Sri Chaitanya IIT Academy, India

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A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 05-12-15**

Time: 9:00 AM to 12:00 Noon **RPTM-13** **Max.Marks: 360**

KEY SHEET

PHYSICS		CHEMISTRY		MATHS	
Q.NO	ANSWER	Q.NO	ANSWER	Q.NO	ANSWER
1	2	31	4	61	3
2	3	32	2	62	2
3	4	33	2	63	3
4	3	34	2	64	4
5	1	35	3	65	3
6	2	36	2	66	2
7	2	37	3	67	4
8	3	38	4	68	4
9	2	39	2	69	3
10	4	40	4	70	2
11	1	41	4	71	2
12	4	42	1	72	1
13	1	43	1	73	4
14	3	44	4	74	2
15	1	45	4	75	2
16	2	46	2	76	2
17	4	47	4	77	1
18	3	48	3	78	1
19	1	49	4	79	2
20	3	50	3	80	3
21	2	51	4	81	3
22	2	52	4	82	3
23	4	53	2	83	3
24	3	54	3	84	1
25	3	55	1	85	1
26	1	56	3	86	3
27	4	57	1	87	2
28	2	58	2	88	4
29	4	59	2	89	3
30	1	60	1	90	2

SOLUTIONS

PHYSICS

1. Ans: 2

Due to Lorentz force, electrons in the moving strip will be displaced upwards, which will creates an electric current in the galvanometer circuit, directed clockwise)

2. Ans:3

$I = \frac{BLv}{R}$, F =BIL, $F = \frac{B^2L^2v}{R}$

$P = F.v = \frac{B^2L^2v^2}{R}$

3. Ans: 4

Conceptual

4. Ans: 3

$E = L\frac{dI}{dt}$ or $dI = \left(\frac{E}{L}\right)dt$ or $I = \left(\frac{1.5}{3}\right)t$

$t = 2I = 6\sec$

5. Ans: 1

$R = \frac{\rho 4a}{\pi d^2/4} = \frac{16\rho a}{\pi d^2}$

$I = \frac{E}{R} = \frac{Ba v \pi d^2}{16\rho a} = \frac{\pi B v d^2}{16\rho}$

6. Ans: 2

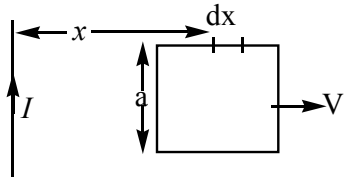
$V_A - V_B = \left[1\times 5 - 15 + 5\times 10^{-3}\left(-10^3\right)\right] volt$

$= -15V$ $V_B - V_A = 15V$

7. Ans: 2

$d\phi = \frac{\mu_0 I}{2\pi x}(adx)$

$\phi = \frac{\mu_0 Ia}{2\pi}\int_{\ell}^{\ell+a}\frac{1}{x}dx$



$$= \frac{\mu_0 Ia}{2\pi}\left[\log_e(l+a) - \log_e l\right]$$

$$E = \frac{d\phi}{dt} = \frac{\mu_0 Ia}{2\pi}\left[\frac{1}{l+a} - \frac{1}{l}\right]\frac{dl}{dt}$$

$$= -\frac{\mu_0 Ia^2 V}{2\pi l(l+a)}$$

8. Ans: 3

$$I = \frac{E}{R_1} = \frac{6}{1} = 6\,amp$$

$$I_0 = \frac{E}{R_2} = \frac{6}{1} = 6\,A,\ \tau = \frac{L}{R_2} = \frac{200\times10^{-3}}{1} = 0.2$$

$$I_2 = I_0\left(1 - e^{-t/\tau}\right) = 6\left(1 - e^{-t/0.2}\right)$$

$$V_2 = E - R_2 I_2 = 6 - 6\left(1 - e^{5t}\right) = 6e^{-5t}$$

9. Ans: 2

Emf will be maximum at mean position

$$mg\frac{l}{2}(1-\cos\alpha) = \frac{1}{2}\left(\frac{ml^2}{3}\right)\omega^2 \quad and\ E = \frac{1}{2}B\omega l^2$$

Since α *is small so* $1-\cos\alpha = 2\sin^2\frac{\alpha}{2} \simeq 2\left(\frac{\alpha}{2}\right)^2 = \frac{\alpha^2}{2}$

So $E = \frac{1}{2}Bl^2\left(\alpha\sqrt{3g/2l}\right) = B\alpha\sqrt{3gl^3/8}$

10. Ans: 4

$$E = B(v\sin\theta)(2R) = 2BVR\sin\theta$$

11. Ans: 1

$$|E| = \frac{d\phi}{dt} = na^{n-1}$$

If $0 < n < 1$, $(n-1)$ negative $|E|$ decays with time

$n = 1$, $|E| = cons\tan t$

$n > 1$ $|E|$ increases with time

12. Ans: 4

$$\tau = \frac{L}{R} = 1\text{sec}$$

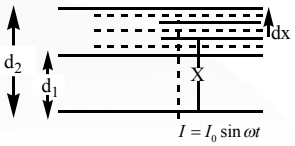
$$I = I_0 e^{-t/\tau} = \left(\frac{8}{2}\right) e^{\log_e 2} = 2amp$$

So, $V_L = 8 - 2\times 2 = 4V$, $W_{\sup plied\ by\ bettary} = 8\times 2 = 16J/s$

Rate of heat dissipated across resistor $= I^2 R = 8J/s$

13. Ans :1

$$d\phi = \frac{\mu_0 I}{2\pi x} l dx$$



So, $\phi = \frac{\mu_0 I}{2\pi} l \log_e\left(\frac{d_2}{d_1}\right)$

$$E = \frac{d\phi}{dt} = \frac{\mu_0 \ell}{2\pi}\log_e\left(\frac{d_2}{d_1}\right) I_0 \omega \cos wt$$

So, $E_{rms} = \frac{\mu_0}{2\pi} l \log_e \frac{d_2}{d_1} I_0 w \frac{1}{\sqrt{2}}$

$$= 2\times 10^{-7}\times 1\times \log_e 2 \times \frac{2\sqrt{2}}{\log_e 2} \times \frac{50}{\sqrt{2}} = 2\times 10^{-5} V$$

14. Ans :3

$$V_{PS} = iR = \frac{B\ell v}{r}\times\frac{r}{6} = \frac{Fr}{6B\ell} \qquad \left[\sin ce,\ v = \frac{Fr}{B^2\ell^2}\right]$$

15. Ans :1

$$B = \frac{\mu_0 I}{b},\ \phi = \frac{\mu_0 I}{b}\ell a$$

Self ind, L = $L = \frac{\phi}{I} = \frac{\mu_0 \ell a}{b}$, $U = \frac{1}{2}LI^2 = \frac{\mu_0 \ell a I^2}{2b}$

16. Ans :2

$$\phi = BA\cos\theta = \frac{1}{2}B\pi r^2 \cos\omega t$$

$$\varepsilon = \frac{-d\phi}{dt} = \frac{1}{2}B\pi r^2 \omega \sin wt\ , \qquad P = \frac{\varepsilon^2}{R} = \frac{B^2\pi^2 r^4 w^2 \sin^2 wt}{4R}$$

$$< P >= \frac{B^2\pi^2 r^4 w^2}{4R}\times\frac{1}{2} = \frac{\left(B\pi r^2 w\right)^2}{8R}$$

17. Ans :4

$\frac{q}{c}+L\frac{dI}{dt}=0$ or $\frac{d^2q}{dt^2}+\frac{q}{LC}=0$

Which is equation of oscillatory motion

So, $q=q_0\sin\omega t \Rightarrow \frac{dq}{dt}=I=q_0\omega\cos wt$ where $w=\frac{1}{\sqrt{LC}}$

18. Ans :3

$V=\frac{LdI}{dt}$, $\frac{dI}{dt}=\frac{V}{L}=\frac{V_0\sin wt}{L}$

Or $I=\frac{-V_0}{Lw}\cos\omega t$

P instantaneous = $VI=\frac{-V_0^2}{L\omega}\sin\omega t\cos\omega t=\frac{-V_0^2}{2\omega L}\sin 2\omega t$

19. Ans :1

$\tan\phi_1=\frac{X_L}{R}$, $\tan\phi_2=\frac{X_C}{R}$

Given $\phi_1=\phi_2$ So, $X_L=X_C$

20. Ans :3

Energy loss in C = energy stored in L

$\frac{1}{2}CV_1^2-\frac{1}{2}CV_2^2=\frac{1}{2}LI^2$

21. Ans :2

$V_{rms}=\sqrt{\frac{\int_0^T V^2dt}{\int_0^T dt}}$

22. Ans : 2

$X_L-X_C=R$

$\frac{1}{2\pi fc}=\left(R+2\pi fL\right)$

23. Ans : 4

$B=\frac{\mu_0 I}{2\pi r}$, $U=\int_{r_{inner}}^{r_{outer}}\frac{B^2}{2\mu_0}2\pi r\ell=\frac{1}{2}LI^2$

So, $L=\frac{\mu_0 I}{2\pi}\log_e\left(\frac{r_{outer}}{r_{inner}}\right)$

$w^2=\frac{1}{LC}$, $T=\frac{2\pi}{w}$

24. Ans: 3

$E_{inside}=\frac{r}{2}\frac{dB}{dt}$, $E_{outside}=\frac{-R^2}{2r}\frac{dB}{dt}$

25. Ans: 3

$d\phi=BdA$, $dA=2xdy$, $x=\sqrt{\frac{y}{K}}$

$$|E| = \frac{d\phi}{dt} = -B2\sqrt{\frac{y}{k}}\frac{dy}{dt},\ \frac{dy}{dt} = \sqrt{2ay}$$

26. Ans: 1

$$\phi = NBA\cos\omega t$$

$$|E| = \frac{d\phi}{dt}$$

27. Ans : 4

$$I = \frac{P}{V} = 0.5A,\ R = \frac{V^2}{P} = 200\Omega$$

$$Z = \frac{E}{I} = \sqrt{R^2 + X_C^2} = \frac{200}{0.5} = 400$$

So, $X_C = \sqrt{(400)^2 - (200)^2} = 200\sqrt{3} = \frac{1}{CW} or,\ C = 9.2\mu F$

28. Ans : 2

$$I'_{rms} = \sqrt{I_{dc}^2 + I_{rms}^2} = \sqrt{5^2 + \left(\frac{10}{\sqrt{2}}\right)^2} = 5\sqrt{3}A$$

29. Ans: 4

$$V(t) = \left(\frac{4V_0}{T}\right)t \quad for\ \ 0 \le t \le \frac{T}{4}$$

$$V^2 = \left(\frac{16V_0^2}{T^2}\right)t^2$$

$$< V^2 >_{0-\frac{T}{4}} = \frac{\left(\frac{16V_0^2}{T^2}\right)\int_0^{T/4} t^2 dt}{\int_0^{T/4} dt} = \frac{V_0^2}{3}$$

$$V_{rms} = \frac{V_0}{\sqrt{3}}$$

30. Ans: 1

$$R = \frac{100}{1} = 100\Omega,\ \ Z = \frac{V_{rms}}{I_{rms}} = \frac{100}{0.5} = 200\Omega$$

$$Z^2 = R^2 + x_L^2,\ x_L = \sqrt{z^2 - R^2} = 100\sqrt{3}$$

$$X_L = 2\pi FL,\ \ L = \frac{xl}{2\pi f} = 0.55H$$