Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 14-11-15**

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

KEY SHEET

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

SOLUTIONS
PHYSICS

1. $\vec{B} = \frac{\mu_0}{4\pi} I\left(\sin 30^0 + \sin 30^0\right)\left[\frac{1}{a\cos 30^0} - \frac{1}{2a\cos 30^0} + \frac{1}{3a\cos 30^0} - .....\infty\right]\hat{k}$

2. *If* $dN \rightarrow$ Number of turns in the interval r and $r+dr$

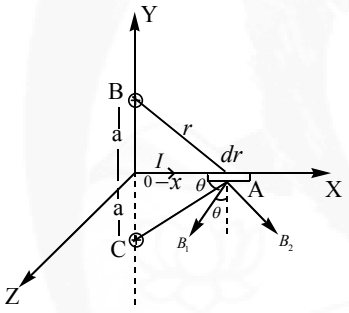
$$dN = \frac{N}{b-a}dr$$

$$M = \int IA\ dN = \int_a^b I\,\pi r^2 \frac{N}{b-a}dr$$

3. $T = \frac{2\pi m}{Bq}$

$$Pitch = V\cos\theta T$$

4.



$$\overrightarrow{B_{net}} = \frac{2\mu_0 I}{2\pi r}\cos\theta\left(-\hat{j}\right)$$

Where, $r = \sqrt{a^2 + x^2}$ and $\cos\theta = \frac{x}{r}$

So, $\vec{B} = \frac{\mu_0 I}{\pi}\frac{x}{a^2 + x^2}(-j)$

$$d\vec{F} = I\,d\vec{l} \times \vec{B}$$

$$= Idx\ \hat{i} \times \left[\frac{\mu_0 I}{\pi}\frac{x}{\left(a^2 + x^2\right)}(-j)\right]$$

$$\vec{F} = \frac{\mu_0 I^2}{\pi}\left(-\hat{k}\right)\int_0^l \frac{x\,dx}{a^2 + x^2}$$

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

5. Below the cable

$B_H = 0.36\cos 30° - 0.2 = 0.11G$

$B_r = 0.36\sin 30° = 0.18G$

$B_{net} = \sqrt{B_H{}^2 + B_V{}^2} \cong 0.21G$

6. $\vec{dl}$ and, $\vec{B}$ should be at right angle to each other so,

$\left(x\hat{i} + y\hat{j}\right).\left(y\hat{i} - x\hat{j}\right) = 0$

7. $r = \dfrac{\sqrt{3}l}{2}$

$B_{net} = 6\left[\dfrac{\mu_0 I}{4\pi r}\left(\sin 60° + \sin 60°\right)\right] - 6\left[\dfrac{\mu_0}{4\pi}\dfrac{i}{r}\left(\sin 30° + \sin 30°\right)\right]$

8.

For $x < R$	$at \quad x = R$
$B = \dfrac{\mu_0 ix}{2\pi R^2}$	$B = \dfrac{\mu_0 i}{2\pi R}$

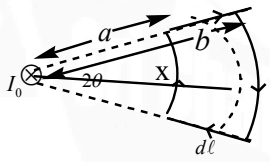
For $x > R$, $B = \dfrac{\mu_0 i}{2\pi x}$

9. $B = \dfrac{\mu_0 I_0}{2R}$, $T_{net} = \left(I\pi r^2\right)\dfrac{\mu_0 I_0}{2R}\sin 30°$

$= \dfrac{\mu_0 \pi I\, I_0 r^2}{4R} = F.r$

$F = \dfrac{\mu_0 \pi I\, I_0 r}{4R}$

10.



$B = \dfrac{\mu_0 I_0}{2\pi r}$

$d\Gamma = 2x\tan\theta dF$

$dF = IdrB, x = r\cos\theta$

$d\Gamma = 2r\cos\theta\tan\theta IdrB$

$= 2r\sin\theta Idr\dfrac{\mu_0 I_0}{2\pi r}$

$= \frac{\mu_0 I I_0 \sin\theta}{\pi} dr$

So, $\tau = \frac{\mu_0 I I_0 \sin\theta}{\pi} \int_a^b dr$

$= \frac{\mu_0 I I_0 (b-a) \sin\theta}{\pi}$

11. Forces on $\overrightarrow{FE}$ and $\overrightarrow{BA}$ are zero

Forces on $\overrightarrow{ED}$ and $\overrightarrow{CB}$ cancels each other

Force on DC is BIL acting along +Z direction

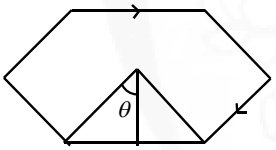
12. $H = nI,$

$M = \frac{B}{\mu_0} - H$

$\frac{\mu_r \mu_0 H}{\mu_0} - H$

Or $M = (\mu_r - 1) nI$

13.



$\theta = \frac{\pi}{n}$, $B_{net} = nB$

And $B = \frac{\mu_0 I}{4\pi}\left[\frac{\sin\theta + \sin\theta}{r}\right]$

$r = R\cos\theta$

14. $\vec{B} = \frac{\mu_0}{4\pi} \frac{q(\vec{V} \times \vec{r})}{|\vec{r}|^3}$, $\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{q\vec{r}}{|\vec{r}|^3}$

$\vec{B} = \mu_0 \varepsilon_0 (\vec{V} \times \vec{E}) = \frac{1}{c^2}(\vec{V} \times \vec{E})$

15. Let $\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$

$\vec{F} = q(\vec{V} \times \vec{B})$

From the given data, $B_x = 0, B_y = 0$

So, $\vec{B} = B_z \hat{k}$

16. $\frac{\mu_0}{4\pi}\frac{2I_1}{y} = \frac{\mu_0}{4\pi}\frac{2I_2}{x}$ *or* $y = \left(\frac{I_1}{I_2}\right)x$

17. $F = \int I\, d\vec{i} \times \vec{B}$

$F = I\left[\int_A^C d\vec{\ell}\right] \times \vec{B}$

$= I(AC)B = I\ell B$

18. $\Delta K = \frac{1}{2}m(2v)^2 - \frac{1}{2}mv^2 = \frac{3}{2}mv^2$, w = Δk, Sr, $2qaE = \frac{3}{2}mv^2$

Or $E = \frac{3}{4}\frac{mv^2}{qa}$

$P = \vec{F}.\vec{V} = qEv = \frac{3}{4}\frac{mv^3}{a}$

At Q rate of work done by both the fields is zero.

19. Total dipole moment = $0.2 \times 1.5 \times 10^{-23} \times 1.8 \times 10^{24}$

$= 5.4 JT^{-1}$

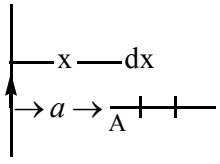
Using curie law, $m\alpha \frac{B}{T}$

Final dipole moment = $5.4 \times \left(\frac{0.96}{0.60}\right)\left(\frac{4.2}{3}\right) = 12.1 JT^{-1}$

20. BINA = Cθ, $I = \frac{C\theta}{BNA}$

21. $B = \frac{\mu_0 I_1}{2\pi r}$

$F = \int_a^{4a} \frac{\mu_0 I_1 I_2}{2\pi r} dr = \frac{\mu_0 I_1 I_2}{2\pi} \log_e 4$

22. 

$dF = \frac{\mu_0 I_1}{2\pi x} I_2 dx$

$d\Gamma = dF(x - a)$

$$\Gamma = \int_{a}^{a+\ell} \frac{\mu_0 I_1 I_2}{2\pi x} dx(x-a)$$

$$\text{Or } \Gamma = \frac{\mu_0 I_1 I_2}{2\pi}\left[\ell - a\log e\left(\frac{a+\ell}{a}\right)\right] = \frac{m\ell^2}{3}\alpha$$

23. $\frac{\mu_0 I, I_2 \ell}{2\pi x} = \frac{\mu_0 I_2 I_3 \ell}{2\pi(20-x)}$ *or*, $\frac{I_1}{x} = \frac{I_3}{20-x}$

24. BeV = Ee or E = BV

25. current sensitivity , $\frac{d\theta}{dI} = \frac{BNA}{C}$

26. $\vec{F} = I\left(\vec{\ell} \times \vec{B}\right)$

27. impulse $J = \int Fdt = B\ell \int Idt = B\ell Q = mu$

28. $mg\sin 60^0 = BI\ell\cos 60^0$

$$B = \frac{mg\tan 60^0}{I\ell}$$

29. From, $\vec{F_1}$, we find $By = \frac{\sqrt{3}}{2}B$

From $\vec{F_2}$, we find $Bz = \frac{1}{2}B$

So, $\vec{B} = \frac{\sqrt{3}}{2}B\,\hat{j} + \frac{1}{2}B\hat{k}$ so, Q = 30^0 with the y - axis

30. $T = \frac{2\pi m}{Bq}$, So, $a = \frac{T_1}{T_2} = 1$

$r = \frac{mv\sin\theta}{Bq}$, $b = \frac{r_1}{r_2} = \frac{\sin 30^0}{\sin 60^0} = \frac{1}{\sqrt{3}}$

$p = v\cos\theta T$, $c = \frac{p_1}{p_2} = \frac{\cos 30^0}{\cos 60^0} = \sqrt{3}$

MATHS

31. $\dfrac{x\,dy - y\,dx}{x^2} = \left(x^2 + y^2\right)xdx$

$\dfrac{x\,dy - y\,dx}{x^2 + y^2} = x^3\,dx$

$\int \dfrac{d\left(\dfrac{y}{x}\right)}{1 + \left(y/x\right)^2} = \int x^3\,dx$

$\tan^{-1}\, y/x = \dfrac{x^4}{4} + c$

32. $x^2y^2dx + e^x ydx - e^x dy = 0$

$x^2\,dx + \dfrac{y\,d\left(e^x\right) - e^x.d\left(y\right)}{y^2} = 0$

$x^2dx + d\left(\dfrac{e^x}{y}\right) = 0$

$\dfrac{x^3}{3} + \dfrac{e^x}{y} = c \Rightarrow x^3y + 3e^x = 3cy$

33. $xdy + ydx + xy\left(xdy - ydx\right) = 0$

$\dfrac{d\left(xy\right)}{xy} + x\,dy - y\,dx = 0$

$\dfrac{d\left(xy\right)}{\left(xy\right)^2} + \dfrac{x^2}{xy}\left(\dfrac{xdy - ydx}{x^2}\right) = 0$

$\dfrac{d\left(xy\right)}{\left(xy\right)^2} + \dfrac{d\left(y/x\right)}{\left(y/x\right)} = c$

$\dfrac{-1}{xy} + \log_e\left(y/x\right) = c$

34. $\dfrac{1}{2}\dfrac{d\left(x^2 + y^2\right)}{\sqrt{a^2 - \left(x^2 + y^2\right)}} = \dfrac{xdy - ydx}{\sqrt{x^2 + y^2}}$