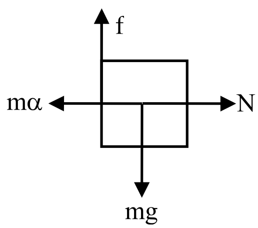
ANSWER KEY (AIPMT-2010)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans	3	2	4	2	3	2	4	1	3	4	2	1	3	2	4	4	1	1	2	4
Ques.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans	2	1	2	2	4	3	1	3	3	1	2	3	2	3	3	1	1	2	4	1
Ques.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans	3	4	3	2	4	4	3	2	4	3	2	2	2	1	2	1	1	4	3	2
Ques.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
Ans	4	4	3	1	1	4	2	1	1	4	1	2	4	1	4	4	3	3	4	2
Ques.	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
Ans	4	2	1	4	3	3	3	1	2	2	1	2	2	2	1	3	1	2	3	2
Ques.	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
Ans	2	1	1	1	2	1	3	3	2	4	2	3	4	2	2	2	2	4	3	4
Ques.	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**	**136**	**137**	**138**	**139**	**140**
Ans	4	1	2	1	4	4	1	3	2	4	4	3	1	1	4	3	1	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	4	2	2	3	4	4	4	4	1	1	4	1	2	2	3	2	1	3	3	3
Ques.	**161**	**162**	**163**	**164**	**165**	**166**	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**	**176**	**177**	**178**	**179**	**180**
Ans	4	4	1	1	3	4	2	3	2	1	1	1	3	2	1	4	4	1	4	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	4	3	3	2	4	2	4	2	2	1	1	3	1	4	4	2	2	2

HINTS & SOLUTIONS

Sol.1



Here $f = mg$ and $N = m\alpha$ but $f \le \mu N$

So $mg \le \mu m\alpha \Rightarrow \alpha \ge \dfrac{g}{\mu}$

Sol.2 $\dfrac{BE}{\text{nucleon}} = \dfrac{0.042 \times 931}{7} = 5.6$ MeV

Sol.3 By conservation of angular momentum

$I_t\omega_i = (I_t + I_b)\omega_f \Rightarrow \omega_f = \left(\dfrac{I_t}{I_t + I_b}\right)\omega_i$

loss in kinetic energy $= \dfrac{1}{2} I_t \omega_i^2 - \dfrac{1}{2}(I_t + I_b)(\omega_f^2)$

$= \dfrac{1}{2}\left(\dfrac{I_b I_t}{I_b + I_t}\right)\omega_i^2$

Sol.4 Electric and magnetic field vectors are perpendicular to each other in electromagnetic wave.

Sol.5 $x = a\sin^2\omega t = \dfrac{a}{2}(1 - \cos^2\omega t)$

Sol.6 Speed of satellite $V = \sqrt{\dfrac{GM}{r}}$

$\Rightarrow \dfrac{V_B}{V_A} = \sqrt{\dfrac{r_A}{r_B}} = \sqrt{\dfrac{4R}{R}} = 2$

$\Rightarrow V_B = (3V)(2) = 6V$

Sol.7 $qvB = qE \Rightarrow v = \dfrac{E}{B}$

but $\dfrac{1}{2}mv^2 = qV$ so $\dfrac{q}{m} = \dfrac{v^2}{2V} = \dfrac{E^2}{2VB^2}$

Sol.8 Let two balls meet at depth h from platform

So $h = \dfrac{1}{2}g(18)^2 = v(12) + \dfrac{1}{2}g(12)^2$

$\Rightarrow v = 75\ ms^{-1}$

Sol.9 For TIR $45 \ge \theta_C \Rightarrow \sin 45 \ge \sin\theta_C$

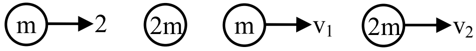
$\Rightarrow \dfrac{1}{\sqrt{2}} \ge \dfrac{1}{\mu} \Rightarrow \mu \ge \sqrt{2}$

Sol.10 $T = 2\pi\sqrt{\dfrac{M}{k}}$, $T' = 2\pi\sqrt{\dfrac{2M}{k}} = \sqrt{2}T$

Sol.11 $\dfrac{Q}{t} = \dfrac{kA(T_1 - T_2)}{\ell}$

$\dfrac{Q'}{t} = \dfrac{k\left(\dfrac{A}{4}\right)(T_1 - T_2)}{4\ell} = \dfrac{1}{16}\ \dfrac{kA(T_1 - T_2)}{\ell}$

$\Rightarrow Q' = \dfrac{Q}{16}$

Sol.12 

Initial condition Final condition

By conservation of linear momentum :

$2m = mv_1 + 2mv_2 \quad \Rightarrow v_1 + 2v_2 = 2$

by definition of e : $e = \frac{1}{2} = \frac{v_2 - v_1}{2 - 0}$

$\Rightarrow v_2 - v_1 = 1 \quad \Rightarrow v_1 = 0$ and $v_2 = 1ms^{-1}$

Sol.13 Wave velocity = $n\lambda = \omega A$

$\Rightarrow \lambda = \frac{\omega A}{n} = \frac{\omega A}{\frac{\omega}{2\pi}} = 2\pi A$

Sol.14 $\vec{v} = \vec{u} + \vec{a}t = (3\hat{i} + 4\hat{j}) + (0.4\hat{i} + 0.3\hat{j})\,(10)$

$= 7\hat{i} + 7\hat{j}$

So speed = $|\vec{v}| = 7\sqrt{2}\ ms^{-1}$

Sol.15 Power = $Fv = v\left(\frac{m}{t}\right)v = v^2(\rho Av)$

$= \rho Av^3 = (100)(2)^3 = 800$ W

Sol.16 $B = \frac{\mu_0 I}{2R} = \frac{\mu_0}{2R}\left(\frac{q}{t}\right) = \frac{\mu_0 qf}{2R}$

Sol.18 $x = \frac{1}{t+5} \quad \Rightarrow v = \frac{dx}{dt} = -\frac{1}{(t+5)^2}$

Acceleration, $a = \frac{dv}{dt} = \frac{2}{(t+5)^3}$

$\Rightarrow a \propto (\text{velocity})^{3/2}$

Sol.19 $\phi = (B)(\pi r^2) \Rightarrow e = \frac{d\phi}{dt} = (B)(2\pi r)\left(\frac{dr}{dt}\right)$

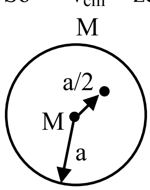
$= (0.025)(2\pi)(2 \times 10^{-2})(10^{-3}) = \pi\mu V$

Sol.20 $N = N_0 e^{-\lambda t} \Rightarrow \frac{N_0}{e} = N_0 e^{-\lambda(5)} \Rightarrow \lambda = \frac{1}{5}$

Now $\frac{N_0}{2} = N_0 e^{-\lambda(t)} \Rightarrow t = \frac{1}{\lambda}\ell n2 = 5\ell n2$

Sol.21 Net external force on system is zero.

So $\vec{v}_{cm}$ = zero

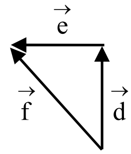
Sol.22 

$V_P = -\frac{GM}{a/2} - \frac{GM}{a} = -\frac{3GM}{a}$

Sol.24 $R = k\ell_1$ and $R + X = k\ell_2$

Sol.25 The frequency of the piano string may be 508 or 516 Hz.

As frequency $\propto \sqrt{\text{Tension}}$ so answer will be 508 Hz.

Sol.26 

$\Rightarrow \vec{f} = \vec{d} + \vec{e}$

Sol.27 Let required resistance be R then

$(R + R_g)I_g = V \Rightarrow (R + 100)\,(30 \times 10^{-3}) = 30$

$\Rightarrow R = 900\Omega$

Sol.28 Here friction force provides centripetal force so

$f = m\omega^2 r$ but $f \le \mu mg$

So $m\omega^2 r \le \mu mg \Rightarrow r \le \frac{\mu g}{\omega^2}$

Sol.30 $E_n = -13.6\left(\frac{Z^2}{n^2}\right) = (-13.6)\left(\frac{4}{4}\right) = -13.6$ eV

Sol.31 $\left[\frac{1}{2}\epsilon_0 E^2\right]$ = [Energy Density]

$= \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$

Sol.32 $m = ZIt = Z\left(\frac{P}{V}\right)t$

$= (0.367 \times 10^{-6})\left(\frac{100 \times 10^3}{125}\right)(60)$

$= 17.61 \times 10^{-3}$ kg

Sol.33 Let distance of man from the floor be (10 + x)m. As centre of mass of system remains at 10m above the floor.

So $50(x) = 0.5(10) \Rightarrow x = 0.1$ m

$\Rightarrow$ distance of the man above the floor = 10 + 0.1

= 10.1m

Sol.34 $\frac{1}{2}mv^2 = \frac{(Ze)(2e)}{4\pi\epsilon_0 d_{min}}$ then $d_{min.} \propto \frac{1}{m}$

Sol.35 $f' = f$ & Intensity $\propto$ Area so $I' = I - \frac{I}{4} = \frac{3I}{4}$

Sol.36 $\Delta Q = \Delta U + \Delta W$ In adiabatic process $\Delta Q = 0$

Sol.37 Total radiant energy per unit area

$= \frac{\sigma(4\pi r^2)T^4}{4\pi R^2} = \frac{\sigma r^2 T^4}{R^2}$

Sol.38 $V_3 = 220$ volt, $I = \frac{220}{100} = 2.2A$

Sol.39 $\eta = \frac{V_S I_S}{V_P I_P} = 0.8 \Rightarrow I_P = \frac{(440)(20)}{(0.8)(200)} = 5A$

Sol.40 $\frac{\text{Power of } S_2}{\text{Power of } S_1} = \frac{n_2\left(\frac{hc}{\lambda_2}\right)}{n_1\left(\frac{hc}{\lambda_1}\right)} = \frac{n_2\lambda_1}{n_1\lambda_2} = 1$

Sol.41 Voltage gain $= \beta\left(\dfrac{R_{out}}{R_{in}}\right)$

$$\Rightarrow \beta = \frac{50\times100}{200} = 25$$

Power gain = β(Voltage gain)

$$= (25)(50) = 1250$$

Sol.42 $T = 2\pi\sqrt{\dfrac{I}{MB_H}}$, $T' = 2\pi\sqrt{\dfrac{I}{M(B_H - B)}}$

$$\Rightarrow T' = 2T = 4s$$

Sol.43

$$q \bullet \xleftrightarrow{\quad d \quad} \bullet q$$

$$F = \frac{(ne)^2}{4\pi\epsilon_0 d^2} \Rightarrow n = \sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$$

Sol.44 $h\nu = \phi_0 + eV_0$ where $h\nu = \dfrac{12400}{2000} = 6.2$ eV

$$\Rightarrow V_0 = 6.2 - 5.01 = 1.19 \approx 1.20 \text{ V}$$

Sol.45 Here $\vec{E} \perp$ Area Vector

Sol.46 $\dfrac{1}{2}\left(\dfrac{C_1}{n_1}\right)(4V)^2 = \dfrac{1}{2}(n_2C_2) \Rightarrow C_2 = \dfrac{16C_1}{n_1 n_2}$

Sol.48 Net force on loop is zero.

Sol.50 $Y = (A + B).C$

Sol.51 Given $-\dfrac{-d[N_2O_5]}{dt} = 6.25 \times 10^{-3}$ mol L^{-1} s^{-1}

For the reaction

$$N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$$

$$\frac{-d[N_2O_5]}{dt} = \frac{1}{2}\frac{d[NO_2]}{dt} = \frac{2d[O_2]}{dt}$$

$$\therefore \frac{d[NO_2]}{dt} = -\frac{2d[N_2O_5]}{dt} = 1.25\times10^{-2} \text{mol } L^{-1} s^{-1}$$

$$\therefore \frac{d[O_2]}{dt} = -\frac{1}{2}\frac{d[N_2O_5]}{dt}$$

$= 3.125 \quad 10^{-3}$ mol L^{-1} s^{-1}

Sol.58 At 25 C pH + pOH = 14

∴ pOH = 2

∴ $[OH] = 10^{-2}$ M

Now Let solulity of $Ba(OH)_2$ be S

$Ba(OH)_2 \rightarrow Ba^{+2} + 2OH^{-2}$

S S 2S

$[OH^-] = 2s = 10^{-2}$

[Solubility of $Ba(OH)_2$] $S = \dfrac{10^{-2}}{2} = 5\times10^{-3}$ mol/L

Now Ksp for $Ba(OH)_2 = 4s^3$

$= 4 \times (5 \times 10^{-3})^3 = 5 \times 10^{-7}$ M^3

Sol.62 For acidic buffer solution

$$[H^+] = \frac{Ka[CH_3COOH]}{[CH_3COO^-]}$$

$$= \frac{1.8\times10^{-5}\times0.10}{0.20} = 9 \times 10^{-6} \text{ M}$$

Sol.65 $2Ag^+ + Cu \rightarrow 2Ag + Cu^{2+}$

n = 2

$\Delta G = -nFE_{cell}$

$\Delta G = -2 \times 96500 \times 0.46$ Joul

$\Delta G = -88.78$ kJ $\simeq -89$ kJ

Sol.70 According to raoults law

$P_s = PX_A$ (X_A = mole fraction of solvent)

and on addition of water the mole fraction of water in the solution increases therefore vapour pressure increases.

Sol.80 Molarity (M) $= \dfrac{wt}{mol.wt.} \; \dfrac{1000}{vol(ml)}$

$$= \frac{25.3}{106} \times \frac{1000}{250}$$

= .955 mol/L of Na_2CO_3

and $Na_2CO_3 \rightarrow 2Na^+ + CO_3^{-2}$

therefore $[Na^+] = 2 \times 0.955 = 1.910$ M

$[CO_3^{-2}] = 0.955$ M

Sol.81 For acidic buffer solution

$$pH = pKa + \log\frac{[Salt]}{[Acid]}$$

Given $[B^-] = [HB]$

and K_b for $B^- = 10^{-10}$

So $K_a = 10^{-4}$ for HB

pH = pka = 4

Sol.84 For order of A :

By run I & IV

[B] remain same but

[A] increases 4 times and rate of reaction also becomes 4 times

$\therefore$ order w.r.t. A is 1

for order of B

By Run III & III

[A] remains same but

[B] becomes 2 times and rate of reaction becomes 4 times

$\therefore$ order w.r.t. B is 2

$\therefore$ rate = $K[A]^1\,[B]^2$

Sol.88 $\Delta S = \Sigma S_P - \Sigma S_R$

$$\Delta S = 50 - \left(\frac{1}{2}\times 60 + \frac{3}{2}\times 40\right)$$

$\Delta S = -40\ \ JK^{-1}\ mol^{-1}$

$\Delta G = \Delta H - T\Delta S$

at Equilibrium $\Delta G = 0$

$$\therefore \quad T = \frac{\Delta H}{\Delta S} = \frac{-30\times 10^3}{-40}$$

$T = 750$ K

Sol.97 For BCC

$$r^+ + r^- = \frac{\sqrt{3}a}{2}$$

$$\therefore \quad r^+ + r^- = \frac{\sqrt{3}\times 387}{2}\ \text{pm}$$

$= 335.14$ pm $\approx$ 335 pm