## ANSWER KEY (AIPMT-1998)

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| Ques. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans | 2 | 4 | 4 | 2 | 3 | 3 | 1 | 3 | 4 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 3 |
| Ques. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Ans | 2 | 4 | 2 | 2 | 2 | 1 | 1 | 3 | 4 | 2 | 3 | 4 | 2 | 1 | 1 | 4 | 1 | 1 | 3 | 2 |
| Ques. | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| Ans | 1 | 1 | 3 | 3 | 1 | 3 | 1 | 2 | 1 | 2 | 2 | 4 | 1 | 1 | 1 | 3 | 1 | 4 | 2 | 4 |
| Ques. | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| Ans | 2 | 1 | 3 | 1 | 4 | 2 | 2 | 4 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 4 | 2 |
| Ques. | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| Ans | 1 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 1 | 1 | 1 | 1 | 4 | 3 | 3 | 3 |
| Ques. | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 |
| Ans | 3 | 1 | 1 | 1 | 2 | 3 | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 |
| Ques. | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |
| Ans | 2 | 4 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 1 |
| Ques. | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |
| Ans | 1 | 1 | 1 | 4 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Ques. | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
| Ans | 1 | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 4 | 2 |

## HINTS & SOLUTIONS

**1.** $\dfrac{N_1}{N_2} = \text{ratio}$

Average weight $= \dfrac{N_1W_1 + N_2W_2}{N_1 + N_2}$

$10.81 = \dfrac{10N_1 + 11N_2}{N_1 + N_2}$

$10.81N_1 = 10.81N_2 \quad = 10N_1 + 11N_2$

$0.81N_1 = 0.19N_2 \quad \Rightarrow \boxed{\dfrac{N_1}{N_2} = \dfrac{19}{81}}$

**2.** Electric field will be zero at the centre of hollow sphere.

**3.** AND gate $\rightarrow$ $C = A\,.\,B$

OR gate $\rightarrow$ $C = A + B$

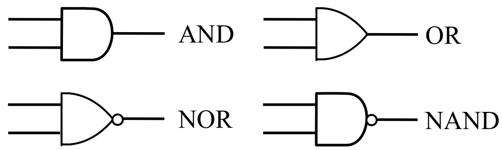
NOT gate $\rightarrow$ (It has only one input)

NAND gate $\rightarrow$ $C = \overline{A.B}$

| A | B | A.B | A + B | $\overline{A.B}$ | $\overline{A+B}$ |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 |

Therefore answer is NAND gate.

**4.** **Note:**




**5.** $v_{wave} = \dfrac{\omega}{k}$

$v_{particle} = \dfrac{dy}{dt} = \underbrace{y_0\,\omega}\qquad \cos(\omega t - kx)$

$\boxed{y_0\omega = 2\dfrac{\omega}{k}} \Rightarrow \boxed{k = \dfrac{2}{y_0} = \dfrac{2\pi}{\lambda}} \Rightarrow \boxed{\lambda = \pi y_0}$

**6.** $(N + 1)T_S = NT_\ell$ because $T \propto \sqrt{\ell}$

$\Rightarrow \quad \dfrac{N+1}{N} = \sqrt{\dfrac{\ell_\ell}{\ell_S}} = \sqrt{\dfrac{2}{0.5}} = 2$

$\Rightarrow \quad \dfrac{N+1}{N} = 2 \Rightarrow N = 1 \;\Rightarrow N + 1 = 2$

**8.** According to law of conservation of angular momentum

$I_\omega = I'\omega'$

$Mr^2\omega = (Mr^2 + 2mr^2)\omega'$

$\omega' = \dfrac{M\omega}{M + 2m}$

**9.** Work energy theorem

$W = \Delta KE$

$x = 3 - 4t^2 + t^3$

$v = \dfrac{dx}{dt} = -8t + 3t^2$

$v_1(t = 0) = 0$

$v_2(t = 4) = 16$

Therefore, $\Delta KE = \dfrac{1}{2}mv_2^2 - \dfrac{1}{2}mv_1^2$

$= \dfrac{1}{2} \times 3 \times 10^{-3} \times 16 \times 16 - 0 = 384$ mJ

**10.** $\because\ F = \dfrac{dP}{dt} \Rightarrow Fdt = dP$

$\Delta P = \text{Impulse} = \int_0^t Fdt = \int_0^t (500 - 100t)dt$

$= 500t - 50t^2$

**11.** $T_{1/2(A)} = 40\text{min},\ T_{1/2(B)} = 20$ min

$t = 80$ min

$n_A = \dfrac{t}{T_{1/2_{(A)}}} = \dfrac{80}{40} = 2$

$n_B = \dfrac{t}{T_{1/2_{(B)}}} = \dfrac{80}{20} = 4$

$\dfrac{N_A}{N_B} = \dfrac{N_0/2^2}{N_0/2^4} = \dfrac{16}{4} = 4 : 1$

**13.** From Einstein's photoelectric effect eq$^n$

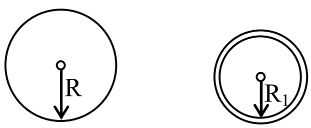
$\dfrac{hc}{\lambda} = \phi_0 + \dfrac{1}{2}mv^2$

$\dfrac{4hc}{3\lambda} = \phi_0 + \dfrac{1}{2}mv_1^2$

$\Rightarrow \dfrac{4}{3}\left(\phi_0 + \dfrac{1}{2}mv^2\right) = \phi_0 + \dfrac{1}{2}mv_1^2$

$\Rightarrow \dfrac{1}{2}mv_1^2 = \dfrac{\phi_0}{3} + \dfrac{1}{2}m\left(\sqrt{\dfrac{4}{3}}v\right)^2 \Rightarrow \boxed{v_1 > \sqrt{\dfrac{4}{3}}v}$

**14.**

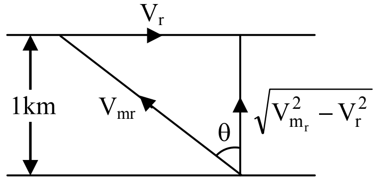



$2\pi R = L$ $\qquad$ $4\pi R_1 = L$

$B_1 = \dfrac{\mu_0 I}{2R} \times N = \dfrac{\mu_0 I\pi}{L}$ ; $B_2 = \dfrac{\mu_0 I}{2R_1} \times 2 = \dfrac{4\mu_0 I\pi}{L}$

$\Rightarrow \boxed{\dfrac{B_1}{B_2} = \dfrac{1}{4}}$

**15.**




$V_{mr} = 5$ km/hr

$t = 15$ min

$t = \dfrac{d}{\sqrt{V_{mr}^2 - V_r^2}} \Rightarrow \dfrac{15}{60} = \dfrac{1}{\sqrt{25 - V_r^2}}$

$\Rightarrow\ 4 = \sqrt{25 - V_r^2} \Rightarrow V_r^2 = 25 - 16 \Rightarrow V_r^2 = 9$

$\Rightarrow\ V_r = 3$ km/hr

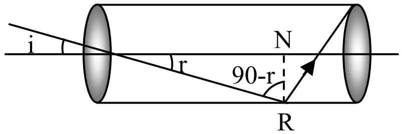
**16.** In elastic collision of bodies of same mass, the velocities get mutually exchanged between them.

**17.** $T_1 - mg = ma \qquad mg - T_2 = ma$

$T_1 = m(g + a) \qquad T_2 = m(g - a)$

$\dfrac{T_1}{T_2} = \dfrac{g + a}{g - a} = \dfrac{14.7}{4.9} = \dfrac{3}{1}$

**19.**




$\therefore \qquad 90^\circ - r > i_c \qquad$ or $\qquad r < 90^\circ - i_c$

According to Snell's law

$\sin i = n \sin r < n \sin (90^\circ - i_c)$

$\Rightarrow \dfrac{\sin i}{\cos i_c} < n \qquad \Rightarrow \dfrac{\sin i}{\sqrt{1 - \sin^2 i_c}} < n$

$\Rightarrow \dfrac{\sin i}{\sqrt{1 - 1/n^2}} < n \qquad \Rightarrow n^2 - 1 > 1$

$\Rightarrow \qquad n > \sqrt{2}$

**20.** $m = ZIt = ZQ \qquad \Rightarrow m \propto Q$

Then amount of librated Ag will be double.

**21.** $K.E_{max} = \dfrac{hc}{\lambda} - \phi$

$= \dfrac{12400\text{eVÅ}}{5000\text{Å}} - 1.5\text{eV}$

$= (2.48 - 1.5)\text{eV} = 0.98$ eV

**22.** $\dfrac{T}{4} = 6$ sec. $\Rightarrow T = 24$ sec.

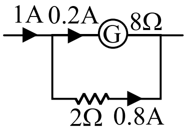
Frequency $= \dfrac{1}{T} = \dfrac{1}{24}$ Hz $= 0.04$ Hz

**23.** $e = M\dfrac{di}{dt} = 0.005 \times \dfrac{d}{dt}(i_0 \sin\omega t)$

$= 0.005\ i_0\ \omega \cos \omega t = e_0 \cos \omega t$

$\therefore \quad e_{max} = 0.005 \times 2 \times 100\pi = \pi$

**24.** $S = \left(\frac{i - i_s}{i_s}\right) G$




$$\frac{i_s}{i} = \frac{G}{S+G} = \frac{8}{2+8} = \frac{8}{10}$$

$i_S = 0.8i = 0.8 \times 1 = 0.8A$

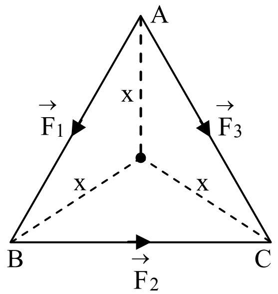
**26.** Here $v\frac{dm}{dt} = m(4.9 + 9.8) = (14.7)m$

$v = 2 km/s$ $m = 1000$

$$2000\frac{dm}{dt} = 14.7 \times 1000$$

$$\frac{dm}{dt} = \frac{14.7}{2} = 7.35 \text{ kg/s}$$

**27.** From the centre distance of three sides are equal




$\therefore$ $F_1X + F_2X - F_3X = 0$

$F_3 = F_1 + F_2$

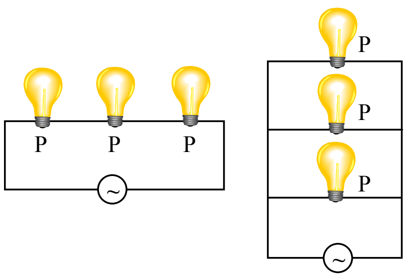
$$\left|\vec{F}_3\right| = \left|\vec{F}_1\right| + \left|\vec{F}_2\right|$$

**28.** $dU = \mu C_V dt = \frac{\mu R dT}{\gamma - 1} = \frac{P(2V - V)}{\gamma - 1} = \frac{PV}{\gamma - 1}$

**29.** $\Delta U = \mu C_V \Delta T = 0$

$\therefore$ $\Delta T = 0$ (temp. constant)

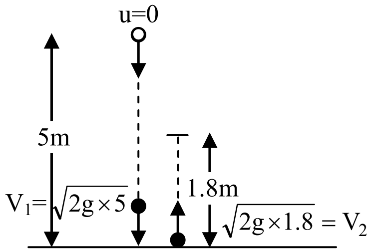
**30.**




$$\frac{1}{P_{eq}} = \frac{1}{P_1} + \frac{1}{P_2} + \frac{1}{P_3} \qquad P_{eq} = P_1 + P_2 + P_3$$

$\Rightarrow$ $\boxed{10 = \frac{P}{3}}$ $\Rightarrow P_{eq} = 3P = 3 \times 30 = 90$ watt

**31.**




$$\frac{V_2}{V_1} = \frac{\sqrt{2g \times 1.8}}{\sqrt{2g \times 5}} = \sqrt{\frac{18}{50}} = \sqrt{\frac{9}{25}}$$

$$\frac{V_2}{V_1} = \frac{3}{5}$$

**32.** $F = \frac{\mu_0 i_1 i_2}{2\pi d} = \frac{4\pi \times 10^{-7} \times 1 \times 1}{2\pi \times 1} = 2 \times 10^{-7}$ N/m

**33.** $n\lambda = 2d \sin\theta$ ; $\theta = 60°$, $n = 2$

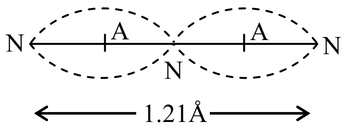
$$d = \frac{2 \times 1 \times 2 \times 10^{-10}}{2 \times \sqrt{3}} = 1.15 Å$$

**34.** $n = \frac{1}{2\pi}\sqrt{k/m}$ ; $n \propto \frac{1}{\sqrt{m}}$

$$\frac{n}{n_2} = \sqrt{\frac{m_2}{m_1}} = \sqrt{\frac{4m}{m}}$$

$$n_2 = \frac{n}{2}$$

**35.**




Therefore $\lambda = 1.21Å$

**36.** $I^2RT = ms\Delta\theta$

$\Rightarrow$ $I^2 \propto \Delta\theta$

$$\frac{\Delta\theta_2}{\Delta\theta_1} = \frac{I_2^2}{I_1^2}$$

$\Rightarrow$ $\frac{\Delta\theta_2}{5} = (2)^2$ $\Rightarrow$ $\Delta\theta_2 = 20°C$

**37.** $v^2 = u^2 - 2as$

$s = \frac{u^2}{2a}$ $\Rightarrow$ $s \propto u^2$

$\Rightarrow$ $\frac{20}{s'} = \frac{u^2}{4u^2}$

$s' = 80$ meter

**38.** $\Delta K.E. =$ force $\times$ displacement $=$ Work done

$\Delta K.E. = qEy$

**39.** $\frac{mv^2}{r} = \frac{1}{4\pi \in_0} \times \frac{e^2}{r^2}$

$v = \frac{e}{\sqrt{4\pi \in_0 rm}}$

**40.** $E = \frac{kp}{r^3}$

$\Rightarrow \quad E \propto \frac{p}{r^3} \quad \Rightarrow \frac{E_1}{E} = \frac{2}{8}$

$\Rightarrow \quad E_1 = \frac{E}{4}$

**41.** **Note :** Load coil = Secondary coil

$\frac{E_s}{E_p} = \frac{N_s}{N_p} = \frac{I_p}{I_s} \quad \Rightarrow \frac{25}{1} = \frac{I_p}{2}$

Therefore $I_p = 50$ A

**42.** If source moves perpendicular to observer's motion then change in freq. = 0

(No doppler's effect)

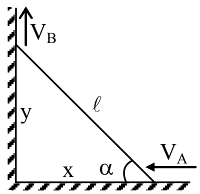
**43.** ${}_{92}U^{235} + {}_0n^1 \rightarrow {}_{56}Ba^{144} + {}_zX^A + 3{}_0n^1$

$235 + 1 = 144 + A + 3 \Rightarrow A = 89$

$92 + 0 = 56 + Z + 0 \Rightarrow Z = 36$

Therefore ${}_{36}X^{89} \rightarrow {}_{36}Kr^{89}$

**44.** $x^2 + y^2 = \ell^2$ = constant




$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$\frac{dx}{dt} = -V_A = -10$

$\frac{dy}{dt} = V_B$ &

$\frac{y}{x} = \tan\alpha = \tan 60^\circ = \sqrt{3}$

$10 = \sqrt{3}V_B \quad \Rightarrow \boxed{V_B = \frac{10}{\sqrt{3}}}$

**45.** According to Stefan's law

$E \propto T^4$

$\frac{E}{E_2} = \left(\frac{T}{2T}\right)^4$

$E_2 = 16E$

**47.** $I_B = \frac{V}{R} = \frac{5}{10^3} = 5 \times 10^{-3}$

$\beta = \frac{I_C}{I_B} = 50 = \frac{\text{out put current}}{\text{input current}}$

$50 = \frac{I_C}{5 \times 10^{-3}}$

$I_C = 25$ mA