
LIVE
JEE MAIN 2024
ATTEMPT – 01 , 29TH JAN 2024 , SHIFT - 01
PAPER DISCUSSION

JEE MAIN 2024 LIVE PAPER DISCUSSION

PHYSICS

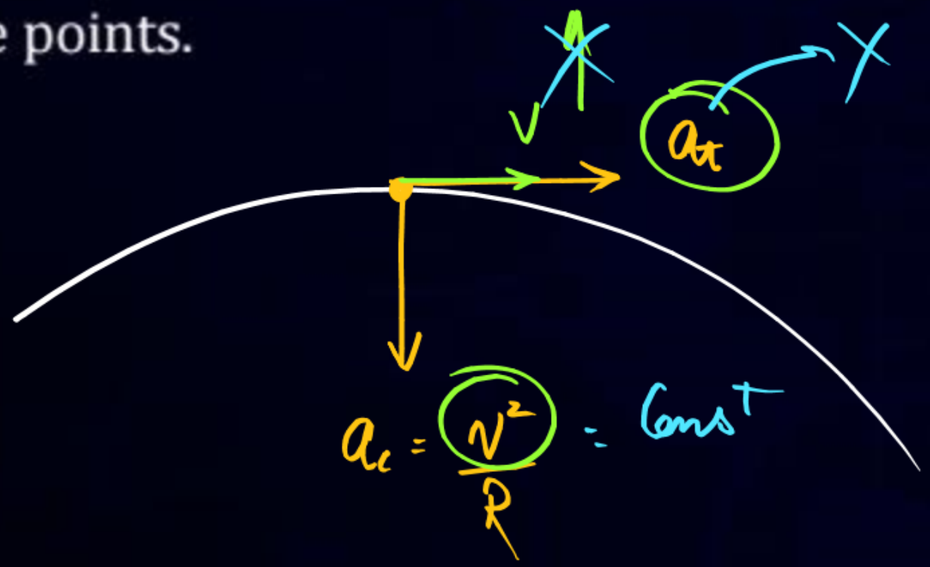
If potential energy of particle is given by $U = 4x^2 + y + z$, find force on the particle in x - direction

$$f_x = -\frac{\partial U}{\partial x}$$

$$f_x = -8x$$

$$x = 1, \quad f_x = -8N$$

An object is moving with an acceleration of constant magnitude in a curved path. if ratio of radius of curvature at two different point is given as 3 : 4, then find the ratio of speeds at those points.



$$\rho = \frac{v^2}{a_\perp}$$

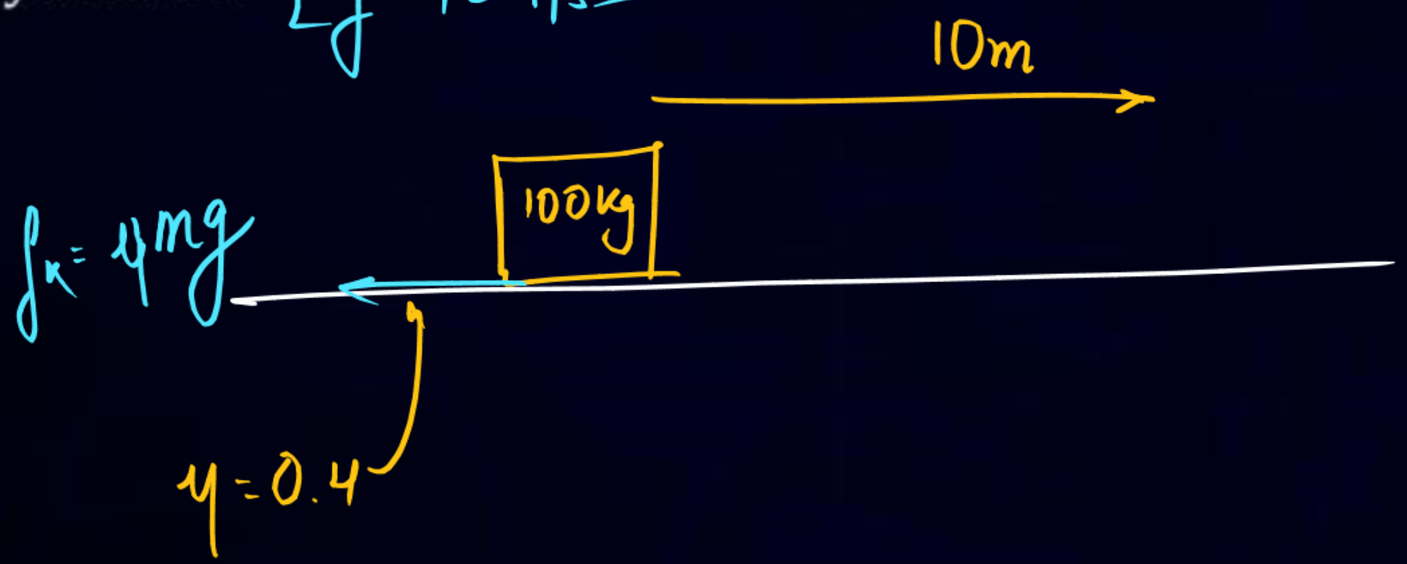
$$\rho \propto v^2$$

$$v \propto \sqrt{\rho}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{\rho_1}{\rho_2}} = \sqrt{\frac{3}{4}}$$

ASAT!!...

A block of 100 kg travels 10 m on a rough surface of coefficient of friction 0.4. Find work done by friction. [$g = 10 m/s^2$]



$$f_k = 0.4 \times 100 \times 10 = 400$$

$$W = -f_k \times d = -4000 J.$$

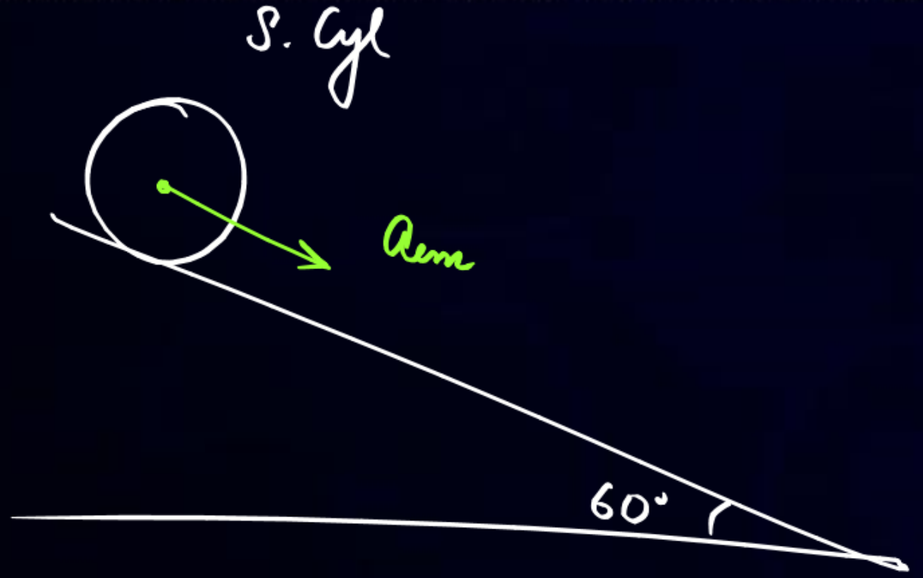
A particle is executing SHM with an amplitude A. Find the ratio of total energy and kinetic energy if it is at x = A/3

$$TE = \frac{1}{2} K A^2$$

$$KE = \frac{1}{2} K (A^2 - x^2)$$

$$\frac{TE}{KE} = \frac{A^2}{A^2 - x^2} = \frac{A^2}{A^2 - \frac{A^2}{9}} = \frac{9}{8}$$

A solid cylinder is released from rest and the surface is sufficiently rough for pure rolling. it rolls without sliding down the inclined plane of inclination $\theta = 60°$ from horizontal. Calculate the acceleration of centre of mass of the cylinder.



$$I = \frac{1}{2}mR^2 = mK^2$$

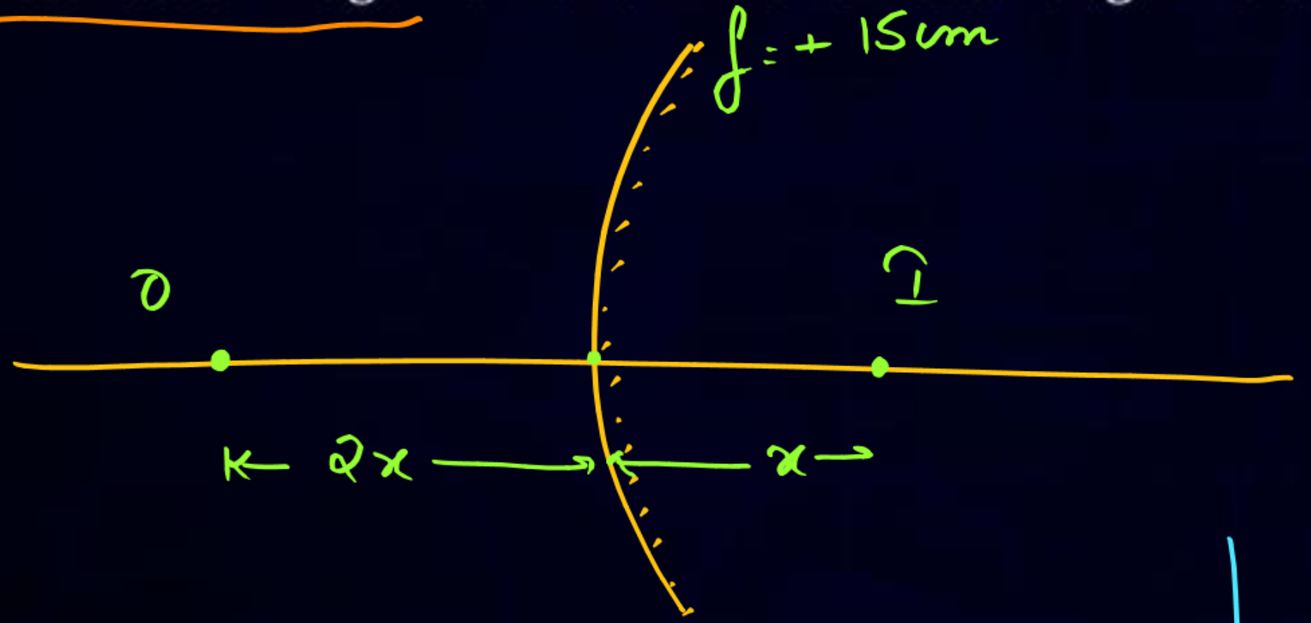
$$\frac{K^2}{R^2} = \frac{1}{2}$$

$$a_{cm} = \frac{g\sin\theta}{1+\eta} = \frac{g\sin\theta}{1+\frac{K^2}{R^2}}$$

$$= \frac{g \times \sqrt{3}}{2\left[1+\frac{1}{2}\right]} = \frac{g}{\sqrt{3}}$$

ASAT!!!

Find distance of image from the mirror of focal length 15 cm. if magnification is 1/2.



Concave / Convex

$$m = \frac{h_i}{h_o} = -\frac{v}{u} = \frac{1}{2}$$

if $u = 2x$

$v = x$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{x} + \frac{1}{-2x} = \frac{1}{15}$$

$$\frac{1}{2x} = \frac{1}{15}$$

$$\boxed{x = 7.5\text{cm}}$$

Value of gravitational acceleration is same at depth d and height h from the surface of earth. Find the value of h. (radius of earth = R_e)

$$g_d = g_h$$

$$g\left(1-\frac{d}{R}\right) = \frac{g}{\left(1+\frac{h}{R}\right)^2}$$

I) $x = d = h \Rightarrow \left(1-\frac{x}{R}\right) = \frac{1}{\left(1+\frac{x}{R}\right)^2}$

$$\frac{R-x}{R} = \frac{R^2}{(R+x)^2}$$

II) $h \ll R$

$$g\left(1-\frac{d}{R}\right) = g\left(1-\frac{2h}{R}\right)$$

$$h = \frac{d}{2}$$

$$(R-x)(R+x)^2 = R^3$$

$$R(R+x)^2 - x(R+x)^2 = R^3$$

$$R(R^2+x^2+2Rx) - x(R^2+x^2+2Rx) = R^3$$

$$R^3 + Rx^2 + 2R^2x - xR^2 - x^3 - 2Rx^2 = R^3$$

$$Rx^2 + 2R^2x - xR^2 - x^3 - 2Rx^2 = 0$$

$$-x^3 + R^2x - Rx^2 = 0$$

$$-x(+x^2 - R^2 + Rx) = 0$$

De broglie wavelength of e and proton are equal. then ratio of K.E. of electron and proton is ?

A 1500

B 1836

C 1600

D 2000

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mK}}$$

$$\lambda^2 = \frac{h^2}{2mK}$$

$$K = \frac{h^2}{2m\lambda^2}$$

$$K \propto \frac{1}{m}$$

$$\frac{K_e}{K_p} = \frac{m_p}{m_e} = 1836$$

e^- : $v = c/4$

photon :

$$\Rightarrow \lambda_e = \lambda_{ph}$$

$$\frac{4h}{mc} = \lambda_{ph}$$

$$\frac{K_e}{E_{ph}} = \frac{\frac{1}{2}mv^2}{\frac{hc}{\lambda_{ph}}} = \frac{1}{2}m\frac{c^2}{16} \times \frac{\lambda_{ph}}{hc}$$

$$= \frac{1}{2}\frac{\cancel{m}\cancel{c^2}}{\cancel{16}_4} \times \frac{1}{\cancel{hc}} \times \frac{\cancel{4}k}{\cancel{mc}}$$

$$= \frac{1}{8}$$

Find the ratio of depth and height from surface of earth at which weight of body become same.

$2h = d$

A 1/2

B 2

C 1/4

D 4

The voltage applied across the resistance R is (200 ± 5) V and current in resistance is 20 ± 0.2. then find % error in resistance.

A 3.5%

B 5%

C 7%

D 3%

$$R = \frac{V}{I}$$

$$\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$$

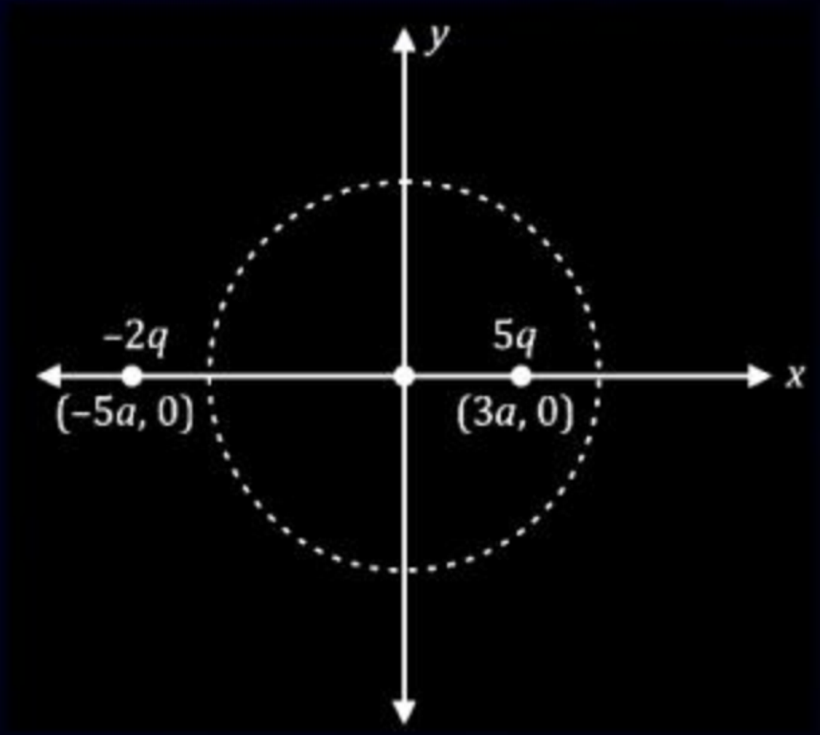
$$= \left(\frac{5}{200} + \frac{0.2}{20}\right) 100$$

$$= \left(\frac{5}{2} + 1\right) = 3.5\%$$

A solid sphere of radius 4a units is placed with its centre at origin. Two charges – 2q at (–5a, 0) and 5q at (3a, 0) is placed. of the flux through the sphere is xq/ε_0, find x

$$\phi = \frac{q_{enc}}{\epsilon_0}$$

$$\boxed{\phi = \frac{5q}{\epsilon_0}}$$



Consider the two statements (Assume density of water to be constant) :

Statement 1 : A capillary tube is first dipped in hot water and then dipped in cold water. The rise is higher in hot water

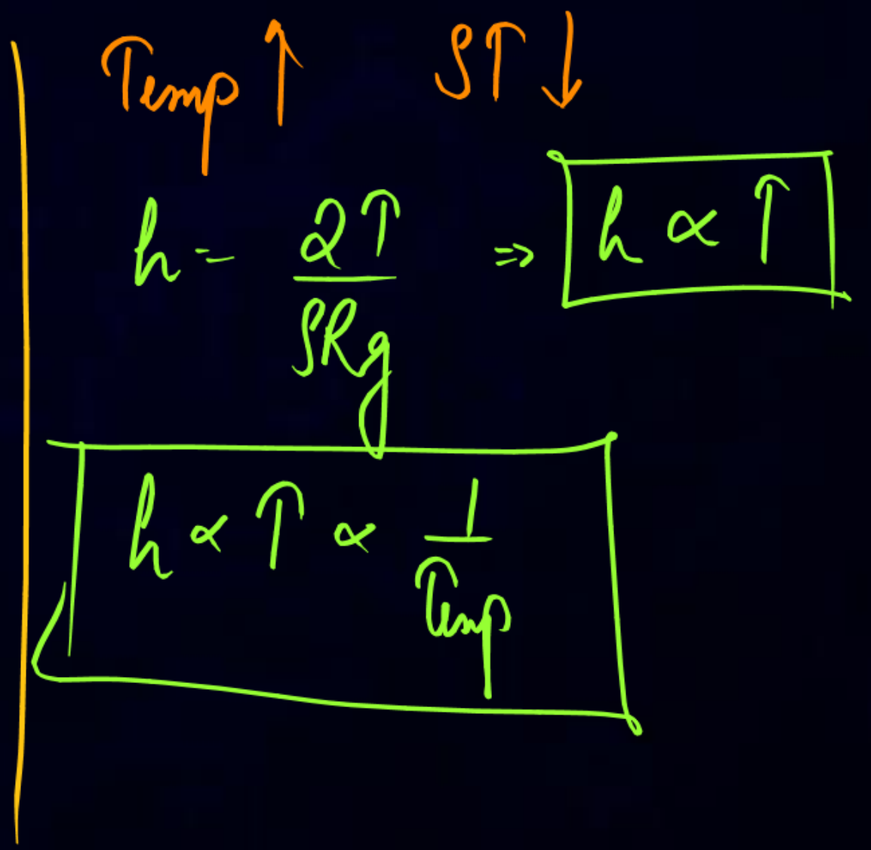
Statement 2 : Capillary tube is first dipped in cold water and then in hot water the rise is higher in cold water

A. Statement 1 is true and statement 2 is false

B. Both statement are true

C. Statement 1 is false, and statement 2 is true

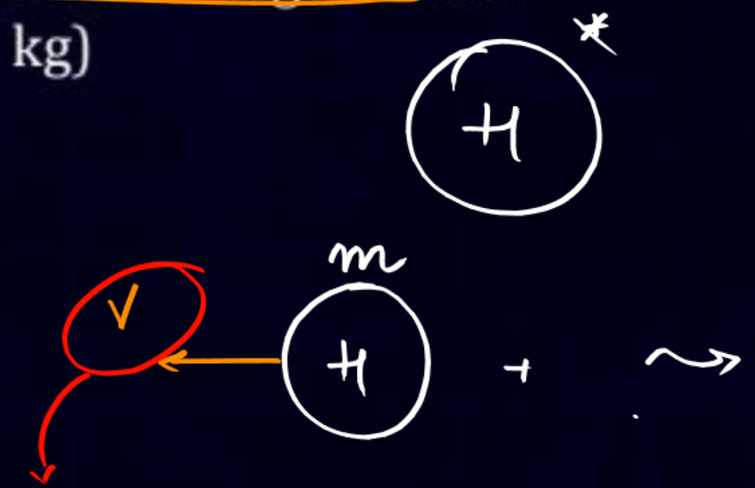
D. Both statement are false



A stationary hydrogen atom excited from first excited state to ground state. Find recoil speed of hydrogen atom atom up to nearest integer value .
(mass of hydrogen atom = 1.8×10^{-27} kg)

$$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$$

$$\boxed{\frac{1}{\lambda} = \frac{3R}{4}}$$



COLM:- $mv = \frac{h}{\lambda}$

$$v = \left(\frac{h}{m}\right)\left(\frac{1}{\lambda}\right)$$

$$v = \frac{h}{m} \times \left(\frac{3R}{4}\right) \times \frac{c}{c}$$

$$v = \frac{3}{4} \times \frac{1}{mc} \times (13.6 \times 1.6 \times 10^{-19})$$

$$= \frac{3}{4} \times \frac{13.6 \times 1.6 \times 10^{-19}}{1.8 \times 10^{-27} \times 3 \times 10^{8}}$$

$$= \frac{136}{18} \times \frac{1}{10}^{2} = \frac{30}{2} \approx 3 \text{ m/s}$$

$u = 0$

If a particle starting from rest having constant acceleration covers distance S_1 in first $(P-1)$ seconds & S_2 in first P seconds, then determine time for which displacement is $S_1 + S_2$

A $\sqrt{2P^2+1-2P}$

B $\sqrt{2P^2+1+2P}$

C $\sqrt{(P-1)^2-P}$

D $2P$

$$S_1 = \frac{1}{2}a(P-1)^2$$

$$S_2 = \frac{1}{2}a(P)^2$$

$$S_1 + S_2 = \frac{1}{2}a(t)^2$$

$$\frac{1}{2}a(P-1)^2 + \frac{1}{2}aP^2 = \frac{1}{2}a(t)^2$$

$$\sqrt{2P^2+1-2P} = t$$

$$t = \sqrt{(P-1)^2 + P^2}$$

Find Work done in the process ABCA ?

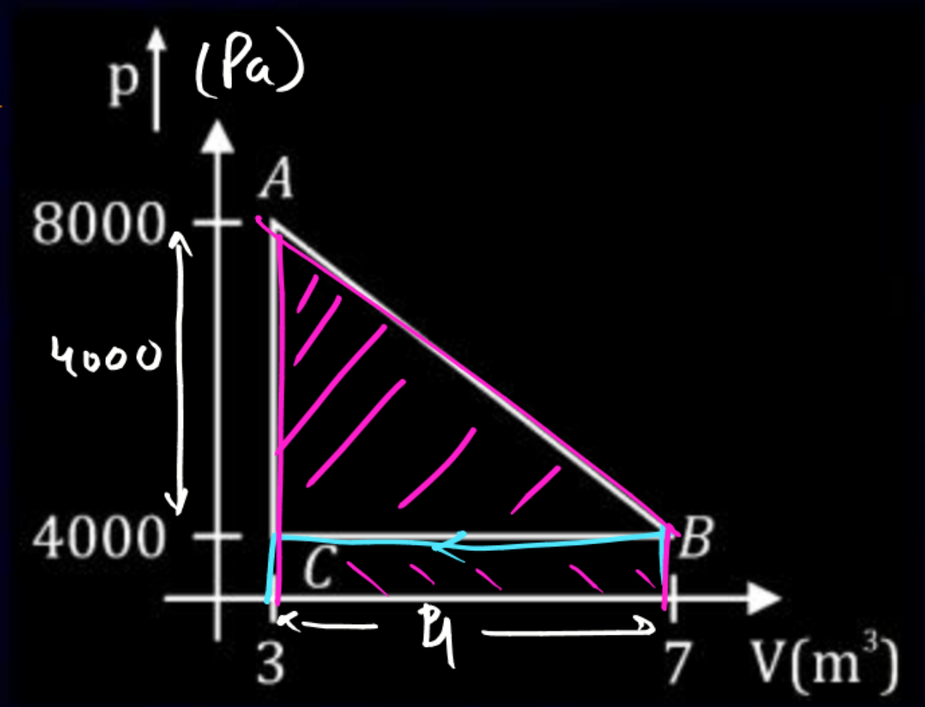
$$W = \frac{1}{2} \times 4 \times 4000$$

$$W = 8000\,J$$

$1N = 10^5$ Dyne

$1m^3 = 10^6 cc$

(Dyne/cc)



$$W_{BC} = 4 \times 4000 = 16000$$

$$W_{AB} = 8000 + 16000 = 24000$$

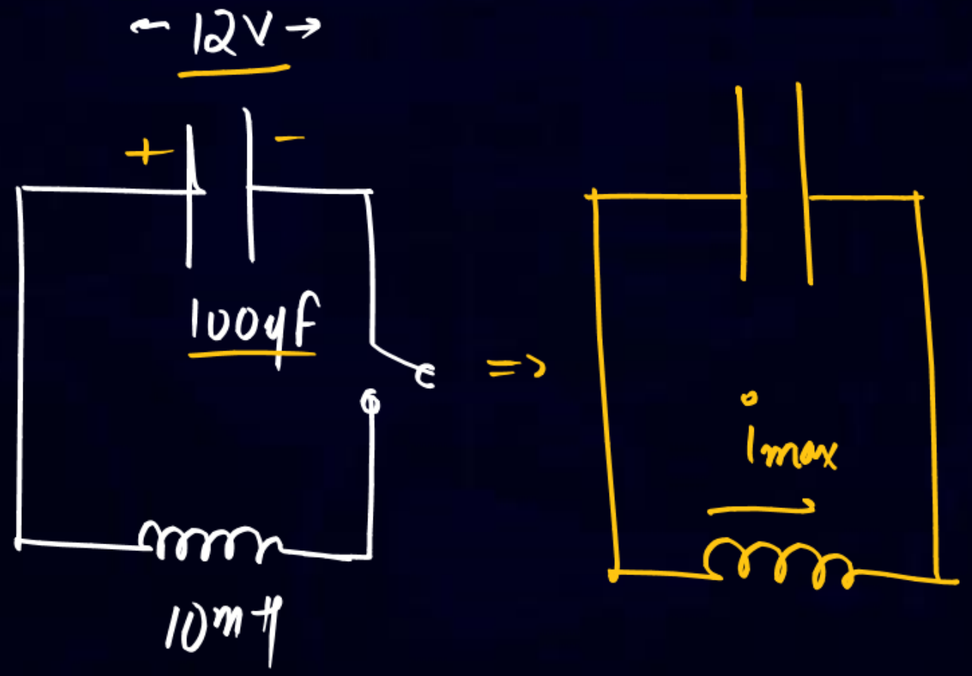
A capacitor having capacitance of 100 μF is charged with a potential difference of 12 V is connected to an inductor of inductance 10 mH. Find the maximum current through the inductor

A 2 A

B 1.6 A

C 2.4 A

D 1.2 A



$$\frac{1}{2}CV^2 = \frac{1}{2}L i_m^2$$

$$100 \times 10^{-6} \times 12 \times 12 = 10 \times i_m^2$$

$$i = \frac{12}{10} = 1.2\,A$$

If electric current passing through a conductor varies with time as $I = I_0 + \beta t$, where $I_0 = 20$ A, $\beta = 3$A/s, then find charge flow through the conductor in first 10 sec.

A. 400 C

B. 500 C

C. 200 C

D. 350 C

$$\frac{dq}{dt} = i = 20 + 3t$$

$$\int_0^q dq = \int_0^{10} (20 + 3t)\,dt$$

$$q = 20 \times 10 + \frac{3}{2} \times 100$$

$$= 200 + 150$$

$$\boxed{q = 350\,C}$$

if $t = 20$ sec

$$\Rightarrow q = 20 \times 20 + \frac{3}{2} \times 20 \times 20$$

$$= 400 \times \frac{5}{2} = 1000\,C$$

RU

If a biconvex lens of material of refractive index 1.5 has focal length 20 cm in air, then its focal length when it is submerged in a medium of refractive index 1.6 is

(A) – 160 cm

(B) 160 cm

(C) 1.6 cm

(D) –16 cm

$$\frac{1}{f_a} = \left(\frac{\mu_g}{\mu_a} - 1\right)\left(\frac{-1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f_a} = (\mu_{ga} - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f_e} = (\mu_{ge} - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{f_e}{f_a} = \frac{\mu_{ga} - 1}{\mu_{ge} - 1}$$

$$\frac{f_e}{20} = \left(\frac{1.5 - 1}{\frac{1.5}{1.6} - 1}\right)$$

$$f_e = 20(0.5)\left(\frac{1.6}{-0.1}\right)$$

$$\boxed{f_e = -160\ \text{cm}}$$

In the following circuit the resistance of square loop ABCD is 16 ohm. Find the voltage across capacitor in steady state.

$i_1 + i_2 = i$ | $i_1 R_1 = i_2 R_2$

(A) 4.5 V

(B) 4 V

(C) 3 V

(D) 1 V

$R = \frac{4 \times 12}{(4+12)} = 3$

$R = 3$

$R_{eq} = 3 + 1 = 4\Omega$

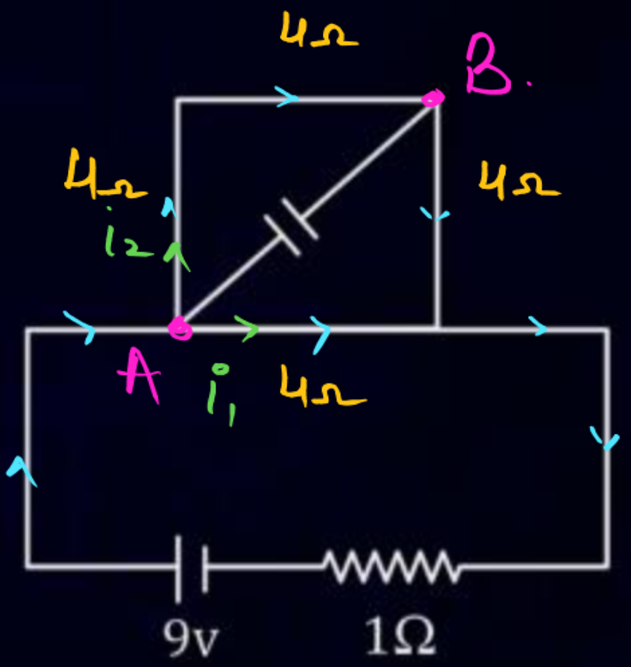
$i = \frac{9}{4} A$

$i_1 = \frac{R_2}{R_1 + R_2} i$

$i_2 = \frac{R_1}{R_1 + R_2} \times i$

$i_1 = \frac{12}{16} \times \frac{9}{4} = \frac{27}{16} i$

$i_2 = \frac{4}{16} \times \frac{9}{4} = \frac{9}{16}$

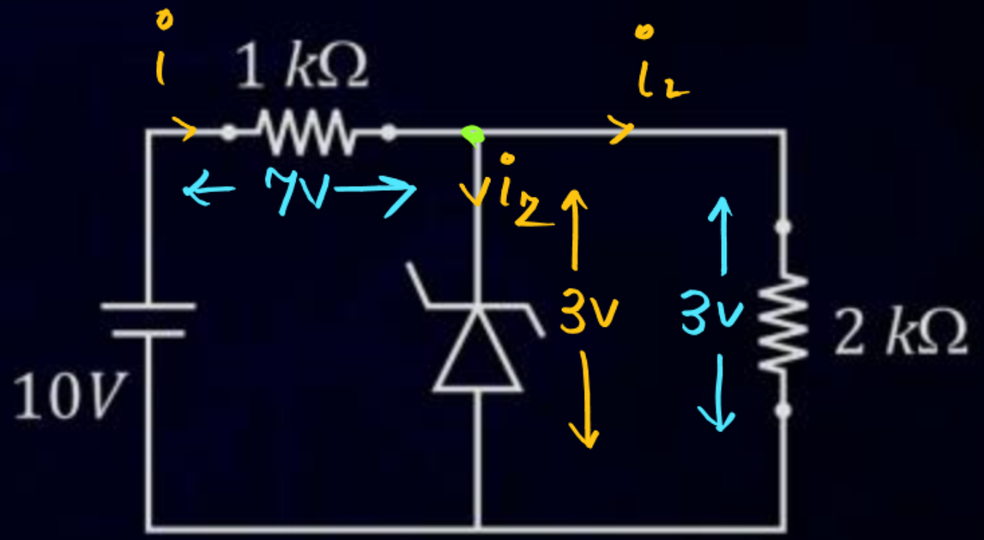


$V_{AB} = iR = \frac{9}{16} \times 4 = 4.5V$

$q = CV$

$q = C \times 4.5$

In the voltage regulator circuit shown below, the reverse breakdown voltage of Zener diode is 3V. Find the current through Zener diode.



A 7 mA

B 1.5 mA

C 5.5 mA

D 10 mA

$$i = \frac{7}{1000} = \frac{14}{2000}$$

$$i_L = \frac{3}{2000}$$

$$\Rightarrow i = i_Z + i_L$$

$$i_Z = i - i_L$$

$$= \frac{14}{2000} - \frac{3}{2000} = \frac{11}{2000} = \frac{11}{2}\,mA = 5.5\,mA.$$

Consider the circuit shown. Galvanometer resistane is 10 Ω and current through galvanometer is 3 mA. find the resistance of shunt.

A $10^{-3}\ \Omega$

B $7.5 \times 10^{-3}\ \Omega$

C $6.75 \times 10^{-3}\ \Omega$

D $3.75 \times 10^{-3}\ \Omega$

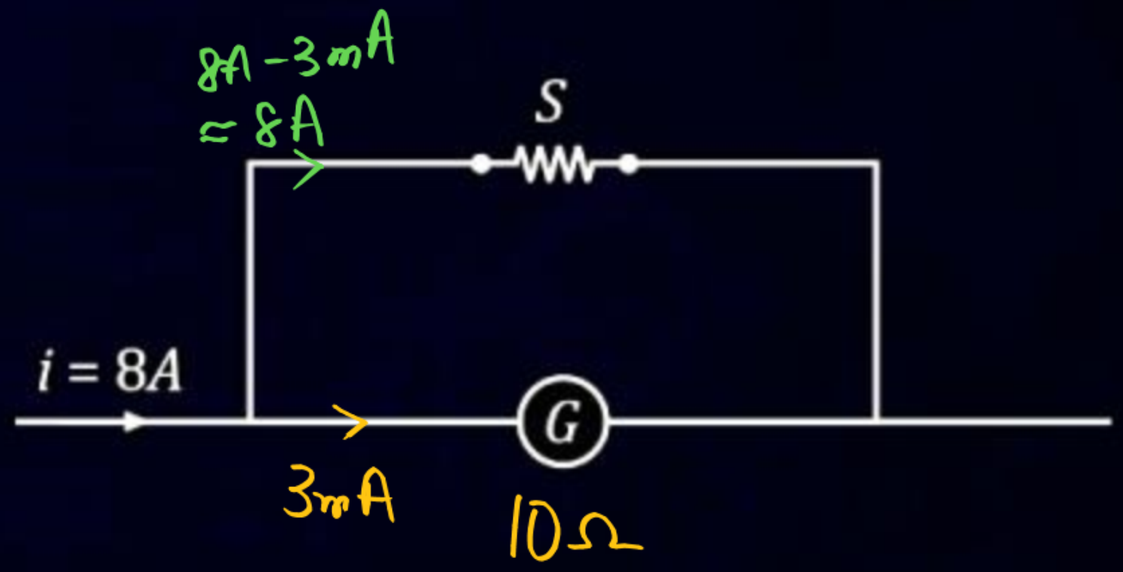
$V = iR$

$8 \times S = \frac{3}{1000} \times 10$

$S = \frac{3}{800}\ \Omega$

$= \frac{30}{8} \times 10^{-3}$

$S = 3.75 \times 10^{-3}\ \Omega$




THANK
YOU