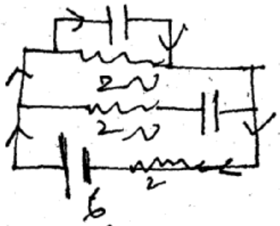
PHYSICS

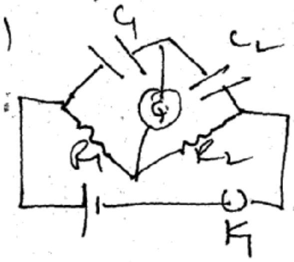
(1)

Q.1. (a)



$i = \frac{6}{2} = 3$ Amp.

Q.2 (d)

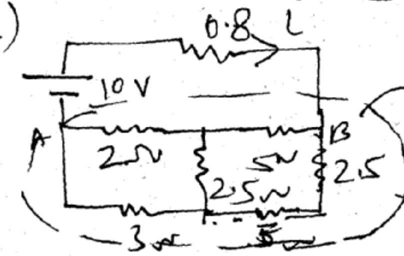


for the balancing

$\frac{C_1}{C_2} \cdot \frac{C_2}{C_1} = \frac{R_1}{R_2}$

$\frac{C}{3} = \frac{6}{2} \Rightarrow C = 1 \mu f$

Q.3. (a)



→ This is a balanced wheat-stone bridge

→ eq. R = 4.2

Total resistance of the circuit = 5 Ω

The current through 8 Ω = $\frac{10}{5} = 2$ Amp

$V_A + 10 - 2 \times 0.8 = V_B \Rightarrow V_A - V_B = -(8.4 V)$.

Q.4. (C) As the potential energy of the system dependens upon the relative orientation & position of the dipoles, it remains same. So work done = zero.

5. (a) Electric field due to -ve part $= \frac{3}{4}\left(\frac{\sigma}{2\varepsilon}\right)$

" " " + ve part $= \frac{1}{4}\frac{\sigma}{2\varepsilon}$

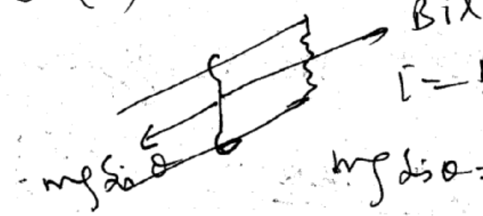
Net electric field downwards $= \frac{\sigma}{4\varepsilon}$

The displacement is against the electric force

$W = -\frac{\sigma}{4\varepsilon} d$

(2)

6. (a)



$i = \frac{Bvl}{R}$

$mg\sin\theta = B \times \frac{Bvl}{R} \times l$

$v = \frac{mgR\sin\theta}{B^2 l^2}$

7. (c) $\frac{200}{R} = 2 \Rightarrow R = 100$

Then $\frac{400}{\sqrt{(100)^2 + (2\pi \times 50 L)^2}} = 2 \Rightarrow L = .55\ H$

9. $F = BiR\sqrt{2}$ $F' = Bi \times 2R$

So $F' = \frac{F}{\sqrt{2}} 2 = F\sqrt{2}$

8. (c) $\sqrt{2} = \frac{V_0}{Z}$ & $1 = \frac{V_0}{Z}\sin\omega t$

$\Rightarrow \sin\omega t = \frac{1}{\sqrt{2}}$ also $Z = \sqrt{(X_L - X_C)^2 + R^2}$
$= 50\sqrt{10}$

So $V_A - V_B = V_{instantaneous} = V_0 \sin\omega t$
$= Z \times 1 \times \frac{1}{\sqrt{2}} = 50\sqrt{5}\ V.$

10. (a) $\frac{Q_1}{3R} + \frac{Q_2}{3R} + \frac{Q_3}{3R} = 0$ (other options may also be correct)

as $\frac{Q_1}{R} + \frac{Q_2}{2R} + \frac{Q_3}{3R} = 0$ is also correct

11. (a) $V_p = V \Rightarrow V_q = 4V$

$\Rightarrow q(V_q - V_p) = \frac{1}{2}mv^2 = q3V$

$\Rightarrow v = \sqrt{\frac{6qV}{m}}$

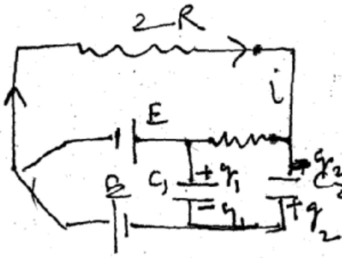
(2)

12. (b)

$$K\frac{Q}{a} - K\frac{2Q}{1.2a} = K\frac{Q}{r} - K\frac{2Q}{r}$$

$\Rightarrow r = 1.5a$

13. (a)



$i = \frac{E}{3R}$

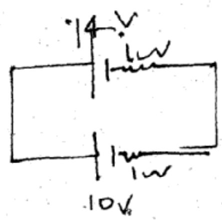
Votage across $C_1 = 2E$

Votage aross $C_2 = 2E - \frac{E}{3} = \frac{5E}{3}$

So $\frac{1}{2} C_1 \times 4E^2 = \frac{1}{2} C_2 \times \frac{25}{9} E^2$

$C_1/C_2 = \frac{25}{36}$

14. (b)

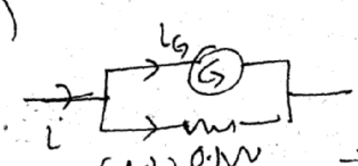


$i = \frac{14-10}{2} = \frac{4}{2} = 2$ Amp.

Power given to smaller cell $= E\,i = 10 \times 2 = 20W$

15. (d) Electric field b/w the plates depends only upon the charge on the Capacitor, which remains constant. So, the E. will remain constant.

16. (a)

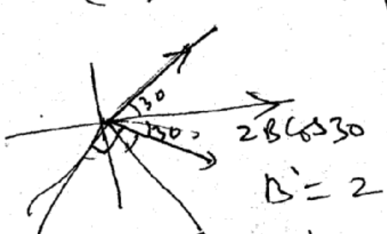


$$i_G = \frac{i \times 0.1}{R_G + 0.1}$$

$$\Rightarrow i = \frac{100 \times 10^{-6} \times (100.1)}{0.1}$$

$i = 10^{-3} \times 100.1$

17. (b)



$$B' = 2\frac{\mu_0}{2\pi} \times \frac{i}{4 \times 10^{-2}} \times \frac{\sqrt{3}}{2} = \frac{4 \times 10^{-7} \times 2 \times \sqrt{3}}{4 \times 10^{-2} \times 2}$$

$B' = 10^{-5} \times \sqrt{3}$

(4)

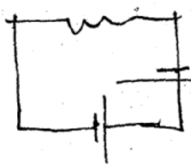
18. (a) After one revolution (Hellical path)

19. (b) $i = i_0\left(1-e^{-tR/L'}\right) = \frac{V}{R}\left(1-e^{-\frac{3}{2}\frac{R}{L}t}\right)$

Distribution of current in L & 2L will be in the inverse ratio of the value of inductance

$\left(\frac{1}{L'} = \frac{1}{L} + \frac{1}{2L}\right)$

20. (a)

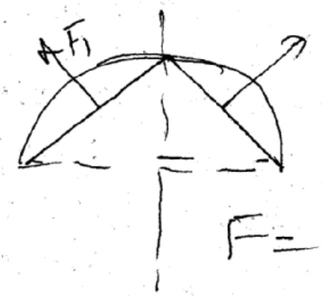


Induced EMF $= A\frac{dB}{dt}$

$= 2.160\text{ V}$

$i = \frac{4.0 - 2.160}{10} = 0.18\text{ A}$

21. (c)



$F_1 = B_0 i R\sqrt{2}$

$F_2 = 2B_0 i R\sqrt{2}$

$F = \sqrt{F_1^2 + F_2^2} = B_0 i R\sqrt{2+8}$

$= B_0 i R\sqrt{10}$

22. (d)

Electric flux due to +q ($\frac{a}{2}$, above)

$\frac{q}{6\varepsilon_0}$ (field downwards)

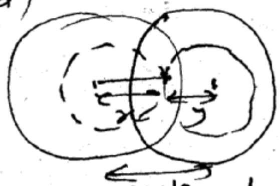
Electric flux due to the charge −q at the corner

$\frac{q}{24\varepsilon_0}$ (field downwards)

Total flux $\left(\frac{q}{6\varepsilon_0} + \frac{q}{24\varepsilon_0}\right)$

22. (b) $V_{ac} = V_{ab} + V_{bc}$
$= Bva + 0$

23. (a)



Net current flows in the superposed part. $x+y=d$ (By the superposition of the two current, net current will become zero.)

$B_1 \times 2\pi x = \mu_0 J \pi x^2$ & $B_2 \times 2\pi y = (-\mu_0 J \pi y^2)$

$B_1 = \frac{\mu_0 J x}{2}$ & $B_2 = \left(-\frac{\mu_0 J}{2} y\right)$

$B = B_1 + B_2 = \frac{\mu_0 J}{2}(x+y) = \frac{\mu_0 J}{2}(d)$

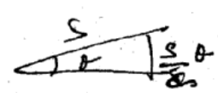
25. (d) The path will be hellical $t = \frac{\pi}{B_0\alpha} = \frac{T}{2}$

$x = \frac{v_0 \pi}{B_0 \alpha}$; as the half revolution will be completed $y = 0$ & $z = -2R$ $\left[R = \frac{mv}{qB}\right]$

26. (d) $M = \int_0^r \frac{q \times 2\pi x\,dx}{\pi r^2} \cdot \frac{w x^2}{2\pi} = \frac{qwr^2}{4}$

$\tau = \vec{M} \times \vec{B} = \frac{qwr^2 B \sin\theta}{4}$ on the disc anticlockwise, so on the axis it will be clockwise.

27. (a) $F = Bil = B\frac{dq}{dt} l$



$\Delta p = F\,dt = B\,dq\,l$

$KE = \frac{p^2}{2m} = \frac{B^2 (dq)^2 l^2}{2m}$ = gain of PE $= mgS\sin\theta$

calculate (dq)

28. (1) In the steady state current through the inductor $i = \left(\frac{E}{r}\right)$

So energy stored across inductor.

$$U = \frac{1}{2} L \left(\frac{E}{r}\right)^2$$

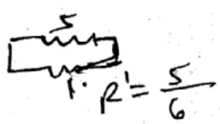
This ~~heat~~ energy will be generated in the form of heat across r & R in the proportionality of the resistances.

So heat across $r = \frac{1}{2} L \left(\frac{E}{r}\right)^2 \times \frac{r}{R+r}$

29. (c)

$$\frac{i}{6} = i \times \frac{5}{(5+R_G)} \Rightarrow 5 + R_G = 30$$

$$R_G = 25$$



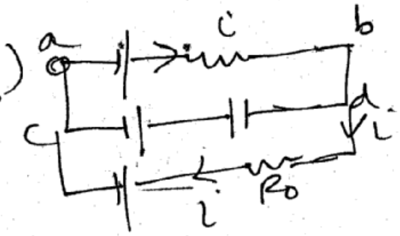
$R' = \frac{5}{6}$

Later $i' = i \times \frac{\frac{5}{6}}{\left(\frac{5}{6}+25\right)} = \frac{5}{5+150} = \frac{5}{155} i$

$$i' = i \times \frac{1}{31}$$

30. (d)

$$i = \left(\frac{E - E_0}{R + R_0}\right)$$



$V_a + E - iR = V_b$

$V_a - V_b = iR - E = \left(\frac{E - E_0}{R + R_0}\right) R - E$

$= V_c - V_d$

$V_c + E + \frac{q}{C} = V_d$ Keep the value of $V_c - V_d$ from above