# ANSWER KEY (AIPMT-2002)

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

# HINTS & SOLUTIONS

**1.** $\because T = 2\pi\sqrt{\dfrac{m}{K}} \quad \Rightarrow K \propto \dfrac{1}{T^2}$

In this case $\quad K = K_1 + K_2$

$$\frac{1}{t_0^2} = \frac{1}{t_1^2} + \frac{1}{t_2^2} \Rightarrow t_0^{-2} = t_1^{-2} + t_2^{-2}$$

**2.** For damped oscillation amplitude $A = A_0e^{-bt}$

$$\frac{A_0}{3} = A_0\, e^{-b(100\,T)} \Rightarrow e^{-100bT} = \frac{1}{3}$$

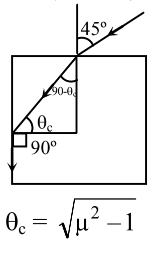
at $t = 200$ T, $A = A_0e^{-b(200\,T)} = A_0(e^{-100bT})^2$

$$\Rightarrow A = A_0\left(\frac{1}{3}\right)^2 = \frac{A_0}{9}$$

**3.** Density of iron is more than Aluminium.

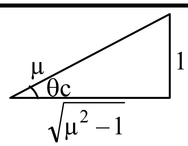
**4.** For given condition snell's law give

$1.\sin 45^o = \mu.\sin(90 - \theta_c)$




$$\frac{1}{\sqrt{2}} = \mu\cos\theta_c = \sqrt{\mu^2 - 1}$$

$$\Rightarrow \mu^2 = 1 + \frac{1}{2} \Rightarrow \mu^2 = \frac{3}{2} \Rightarrow \mu = \sqrt{\frac{3}{2}}$$




$\sin\theta_c = \dfrac{1}{\mu}$

$$\Rightarrow \cos\theta_c = \sqrt{\frac{\mu^2 - 1}{\mu}}$$

Alternate solution (objective method)

for given condition $\mu = \sqrt{1 + \sin^2\theta}$

$$\Rightarrow \mu = \sqrt{1 + \sin^2 45^o} = \mu = \sqrt{1 + \frac{1}{2}} = \sqrt{\frac{3}{2}}$$

**6.**

| Extreme position | Mean position | Extreme position |
|---|---|---|
| $x = -a$ | $x = 0$ | $x = +a$ |
| P.E. (max) | K.E. (Max.) | (P.E.) Max. |

**9.** $\because \lambda = \dfrac{h}{mv} \qquad \therefore \lambda \propto \dfrac{1}{m}$

**13.** Smooth surface is given so rolling motion is not possible. Sphere will perform linear motion.

**14.** For the aparture, limit of resolution –

$$\frac{y}{D} \geq \frac{\lambda}{d} \Rightarrow y \geq \frac{\lambda D}{d}$$

$$y \geq \frac{5\times10^{-7}}{2\times10^{-3}} \times 50 \geq 1.25 \text{ cm.}$$

**15.** For image formation $f \le d/4$

**18.** $P \propto (T^4 - T_0^4)$

$$\frac{P_2}{P_1} = \frac{(1500)^4 - (500)^4}{(1000)^4 - (500)^4} = \frac{500^4(3^4 - 1)}{500^4(2^4 - 1)}$$

$$\frac{P_2}{60} = \frac{80}{15} \Rightarrow P_2 = 320\text{ W}$$

**19.** Use $\dfrac{dQ}{dt} = \dfrac{KA}{L}(T_1 - T_2)$

**20.** $\%n = \left(1 - \dfrac{T_2}{T_1}\right) \times 100$

For 50% $\dfrac{50}{100} = 1 - \dfrac{500}{T_1} \Rightarrow T_1 = 1000\text{ K}$

For 60% $\dfrac{60}{100} = 1 - \dfrac{T_2}{1000} \Rightarrow T_2 = 400\text{ K}$

**23.** $\vec{a} = \dfrac{\vec{F}}{m} = 2t^2\hat{i} + \dfrac{4}{3}t\,\hat{j}$

$d\vec{v} = (2t^2\hat{i} + \dfrac{4}{3}t\,\hat{j})dt$

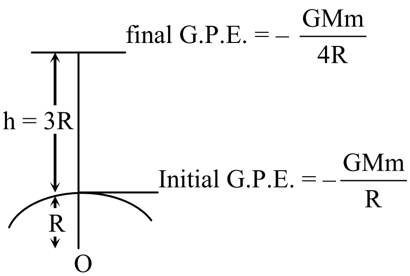
Integrate on both sides

$$\vec{v} = 2\left[\frac{t^3}{3}\right]\hat{i} + \frac{4}{3}\left[\frac{t^2}{2}\right]\hat{j}$$

at t = 3 sec. $\vec{v} = \dfrac{2}{3}(3)^3\hat{i} + \dfrac{4}{6}(3)^2\hat{j}$

$= 18\,\hat{i} + 6\,\hat{j}$

**24.**

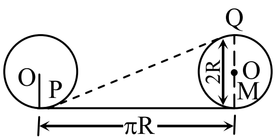



Change in G.P.E. = final energy – initial energy

$$= -\frac{GMm}{4R} + \frac{GMm}{R} = \frac{GMm}{R}\left[1 - \frac{1}{4}\right]$$

$$= \frac{3}{4}\frac{GMm}{R} = \frac{3}{4}\frac{GM}{R^2}mR = \frac{3}{4}gmR$$

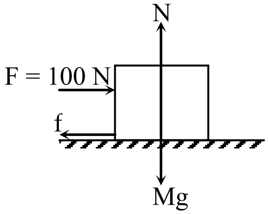
**25.**




displacement $PQ = \sqrt{(PM)^2 + (QM)^2}$

$= \sqrt{(\pi R)^2 + (2R)^2} = \sqrt{\pi^2 + 4}$ $(\because R = 1m)$

**26.** $f_{max} = \mu N = \mu Mg = (0.5)(10)(10) = 50\text{ N}$




$\Rightarrow a = \dfrac{\text{net force}}{\text{mass}}$

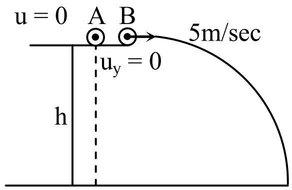
$= \dfrac{100 - 50}{10}$

$= 5\text{ m/sec}^2$

**27.** $T = m(g + a) = 1000\,(9.8 + 1)$

$= 10{,}800\text{ N}$

**28.**




For particle (A)

$h = \dfrac{1}{2}gt^2$

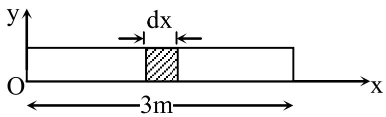
$t_A = \sqrt{\dfrac{2h}{g}}$

For particle (B) In vertical direction

Use $s = ut + \dfrac{1}{2}at^2$

$\Rightarrow h = \dfrac{1}{2}g\,t_B^2 \Rightarrow t_B = \sqrt{\dfrac{2h}{g}}$

**29.**




Here ρ = kx where k is a constant mass of small element of dx length is

$dm = kx.dx$

$$x_{cm} = \frac{\int x.dm}{\int dm} = \frac{\int_0^3 x(x\,dx)}{\int_0^3 x.dx} = \frac{\left[\frac{x^3}{3}\right]_0^3}{\left[\frac{x^2}{2}\right]_0^3} = \frac{\frac{27}{3}}{\frac{9}{2}} = 2$$

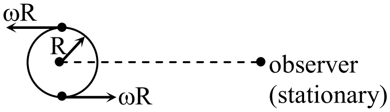
**30.** $P_1 = \sqrt{2mE_1}$ ; $P_2 = \sqrt{2mE_2}$

$$= \sqrt{2m\left(E_1 + \frac{300}{100}E_1\right)} = \sqrt{2m(4E_1)} = 2P_1$$

$$\% \text{ change} = \frac{P_2 - P_1}{P_1} \times 100 = \frac{2P_2 - P_1}{P_1} \times 100 = 100\%$$

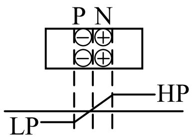
**31.** $\beta = \dfrac{\alpha}{1-\alpha} = 24$

**33.**




$$n_{max} = n_0\left(\frac{V}{V-\omega R}\right); \; n_{min} = n_0\left(\frac{V}{V+\omega R}\right)$$

**34.**




**37.** The value of ρ doesnot depends on geometry but increaes with increase in temperature.

**38.** In A.C. circuit power loss $P = V I \cos\phi$

$P = VI = I^2R \quad (\because \; \phi = 0 \text{ at resonance})$

**39.** Inside the conductor $E = 0$ so potential remains same.

**40.** T.P.D (V) = E – Ir(Remember it)

$$V = E - \left(\frac{E}{R+r}\right)r = \frac{ER}{(R+r)}$$

from given conditions $E = 2.2$ & when $R = 5$ then TPD $V = 1.8$ V

therefore $1.8 = \dfrac{2.2 \times 5}{5+r} \Rightarrow r = \dfrac{10}{9}\,\Omega$

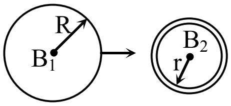
**42.** $V_{common} = \dfrac{C_1V_1 + C_2V_2}{C_1 + C_2} = (\because \; V_2 = 0)$

$$\Rightarrow V_{common} = \frac{C_1V}{C_1 + C_2}$$

**43.** $\text{E.P.E} = 8\left[\dfrac{1}{4\pi\epsilon_0}\dfrac{(q)(-q)}{(\sqrt{3}b/2)}\right] = \dfrac{-4q^2}{\sqrt{3}\pi\epsilon_0 b}$

Note : distance between centre to any corner $= \dfrac{\sqrt{3}b}{2}$

**45.** $B_1 = B = \dfrac{\mu_0 I}{2R}$




$$B_2 = \frac{\mu_0(2I)}{2r}$$

$\because \; 2 \times 2\pi r = 2\pi R \qquad \therefore \; r = R/2$

$$\Rightarrow B_2 = 4\frac{\mu_0 I}{2R} = 4B$$

**46.** Lorentz forece $\vec{F}_L = \vec{F}_e + \vec{F}_m$

$= q\vec{E} + q(\vec{v} \times \vec{B})$

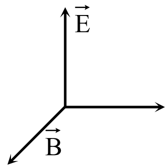
**47.** $T = 2\pi\sqrt{\dfrac{1}{MB}} \Rightarrow T \propto \dfrac{1}{\sqrt{M}}$

case I : $M_1 = 2M + M$

case II : $M_2 = 2M - M$

$$\frac{T_1}{T_2} = \sqrt{\frac{M}{3M}} = \frac{1}{\sqrt{3}} \Rightarrow T_2 = \sqrt{3}\; T_1$$

**48.** For electromagnetic wave




$$\vec{v}_{wave} = \vec{E} \times \vec{B}$$

**49.** $t = nT, \; X = \dfrac{X_0}{2^n}, \; n = \dfrac{t}{T} = \dfrac{30}{10} = 3$

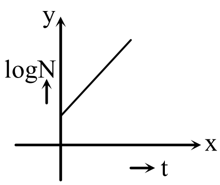
Active nuclei $X = \dfrac{4 \times 10^{16}}{(2)^3}$ and

decayed nuclie $X = (X_0 - X) = 3.5 \times 10^{16}$

**50.** ${}_8O^{16} + {}_1H^2 \rightarrow {}_ZX^A + {}_2He^4$

use converstion of change and mass

**120.** Rate of increase of bacteria $\rightarrow \dfrac{dN}{dt}$




$$\frac{dN}{dt} = \mu N \Rightarrow N = N_0 e^{\mu t}$$

$\Rightarrow \log N = \log N_0 + \mu t$

$(y = mx + c \; ; \; y = \log N, \; m = \mu \; ; \; x = t)$