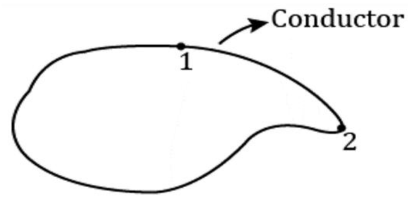
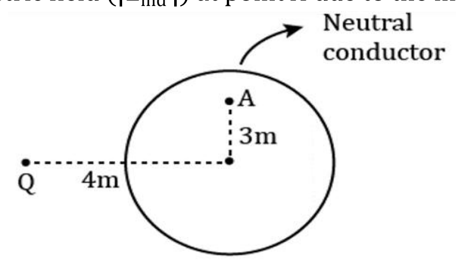
Q.1 In the given figure, σ_1 and σ_2 are the surface charge densities around points 1 and 2 respectively. Then:



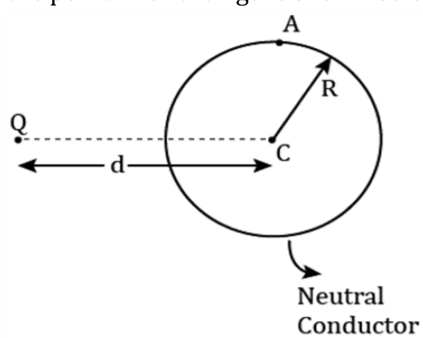
(A) $\sigma_1 > \sigma_2$ **(B)** $\sigma_1 < \sigma_2$ **(C)** $\sigma_1 = \sigma_2$ **(D)** can't be interpreted

Q.2 Find the magnitude of the electric field ($|\overrightarrow{E_{ind}}|$) at point A due to the induced charges on the sphere.



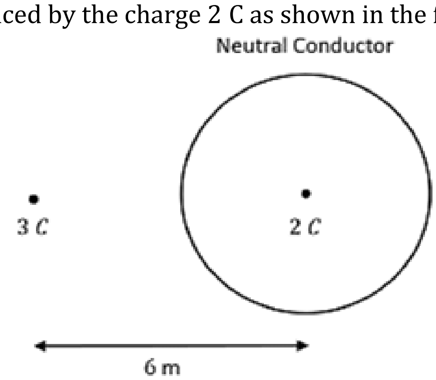
(A) $\frac{KQ}{5}$ **(B)** $\frac{KQ}{25}$ **(C)** $\frac{KQ}{16}$ **(D)** $\frac{KQ}{4}$

Q.3 Find the net electric potential at the point A for the figure shown below



(A) $\frac{KQ}{R}$ **(B)** $\frac{KQ}{\sqrt{R^2+d^2}}$ **(C)** $\frac{KQ}{d}$ **(D)** zero

Q.4 What is the net force experienced by the charge 2 C as shown in the figure.



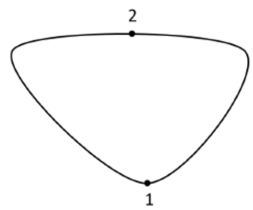
(A) 1.5×10^9 N (B) 3×10^9 N **(C)** 9×10^9 N **(D)** Zero

Q.5 A spherical conductor of radius 3 m carries a charge of 2 μC on its surface. What is the value of an electric field just outside the surface of the sphere?
(A) 2×10^3 N/C **(B)** 4×10^3 N/C **(C)** 2×10^6 N/C **(D)** 4×10^6 N/C

Q.6 A spherical conductor of radius R carries charge Q on its surface. The value of the electric field just outside the surface of the conductor is E. If the radius of the conductor is doubled while keeping the charge the same, what will be the value of the new electric field just outside the surface of the conductor?

(A)$\frac{E}{2}$ **(B)**2E **(C)**$\frac{E}{4}$ **(D)**E

Q.7 In the given figure, P_1 and P_2 are the pressure experienced at the points 1 and 2 on a charged conductor respectively. Then:



(A)$P_1 > P_2$ **(B)**$P_1 < P_2$ **(C)**$P_1 = P_2$ **(D)**can't be interpreted

Q.8 What is the pressure experienced by a charged surface having a surface charge density of $3 \times 10^{-5} C/m^2$.

(A)50.8 N/m^2 **(B)**40.8 N/m^2 **(C)**20.8 N/m^2 **(D)**25.8 N/m^2

Q.9 A metallic surface can handle a maximum pressure of 10000 N/m^2. What is the maximum surface charge density the metal surface can have. (Take, $\epsilon_o = 8.85 \times 10^{-12}$ and $\sqrt{17.7} = 4.21$)

(A)6.22×10^{-4} C/m^2 **(B)**8.42×10^{-4} C/m^2 **(C)**9×10^{-4} C/m^2 **(D)**4.21×10^{-4} C/m^2

Q.10 If the value of the electric field just outside the surface of a uniformly charged disc of radius 4 m, is 10 N/C. Then the electric field due to the disc at point lying on the axis of the disc, at a distance of 3 m from the center will be:

(A)2 N/C **(B)**4 N/C **(C)**8 N/C **(D)**zero

WORK SHEET

Relative Acceleration

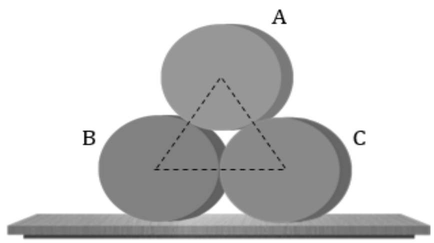
Q.1 A man in a hot air balloon, throws a stone downwards with a speed of 5 m/s with respect to the balloon. If the balloon is moving upwards with a constant acceleration of5 m/s2, then the velocity of the stone relative to the man after 2 second is **(Takeg $= \mathbf{10\ m/s^2}$)**

(A)10 m/s **(B)**30 m/s **(C)** 15 m/s **(D)**35 m/s

Normal Force

Q.2 Cylinders B and C are fixed and cylinder A is kept above them as shown in figure. If the system is at rest, find the normal reaction at the contact point ofA & B. (All cylinders are identical and have mass m)

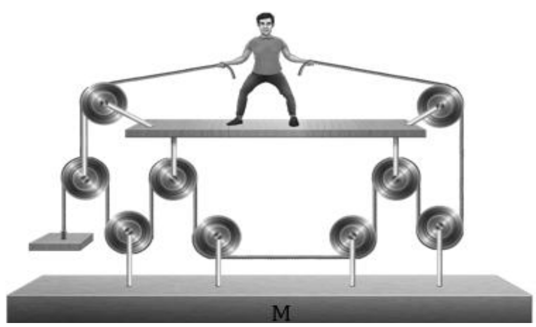
(A)$\frac{mg}{2\sqrt{2}}$ **(B)**$\frac{mg}{\sqrt{3}}$ **(C)**$\frac{\sqrt{3}}{2}$ mg **(D)**$\frac{2}{3}$ mg



Constrained Motion: General Approach

Q.3 System is shown in the figure and man is pulling the rope from both sides with constant speed 'u'. Then what will be the velocity of the block, if the rope is inextensible?

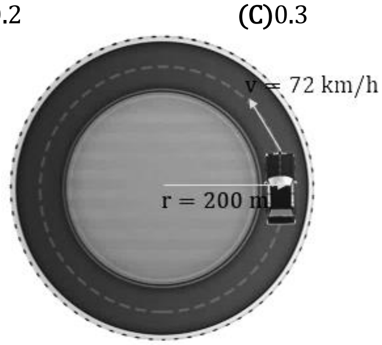
(A)$\frac{3u}{4}$ **(B)**$\frac{u}{2}$ **(C)** $\frac{u}{4}$ **(D)**u



Friction and Horizontal Circular Motion Problems

Q.4 A1200 kg automobile rounds a level curve of radius200 m, on an unbanked road with a velocity of 72 km/h. What is the minimum coefficient of static friction between the tires and road in order that the automobile may not skid**? (g = 10 m/s2)**

(A)0.15 **(B)**0.2 **(C)**0.3 **(D)**0.4



Torque

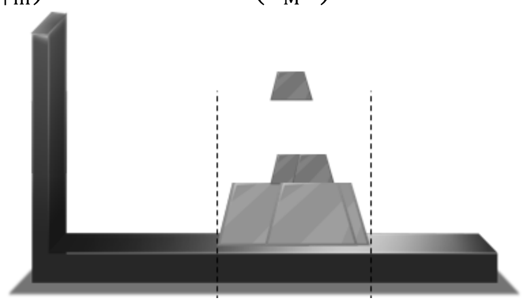
Q.5 The position vector $\vec{r}$ of a particle of mass 0.1 kg is given by the $\vec{\mathbf{r}}(\mathbf{t}) = \left(\frac{\mathbf{10}}{\mathbf{3}}\mathbf{t}^{\mathbf{3}}\ \hat{\mathbf{i}} + \mathbf{5t}^{\mathbf{2}}\ \hat{\mathbf{j}}\right)$ **m. At** $\mathbf{t} = \mathbf{1}$ s, the torque experienced by the particle due to force with respect to the origin is given by

(A) $\frac{20}{3}\hat{k}\ \text{N} - \text{m}$ **(B)** $\frac{20}{3}\hat{j}\ \text{N} - \text{m}$ **(C)** $-\frac{20}{3}\hat{k}\ \text{N} - \text{m}$ **(D)** $-\frac{20}{3}\hat{j}\ \text{N} - \text{m}$

Simple Harmonic Oscillation

Q.6 A mass M attached to a horizontal spring, executes SHM with amplitude A1 on a smooth horizontal surface. When the mass M passes through its mean position, then a small mass m is placed over it and both of them move together with amplitudeA2. The ratio of (A1 / A2) will be

(A) $\frac{M+m}{M}$ **(B)** $\left(\frac{M}{M+m}\right)^{1/2}$ **(C)** $\left(\frac{M+m}{M}\right)^{1/2}$ **(D)** $\frac{M}{M+m}$

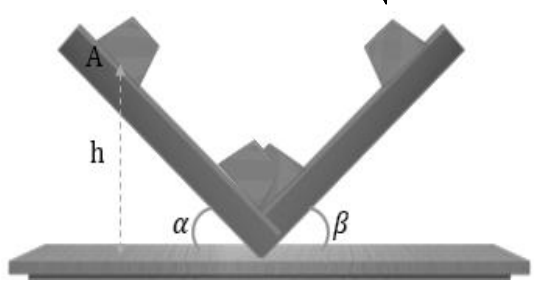


Time Period of Pendulum

Q.7 A block is released from point A as shown in figure. All surfaces are smooth and there is no loss of mechanical energy anywhere. Find the time period of oscillations of block.

(A) $2\sqrt{\frac{2h}{g}}\left[\frac{1}{\sin\alpha} + \frac{1}{\sin\beta}\right]$ **(B)** $2\sqrt{\frac{2h}{g}}\left[\sin\alpha + \cos\beta\right]$

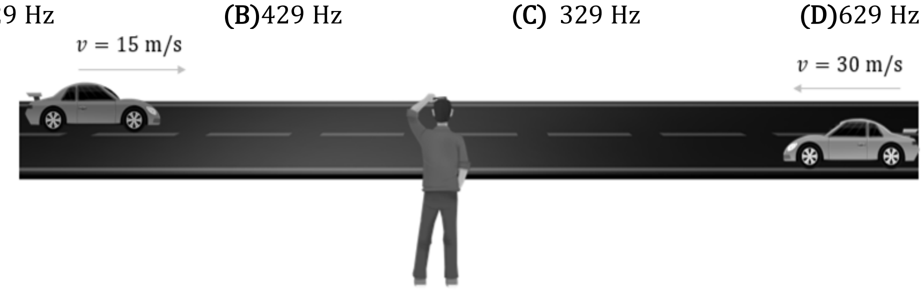
(C) $2\sqrt{\frac{h}{g}}\left[\frac{1}{\sin\alpha} + \frac{1}{\sin\beta}\right]$ **(D)** $2\sqrt{\frac{2h}{g}}\left[\frac{1}{\sin\alpha} + \sin\beta\right]$



Beat Frequency

Q.8 Two cars A and B approaches a stationary observer from opposite sides with speed 15 m/s and 30 m/s respectively. Observer hears no beats. If the frequency of the horn of the car B is 504 Hz, then the frequency of the horn of the car A will be [Take speed of sound = 330 m/s]

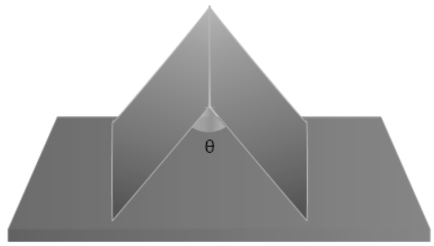
(A) 529 Hz **(B)** 429 Hz **(C)** 329 Hz **(D)** 629 Hz



Mirrors at an Angle

Q.9 Two mirrors are inclined at an angle**θ.** For an object placed along the angular bisector of the two mirrors, 11 images are noticed. Find the angle between the mirrors

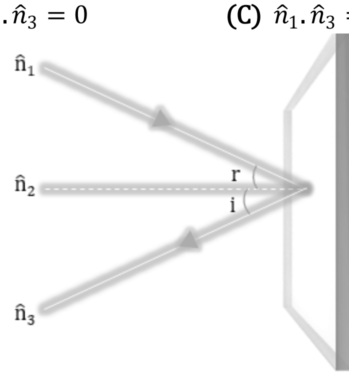
(A)30° **(B)**32.8° **(C)** 16.4° **(D)**15°



Reflection of Light

Q.10 $\hat{n}1$ is the unit vector along incident ray, $\hat{\mathbf{n}}\mathbf{2}$ along the normal to plane mirror and $\hat{\mathbf{n}}\mathbf{3}$is the unit vector along reflected ray direction, then which of the following must be true?

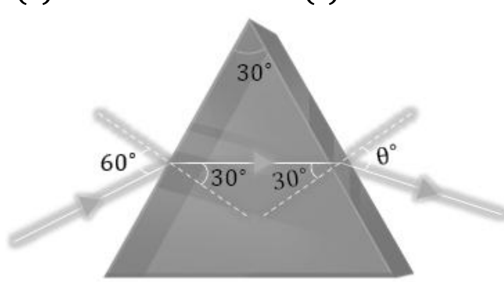
(A)$\hat{n}_1.\hat{n}_2 = 0$ **(B)**$\hat{n}_1.\hat{n}_3 = 0$ **(C)** $\hat{n}_1.\hat{n}_3 = 0$ **(D)**$(\hat{n}_1 \times \hat{n}_2) \times \hat{n}_3 = 0$



Deviation in Prism

Q.11 The angle of the prism is**30°.** The ray's incident at 60° on one refracting surface suffers a total deviation of**30°.** Find the angle of emergence.

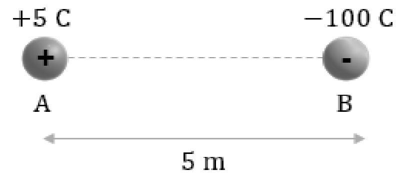
(A)0° **(B)**30° **(C)**60° **(D)**90°



Electric Field

Q.12 Find the distance of the point from A where the net electric field will be zero for the given configuration.

(A)0.4 mTowards left **(B)**1.4 mtowards left
(C) 2.4 m Towardsleft **(D)**3.4 mtowards left



Electric Field

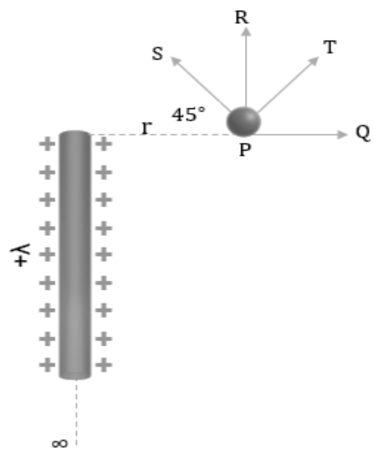
Q.13 Two charges q_1 and q_2 are kept on $x-$ axis and electric field at different points on $x-$ axis is plotted against x. Choose correct statement about nature and magnitude of q_1 and q_2.

(A) $q_1 + \text{ve},\ q_2 - \text{ve};\ |q_1| > |q_2|$ **(B)** $q_1 + \text{ve},\ q_2 - \text{ve};\ |q_1| < |q_2|$
(C) $q_1 - \text{ve},\ q_2 + \text{ve};\ |q_1| > |q_2|$ **(D)** $q_1 - \text{ve},\ q_2 + \text{ve};\ |q_1| < |q_2|$

Electric Field

Q.14 For the given semi-infinite rod, if a positive test charge at rest is kept at point **P**, then it will take path

(A) PT **(B)** PR **(C)** PS **(D)** PQ

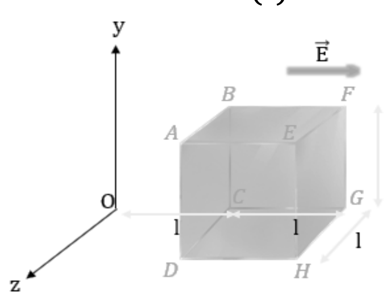


Introducing Flux

Q.15 The electric field in a region is given by $\vec{\mathbf{E}} = \boldsymbol{\alpha x}\ \hat{\mathbf{i}}$. Here, α is a positive constant of proper dimension. Find the total flux passing through a cube bounded by the coordinates,

$\mathbf{x = l,\ x = 2l, y\ 0,\ yl,\ z\ 0,\ z = l}$.

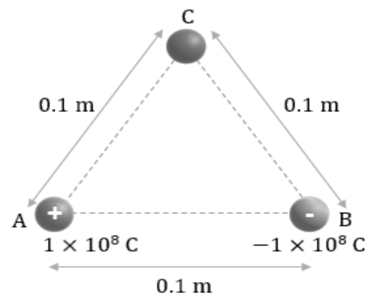
(A) αl^3 **(B)** $2\alpha l^3$ **(C)** $3\alpha l^3$ **(D)** $4\alpha l^3$



Superposition of Electric Fields

Q.16 For the given arrangement, find the value of electric field at C.

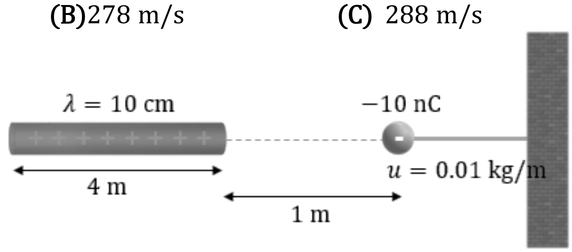
(A) 2×10^3 N/C **(B)** 3×10^3 N/C
(C) 5×10^3 N/C **(D)** 9×10^3 N/C



Electric Field Due to an Arc at the Centre

Q.17 One end of a string is fixed with a wall and the other end has a point charge -10 nC. It is kept along the axis of a finite line charge as shown in figure. If string is plucked, then the speed of the wave generated will be:

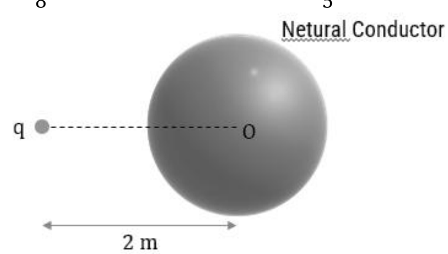
(A) 268 m/s **(B)** 278 m/s **(C)** 288 m/s **(D)** 298 m/s



Electric Field

Q.18 Find the magnitude of the electric field $(|\vec{E}_{ind}|)$ at the center of the sphere due to the induced charges on the sphere.

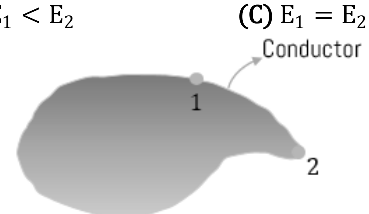
(A) $\frac{Kq}{2}$ **(B)** $\frac{Kq}{8}$ **(C)** $\frac{Kq}{5}$ **(D)** $\frac{Kq}{4}$



Electric Field

Q.19 In the given figure, σ_1 and σ_2 are the surface charge densities around points 1 and 2 respectively. Then the relation between the electric fields E_1 and E_2 near the points 1 and 2 respectively will be:

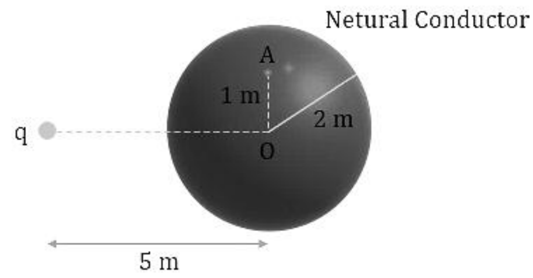
(A) $E_1 > E_2$ **(B)** $E_1 < E_2$ **(C)** $E_1 = E_2$ **(D)** can't be interpreted



Equipotential Surfaces

Q.20 Find the net electric potential at the point A for the figure shown below:

(A) $\frac{Kq}{2}$ **(B)** $\frac{Kq}{5}$ **(C)** Kq **(D)** $\frac{Kq}{4}$


Netural Conductor
A
1 m
2 m
q
O
5 m

ANSWER KEY

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