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NEET PHYSICS PAPER SOLUTION 2019

IN THIS PAPER FOCUS ON

RIVER MAN PROBLEM

MAGNETIC FIELD DUE TO SOLID CYLINDER

ELECTRIC FIELD DUE TO SPHERICAL SHELL

AND GATE-LOGIC GATE

1. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes $(L + l)$. The elastic potential energy stored in the extended wire is :

(1) Mgl

(2) MgL

(3) ✓ $\frac{1}{2} Mgl$

(4) $\frac{1}{2} MgL$

2. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when :

(1) the mass is at the highest point

(2) the wire is horizontal

(3) ✓ the mass is at the lowest point

(4) inclined at an angle of 60° from vertical

ANS-1 →

$U = \frac{1}{2}$ (WORK DONE BY GRAVITY)

$= \frac{1}{2} mg(l)$

ANS-2

$T - mg\cos\theta = \frac{mv^2}{r}$

position ①

$\theta = 180°$

$T_1 - mg\cos 180° = \frac{mv^2}{r}$

$T_1 = \frac{mv^2}{r} - mg$ —①

position ②

$T_2 - mg\cos 90 = \frac{mv^2}{r}$

$T_2 = \frac{mv^2}{r}$ —②

position ③

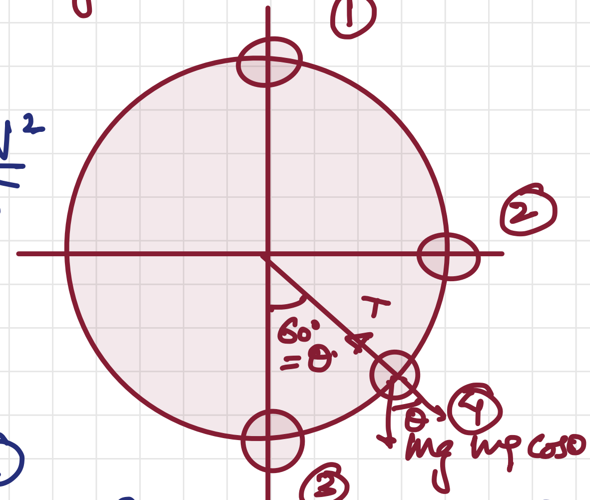
$T_3 - mg\cos 0 = \frac{mv^2}{r}$

$T_3 = \frac{mv^2}{r} + mg$ —③

position ④

$T_4 - mg\cos 60 = \frac{mv^2}{r}$

$T_4 = \frac{mv^2}{r} + \frac{mg}{2}$ —④



From eqn ①, ②, ③, ④ T_3 is maximum. Hence broken at lowest point

3. Ionized hydrogen atoms and α-particles with same momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths $r_H : r_\alpha$ will be :

(1) 2 : 1

(2) 1 : 2

(3) 4 : 1

(4) 1 : 4

ANS - 3

$$qvB = \frac{mv^2}{r} \Rightarrow r = \frac{mv}{qB}$$

$$\frac{r_1}{r_2} = \frac{m_1 v_1}{q_1 B} \cdot \frac{q_2 B}{m_2 v_2}$$

, same momenta $m_1 v_1 = m_2 v_2$

$$\frac{r_1}{r_2} = \frac{q_2}{q_1} = \frac{2e}{e}$$

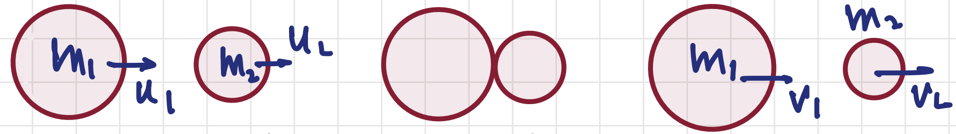
4. Body A of mass 4m moving with speed u collides with another body B of mass 2m, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is :

(1) $\frac{1}{9}$

(2) $\frac{8}{9}$

(3) $\frac{4}{9}$

(4) $\frac{5}{9}$



$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$e = \frac{v_2 - v_1}{u_1 - u_2} \Rightarrow v_2 - v_1 = u_1 - u_2$$

$u_2 = 0,\ u_1 = u,\ v_1 = ?,\ v_2 = ?$

$$m_1 u = m_1 v_1 + m_2 v_2$$

$$v_2 - v_1 = u_1 \Rightarrow v_2 = u_1 + v_1 \qquad u_1 = u$$

$$m_1 u = m_1 v_1 + m_2(u + v_1)$$

$$m_1 u = m_1 v_1 + m_2 u + m_2 v_1$$

$$u(m_1 - m_2) = v_1(m_1 + m_2)$$

$$v_1 = \frac{u(m_1 - m_2)}{(m_1 + m_2)}$$

% ENERGY LOST of A

$$= \frac{\frac{1}{2}m_1u_1^2 - \frac{1}{2}m_1v_1^2}{\frac{1}{2}m_1u_1^2}$$

$$= \frac{\frac{1}{2}m_1u^2 - \frac{1}{2}m_1\left[\frac{u(m_1-m_2)}{(m_1+m_2)}\right]^2}{\frac{1}{2}m_1u^2}$$

$$= \frac{1 - \frac{(m_1-m_2)^2}{(m_1+m_2)^2}}{1} = \frac{(m_1+m_2)^2 - (m_1-m_2)^2}{(m_1+m_2)^2}$$

$$= \frac{(m_1+m_2+m_1-m_2)(m_1+m_2-m_1+m_2)}{(m_1+m_2)^2} = \frac{4m_1m_2}{(m_1+m_2)^2}$$

FORMULA

$$= \frac{4(4m)(2m)}{(4m+2m)^2} = \frac{32m^2}{36m^2} = \frac{8}{9}$$

5. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2°. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water ? ($\mu_{water} = 4/3$)

(1) 0.266°
(2) 0.15° ✓
(3) 0.05°
(4) 0.1°

ANS-5

Angular width $\theta = \beta / D$

$\theta = \frac{D\lambda}{dD} = \frac{\lambda}{d}$

When immersed in water

$\theta' = \lambda' / d$

$\frac{\theta}{\theta'} = \frac{\lambda}{\lambda'} = \mu, \quad \theta' = \theta / \mu = \frac{0.2^\circ}{(4/3)} = 0.15^\circ$

6. In which of the following devices, the eddy current effect is **not** used ?

(1) induction furnace
(2) magnetic braking in train
(3) electromagnet
(4) electric heater ✓

(1), (2), (3) → eddy current

ANS-7

ELECTRIC HEATER
↳ Joules heating effect

7. A soap bubble, having radius of 1 mm, is blown from a detergent solution having a surface tension of 2.5×10^{-2} N/m. The pressure inside the bubble equals at a point Z_0 below the free surface of water in a container. Taking $g = 10$ m/s^2, density of water $= 10^3$ kg/m^3, the value of Z_0 is :

(1) 100 cm

(2) 10 cm

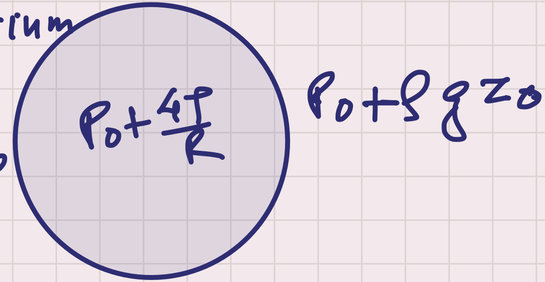
(3) 1 cm

(4) 0.5 cm

ANS-7

Under equilibrium position

$$P_0 + \frac{4T}{R} = P_0 + \rho g z_0$$



$$z_0 = \frac{4T}{R \rho g}$$

$$= \frac{4 \times 2.5 \times 10^{-2}}{10^{-3} \times 10^{3} \times 10} = 1 \text{ cm.}$$

8. Which colour of the light has the longest wavelength?

(1) red

(2) blue

(3) green

(4) violet

ANS-8 →

VIBGYOR

⟶ increasing (λ)

$\lambda_R > \lambda_G > \lambda_B > \lambda_V$.

9. A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it ?

(1) 3 J

(2) 30 kJ

(3) 2 J

(4) 1 J

ANS- 9

WORK REQUIRED = CHANGE IN KE

$= K_f - K_i$

$= 0 - \left(\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2\right)$

$= 0 - \left(\frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{mR^2}{2}\right)\frac{v^2}{R^2}\right)$

$= 0 - \left(\frac{1}{2}mv^2 + \frac{1}{4}mv^2\right)$

$= \frac{3}{4}mv^2 = \frac{3}{4} \times 100 \times (20 \times 10^{-2})^2$

$= 3J$

10. The displacement of a particle executing simple harmonic motion is given by

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

Then the amplitude of its oscillation is given by :

(1) $A_0 + \sqrt{A^2 + B^2}$

(2) $\sqrt{A^2 + B^2}$ ✓

(3) $\sqrt{A_0^2 + (A+B)^2}$

(4) $A+B$

ANS- 10

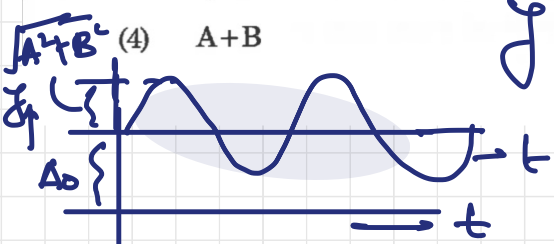
$y = A_0 + A\sin\omega t + B\cos\omega t$

$y = A_0 + \sqrt{A^2+B^2}\left[\frac{A}{\sqrt{A^2+B^2}}\sin\omega t + \frac{B}{\sqrt{A^2+B^2}}\cos\omega t\right]$

$y = A_0 + \sqrt{A^2+B^2}\left[\cos\alpha\sin\omega t + \sin\alpha\cos\omega t\right]$

$= A_0 + \sqrt{A^2+B^2}\sin(\omega t+\alpha)$

Amplitude | $\sin(\omega t+\alpha) = 1$



11. Two similar thin equi-convex lenses, of focal length f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1. When the space between the two lenses is filled with glycerin (which has the same refractive index ($\mu = 1.5$) as that of glass) then the equivalent focal length is F_2. The ratio $F_1 : F_2$ will be :

(1) 2 : 1

(2) 1 : 2 ✓

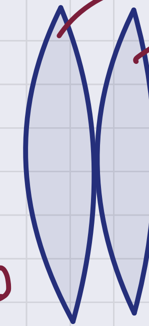
(3) 2 : 3

(4) 3 : 4

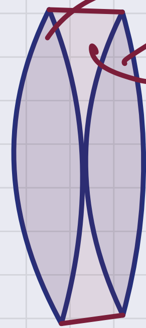
ANS-11

CASE-1

$$\frac{1}{F_1} = \frac{1}{f} + \frac{1}{f} = \frac{2}{f}$$



CASE-2



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

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

12. Increase in temperature of a gas filled in a container would lead to :

(1) increase in its mass

(2) increase in its kinetic energy ✓

(3) decrease in its pressure

(4) decrease in intermolecular distance

ANS-12

$$U = \frac{f}{2} nRT$$

If T ↑↑, KE ↑↑

13. An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, (nearly) : ($m_e = 9 \times 10^{-31}$ kg)

(1) 12.2×10^{-13} m

(2) 12.2×10^{-12} m

(3) 12.2×10^{-14} m

(4) 12.2 nm

14. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is : ($\alpha_{Cu} = 1.7 \times 10^{-5}$ K^{-1} and $\alpha_{Al} = 2.2 \times 10^{-5}$ K^{-1})

(1) 6.8 cm

(2) 113.9 cm

(3) 88 cm

(4) 68 cm

ANS-13 $\lambda = \frac{12.27}{\sqrt{V}} A^0 \rightarrow \bar{e}$

accelerated through P.D. V

$\lambda = \frac{12.27 \times 10^{-10}}{\sqrt{10,000}} = 12.27 \times 10^{-12}$ mt

ANS-14 $\rightarrow l_t = l_0 (1 + \alpha \Delta T)$

$l_t - l_0 = l_0 \alpha \Delta T$

$\Delta l = l_0 \alpha \Delta T$

$\hookrightarrow$ increase in length

$\alpha_{Cu} L_{Cu} \Delta T = \alpha_{Al} L_{Al} \Delta T$

$1.7 \times 10^{-5} \times 88 = 2.2 \times 10^{-5} \times L_{Al}$

$L_{Al} = \frac{1.7 \times 88}{2.2} = 68$ cm

15. Pick the **wrong** answer in the context with rainbow.

(1) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.

(2) The order of colours is reversed in the secondary rainbow.

(3) ✓ An observer can see a rainbow when his front is towards the sun.

(4) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.

ANS-15

Rainbow can not be observed when observer faces towards the sun.

16. A body weighs 200 N on the surface of the earth. How much will it weigh half way down to the centre of the earth ?

(1) 150 N

(2) 200 N

(3) 250 N

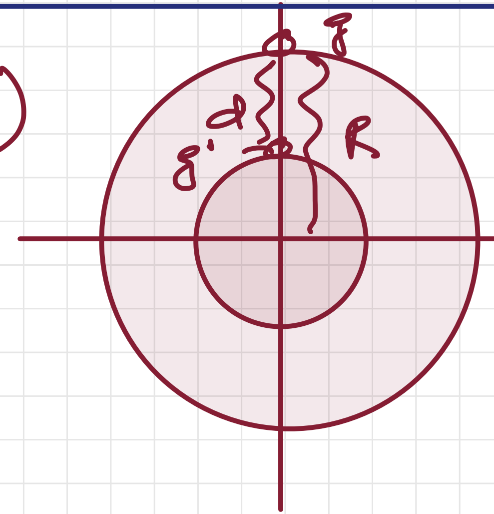
(4) ✓ 100 N

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

$$mg' = mg\left(1 - d/R\right)$$

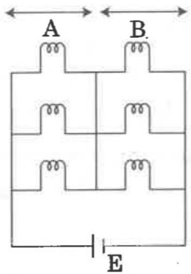
$$= 200\left(1 - \frac{R}{2R}\right)$$

$$= 100\ N$$



17. Six similar bulbs are connected as shown in the figure with a DC source of emf E, and zero internal resistance.

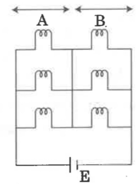
The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be :

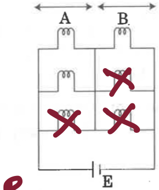


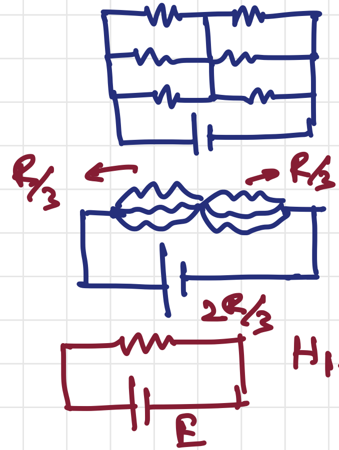
(1) 4 : 9
(2) 9 : 4
(3) 1 : 2
(4) 2 : 1

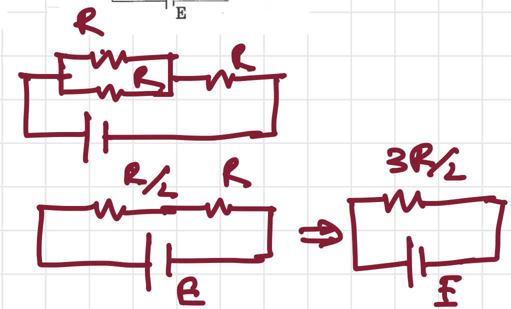
ANS-17

CASE-I
All are glowing









$H_1 = \frac{E^2}{(2R/3)}$ — (1)

$H_2 = \frac{E^2}{(3R/2)}$ — (2)

$\frac{\text{eqn}(1)}{\text{eqn}(2)}$

$\frac{H_1}{H_2} = \frac{3E^2}{R\,2} \cdot \frac{3R}{E^2\,2} = 9/4$

18. For a p-type semiconductor, which of the following statements is **true** ?

(1) Electrons are the majority carriers and trivalent atoms are the dopants.
(2) Holes are the majority carriers and trivalent atoms are the dopants.
(3) Holes are the majority carriers and pentavalent atoms are the dopants.
(4) Electrons are the majority carriers and pentavalent atoms are the dopants.

ANS-18

Intrinsic semiconductor + DOPING (TRIVALENT) = P-Type that creates deficiency of valence e called holes (majority carrier)

19. Average velocity of a particle executing SHM in one complete vibration is :

(1) $\frac{A\omega}{2}$

(2) $A\omega$

(3) $\frac{A\omega^2}{2}$

(4) zero

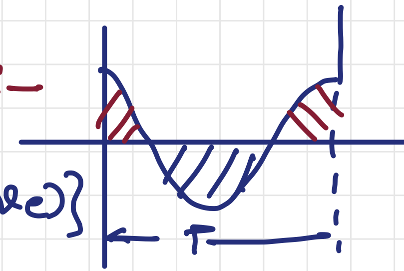
ANS-19

$$v_{avg} = \frac{1}{T}\int_0^T a\omega \cos \omega t \, d\omega t$$

$$= 0$$

OR- IN-OTHER WORDS—

– TOTAL AREA OF THE GRAPH = 0 [(+ve) + (-ve)] [up + down] = 0



20. The unit of thermal conductivity is :

(1) $J\ m\ K^{-1}$

(2) $J\ m^{-1}\ K^{-1}$

(3) $W\ m\ K^{-1}$

(4) $W\ m^{-1}\ K^{-1}$

ANS-20

$$\frac{dQ}{dt} = KA\frac{dT}{dx} \Rightarrow K = \frac{dQ/dt}{A\left(dT/dx\right)}$$

$$K = \frac{\text{Joules/sec}}{mt^2\left(\frac{K}{mt}\right)} = \frac{\left(\frac{\text{Joules}}{\text{sec}}\right)}{mt\ K}$$

$$= \frac{\text{watt}}{mt\ K}$$

$$= W\ m^{-1}\ K^{-1}$$

21. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2π revolutions is :

(1) 2×10^{-6} N m ✓

(2) 2×10^{-3} N m

(3) 12×10^{-4} N m

(4) 2×10^{6} N m

ANS-21

$\tau = I(\alpha)$

$\omega^2 = \omega_0^2 + 2(\alpha)(\theta)$

$(0)^2 = \left(2\pi\times\frac{3}{60}\right)^2 - 2\alpha(2\pi)(2\pi)$

$\frac{4\pi^2}{20\times20} = 2(\alpha)(2\pi)(2\pi) \Rightarrow \alpha = \frac{1}{800}$

$\tau = \frac{MR^2}{2}\times\frac{1}{800} = \frac{2\times(4\times10^{-2})^2}{2}\times\frac{1}{800}$

$= \frac{2\times16\times10^{-4}}{2}\times\frac{1}{800} = 2\times10^{-6}$ N mt

22. A force $F = 20 + 10y$ acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle from $y = 0$ to $y = 1$ m is :

(1) 30 J

(2) 5 J

(3) 25 J ✓

(4) 20 J

ANS-22

$\int dW = \int F\,dy = \int_0^1 (20+10y)\,dy$

$= \left[20y + \frac{10y^2}{2}\right]_0^1 = \left[20 + \frac{10}{2} - 0\right]$

$= 25$ J

23. Which of the following acts as a circuit protection device ?

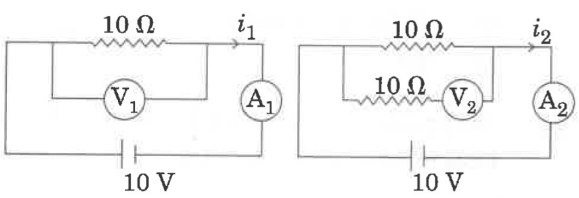
(1) conductor

(2) inductor

(3) switch

(4) fuse

24. In the circuits shown below, the readings of the voltmeters and the ammeters will be :



Circuit 1 Circuit 2

(1) $V_2 > V_1$ and $i_1 = i_2$

(2) $V_1 = V_2$ and $i_1 > i_2$

(3) ✓ $V_1 = V_2$ and $i_1 = i_2$

(4) $V_2 > V_1$ and $i_1 > i_2$

ANS-23

FUSE WIRE – Less melting point

Due to heat it melts.

ANS-24 Ideal Ammeter

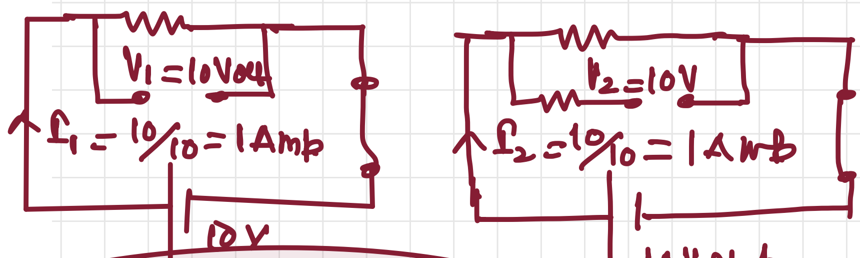
↳ Res = 0

Ideal Voltmeter

Res = ∞

CIRCUIT–I

CIRCUIT–2



$V_1 = V_2$, $I_1 = I_2$

25. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre :

(1) increases as r increases for r < R and for r > R

(2) zero as r increases for r < R, decreases as r increases for r > R ✓

(3) zero as r increases for r < R, increases as r increases for r > R

(4) decreases as r increases for r < R and for r > R

ANS–25

$r = a < R$

Apply gauss theorem

$\oint E.ds = q/\epsilon_0$

$E.4\pi b^2 = 0$, $q = 0$

$E = 0$ | inside. charge resides at the surface

At surface

$r = R$

$\oint E.ds = q/\epsilon_0$ charge enclosed $= Q$

$E.4\pi R^2 = Q/\epsilon_0$

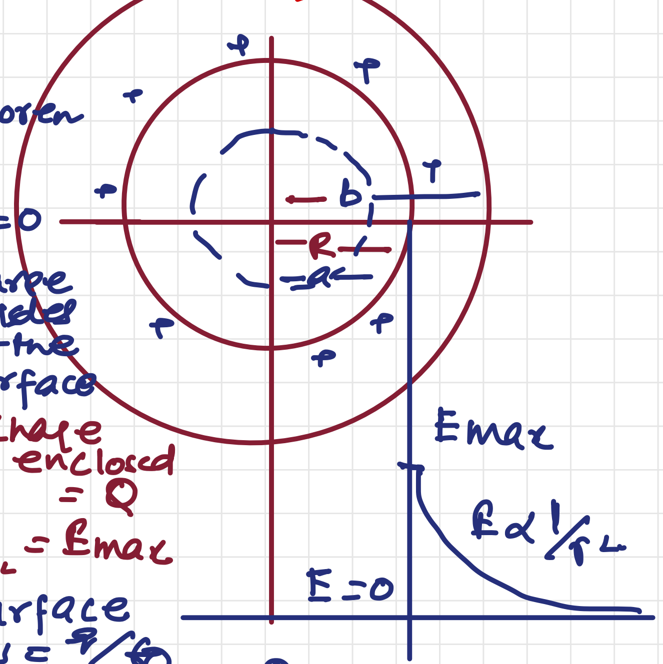
$E = \frac{1}{4\pi\epsilon_0} Q/R^2 = E_{max}$

out side the surface

$r = b > R$, $\oint E.ds = q/\epsilon_0$

$E.4\pi b^2 = Q/\epsilon_0 \Rightarrow E = \frac{1}{4\pi\epsilon_0}\frac{Q}{b^2}$

$E \propto 1/r^2$



26. At a point A on the earth's surface the angle of dip, $\delta = +25°$. At a point B on the earth's surface the angle of dip, $\delta = -25°$. We can interpret that :

(1) A and B are both located in the northern hemisphere.

(2) A is located in the southern hemisphere and B is located in the northern hemisphere.

(3) A is located in the northern hemisphere and B is located in the southern hemisphere.

(4) A and B are both located in the southern hemisphere.

ANS–26 → $0 < \delta < 90°$

positive in NORTHERN HEMISPHERE

NEGATIVE IN SOUTHERN HEMISPHERE

27. The total energy of an electron in an atom in an orbit is -3.4 eV. Its kinetic and potential energies are, respectively :

(1) -3.4 eV, -3.4 eV

(2) -3.4 eV, -6.8 eV

(3) 3.4 eV, -6.8 eV

(4) 3.4 eV, 3.4 eV

28. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction?

(1) 180°

(2) 0°

(3) equal to angle of incidence

(4) 90°

ANS-27

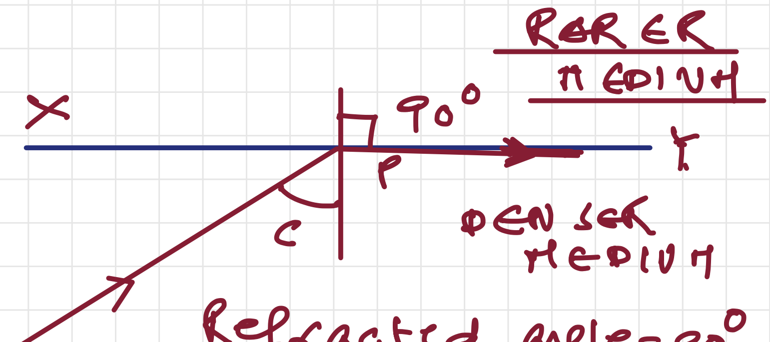
As per Bohr's model

$TE = -3.4$ eV

$KE = -TE = 3.4$ eV

$PE = -2(KE) = -6.8$ eV

ANS-28



Refracted angle = 90°

and angle of incidence will be critical angle

29. The work done to raise a mass m from the surface of the earth to a height h, which is equal to the radius of the earth, is :

(1) mgR

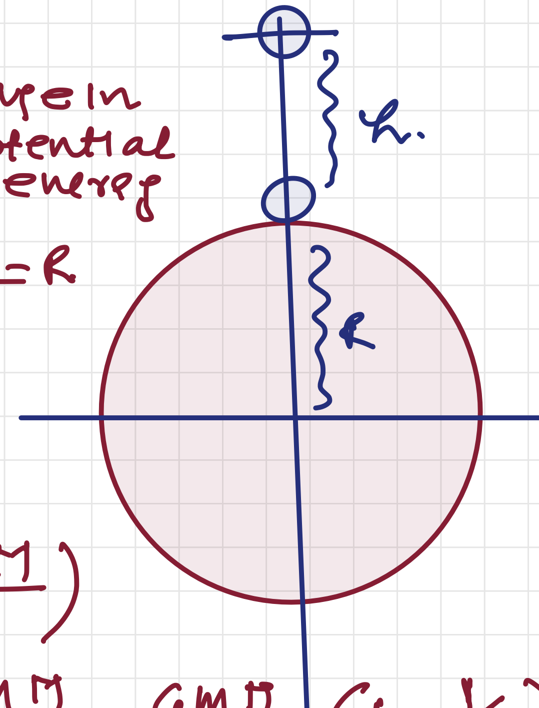
(2) 2 mgR

(3) $\frac{1}{2}$ mgR ✓

(4) $\frac{3}{2}$ mgR

ANS–28

WORK DONE = change in potential energy



$h = R$

$U_f = -\frac{GMm}{(R+h)}$

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

$WD = U_f - U_i$

$= -\frac{GmM}{2R} - \left(-\frac{GmM}{R}\right)$

$= -\frac{GmM}{2R} + \frac{GmM}{R} = \frac{GmM}{R}\left(1 - \frac{1}{2}\right)$

$= \frac{GmM}{2R}$

$= \frac{gR^2 m}{2R} = \frac{mgR}{2}$

$g = \frac{GM}{R^2}$ ← Remember

$GM = gR^2$

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30. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be :

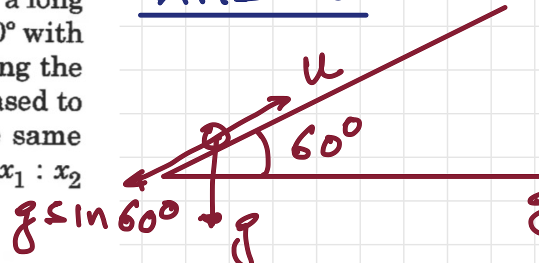
(1) $1 : \sqrt{2}$

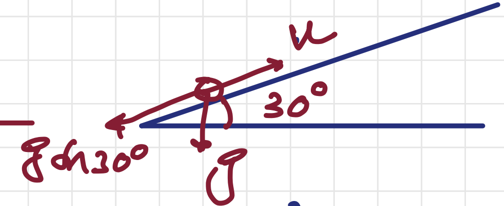
(2) $\sqrt{2} : 1$

(3) $1 : \sqrt{3}$

(4) $1 : 2\sqrt{3}$

ANS-30





$v^2 = u^2 + 2ax_1$

$(0)^2 = u^2 - 2g\sin 60\, x_1$

$u^2 = 2g\sin 60\, x_1$

$v^2 = u^2 + 2ax_2$

$(0)^2 = u^2 - 2g\sin 30\, x_2$

$u^2 = (2g\sin 30)\, x_2$

$2g\sin 60\, x_1 = 2g\sin 30\, x_2$

$\frac{\sqrt{3}}{2} x_1 = \frac{x_2}{2} \Rightarrow \frac{x_1}{x_2} = \frac{1}{\sqrt{3}}$

31. α-particle consists of :

(1) 2 protons and 2 neutrons only

(2) 2 electrons, 2 protons and 2 neutrons

(3) 2 electrons and 4 protons only

(4) 2 protons only

ANS-31

$_2He^4$

2 proton
2 Neutrons } only

32. The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by :

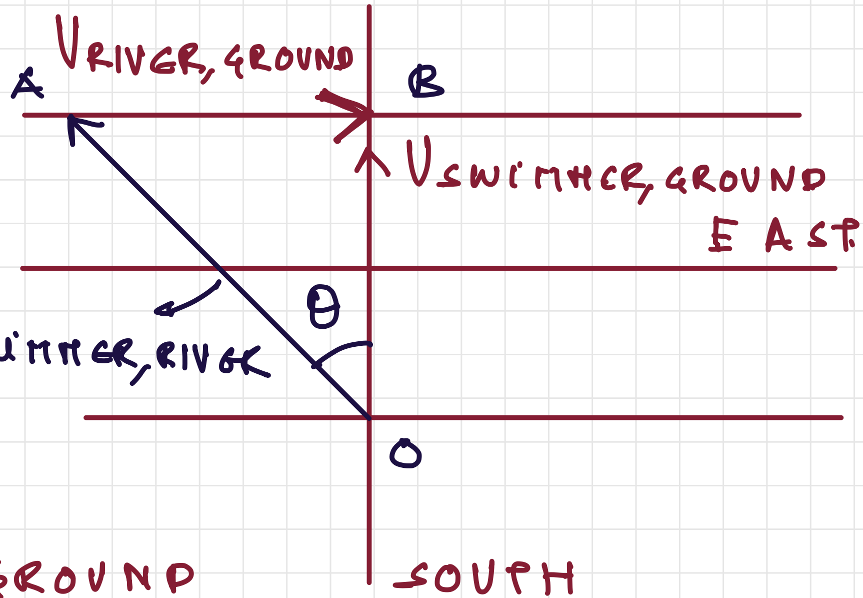
(1) 30° west ✓

(2) 0°

(3) 60° west

(4) 45° west

ANS-32

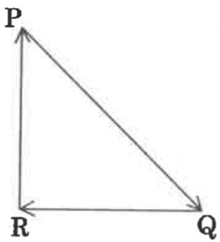


$V_{swimmer\ w.r.t\ ground} = V_{swimmer\ w.r.t\ river} + V_{RIVER\ w.r.t\ grond}$

ΔOAB

$$\sin\theta = \frac{AB}{OA} = \frac{V_{RIVER, GROUND}}{V_{swimmer, RIVER}} = 10/20 = 1/2, \quad \theta = 30^\circ$$

33. A particle moving with velocity $\vec{V}$ is acted by three forces shown by the vector triangle PQR. The velocity of the particle will :



(1) increase

(2) decrease

(3) remain constant

(4) change according to the smallest force $\overrightarrow{QR}$

ANS-33 → All forces are forming close loop. hence $F_{net} = 0 = m\frac{dV}{dt} \Rightarrow V = \text{constant}$

34. Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed v_A and v_B respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be :

(1) $r_A : r_B$

(2) $v_A : v_B$

(3) $r_B : r_A$

(4) 1 : 1

ANS-34

$\omega = \frac{2\pi}{T}$

for particle ①, $\omega_1 = \frac{2\pi}{T_1}$

for particle ②, $\omega_2 = \frac{2\pi}{T_2}$

Since $T_1 = T_2 = T$

$\frac{\omega_1}{\omega_2} = \frac{1}{1}$

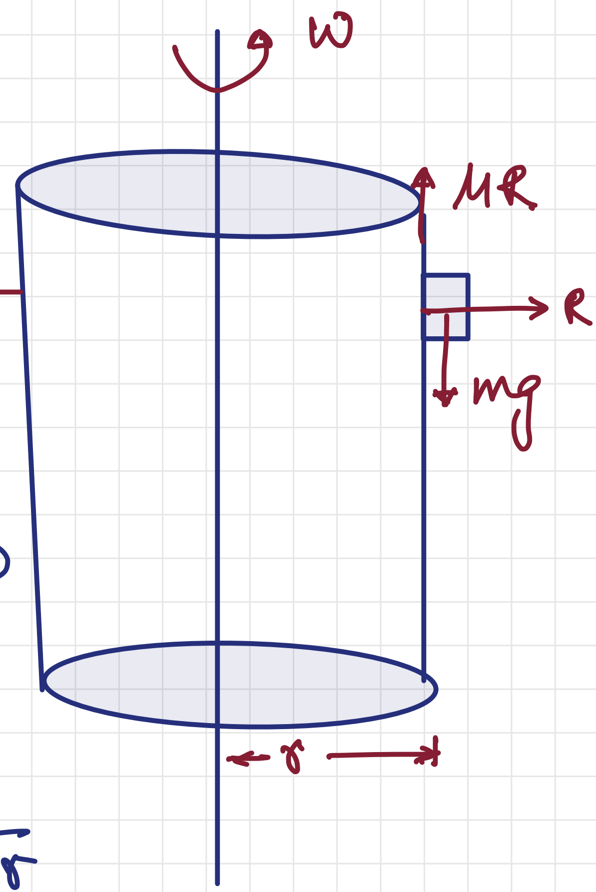
35. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1 m. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be : $(g = 10\ m/s^2)$

(1) $\sqrt{10}$ rad/s

(2) $\frac{10}{2\pi}$ rad/s

(3) ✓ 10 rad/s

(4) 10π rad/s



Under equilibrium motion

$\mu R = mg$ — ①

$R = m\omega^2 r$ — ②

EQUATION ① / EQUATION ②

$$\frac{\mu R}{R} = \frac{mg}{m\omega^2 r}$$

$$\mu = \frac{g}{\omega^2 r} \Rightarrow \omega^2 = \frac{g}{\mu r}$$

$$\omega^2 = \frac{100}{0.1\,(1)} \Rightarrow \omega = \sqrt{100} = 10\ \text{rad/sec}$$

36. Two parallel infinite line charges with linear charge densities $+\lambda$ C/m and $-\lambda$ C/m are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges?

(1) zero

(2) $\frac{2\lambda}{\pi\epsilon_0 R}$ N/C

(3) $\frac{\lambda}{\pi\epsilon_0 R}$ N/C ✓

(4) $\frac{\lambda}{2\pi\epsilon_0 R}$ N/C

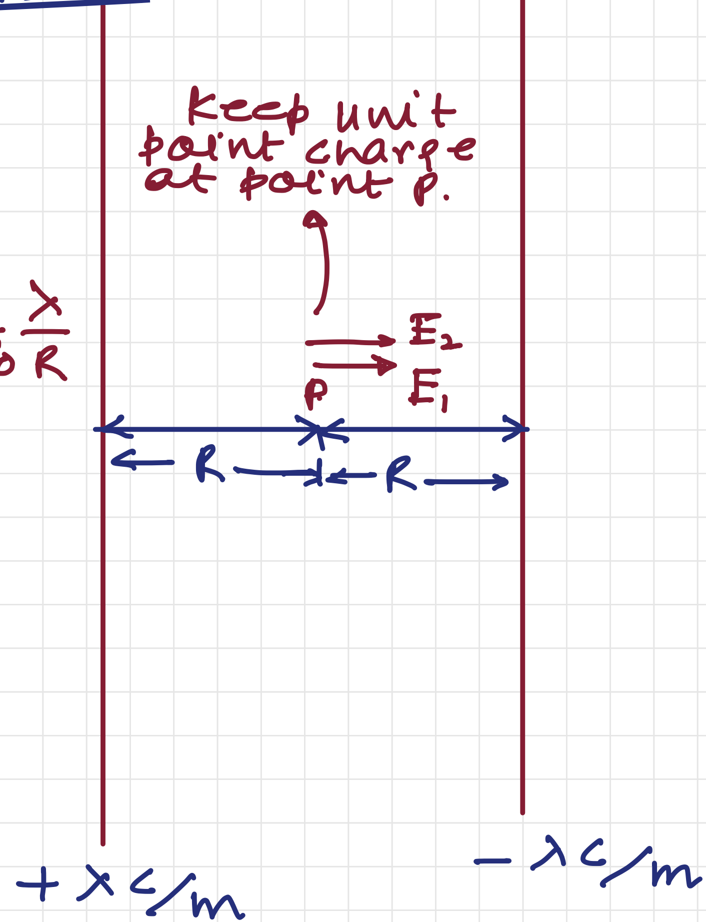
ANS-36

$$E_{NET} = E_1 + E_2$$

$$= \frac{1}{2\pi\epsilon_0}\frac{\lambda}{R} + \frac{1}{2\pi\epsilon_0}\frac{\lambda}{R}$$

$$= 2\left(\frac{1}{2\pi\epsilon_0}\frac{\lambda}{R}\right)$$

$$E = \frac{\lambda}{\pi\epsilon_0 R}$$



37. Two point charges A and B, having charges $+Q$ and $-Q$ respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then force between the charges becomes :

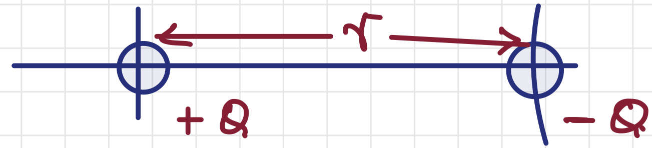
(1) F

(2) $\frac{9F}{16}$ ✓

(3) $\frac{16F}{9}$

(4) $\frac{4F}{3}$

CASE-I



$$|F_1| = \frac{1}{4\pi\epsilon_0}\frac{Q \cdot Q}{r^2} \quad \text{—— (1)}$$

CASE-2

$q_1 = Q - Q/4$
$= \frac{3Q}{4}$

$q_2 = -Q + Q/4$
$q_2 = -\frac{3Q}{4}$

$$|F_2| = \frac{1}{4\pi\epsilon_0}\frac{\left(\frac{3Q}{4}\right)\left(\frac{3Q}{4}\right)}{r^2} \quad \text{—— (2)}$$

EQUATION (1)/EQUATION (2)

$$\frac{|F_1|}{|F_2|} = \frac{\frac{1}{4\pi\epsilon_0}\frac{Q^2}{r^2}}{\frac{1}{4\pi\epsilon_0}\frac{\left(\frac{3Q}{4}\right)^2}{r^2}}$$

$$\frac{|F_1|}{|F_2|} = \frac{Q^2}{r^2}\cdot\frac{r^2 \times 16}{9Q^2} = \frac{16}{9}, \quad F_2 = \frac{9}{16}F$$

38. A small hole of area of cross-section 2 mm^2 is present near the bottom of a fully filled open tank of height 2 m. Taking $g = 10\ m/s^2$, the rate of flow of water through the open hole would be nearly :

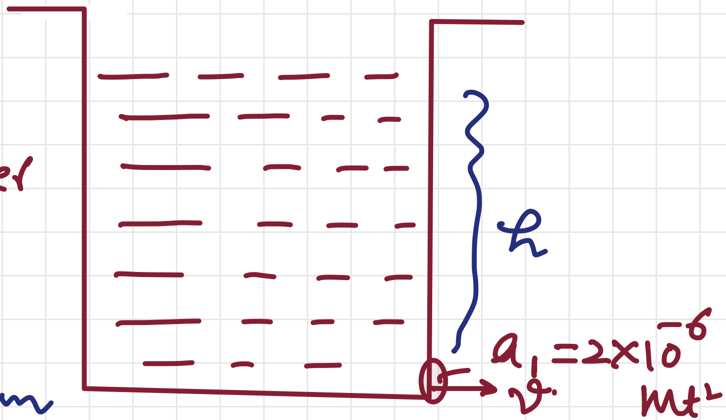
(1) $12.6 \times 10^{-6}\ m^3/s$ ✓

(2) $8.9 \times 10^{-6}\ m^3/s$

(3) $2.23 \times 10^{-6}\ m^3/s$

(4) $6.4 \times 10^{-6}\ m^3/s$

Rate of flow of water (mt^3/se)



Velocity of water which is coming out from the orifice $= \sqrt{2gh}$

Rate of flow of liquid $= (a)(v)$

$= (mt^2)(mt/sec) = \frac{mt^3}{sec}$

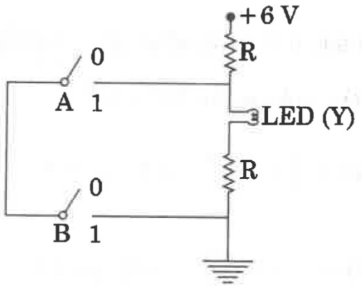
$= a \times \sqrt{2gh}$

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

$= 2\times10^{-6} \times 2 \times 3.3$

$= 12.6\times10^{-6}\ mt^3/sec$

39.



The correct Boolean operation represented by the circuit diagram drawn is :

(1) AND

(2) OR

(3) NAND ✓

(4) NOR

ANS-39

when A, B = 1 (switch is closed)
when A, B = 0 (switch is open)

A	B	Y	EFFECT ON BULB
0	0	1 →	BULB GLOWS
0	1	1 →	BULB GLOWS
1	0	1 →	BULB GLOWS
1	1	0 →	BULB DOES NOT GLOW

BULB GLOWS MEANS 1

BULB DOES NOT GLOW MEANS 0

Hence NAND GATE

40. In which of the following processes, heat is neither absorbed nor released by a system ?

(1) isothermal

(2) adiabatic ✓

(3) isobaric

(4) isochoric

ANS-40

NO-EXCHANGE OF HEAT

ADIABATIC

STUDENT SHOULD REMEMBER EACH YEAR OF NEET THIS type of ONE QUESTION IS ASKED IN NEET PAPER, i.e ON HEAT

41. A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field 5×10^{-5} T. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s, the emf induced in the coil will be :

(1) 2 V

(2) 0.2 V

(3) 2×10^{-3} V

(4) 0.02 V

ANS-41

$$e = -N \frac{d\phi}{dt}$$

$$= -N \frac{(\phi_f - \phi_i)}{t_2 - t_1}$$

$$\phi_i = BA \cos 0 = BA$$

$$\phi_f = BA \cos 90 = 0$$

$$e = -\frac{N(0 - BA)}{(t_2 - t_1)} = \frac{NBA}{(t_2 - t_1)}$$

$$= \frac{800 \times 5 \times 10^{-5} \times .05}{(0.1)}$$

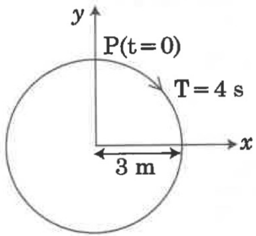
$$= \frac{800 \times 5 \times 5 \times 10^{-5} \times 10}{100}$$

$$= 80 \times 25 \times 10^{-5}$$

$$= 2000 \times 10^{-5}$$

$= 0.2$ Volt

42. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.



y - projection of the radius vector of rotating particle P is :

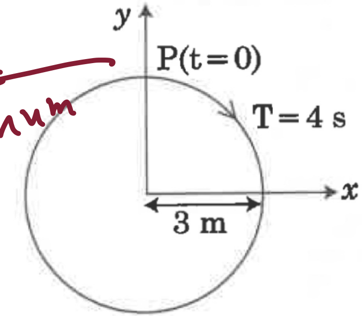
(1) $y(t) = -3\cos 2\pi t$, where y in m

(2) $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m

(3) $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m

(4) ✓ $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

ANS-42



at t=0 y = maximum

Hence equation is $y = a\cos\omega t$

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

$y = a\cos\omega t$

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

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

43. A parallel plate capacitor of capacitance 20 μF is being charged by a voltage source whose potential is changing at the rate of 3 V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively :

(1) zero, 60 μA

(2) 60 μA, 60 μA ✓

(3) 60 μA, zero

(4) zero, zero

ANS- 43

$q = CV$

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

$\frac{dV}{dt} = \frac{3 \text{ volt}}{\text{sec}}$

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

$\frac{dq}{dt} = 20 \times 10^{-6} \times 3$

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

$= 60$ μA

$I_d = I_c = 60 \mu A$

$\oint \bar{B} \cdot d\bar{l} = \mu_0 (I + I_d)$ (As per maxwell modified Law

continuity of current.

44. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$, will be :

(1) $\left(\frac{3}{13}\right)\%$

(2) 16% ✓

(3) -10%

(4) 10%

ANS- 44

$$X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$$

% error

$$\frac{\Delta X}{X} \times 100\% = 2\frac{\Delta A}{A} \times 100\% + \frac{1}{2}\frac{\Delta B}{B} \times 100\% + \frac{1}{3}\frac{\Delta C}{C} \times 100\% + 3\frac{\Delta D}{D} \times 100\%$$

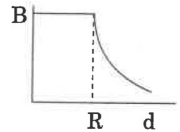
$$= 2(1\%) + \frac{1}{2}(2\%) + \frac{1}{3}(3\%) + 3(4\%)$$

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

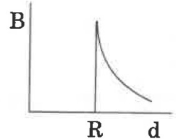
$$= 16\%$$

45. A cylindrical conductor of radius R is carrying a constant current. The plot of the magnitude of the magnetic field, B with the distance, d, from the centre of the conductor, is correctly represented by the figure :

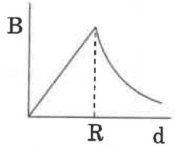
(1)



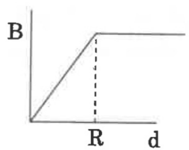
(2)



(3) ✓



(4)



NOTE
↳ VERY IMPORTANT QUESTION
↳ This question is asked in NEET-2020, NEET-2021

So please write this derivation twice.

Imp for CBSE as well as state board exam.

ANS – (45)

Inside

$\oint B \cdot dl = \mu_0 I'$

$B \cdot 2\pi r = \mu_0 I'$

$\frac{I}{\pi R^2} = \frac{I'}{\pi r^2}$ — current density constant

$I' = \frac{I r^2}{R^2}$ — net current enclosed $= I'$

$B \cdot 2\pi r = \mu_0 \frac{I r^2}{R^2}$

$B = \frac{\mu_0}{2\pi} \frac{I r}{R^2}$

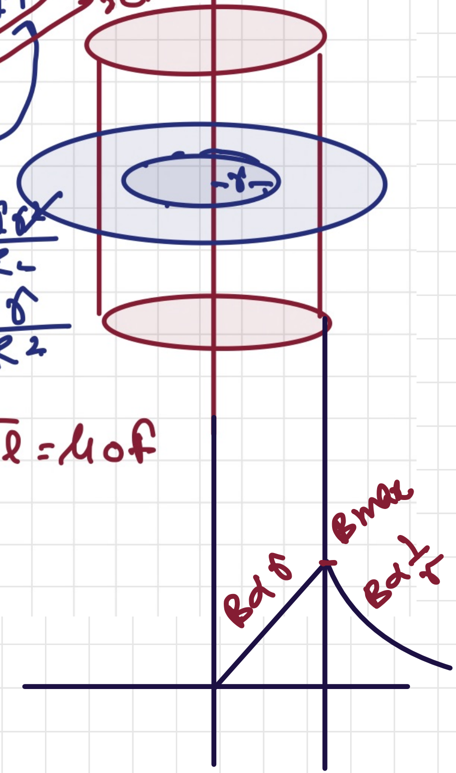
$B \propto r$

outside $\oint B \cdot dl = \mu_0 I$

$B \cdot 2\pi r = \mu_0 I$

$B = \frac{\mu_0}{2\pi} \frac{I}{r}$

$B \propto 1/r$



Rough work sheet

Rough work

Rough work