ANSWER KEY (AIPMT-2007)

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

HINTS & SOLUTIONS

1. $R = \frac{V}{I} = \frac{J}{IC} \equiv \frac{ML^2T^{-2}}{I^2T} = ML^2T^{-3}I^{-2}$

2. Acceleration $\frac{dv}{dt} = f = f_0\left(1-\frac{t}{T}\right)$

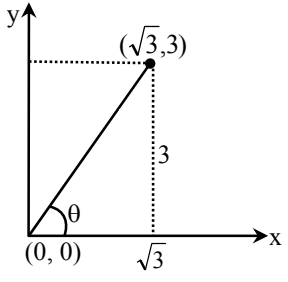
$\Rightarrow \int_0^v dv = f_0\int_0^T\left(1-\frac{t}{T}\right)dt$

$\Rightarrow v = f_0\left(t-\frac{t^2}{2T}\right)_0^T = f_0\left(T-\frac{T^2}{2T}\right) = \frac{1}{2}f_0T$

3. Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$= \frac{2d}{\frac{d}{v_u}+\frac{d}{v_d}} = \frac{2v_dv_u}{v_d+v_u}$

4.



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

$\Rightarrow \theta = 60^\circ$

5. By using $v = u + at$,

$0 = v - \mu gt \Rightarrow t = \frac{v}{\mu g}$

6. Net work done = work done by gravitational force + work done by spring force

$= mg(h + d) - \frac{1}{2}Kd^2$

7. $\theta = \omega t + \frac{1}{2}\alpha t^2 = (2)(2) + \frac{1}{2}(3)(2)^2$

$= 4 + 6 = 10$ rad

8. $\because |\vec{A}\times\vec{B}| = \sqrt{3}(\vec{A}.\vec{B})$

$\therefore AB\sin\theta = \sqrt{3}AB\cos\theta$

$\Rightarrow \tan\theta = \sqrt{3} \Rightarrow \theta = 60^\circ$

9. $x = 9t^2 - t^3 \qquad \therefore v = 18t - 3t^2$

$\Rightarrow \frac{dv}{dt} = 18 - 6t$

for maximum speed $\frac{dv}{dt} = 0$, and $\frac{d^2v}{dt^2}$ negative

so $18 - 6t = 0 \Rightarrow t = 3s$

at $t = 3s$, $x = 9(3)^2 - (3)^3 = 81 - 27 = 54$ m

10. For given conditions $mg = m\omega^2a = ka$

$\Rightarrow a = \frac{mg}{k} = \frac{2\times10}{200} = 0.1 = 10$ cm

11. As perpendicular distance from origin is constant so $L_A = L_B$

12. $\because \tau = I\alpha \ \therefore (mg)\ \frac{\ell}{2} = \left(\frac{m\ell^2}{3}\right)\alpha \Rightarrow \alpha = \frac{3g}{2\ell}$.

13. K.E. $= \frac{GMm}{2r} \Rightarrow$ Kinetic energies are unequal

$T = \frac{2\pi r^{3/2}}{\sqrt{GM}} \Rightarrow$ Time period are equal

P.E. $= -\frac{GMm}{r} \Rightarrow$ Potential energies are unequal

$v = \sqrt{\frac{GM}{r}} \Rightarrow$ Orbital speeds are equal

14. Solar constant $= \frac{\sigma(4\pi r^2)T^4}{(4\pi R^2)} = \frac{\sigma r^2 (t+273)^4}{R^2}$

15. $\eta = 1 - \frac{T_2}{T_1} \Rightarrow \frac{1}{6} = 1 - \frac{T_2}{T_1}$

and $\frac{1}{3} = 1 - \frac{(T_2 - 62)}{T_1} \Rightarrow \frac{1}{3} = 1 - \frac{T_2}{T_1} + \frac{62}{T_1}$

$\Rightarrow \frac{1}{3} = \frac{1}{6} + \frac{62}{T_1} \ = \frac{1}{6} = \frac{62}{T_1}$

16. $E = \sigma T^4 \therefore E \propto (727 + 273)^4 \Rightarrow E \propto (1000)^4$

17. Refractive index $\mu = \frac{c}{v} = \frac{c}{v\lambda}$

$= \frac{3\times10^8}{2\times10^{14}\times5000\times10^{-10}} = 3$

18. If $v = v_0 \sin\omega t$ then $a = a_0 \cos\omega t$

$\Rightarrow$ phase difference $= \frac{\pi}{2} = 0.5\pi$

19. $\because$ K.E. $= K_0\cos^2\omega t$

$\therefore$ Maximum P.E. = Maximum K.E.

= Total energy = K_0

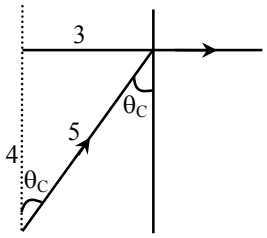
20. $\because \ x = a\sin\omega t$

$\therefore \ \frac{a}{2} = a\sin\omega t \Rightarrow \omega t = \frac{\pi}{6}$

$\Rightarrow \left(\frac{2\pi}{T}\right)t = \frac{\pi}{6} \Rightarrow \ t = \frac{T}{12}$

21. In EM waves $\vec{E}$ and $\vec{B}$ are in same phase and perpendicular to each other.

22.



$\frac{1}{\mu} = \sin\theta_C = \frac{3}{5} \Rightarrow \mu = \frac{5}{3}$

$\Rightarrow v = \frac{c}{\mu} = \frac{3\times10^8}{5/3} = \frac{9}{5}\times10^8$

$= 1.8 \times 10^8 \ ms^{-1}$

23. $W = \Delta U = Q(V_D - V_C)$ here $V_C = 0$

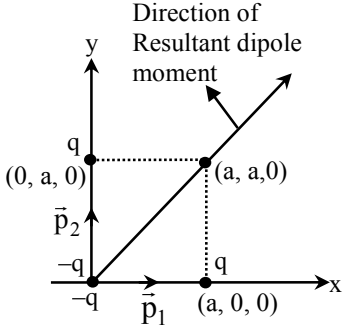
$= Q\left[\frac{q}{4\pi\epsilon_0(3L)} - \frac{q}{4\pi\epsilon_0(L)} - 0\right] = \frac{-Qq}{6\pi\epsilon_0 L}$

24. $\phi_{total} = \phi_{curved} + \phi_{plane\ surfaces} = \frac{q}{\epsilon_0}$

$\phi + 2\phi_A = \frac{q}{\epsilon_0} \Rightarrow \phi_A = \frac{1}{2}\left(\frac{q}{\epsilon_0} - \phi\right)$

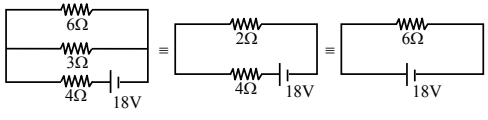
25. Magnitute $= \sqrt{p^2 + p^2} = \sqrt{2}p = \sqrt{2}qa$

Direction is shown in figure.



26. Work done in charging fully both the condensers $= \frac{1}{2}CV^2 + \frac{1}{2}\left(\frac{C}{2}\right)V^2 = \frac{3}{4}CV^2$

27.



Total power dissipated $= \frac{V^2}{R} = \frac{(18)\ (18)}{6}$

$= 54$ W

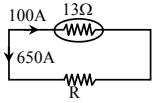
28. $m = ZIt = (30 \times 10^{-5})\ (1.5)\ (10 \times 60) = 0.27$ gm

29. $\because T_n = \dfrac{T_C + T_i}{2}$ & $T_C = 0^\circ C \therefore T_n = \dfrac{T_i}{2}$

30. for balanced wheatstone bridge circuit

$$\frac{2}{2} = \frac{2}{\left(\frac{6S}{S+6}\right)} \Rightarrow S + 6 = 3S \Rightarrow S = 3\Omega$$

31.



$13 \times 100 = 650 \times R$

$\Rightarrow R = 2\Omega$

32. $T = \dfrac{2\pi m}{qB}$ which is independent of both R and v.

33. Magnetic moment $M = IA = \left(\dfrac{qv}{2\pi R}\right)(\pi R^2)$

$$= \frac{qvR}{2}$$

34. In magnetic field a charged particle moves in a circular orbit.

35. Induced emf in primary coil

$$E_P = \frac{d\phi}{dt} = \frac{d}{dt}(\phi_0 + 4t) = 4 \text{volt}$$

Induced emf in secondary coil

$$\frac{E_S}{E_P} = \frac{N_S}{N_P} \Rightarrow \frac{E_S}{4} = \frac{1500}{50} \Rightarrow E_S = 120 \text{ volt}$$

36. Current is maximum at resonance

$$\Rightarrow \omega^2 = \frac{1}{LC} \Rightarrow L = \frac{1}{\omega^2 C}$$

$$= \frac{1}{(1000)^2 (10 \times 10^{-6})} = 0.1\text{H} = 100\text{mH}$$

37. The efficiency of transformer

$$\eta = \frac{V_S I_S}{V_P I_P} \times 100 = \frac{100}{220 \times 0.5} \times 100 \approx 90\%$$

38. Above curie temperature ferromagnetic material behaves as paramagnetic material.

39. No. of photoelectrons or intensity $\propto \dfrac{1}{(\text{distance})^2}$

40. $n = \dfrac{P}{hv} = \dfrac{2 \times 10^{-3}}{6.62 \times 10^{-34} \times 6 \times 10^{14}} = 5 \times 10^{15}$

41. Radius of semicircular path

$$R = \frac{mv}{qB} = \frac{\sqrt{2mqV}}{qB}$$

As V and B are constant so

$$R\ \alpha\ \frac{\sqrt{mq}}{q} \Rightarrow \frac{q}{m} \propto \frac{1}{R^2}$$

42. $\because R = R_0 A^{1/3}$

$$\therefore \frac{R_{Te}}{R_{Al}} = \left(\frac{125}{27}\right)^{1/3} = \left(\frac{5^3}{3^3}\right)^{1/3} = \frac{5}{3}$$

$$\Rightarrow R_{Te} = \left(\frac{5}{3}\right)(3.6) = 6 \text{ fm}$$

45. $\dfrac{N_A}{N_B} = \dfrac{N_0 e^{-\lambda_A t}}{N_0 e^{-\lambda_B t}} = \dfrac{e^{-5\lambda t}}{e^{-\lambda t}}$

$$\Rightarrow \frac{1}{e^{4\lambda t}} = \frac{1}{e^2} \Rightarrow t = \frac{1}{2\lambda}$$

46. Total energy in first excited state

$$= -\frac{13.4}{4} = -3.4 \text{ eV}$$

K.E. in first excited state = – total energy in that state = – (–3.4) = 3.4 eV

48. Voltage gain $= (\beta)\left(\dfrac{R_0}{R_i}\right) = 50$

$$\Rightarrow \beta = \frac{(50)(100)}{(200)} = 25$$

Power gain $= (\beta^2)\left(\dfrac{R_0}{R_i}\right) = (25)^2\left(\dfrac{200}{100}\right)$

$$= 625 \times 2 = 1250$$

49. For given logic circuit

$Y = \overline{\overline{A + B}} = A + B \Rightarrow$ OR gate

50. For cubic crystal structure

$a = b = c$ & $\alpha = \beta = \gamma = 90^\circ$