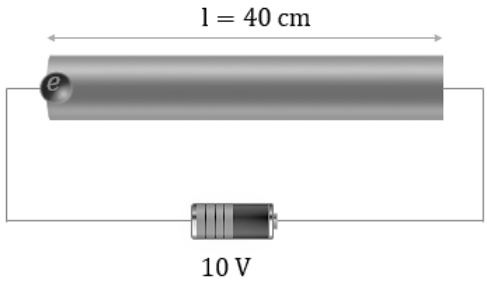
Q.1 Across a conductor of length 40 cm, a potential difference of 10 V is maintained. The mobility of electrons if the drift velocity of electrons is 5×10^{-6} m/s is

(A) 2×10^{-7} m^2/Vs **(B)** 1×10^{-7} m^2/Vs

(C) 4×10^{-6} m^2/Vs **(D)** 0.5×10^{-7} m^2/Vs



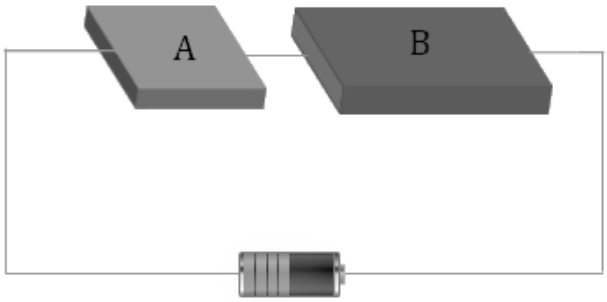
Q.2 An electron has drift velocity of 4×10^{-4} m/s. If the mobility of electron is 3×10^{-2} $m^2V^{-1}s^{-1}$, then applied electric field is

(A) 4×10^{-6} Vm^{-1} **(B)** 7.5×10^{-6} Vm^{-1}

(C) 1.33×10^{-2} Vm^{-1} **(D)** 3.33×10^{-9} Vm^{-1}

Q.3 Two square metal plates A and B are of the same thickness and material. The side of B is twice of that ofA. These are connected as shown in figure (series connection). If R_A and R_B are the resistances of A andB, respectively, then $\frac{R_A}{R_B}$ is

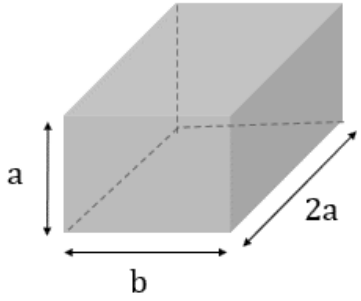
(A) 1: 2 **(B)** 2: 1 **(C)** 1: 1 **(D)** 4: 1



Q.4 All the edges of a block with parallel faces are unequal. Its longest edge is twice its shortest edge. The ratio of the maximum to minimum resistance between parallel faces is

(A) 2 **(B)** 4

(C) 8 **(D)** Indeterminate unless the length of the third edge is specified.

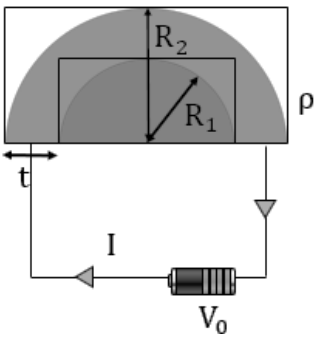


Q.5 2 A of current is flowing through a wire of resistance 5 Ω. If the length of the wire is 4 m, then calculate the value of electric field inside the conductor.

(A) 5 N/m **(B)** 1.5 N/m **(C)** 2.5 N/m **(D)** 8 N/m

Q.6 Shown in the figure is a semicircular metallic strip that has thickness t and resistivity ρ . Its inner radius is R_1 and outer radius is R_2 . If a voltage V_0 is applied across its two ends, a current I flows in it. The value of current I is given

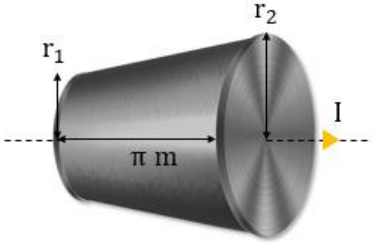
(A) $I = \frac{V_0 t}{\pi\rho}\ln\left(\frac{R_1}{R_2}\right)$ **(B)** $I = \frac{V_0 t}{\pi\rho}\ln\left(\frac{R_2}{R_1}\right)$ **(C)** $I = \frac{V_0 R_1 R_2}{\pi\rho t}\ln\left(\frac{R_1}{R_2}\right)$ **(D)** $I = \frac{V_0 \pi t}{\rho}\ln\left(\frac{R_1}{R_2}\right)$



Q.7 A portion of length π m is cut out of a conical solid wire. The two ends of this portion have circular cross-sections of radii $r_1 = 5$ cmand$r_2 = 10$ cm. It is connected lengthwise to a circuit and a current $I = 2$ A is flowing through it. The resistivity of the material of the wire is$\rho = 1.5 \times 10^{-3}$ Ωm. Calculate the resistanceR, of the considered portion and the voltage, V developed across it.

(A) $R = 0.3\Omega$, $V = 0.6$ volts **(B)** $R = 0.6\Omega$, $V = 0.6$ volts

(C) $R = 0.6\Omega$, $V = 0.3$ volts **(D)** $R = 3\Omega$, $V = 6$ volts



Q.8 In order to increase the resistance of a given wire of uniform cross section to four times its aloe, a fraction of its length is stretched uniformly till the full length of the wire becomes 3/2 times the original length. What is the value of this fraction?

(A) $\frac{1}{4}$ **(B)** $\frac{1}{8}$ **(C)** $\frac{1}{16}$ **(D)** $\frac{1}{6}$

Q.9 The length of a given cylindrical wire is increased by 100%. Due to the consequent decrease in the diameter, the change in the resistance of the wire will be

(A) 300% **(B)** 200% **(C)** 100% **(D)** 50%

Q.10 The resistance of a wire is10 Ω. Its length is increased by 10% by stretching. The new resistance will now be

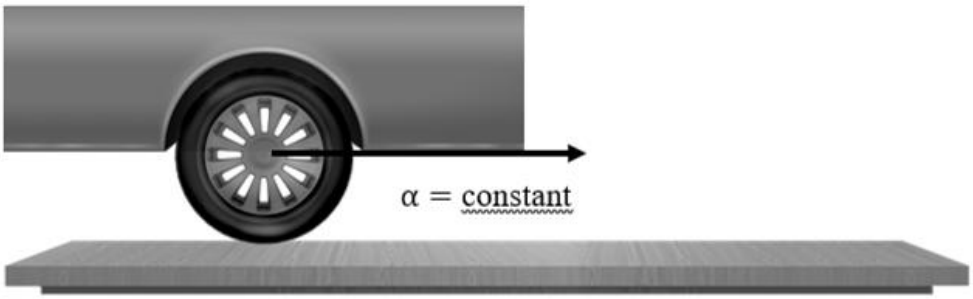
(A) 12.1 Ω **(B)** 1.21 Ω **(C)** 1.13 Ω **(D)** 11 Ω

WORKSHEET

Angular Displacement

Q.1 The wheel of a car accelerates uniformly from rest, rotates through 1.5 rad during the firstsecond. The angle rotated during the next second will be:

(A)7.5 rad **(B)**4.5 rad **(C)** 1.5 rad **(D)**6.5 rad



Velocity in 1D

Q.2 In a gravity free room a man of mass m1 is standing at a height h above the floor. He throws a ball of mass m2 vertically downwards with a speedu. Find the distance of the man from the floor when the ball reaches the ground. (Neglect the height of the man)

(A) $\left(\frac{m_1+m_2}{m_1-m_2}\right)h$ **(B)** $\frac{h}{m_1}$ **(C)** $\left(1+\frac{m_2}{m_1}\right)h$ **(D)** $\frac{m_2}{m_1}h$

Work Done When Force Is Varying

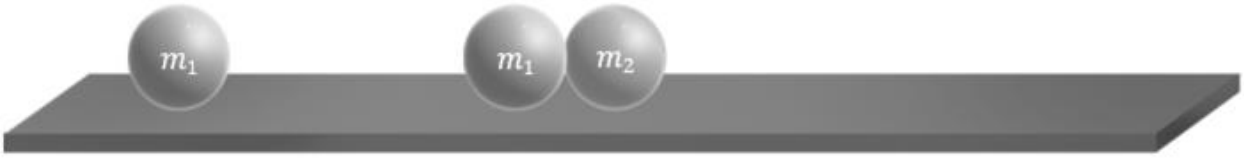
Q.3 A time dependent force $F = \beta t$ acts on a particle of mass4 kg. If the particle starts from rest, the work done by the force during the first 1 second will be [β is a (+)ve constant]

(A) $\frac{\beta}{32}$ **(B)** $\frac{32}{\beta}$ **(C)** $\frac{\beta^2}{32}$ **(D)** $\frac{\beta^2}{16}$

Elastic Collision in 1-D

Q.4 A body of 1 kg makes an elastic collision with a second body at rest and continues to move in the original direction, but with half of its original speed. What is the mass of the second body?

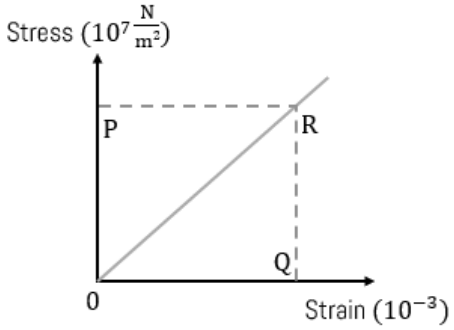
(A) $\frac{1}{2}$ kg **(B)**2 kg **(C)** $\frac{1}{3}$ kg **(D)**3 kg



Stress-Strain Graph

Q.5 The figure shows the stress-strain plot for an Aluminium wire, which is stretched by a machine pulling in opposite directions at the ends of the wire. The wire has an initial length of0.8 m and initial cross-sectional area of$\mathbf{2}.0 \times 10^{-6}$ m2. How much work is done by the machine on the wire to produce a strain of$\mathbf{1}.\mathbf{0} \times \mathbf{10}^{-\mathbf{6}}$?

(A)54.4 mJ **(B)**56 mJ **(C)** 108.8 mJ **(D)**128 mJ

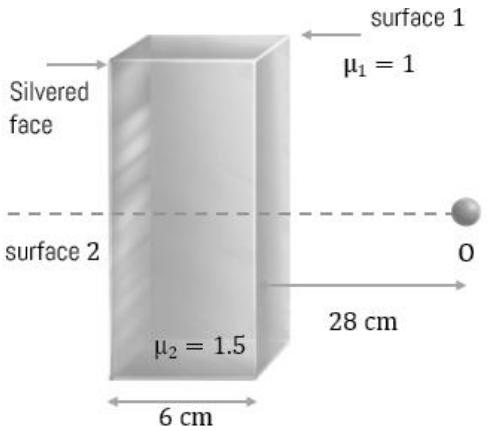


Apparent Depth

Q.6 An object is placed in front of a slab ($\mu = 1.5$) of thickness 6 cm at a distance of 28 cm from it, while the other face of the slab is silvered. Find the position of the final image.

(A)54 cm From surface 1 **(B)**54 cm from surface 2

(C)36 cm From surface 1 **(D)**36 cm from surface 2



Apparent Depth

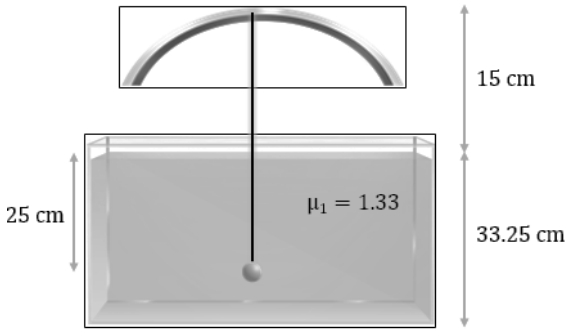
Q.7 A concave mirror of radius of curvature 60 cm is placed at the bottom of a tank containing water up to a height of 20 cm. The mirror faces upwards with its axis vertical, solar light falls normally on the surface of water and the image of the sun is formed. If $\mu = 4/3$ for water, then with the observer in air, the distance of the image from the surface of water is

(A)30 cm **(B)**20 cm **(C)** 7.5 cm below **(D)**7.5 cm above

Image Formation in Concave Mirror

Q.8 Final image of a point source O placed at the bottom of the container filled with water is formed at 25 cm below the water level as shown in the figure. Focal length of the mirror (in cm) is

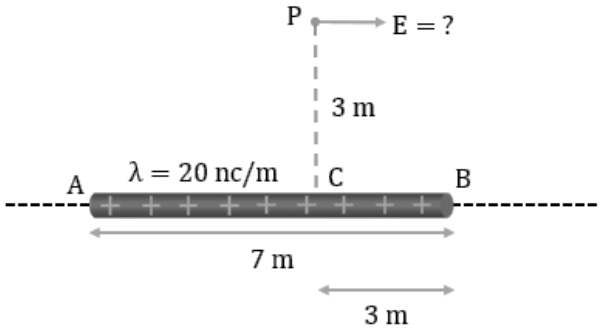
(A) -15 **(B)** -18 **(C)** -25 **(D)** -30



Electric Field Due to a Line of Charge Not on Its Axis

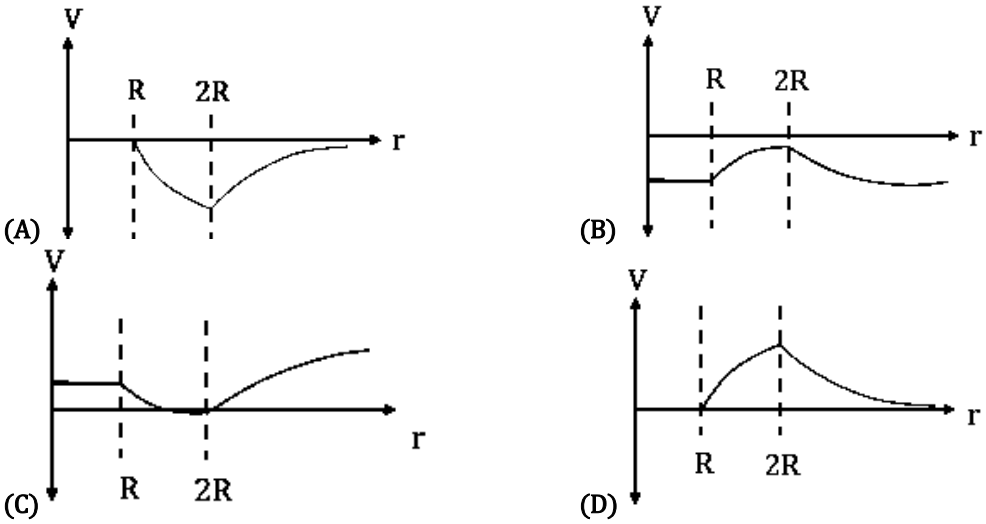
Q.9 For a finite line charge, find the electric field in a direction parallel to the axis of the line charge at pointP.

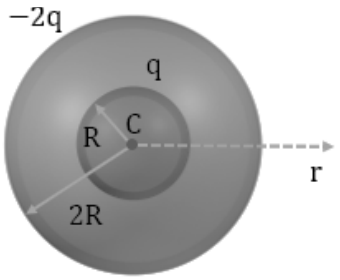
(A) 3.4 N/C **(B)** 4.4 N/C **(C)** 5.4 N/C **(D)** 6.4 N/C



Electric Potential Due to Shell

Q.10 Correct curve of potential (V) versus distance (r) from centre of two charged spherical shells is





The Flow of Electrons as Electric Current

Q.11 The electron with charge ($q = 1.6 \times 10^{-19}$ C) moves in an orbit of radius 5×10^{-11} m with a speed of 2.2×106 ms^{-1}, around an atom. The equivalent current is:

(A) 1.12×10^{-6} A **(B)** 1.12×10^{-3} A **(C)** 1.12×10^{-9} A **(D)** 1.12 A

Current and Drift Velocity Relation

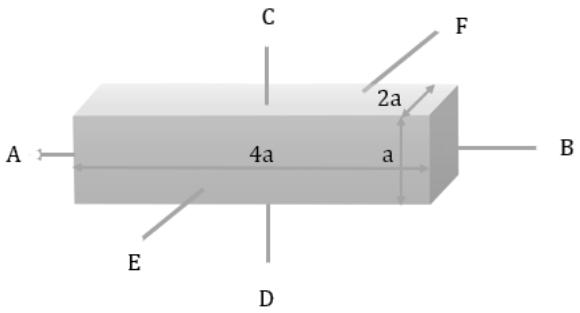
Q.12 Two wires, each of the radius r but of different materials are connected together end to end (in series). If the densities of charge carried in the two wires are in the ratio1: 4, the drift velocity of electrons in the two wires will be in the ratio of.

(A) 1 : 2 **(B)** 2 : 1 **(C)** 4 : 1 **(D)** 1 : 4

Resistance and Resistors

Q.13 A Conductor with rectangular cross-section has dimensions (a × 2a × 4a) as shown in figure. Resistance across ABis x, across CD is y and across EF is z. Then

(A) x = y = z **(B)** $x > y > z$ **(C)** $y > z > x$ **(D)** $x > z > y$



Drift Velocity

Q.14 A potential difference of 6 V is applied across a conductor of length0.12 m. The drift velocity of an electron is [mobility of electron $= 5.6 \times 10^{-6}$ m2/Vs]

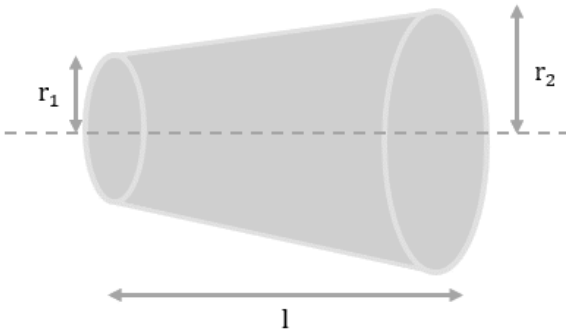
(A) 1.4×10^{-4} m/s **(B)** 2.8×10^{-6} m/s

(C) 5.6×10^{-4} m/s **(D)** 2.8×10^{-4} m/s

Resistance and Resistors

Q.15 A wire in the shape of frustum, has circular cross-sections of radii r1 = 2.5 cm and r2 = 4 cm. The resistivity of the material of the wire is $\rho = 2 \times 10^{-3}$ Ωm. Calculate the resistance of the wire, if the length of the wire is 10 cm.

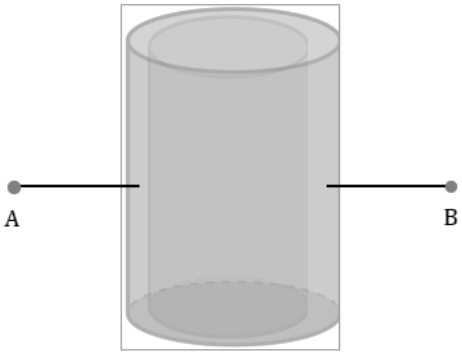
(A) $\frac{1}{5\pi}$ Ω **(B)** $\frac{2}{5\pi}$ Ω **(C)** $\frac{3}{5\pi}$ Ω **(D)** $\frac{4}{5\pi}$ Ω



Resistance and Resistors

Q.16 A cylindrical tube of length l has inner radius a while outer radius b. The resistance of the tube between its inner and outer surfaces will be (resistivity of material is ρ)

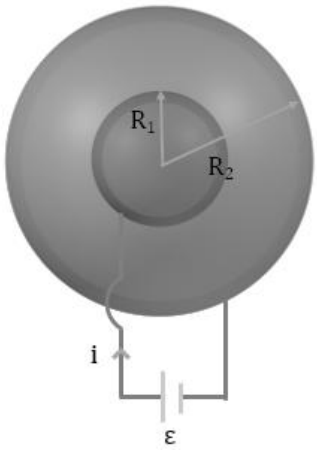
(A) $\ln\left(\frac{b2}{a}\right)$ **(B)** $\frac{\rho}{2\pi l}\ln\frac{b}{a}$ **(C)** $\frac{\rho l}{2\pi bl}\ln a$ **(D)** $\frac{\ln^2\left(a/b\right)}{2\pi l}$



Resistance and Resistors

Q.17 A cell of emf ε is connected across a thick spherical shell of inner radius R1 and outer radius R2 as shown in figure. If resistivity of sphere is ρ, current through the cell is :

(A) $\frac{\pi\varepsilon(R_1+R_2)^2}{R_2-R_1}$ **(B)** $\frac{4\pi\varepsilon R_1R_2}{\rho(R_2-R_1)}$ **(C)** $\frac{\pi\varepsilon(R_1+R_2)^2}{(R_2-R_1)^2}$ **(D)** $\frac{\pi\varepsilon R_1R_2}{\rho(R_2-R_1)}$



Resistance and Resistors

Q.18 If a copper wire is stretched to make it 0.1 percent longer. The percentage change in its resistance is

(A)0.2 percent Increase **(B)**0.2 percent decrease

(C) 0.1 percent Increase **(D)**0.1 percent decrease

Conductivity and Resistivity

Q.19 A wire of 1 Ω has a length of 1 m. It is stretched till its length increases by25 percent. The percentage change in the resistance to the nearest integer is –

(A)25 percent **(B)**12.5 percent **(C)** 76 percent **(D)**56 percent

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(C)	(C)	(B)	(C)	(B)	(A)	(B)	(A)	(A)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(C)	(C)	(C)	(B)	(C)	(D)	(B)	(D)	(A)
Q.	11	12	13	14	15	16	17	18	19	

Sol.	(B)	(C)	(D)	(D)	(A)	(B)	(B)	(A)	(D)