured over you at once Ideally, a step-by-step course should accompany or lead up to this experience It will also help a great deal if you can easily get the sort of English books in which you are interested. To read a lot is essential. It is stupid not to venture outside the examination 'set books' or the textbooks you have chosen for intensive study. Read as many books in English as you can, not as a study but for pleasure. Do not choose the most difficult books you find with the idea of listing and learning as many new words as possible Choose what is likely to interest you and

be sure in advance that it is not too hard You should not have to be constantly looking up new words in the dictionary, for that deadens interest and checks real learning. Look up a word here and there but as a general policy try to push ahead, guessing what words mean from the context. It is extensive and not intensive reading that normally helps you to get interested in extra reading and thereby improve your English. You should enjoy the feeling which extensive reading gives of having some command of the language. As you read, you will become more and more familiar with words and sentence patterns you already know; understanding them better and better as you meet them in more and more contexts, some of which may differ only slightly from others.

97. What does the author recommend for improving English?

a. ask for other
b. indirect method
c. step by step
d. direct method

98. What is essential to learn English?

a. ignoring tradition
b. to read a lot of books
c. acts of vandalism
d. simplicity and spontaneity

99. When can you learn English faster?

a. live in an English speaking community.
b. if we read novels
c. write essays more
d. watching English movie more

100. Which book should be chosen to improve English?

a. Most difficult books
b. Course books
c. textbooks
d. interesting books

Answer Key

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

97.c	98.b	99.a	100.d

Solutions

1. c

The pressure gradient is $\frac{dP}{dx} = \frac{dF}{dAdx} = \frac{dF}{dV}$

The dimensional formula of pressure gradient = $\frac{[MLT^{-2}]}{[L^3]} = [ML^{-2}T^{-2}]$

$\rightarrow$ Try to find the dimensional formula of temperature gradient, energy gradient, potential gradient etc.

2. a

$u = 108km/hr = \frac{108 \times 1000}{3600} = 30m/s$
$v = u + at$
$=> 0 = 30 + a \times 10$
$a = -3m/s^2$
Now, Retarding Force $F = m.a$
$= 120 \times 3 = 360N$

3. b

Value of 'g' will be g/n times a height
$h = (\sqrt{n} - 1)R \quad (R \rightarrow \text{radius of earth})$
Value of 'g' will be g/2 at a height h $= (\sqrt{2} - 1)$
$R = (1.414 - 1)R = 0.414R$from earth surface

4. b

Stress $= \frac{\text{weight}}{\text{Area}}$
$= \frac{(AL)\rho g}{A} = L\rho g = 10^6 \rightarrow L = 34$ m.

5. c

$P_1V_1 = P_2V_2$

$(\rho gH + x\rho g)\frac{4}{3}\pi r^3 = H\rho g \times \frac{4}{3}\pi(2r)^3$

$x = 7H$

6. b

If relative humidity is 100% then room temperature $=$ dew point.

7. b

For adiabatic process,
$PV^Y =$ constant
$TV^{v-1} =$ constant
$T^\gamma P^{1-r} =$ constant
Here,$T_1{V_1}^{\gamma^{-1}} = T_2V_2^{Y-1}$

$$T_2 = T_1\left(\frac{V_1}{V_2}\right)^{\gamma-1}$$

or,
$$= 300 \times \left(\frac{27}{8}\right)^{\frac{5}{3}-1}$$
$$= 300 \times \left(\frac{3}{2}\right)^{3-2/3} = 675K.$$

Rise in temperature $= (675 - 300)K = 375$

$K = 375^\circ C$

8. c

$t = \frac{d}{v} = \frac{d}{c/\mu} = 1.5 \times \frac{(9.5 \times 10^{-2})}{3 \times 10^8} = 4.75 \times 10^{-10} = 0.475ns$

9. a

Critical angle for glass :42°

Hence light suffers total internal refelction and is deviated 90

If light falls normally on the larger face , deviation produced = 180°

10. c

When outer sphere is earthed ,

$C_1 = \frac{4\pi\epsilon_o ab}{b-a}$

When outer sphere is earthed ,

$C_2 = \frac{4\pi\epsilon_o b^2}{b-a}$

$\Delta C = 4\pi\epsilon_o b$

11. d

12. d

It shows no particular direction at earth's magnetic pole as $H = 0$ at magnetic poles. So, it may stay in any direction.

13. b

$VR_{=}V_L$

$IR = IX_L$

$R = X_L$

$Z = \sqrt{(R^2 + X_L^2)} = \sqrt{(R^2 + R^2)} = \sqrt{2}R$

i. e $Z = \sqrt{2}$ times

Similarly, voltage read 1/√2 times

= 1/√2 ×100=70.7 V

14. d

Now the waves do not become coherent

15. c

$\frac{a_p}{a_q} = \frac{r_q}{r_p} = \frac{25}{9}$

16. a

K. E of a proton = qV Joule =1 eV

17. a

Rutherford's gold foil experiment

18. b

We know, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$\therefore n(A \cap B) = n(A) + n(B) - n(A \cup B)$

$= 70 + 60 - 110 = 20$

19. c

Find ordered pair $(m, n), m, n \in \mathbb{N}$ such that $mn = 8$

$(1, 8), (2, 4), (4, 2), (8, 1)$

20. d

$$\left|\frac{(1+i)(2+i)}{(3+i)}\right|$$

$$\frac{|(1+i)||(2+i)|}{|(3+i)|}$$

$$= \frac{\sqrt{1^2+1^2}\sqrt{2^2+1^2}}{\sqrt{3^2+1^2}}$$

$$= \frac{\sqrt{2} \times \sqrt{5}}{\sqrt{10}} = 1$$

21. c

Putting $x = 1$

$$\left(1 + \frac{1}{1}\right)^n = 64$$

$$2^n = 2^6$$

$$n = 6$$

22. d

$$\cos^{-1}\frac{1}{x} + \cos^{-1}\frac{1}{y}$$

$$\sec^{-1} x + \sec^{-1} y$$

$$\operatorname{cosec}^{-1} y + \sec^{-1} y$$

$$\sin^{-1}\frac{1}{y} + \cos^{-1}\frac{1}{y} = \frac{\pi}{2}$$

23. c

$$\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$$

$$\tan^{-1}\frac{(1+x)+(1-x)}{1-(1+x)(1-x)} = \frac{\pi}{2}$$

$$\frac{(1+x)+(1-x)}{1-(1+x)(1-x)} = \tan\frac{\pi}{2} = \frac{n}{0}$$

$$1 - (1 - x^2) = 0$$

$$x = 0$$

24. c

$$\frac{a}{\cos A} = \frac{b}{\cos B}$$

$$\frac{a}{b} = \frac{\cos A}{\cos B}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{b} = \frac{\sin A}{\sin B}$$

$$\frac{\cos A}{\cos B} = \frac{\sin A}{\sin B}$$

$$\tan A = \tan B \rightarrow A = B \rightarrow a = b$$

$$A + B + C = \pi$$

$$2A + C = \pi$$

$$2A = \pi - C$$

$$\sin 2A = \sin C$$

$$2 \sin A \cos A = \sin C$$

$$2 \sin A \cos B = \sin C$$

25. b

$(\vec{a} \times \vec{b})^2 = (ab \sin \theta)^2 = a^2 b^2 \sin^2 \theta$
$= a^2 b^2 – a^2 b^2 \cos^2 \theta$
$= a^2 b^2 – (\vec{a} \cdot \vec{b})^2$

26. a

$$P = \left| \frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}} \right| = \left| \frac{8 \times 2 + 15 \times 3 + 24}{\sqrt{8^2 + 15^2}} \right| = \left| \frac{85}{17} \right| = 5$$

27. d

The equation of the circle is: $x^2 - 2ax + y^2 = 0$ $(x - a)^2 + y^2 = a^2$ radius $= a$ area of circle $= \pi a^2$

28. d

$x = \text{at}^2$

$$y = 4at$$

$$y^2 = 16a^2 t^2$$

$$y^2 = 16a^2 \frac{x}{a}$$

$y^2 = 16ax$ It is equation of parabola.

29. b

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

$$\frac{x^2}{4} - \frac{y^2}{1} = 1$$

$$c = \sqrt{4 + 1} = \sqrt{5}$$

Foci is $(\pm c, 0) = (\pm 5, 0)$

30. c

Let point divides line k: 1 internally Y – coordinates = $5 = \frac{k \times 11 + 1 \times 3}{k + 1}$

$5k + 5 = 11k + 3$

$2 = 6k$

$k : 1 = 1 : 3$

Now, Z – coordinates = $\frac{7 \times 1 + (-5) \times 3}{1 + 3} = -2$

31. d

$\lim_{x \to 0} \left(\frac{\sqrt{1 - \cos 2x}}{\sqrt{2}\, x} \right)$

$\lim_{x \to 0} \sqrt{\frac{1 - \cos 2x}{2x}}$

$\lim_{x \to 0} \sqrt{\frac{2 \sin^2 x}{2x}}$

$\lim_{x \to 0} \frac{\pm\sqrt{2} \sin x}{\sqrt{2x}}$

Limit doesnt exist.

32. c

$f'(x) = \frac{de^{sin^{-1}x}}{dx}$

$= \frac{de^{sin^{-1}x}}{d(\sin^{-1} x)} \times \frac{d \sin^{-1} x}{dx} = e^{\sin^{-1} x} \frac{1}{\sqrt{1 - x^2}}$

33. c

$y = e^{ax+b}$

$y_1 = ae^{ax+b}$

$y_2 = a^2 e^{ax+b}$

$(y_2)_0 = a^2 e^{0+b} = a^2 e^b$

34. c

$y = \frac{a^2}{(cos^2 x)} + \frac{b^2}{(sin^2 x)}$

$y = a^2 \sec^2 x + b^2 \operatorname{cosec}^2 x$

$\frac{dy}{dx} = a^2 2 \sec x \sec x \tan x - b^2 2 \csc x \csc x \cot x$

$0 = a^2 \frac{\sin x}{\cos^3 x} - b^2 \frac{\cos x}{\sin^3 x}$

$0 = a^2 \sin^4 x - b^2 \cos^4 x$

$\tan^2 x = \frac{b}{a}$

$$\tan x = \frac{\sqrt{b}}{\sqrt{a}}$$

$$\sin x = \frac{\sqrt{b}}{a+b}$$

$$\cos x = \frac{\sqrt{a}}{a+b}$$

$$y = \frac{a^2}{(\frac{\sqrt{a}}{a+b})^2} + \frac{b^2}{(\frac{\sqrt{b}}{a+b})^2} = 2(a+b)^2$$

35. c

$A = \pi r^2$

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

$$\frac{dA}{dt} = 2\pi \times 10 \times 3.5 = 220 \text{sq. cm/s}$$

36. d

$$\int_1^2 \frac{dx}{x+2} = \log_e(x+2)|_1^2 = \log_e 4 - \log_e 3 = \log_e \frac{4}{3}$$

37. b

Since the curve is symmetrical about x-axis:

$$\text{Required Area } (A) = 2\int_0^1 y dx [\because a = 1]$$

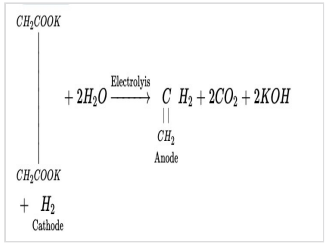
$$= 2\int_0^1 \sqrt{4x} dx$$

$$= 4\left[\frac{x^{3/2}}{3/2}\right]_0^1$$

$$= 4 \cdot \frac{2}{3}\left[x^{3/2}\right]_0^1$$

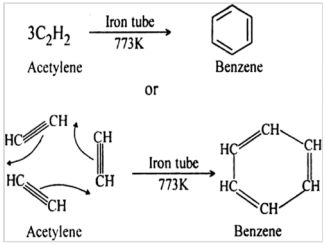
$$= 8/3 \text{ sq. units}$$

38. c



39. a

On polymerisation, it gives us benzene which has 6 carbon atoms



40. d

The contact process is the current method of producing sulfuric acid in the high concentrations needed for industrial processes. Platinum used to be the catalyst for this reaction, however as it is susceptible to reacting with arsenic impurities in the sulfur feedstock, Vanadium (V) oxide (V_2O_5) is now preferred.

$$2\,SO_2\,(g) + O_2(g) \xrightarrow{V_2O_5} 2\,SO_3$$

41. d

There can be maximum of 4 hydrogen bonds in which a water molecule can participate.

42. b

Alkali metals (or their salts) impart colour to Bunsen flame due to their low ionisation energies.

43. a

Copper matte is charged in to Bessemer convertor. Hot air blast is blown to convert Cu_2S to metallic copper.

$$2\,Cu_2S + 3\,O_2 \longrightarrow 2\,Cu_2O + 2\,SO_2$$

$$2\,Cu_2O + Cu_2S \longrightarrow 6\,Cu + SO_2$$

Some Cu_2S is oxidized to Cu_2O. The reaction between Cu_2S and Cu_2O gives metallic copper. The process is auto reduction. The solidified copper obtained has blisters on the surface due to the evolution of SO_2 . It is about 99% pure.

44. b

$Magnetite$: Fe_3O_4

$Hematite$: Fe_2O_3

Siderite : $FeCO_3$

Iron pyrite : FeS_2

45. c

$M^{++} \longrightarrow M^{+4} + 2\,e^-$

46. c

In trivalent state of B (BF3), the number of electrons around the central atom in a molecule will be only six. Such electron deficient molecules tend to accept a pair of electrons to achieve stable electronic configuration and behave as Lewis acids. Boron compounds behave as Lewis acids because of their vacant orbital.

47. a

48. d

Electropositivity increases down the group in a periodic table because of increase in size and decrease in ionisation enthalpy.

49. a

50. b

51. a

52. a

53. c

54. c

55. a

56. a

57. b

58. a

59. b

60. b

61. c

$R = 4H_1 \cot\theta$ ..... (i)

And

$R = 4H_2 \cot(90°–\theta) = 4H_2 \tan\theta$.....$(ii)$

Multiplying (i) and (ii)

$R^2 = 16H_1H_2$

$or, R = 4\sqrt{H_1H_2}$

62. a

$(F - mg)h = mah$

or, $Fh - mgh = mah$

or, $250 = mh(g + a)$

or, $g + a = \dfrac{250}{2} \times 10$

or, $a = 12.5 - 10 = 2.5m/s^2$

63. c

For simple pendulum in SHM,

$$T = 2\pi\sqrt{\frac{l}{g}} - - - - - (i)$$

When both is immersed in liquid, force of body acts on bob constant.

So, effective weight $= Mg - 0$

$V\rho g = V(\dfrac{\rho}{10}g)$

$= \dfrac{9}{10} \times V\rho g = \dfrac{9}{10}Mg$

If this iseffective acceleration due gravity,

$Mg_{eff} = \dfrac{9}{10}Mg = g_{eff} = \dfrac{9}{10}R$

$T = 2\pi\sqrt{\dfrac{l}{g_{eff}}} = 2\pi\sqrt{\dfrac{l}{\frac{9}{10} \times g}}$

From (i) and (ii),

$\dfrac{T}{t} = \sqrt{\dfrac{10}{9}}$

$T_i = \sqrt{\dfrac{10}{9}}T$

Note: when a metallic ball is hanged from a spring is immersed in liquid then potential remains constant

64. d

$F = \sigma \times 2(l + b) = 7 \times 10^{-2} \times 2(0.06 + 0.04) = 0.014N$

65. a

$\bar{C} = \sqrt{3RT/\bar{C}^2}$

or, $M = 3RT/\overline{C}^2 = 3 \times 8.31 \times 300/(1930)^2$

$= 2 \times 10^{-3}kg = 2g$

66. b

$\dfrac{v}{u} = 3$

$v = 30cm$

$u = 10cm$

$$\frac{1}{f} = \frac{1}{10} + \frac{1}{30} = \frac{4}{30}$$

$f = 7.5cm$

67. c

C=$\frac{\epsilon_0 \mathrm{A}}{\mathrm{d}}$=1PF=$10^{-12}$F

$\mathrm{C}' = \frac{\epsilon_\mathrm{r}\epsilon_0 \mathrm{A}}{2\mathrm{d}}$

or,$2 \times 10^{-12} = \frac{\epsilon_\mathrm{r}}{2 \times 10^{-12}}$

or,ϵ_r=4

68. c

The circuit can be redrawn as:

$$\frac{1}{R_{AB}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

69. b

The field at axis of circular coil is given by

$$B = \frac{\mu_0 N i R^2}{2(R^2 + x^2)^{3/2}} = \frac{4\pi \times 10^{-7} \times 500 \times 7 \times 1.5^2}{2(1.5^2 + 1.8^2)^{3/2}} = 3.84 \times 10^{-4} T$$

As 1 gauss = 10^{-4}T so, B = 3.84 gauss

70. d

$$B = \frac{\mu_o}{4\pi} \frac{2\pi I a^2}{(a^2 + x^2)^{\frac{3}{2}}}$$

where,
a=radius
x= distance

As given x>>>>a so, above relation can be written as;

$$B = \frac{\mu_0}{4\pi} \frac{2\pi I a^2}{x^3}$$

so, Bis either proportional to a^2 or $\frac{1}{x^3}$

i.e;b$\propto a^2 \propto \frac{1}{x^3}$(Here,x=r)

71. b

72. a

73. c

$$h = \frac{\triangle E}{\triangle f} = \frac{E_2 - E_1}{f_2 - f_1}$$

74. a

75. c

The domain of function $f(x) = x^2$ is $(-\infty, \infty)$

The domain of function $f^{-1}(x) = \sqrt{x}$ is $[0, \infty)$ Hence the range of f(x) is $[0, \infty)$.

76. a

$A_{3\times3}, A'_{3\times3}$

$B_{3\times2}, B'_{2\times3}$

$C_{3\times1}, C'_{1\times3}$

A^2 has order of 3×3

2B has order of 3×2

Hence, $A^2 + 2B - 2A$ is not defined.

77. a

Equation will have real roots if $b^2 - 4ac \geq 0$

or, $(-k)^2 - 4.1.64 \geq 0$

or, $k^2 \geq 256$

or, $k \in [-16, 16]$

For, next equation, $(-8)^2 - 4.1 \cdot k \geq 0$ or, $64 - 4k \geq 0$
or, $k \leq 16$

or, $k \in [0, 16]$

So, $k = 16$ satisfies both

78. b

$S = \left(1^2 + 1\right) + \left(2^2 + 2\right) + \left(3^2 + 3\right) + \ldots..(n + n)$

$= \left(1^2 + 2^2 + 3^2 + \ldots..n^2\right) + (1 + 2 + 3 + \ldots..n)$

$= \frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}$

$= \frac{n(n+1)}{6}(2n + 1 + 3) = \frac{n(n+1)(n+2)}{3}$

79. b

$\frac{1}{2 \cdot 3} + \frac{1}{4 \cdot 5} + \frac{1}{6 \cdot 7} + \ldots..\ldots\infty$

$= \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{4} - \frac{1}{5}\right) + \left(\frac{1}{6} - \frac{1}{7}\right) + \ldots..\ldots\infty$

$= -\left(-\frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \ldots\right)$

$= -\left\{\log_e(1 + 1) - 1\right\}$

$= 1 - \log_e 2$

80. a

Here, $2\cos A \cos 3A + 1 = 0$

Or, $2\cos A(4\cos^3 A – 3\cos A) + 1 = 0$

Or, $8\cos^4 A – 6cos^2 A + 1 = 0$

Or, $(4\cos^2 A - 1)(2\cos^2 A – 1) = 0$

Either, $4\cos^2 A – 1 = 0$ or, $\cos^2 A = (\frac{1}{2})^2 \rightarrow A = n\pi \pm \frac{\pi}{3}$

81. c

82. b

$\left(\vec{a} \times \vec{b}\right) \cdot \vec{c}$

$= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -2 & 1 & -3 \\ 1 & -2 & -1 \end{vmatrix} . \left(\vec{i} + \vec{j} + \vec{k}\right)$

$(-7\vec{i} - 5\vec{j} + 3\vec{k}) \cdot (\vec{i} + \vec{j} + \vec{k})$

$-7 - 5 + 3 = -9$

83. b

$m_1 = 5m_2$

$m_1 + m_2 = 5m_2 + m_2 = 6m_2 = -\frac{2h}{b} \rightarrow m_2 = -\frac{h}{3b}$

$m_1 m_2 = 5m_2^2 = \frac{a}{b}$

$5(-\frac{h}{3b})^2 = \frac{a}{b}$

$5h^2 = 9ab$

84. a

85. a

86. b

Dr's of OP = $(a – 0), (a – 0), (a - 0) = a, a, a$

So equation of plane passing through (a, a, a) and $\perp^r$ to OP is

$a(x – a) + a(y – a) + a(z – a) = 0$

or, $ax – a^2 + ay – a^2 + az – a^2 = 0$

or, $x + y + z = \frac{3a^2}{a} = 3a$

The intercepts are $3a, 3a, 3a$

Hence the sum is $9a$

87. d

$\lim_{x \to \infty} (\frac{x - 4}{x + 5})^{2x}$

$\lim_{x \to \infty} \frac{(1 - \frac{4}{x})^{2x}}{(1 + \frac{5}{x})^{2x}}$

$\frac{e^{-8}}{e^{10}}$

e^{-18}

88. a

Putting $= \sin A$

$= \frac{d}{dx}\left(\sec^{-1}\frac{1}{\sqrt{1-\sin^2 A}}\right)$

$= \frac{d}{dx}\left(\sec^{-1}\frac{1}{\cos A}\right)$

$= \frac{d}{dx}\sec^{-1}\sec A = \frac{dA}{dx}$

$\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}$

89. b

It is form of $\int_a^b \frac{f(x)}{f(x)+f(a+b-x)}\,dx = \frac{b-a}{2}$

$So, \frac{b-a}{2} = \frac{\left(\frac{\pi}{2}\right)-0}{2} = \frac{\pi}{4}$

90. b

91. a

$2\,\mathrm{NaCl} + 4\,\mathrm{HNO_3} \longrightarrow 2\,\mathrm{NaNO_3} + \mathrm{Cl_2} + 2\,\mathrm{NO_2} + 2\,\mathrm{H_2O}$

92. a

The process of hardening the surface of wrought iron by depositing a surface layer of steel on it is called case-hardening. It is done by heating wrought iron in contact with potassium ferrocyanide. Alternatively, case hardening can also be done by heating wrought iron with charcoal and then plunging it a suitable oil.

93. b

$x = \frac{2 \times V.D.}{E + 35.5}$

$= \frac{2 \times 59.25}{4 + 35.5}$

$= 3$

94. b

$\mathrm{Normality} = \mathrm{Molarity} \times 2$

For $\mathrm{Ca(OH)_2}$

i.e. $0.2 = \mathrm{molarity}\ \times 2$

$\mathrm{Molarity} = 0.1\,\mathrm{M}$

Now,

$\mathrm{M} = \frac{\text{no. of moles}}{\text{volume in ltr}}$

$$0.1 = \frac{\frac{m}{74}}{\frac{200}{1000}}$$

100. d

or, $m = 1.48$ gm

So, $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

Hence, $1.48\,\text{gm}\ Ca(OH)_2$ gives $\frac{100}{74} \times 1.48 =$
$4\,\text{gm of}\ CaCO_3$

95. d
$Ca(OH)_2 \rightleftharpoons Ca^{++} + 2\,OH^-$

$K_{sp} = s(2s)^2 = 4s^3 = 4(\sqrt{3})^2 = 12\sqrt{3}$

96. c
$\frac{w_1}{E_1} = \frac{w_2}{E_2}$

$w_2 = w_1 \times \frac{E_2}{E_1}$

$w_2 = 0.504 \times \frac{8}{1} = 4.5$

97. c

98. b

99. a