PRACTICE PAPER – XII

ANSWERS KEY

MATHEMATICS

1. C
2. B
3. B
4. B
5. A
6. D
7. D
8. C
9. C
10. B
11. A
12. B
13. C
14. D
15. D
16. A
17. C
18. B
19. A
20. B
21. A
22. B
23. D
24. C
25. A
26. B
27. D
28. C
29. D
30. D
31. A
32. C
33. D
34. B
35. B
36. A
37. C
38. A

39. A
40. B
41. C
42. B
43. D
44. C
45. C

PHYSICS

46. D
47. A
48. B
49. A
50. C
51. C
52. B
53. A
54. C
55. C
56. B
57. C
58. B
59. A
60. B
61. D
62. D
63. A
64. C
65. C
66. A
67. B
68. A
69. B
70. A
71. B
72. D
73. D
74. D
75. D
76. B
77. B
78. B
79. C
80. C

81. A
82. D
83. B
84. C
85. C

CHEMISTRY

86. A
87. C
88. D
89. C
90. C
91. A
92. D
93. B
94. B
95. D
96. D
97. C
98. C
99. D
100. A
101. B
102. D
103. B
104. A
105. A
106. D
107. D
108. C
109. C
110. B
111. C
112. B
113. A
114. C
115. A
116. C
117. C
118. D
119. D
120. A
121. A

122.	C
123.	A
124.	D
125.	C

LOGICAL REASONING

126.	D
127.	C
128.	A
129.	A
130.	D
131.	D
132.	D
133.	C
134.	C
135.	B

ENGLISH

136.	B
137.	C
138.	A
139.	A
140.	D
141.	A
142.	A
143.	D
144.	A
145.	A
146.	B
147.	C
148.	B
149.	D
150.	D

PRACTICE PAPER - XII

EXPLANATIONS

Sol 1.

Distance of (x, y) from y-axis (x = 0) is

$$is = \frac{|X|}{\sqrt{1^2 + 0^2}} = |X|$$

Sol 2.

If the required ratio is k : 1, then the dividing point i.e.

$\left(\frac{2k+1}{k+1}, \frac{7k+3}{k+1}\right)$ lies on the line 3x + y = 9, i.e. $3\left(\frac{2k+1}{k+1} + \frac{7k+3}{k+1}\right)$

Sol 3.

Since, A, B, C are in A.P., therefore

$$2B = A + C$$

$$\Rightarrow \quad 2B = 180^\circ - B$$

$$(\because A + B + C = 180^\circ)$$

$$\Rightarrow \quad B = 60^\circ$$

$$\Rightarrow \quad \cos B = \frac{1}{2}$$

$$\Rightarrow \frac{c^2 + a^2 - b^2}{2ac} = \frac{1}{2}$$

$$\Rightarrow \quad c^2 + a^2 - ac = b^2$$

Sol 4.

$r = \frac{\Delta}{s} = \frac{80cm^{\ 2}}{\frac{1}{2}(8)cm} = 20$ cm

Sol 5.

Distance of the given line from the centre (0, 0) of the circle is $\frac{|0+0-20|}{\sqrt{3^2+4^2}} = \frac{20}{5} = 4$ radius of the circle, therefore, he line is a tangent to the circle.

Sol 6.

Slope of a line parallel to y=axis is not defined as it makes an angle of 90° with +ve direction of x-axis and tan 90° is not defined.

Sol 7.

$\text{Sin}^4\boldsymbol{\theta} - 2\sin^2\boldsymbol{\theta} - 1 = 0$

$\Rightarrow \quad \sin^2\boldsymbol{\theta} = \frac{2 \pm \sqrt{4}+4}{2}$

$\Rightarrow \quad \sin^2\boldsymbol{\theta} = 1 \pm \sqrt{2}$

Which is not possible as $1 + \sqrt{2} > 1$ and $1 - \sqrt{2} < 0$. So, no value of $\boldsymbol{\theta}$ can satisfy the given equation.

Sol 8.

$\text{Cos}\,(2\sin^{-1} x) = \frac{1}{9}$

$\Rightarrow \quad 1 - 2\sin^2(\sin^{-1} x) = \frac{1}{9}$

$\Rightarrow \quad 1 - 2x^2 = \frac{1}{9}$

$\Rightarrow \quad x = \pm\frac{2}{3}$

Sol 9.

If the image of a point P in a line is p', then mid-point of [PP'] lies on the line I and the line PP' is perpendicular to the line I.

Sol 10.

$\tan^{-1}\frac{1}{7} + 2\tan^{-1}\frac{1}{3} = \tan^{-1}\frac{1}{7} + \tan^{-1}\left(\frac{2/3}{1-\frac{1}{9}}\right)$

$= \tan^{-1}\frac{1}{7} + \tan^{-1}\frac{3}{4}$

$= \tan^{-1}\left(\frac{\frac{1}{7}+\frac{3}{4}}{1-\frac{1}{7}-\frac{3}{4}}\right)$

Sol 11.

$\text{Cos}\,A = \frac{a^2 + c^2 - a^2}{2bc} \Rightarrow \quad \cos 60^\circ = \frac{9+c^2-16}{2 \times 3c}$

$\Rightarrow \quad \frac{1}{2} = \frac{c^2-7}{6c} \Rightarrow \quad c^2 - 3c - 7 = 0$

Sol 12.

The vertex of the given parabola is given by $y = 0$, $x + a = 0$, i.e. $(-a, 0)$.

Sol 13.

Slope of any line parallel to x-axis is, tan 0 =0.

Sol 14

bc $\cos^2\frac{A}{2}$ + ca $\cos^2\frac{B}{2}$ + ab $\cos^2\frac{C}{2}$

$= s(s - a) + s(s - b) + s(s - c)$

$= s(3s - (a + b + c)\}$

$= s\{3s - 2s\} = s^2$

Sol 15.

$a \cos A = b \cos B$

$\Rightarrow$ $k \sin A \cos A = k \sin B \cos B$

$\Rightarrow$ $\sin 2A = \sin 2B$

$\Rightarrow$ $2A = 2B$ or $2A = 180^\circ - 2B$

$\Rightarrow$ $A = B$ or $A + b = 90^\circ$

$\Rightarrow$ $A = B$ or $C = 90^\circ$

Sol 16.

Here, $f(\pi + x) = \sin^2 (\pi + x) + \tan(\pi + x) = f(x)$. therefore, f is periodic with period 1.

Sol 18.

As, $n^3 + (n + 1)^3$ is always a multiple of 9 (can be proved by induction), therefore $P \subset Q$.

Sol 19.

$\text{Log}_4 [\log_3 \{\log_2 (x))\}] = 1$

$\Rightarrow \log_3 \{\log_2 (x)\} = 4^1 = 4$

$\Rightarrow \log_2 (x) = 3^4$

$\Rightarrow x = 2^{3^4}$

Sol. 20.

Let y = cos (sin x), x = sin x,

$\therefore \frac{dy}{dx} = \frac{dy}{dx} / \frac{dz}{dx}$

$= \frac{-\sin(\sin x)\cos x}{\cos x}$

= - sin (sin x)

Sol 21.

Given, x sin (a + y) = sin y

$\Rightarrow$ $x = \frac{\sin y}{\sin(a+y)}$,

Differentiate both sides with respect to y.

Sol 22.

When $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, [c] = -2, -1, 0, or 1

$\therefore$ cos [x] with take values cos (-2), cos (1),

Cos (0) and cos 1

And here $R_f = \{1, \cos 1, \cos 2\}$

Sol 23. For D_f, $x \neq 0, (2 - x)x \geq 0$

$\Rightarrow$ $x \notin [0, 1]$ and $0 \leq x \leq 2$

$\Rightarrow$ $x \in [1, 2]$

Sol 24.

$F(x) = x^3$

$f'(x) = 3x_2 = 0$ when $x = 0$

Note that f′(x) does not change sign as we move from left and right through 0. So f has a point of inflection at 0.

Sol 25.

$$\lim_{x \to \frac{\pi}{4}} \frac{\sec x - \sqrt{2}}{x - \frac{\pi}{4}} = \lim_{x \to \frac{\pi}{4}} \frac{\sec x \tan x}{1} = \sec\frac{\pi}{4}\tan\frac{\pi}{4} = \sqrt{2}.$$

Sol 26.

In [1, 2], $x_2 < x^2 + 1$

⇒ $\sqrt{x^2} < \sqrt{x^2 + 1}$

⇒ $\frac{1}{\sqrt{x^2}} > \frac{1}{\sqrt{x^2} +1}$

⇒ $\frac{1}{x} > \frac{1}{\sqrt{x^2+1}}$

⇒ 1 < J.

Sol 27.

$\frac{d}{dx}$ (log (tan x)) = $\frac{1}{tan\ x}$ sec^2x

i.e. numberator is each differential of denominator.

Sol 28.

f' (x) = $\frac{-3}{(3x+1)^2}$

⇒ f' (0) = $\frac{-3}{1}$ = 3.

Sol 29.

y = sin^{-1} x, z = $cos^{-1} \sqrt{1 - x^2} = cos^{-1} (\sqrt{1 - sin^2 y})$

(∵ y = sin^{-1} x ⇒ x = sin y)

⇒ y = z

⇒ $\frac{dy}{dx}$ = 1.

Sol 31. $\int \left(e^{a \log^x} + e^x \log^x\right) dx = \int (e^{\log^{x^a}} + e^{xlog\ ax})$ dx

$(x^a + a^x)$ dx

$= \frac{x^{a+1}}{a+1} + \frac{a^x}{\log a}$

Sol 32.

Both $\frac{\vec{u}\ x\ \vec{v}}{|\ \vec{u}\ x\ \vec{v}|}$ and - $\frac{\vec{u}\ x\ \vec{v}}{|\ \vec{u}\ x\ \vec{v}|}$ are at right angle to $\vec{u}$ and $\vec{v}$.

Sol 33. $\overline{BA} \times \vec{r} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1+2 & 2+2 & 5+3 \\ 2 & 2 & 5 \end{vmatrix}$

$= 4\,\hat{\jmath} + 6\hat{\jmath} + 2\lambda\hat{k}$

$\Rightarrow 4 - 8 = 2\,\lambda$

$\Rightarrow \lambda = -2$ (equating components along z - axis).

Sol 34.

Put $x^{1/3} = t$, i.e. $x = t^3$

Sol 35.

Required area is above the curve = x^2 and below the curve $y = \sqrt{x}$.

The two curves meet in points (0, 0) and (1, 1).

∴ Required area $= \int_0^1 (\sqrt{x} - x^2)dx$.

Sol 36.

$(\vec{A} + \vec{B}) \,.\, \vec{c} = 0$

$\Rightarrow (1 - t)\,\hat{\imath} + (2 + 2t)\,\hat{\jmath} + (3 + t)\,\hat{k} . (3\,\hat{\imath} + \hat{\jmath}) = 0$

$\Rightarrow (1 - t).\,3 + (2\ 2t).\,1 + (3 + t)\,0 = 0$

$\Rightarrow t = 5$

Sol 37.

Required area = $|\vec{a} \times \vec{b}|$

Sol 38.

$\int (1 - \cos x)\,\text{cosec}^2\,dx = \int (\text{cosec}^2 x - \cot\ \times)\,dx$

$= (-\cot x + \text{cosec}\,x + c)$

$= \frac{1 - \cot x}{\sin x} + c = \tan\frac{x}{2} + c$

Sol 39.

Given expression = $6\,[\vec{a}\vec{b}\vec{c}] + 6\,[\vec{b}\vec{c}\vec{a}]$

$+ 12\,[\vec{c}\vec{b}\vec{a}] \qquad = 12\,[\vec{a}\vec{b}\vec{c}] - 12\,[\vec{a}\vec{b}\vec{c}] = 0$

Sol 41.

Since, the product of a non zero rational and an irrational,

$\therefore$ x, y $\in$ Q

$\Rightarrow$ x = 0

Sol 43.

$\Delta = 0^2 - 4.\ a.\ 1 = -4a < 0$,

Hence the roots of the given equation or non-real.

Sol 44.

$x^2 = (-\cos\boldsymbol{\theta})^2 - 4$

$= \cos 2\boldsymbol{\theta} - 4 \leq -3$

$(\because \cos^2 \boldsymbol{\theta} \leq \forall\ \boldsymbol{\theta})$

Hence, the roots of the given equation are non-real

Sol 45.

$\frac{(1+i)^n}{(1-i)^{n-2}} = \frac{(1+i)^n}{(1-i)} \frac{1}{(1-i)^{-2}}$

$= i^n (-2i) = -2i^{n+1}$

$= (-2)\ i^{n-I}\ i^2$

$= 2i^{n-1}$

Sol 46.

The unit of magnetic field is weber/(metre)^2. In S.I. system, the unit for magnetic field is called tesla.

Mathematically, 1 tesla = weber / (metre)^2

Sol 47.

Planck's constant, H $= \frac{\text{Energy in each photon}}{\text{Frequency of radiation}}$

$\therefore$ Dimensions of Planck's constant

$= \frac{\text{Dimensions of energy}}{\text{Dimensions of frequency}} = \frac{[ML^2T^{-2}]}{[M^\circ L^\circ T^{-1}]} = [ML^2T^{-1}]$

Sol 48.

Given, speed of boat in still water, v_b = 5 km/hr; width of the river = 1 km

Time taken to cross the river along the shortest possible path = 15 min = $\frac{1}{4}$ hour.

∴ Resultant velocity of the boat = 4 km/hr.

∴Velocity of river = $\sqrt{(5)^2 - (4)^2}$

$= \sqrt{25 - 16} = 3$ km/hr.

Sol 49.

In both the cases, the initial velocity in the vertical downward direction is zero. Therefore they will hit the ground simultaneously.

Sol 50.

Given, Equation of displacement,

$X = \boldsymbol{\alpha}t^3 + \boldsymbol{\beta}t^2 + \boldsymbol{\gamma}t + \boldsymbol{\delta}$.

Velocity, $v = \frac{dx}{dt} = \frac{d}{dt}(\boldsymbol{\alpha}t3 + \boldsymbol{\beta}t^2 + \boldsymbol{\gamma}t + \boldsymbol{\delta})$

$= 3\boldsymbol{\alpha}t^2 + 2\boldsymbol{\beta}t + \boldsymbol{\gamma}$.

When t = 0, initial velocity

$v_\circ = 3(0) + 2(0) + \boldsymbol{\gamma} = \boldsymbol{\gamma}$.

Similarly, acceleration, $= \frac{dv}{dt} = \frac{d}{dt}$

$(3\boldsymbol{\alpha}t^2 + 2\boldsymbol{\beta}t + \boldsymbol{\gamma}) = 6\boldsymbol{\alpha}t + 2\boldsymbol{\beta}$.

When t = 0, then $\boldsymbol{\alpha}_\circ = 6\boldsymbol{\alpha}(0) + 2\boldsymbol{\beta} = 2\boldsymbol{\beta}$.

Thus ratio of initial acceleration to initial velocity

$(\frac{a_\circ}{v_\circ}) = \frac{2\beta}{\gamma} \propto \frac{\beta}{\gamma}$.

Sol 51.

Given, Speed of cyclist, v = 4.9 m/s, and radius of circular path, r = 4 m.

Coefficient of friction between the cycle tyres and road

$\boldsymbol{\mu} = \frac{v^2}{rg} = \frac{(4.9)^2}{4 \times 9.8} = 0.61$.

Sol 52.

Given, mass of body, m = 5 kg;

Radius of circle, r = 1 m and angular velocity

ω = 2 rad/sec.

Centripetal force = $\frac{mv^2}{r} = m\omega^2 r$ . . . . where $v = \omega r$

= 5 x (b)^2 x 1 = 20 N

Sol 53.

Given, mass of bullet, m = 25 g = 0.025 kg; Initial velocity of bullet, u = 200 m/s;

Final velocity, v = 0

And distance, s = 5 cm = 0.05m.

We know, $v^2 = u^2 - 2as$

Or $0 = (200)^2 - 2a \times 0.05$

Or acceleration, $a = \frac{(200)^2}{2 \times 0.05} = 400000$ m/sec^2.

∴ Average resistance offered by the target,

F = m.a

= 0.025 × 400000

= 10000 N

= 10 kN.

Sol 54.

Power, $P = \frac{Work\ done}{Time\ taken}$

$= \frac{F.s}{t} = \frac{mas}{1}$

$= \frac{m}{t} \times \frac{v}{t} \times s = \frac{m}{t^2} \times v \times s$

$= \frac{m}{t^2} \times \frac{s}{t} \times s = \frac{ms^2}{t^3}$

Since P and m are constant, therefore $s^2 \propto t^3$ or $s \propto t^{3/2}$. .....(Where s = Distance moved by the body in time t)

Sol 55.

Given, Initial radius of earth, $R_1 = R$ and final radius of earth,

$R_2 = R\,(1 - 0.01)$

$= 0.99\,R.$

Acceleration due to gravity. $g = \frac{GM}{R^2} \propto \frac{1}{R^2}$.

$\therefore \frac{g_1}{g_2} = (\frac{R_2}{R_1})^2 = (\frac{0.99R}{R})^2 = 0.098$

Or $g_2 = \frac{g_1}{0.98} = 1.02\, g_1 = 2\%.$

Positive sig indicates increase.

Sol 56.

Acceleration due to gravity at the equator,

$G' = g - R\omega^2.$

Thus if the spinning speed or angular velocity (ω) of earth increases, then value of g′ will decrease. Therefore weight of the body will decrease.

Sol 57.

Energy required to raise the satellite to a height 'h'

$E_1 = GMm\left[\frac{1}{R+h} - \frac{1}{R}\right]$

$= \frac{GMmh}{R\,(R+h)} = \frac{gR^2mh}{R(R+h)}$

$= \frac{gmRh}{R+h}$ .... (i)

Where $GM = gR^2$ also velocity required to put the satellite into the orbit.

$v = \sqrt{\frac{gR^2}{R+h}}.$

Thus kinetic energy required to put the satellite into the orbit

$E_2 = \frac{1}{2}mv^2 = \frac{1}{2}m \times \frac{gR^2}{R+h}$ ...(ii)

$\frac{E_1}{E_2} = \frac{\frac{gmRh}{R+h}}{\frac{1}{2}mx\frac{gR^2}{R+h}} = \frac{2h}{R}$ or $E_1 : E_2 = 2h : R.$

Sol 58.

Given, Angular velocity of circular disc = **ω**. As the man walks towards the centre of the disc, then its moment of inertia decreases. As a result of this, angular velocity of the disc will increase.

Sol 59.

Ratio of specific heats at constant pressure and constant volume

$\boldsymbol{\gamma} = 1 + \frac{2}{n}$

Or $\boldsymbol{\gamma} - 1 = \frac{2}{n}$

Or Degree of freedom, $n = \frac{2}{\gamma - 1}$

Sol 60.

Given: Acceleration of lift, $a = \frac{g}{3}$

And, initial time-period of pendulum, $T_1 = T$.

Effective acceleration when it is ascending,

$G_2 = g - a = -\frac{g}{3} = \frac{2}{3}$

Time-period of simple pendulum.

$$T = 2\boldsymbol{\pi}\sqrt{\frac{1}{g}} \propto \sqrt{\frac{1}{g}}.$$

$$\therefore \quad \frac{T_1}{T_2} = \sqrt{\frac{g_2}{g_1}} = \sqrt{\frac{\frac{2}{3}g}{g}} = \sqrt{\frac{2}{3}}$$

Or $T_2 = \left(\sqrt{\frac{3}{2}}\right) T_1 = \left(\sqrt{\frac{3}{2}}\right) T$

Sol 61.

Given, equation of sound wave

$$Y = 0.00515 \sin(62.4 \times + 316\, t).$$

The standard equation of the wave is

$$Y = a \sin 2\boldsymbol{\pi}\left[\frac{x}{\lambda} + \frac{t}{T}\right]$$

Comparing the given equation with the standard equation, we get

$\frac{2\pi}{\lambda} = 62.4$

∴ Wavelength of the wave,

$\boldsymbol{\lambda} = \frac{2\pi}{62.4}$ 0.1 unit.

<u>Sol 62</u>.

Given, length of pendulum = 1 Maximum angular displacement = **θ**

and mass of bob = m

Height of the bob at maximum angular displacement, h = l –l cos **θ** = (1 – cos **θ**). Also at the end of displacement, Kinetic energy of the bob = potential energy of the bob = mgh = mgl (1 – cos **θ**).

<u>Sol 63</u>.

Given, equation of standing wave is

Y = a sin(100 t).cos(0.01 x)

We know that the standard equation of standing wave is

Y = a sin(**ω**t). Cos(kx)

Comparing the given equation with standard equation, we get

ω = 100 and k = 0.01

Velocity of standing wave,

$V = \boldsymbol{\lambda} v = \frac{2\pi}{k} \times \frac{\omega}{2\pi}$

.....(where $\boldsymbol{\lambda} = \frac{2\pi}{k}$ and $v = \frac{\omega}{2\pi}$

$= \frac{\omega}{k} = \frac{100}{0.01}$ 10^4 m/s.

<u>Sol 64</u>.

Given, equations of simple harmonic motions are

$Y1 = \sin\left(\omega t + \frac{\pi}{3}\right)$ and y2 = sin(**ω**t)

The standard equation of a simple harmonic

Motion is

Y = a sin(**ω**t + **ϕ**)

Comparing the given equations with the standard equation, we get

A1 = 1; a2 = 1 and $\phi = \frac{\pi}{3} = 60°$

Now, amplitude due to superposition of simple harmonic motions,

$$A = \sqrt{a_1^2 + a_2^2 + 2a_1a_2\, cos\phi}$$

$$= \sqrt{(1)^2 + (1)^2 + 2 \times 1 \times 1 \times cos60°}$$

$$= \sqrt{1 + 1(2 \times 0.5)}$$

$$= \sqrt{3}$$

Sol 65.

Given, time required for maximum displacement, t = 0.17 sec.

Time period of sinusoidal wave,

T = 4t = 4 × 0.17 = 0.68 sec

∴ Frequency, $f = \frac{1}{T} = \frac{1}{0.68} = 1.47$ Hz.

Sol 66.

Current flows in the direction of flow of positive charge. Similarly electric field exists in the direction of flow of positive charge. Therefore electric field exists in the direction of the flow of current.

Sol 67.

Given, radius of each small drop = r;

Potential on each small drop = V

And, radius of big drop = R.

Since volume of two small drops remains same after coalesce to form one big drop,

Therefore: $2 \times \frac{4}{3}\pi r^3 = \frac{4}{3}$

Or $R = (2)^{1/3}$ r

Potential on each small drop,

$$V = \frac{1}{4\pi\varepsilon_\circ}\frac{q}{r}$$

Where, q = Charge on each small drop

Also, since charge on big drop is double the charge on each small drop, therefore potential on big drop

$= \frac{1}{4\pi\varepsilon_\circ}\frac{2q}{R} = \frac{1}{4\pi\varepsilon_\circ}\frac{2q}{(2)^{1/3}r}$

$= (b)^{2/3}\frac{1}{4\pi\varepsilon_\circ}\frac{q}{r} = (b)^{2/3}$

Sol 68.

The energy stored in a capacitor is in the form of electrostatic energy. It is actually stored between the plates of the capacitor.

Sol 69.

Given, capacitances C_1, C_3, C_4, C_5 = 4 **μ**f

Each and capacitances C_2 = 10 **μ**F.

We know if a battery is connected across A and B, the points b and d are at the same potential (since $C_1 = C_4 = C_3 = C_5$ = 4 **μ**f).

Therefore no charge flow through C_2. Thus it has no role in the circuit.

Also, since C_1 and C_5 are in series, therefore relation for their equivalent capacitance is

$C' = \frac{C_1 \times C_2}{C_1 + C_5} = \frac{4\times 4}{4+4}$

Similarly, C_4 and C_3 are in series, hence their equivalent capacitance,

$C'' = \frac{C_3 \times C_4}{C_3 + C_4} = \frac{4\times 4}{4+4} = 2$**μ**f

Now C' and C'' are in parallel, therefore effective capacitance between A and B

= C' + C'' = 2 + 2 = 4 **μ**F.

Sol 70.

Given, power of bulb, P = 100 W Voltage of bulb, V = 200 V and supply

Voltage, Vs = 160 V.

Resistance of bulb, $R = \frac{V^2}{P} = \frac{(200)^2}{100} = 400\ \Omega$.

Therefore actual power consumption, $P = \frac{(V_S)^2}{R} = \frac{(160)^2}{400} = 64$ W

Sol 71.

Voltmeter is a device used to measure potential difference and is connected in parallel in the circuit. Since minimum current passes through is, therefore we must connect a high resistance in series with the galvanometer.

Sol 72.

Given, resistance of galvanometer, G = 100 Ω;

Maximum current across the galvanometer,

$I_g = 0.01$ A

And current range in ammeter, I = 10 A

Shunt resistance that should be connected in parallel to convert the galvanometer into an ammeter

$S = \left(\frac{I_g}{I - I_g}\right) \times G = \left(\frac{0.01}{10 - 0.01}\right) \times 100 = 0.1\Omega.$

Sol 73.

In an open circuit no current is drawn from the cell. And the potential difference between two electrodes of a galvanic cell, in as open circuit, is called electromotive force of the cell.

Sol 74.

Given, magnetic field at centre of circular loop,

$B_\circ = 0.50 \times 10^{-4}$ T;

Radius of circular loop, r = 12 cm = 0.12 m

And distance of the point from centre, x = 5

Cm = 0.05 m.

Magnetic field at the centre of a current-carrying circular loop,

$B_\circ = \frac{\mu_\circ i}{2r}$ ..(i)

Also, magnetic field at an axial point of a circular loop

$B = \frac{\mu_\circ i r^2}{2(r^2 + x^2)^{3/2}}$ ...(ii)

Dividing equation (ii) by equation (i), we get

$\frac{B}{B_\circ} = \frac{r^3}{(r^2 + x^2)^{3/2}}$

Or $B = B_\circ \times \frac{r^3}{(r^2+x^2)^{3/2}}$

$= 0.50 \times 10^{-4} \times \frac{(0.12)^3}{[(0.12)^2+(0.05)^2]^{3/2}}$

$= \frac{0.50\times10^{-4}\times(0.12)^3}{[0.0169]^{3/2}}$

$= 0.50 \times 10^{-4} \times \left(\frac{0.12}{0.13}\right)^3$

$= 3.9 \times 10^{-5}$ T

Sol 75.

Given, e.m.f. = 15 volt; Inductance, L = 5 H

And resistance, R = 10 Ω.

Time constant of LR-circuit,

$\boldsymbol{\lambda} = \frac{L}{R} = \frac{5}{10} = \frac{1}{2}$ sec.

Current in LR-circuit,

$I = I_\circ (1 - e\text{-}t/\boldsymbol{\lambda}) = 10(1 - e\text{-}2t)$.

∴ current at t = ∞, $I\infty = I_\circ$

Similarly current at t = 1 sec, $I1 = I_\circ (1 - e\text{-}2)$.

Thus ratio of currents $= \left(\frac{I_\infty}{I_1}\right) = \frac{I_\circ}{I_\circ(1-e^{-2})}$

$= \frac{1}{1-e^2} = \frac{e^2}{e^2-1}$.

Sol 76.

Given, magnetic moment of first magent,

$M_1 = M$;

Magnetic moment of second magent,

$M_2 = 2M$;

Time-period when the magnets are placed with identical poles in same direction = T_1

And time-period when the magnets are placed with opposite poles are together = T_2.

In a vibration magnetometer, time-period of vibration when identical poles are in the same direction,

$$T_1 = 2\pi\sqrt{\frac{K}{(M_1+M_2)H}}$$

$$= 2\pi\sqrt{\frac{K}{(M+2M)H}}$$

$$= 2\pi\sqrt{\frac{K}{3MH}}.$$

Similarly, time-period of vibration when opposite poles are together

$$T_2 = 2\pi\sqrt{\frac{K}{(M_2-M_1)H}}$$

$$= 2\pi\sqrt{\frac{K}{(2M-M)H}}$$

$$= 2\pi\sqrt{\frac{K}{MH}}.$$

Thus $T_2 > T_1$ ...(where K is a constant)

Sol 77.

The range of wavelengths of X-rays in 10^{-10} to 10^{-8} m, ratio waves greater than 10^{-1}, UV rays 10^{-8} to 4×10^{-7} m and IR rays 7.8×10^{-7} to 10^{-3} m.

Therefore radio waves have the maximum wavelength.

Sol 78.

Given, angle of refration, A = 60 , and refractive index, $\mu = 1.5$.

When a ray of light is to emerge grazingly at the second surface of the prism, the angle of incidence at first surface should be limiting angle of incidence.

Also relation for the limiting angle of incidence

(i)lim is

$\sin (i)_{lim} = \sin A. \sqrt{\mu^2 - 1}$-cos A

$= \sin 60° \sqrt{(1.5)^2 - 1}$- cos 60°

$= \frac{\sqrt{3}}{2} \times 1.118 - \frac{1}{2} = 0.4682$ or $(i)_{lim} = 28°$

Sol 79.

Given, separation between marks = d’

Distance between paper and observer,

D = 50 m;

Aperture of eye-lens, a = 2 mm = 2×10^{-3} m

And mean wavelength of light,

$\lambda = 5000$ Å $= 5000 \times 10^{-10}$ m

The least distance between the marks to be seen separate,

$D = \frac{1.22\lambda}{a} \times D$

$= \frac{1.22 \times (5000 \times 10^{-10})}{2 \times 10^{-3}} \times 50$

$= 15.25 \times 10^{-3}$ m = 1.525 cm.

Sol 80.

Two mirrors on adjacent walls will give three images. And one mirror on the roof will give one image of objective and three images of the earlier formed images. Therefore total images will be 7.

Sol 81.

Given, focal length of the convex lens,

F1 = + 40 cm

And focal length of the concave lens,

F2 = - 25 cm

(minus sign due to concave).

Relation for the focal length of the combination (f) is

$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

$= \frac{1}{40} - \frac{1}{25} = -\frac{3}{200}$

Or $f = -\frac{200}{3} = -66.7$ cm.

∴ Power of the spectacles, $P = \frac{100}{f} = \frac{100}{-66.7} = -1.5$ D.

Sol 82.

The velocity of an electron in an orbit of an atom is inversely proportional to the radius of orbit. Therefore velocity of electron in the innermost orbit of an atom is the highest.

Sol 83.

In Balmer series, all the lines correspond to tranition of electrons from higher excited state to the orbit having n = 2 i.e. $n_1 = 2$, $n_2 = 3$,

4, 5 ...

And maximum wavelength of Balmer series

$(n_2 = 3)$ $\boldsymbol{\lambda}_{max} = 6564$ Å.

And minimum wavelength of Balmer series

$(n_2 = \infty)\boldsymbol{\lambda}_{min} = 3646$ Å.

The value of maximum and minimum wavelengths indicate that the series lie in the visible region.

Sol 84.

Given, original number of atoms, N = 2828

Half-life, $(t)_{1/2} = 2$ days and time of decay,

T = 1 day.

Number of half-lives, $n = \frac{t}{(t)_{1/2}} = \frac{1}{2}$

Number of nuclei left after one day

$= \left(\frac{1}{2}\right)^n \times$ Original number of atoms

$= \left(\frac{1}{2}\right)^{1/2} \times 2828 = 2000$

Sol 85.

Heavy water is rich in protons. When fast moving neutrons have head on collosion with the protons of heavy water, they lose their energy and get slow down.

Sol 86.

For a first ordr reaction,

$$\text{Rate constant, k} \propto - \frac{1}{Time\ taken}$$

Since the unit of time is sec, therefore the unit of rate constant is sec^{-1}.

Sol 87.

Given, Charge of an electron,

$e = - 1.6 \times 10^{-10}$ C

Magnitude of charge of an electron is equal to that of a proton.

Since Li^+ has one proton, therefore the value of free charge on Li^+ ion is 1.6×10^{-10} C.

Sol 88.

Given, element with atomic number = 7

The electrons of element with of atomic no.

7 are arranged in shell K, L as 2, 5.

Also, the electrons present in the outermost shell of an atom are known as valence electrons and it decides valency of the atom.

Since the outer shell (L) contains 5 electrons, therefore its valency is 5.

Sol 89.

$$CaCO_3 \rightarrow CaO + CO_2$$

(Calciumacarbonate) (Calcumoxide) (Carbondioxide)

Also, molecular weight of $CaCO_3$

$= 40 + 12 + (3 \times 16) = 100$.

Therefore 100 g of $CaCO_3$ will give 56 g of CaO.

Sol 90.

A positron is the positive counterpart of an electron.

And its mas is 9.1×10^{-31} kg. i.e.,

Equivalent to mass of an electron.

Sol 91.

Given, volume of water sample, V1 = 100 ml;

Volume of HCI solution, V_2 = 5 ml;

Normality of HCI solution, N_2 = 0.09 N

And molecular weight of $NaCO_3$ = 106.

Normality or hardness of the water sample,

$$N1 = \frac{N_2 \times V_2}{V_1} = \frac{0.09 \times 5}{100}$$

$= 4.5 \times 10^{-3} = 4.5 \times 10^{-3} \times 1000$

= 4.50 mg-eq/ltr.

Sol 92.

The shape of iodine heptafluoride (IF_7) molecules is pentagonal bipyrmidal and it has sp^3d^3-hybridisation with bond angle 72° 90'.

Sol 93.

Given, rate of diffusion of CH_4 (RCH_4) = 2 ×

Rate of diffusion of the gas X (R_X)

From Graham's law of diffusion that the rate of diffusion of a gas ® is inversely proportional to square root of its molecular mass (M).

Also, molecular mass of CH_4 (MCH_4)

= 12 + (1× 4) = 1c.

∴ $$\frac{R_{CH_4}}{R_X} = \sqrt{\frac{M_X}{M_{CH_4}}}$$

Or $$\frac{2}{1} = \sqrt{\frac{M_X}{16}} = \sqrt{\frac{M_X}{4}}$$

Or $$\sqrt{M_X} = 4 \times 2 = 8$$

Or M_X = 64.

Sol 94.

IA and IIA group metals have high oxidationpotential due to which their chemical reduction is not possible. Therefore they ae extracted by electrolytic reduction.

Sol 95.

Element having atomic number 56 has the electronic configuration [Xe] $6S^2$. Thus it is placed in the 6^{th} period of II A group. And the element is Barium (Ba) .

Also, the II A group elements are known as alkaline earth metals. Therefore barium (Ba) belongs to alkaline earth metal.

Sol 96.

Given, azimuthal quantum number (i) = 3.

For a give value of I, the values of magnetic quantum number (m) are – I, 0, + I.

Since the value of I is equal to 3, therefore the values of m will be 0, $\pm$ 1, $\pm$2, $\pm$3.

Sol 97.

The alicyclic compounds are those cyclic carbon compounds which do not possess a benzene ring with its system of conjugate double bonds and have aliphatic characteristic. Since cyclohexane has these characteristic, therefore it is an alicyclic compound.

Sol 98.

Nitrate ion NO_3^- has resonating structure as all the three nitrogen-oxygen bonds are indentical.

And charge on each oxygen atoms $= -\frac{1}{3}$.

Therefore resonance hybrid of nitrate ion

(NO_3^-) is as shown in option '3;.

Sol 99.

The homologue of a compound is differs by

CH_2 with its molecular formula.

Since the given compound is ethylene

(C_2H_2), therefore its homologue is

$$C_2H_2 + CH_2 = C_3H_4.$$

<u>Sol 100</u>.

In liquid state, water molecules contain two hydrogen bonds, while in solid state water is ice an it contains 4 hydrogen bonds in its one molecule. This happens due to spatial arrangement of atoms of liquid water and solid water viz ice.

<u>Sol 101</u>.

Graphite is the only substance among the given molecules, which has free electrons. That is why, it shows electrical conduction.

<u>Sol 102</u>.

The rate of a chemical reaction is a function of time (t). Also when the concentration or pressure during a chemical reaction changes, the rate of chemical reaction also changes.

<u>Sol 103</u>.

Given, interatomic distance in hydrogen (H_2)

Molecule, $I_{H_2} = 74$ Pm

And interatomic distance in chlorine (CI_2)

Molecule, $I_{C_2} = 198$ Pm

For atoms linked by one **π**-bond, covalent radius

$$r = \frac{Interatomic\ distance}{2}$$

∴ Covalent radius of hydrogen,

$$r_H = \frac{I_{H_2}}{2} = \frac{74}{2} = 37 \text{ Pm}$$

and covalent radius of chlorine,

$$r_{CI} = \frac{I_{CI_2}}{2} = \frac{198}{2} = 99 \text{ Pm.}$$

Also, $H_2(g) + CI(g) \rightarrow 2HCI(g)$.

Therefore bond length of HCI molecule,

$$L_{HCI} = r_H + r_{CI} = 37 + 99 = 136 \text{ Pm}$$

Sol 104.

Manganese ($Mn^{2+)}$ ion contains 23 electrons. Therefore its electronic configuration will be $[Ar]^{18}3d^54s^0$.

Thus the electronic configuration of manganese (Mn2+) ion in its ground state is $3d^5\ 4s^0$.

Sol 105.

In ethylene ($C_2\ H_2$), carbon atom is ap^0 hybridised. And bond angle between two carbon atoms is 120°. Therefore its molecular shape is square planar.

The functional isomers have the same molecular formula but different functional group. The functional isomer of ethanol is dimethyl ether.

Sol 107.

First carbon atom has two **π**-bonds and it is sp-hybridised. And second carbon atom has one **π**-bond and it is sp2-hybridised. Therefore bybridisation of carbons of C – C single bond of HC = C – CH = CH_2 is sp – sp_2.

Sol 108.

In an atom, the protons are positively charged particles. Since the protons are concetratd at the nucleus, therefore the positive charge of an atom is concentrated at the nucleus.

Sol. 109

From the Faraday's first law of electrolysis the ions produced during electrolysis of an electrolyte is directly proportional to the quantity of electricity passed.

Sol 110.

In graphite, the carbon atoms is sp^2-hybridized and each carbon atom is joined to three other carbon atoms by covalent bond and forms flat hexagonal ring.

Sol 111.

Carborundum is silicon carbide (SiC). It is used as abrasive for polishing metallic surface.

Sol 112.

Nitrous oxide is poisonous in nature. When it is inhaled in small quantities, it produces hystericallaugher. That is why, nitrous oxide is known as a laughing gas.

Sol 113.

$$ZnO + BaO \xrightarrow{1100C} BaZnO_2$$

(zinc oxide) (Barium oxide) (Barium Zincate)

Thus in this reaction, the compound produced is barium zincate ($BaZnO_2$).

Sol 114.

Given, Standard potential of Mg,

$$E^{\circ}_{Mg} = -2.37\ V$$

And standard potential of Cu, $E^{\circ}_{Cu} = +0.34$ V.

e.m.f. of the cell = $E_{Cu} - E_{Mg}$

$$= 0.34 - (-2.37) = 2.71\ V.$$

Sol 115.

$$2ZnS + 3O2 \rightarrow 2ZnO + 2SO2 \quad ...(i)$$

(Zinc Blende) (Oxygen) (Zinc oxide) (Sulphur dioxide)

$$ZnO + C \rightarrow Zn + CO \quad ...(ii)$$

And(Zinc Oxide) (Carbon) (Zinc) (Carbon monoxide)

Thus in the metallurgy of zinc, the zinc oxide

(ZnO) obtained from roasting, when smelted with carbon C, it gives zinc (Zn) and evolved carbon monoxide (CO).

Therefore zinc oxide is removed by the process of smelting

Sol 116.

$$C_2H_5OH \xrightarrow[100-110^{\circ}C]{Conc.H_2SO_4} C_2H_5HSO_4$$

(Ethanol Excess) (Ethyl hydrogen sulphate)

$C_2H_5OH \xrightarrow{140°C}$ $(C_2H_5)_2O$ + H_2SO_4

(Ethoxy ethane) (Sulphuric acid)

Thus in this reaction, ethoxy ethane

[$(C_2H_5)_2O$] is obtained.

Sol 117.

2Cu + h2O + CO2 → CuCO3. Cu(OH)2

(Copper) (water) (Carbon Dioxide) (Copper carbonateCopper hydroxide)

Thus in this reaction copper carbonate (CuCO3) and copper hybroxide [Cu(OH)2] are formed which provide green powdery/pasty coating.

Sol 118.

Diphenyl carbonium (C_6H_5 CH-C_6H_5)

Ion has maximum number of resonating structures. Therefore it is the most stable carbonium ion.

Sol 119.

$4Na + O2 \xrightarrow{\Delta H} 2Na2O.$

(Sodium) (oxygen) (Sodium monoxide)

And

$2Na + O_2 \xrightarrow{\Delta H} Na_2O_2$

(Sodium) (Oxygen) (Sodium peroxide)

Thus in these reaction 4 moles of sodium forms sodium monoxide (Na_2O) while 2 mole of sodium forms sodium peroxide (Na_2O_2).

Sol 120.

Starch gives a blue coloured complex with iodine and this colour serves as the analytical test for iodine. This reaction involves the insertion of iodine molecules in the channel provided by the water soluble portion of starch where they are held by Van der Waal's forces. Therefore starch is used as a indicator in the titration of iodine against sodium thiosulphate.

<u>Sol 121</u>.

Bronsted base strength can be estimated from effective charge on oxygen. The effective charge of oxygen on ClO^- , $ClO2^-$,

$ClO3^-$ and $ClO4^-$ are – 1, $-\frac{1}{2}, -\frac{1}{3}$ and $-\frac{1}{4}$

Respectively, Also, greater the effective charge, lower will be the stability and greater will the base strength. Since ClO^- has greater effective charge, therefore it is the strongest Bronsted base.

<u>Sol 122</u>.

Given: Complex ion $[Co^{III}(NH_3)_5Cl]^X$.

Let x be the oxidation number of the given complex ion.

Oxidation numbers of Co, N, H and Cl are +3, -3, + 1, respectively.

∴ Charge (x) = 3 + [5(- 3 + 3(+ 1)

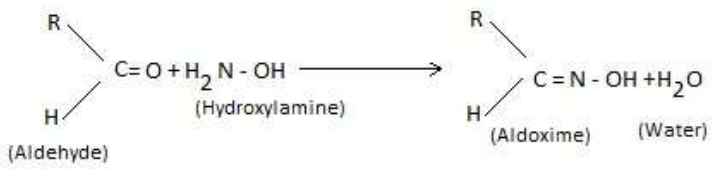
+ (- 1)}] + 1 = 2.

Thus complex salt would be $[Co^{III} (NH_3)_5]Cl_2$

And it can be prepared by the combination of

$[Co^{III}(NH_3)_5 Cl]^X$ with $2Cl^-$.

<u>Sol 123</u>.



Thus in this reaction aldoxime is given out.

<u>Sol 124</u>.

Given, $_4Be + {_2H^4} \rightarrow {_6C1^2} + {_0n^1}$.

Let mass no. of Be be X.

$$X + 4 = 12 + 1.$$

∴ $X + 4 – 12 – 1 = 0$

Or $X – 9 = 0$

Or X = 9

Thus mass number of beryllium (Be) be 9.

Sol 125.

When aniline is warmed with chloroform and an alcoholic solution of potassium bydroxide (KOH) it forms phenyl isocyanide, which gives very unpleaseant' smell. This reaction is calld carbylamines reaction.

Sol 128.

Given, series 2, 6, 12, 20 ……….

Difference of the given numbers are in increasing order as :

6 – 2 = 4, 12 – 6 = 6, 20 – 12 = 8.

Therefore 30 will come next to complete the series (i.e, 30 – 20 = 10).

Sol 129.

Given, series 0, ……….., 8, 27, 64, 125m

The given numbers are the cubes of the number in increasing order as:

(0)3 = 0, (a)3 = 1, (b)3 = 8, (c)3 = 27, (d)3 = 64

And (5)3 = 125.

Therefore 1 will com to complete the series.

Sol 130.

Given, alphabetic series bab_b_b_ _ abb.

The set of four given alphabets, the alphabets b, a, b, b are sequentially placed to complete the series.

Therefore the series will be babbbabbbabb.

Sol 131.

Given, Word 'SUPERIMPOSABLE'.

The words 'POSSIBLE, REPOSURE and SPIRE can b e formed from the given word 'SUPERIMPOSABLE'. But the alphabet 'T' of the word REPTILE is not present in SUPEIMPOSABLE'. Therefore it cannot be formed from the letters in given word.

Sol 132.

Given, code of 'STEADY' = 931785 and code of 'ENTRY' = 12345.

From the given codes, that the value of

S = 9, T = 3, 'E = 1, D = 8, Y = 5, N = 2 and R = 4.

Therefore code of the word SEDATE = 918731.

Sol 133.

Given, $\sqrt{\frac{4}{3} - \sqrt{\frac{3}{4}}} = \frac{2}{\sqrt{3}} - \frac{\sqrt{3}}{2}$

$$= \frac{(2\times2)-(\sqrt{3}\times\sqrt{3})}{2\sqrt{3}}$$

$$= \frac{4-3}{2\sqrt{3}}$$

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

Sol 134.

Given, $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = \text{a} + \text{b}\sqrt{3}$.

Now, $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = \frac{5+2\sqrt{2}}{7+4\sqrt{3}} \times \frac{7-4\sqrt{\ }3}{7-4\sqrt{3}}$

$$= \frac{35-20\sqrt{3}+14\sqrt{3}-24}{(7)^2-(4\sqrt{3})^2}$$

$$= \frac{11-6\sqrt{3}}{49-48}$$

Or $\quad\quad$ $\text{a} + \text{b}\sqrt{3} = 11 - 6\sqrt{3}$

Comparing both sides, we get

A = 11 and b = -6

Sol 135.

Given, Sum of three consecutive odd numbers = 57.

Let the numbers be x, (x + 2) and (x + 4).

Sum of numbers = x + (x + 2) + (x + 4) = 57

Or $\quad\quad$ 3x + 6 = 57

Or $3x = 51$ or $x = 17$

Thus the numbers are 17, 19,21. And the middle number = 19.