clamphook

ClampHook CBT Mock Test, 24th June, Shift 1

Tribhuvan University

2080

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

1. The dimension of angular momentum is:

a. $[MLT^{-1}]$ b. $[ML^{-1}T]$

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

2. A body of mass 10 kg is moving east with a uniform speed of 2 m/s . A force of 20 N is applied to it towards north . What is displacement after 2second ?

a. $4m$ b. $8m$

c. $4\sqrt{2}m$ d. $8\sqrt{2}m$

3. The mass of X is of 10 kg and Y is of 20 kg. The acceleration due to gravity on the surface of moon g_m is $1.6m/s^2$ then gravitation field intensity of:

a. X and Y on the surface of earth is same.

b. X on the surface of moon is equal to that Y on the surface of the earth.

c. X on the surface of moon is twice that of Y on the surface of moon.

d. X on the surface of moon is 6 times that of Y on the surface of moon.

4. A and A are two amplitudes of particles showing SHM, the resultant amplitude is [IOE 2078]

a. 2A b. 0

c. 0 to $2A$ d. 0 to A

5. A body of volume 100cc. is immersed completely in water contained in a jar. The weight of water and the jar before immersion of the body was 600 g wt. After immersion weight of water and jar will be [IOE 2075]

a. $500g$ b. $700g$

c. $100g$ d. $200g$

6. A closed vessel conatins a gas at temperature of 250 K . If the gas is heated through 1K , then percentage increase in its pressure

a. 0.1% b. 0.2%

c. 0.3% d. 0.4%

7. A cup of tea cools from $80°C$ to $60°C$ in one minute. The ambient temperature is $30°C$. In cooling from $60°C$ to $50°C$, it will take

a. 30 sec b. 60 sec

c. $90sec$ d. 48 sec

8. Magnification of plane mirror is

a. 1 b. -1

c. 0 d. ∞

9. The angle of a prism is A. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2A on the first surface returns back through the same path after suffering reflection at the silvered surface.The refractive index μ, of the prism i

a. $2 \sin A$
b. $2 \cos A$
c. $\frac{1}{2} \cos A$
d. $\cos \frac{A}{2}$

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10. Two point charges placed at a certain distance r in air exert a force of F on each other . Then the distance at which these charge will experience the same force in a medium of dielectric constant K is:

a. r
b. $\frac{r}{K}$
c. $\frac{r}{\sqrt{K}}$
d. $\sqrt{K} \times r$

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11. a certain charge liberates 0.8 g of oxygen. The same charge will liberate how many grams of silver?

a. 108 g
b. 10.8 g
c. 0.8 g
d. 108/ 0.8 g

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12. When a charged particle enters in strong magnetic field, its kinetic energy

a. Increases
b. Decreases
c. Remain constant
d. First increases and becomes constant

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13. If magnet is pulled away from coil, the induced current will [IOE 2074]

a. pull magnet towards coil
b. push magnet away from coil
c. not affect the motion of magent
d. none of these

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14. The fringe width interference of monochromatic light produced by double slit experiment is β . The wavelength of light is λ . Then the ratio of the slits and the screen is :

a. $\beta\lambda$
b. $\frac{\lambda}{\beta}$
c. $\frac{1}{\lambda\beta}$
d. $\frac{\beta^2}{\lambda}$

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15. The phase difference between the two waves $x = a \sin(\omega t + \frac{\pi}{6})$ and $y = a \cos \omega t$ is

a. $\frac{\pi}{2}$
b. $\frac{\pi}{3}$
c. π
d. $\frac{3\pi}{4}$

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16. When a charged particle moves perpendicular to the uniform magnetic field, then

a. Its momentum changes, total energy is same
b. Both momentum and total energy remains the same
c. Both momentum and its total energy will change
d. Total energy changes, momentum remains same

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17. The ratio of the radii of the nuclei $_{12}A^{27}$ and $_{52}Te^{125}$ is approximately

a. 6 : 10
b. 10: 6
c. 27: 125
d. 3: 5

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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

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19. If $A = \begin{bmatrix} 1 & 5 \\ 2 & 7 \end{bmatrix}, A^{-1} =$ [IOE 2077]

a. $\begin{bmatrix} 7 & -5 \\ -2 & 1 \end{bmatrix}$

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

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

d. $\begin{bmatrix} 1 & -5 \\ -2 & 7 \end{bmatrix}$

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20. The value of $(1+i)^5 + (1-i)^5 =$

a. 1

b. -1

c. -8

d. i

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21. There are 12 persons in a room. Everybody makes a handshake with other. How many handshakes will be there all together?

a. 6

b. 24

c. 36

d. 66

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22. If $3\tan(\theta - 15^\circ) = \tan(\theta + 15^\circ)$, then θ is

a. $n\pi + \frac{\pi}{4}$

b. $n\pi + \frac{\pi}{6}$

c. $n\pi + \frac{\pi}{8}$

d. $n\pi + \frac{\pi}{3}$

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23. If $x + y + z = xyz$, then $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z =$

a. π

b. $\frac{\pi}{2}$

c. 1

d. $\frac{\pi}{4}$

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24. If radius of incircle of a triangle with its sides 5 K , 6 K and 5 K is 6 , then K is equal to :

a. 3

b. 4

c. 5

d. 6

---

25. If $\overrightarrow{a} = -7\overrightarrow{b}$ and $\overrightarrow{c} = 8\overrightarrow{b}$ and is non zero vector then angle between $\overrightarrow{a}$ and $\overrightarrow{c}$ is [IOE 2076]

a. 0°

b. 45°

c. 90°

d. 180°

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26. The ratio in which the join of the points $(1, 3)$ and $(4, -5)$ by the x-axis is

a. $1:4$

b. $4:1$

c. $3:5$

d. $5:3$

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27. The equation of the circle passing through the origin and intercepting lengths a and b on the axes is

a. $x^2 + y^2 + ax + by = 0$

b. $x^2 + y^2 + ax - by = 0$

c. $x^2 + y^2 - ax + by = 0$

d. $x^2 + y^2 - ax - by = 0$

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28. The equation $2x = e^{-x} + e^{x}$ and $2y = e^{x} - e^{-x}$ represent

a. Circle

b. Ellipse

c. Parabola

d. Hyperbola

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29. If the equation $kx^2 - 4y^2 = 20$ represent rectangular hyperbola then the value of k is

a. 4

b. -4

c. 5

d. -5

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30. If the midpoint of line intercepting coordinate axes is (3, 2). The equation of line is [IOE 2077]

a. $2x + 3y = 12$

b. $3x + 2y = 12$

c. $2x + 3y = 6$

d. $3x + 2y = 6$

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31. The value of $f(0)$ so that the function $f(x) = \dfrac{2x - \sin^{-1} x}{2x + \tan^{-1} x}$ is continuous at $x = 0$ is

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

32. If $x = a\sec^3\theta$ and $y = b\tan^3\theta$, $\frac{dy}{dx} =$

a. $\frac{b}{a}\sin\theta$
b. $\frac{a}{b}\sin\theta$
c. $\frac{b}{a}\cos\theta$
d. $\frac{a}{b}\cos\theta$

33. $\frac{d}{dx}\cosh^{-1}(\sec x) =$

a. $\sec x$
b. $\cot x$
c. $\cos x$
d. $\sin x$

34. In case of strictly decreasing functions, the derivative is [IOE 2075]

a. zero
b. positive or zero
c. negative
d. positive

35. Every continuous function is

a. differentiable
b. increasing
c. not differentiable always
d. decreasing

36. If $f"(x) = \frac{x^3}{3}$ then degree of f(x) is [IOE 2076]

a. 2
b. 3
c. 4
d. 5

37. The area bounded by the curve $y^2 = 8x$ and $x^2 = 8y$ is:

a. $\frac{64}{3}$
b. $\frac{64}{6}$
c. $\frac{64}{7}$
d. $\frac{64}{5}$

38. $\mathrm{R{-}CH_2{-}CCl_2{-}R} \longrightarrow \mathrm{R{-}C \equiv C{-}R}$ This reaction is favorable in the presence of which reagent?

a. Na
b. HCl in water (aqueous medium)
c. KOH in Ethanol (alcoholic medium)
d. Zn in alcohol

39. Which hybridization is present in carbon of formaldehyde?

a. sp
b. $\mathrm{sp^2}$
c. $\mathrm{sp^3}$
d. $\mathrm{dsp^3}$

40. When $\mathrm{H_2S}$ reacts with halogens, halogens

a. Form sulphur halides
b. Are oxidized
c. Are reduced
d. None of these

41. Which of following halogen acids has the lowest melting point?

a. HF
b. HCl
c. HBr
d. HI

42. When NaOH crystals are left in open air, they acquire a fluid layer around each crystal as

a. They start melting.
b. They absorb moisture from air.
c. They react with air to form a liquid.
d. They absorb $\mathrm{CO_2}$ from air

43. In the reaction between $CuSO_4$ and KI, a white precipitate is obtained. The ppt. has the composition

a. CuI_2 b. Cu_2I

c. $KCuI_2$ d. Cu_2I_2

44. Percentage of carbon is same in

a. Pig iron and cast iron b. Pig iron and wrought iron

c. cast iron and steel d. Steel and pig iron

45. Conjugate base of Zn^{2+} is

a. $Zn(OH)^+$ b. $Zn(OH)_2$

c. ZnO d. $Zn(H_2O)^{2+}$

46. The oxidation number of chromium in CrO_2Cl_2 is

a. $+3$ b. $+4$

c. $+5$ d. $+6$

47. Which of the following are isoelectronic with each other?

a. Na^+, Ne b. K^+, O

c. O, Ne d. Na^+, K^+

48. In SO_2 molecule, S atom is

a. sp^3 hybridized b. sp^2 hybridized

c. sp hybridized d. dsp^2 hybridized

49. I am as old as _____ are.

a. him b. her

c. them d. they

50. The director, besides his colleagues,..... the committee.

a. make up b. have made up

c. makes up d. are making up

51. I am surprised _____ the results. [IOE 2077]

a. by b. with

c. at d. of

52. Gopal killed Ram . Its pattern is [IOE 2075]

a. S + V + O b. S + V + SC

c. S + V + OC d. S + V + Adverbial

53. The student _____ her notes now.

a. wrote b. writes

c. has written d. is writing

54. You must look into the matter.

a. The matter has been looked into by you. b. The matter may be looked into by you.

c. The matter must be looked into by you. d. The matter is being looked into by you.

55. Which of the following word doesn't sound '/n/' ? [IOE 2074]

a. singer b. pin

c. tongue d. string

56. "If you want to score high on exam, you'll have to study hard." This sentence is [IOE 2074]

a. simple b. compound

c. complex d. none of these

57. Kindly put on your uniforms. It is time to go to school.

a. wash
b. wear
c. stitch
d. iron

58. Antonym of 'irascible' is:

a. determined
b. placid
c. reasonable
d. pliant

59. He asked me what I ..... do for a living.

a. may
b. should
c. could
d. will

60. Synonyms of fostering is

a. safegaurding
b. neglecting
c. Ignoring
d. Nurturing

61. A cricket player can throw a ball to maximum distance R.The maximum vertical distance to which he can throw it is:

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

62. Ball A attached to one end of rigid weightless rod. While an identical ball B is attached to the center of the rod. Each ball has mass 0.5 kg and the length of each half of the rod is 0.4 m. This arrangement is held by an empty end is whirled around in a horizontal circle at a constant rate, so each ball is in uniform circular motion. Ball A travels at a constant speed of 4 m/s. The tension on the left of the rod is: [IOE 2075]

a. 5 N
b. 10 N
c. 15 N
d. 20 N

63. The total energy of particle executing SHM is E. The KE of particle at half of amplitude is:

a. $E/2$
b. $E/\sqrt{2}$
c. $E/4$
d. $3E/4$

64. A square frame of side L is dipped in a liquid soap. When it is taken out of the liquid a soap film is formed on it. If the surface tension of soap is T, The force acting on frame is: [IOE 2072]

a. 2TL
b. 4TL
c. 8TL
d. 16TL

65. The temperature at which nitrogen molecule will have same rms speed as oxygen molecule at $127°C$ is:

a. $77°C$
b. $350°C$
c. $273°C$
d. $127°C$

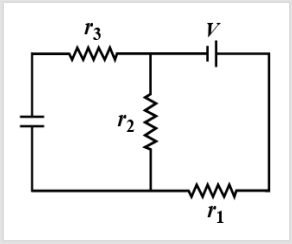
66. A prism having angle $8°$, $\mu = 1.5$ is contact arranged with other prism having angle 'A' and refractive index 1.8 such that net deviation is zero, $A =$ [IOE 2078]

a. $6°$
b. $5°30'$
c. $5°$
d. $4°$

67. Three capacitors each of capacitance 3 μF, are connected in series. The net capacitance is:

a. $\frac{1}{3}\mu F$
b. 1 μF
c. 3μF
d. 9 μF

68. In the circuit of figure, the final voltage drop across the capacitor C is:



a. $\frac{Vr_1}{r_1+r_2}$

b. $\frac{V(r_1+r_2)}{r_2}$

c. $\frac{V(r_1+r_2)}{r_1+r_2+r_3}$

d. $\frac{Vr_2}{r_1+r_2}$

69. A wire having length l and carrying current I is bent in circular form. Then the dipole moment of circular coil

a. $\frac{Il^2}{4\pi}$

b. $\frac{IL^2}{2\pi}$

c. $4\pi^2L^2I$

d. πL^2I

70. In LCR circuit, during resonance, Impedance is equal to? [IOE 2078]

a. Resistance

b. Inductance

c. Capacitance

d. $|X_C - X_L|$

71. The end correction of a closed organ pipe will increase if [IOE 2078]

a. the organ pipe is made thinner

b. the organ pipe is made wider

c. the length of organ pipe is increased

d. the length of organ pipe is decreased

72. A source of sound moves towards a listener with a velocity equal to that of sound. If the source emits n waves per second, then the listener moving away from the source with the same velocity receives [IOE 2078]

a. n waves/sec

b. 2n waves per second

c. n/2 waves/sec

d. 0 waves per second

73. . A beam of x-ray incident on crystal of lattice constant 3 A. The first order reflection is obtained at grazing angle 30o Then the wavelength of x-ray is:

a. 1. 5 Å

b. 3 Å

c. 4.5 Å

d. 6 Å

74. The ionization energy of hydrogen is 13.6 eV. The energy required to excite the electron in singly ionized helium atom (He^+) from first to second orbit is

a. $13.6eV$

b. $2x13.6eV$

c. $3 \times 13.6eV$

d. $4 \times 13.6eV$

75. The range of function $f(x) = \frac{x-1}{|x-1|}, x \neq 1$ is [IOE 2075]

a. $\{-1, 1\}$

b. $R - \{-1\}$

c. $(-1, 1]$

d. $R - \{1\}$

76. If A is a $m \times n$ matrix and B is a matrix such that both AB and BA are defined, then the order of B is

a. $m \times n$

b. $n \times m$

c. $m \times m$

d. $n \times n$

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. If $x > 1, y > 1, z > 1$ are in G.P. then $\frac{1}{1+\ln x}, \frac{1}{1+\ln y}, \frac{1}{1+\ln z}$ are in:

a. GP
b. HP
c. AP
d. None

79. If $C_0, C_1, C_2, ..., C_n$ are the coefficients in the expansion $(1+x)^n$ then the value of $C_0 + 3C_1 + 5C_2 + ... + (2n+1)C_n$ is:

a. $n2^n$
b. $n2^n - 1$
c. $n2^n + n$
d. $n2^n + 2^n$

80. $\cos^{-1} x + \cos^{-1} y = \frac{2\pi}{3}$ then $\sin^{-1} x + \sin^{-1} y$ is. [IOE 2077]

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

81. In ΔABC, $1 - \tan\frac{A}{2}\tan\frac{B}{2} = ?$ [IOE 2078]

a. $\frac{c}{s}$
b. $\frac{s}{c}$
c. $-\frac{c}{s}$
d. $-\frac{s}{c}$

82. If the vector $\vec{a} = 2\vec{i} + 3\vec{j} + 6\vec{k}$ and $|\vec{b}| = 21$ such that $\vec{a}$ and $\vec{b}$ are collinear. The $\vec{b}$ equals to [IOE 2077]

a. $\pm(2\vec{i} + 3\vec{j} + 6\vec{k})$
b. $\pm 3(2\vec{i} + 3\vec{j} + 6\vec{k})$
c. $\vec{i} + \vec{j} + \vec{k}$
d. $\pm 21(2\vec{i} + 3\vec{j} + 6\vec{k})$

83. $Ax^2 + By^2 + Cx + Cy = 0$ represents a pair of straight lines if: [IOE 2077]

a. A+B=0
b. A=B
c. A-2B=0
d. A+2B=0

84. The equation of tangent to the circle $x^2 + y^2 = 4$ which is parallel to $3x + 4y - 5 = 0$ is [IOE 2074]

a. 3x + 4y ± 5 = 0
b. 3x + 4y ± 7 = 0
c. 3x + 4y ± 8 = 0
d. 3x + 4y ± 10 = 0

85. The vertex of the parabola $y^2 + 2y + x = 0$ lies in .....quadrant. [IOE 2077]

a. 1st
b. 2nd
c. 3rd
d. 4th

86. The projection of the line joining the point (1,2,2) and (2,7, 3) on the plane 2x – y + 3z = 0 is [IOE 2074]

a. 2 units
b. 22 units
c. 3 units
d. $3\sqrt{3}$ units

87. $\lim_{x\to\infty} \frac{\sqrt{2x+1} - 3}{\sqrt{x+1} - 2}$ [IOE 2077]

a. 1
b. $\frac{1}{\sqrt{2}}$
c. $\sqrt{2}$
d. Doesnt exist

88. Derivative of $\cos x^2$ wrt. x is [IOE 2077]

a. $2x\cos x^2$
b. $-2x\cos x^2$
c. $-2x\sin x^2$
d. $-\sin x^2$

89. $\int \frac{dx}{e^{2x} - 1}$ [IOE 2078]

a. $\sin^{-1} e^x$
b. $\tan^{-1} e^x$
c. $\cos^{-1} e^x$
d. $\sec^{-1} e^x$

90. First organic compound synthesized in laboratory from its element is

a. Urea
b. CH_4
c. CH_3COOH
d. C_2H_2

91. Cl_2 **gas on reaction with hot and concentrated** $NaOH$ **gives:**

a. $NaClO_3$, $NaClO$
b. $NaClO$, $NaClO_3$
c. $NaCl$, $NaClO_3$
d. $NaCl$, $NaClO$

92. The region in which main metals are found in earth is called

a. Atmophil
b. Lithophil
c. Chalcophil
d. Siderophil

93. The percentage of element M is 53 in its oxide of molecular formula M_2O_3**. Its atomic mass is about**

a. 45
b. 9
c. 18
d. 27

94. 10 gm of a mixture of $CaCO_3$ **and** $MgCO_3$ **(30 %** $CaCO_3$ **and 70 %** $MgCO_3$**) is allowed to react completely with** $2.0\,M$ HCl**. The volume of the acid required is**

a. 113.3 ml
b. 213.3 ml
c. 225 ml
d. 23 ml

95. The pH of solution having $0.1\,M$ CH_3COOH $(K_a = 10^{-5})$ **and** $0.2\,M$ CH_3COONa **is**

a. 4.3
b. 2.3
c. 5.3
d. 11.3

96. The charge (in coulombs) on the N_3^- **ion is**

a. 96500
b. 4.8×10^{19}
c. 4.8×10^{-10}
d. 2.89×10^5

Read the following passage carefully, and find out the correct answers for the questions given below:
(Questions from 97 to 100)

It was in Germany and France that the first successful attempts were made to produce an internal-combustion engine driven by petrol. In England people were strangely timid about horseless vehicles. English inventors were handicapped by a quaint old law which forbade any such vehicle to attain a greater speed than four miles an hour, and compelled each one to be preceded by a man carrying a red flag. This law was not repealed until 1896.

The earliest motor cars were looked upon as mere jokes, or as rather dangerous playthings, by every one except their inventors. Some of them were single-seaters, others would carry two or even three people; but all were noisy, clumsy, queer-looking things. When in 1888, Carl Benz, a German, produced a three-wheeled, internal-combustion car, a great forward stride had been made. Another German, whose name, Daimler, is often seen on motor cars to this day; was experimenting about the same time, and testing a petrol- driven engine.

It is easy to understand how the introduction of the petrol- driven engine revolutionized road transport throughout the world. Until then the necessary power to push a vehicle along could not be obtained without the cumbersome tanks and boilers and furnaces of the steam engine. The internal- combustion engine is light in weight and small in size by comparison; the fuel is burned in it, so that there is no waste, like the dusty cinders of a coal-fire.

97. How did most people regard early motor cars?

a. Not better than horse-driven vehicles.
b. A mere joke, or as rather dangerous playthings.
c. A mere scientific experiment.
d. A cumbersome vehicle.

98. What made the English inventors handicapped?

a. General public did not welcome the invention.
b. The quaint old law, which forbade any such vehicle to attain a greater speed than four miles/hour.
c. Non-availability of adequate fuel to power the engine.
d. None of these.

99. What does 'repealed' mean?

a. repeated
b. abolished
c. contradicted
d. enforced

100. Which among the following words is as nearly opposite meaning to 'clumsy' used in the passage?

a. unhandy
b. refined
c. unusually large
d. unusual

Answer Key

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

Solutions

1. c

$L = mvr = [ML^2T^{-1}]$

2. c

Displacement towards east , $x = 2 \times 2 = 4m$

Acceleration towards north $= \frac{\text{force}}{\text{mass}} = \frac{20}{10} = 2m/s^2$

Displacement towards north,

$y = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times 2^2 = 4$

Net displacement $= \sqrt{x^2 + y^2} = \sqrt{4^2 + 4^2} = 4\sqrt{2}m$

3. a

Gravitational intensity at a point experienced by a unit point mass when placed at that point.

$$E = \frac{F}{M} = \frac{GM}{r^2}$$

i. e 'E' is independent of the mass of an object and only depends on acceleration due to gravity of a planet.

4. c

$R = \sqrt{A^2 + B^2 + 2AB\cos\phi}$

A,B are amplitudes, ϕ is phase difference and R is resultant amplitude.

Max: $R = \sqrt{A^2 + B^2 + 2AB\cos 0^\circ} = A + B = A + A = 2A$

Min: $R = \sqrt{A^2 + B^2 + 2AB\cos 180^\circ} = A - B = A - A = 0$

5. b

$W = W_1 + W_2 = W_1 + V\rho = 600g + 100 \times 1 \times 1 = 700g$

6. d

$\frac{\Delta P}{P} \times 100\% = \frac{\Delta T}{T} \times 100\% = \frac{1}{250} \times 100\% = 0.4\%$

7. d

Case I:

$\frac{dT}{dt} \propto (T - T_0)$

$\frac{20}{60} = k \times (\frac{80 + 60}{2} - 30)$

$k = \frac{1}{120}$ unit

Case II:

$\frac{dT}{dt} \propto (T - T_0)$

$\frac{dT}{dt} = k\,(T - T_0)$

$\frac{10}{x} = \frac{1}{120} \times (\frac{60 + 50}{2} - 30)$

$x = 48sec$

8. b

image is same size of object.

The image is virtual.

9. b

Since the ray retraces back to its original path ,

$\mathrm{r}_2 = 0$

$\mathrm{r}_1 + \mathrm{r}_2 = \mathrm{A} \rightarrow \mathrm{r}_1$

Now applying snell rule between incident ray and refracted ray.

$(1)\sin(2A) = \mu\sin(A) \Rightarrow 2\sin A\cos A = \mu\sin A$

$\mu = 2\cos A$

10. c

$$F_\circ = \frac{q^2}{4\pi\epsilon_\circ r'^2}$$

$$F_m = \frac{q^2}{4\pi\epsilon_\circ K r^2}$$

$$\frac{r'}{r} = \frac{1}{\sqrt{K}}$$

$$r' = \frac{r}{\sqrt{K}}$$

11. b

$$\frac{m_2}{m_1} = \frac{z_2}{z_1}$$

$$\frac{m_2}{0.8} = \frac{108}{8} = 10.8g$$

12. c

Since, only direction of charge particle is changed inside magnetic field.And kinetic energy is scaler quantity. So, it remains unchanged.

13. a

According to Lenz's law, the induce current will oppose the cause of induction.

14. b

Here , fringe width = β

Wavelength of light used = λ

Slit separation = d

Distance between slit and screen = D

From Young's Double slit experiment , we have

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

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

15. b

$$x = a\sin(\omega t + \frac{\pi}{6})$$

$$y = a\cos\omega t = a\sin(\omega t + \frac{\pi}{2})$$

$$\Delta\phi = \phi_2 - \phi_1 = \frac{\pi}{2} - \frac{\pi}{6} = \frac{\pi}{3}$$

16. a

The magnetic force will act perpendicular to velocity at every instant ,path will be circle. Due to change in direction momentum will change but the total energy will remain same.

17. d

$$R \propto (A)^{1/3}$$

$$R_1 \propto (A_1)^{1/3}$$

$$R_1 \propto (27)^{1/3}$$

$$R_2 \propto (125)^{1/3}$$

$$R_1 : R_2 = 3 : 5$$

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

$$|A| = \begin{vmatrix} 1 & 5 \\ 2 & 7 \end{vmatrix} = 1 \times 7 - 5 \times 2 = -3$$

$$adjA = \begin{bmatrix} 7 & -5 \\ -2 & 1 \end{bmatrix}$$

$$A^{-1} = \frac{adjA}{|A|} = \begin{bmatrix} -\frac{7}{3} & \frac{5}{3} \\ \frac{2}{3} & -\frac{1}{3} \end{bmatrix}$$

20. c

We know:

$$(1+i)^n = (-4)^Q(1+i)^R$$

$$(1+i)^5 = (-4)^1(1+i) = -4-4i$$

$$(1-i)^5 = (-4)^1(1-i) = -4+4i$$

Adding,

$$(1+i)^5 + (1-i)^5 = -8$$

21. d

First person shaking hands with second person and second person with first person will not be two different handshakes. Here, order is not important. There will be as many handshakes as there are combinations of 12 different things taken 2 at a time.

Total number of handshakes = ${}^{12}C_2 = 66$

22. a

$3\tan(\theta - 15^\circ) = \tan(\theta + 15^\circ)$

$$3 = \frac{\tan(\theta+15^\circ)}{\tan(\theta-15^\circ)}$$

Using competendo and dividendo

$$\frac{3+1}{3-1} = \frac{\tan(\theta+15^\circ)+\tan(\theta-15^\circ)}{\tan(\theta+15^\circ)-\tan(\theta-15^\circ)}$$

$$2 = \frac{\sin(\theta+15^\circ)\cos(\theta-15^\circ)+\sin(\theta-15^\circ)\cos(\theta+15^\circ)}{\sin(\theta+15^\circ)\cos(\theta-15^\circ)-\sin(\theta-15^\circ)\cos(\theta+15^\circ)}$$

$$2 = \frac{\sin 2\theta}{\sin 30^\circ}$$

$$\sin 2\theta = 1$$

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

$$\theta = n\pi + \frac{\pi}{4}$$

23. a

$\tan^{-1} x + \tan^{-1} y + \tan^{-1} z$

$$\tan^{-1}\frac{x+y}{1-xy} + \tan^{-1} z$$

$$\tan^{-1}\frac{\frac{x+y}{1-xy}+z}{1-\frac{x+y}{1-xy}\times z}$$

$$\tan^{-1}\frac{x+y+z-xyz}{1-xy-yz-zx}$$

$$x+y+z = xyz$$

so,

$\tan^{-1} 0 = \pi$

24. b

$s = \frac{5K + 6K + 5K}{2} = 8K$

$\Delta = \sqrt{8K(8K - 5K)(8K - 6K)(8K - 5K)} = 12K^2$

$r = \frac{\Delta}{s}$

$6 = \frac{12K^2}{8K}$

$K = 4$

25. d

$\overrightarrow{a} = -7\overrightarrow{b}$

$\overrightarrow{a} = -\frac{7}{8}\overrightarrow{b}$ Because, $[\overrightarrow{c} = 8\overrightarrow{b}]$

$\overrightarrow{a}$ and $\overrightarrow{c}$ are anti parallel.

26. c

Here

$(x_1, y_1) = (1, 3)$

$(x_2, y_2) = (4, -5)$

$(x, y) = (x, 0)$

m_1, m_2

$y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$

$0 = \frac{m_1 \times -5 + m_2 \times 3}{m_1 + m_2}$

$\frac{m_1}{m_2} = \frac{3}{5}$

27. d

Circle passes through (0,0), (a,0) and (0,b).

Let center be (x,y).

$(x-0)^2 + (y-0)^2 = (x-a)^2 + (y-0)^2 = (x-0)^2 + (y-b)^2$

Taking first two:

$x^2 + y^2 = x^2 - 2ax + a^2 + y^2$

$a(a - 2x) = 0 \rightarrow x = \frac{a}{2}$

Taking first and third:

$x^2 + y^2 = x^2 + y^2 - 2by + b^2$

$b(b - 2y) = 0 \rightarrow y = \frac{b}{2}$

center is $(\frac{a}{2}, \frac{b}{2})$

$$x^2 + y^2 = r^2$$

$$r^2 = \frac{a}{2}^2 + \frac{b}{2}^2 = \frac{a^2 + b^2}{4}$$

The equation of a circle is:

$$(x - \frac{a}{2})^2 + (y - \frac{b}{2})^2 = \frac{a^2 + b^2}{4}$$

$$x^2 - ax + \frac{a^2}{4} + y^2 - by + \frac{b^2}{4} = \frac{a^2 + b^2}{4}$$

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

28. d

$2x = e^{-x} + e^{x}$

$$x = \frac{e^{-x} + e^{x}}{2} = \cosh x \text{ ... (i)}$$

$$2y = e^{x} - e^{-x}$$

$$y = \frac{e^{x} - e^{-x}}{2} = \sinh x \text{ ... (ii)}$$

Squaring and subtracting (ii) from (i)

$$x^2 - y^2 = \cosh^2 x - \sinh^2 x = 1$$

$$x^2 - y^2 = 1$$

29. a

$\mathrm{kx}^2 - 4\mathrm{y}^2 = 20$

$$\frac{\mathrm{x}^2}{\frac{20}{k}} - \frac{\mathrm{y}^2}{5} = 1$$

For rectangular hyperbola: $a = b$

$$\frac{20}{k} = 5$$

$$k = 4$$

30. a

Let the intercept of line be a in x-axis and b in y-axis then,

$$(\frac{a + 0}{2}, \frac{0 + b}{2}) = (3, 2)$$

$$(a, b) = (6, 4)$$

$$\frac{x}{6} + \frac{y}{4} = 1$$

$$2x + 3y = 12$$

31. b

$\lim_{x \to 0} f(x)$

$$= \lim_{x \to 0} \frac{2x - \sin^{-1} x}{2x + \tan^{-1} x} (0/0)$$

Using L' Hospital Rule:

$$= \lim_{x \to 0} \frac{2 - \frac{1}{1 - x^2}}{2 + \frac{1}{1 + x^2}}$$

$= \frac{1}{3}$

For continuity

$\lim_{x \to 0} f(x) = f(0)$

$f(0) = \frac{1}{3}$

32. a

$x = a \sec^3 \theta$

$\frac{dx}{d\theta} = 3a \sec^2 \theta \cdot \sec \theta \cdot \tan \theta$
$= 3a \sec^3 \theta \tan \theta$
and $y = b \tan^3 \theta$
$\frac{dy}{d\theta} = 3b \tan^2 \theta \cdot \sec^2 \theta$

Now

$\frac{\mathrm{dy}}{\mathrm{d}x} = \frac{\mathrm{dy}/\mathrm{d}\theta}{\mathrm{dx}/\mathrm{d}\theta} = \frac{3\,\mathrm{btan}^2\,\theta \sec^2 \theta}{3\,\mathrm{asec}^3\,\theta \tan \theta} = \frac{\mathrm{b}}{\mathrm{a}} \frac{\sin \theta / \cos \theta}{1/\cos \theta} = \frac{\mathrm{b}}{\mathrm{a}} \sin \theta$

33. a

$$\frac{d}{dx} \cosh^{-1} x = \frac{1}{\sqrt{x^2 - 1}} \text{ and}$$

$$\frac{d}{dx}\left(\cosh^{-1}(\sec x)\right) = \frac{1}{\sqrt{\sec^2 x - 1}} \cdot \sec x \cdot \tan x$$

$$= \frac{1}{\tan x} \cdot \sec x \cdot \tan x = \sec x$$

34. c

Strictly Increasing: Positive

Neither increasing nor decreasing: 0

Strictly Decreasing: Negative

35. c

Differentiability implies continuity.

Continuous doesn't necessarily imply differentiability.

36. d

$f"(x) = \frac{x^3}{3}$

Integrating

$f'(x) = \frac{x^4}{12} + c_1$

Integrating

$f(x) = \frac{x^5}{60} + c_1 x + c_2$

37. a

$\text{Area } (A) = \int_0^8 (y_1 - y_2) dx$
$= \int_0^8 \left(\sqrt{8x} - \frac{x^2}{8}\right) dx$
$= \left[\sqrt{8} \frac{x^{1/2+1}}{3/2} - \frac{x^3}{24}\right]_0^8$
$= \frac{64}{3} \text{ sq units}$

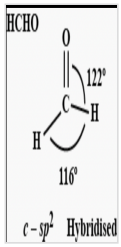
38. c

$$\mathrm{R-CH_2-CCl_2-R \xrightarrow{KOH+C_2H_5OH} R-C \equiv C-R}$$

This reaction is an example of dehydrohalogenation. Hence, alcoholic KOH is used as a reagent.

39. b

Double bonded carbon is $\mathrm{sp^2}$ hybridized.



It is formaldehyde and it contains 3 sigma and 1 π bond so it's hybridization will be $\mathrm{sp^2}$ and geometry will be trigonal planar.

40. c

$\mathrm{H_2S + X_2(Cl, Br, I{=}X) \longrightarrow 2\,HX + S}$. here the halogen are reduced.

41. b

Hydrogen chloride (HCl) has the lowest boiling point among halogen acids. HF has abnormally high boiling point due to hydrogen bonding while other are gases at room temperature.

42. b

NaOH is a deliquescent whit crystalline solid. It absorbs moisture from the atmosphere.

43. d

$\mathrm{2\,CuSO_4 + 4\,KI \longrightarrow Cu_2I_2 + 2\,K_2SO_4 + I_2}$

44. a

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

45. a

46. d

Let O.N. of $\mathrm{Cr} = x$
$or, x + 2 \times (-2) + 2 \times (-1) = 0$

or,$x - 4 - 2 = 0$

$\therefore x = +6$

47. a

$\mathrm{Na^+}$ and Ne are isoelectronic which contain 10 electrons.

48. b

2 bond pair $+1$ lone pair, so S atom is $\mathrm{sp^2}$ hybridised.

49. d

50. c

51. c

52. a

53. d

54. c

55. b

56. c

57. b

58. b

irascible means easily angered; placid means calm or serene

59. b

60. d

61. c

$R = \frac{u^2}{g}$

or,$u = \sqrt{Rg}$

or, $0 = u^2 – 2gH$

or, $H = \frac{Rg}{2g} = \frac{R}{2}$

62. c

$\omega = \frac{v_A}{r_A} = \frac{4}{0.8} = 5rad/s$

$T_{AB} = mr_a\omega^2 = 0.5 \times 0.8 \times 5^2 = 10N$

$T_{BO} = T_{AB} + mr_B\omega^2 = 10 + 5 = 15N$

63. d

$E = \frac{1}{2}m\omega r^2$

$or, E = \frac{1}{2}m\omega(r^2 - y^2)$

$or, E = \frac{1}{2}m\omega(r^2 - \frac{r^2}{4}) = \frac{3E}{4}$

64. c

Net force acting on it = 2(force on one surface)= 2×T×(perimeter) = 2×T×4L = 8TL

65. a

$\frac{c_{N_2}}{c_{O_2}} = \sqrt{\frac{T_{N_2}}{T_{O_2}} \times \frac{M_{O2}}{M_{N2}}}$

$1 = \sqrt{\frac{T_{N_2}}{400} \times \frac{32}{28}}$

$T_{N_2} = 350K = 77^\circ C$

66. c

$\delta_1 = 8(1.5 - 1) = 4$

$\delta_2 = A(1.8 - 1) = 0.8A$

For net deviation zero:

$\delta_1 = \delta_2$

$A = 5^\circ$

67. b

$\frac{1}{\mathrm{C_s}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

$\mathrm{C_s} = 1\mu\mathrm{F}$

68. d

In steady state, the capacitor arms presents an infinite resistance. So the potential difference across C is that across r_2.

Current through $r_2 = \frac{V}{r_1 + r_2}$

PD across $r_2 = V \times \frac{r_2}{r_1 + r_2}$

69. a

$2\pi R = L = R^2 = \frac{L^2}{4\pi^2}$

$M = IA = I\pi R^2 = \pi I \times \frac{L^2}{4\pi^2} = \frac{IL^2}{4\pi}$

70. a

71. b

72. d

73. b

2d sin θ = λ

or, λ = 2 x 3 x sin 300 = 3 Å

74. c

$E_1 = -13.6eV$

For Helium

$E = -13.6 \times Z^2/2^2 - (-13.6Z^2/1)$

$= 4(13.6–3.4) = 40.8eV$

75. a

For every $x > 1, (x-1)$ is positive.

i.e., $f(x>1) = \frac{(x-1)}{|x-1|} = \frac{(x-1)}{(x-1)} = 1$

For every $x < 1, (x-1)$ is negative.

i.e., $f(x<1) = \frac{(x-1)}{|x-1|} = \frac{(x-1)}{-(x-1)} = -1$

76. b

As AB is defined:

column of A = row of B $\implies$ row of B = n

As BA is defined:

column of B = row of A $\implies$ column of B = m

77. a

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

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

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

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

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. b

x, y, z are in GP Then, $\ln x$, lny, $\ln z$ are in AP or, $1 + \ln x, 1 + \ln y + 1 + \ln z$ are in A.P

$\therefore \frac{1}{1+\ln x}, \frac{1}{1+\ln y}, \frac{1}{1+\ln z}$ are in HP

79. d

$S = C_0 + 3C_1 + 5C_2 + ... + (2n-1)C_{n-1}) + (2n + 1)C_n ...$ (i)

$S = (2n+1)C_n + (2n-1)C_{n-1} + ... + 5C_2 + 3C_1 + C_0$ .... (ii)

$S = (2n+1)C_0 + (2n-1)C_1 + ... + (2n-1)C_{n-1} + (2n+1)C_n ...$ (iii)

Adding equation (i) and (iii)

$2S = (2n+2)C_0 + (2n+2)C_1 + ... + (2n+2)C_{n-1} + (2n+2)C_n$

$S = (n+1)C_0 + (n+1)C_1 + ... + (n+1)C_{n-1} + (n+1)C_n$

$S = (n+1)(C_0 + C_1 + C_2 + ... + C_n)$

$S = (n+1)2^n$

80. c

$\cos^{-1} x + \cos^{-1} y = \frac{2\pi}{3}$

$\frac{\pi}{2} - \sin^{-1} x + \frac{\pi}{2} - \sin^{-1} y = \frac{2\pi}{3}$

$\sin^{-1} x + \sin^{-1} y = \frac{\pi}{3}$

81. a

$\tan\frac{A}{2} + \tan\frac{B}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}\sqrt{\frac{(s-a)(s-c)}{s(s-b)}} = \frac{s-c}{s}$

$1 - \tan\frac{A}{2} + \tan\frac{B}{2} = 1 - \frac{s-c}{s} = \frac{c}{s}$

82. b

$\vec{a} = k\vec{b}$

$a^2 = k^2 b^2$

$2^2 + 3^2 + 6^2 = k^2 21^2$

$49 = 441k^2$

$k^2 = \frac{1}{9}$

$k = \pm\frac{1}{3}$

$\vec{b} = \pm 3(2\vec{i} + 3\vec{j} + 6\vec{k})$

83. a

84. d

Centre is $(0, 0)$ and radius $= 2$

Equation of tangent parallel to $3x + 4y - 5 = 0$ is $3x + 4y + k = 0$

Now, distance from centre to tangent = radius = $\frac{3\times 0 + 4\times 0 + k}{\sqrt{3^2 + 4^2}} = 2$

$\therefore k = \pm 10$

So, equation of tangent is $3x + 4y \pm 10 = 0$

85. d

Given parabola can be written as

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

Hence vertex is (1, -1), which lies in IV quadrant.

86. d

D.rs. of line = 2 -1, 7 – 2, 3 – 2, = 1, 5, 1

d.r.s of line perpendicular to 2x – y + 3z = 0 are 2, - 1, 3,

so, $a_1a_2 + b_1b_2 + c_1c_2 = 1 \times 1 + 5 \times (-1) + 1 \times 3 = 0$

line and perpendicular to plane are at right angle which means the project is just the length of line.

$$\sqrt{(2-1) + (7-2)^2 + (3-2)^2} = 3\sqrt{3}$$

87. c

$$\lim_{x \to \infty} \frac{\sqrt{2x+1} - 3}{\sqrt{x+1} - 2}$$

$$\lim_{x \to \infty} \frac{\sqrt{x}}{\sqrt{x}} \frac{\sqrt{2 + \frac{1}{x}} - \frac{3}{\sqrt{x}}}{\sqrt{1 + \frac{1}{x}} - \frac{2}{\sqrt{x}}}$$

$\sqrt{2}$

88. c

89. d

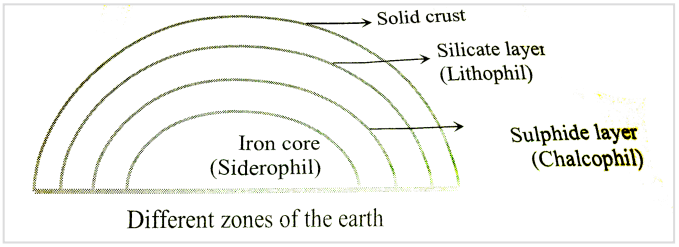
90. c

First organic compound synthesized in laboratory from its element is Acetic Acid.

91. c

$$3\,Cl_2 + 6\,NaOH \xrightarrow{(\text{hot and conc}\cdot)} 5\,NaCl + NaClO_3 + 3\,H_2O$$

92. b



Different zones of the earth

93. d

If m is atomic mass of M

$$\%\text{ of O in } M_2O_3 = \frac{48}{2m + 48} \times 100$$

$$100 - 53 = \frac{4800}{2m + 48}$$

$$m = 27$$

94. a

$w_{CaCO_3} = 3$ gm

$w_{MgCO_3} = 7$ gm

$$\frac{w}{E} + \frac{w}{E} = \frac{NV}{1000}$$

$$\frac{3}{50} + \frac{7}{42.15} = \frac{2 \times V}{1000}$$

$V = 113.03$ ml

95. c

$pKa = -\log Ka = -\log 1 \times 10^{-5} = 5$

$$\text{pH} = p\,\text{Ka} + \log \frac{[\text{salt}]}{[\text{acid}]} = 5 + \log \frac{0.2}{0.1} = 5.3$$

96. d

$\mathrm{N_3^- + 3\,e^- \longrightarrow N}$

$= 3 \times 96500$ C

$= 2.89 \times 10^5$ C

97. b

98. b

99. b

100. b