# ANSWER KEY (AIPMT-2004)

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

# HINTS & SOLUTIONS

**1.** If rated voltage = supply voltage then in series combination of bulbs

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

For this question

$$\frac{1}{P_{eq}} = \frac{1}{60} + \frac{1}{60} + \frac{1}{60} = \frac{3}{60} = \frac{1}{20} \Rightarrow P_{eq} = 20\text{watt}$$

**2.** Material same $\Rightarrow \rho$ unchanged

$$R = \frac{\rho\ell}{A} = \frac{\rho\ell}{\pi a^2} \Rightarrow R \propto \frac{\ell}{a^2}$$

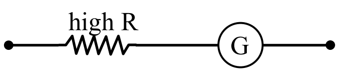
therefore $R' \propto \dfrac{2\ell}{(2a)^2}$

$$\Rightarrow R' = \frac{R}{2}$$

**3.** According to question $R = \dfrac{r}{n} \Rightarrow r = nR$

$R_{series} = nr = n^2R$

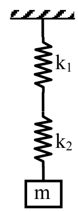
**4.** $F = \dfrac{q_1 q_2}{4\pi \epsilon_0 r^2} \Rightarrow [\epsilon_0] = \dfrac{\text{Coulomb}^2}{\text{Newton Meter}^2}$

**5.** Voltmeter $\rightarrow$ 

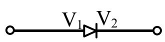

**6.** IN SHM if $v = v_{max}$ then $a = 0$

$v = 0$ then $a = a_{max}$

**7.** In series $\dfrac{1}{k_{eff}} = \dfrac{1}{k_1} + \dfrac{1}{k_2} + \ldots.$

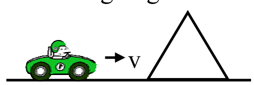



**8.** Diode is in FB if $V_1 > V_2$




Diode is in RB if $V_2 > V_1$

**9.** According to given condition




cliff is stationary source of freq. f' where

$$f' = \left(\frac{v}{v - v_{car}}\right)f$$

Freq. heard by the driver

$$f'' = \left(\frac{v + v_{car}}{v}\right)f' = \left(\frac{v + v_{car}}{v - v_{car}}\right)f = 2f$$

$\Rightarrow v + v_{car} = 2v - 2v_{car} \Rightarrow 3v_{car} = v$

$\Rightarrow v_{car} = v/3$

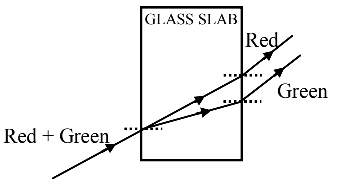
**10.** $g = \frac{GM}{R^2} = \frac{G\frac{4}{3}\pi R^3\rho}{R^2} = \frac{4}{3}\pi G\rho R$

Now according to question $g_{planet} = g_{earth}$

$\Rightarrow \frac{4}{3}\pi G\rho_{planet} \times R_{planet} = \frac{4}{3}\pi G\rho_{earth} \times R_{earth}$

$\Rightarrow R_{planet} = \frac{R_{earth}}{2}$ $(\because \rho_{planet} = 2\rho_{earth})$

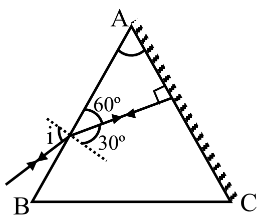
**11.**




Red and green rays emerge from two points, propagating in two different parallel directions.

**12.** $\because E = \frac{P^2}{2m} \therefore E \propto \frac{1}{m}$ if $m_1 > m_2$ then $E_1 < E_2$

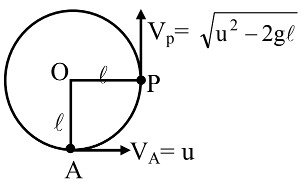
**13.** According to question from snaell's law




1. $\sin i = \mu \sin 30^\circ \Rightarrow \sin i = \sqrt{2} \times \frac{1}{2} = \frac{1}{\sqrt{2}}$

$\Rightarrow i = 45^\circ$

**14.**




Magnitude of change in velocity $= |\vec{V}_p - \vec{V}_A|$

$= \sqrt{V_p^2 + V_A^2}$ $(\because$ angle between $\vec{V}_p$ and $\vec{V}_A$ is $90^\circ)$

$= \sqrt{u^2 - 2g\ell + u^2} = \sqrt{2(u^2 - g\ell)}$

**16.** For half wave diode rectifier (HWR)

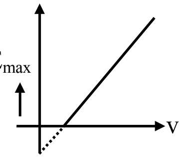
$V_{dc} = \frac{V_0}{\pi} = \frac{10}{\pi}$ volts

**17.** According to question

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \Rightarrow x = v\sqrt{\frac{m}{k}} = 1.5\sqrt{\frac{0.5}{50}} =$ 0.15m

**18.** Product is more stable so that its mass is less than the sum of masses of reactants i.e. $m_3 < (m_1 + m_2)$

**19.** $h\nu = \phi + KE_{max} \Rightarrow$




**20.** Z = number of protons

In $^{A}_{Z}X$

A-Z = number of neutrons

**21.** $\because F = \frac{Gm_1m_2}{r^2}$

$\therefore [G] = \left[\frac{Fr^2}{m^2}\right] \equiv \frac{MLT^{-2}L^2}{M^2}$

$= M^{-1}L^3T^{-2}$

**22.** Use power $\left(P = \frac{V^2}{R}\right)$ and get required result

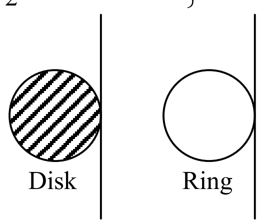
**23.** $I = \frac{e}{R} = \frac{1}{R}\left(\frac{\Delta\phi}{\Delta t}\right) = \frac{\Delta Q}{\Delta t} \Rightarrow Q = \frac{\Delta\phi}{R}$

**24.** Use $qV_{acc} = \frac{1}{2}mv^2$ and get required result

**25.** $PV = \mu RT$ where $\mu = \frac{5}{32}$ moles

**26.** Wien's displacement law $\lambda_m T = b$

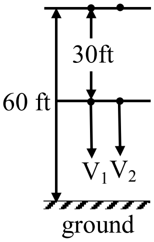
**27.** $\left.\begin{array}{l} I_{disk} = \frac{5}{4}MR^2 = MK_{disk}^2 \\ I_{ring} = \frac{3}{2}MR^2 = MK_{ring}^2 \end{array}\right\} \Rightarrow \frac{K_{disk}}{K_{ring}} = \sqrt{\frac{5}{6}}$



**28.** form conservation of angular momentum

$$I_1\omega = (I_1 + I_2)\omega' \Rightarrow \omega' = \frac{I_1\omega}{I_1 + I_2}$$

**29.**




Here $V_1 = V_2 = \sqrt{2gh}$

$$\frac{KE_1}{KE_2} = \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2} = \frac{m_1}{m_2} = \frac{2}{4} = \frac{1}{2}$$

**30.** $\left.\begin{array}{l} M_0 = 100\text{g (initial mass)} \\ M = 25\text{g (active mass)} \end{array}\right\} \Rightarrow \frac{N_0}{N} = \frac{100}{25}$

$\Delta = 2^2 \Rightarrow n = 2$

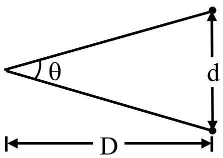
Therefore required time = $2 \times T_{1/2}$ = 3200 yrs

**31.** Mass of nucleus is slightly less than sum of masses of its constituents. This mass difference is equivalent to binding energy.

$$\therefore \Delta m = \frac{E}{C^2} = (ZM_P + NM_n) - M(N,Z)$$

Hence $M(N, Z) = NM_n + ZM_P - \dfrac{B}{C^2}$

**32.**




$\theta = \dfrac{d}{D}$ but $\theta \approx \dfrac{\lambda}{a}$

(Note : - exact relation $\theta = \dfrac{1.22}{a}\lambda$ )

$$\frac{d}{D} = \frac{\lambda}{a} \Rightarrow d = \frac{\lambda D}{a}$$

$$\Rightarrow d = \frac{5000\times10^{-10}\times10^3}{10\times10^{-2}} = 5 \text{ mm}$$

**33.** $y_1 = 10^{-6} \sin \{100t + \dfrac{x}{50} + 0.5\}$

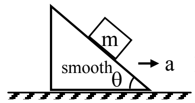
$y_2 = 10^{-6} \cos \{100t + \dfrac{x}{50}\}$

$= 10^{-6} \sin \{\dfrac{\pi}{2} + 100t + \dfrac{x}{50}\}$

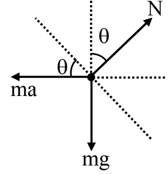
Phase difference between $y_1$ & $y_2 = \dfrac{\pi}{2} - 0.5$

= 1.58 – 0.5 = 1.08 radians.

**34.**

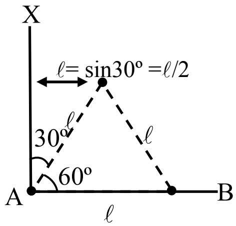



FBD of m




Here $N \cos\theta = mg \Rightarrow N = \dfrac{mg}{\cos\theta}$

**35.**




$$I_{AX} = m\ell^2 + m\left(\frac{\ell}{2}\right)^2 = m\ell^2 + \frac{m\ell^2}{4} = \frac{5}{4}m\ell^2$$

**36.** Energy of photon = $E_3 - E_2$

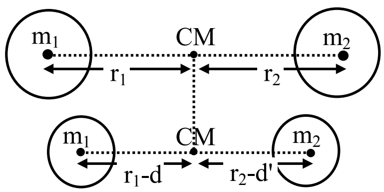
$$= \frac{-13.6}{9} - \left(\frac{-13.6}{4}\right) = \frac{5}{36}\times13.6 = 1.9 \text{ eV}$$

**37.** From $\tau = I\alpha$ and $\omega = \omega_0 + \alpha t$

Here $\omega_0 = \dfrac{60\times2\pi}{60}$ rad/sec. = $2\pi$ rad/sec.

$$\tau = I\left(\frac{\omega_0}{I}\right) = 2\times\frac{2\pi}{60} = \frac{\pi}{15} \text{ N–m}$$

**38.**




$m_1r_1 = m_2r_2$ …(1)

$m_1(r_1 - d) = m_2(r_2 - d')$ ….. (2)

from (1) and (2) we get $d' = \dfrac{m_1}{m_2}d$

**39.** $|\vec{A}\times\vec{B}| = \sqrt{3}\,\vec{A}.\vec{B}$

$\Rightarrow AB\sin\theta = \sqrt{3}\,AB\cos\theta$

$\Rightarrow \tan\theta = \sqrt{3}$

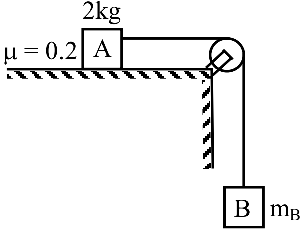
$\theta = 60^o$

therefore $|\vec{A}+\vec{B}| = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

$= \sqrt{A^2 + B^2 + 2AB\cos 60^o}$

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

**40.**




According to question

$T = m_B g = \mu(m_A g)$

$\Rightarrow m_B = \mu m_A = 0.2 \times 2 = 0.4$ kg

**41.** Photo emf $\propto$ Current through cell

But current $\propto$ Intensity

so photo emf $\propto$ Intensity of light falling on the cell.

**42.** Bohr model of atoms assumes that the angular momentum of electrons is quantised.

**43.** The output of OR gate is 1 if either or both inputs are 1.

**44.** $F = p\dfrac{dE}{dr} = 0\ (\because E = \text{constant})$

$u = -\vec{p}.\vec{E} = -PE$ (minimum)

**45.** Time constant $= \dfrac{L}{R} = \dfrac{40}{8} = 5$ seconds.

**46.** $\Delta U = \mu C_V \Delta T$ and $0 = W + \Delta U$

$\Rightarrow \Delta U = -6R\ (\therefore\ W = 6R)$

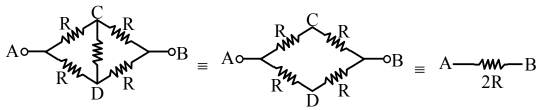
Therefore $-6R = 1\left(\dfrac{R}{\gamma - 1}\right)\Delta T = \dfrac{3}{2}R\Delta T$

$= \Delta T = -4 \Rightarrow T_{final} = (T - 4)K$

**47.** % Watt hour efficiency $= \dfrac{E_{out}}{E_{in}} \times 100$

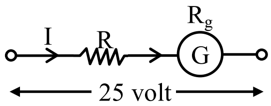
$= \dfrac{(14)(5)(15)}{(15)(10)(8)} \times 100 = 87.5\%$

**48.** Given circuit can be reduced to




required current $= \dfrac{V}{2R}$

**49.**

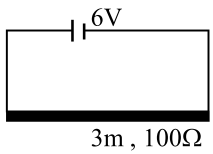



According to question $25 = I(R + Rg)$

$= (4 \times 10^{-4} \times 25)(R + 50)$

$\Rightarrow R + 50 = 2500 \Rightarrow R = 2450\Omega$

**50.**




Voltage on 50 cm. $= \dfrac{6}{300} \times 50 = 1$ volt.