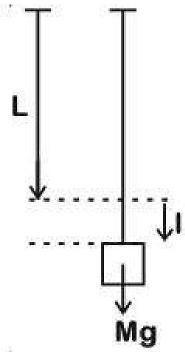
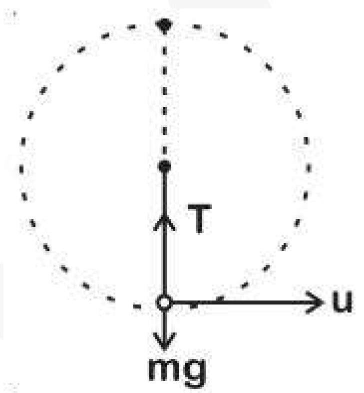
NEET 2019 PHYSICS SOLUTIONS

1. 

$U = \frac{1}{2}(\text{ work done by gravity })$

$U = \frac{1}{2}Mgl$

2. 

$T - mg = \frac{mu^2}{l}$

$T = mg + \frac{mu^2}{l}$

The tension is maximum at the lowest position of mass, so the chance of breaking is maximum.

3. $r_H = \frac{p}{eB}$

$r_\alpha = \frac{p}{2eB}$

$\frac{r_H}{r_\alpha} = \frac{\frac{p}{eB}}{\frac{p}{2eB}}$

$\frac{r_H}{r_\alpha} = \frac{2}{1}$

4. Fractional loss of KE of ccolliding body

$$\frac{\Delta KE}{KE} = \frac{4(m_1 m_2)}{(m_1 + m_2)^2}$$

$$= \frac{4(4m)2m}{(4m+2m)^2}$$

$$= \frac{32m^2}{36m^2} = \frac{8}{9}$$

5. In air angular fringe width $\theta_0 = \frac{\beta}{D}$

Angular fringe width in water $\theta_w = \frac{\beta}{\mu D} = \frac{\theta_0}{\mu}$

$$= \frac{0.2^\circ}{\left(\frac{4}{3}\right)} = 0.15^\circ$$

6. Electric heater does not involve Eddy currents. It uses Joule's heating effect.

7. Excess pressure $= \frac{4T}{R}$ Gauge pressure $= \rho g Z_0$

$$P_0 + \frac{4T}{R} = P_0 + \rho g Z_0$$

$$Z_0 = \frac{4T}{R \times \rho g}$$

$$z_0 = \frac{4 \times 2.5 \times 10^{-2}}{10^{-3} \times 1000 \times 10} m$$

$Z_0 = 1$ cm

8. Red has the longest wavelength among the given options.

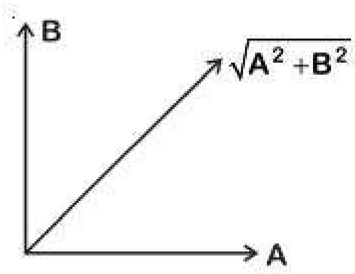
9. Work required = change in kinetic energy

Final KE = 0

$$\text{Initial KE} = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 = \frac{3}{4}mv^2$$

$$= \frac{3}{4} \times 100 \times \left(20 \times 10^{-2}\right)^2 = 3J \qquad |\Delta KE| = 3J$$

10.



$y = A_0 + A\sin\omega t + B\sin\omega t$

Equate SHM

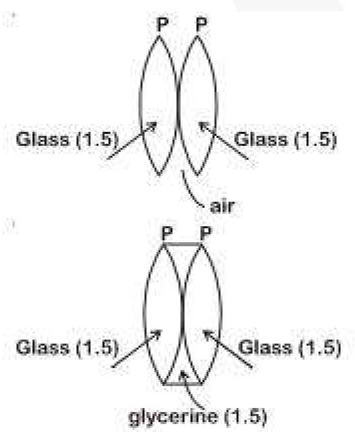
$y' = y - A_0 = A\sin\omega t + B\cos\omega t$

Resultant amplitude

$$R = \sqrt{A^2 + B^2 + 2AB\cos 90°}$$

$$= \sqrt{A^2 + B^2}$$

11.



Equivalent focal length in air $\frac{1}{F_1} = \frac{1}{f} + \frac{1}{f} = \frac{2}{f}$

When glycerin is filled inside, glycerin lens behaves like a diverging lens of focal length (–f)

$$\frac{1}{F_2} = \frac{1}{f} + \frac{1}{f} - \frac{1}{f} = \frac{1}{f}$$

$$\frac{F_1}{F_2} = \frac{1}{2}$$

12. Increase in temperature would lead to the increase in kinetic energy of gas (assuming far as to be ideal) as $U = \frac{F}{2}nRT$

13. For an electron accelerated through a potential V

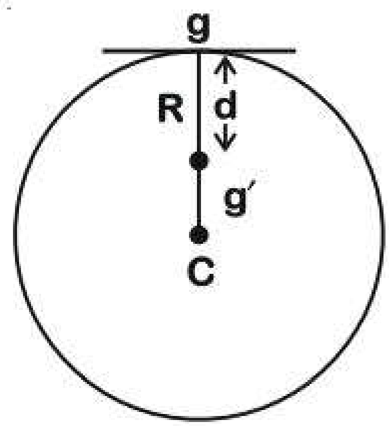
$$\lambda = \frac{12.27}{\sqrt{V}}\text{Å} = \frac{12.27\times10^{-10}}{\sqrt{10000}} = 12.27\times10^{-12}\,\text{m}$$

14. $\alpha_{Cu}L_{Cu} = \alpha_{Al}L_{Al}$

$1.7\times10^{-5}\times88\text{cm} = 2.2\times10^{-5}\times L_{Al}$

$L_{Al} = \frac{1.7\times88}{2.2} = 68\text{cm}$

15. Rainbow can't be observed when observer faces towards sun.

16. 

Acceleration due to gravity at a depth d from surface of earth

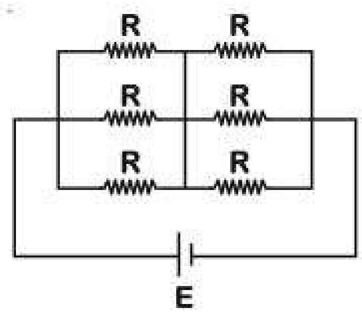
$g' = g\left(1-\frac{d}{R}\right)\ldots(1)$

Where g = acceleration due to gravity at earth's surface
Multiplying by mass 'm' on both sides of (1)

$mg' = mg\left(1-\frac{d}{R}\right) \quad \left(d=\frac{R}{2}\right)$

$= 200\left(1-\frac{R}{2R}\right) = \frac{200}{2} = 100\text{N}$

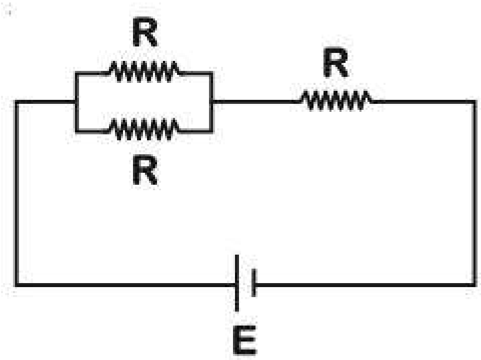
17. (i) All bulbs are glowing



$$R_{eq} = \frac{R}{3} + \frac{R}{3} = \frac{2R}{3}$$

$$\text{Power}\left(P_i\right) = \frac{E^2}{R_{eq}} = \frac{3E^2}{2R} \qquad ......(1)$$

(ii) Two from section A and one from section B are glowing.



$$R_{eq} = \frac{R}{2} + R = \frac{3R}{2}$$

$$\text{Power}\left(P_f\right) = \frac{2E^2}{3R} \qquad ...(2)$$

$$\frac{P_i}{P_f} = \frac{3E^2 3R}{2R2E^2} = 9:4$$

18. In p-type semiconductor, an intrinsic semiconductor is doped with trivalent impurities, that creates deficiencies of valence electrons called holes which are majority charge carriers.

19. In one complete vibration, displacement is zero. So, average velocity in one complete vibration

$$= \frac{\text{Displacement}}{\text{Time interval}} = \frac{y_f - y_i}{T} = 0$$

20. The heat current related to difference of temperature across the length l of a conductor of area A is

$$\frac{dH}{dt} = \frac{KA}{\ell}\Delta T \qquad \text{(K= coefficient of thermal conductivity)}$$

$$\therefore \quad K = \frac{\ell dH}{Adt\Delta T}$$

Unit of K = $Wm^{-1} K^{-1}$

21. Work energy theorem.

$$W=\frac{1}{2}I\left(\omega_f^2-\omega_i^2\right)$$

$\theta = 2\pi$ revolution $= 2\pi\times 2\pi = 4\pi^2 \text{rad}$

$$W_i = 3\times\frac{2\pi}{60}\text{rad / s}$$

$$\Rightarrow -\tau\theta=\frac{1}{2}\times\frac{1}{2}mr^2\left(0^2-\omega_i^2\right)$$

$$\Rightarrow -\tau=\frac{\frac{1}{2}\times\frac{1}{2}\times 2\times\left(4\times 10^{-2}\right)\left(-3\times\frac{2\pi}{60}\right)^2}{4\pi^2}$$

$$\Rightarrow \tau = 2\times 10^{-6}\,\text{Nm}$$

22. Work done by variable force is

$$\mathbf{W}=\int_{y_1}^{y_f}\mathbf{Fdy}$$

Here, $y_i = 0$, $y_f = 1$ m

$$\therefore W=\int_0^1(20+10y)dy=\left[20y+\frac{10y^2}{2}\right]_0^1=25J$$

23. Fuse wire has less melting point so when excess current flows, due to heat produced in it, it melts.

24. For ideal voltmeter, resistance is infinite and for the ideal ammeter, resistance is zero.

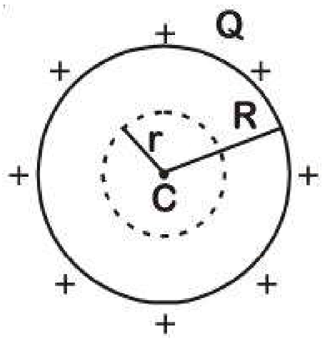
$$V_1 = i_1\times 10=\frac{10}{10}\times 10 = 10\text{volt}$$

$$V_2 = i_2\times 10=\frac{10}{10}\times 10 = 10\text{volt}$$

$$V_1 = V_2$$

$$i_1 = i_2 = \frac{10V}{10\Omega}=1A$$

25.



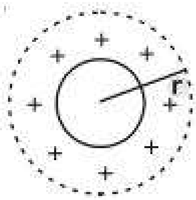
Charge Q will be distributed over the surface of hollow metal sphere.

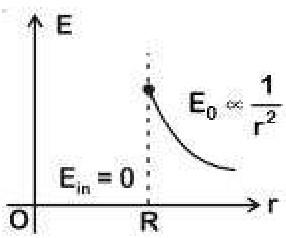
(i) For r < R (inside)

By Gausslaw, $\oint \vec{E}_{in} \cdot \overrightarrow{dS} = \frac{q_{en}}{\varepsilon_0} = 0$

$\Rightarrow E_{in} = 0 \quad (\because q_{en} = 0)$

(ii) For r > R (outside)





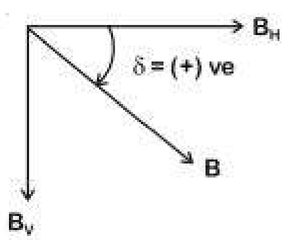
$\oint \vec{E}_0 \cdot \overrightarrow{dS} = \frac{q_{en}}{\varepsilon_0}$

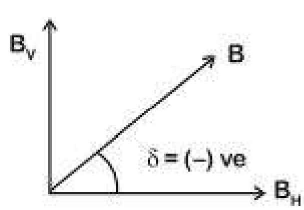
Here, $q_{en} = Q(\because q_{en} = Q)$

$\therefore E_0 4\pi r^2 = \frac{Q}{\varepsilon_0}$

$\therefore E_0 \propto \frac{1}{r^2}$

26. Angle of dip is the angle between earth's resultant magnetic field from horizontal. Dip is zero at equator and positive in northern hemisphere.





In southern hemisphere dip angle is considered as negative.

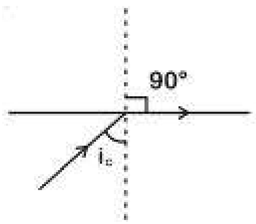
27. In Bohr's model of H atom

$\therefore \quad K.E. = |TE| = \frac{|U|}{2}$

$\therefore \quad K \cdot E = 3.4eV$

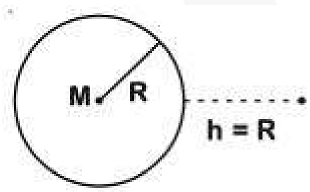
$U = -6.8eV$

28.



At $i = i_c$, refracted ray grazes with the surface.
So angle of refraction is 90°.

29.



Initial potential energy at earths surface is

$$U_i = \frac{-GMm}{R}$$

Final potential energy at height h = R

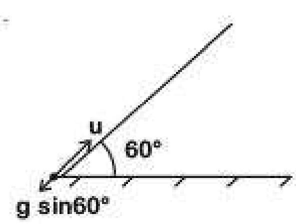
$$U_f = \frac{-GMm}{2R}$$

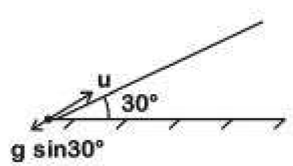
As work done = Change in PE

$\therefore w = U_f - U_1$

$$= \frac{GMm}{2R} = \frac{gR^2 m}{2R} = \frac{mgR}{2} \quad \left(\because GM = gR^2\right)$$

30.





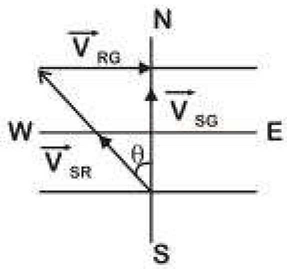
(Stopping distance) $x_1 = \frac{u^2}{2g \sin 60^\circ}$

(Stopping distance) $x_2 = \dfrac{u^2}{2g\sin 30^\circ}$

$$\Rightarrow \quad \frac{x_1}{x_2} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{1\times 2}{2\times\sqrt{3}} = 1:\sqrt{3}$$

31. α-particle is nucleus of Helium which has two protons and two neutrons.

32. $V_{SR} = 20$ m/s $\qquad V_{RG} = 10$ m/s



$\vec{V}_{SG} = \vec{V}_{SR} + \vec{V}_{RG}$

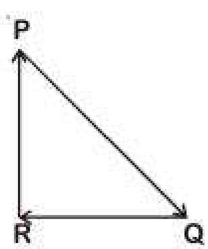
$\sin\theta = \dfrac{|\vec{V}_{RG}|}{|\vec{V}_{SR}|}$

$\sin\theta = \dfrac{10}{20}$

$\sin\theta = \dfrac{1}{2}$

$\theta = 30°$ west

33.



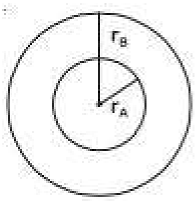
As forces are forming closed loop in same order

So, $\vec{F}_{net} = 0$

$\Rightarrow m\dfrac{d\vec{v}}{dt} = 0$

$\Rightarrow \quad \vec{v} = \text{constant}$

34.



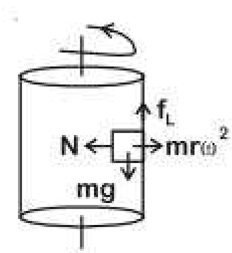
$$T_A = T_B = T$$

$$\omega_A = \frac{2\pi}{T_A}$$

$$\omega_B = \frac{2\pi}{T_B}$$

$$\frac{\omega_A}{\omega_B} = \frac{T_B}{T_A} = \frac{T}{T} = 1$$

35.



For equilibrium of the block limiting friction

$$f_L \geq mg$$

$$\Rightarrow \mu N \geq mg$$

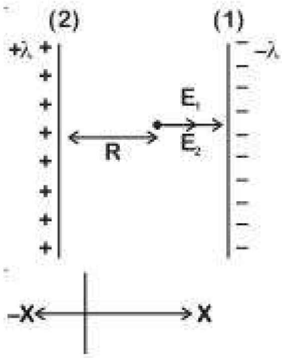
$$\Rightarrow \mu mr\omega^2 \geq mg$$

$$\omega \geq \sqrt{\frac{g}{r\mu}}$$

$$\omega_{min} = \sqrt{\frac{g}{r\mu}}$$

$$\omega_{min} = \sqrt{\frac{10}{0.1 \times 1}} = 10 rad/s$$

36.



Electric field due to line charge (1)

$$\vec{E}_1 = \frac{\lambda}{2\pi\varepsilon_0 R}\hat{i}\,N/C$$

Electric field due to line charge (2)

$$\vec{E}_{net} = \vec{E}_1 + \vec{E}_2$$

$$= \frac{\lambda}{2\pi\varepsilon_0 R}\hat{\mathbf{i}} + \frac{\lambda}{2\pi\varepsilon_0 R}\hat{\mathbf{i}}$$

$$= \frac{\lambda}{\pi\varepsilon_0 R}\hat{i}\,N/C$$

37.

$$F = \frac{kQ^2}{r^2}$$

If 25% of charge of A transferred to B then

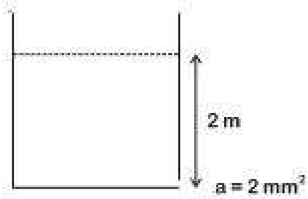
$$q_A = Q - \frac{Q}{4} = \frac{3Q}{4}$$

$$F_1 = \frac{kq_A q_B}{r^2}$$

$$F_1 = \frac{k\left(\frac{3Q}{4}\right)^2}{r^2}$$

$$F_1 = \frac{9}{16}\frac{kQ}{r^2}$$

$$F_1 = \frac{9F}{16}$$

38. 

Rate of flow liquid

$Q = au = a\sqrt{2gh}$

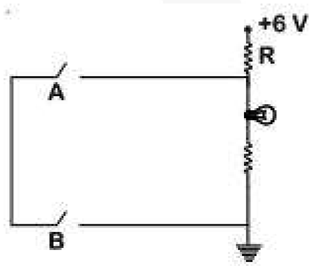
$= 2\times10^{-6} m^2 \times \sqrt{2\times10\times2} m/s$

$= 2 \times 2 \times 3.14 \times 10^{-6} m^3/s$

$= 12.56 \times 10^{-6} m^3/s$

$= 12.6 \times 10^{-6} m^3/s$

39. From the given logic circuit LED will glow, when voltage across LED is high.



Truth Table

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

This is out put of NAND gate.

40. In adiabatic process, there is no exchange of heat.

41. Magnetic field $B = 5 \times 10^{-5}$ T

Number of turns in coil N = 800

Area of coil A = 0.05 m 2

Time taken to rotate $\Delta t = 0.1$ s

Initial angle $\theta_1 = 0°$

Final angle $\theta_2 = 90°$

Change in magnetic flux $\Delta\phi$

$= NBA\cos 90° - BA\cos 0°$

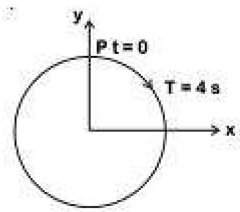
$= - NBA$

$= - 800 \times 5 \times 10^{-5} \times 0.05$

$= - 2 \times 10^{-3}$ weber

$$e = -\frac{\Delta\phi}{\Delta t} = \frac{-(-)2\times10^{-3} Wb}{0.1 s} = 0.02 V$$

42. At $t = 0$, y displacement is maximum, so equation will be cosine function.



$T = 4$ s

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{4} = \frac{\pi}{2} \text{rad/s}$$

$$y = a\cos\omega t$$

$$y = 3\cos\frac{\pi}{2}t$$

43. Capacitance of capacitor $C = 20\mu F$

$= 20 \times 10^{-6}$ F

Rate of change of potential

$$\left(\frac{dV}{dt}\right) = 3v/s$$

$$q = CV$$

$$\frac{dq}{dt} = C\frac{dV}{dt}$$

$i_c = 20 \times 10^{-6} \times 3$

$= 60 \times 10^{-6}$ A

$= 60\mu A$

As we know that $i_d = i_c$

$= 60\mu A$

44. Given $x = \dfrac{A^2B^{\frac{1}{2}}}{C^{\frac{1}{3}}D^3}$

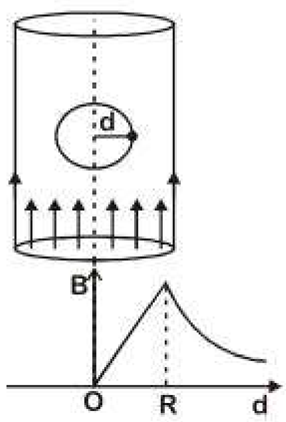
$$\% \text{ error}, \frac{\Delta x}{x}\times 100 = 2\frac{\Delta A}{A}\times 100 + \frac{1}{2}\frac{\Delta B}{B}\times 100 + \frac{1}{3}\frac{\Delta c}{c}\times 100 + 3\frac{\Delta D}{D}\times 100$$

$$= 2\times 1\% + \frac{1}{2}\times 2\% + \frac{1}{3}\times 3\% + 3\times 4\%$$

$= 2\% + 1\% + 1\% + 12\%$

$= 16\%$

45.



Inside (d < R)

Magnetic field inside conductor

$$B = \frac{\mu_0}{2\pi}\frac{i}{R^2}d$$

or $B = Kd$ ...(i)

Straight line passing through origin

At surface (d = R)

$$B = \frac{\mu_0}{2\pi}\frac{i}{R} \quad ....(ii)$$

Maximum at surface

Outside (d > R)

$$B = \frac{\mu_0}{2\pi}\frac{i}{d}$$

or $\mathbf{B} \propto \frac{1}{d}$ (Hyperbolic)