Q.1 A small plane area is rotated in an electric field. The flux of electric field through the area is maximum when

(A) Electric field lines are parallel to the surface.

(B) Electric field lines are perpendicular to the surface.

(C) Electric field lines are at 60° to the surface.

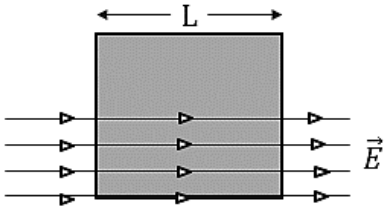
(D) Electric field lines are at 45° to the surface.

Q.2 In a region of space, the electric field is given by $\vec{\mathbf{E}} = 8\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$. The electric flux through a surface of area of **100** units in $\mathbf{x} - \mathbf{y}$ plane is

(A) 800 Units **(B)** 300 Units **(C)** 400 Units **(D)** 1500 Units

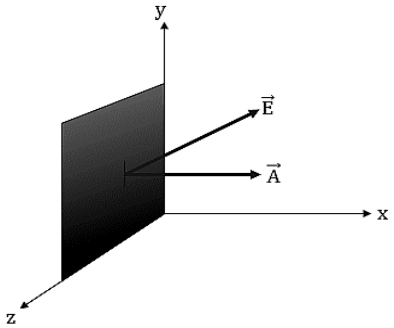
Q.3 A square of side **L** is in the plane of the paper. A uniform electric field **E**, also in the plane of the paper, is limited only to the lower half of the square surface as shown in the figure. The electric flux (in SI unit) associated with the surface is

(A) $2EL^2$ **(B)** $3EL^2$ **(C)** Zero **(D)** EL^2



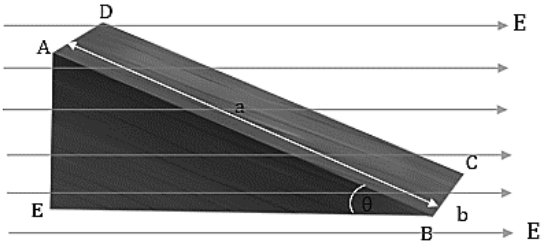
Q.4 The electric field in a region is given by $\vec{\mathbf{E}} = (1200\,\hat{\mathbf{i}} + 1600\,\hat{\mathbf{j}})\ \mathbf{N/C}$. Find the flux of this field through a rectangular surface of area $0.2\ \mathbf{m^2}$ parallel to the y-z plane.

(A) $140\ \text{N} - \text{m}^2/\text{C}$ **(B)** $240\ \text{N} - \text{m}^2/\text{C}$ **(C)** $340\ \text{N} - \text{m}^2/\text{C}$ **(D)** $440\ \text{N} - \text{m}^2/\text{C}$



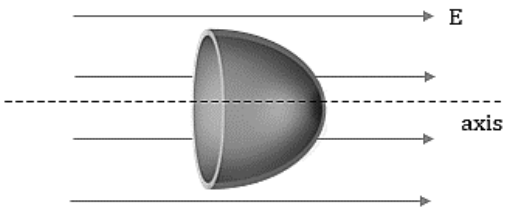
Q.5 Find the flux of the electric field through surface **ABCD** of the inclined plane as shown in figure.

(A) E abCosθ **(B)** E abSinθ **(C)** E abTanθ **(D)** E abCotθ



Q.6 A uniform electric field **E** is parallel to the axis of a hollow hemisphere of radius **r**. The electric flux through the hemispherical surface is

(A) $4\pi r^2 E$ **(B)** $\frac{3}{8}\ r^2\,E$ **(C)** $\pi r^2 E$ **(D)** $2\pi r^2 E$



Q.7 The number of electric field lines crossing an area **A** is $\mathbf{n_1}$ when $\vec{A} \parallel \vec{E}$, while number of field lines crossing same area is $\mathbf{n_2}$ when $\vec{E}$ makes an angle of $30°$ with $\vec{A}$, then

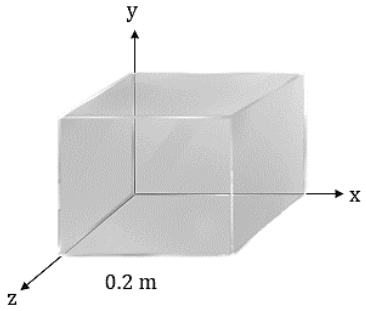
(A) $n_1 = n_2$ **(B)** $n_1 > n_2$ **(C)** $n_1 < n_2$ **(D)** $n_1 \leq n_2$

Q.8 A cylinder of radius **R** and length **L** is placed in a uniform electric field of magnitude $\vec{E}$ parallel to the axis of the cylinder. The outward flux over the surface of the cylinder is

(A) $2\pi R^2 E$ **(B)** $\frac{\pi R^2 E}{2}$ **(C)** $2\Pi rle$ **(D)** $\pi R^2 E$

Q.9 A cube has sides of length $\mathbf{l = 0.2\ m}$. It is placed with one corner at the origin as shown in figure. The electric field is uniform and given by $\vec{E} = (2.5\hat{i} - 4.2\hat{j})\ N/C$. Find the electric flux through the entire cube.

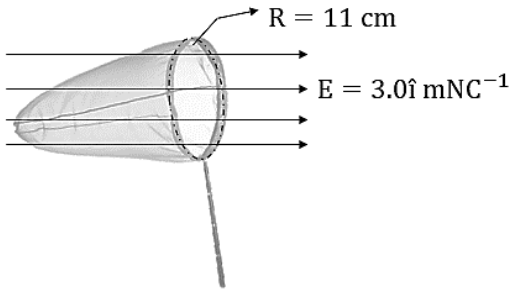
(A) $5\ N - m^2/C$ **(B)** $10\ N - m^2/C$ **(C)** $15\ N - m^2/C$ **(D)** Zero



Q.10 A butterfly net is in a uniform electric field of magnitude $\mathbf{E = 3.0\hat{i}\ mNC^{-1}}$. The circular rim of radius $\mathbf{R = 11\ cm}$, is aligned perpendicular to the field as shown in the diagram. If the butterfly net contains no net charge, then find the magnitude of electric flux ($|\boldsymbol{\phi}|$) passing through the circular rim of net.

(A) $2.228 \times 10^{-4}\ Nm^2C^{-1}$ **(B)** $1.114 \times 10^{-4}\ Nm^2C^{-1}$

(C) $3.342 \times 10^{-4}\ Nm^2C^{-1}$ **(D)** $0\ Nm^2C^{-1}$



WORK SHEET

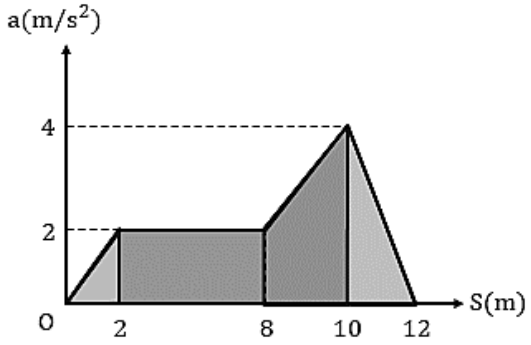
Q.1 A police jeep travelling at a speed of **45 km/h** is chasing a thief's car moving at a speed of**153 km/h**. If police fire a bullet with a muzzle velocity of **180 m/s**, the velocity with which it strikes the thief's car is

(A)54 m/s **(B)**150 m/s **(C)**450 m/s **(D)**250 m/s

A-t Graph

Q.2 The acceleration-displacement graph of a particle moving in a straight line is shown in the figure. Initial velocity of the particle is **zero**. Find the velocity of the particle when displacement of the particle is **12 m**.

(A)$3\sqrt{2}$ m/s **(B)**$2\sqrt{5}$ m/s **(C)**4 m/s **(D)** $4\sqrt{3}$ m/s



Q.3 A pendulum has a time period **T** for small oscillations. An obstacle **P** is situated below the point of suspension **O** at a distance $\frac{3l}{4}$ as shown in the figure below. The pendulum is released from rest. Throughout the motion the moving string makes small angle with vertical. Find the time after which the pendulum returns back to its initial position.

(A)T **(B)**$\frac{3T}{4}$ **(C)**$\frac{4T}{3}$ **(D)**$\frac{5T}{4}$

Q.4 A string is hanging from a rigid support. A transverse wave pulse is setup at the free end. The velocity **v** of the pulse related to the distance **x** covered by it is

(A)$v \propto \sqrt{x}$ **(B)**$v \propto x$ **(C)**$v \propto \frac{1}{x}$ **(D)**$v \propto \frac{1}{x^2}$

Q.5 Two sound waves of wavelength **1 m** and **1.01 m** in a gas produce **10** beats in **3 s**. The velocity of sound in the gas is

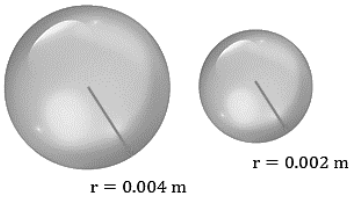
(A)330 m/s **(B)**337 m/s **(C)**360 m/s **(D)**300 m/s

Q.6 A light rod of length **2 m** is suspended from the ceiling horizontally by means of two vertical wires of equal length tied to it ends. One of the wire is made of steel and it's cross section is $10^{-3}\ m^2$ and the other is of brass of cross section$2 \times 10^{-3}\ m^2$. The position along the rod at (from the end where brass wire is tied) which a weight may be hung to produce equal stress on both wire
($Y_{steel} = 2 \times 10^{11}\ Nm^{-2}$; $Y_{brass} = 10^{11}\ Nm^{-2}$)

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

Q.7 Two separate air bubbles **A** and **B** of radii **0.004 m** and **0.002 m** formed of the same liquid surface tension **0.07 N/m** come together to form a double bubble. Find the radius and the sense of curvature of the internal film surface common to both the bubbles.

(A)0.4 m **(B)**0.0004 m **(C)**0.004 m **(D)**4 m

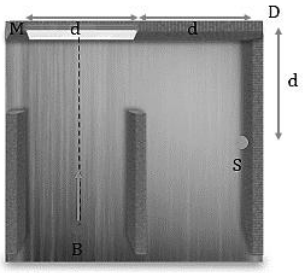


Q.8 A mixture of **4 g** of hydrogen and **8 g** of helium at NTP has a density about

(A) $0.22\ \text{kg/m}^3$ **(B)** $0.62\ \text{kg/m}^3$ **(C)** $0.12\ \text{kg/m}^3$ **(D)** $0.43\ \text{kg/m}^3$

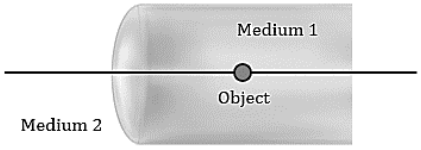
Q.9 Figure shows an over-head view of a corridor with a plane mirror **M** mounted at one end. A burglar **B** sneaks along the corridor directly toward the centre of the mirror. If $\mathbf{d = 3.0\ m}$, how far from the mirror will he be, when the security guard **S** first observes him in the mirror ?

(A) 2 m **(B)** 1.5 m **(C)** 4 m **(D)** 6 m



Q.10 Refraction takes place at a concave spherical boundary (of radius of curvature **R**) separating glass - air medium. For the image to be real, the object which is placed in glass at a distance $\mathbf{u}\left(\mu_{\text{glass}} = \frac{3}{2}\right)$

(A) $u > 3R$ **(B)** $u < 3R$ **(C)** $u > 2R$ **(D)** $u < R$

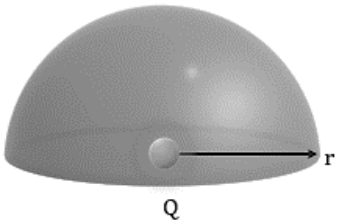


Q.11 **Unit of electric flux is**

(A) $\text{N} - \text{m}^2/\text{C}$ **(B)** $\frac{\text{N}}{\text{C}^2 - \text{m}^2}$ **(C)** $\text{N} - \text{m/C}$ **(D)** $\frac{\text{N}}{\text{m}^2 - \text{C}}$

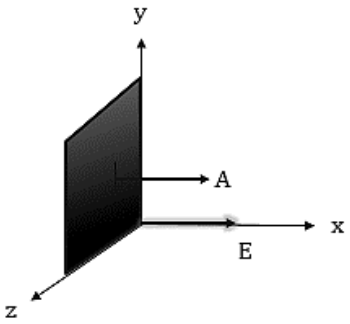
Q.12 A charge **Q** is placed just outside a closed hemisphere of radius **r** as shown in the figure. Find the total flux associated with the hemisphere.

(A) Zero **(B)** $\frac{\text{Q}}{\varepsilon_0}$ **(C)** $\frac{\text{Q}}{2\varepsilon_0}$ **(D)** None of the above



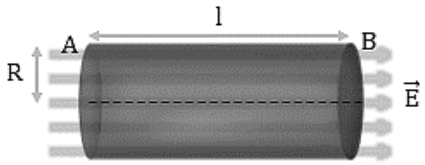
Q.13 A uniform electric field of magnitude $\mathbf{E = 100\ N/C}$ exists in the space in $+\mathbf{x} -$ direction. Calculate the flux of this field through a plane square of edge **10 cm** placed in the $\mathbf{y} - \mathbf{z}$ plane. Take the normal along the positive $\mathbf{x} -$ axis to be positive.

(A) $1\ \text{N} - \text{m}^2/\text{C}$ **(B)** $2\ \text{N} - \text{m}^2/\text{C}$ **(C)** $3\ \text{N} - \text{m}^2/\text{C}$ **(D)** $4\ \text{N} - \text{m}^2/\text{C}$



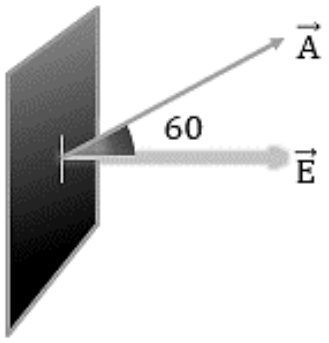
Q.14 A cylinder of radius **R** and length **l** is placed in a uniform electric field **E** parallel to the axis of the cylinder. The total flux over the curved surface of the cylinder is

(A) Zero **(B)** $\pi R^2 E$ **(C)** $2\pi R^2 E$ **(D)** $\frac{E}{\pi R^2}$



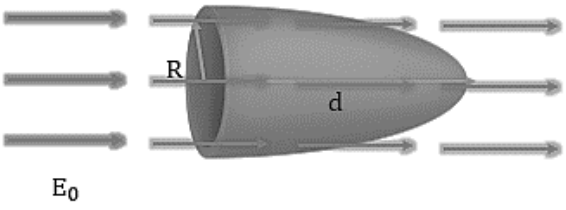
Q.15 A square frame of edge **5 cm** is placed with its positive normal making an angle of **60°** with a uniform electric field of **200 N/C**. Find the electric flux through the surface bounded by the frame.

(A) $0.15\ \mathrm{N-m^2/C}$ **(B)** $0.25\ \mathrm{N-m^2/C}$ **(C)** $0.35\ \mathrm{N-m^2/C}$ **(D)** $0.45\ \mathrm{N-m^2/C}$



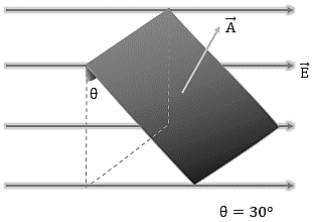
Q.16 If the constant electric field in the figure has a magnitude $\mathbf{E_0}$, calculate the total electric flux through the paraboloid surface.

(A) $E_0\pi R^2$ **(B)** $2E_0\pi R^2$ **(C)** $2E_0\pi R$ **(D)** $\frac{E_0}{2\pi R}$



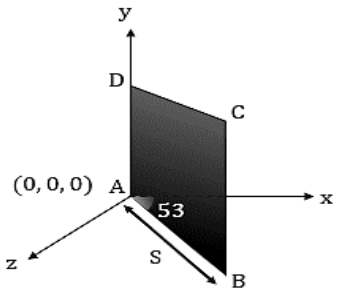
Q.17 Find the Flux through the rectangular piece of area **10 cm × 20 cm**, when placed in a uniform electric field intensity of **200 N/C** as shown in figure.

(A) $4\ \mathrm{Nm^2C^{-1}}$ **(B)** $3.5\ \mathrm{Nm^2C^{-1}}$ **(C)** $2.5\ \mathrm{Nm^2C^{-1}}$ **(D)** Zero



Q.18 Electric field in the region is given by $\vec{\mathbf{E}} = (\mathbf{2\hat{i} + 3\hat{j} + 4\hat{k}})\ \mathbf{NC^{-1}}$. The flux associated with a square plate of side **5 cm** as shown in the figure is

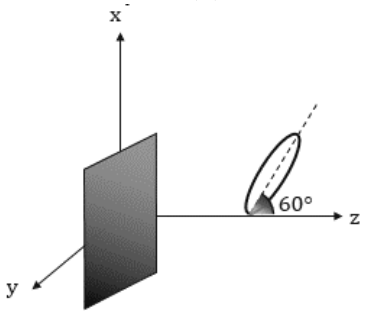
(A) $10\ \mathrm{Nm^2C^{-1}}$ **(B)** $-10\ \mathrm{Nm^2C^{-1}}$ **(C)** $20\ \mathrm{Nm^2C^{-1}}$ **(D)** $-20\ \mathrm{Nm^2C^{-1}}$



Q.19 In **XY** −plane, there is surface charge density of $\mathbf{5 \times 10^{-16}\ Cm^{-2}}$ on a long uniformly charged sheet. A circular loop of radius $\mathbf{0.1\ m}$ makes an angle of $\mathbf{60^\circ}$ with **Z** −axis. Determine the electric flux through the loop?

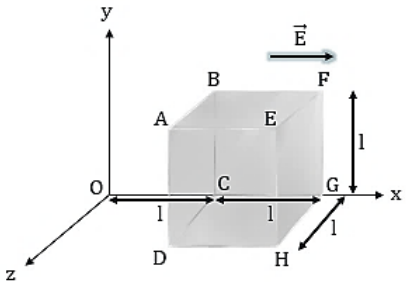
(A) $7.68 \times 10^{-7}\ \mathrm{Nm^2C^{-1}}$ **(B)** $7.68 \times 10^{-9}\ \mathrm{Nm^2C^{-1}}$

(C) $9.46 \times 10^{-7}\ \mathrm{Nm^2C^{-1}}$ **(D)** $9.46 \times 10^{-9}\ \mathrm{Nm^2C^{-1}}$



Q.20 The electric field in a region is given by $\vec{\mathbf{E}} = \mathbf{\alpha x\ \hat{i}}$. Here, **α** is a positive constant of proper dimension. Find the total flux passing through a cube bounded by the coordinates, $\mathbf{x = l}$, $\mathbf{x = 2l}$, $\mathbf{y = 0}$, $\mathbf{y = l}$, $\mathbf{z = 0}$, $\mathbf{z = l}$.

(A) αl^3 **(B)** $2\alpha l^3$ **(C)** $3\alpha l^3$ **(D)** $4\alpha l^3$



ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(B)	(C)	(B)	(B)	(C)	(B)	(D)	(D)	(B)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(D)	(B)	(A)	(B)	(C)	(C)	(C)	(B)	(A)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(A)	(A)	(A)	(A)	(B)	(A)	(B)	(C)	(A)	(A)