Physics (1432)

1\.

The total no of lines of force which will come out of the loop = no of lines of force which will go inside the x-y plane (excluding the ring's Area)

hence Net flux of x-y plane = zero

2\. Displacement vector b/w M & Q = 2R

So $EMF = B \times v \, l = Bv \times 2R$

& from the Right Hand Rule Q is at higher pot.

3\. The EMF across CD = Bvl so the current

$i = \frac{Bvl}{R} \Rightarrow$ Power generated across R

$= i^2 R = \frac{B^2 v^2 l^2}{R^2} \times R = \frac{B^2 v^2 l^2}{R}$

= power needed to slide the slider

4\. $B_1 = \frac{\mu_0}{2} \times \frac{i}{R}$ & $B_2 = \frac{\mu_0}{2} \times \frac{i}{(R/2)} \times 2 \longrightarrow$ no of turns.

$= 4B_1$

5\. $\frac{d\phi}{dt} = \mathcal{E}$ & $i = \frac{\mathcal{E}}{R}$ $H = \int dH = \int_0^{T/2} i^2 R \, dt$ Total Heat $H' = 2H$

$i = 0$ at $t = \frac{T}{2}$ So the current changes the dirⁿ at $t = \frac{T}{2}$

6\.

Consider a ring of radius x & thickness dx

No of turns of this ring $= \left(\frac{N}{a} dx\right)$

Flux of this ring $\pi x^2 B_0 \sin wt \frac{N}{a} dx$

The total flux $= B_0 \sin wt \times \frac{N}{a} \pi \int_0^a x^2 dx$

$\phi = \frac{1}{3} B_0 N \pi a^2 \sin wt = \frac{B_0 N}{a} \pi \sin wt \frac{a^3}{3}$

$\mathcal{E} = \frac{d\phi}{dt} = \frac{1}{3} B_0 N \pi a^2 w \cos wt$, So the $\mathcal{E}_{max}$.

Physics (1432)

7. (a) The pattern of voltage across R during the charging & discharging of the capacitor will be same but in the opposite direction

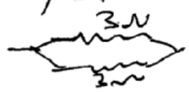
8. (d) Magnetic field in the middle is uniform & near the end it decreases so, the rate of change of flux.

9. $\tau = RC$ in second case $R' = \frac{R}{4}$ is 4 : 1

10. $q = q_0 e^{-t/RC} \Rightarrow i = -\frac{q_0}{RC} e^{-t/RC}$ at $t=0$ i is max.

$$i = \frac{15 \times 10^{-3}}{25 \times 1 \times 10^{-6}} = \frac{15 \times 10^{3}}{25} = 6 \times 10^{2} \text{ Amp}$$

11. Steady state current is $\frac{E}{R} = \frac{12}{1.5} = 8$ A

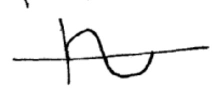


$R = 1.5\Omega$.

12. Initial B(t) will be small & $I_2(t)$ will be large so the product will be very small gradually B(t) will increase but $I_2(t)$ will decrease the product will acquire a max. value, finally $I_2(t)$ will tend to be zero. So the product will decrease.

13. (b) $E\, 2\pi r = \pi a^2 \times \frac{dB(t)}{dt} \Rightarrow E \propto \frac{1}{r}$

14. (a) Rotation about the ZZ' & YY' will cause the change of flux $\therefore \phi = BA\cos\omega t$ & $\varepsilon = BA\omega \sin\omega t$ for one complete cycle the EMF will be as



So the (a)

15. (a) $\phi = \frac{\pi a^2}{2} B \cos\omega t \Rightarrow \varepsilon = \frac{\pi a^2}{2} B\omega \sin\omega t = \varepsilon_0 \sin\omega t$

$$\Rightarrow \varepsilon_{rms} = \frac{\varepsilon_0}{\sqrt{2}} \quad \bar{P} = \frac{\varepsilon_{rms}^2}{R} = \left(\frac{\pi a^2}{2} \frac{B\omega}{\sqrt{2}}\right)^2 \times \frac{1}{R}$$

16. (d) at $t=0$ current is zero gradually it increases & acquires a max. definite value $\frac{E}{R}$.

17. (b) $\phi = BA = B \times m^2 = \frac{kg}{sec^2\, A} \times m^2$ $\quad F = Bil \Rightarrow B = \frac{F}{il} = \frac{kg\, m}{sec^2\, A\, m}$

Physics 1432

18. (a) It will remain same, as each spoke is equivalent to a cell & all the cells are connected in parallel.

19. (c) $\phi = \pi r^2 B$ & $\frac{d\phi}{dt} = -\varepsilon = 2\pi r \frac{dr}{dt} B$

20 (b) As the current tend to ~~incr~~ decrease the EMF generated across the inductors tries to oppose the decrease of current i.e it supports the Applied EMF.

21. (b) In fig (C) & (D) the flux linked will be zero $(\vec{B}\cdot\vec{A} = 0)$
In fig (B) the ~~change of~~ flux will be zero as $\frac{1}{2}$ of the coil will have +ve flux & the other half will have −ve flux.

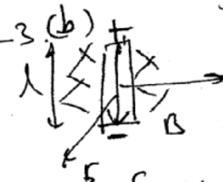
22. (a)

$\phi = \pi R^2 . B \Rightarrow EMF = \pi r^2 \frac{dB}{dt} = E \times 2\pi r$

$\Rightarrow E = \frac{1}{2}\frac{dB}{dt} r \Rightarrow F = \frac{1}{2} Q r \frac{dB}{dt}$

$\tau = Fr = \frac{1}{2} Q r^2 \frac{dB}{dt}$

23. (b)



EMF across the rod $= Bvl$
In this case the upper end will be at high Pot. compared to lower end. So there will be electric field.

24. (C) As the loop will enter into the magnetic field the flux will increase as a result the EMF will be negative which will be constant but will change it's sign after $\frac{1}{2}$ rotation.

$\phi = \frac{\pi r^2 \theta}{2\pi} B = \frac{\pi r^2}{2\pi} B \times \omega t$

$\Rightarrow \varepsilon = -\frac{d\phi}{dt} = \frac{-\pi r^2}{2\pi} B\omega$

25. (d) When the magnet will move towards the coil or away from it, the flux of the coil will change & EMF will be induced across it generating current & heat, the magnetic field of this current will oppose the motion of the magnet, Gradually KE of

of the magnet will be generated as heat across the coil

26. (c) $\varepsilon_2 = M\frac{di_1}{dt} \Rightarrow 2\,mV = M \times k$

and $\varepsilon_1 = M\frac{di_2}{dt} = \frac{2\,mV}{\cancel{k}} \times 3\cancel{k} = 6\,mV$

27. (d) $B = \mu_0 n i$, If length of the solenoid is l & area of one turn is V

$$\phi = \underbrace{\mu_0 n i \times A}_{\text{flux of one turn}} \times nl = \mu_0 n i \times Al \times n = B \times V \times n$$

28. (a) (b)

29. (a) (b) (d)

30. (b) $B = \mu_0 n i$

$$\phi = \underbrace{\mu_0 \frac{n}{l} \cancel{i} \times A}_{\text{of one turn}} \times n = L\cancel{i}$$

$L \propto \frac{n^2}{l} \Rightarrow$ L becomes two times