www.clamphook.com

clamphook

Set C

Clamphook CBT

2080

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

1. The force acting on a conductor of length L carrying a current I placed in magnetic field B is given by $F = BIL\sin\theta$. The dimensional formula of B is:

a. $[MLT^{-2}A^{-1}]$ b. $[MT^{-2}A^{-1}]$

c. $[ML^2T^{-2}A^{-1}]$ d. $[LT^{-2}A^{-1}]$

2. If the normal force is doubled the co-efficient of friction is [IOE 2075]

a. doubled b. halved

c. remains same d. four times

3. Time taken by a radio wave to go and come back from a communication satellite to earth is nearly

a. 1/3 s b. 1/4 s

c. 1/2 s d. 1 s

4. Radius of Gyration of an uniform rod about an axis through its middle is

a. $\frac{L}{3^{1/2}}$ b. $\frac{L}{8^{1/2}}$

c. $\frac{L}{12^{1/2}}$ d. $\frac{L}{2^{1/2}}$

5. If the work done in blowing a soap bubble of volume V is W, then the work done in blowing a soap bubble of volume $2V$ is

a. W b. $\sqrt{2}W$

c. $2W$ d. $4^{1/3}W$

6. A constant volume gas thermometer using helium records 20kPa at triple point of water (273.16 k) and 14.3 kPa at temperature of dry ice then the temperature of dry ice is:

a. 195.3 K b. 382 k

c. $0.11^{\circ}C$ d. $0.014^{\circ}C$

7. Two rods A and B of different materials are welded together as shown in the figure . If their thermal conductivities are K_1 and K_2, the thermal conductivities of the composite rod will be

a. $2\,(K_1 + K_2)$ b. $\frac{3}{2}\,(K_1 + K_2)$

c. $K_1 + K_2$ d. $\frac{K_1 + K_2}{2}$

8. A mirror is inclined at an angle θ with the horizontal . If a ray of light is horizontally incident at angle of incidence θ ,the reflected ray make an angle with the horizontal

a. θ b. $90 + \theta$

c. $180 + \theta$ d. 90

9. The cover of a book appears red when seen through a piece of red glass, then the cover may be of :

a. red colour b. white colour

c. green colour d. red or white .

10. The capacitance of a capacitor is independent of

a. quality of plates. b. size of plates .

c. distance between the plate . d. medium between plates .

11. A thermo emf. Of a thermo couple is $50\mu \frac{V}{K}$ at room temperature. A Galvano meter of resistance 50Ω and capable of detecting a current of order of 2μ A is used. The smallest temperature difference that can be detected with this Galvano meter.

a. 2 K b. 5 K

c. 10 K d. 15 K

12. A long wire carries a current of 0.5 A. The flux density at a distance of 0.01 m is

a. 2×10^{-5} b. 5×10^{-5}

c. 10^{-5} d. 10^{-7}

13. Power dissipated in pure inductor inductance 'L' when current 'i' passes through it is

a. 0 b. Li^2

c. $\frac{1}{2}Li^2$ d. $\frac{1}{4}Li^2$

14. Young's double slit experiment is made in a liquid . The 10^{th} bright fringe in liquid lies where 6^{th} dark fringe lies in vacuum . The refractive index of the liquid is approximately [BP 2009]

a. 1.8 b. 1.54

c. 1.67 d. 1.2

15. The tension of a piano wire is 16 kg wt . The change in tension needed to produce a new tone one octave lower is :

a. 4 kg wt b. 8 kg wt

c. 12 kg wt d. 32 kg wt

16. Power of ionization of a gamma particle is

a. More than that of alpha particle b. More than of a beta particle

c. Less than those of alpha beta particle and more than those of beat particle . d. Less than both alpha & beta particle

17. The packing fraction for ${}_7N^{14}$ isotope, whose mass is 14.003 amu is

a. 3×10^{-3} b. 1.00002

c. 2.1×10^4 d. 0.9

18. Let A be the set of n distinct numbers elements. Then the total number of distinct functions from A to A is

a. n^2
b. n^n
c. 2^n
d. None

19. If $A = \begin{bmatrix} 5 & 1 \\ 3 & 2 \end{bmatrix}$ then A^{-1} [IOE 2077]

a. $\frac{1}{7}\begin{bmatrix} 2 & -1 \\ -3 & -5 \end{bmatrix}$
b. $\frac{1}{7}\begin{bmatrix} 2 & -1 \\ 3 & -5 \end{bmatrix}$
c. $\frac{1}{7}\begin{bmatrix} 2 & -1 \\ -3 & 5 \end{bmatrix}$
d. $\frac{1}{7}\begin{bmatrix} -2 & 1 \\ 3 & -5 \end{bmatrix}$

20. $|z_1 + z_2| = |z_1| + |z_2|$ is possible if

a. $z_2 = \bar{z_1}$
b. $z_1 z_2 = 1$
c. $arg(z_1) = arg(z_2)$
d. $|z_1| = |z_2|$

21. In how many ways can 4 envelopes can be dropped into 5 letter boxes?

a. 20
b. 9
c. 5^4
d. 4^5

22. If $\sin^2 x - 2\cos x + \frac{1}{4} = 0$, then x is

a. $2n\pi \pm \frac{\pi}{3}$
b. $2n\pi \pm \frac{\pi}{4}$
c. $2n\pi \pm \frac{\pi}{6}$
d. $2n\pi \pm \frac{\pi}{2}$

23. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}(x)$, then x is equal to:

a. $\frac{a-b}{1+ab}$
b. $\frac{b}{1-ab}$
c. $\frac{b}{1+ab}$
d. $\frac{a+b}{1-ab}$

24. In any triangle ΔABC , the value of $a\cot A + b\cot B + c\cot C$ is :

a. $R + r$
b. $2R + r$
c. $R + 2r$
d. $2(R + r)$

25. If $\vec{a} = 2\vec{i} + 2\vec{j} + \vec{k}$and $\vec{b} = 5\vec{i} - 3\vec{j} + \vec{k}$, the projection of $\vec{a}$ upon $\vec{b}$ is [IOE 2075]

a. $\frac{5}{\sqrt{35}}$
b. $\frac{5}{3}$
c. $\frac{\sqrt{35}}{5}$
d. $\frac{3}{5}$

26. If sum of slopes of the lines gives by $x^2 - 2cxy - 7y^2 = 0$ is four times their product then 'c' has [IOE 2077]

a. 1
b. -1
c. -2
d. 2

27. The parametric equations of the circle $x^2 + y^2 + 2x - 4y + 4 = 0$ are

a. $x = -1 + \cos\theta, y = 2 + \sin\theta$
b. $x = -1 - \cos\theta, y = 2 + \sin\theta$

c. $x = 1 + \cos\theta, y = 2 - \sin\theta$ d. $x = 1 + \cos\theta, y = 2 + \sin\theta$

28. The equation of pair of tangents drawn from the point $(3, 5)$ to the parabola $y^2 = 8x$ is :

a. $16x^2 - 40xy + 24y^2 - 104x - 120y + 144 = 0$
b. $16x^2 + 40xy + 24y^2 + 104x - 120y + 144 = 0$
c. $16x^2 - 40xy + 24y^2 + 104x - 120y + 144 = 0$
d. $16x^2 - 40xy + 24y^2 + 104x + 120y + 144 = 0$

29. If the line $lx + my + n = 0$ is a tangent to the ellipse $b^2x^2 + a^2y^2 = a^2b^2$ then

a. $n^2 = a^2l^2 - b^2m^2$
b. $n^2 = a^2l^2 + b^2m^2$
c. $n^2 = b^2l^2 + a^2m^2$
d. $n^2 = b^2l^2 - a^2m^2$

30. The set of value of λ for which the three planes $\lambda x + 3y - z - 2 = 0, 3x + 3y + z - 4 = 0$ and $x - y + \lambda z - 5 = 0$ intersect in a unique point is

a. R
b. ϕ
c. Q
d. $R - \{0\}$

31. $\lim_{x \to 1} \frac{\sin(x^2 - 1)}{(x - 1)}$ [IOE 2075]

a. 0
b. 1
c. -1
d. 2

32. If $y = \sqrt{\tan x + \sqrt{\tan x + \sqrt{\tan x + \ldots + \infty}}}$, then $\frac{dy}{dx} =$

a. $\frac{\tan^2 x}{(2y - 1)}$
b. $\frac{\cot^2 x}{(2y - 1)}$
c. $\frac{\cos^2 x}{(2y - 1)}$
d. $\frac{\sec^2 x}{(2y - 1)}$

33. If $y = |\cos x| + |\sin x|$ then $\frac{dy}{dx}$ at $x = \frac{2\pi}{3}$ is:

a. $\frac{\sqrt{3} - 1}{4}$
b. $\frac{\sqrt{3} + 1}{2}$
c. $\frac{\sqrt{3} - 1}{2}$
d. $\frac{\sqrt{3} + 1}{4}$

34. The slope of the tangent to the curve $y = 16 - x^2$ at $x = 0$

a. 2
b. -2
c. 16
d. 0

35. What is the maximum value of $(\frac{1}{x})^x$?

a. $e^{1/e}$
b. $(\frac{1}{e})^e$
c. e^{-e}
d. None

36. $\int \frac{\cos x + \sin x}{\cos x - \sin x} dx =$ [IOE 2077]

a. $\log(\cos x + \sin x) + c$
b. $-\log(\cos x + \sin x) + c$
c. $\log(\cos x - \sin x) + c$
d. $-\log(\cos x - \sin x) + c$

37. The area bounded by the curve $y = \ln x$, the x-axis and the straight line $x = e$ is:

a. e b. e^2

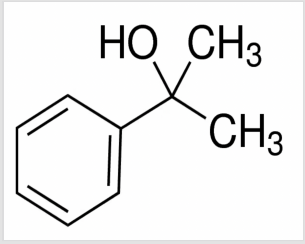
c. $1 - e$ d. 1

38. Methanal and ethanal can be distinguished by [IOE 2078]

a. $KMnO_4$ b. $K_2Cr_2O_7$

c. $AgNO_3$ d. Iodoform test

39. The IUPAC name of



a. 2 - phenyl-1-propanal b. 2 - phenyl-2-propanal

c. 1 - propoaldehyde phenol d. 1 - Aldehyde 2 - methyl phenol

40. Gold dissolves in aqua regia forming

a. Auric chloride b. Aurous chloride

c. Chloroauric acid d. Aurous nitrate

41. Heavy water is

a. D_2O b. H_2O

c. T_2O d. H_2 and CO

42. Which of the following has the highest melting point

a. Na b. K

c. Li d. Rb

43. Substance soluble in ammonia is

a. $As(OH)_3$ b. $Fe(OH)_3$

c. $Cr(OH)_3$ d. $Cu(OH)_2$

44. Pig iron is also called

a. Wrought iron b. Steel

c. Cast iron d. Wrought iron

45. When SO_2 is passed through potassium iodate then the oxidation number of iodine change from

a. +5 to 0 b. +7 to -1

c. -5 to 0 d. +7 to 0

46. Reduction never involves

a. gain of electrons by its atoms b. loss of electrons by its atoms

c. decrease in oxidation number d. decrease in the valency of electropositive components

47. $n = 4$ and $l = 1$ is represented by which of the following? [IOE 2077]

a. 4s b. 4p

c. 4d d. 5f

48. Which of the following does not belong to Cu group? [IOE 2077]

a. Hg b. Ag

c. Au d. All belong to Cu group

49. ..... of them had seen it before.

a. Neither
b. those
c. such
d. this

50. A number of examples..... cited.

a. were
b. has been
c. was
d. is

51. They are playing _____ the ground. [2077]

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

52. The sentence structure of ‚Äòl am doing my homework ‚Äò, is [IOE 2076]

a. S + V + O + C
b. S + V + IO + DO
c. S + V + O + Adverbial
d. none

53. He _____ his office while his wife _____the foo(d)

a. did, cooked
b. has done, cooked
c. was doing, cooked
d. was doing, was cooking

54. They had to meet her.

a. she have to be met by them.
b. she has to be met by them.
c. she had to be meet by them
d. she had to be met by them

55. How many syllables does the word “mountain” have?

a. One
b. Two
c. Three
d. Four

56. Although I like to go camping, I haven’t had the time to go lately, and I haven’t found anyone to go with.

a. Simple Sentence
b. Compound Sentence
c. Complex Sentence
d. Compound-Complex Sentence

57. Can I borrow your book when you _____ it . [2078]

a. read
b. finish
c. will have finished
d. have read

58. The antonym of the word ‘novice’ is [IOE 2074]

a. recruit
b. apprentice
c. veteran
d. amateur

59. We all insisted that she .....the meeting.

a. attend
b. attends
c. attended
d. would attend

60. Synonym of germinate is

a. sprout
b. decay
c. produce
d. breed

61. A car starts from rest and moves with constant acceleration. The ratio of distance covered in nth second to that covered in n second is:

a. $\frac{2}{n^2}-\frac{1}{n}$
b. $\frac{1}{n}+\frac{2}{n^2}$
c. $\frac{2}{n}-\frac{1}{n^2}$
d. $\frac{2}{n}+\frac{1}{n^2}$

62. An electric fan has blades of length 30 cm as measured from the axis of rotation. If the fan is rotating at 1200 r.p.m. The acceleration of a point on the tip of the blade is about

a. 1600 m/s^2
b. 4740 m/s^2
c. 2370 m/s^2
d. 5055 m/s^2

63. A wire of lengths l elongates by x for a force F applied on it. The elongation developed on wire of same materials having length 2l, radius double by force 2F is:

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

64. A rectangular plate of dimensions $6cm \times 4cm$ and thickness $2mm$ is placed with its largest face flat on the surface of the water. The downward force on the plate due to surface (surface tension of water $= 7 \times 10^{-2} Nm^{-1}$) [IOE 2077]

a. $5.88 \times 10^{-3} N$
b. $8.68 \times 10^{-3} N$
c. $1.4 \times 10^{-2} N$
d. $0.7 \times 10^{-2} N$

65. A ball is pumped upto 4atm at $290^o C$ and it suddenly bursts then the new temperature is : [IOE 2077]

a. 188 K
b. 179 K
c. 379 K
d. 269 K

66. A ray of light is travelling from one medium to another . The wavelength of the light at former and later medium is 4000 and 6000 respectively . Then the value of critical angle is [IE – 03]

a. 30°
b. 45°
c. 60°
d. $\sin^{-1}\frac{2}{3}$

67. Two charges of 4μC each are placed at corners A and B of equilateral triangle ABC of side 0.1 in air. The electric potential at C is [IOE 2074]

a. 9×10^4 V
b. 18×10^4 V
c. 36×10^4 V
d. 72×10^4 V

68. A 10 m long potentiometer wire with resistance 2 Ω/m is connected in series with battery of emf 3 V and 10 Ω Resistance . The potential gradient across potentiometer wire is [IOE 2076]

a. 0.1 V/m
b. 0.2 V/m
c. 1 V/m
d. 2 V/m

69. A metallic wire is folded to form a square loop of side a. It carries a current i and is kept perpendicular to a uniform magnetic field. If the shape of the loop is changed from square to a circle without changing the length of the wire and current, the amount of work done in doing so is

a. $iBa^2(\pi + 2)$
b. $iBa^2(\pi - 2)$
c. $iBa^2(\frac{4}{(\pi - 1)}$
d. $iBa^2(1 - \frac{4}{\pi})$

70. An alternating potential $V = V_o \sin \omega t$ is applied across a circuit. As a result, the current $I = I_o sin(\omega t – \pi/2)$ flows in it. The power consumed in the circuit per cycle is:

a. zero
b. $0.5 V_0 I_0$

c. $0.707V_0I_0$ d. $1.414V_0I_0$

71. Ratio of frequency in fundamental mode of open pipe to the first harmonic of closed pipe: [IOE 2078]

a. 3:5 b. 4:3

c. 1:2 d. 2:1

72. A train moves toward a stationary observer with the speed of 34 m/sec. The train sounds a whistle and its frequency registered by the observer is f_1. If the train speed is reduced to 17 m/sec, the frequency of registered is f_2. If the speed of sound is 340 m/sec then the ratio $\frac{f_1}{f_2}$ is:

a. $\frac{18}{19}$ b. $\frac{1}{2}$

c. 2 d. $\frac{19}{18}$

73. The change in wavelength of light from 4000 Å to 3600 Å, the change in stopping potential will be:

a. +0.35 volt b.
- 0.35 volt

c.
- 0.4 volt d.
-
0. 4 volt

74. The number of revolution made by an electron of H – atom in fourth Bohr's orbit in 3 seconds is [IOE 2075]

a. 3.06×10^{12} b. 3.06×10^{13}

c. 3.06×10^{14} d. 3.06×10^{15}

75. If $f(x) = 3x + 1, fof(x) = ?$ [IOE 2078]

a. $9x + 4$ b. $3x^2 + 1$

c. $(3x + 1)^2$ d. $27x^3 + 9x^2 + 9x + 1$

76. If $A = \begin{bmatrix} a & b \\ 0 & a \end{bmatrix}$, I is the unit matrix of order 2 and a, b are arbitrary constants, then $(aI + bA)^2$ is equal to

a. $a^2I + abA$ b. $a^2I + 2abA$

c. $a^2I + b^2A$ d. None of these

77. If $z = x + iy, |z - zi| = 1$, then

a. z lies on circle b. z lies on x -axis

c. z lies on y-axis d. none

78. A man has 10 shirts and 8 ties. The number of different outfits he can wear are [IOE 2077]

a. ${}^{10}P_5$ b. ${}^{10}C_5$

c. $10! \times 8!$ d. 80

79. $\sum_{n=0}^{\infty} \frac{n^2 + 1}{n!}$ [IOE 2076]

a. e b. $2e$

c. $3e$ d. $4e$

80. Minimum value of $\sin x - \cos x$ is [IOE 2078]

a. 1 b. 0

c. $\sqrt{2}$ d. $-\sqrt{2}$

81. If sides of a triangle a, b, c are in A.P., the cosec A, Cosec B and cosec C are in [IOE 2074]

a. AP b. GP

c. HP d. None

82. If $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$ [IOE 2077]

a. 120° b. 30°

c. 90° d. 0°

83. The point of intersection of lines $2x^2-xy-y^2+5x+y+2=0$ are: [IOE 2077]

a. (1,-3) b. (4,-5)

c. (-1,1) d. (7,3)

84. The equation of the tangent to circle $x^2+y^2=5$ which is perpendicular to the line $x+2y+5=0$ [IOE 2076]

a. $x-2y+5=0$ b. $2x+y+5=0$

c. $2x-y+5=0$ d. $2x-y-5=0$

85. The equation of directrix of $2x^2+8x+8y-1=0$ is [IOE 2076]

a. 9y – 17 = 0 b. 9y + 17 = 0

c. 8y – 17 = 0 d. 8y + 17 = 0

86. The line joining the points (-1,5,8) and (5,7,2) is divided by the plane z = 4 in the ratio : [IOE 2078]

a. 1:2 b. 2:1

c. 1:3 d. 3:1

87. $\lim_{x\to 0}\frac{(e^{x^2}-\cos x)}{x^2}$ [IOE 2078]

a. 1 b. 0

c. 1.5 d. Doesnt exist

88. Evaluate $\frac{d}{dx}(\frac{1}{a-bx})$ [IOE 2078]

a. $\log(a-bx)$ b. $b\log(a-bx)$

c. $\frac{b}{(a-bx)^2}$ d. $-\frac{b}{(a-bx)^2}$

89. If $f(x)=e^{\tan x}$ then $\int_0^{\frac{\pi}{4}}\log f(x)dx$ [IOE 2078]

a. $\ln 2$ b. $\ln\sqrt{2}$

c. $\ln 4$ d. $-\ln\sqrt{2}$

90. The property by which an substance has the same molecular formula but different structure is

a. isomorphism b. polymorphism

c. isomerism d. allotropism

91. What is formed when oxalic acid is dehydrated by conc.H_2SO_4?

a. $C+CO_2$ b. CO

c. CO_2 d. $CO+CO_2$

92. Hydrated alumina is converted to anhydrous form by

a. Roasting
b. Calcinations
c. Smelting
d. Leaching

93. Which one of the following pairs of compounds illustrate the law of multiple proportions?

a. H_2S and SO_2
b. NH_3 and NCl_3
c. $FeCl_2$ and $FeCl_3$
d. CuO and Cu_2O

94. $100\,ml$ of $0.3\,N$ HCl was mixed with $200\,ml$ of $0.6\,N$ H_2SO_4. The normality of resulting mixture was

a. 0.5
b. 1.0
c. 1.5
d. 2.0

95. A solution was prepared by dissolving 0.0005 mole of Ba(OH)2 in 100ml of gthe solution if the base is assumed to ionize completely, the pOH of the solution will be

a. 12
b. 10
c. 1
d. 2

96. Silver is deposited on a metallic vessel of surface area $800cm^2$ by passing a current of 0.2 Amp for 3 hours. The thickness of silver deposited is (density of silver =10.47 g/cc)

a. 2.88×10^{-4} cm
b. 1.22×10^{-3} cm
c. 2.88 cm
d. 4.16×10^{-3} cm

Read the following passage carefully, and find out the correct answers for the questions given below.

(Questions from 97 to 100)

Mikhail Gorbachev's ouster, though dramatic in every respect, is on no account a surprise. Both his foes and his closest friends have been warning of it with a heightening sense of urgency for the past several months. Its consequences, however, are wholly unpredictable. The USSR could well witness protracted violence should the reformists and those republics which have sought varying degrees of sovereignty for themselves choose to defy the central authority. It is possible that the country after an initial period of uncertainty and perhaps even violence could revert to the pre-perestroika system. Equally uncertain is the course of East-West relations. These are bound to deteriorate though the extent of deterioration must remain a matter of conjecture. Hailed abroad as a leader who had dared to free Soviet citizens from fear, enabled the countries of Eastern Europe to become democracies even as they regained their full sovereign status, paved the way for the reunification of Germany and exposed the moribund and totalitarian character of communism, he appeared at home to come under fire from all sides.

97. The removal of Mikhail Gorbachev from power is

a. dramatic but expected.
b. uncalled for and unexpected.
c. strange and cruel.
d. good for the country.

98. During Gorbachev's reign, the Soviet people were

a. not free to express.
b. afraid to speak against the government.
c. committed to communism.
d. not secure.

99. The relations between the Soviet Union and the Western countries

a. are likely to remain unaffected.
b. will definitely get worse.
c. may improve considerably.
d. will improve but slowly.

100. The post-Gorbachev era may witness

a. a more open economy.
b. reversal of perestroika.
c. greater role for economic reform.
d. weak and fragile economy.

Answer Key

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

Solutions

1. b

$F = BIL\sin\theta$

$[F] = [BIL]$

$[MLT^{-2}] = [B][AL]$

$[B] = [MT^{-2}A^{-1}]$

2. c

The coefficient of friction is a property of the two surfaces in contact. If we double the normal force, we double the amount of friction, but the coefficient of friction is the same, since the nature of the two surfaces in contact has not changed.

3. b

$$2s = ct \rightarrow t = \frac{2s}{c} = \frac{2 \times 36500 \times 10^3}{3 \times 10^8} \approx \frac{1}{4}s$$

4. c

Moment of inertia of uniform rod about its axis through middle

$$I = \frac{mL^2}{12} - - - - - - - - (i)$$
$$Also, I = mk^2 - - - - - - - - - - - (ii)$$
$$From'(i)\ and\ (ii),$$
$$k = \sqrt{\frac{I}{m}} = \sqrt{\frac{mL^2}{12m}} = \frac{L}{(12)^{1/2}}$$

5. d

$$V \propto R^3$$
$$R \propto V^{1/3}$$
$$W \propto R^2 = W \propto V^{2/3}$$
so, $$\frac{W_1}{W_2} = \left(\frac{V_1}{V_2}\right)^{2/3} = \frac{1}{2^{2/3}} = \frac{1}{4^{1/3}}$$
$$W_2 = 4^{1/3}W_1$$

6. a

$$\frac{T}{T_{TP}} = \frac{P}{P_{TP}}$$

$$T = 14.3\frac{273.16}{20}$$

or, $T = 195.3K$

7. d

If the ends of rods are maintained at temperature θ_1 and θ_2 the rate of flows of heat through each rod is given by

$$\frac{Q_1}{t} = \frac{K_1 A\,(\theta_1 - \theta_2)}{d} \text{ and } \frac{Q_2}{t} = \frac{k_2 A\,(\theta_1 - \theta_2)}{d}$$

The cross sectional area of the composite rod is $2A$. For the composite rod,

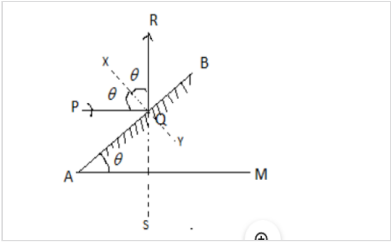
$$\frac{Q}{t} = \frac{K(2(a)\,(\theta_1 - \theta_2)}{d}$$

Also, $$\frac{Q}{t} = \frac{Q_1}{t} + \frac{Q_2}{t}$$

or, $K \times 2A = K_1 A + K_2 A$

$$K = \frac{K_1 + K_2}{2}$$

8. d



9. d

Red glass allows only red light to pass . SO, if the cover is red/white}.

10. a

: As , $C = \frac{\epsilon_o A}{d}$

11. a

Let θ be the smallest temperature difference that can be measured. Corresponding thermo emf in a thermo couple is:

$$E = 50\mu V \times \theta = 50 \times \theta \times 10^{-6} V$$

Smallest p.d. across the galvanometer = I R

$= \left(2 \times 10^{-6}\right) \times 50V$

$\left(2 \times 10^{-6}\right) \times 50V = 50 \times \theta \times 10^{-6}V$
$\theta = 2K$

12. c

For straight current carrying conductor of infinite length

$B = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 0.5}{2\pi \times 0.01} = 10^{-5}$ tesla

13. a

$P = I_{rms} E_{rms} \cos\phi$

Since φ = π/2

cos π/2 = 0

P = $I_{rms} E_{rms} \times 0 = 0$

14. a

$\beta = \frac{\lambda D}{d}$ and $\beta = \frac{\beta}{\mu}$

For the 6^{th} dark fringe, $x = \frac{2n-1}{2}\beta$
For, the 10^{th} bright fringe, x= n $\beta' = 5.5\beta$

$\text{or, } \frac{10\beta}{\mu} = 5.5\beta$

$\mu = \frac{10}{5.5} = 1.8$

15. c

16. d

Order of ionization = α > β> γ

17. b

18. b

Remember : the number of function from A to A is n^n

19. c

20. c

$|z_1 + z_2| = |z_1| + |z_2|, \iff \arg z_1 = \arg z_2$

21. c

22. a

$\sin^2 x - 2\cos x + \frac{1}{4} = 0$

$1 - \cos^2 x - 2\cos x + \frac{1}{4} = 0$

$\cos^2 x + 2\cos x = \frac{5}{4}$

$4\cos^2 x + 8\cos x - 5 = 0$

$4\cos^2 x + 10\cos x - 2\cos x - 5 = 0$

$(2\cos x + 5)(2\cos x - 1) = 0$

$(2\cos x + 5) \neq 0$

$(2\cos x - 1) = 0$

$\cos x = \frac{1}{2}$

$x = 2n\pi \pm \frac{\pi}{3}$

23. d

$\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}(x)$

Let $a = \tan A, b = \tan B$

$\sin^{-1}\left(\frac{2\tan A}{1+\tan^2 A}\right) + \sin^{-1}\left(\frac{2\tan B}{1+\tan^2 B}\right) = 2\tan^{-1}(x)$

$\sin^{-1}(\sin 2A) + \sin^{-1}(\sin 2B) = 2\tan^{-1}(x)$

$2A + 2B = 2\tan^{-1} x$

$x = tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{a+b}{1-ab}$

24. d

$a\cot A + b\cot B + c\cot C$

$a\frac{\cos A}{\sin A} + b\frac{\cos B}{\sin B} + c\frac{\cos C}{\sin C}$

We know:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$

$= 2R\cos A + 2R\cos B + 2R\cos C$

$= 2R(\cos A + \cos B + \cos C)$

$= 2R(1 + 4\sin(\frac{A}{2})\sin(\frac{B}{2})\sin(\frac{C}{2}))$

$= 2R(1 + \frac{r}{R})$

$= 2(R + r)$

25. b

Projection of $\vec{b}$ upon $\vec{a}$ is = $\vec{b} \cdot \frac{\vec{a}}{|\vec{a}|} = \frac{5}{3}$

26. d

$a = 1, h = -c \; and \; b = -7$
$Here, m_1 + m_2 = 4m_1m_2$
$or, -\frac{2h}{b} = 4 \times \frac{a}{b}$
$or, -\frac{2c}{7} = -\frac{4}{7}$
$\therefore c = 2$

27. a

$\mathrm{x}^2+\mathrm{y}^2+2\mathrm{x}-4y+4=0$

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

$(x+1)^2+(y-2)^2=1^2$

$x+1=\cos\theta$

$y-2=\sin\theta$

$x=-1+\cos\theta,\mathrm{y}=2+\sin\theta$

28. c

$T^2=SS_1$

$(yy_1-2a(x+x_1))^2=(y^2-8x)(y_1^2-8x_1)$

$(5y-4x-12)^2=(y^2-8x)(5^2-8\times3)$

$25y^2+16x^2-40xy-120y+96x+144=y^2-8x$

$16x^2+24y^2-40xy-120y+104x+144=0$

29. b

$\mathrm{b}^2\mathrm{x}^2+\mathrm{a}^2\mathrm{y}^2=\mathrm{a}^2\mathrm{b}^2$

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

$lx+my+n=0\rightarrow y=-\frac{l}{m}x-\frac{n}{m}$ is a tangent to the ellipse.

$c^2=a^2m^2+b^2$

$(\frac{n}{m})^2=a^2(-\frac{l}{m})^2+b^2$

$n^2=a^2l^2+b^2m^2$

30. b

Using the condition for 3 planes to have a unique common point we have,

$$\begin{vmatrix}\lambda & 3 & -1\\ 3 & 3 & 1\\ 1 & -1 & \lambda\end{vmatrix}\neq0$$

$\Rightarrow3\lambda^2-8\lambda+9\neq0$

Discriminant of the quadratic is <0

$\Rightarrow3\lambda^2-8\lambda+9$ will never vanish for any real λ.

31. d

$\lim\limits_{x\to1}\frac{\sin\left(x^2-1\right)}{(x-1)}$

($\frac{0}{0}$ form, apply L'Hospital rule)

$$= \lim_{x \to 1} \frac{\cos(x^2 - 1) \times 2x}{1}$$

$$= 2 \times 1 \times \cos 0$$

$$= 2$$

32. d

$y = \sqrt{\tan x + y}$

Squaring, $y^2 = \tan x + y$

$$2y \cdot \frac{dy}{dx} = \sec^2 x + \frac{dy}{dx}$$

$$\frac{dy}{dx} = \frac{\sec^2 x}{(2y - 1)}$$

33. c

Around $x = \frac{2\pi}{3}$

$|\cos x| = -\cos x$ and $|\sin x| = \sin x$

ie. $y = -\cos x + \sin x$

$$\frac{dy}{dx} = \sin x + \cos x$$

when $x = \frac{2\pi}{3}$: $\frac{dy}{dx} = \sin \frac{2\pi}{3} + \cos \frac{2\pi}{3}$

$$= \frac{\sqrt{3}}{2} - \frac{1}{2} = \frac{\sqrt{3} - 1}{2}$$

34. d

$y = 16 - x^2$

$$\frac{dy}{dx} = -2x$$

$$\frac{dy}{dx} = -2 \times 0 = 0$$

35. a

$y = (\frac{1}{x})^x$

$$\log y = x \log(\frac{1}{x})$$

$$\frac{1}{y}\frac{dy}{dx} = \log(\frac{1}{x}) + x\frac{1}{\frac{1}{x}}(-\frac{1}{x^2})$$

$$\frac{1}{y}\frac{dy}{dx} = \log(\frac{1}{x}) - 1$$

$$\frac{1}{x} = e$$

$$x = \frac{1}{e}$$

$y = (\frac{1}{\frac{1}{e}})^{\frac{1}{e}}$

$y = e^{1/e}$

36. d

Put $y = \cos x - \sin x$
$dy = (-\sin x - \cos x)dx$
$i.e. (\cos x + \sin x)dx = -dy$
$So, \int \frac{-dy}{y} = -\log y + c = -\log(\cos x - \sin x) + c$

37. d

$\ln x = 0 \Rightarrow x = 1$

$\therefore$ Area $(A) = \int_1^e y dx = \int_1^e \ln x dx$
$= [x \ln x - x]_1^e$
$= (e \ln e - e) - (0 - 1)$
$= e.1 - e + 1 = 1$

38. d

When ethanal is heated with iodine and NaOH solution, it gives yellow crystalline precipitate of iodoform while methanal does not give this test.

39. b

40. c

by dissolving gold in aqua regia(a mixture of concentrated nitric and hydrochloric acid) followed by careful evaporation of the solution chloroauric acid forms.

$\mathrm{Au + HNO_3 + 4\,HCl \longrightarrow HAuCl_4 + NO + 2\,H_2O}$

41. a

Heavy water is $\mathrm{D_2O}$.

42. c

All alkali metals are soft and they can be easily cut through a knife except Li. Li is hard due to its anamolous behaviour. This is due to its exceptional smaller size and higher polarising power. Since, Li is harder than Na, K and Rb it has the higher boiling and melting point.

43. d

$\mathrm{Cu(OH)_2 + 4\,NH_4OH \longrightarrow [Cu(NH_3)_4](OH)_2 + 4\,H_2O}$

44. c

Percentage of carbon is same in cast iron and pig Iron and consists of 2 % carbon.

45. a

$\mathrm{SO_2 + H_2O + \overset{+5}{K}IO_3 \longrightarrow H_2SO_4 + \overset{0}{I_2} + K_2SO_4}$

Thus, we can see that oxidation state of iodine changes from +5 in $\mathrm{KIO_3}$ to 0 in $\mathrm{I_2}$.

46. b

When substance undergoes reduction there will be gain of electrons and decrease in oxidation number. As substance gained electrons so there will be decrease in valency of electropositive element.

But during reduction substance never undergoes loss of electrons.

47. b

The principle quantum number n=4, represents the fourth orbit.

A subshell is the set of states defined by a common azimuthal quantum number l, within a shell.

The values $\mathrm{l}=0, 1, 2, 3$ correspond to the s, p, d, and f shells, respectively. Hence, $\mathrm{n}=4$, $\mathrm{l}=1$ represents 4p subshell.

48. a

Group elements Group 11, by modern IUPAC numbering, is a group of chemical elements in the periodic table, consisting of copper (Cu), silver (Ag), and gold (Au), and roentgenium (Rg)

49. a

50. a

51. a

52. c

53. d

54. d

55. b

56. d

57. b

58. c

The meaning of NOVICE is a person admitted to probationary membership in a religious community.

The meaning of RECRUIT is to fill up the number of with new members

The meaning of APPRENTICE is one bound by indenture to serve another for a prescribed period with a view to learning an art or trade.

The meaning of VETERAN is a former member of the armed forces.

The meaning of AMATEUR is one who engages in a pursuit, study, science, or sport as a pastime rather than as a profession.

59. d

60. a

61. c

$$\frac{S_n^{th}}{S_n} = \frac{\frac{a}{2}(2n-1)}{\frac{a}{2}n^2}$$

$$= \frac{2n}{n^2} - \frac{1}{n^2} = \frac{2}{n} - \frac{1}{n^2}$$

62. b

$\omega^2 r = 4\pi^2 n^2 r = 4\pi^2 (\frac{1200}{60})^2 \times 30 \times 10^{-2} = 4740 m/s^2$

63. b

$$\frac{e_2}{e_1} = 2F \cdot \frac{\frac{2L}{\pi(2r)^2Y}}{\frac{FL}{\pi r^2 Y}} = \frac{4}{4}$$

or, $e_2 = e_1$

64. c

$F = T \times P = T \times 2(a+b) = 7 \times 10^{-2} \times 2(6+4) \times 10^{-2} = 1.4 \times 10^{-2} N$

65. c

It is an adiabatic process:

$$PT^{\frac{\gamma}{1-\gamma}} = C$$

$$(\frac{P_2}{P_1})^{\frac{1-\gamma}{\gamma}} = \frac{T_1}{T_2}$$

$$\left(\frac{1}{4}\right)^{\frac{-0.4}{1.4}} = \frac{290+273}{T_2}$$

$$T_2 = 378.87K$$

66. d

${}_1\mu_2 = \frac{1}{\sin C}$ [C′ is the critical angle]

or, $\frac{\mu_2}{\mu_1} = \frac{1}{\sin C}$

Also, $\mu \propto \frac{1}{\lambda}$ (By Cauchy's formula)

$$\frac{\lambda_2}{\lambda_1} = \frac{1}{\sin C}$$

or, $\sin C = \frac{\lambda_2}{\lambda_1} C = (\frac{\lambda_2}{\lambda_1})$

$= \sin^{-1}(\frac{4000}{6000}) = \sin^{-1}(\frac{2}{3})$

67. d

Soln: V_c = V_c(due to A) + V_c(due to B)

$= \frac{1}{4\pi\varepsilon_0}\frac{q_1}{a} + \frac{1}{4\pi\varepsilon_0}\frac{q_2}{a}$

$= 73 \times 10^4$ V

68. b

$I = \frac{E}{R_{pot}+R} = \frac{3}{(10\times 2)+10} = 0.1A$

Potential gradient = $\frac{IR_{pot}}{l} = \frac{0.1\times 20}{10} = 0.2V/m$

69. d

Work done (W) = change in potential energy (ΔU)

Here, initial area $(A) = a^2$

Final area $(A_f) = \pi R^2 = \frac{4a^2}{\pi}$ $(2\pi R = 4a, so, R = \frac{2a}{\pi})$

Initial potential energy $(U_i) = -MBcos0^\circ = -iBA = -iBa^2$

Final potential energy $(U_f) = -M_f B cos0^\circ = -iBA_f = -iB\frac{4a^2}{\pi}$

work done $(W) = U_f - U_i = -ib(\frac{4a^2}{\pi}) - (-iBa^2) = iBa^2(1 - \frac{4}{\pi})$

70. a

$\theta = \frac{\pi}{2}$

$\cos\theta = 0$

$P = \frac{1}{2}V_0 I_0 \cos\theta = 0$

71. c

72. d

$f_1 = (\frac{v}{v - v_{s_1}}) \times f = (\frac{340}{340 - 34}) \times f$

$= \frac{10}{9} \times f$

$f_2 = (\frac{v}{v - v_{s_2}}) \times f = (\frac{340}{340 - 17}) \times f$

$= \frac{20}{19} \times f$

$\frac{f_1}{f_2} = 19 \times \frac{10}{20} \times 9 = \frac{19}{18}$

73. a

74. c

Frequency of electron of bohr's model

$f = 6.54 \times 1015\frac{z^2}{n^3}$

so, electron of fourth orbit of H – atom

$f = 6.54 \times 10^{15} \times \frac{12}{43}$

so, number of revolution in 3 seconds$= 3 \times 1.02 \times 10^{14}$
$= 3.06 \times 10^{14}$ revolutions

75. a

$f(x) = 3x + 1$

$fof(x) = 3(3x + 1) + 1 = 9x + 4$

76. b

$(aI + bA)^2 = \begin{bmatrix} a & b \\ 0 & a \end{bmatrix} \begin{bmatrix} a & b \\ 0 & a \end{bmatrix} = \begin{bmatrix} a^2 & 2ab \\ 0 & a^2 \end{bmatrix} = a^2 I + 2abA$

77. a

$z = x + iy$ Given, $|z - zi| = 1, |x + iy - (x + iy)i| = 1$

$|x + iy - xi - i^2 y| = 1$

$x + iy - ix + y\ | = 1$

$(x + y) + i(y - x) = 1$

or, $\sqrt{(x+y)^2+(y-x)^2}=1$

or, $x^2+2xy+y^2+y^2-2yx+x^2=1$

or, $2\left(x^2+y^2\right)=1$

or, $x^2+y^2=\frac{1}{2}$, i.e., z lies on circle

78. d

He can choose any one shirt out of 10 shirts and other one tie out of 8 ties for a unique outfit.

$\therefore$ total number of outfits = $10 \times 8 = 80$

79. c

$$\sum_{n=0}^{\infty}\frac{n^2+1}{n!}$$

$$\sum_{n=0}^{\infty}\frac{n^2}{n!}+\sum_{n=0}^{\infty}\frac{1}{n!}$$

$$\sum_{n=1}^{\infty}\frac{n}{(n-1)!}+e$$

$n=k+1$

$$\sum_{k=0}^{\infty}\frac{k+1}{(k)!}+e$$

$$\sum_{k=0}^{\infty}\frac{k}{(k)!}+\sum_{k=0}^{\infty}\frac{1}{(k)!}+e$$

$$\sum_{k=1}^{\infty}\frac{1}{(k-1)!}+\sum_{k=0}^{\infty}\frac{1}{(k)!}+e$$

$e+e+e=3e$

80. d

Minimum values of $a\sin x+b\cos x$ is $-\sqrt{a^2+b^2}$

81. c

a, b, c are in A.P.

$b=\frac{a+c}{2}$

or, $2R\sin B=\frac{(2R\sin A+2R\sin C)}{2}$

i.e., $\sin A, \sin B, \sin C$ are in A.P.

or, $1/\sin A, 1/\sin B, 1/\sin C$ are H.P.

so, cosec A, cosec B, cosec C are in H.P.

82. c

83. c

84. c

The equation of line which is perpendicular to $x + 2y + 5 = 0$ is $2x–y + k = 0$ For tangency of this
line to circle. Distance from center (0, 0) to line = radius
Hence, equation of tangent: $2x - y + 5 = 0$

85. c

$2x^2 + 8x + 8y–1 = 0$

or, $x^2 + 4x + 4y–\frac{1}{2} = 0$

or, $(x + 2)^2 + 4y–4–\frac{1}{2} = 0$

or,$(x + 2)^2 = -4(y–\frac{9}{8})$

Comparing with $(x - h)^2 = 4a(y - k)$

$h = -2, a = -1$ and $k = 9/8$ equation of directrix is:

$y = -a$

$y - \frac{9}{8} = 1$

$8y - 17 = 0$

86. b

87. c

$\lim_{x\to 0}\frac{(e^{x^2} - \cos x)}{x^2}(0/0)$

$\lim_{x\to 0}\frac{(e^{x^2}2x + \sin x)}{2x}$

$\lim_{x\to 0}\frac{(e^{x^2}2x)}{2x} + \lim_{x\to 0}\frac{\sin x}{2x}$

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

88. d

89. b

90. c

The property by virtue of which the compound has the same molecular formula but different structural formulae is called isomerism.

91. d

$(\mathrm{COOH})_2 + \mathrm{H_2SO_4} \longrightarrow \mathrm{CO\,(g)} + \mathrm{CO_2\,(g)} + \mathrm{H_2O\,(l)}$

92. b

The process of converting hydrated alumina into anhydrous alumina is called calcination.

93. d

The masses of Cu reacting with a fixed masses of oxygen bear a simple ration of 1:2.

94. a

$100\,\mathrm{ml\ of\ 0.3\,N\ HCl} = (100\ \times 0.3)\,\mathrm{ml\ of\ 1\,N\ HCl} = 30\,\mathrm{ml\ of\ 1\,N\ HCl}$

$200\,\text{ml of } 0.6\,\text{N } H_2SO_4 = (200 \times 0.6)\,\text{ml of } 1\,\text{N } H_2SO_4 = 120\,\text{ml of } 1\,\text{N } H_2SO_4$

$VN + V_1N_1 = V_mN_m$

$30 \times 1 + 120 \times 1 = 300 \times N$

$N = 0.5$

95. d

$Ba(OH)_2 \rightleftharpoons Ba^{++} + 2\,OH^-$

Conc. of $Ba(OH)_2$=$0.0005 \times 10 = 0.005\,M$

OH^- conc $\cdot = 2 \times 0.005 = 0.01 = 10^{-2}$

$pOH = -\log\,[OH^-] = -\log\,(10^{-2}) = 2$

96. a

W=ZIt

$\rho V = \dfrac{E}{96500} \times It$

$\rho \times \text{area} \times \text{thickness} = \dfrac{108}{96500} \times 0.2 \times 3 \times 60 \times 60$

$10.47 \times 800 \times \text{thickness} = 2.4156$

$\text{thickness} = 2.88 \times 10^{-4}\,\text{cm}$

97. a

98. d

99. b

100. b