Q.1 A metal disk with a charge $Q_1 = -1e$ is placed near a metal sphere that has a charge $Q_2 = -4e$. If the disk touched the sphere, what is the possible final charge on each object?

(A) $Q_1 = -2e,\ Q_2 = -3e$ **(B)** $Q_1 = -3e,\ Q_2 = -3e$

(C) $Q_1 = -1e,\ Q_2 = +7e$ **(D)** $Q_1 = -2e,\ Q_2 = -2e$

Q.2 Five balls A, B, C, D and E are used in an experiment and following observations have been made:

(1) Ball A repels C and attracts B.

(2) Ball D attracts B and has no effect on E

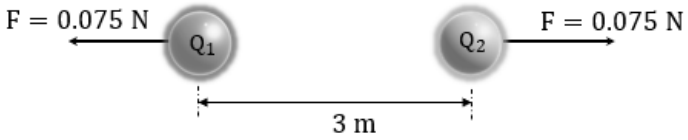
(3) A negatively charged rod attracts both A and E.

Based on above information, select the correct charge configuration for balls (if any):

	A	B	C	D	E
(P)	+	-	+	0	+
(Q)	+	-	+	+	0
(R)	+	-	+	0	0
(S)	+	-	-	0	0

(A) P **(B)** Q **(C)** R **(D)** S

Q.3 Two-point charges Q_1 and Q_2 are 3 m apart and their combined charge is 20 μC. If one repels the other with force of 0.075 N. Calculate the two charges. (in μC)

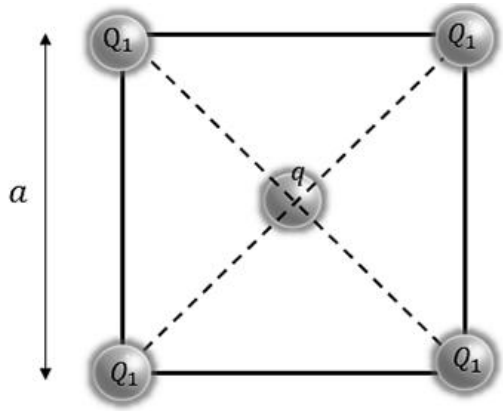


(A) 15, 5 **(B)** 10,10 **(C)** 35, –15 **(D)** 25, –5

Q.4 Two-point charges repel each other with a force of 100 N. One of the charges is increased by 10% and the other is reduced by 10%. The new force of repulsion at the same distance would be

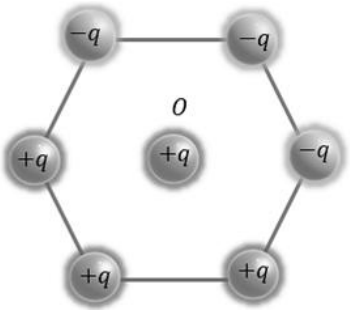
(A) 100 N **(B)** 121 N **(C)** 99 N **(D)** 110 N

Q.5 Four positive charges $(2\sqrt{2}-1)Q$ are arranged at the four corners of a square. Another charge q is placed at the centre of the square. For what value of q , is the resulting force acting on each corner charge be zero?



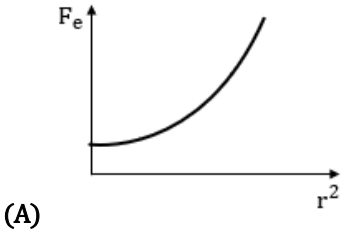
(A) $-\frac{7Q}{4}$ **(B)** $-\frac{4Q}{7}$ **(C)** $-Q$ **(D)** $-(\sqrt{2}-1)Q$

Q.6 Six-point charges are placed at the vertices of a hexagon of side 1m as shown in figure.What will be the force experienced by a charge +q placed at centre of hexagon?

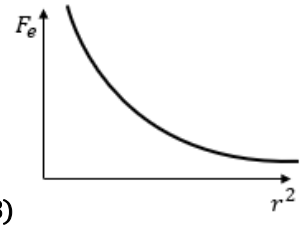


(A) Zero **(B)** $4kq^2$ **(C)** $3kq^2$ **(D)** $6Kq^2$

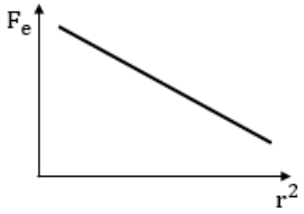
Q.7 Which of the following graph of electrostatic force between two positive charges (F_e) vs. r^2, is a correct representation? (r is the distance between two charges)



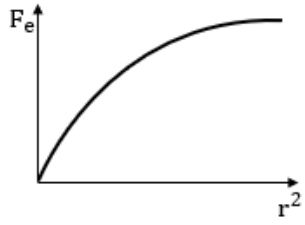
(A)



(B)

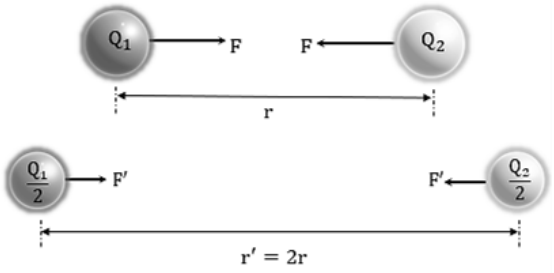


(C)



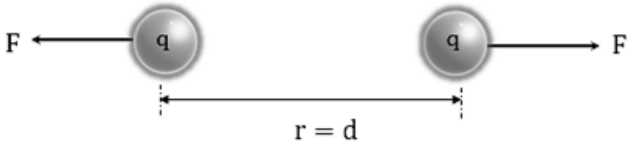
(D)

Q.8 Two-point charges Q_1 and Q_2 exerts force F on each other, when kept at certain distance apart. If the charge on each particle is halved and the distance between them is doubled, then the new force between the two particles would be



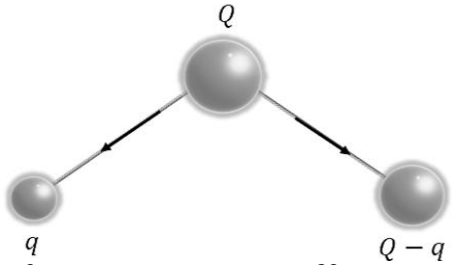
(A) $\frac{F}{2}$ **(B)** $\frac{F}{4}$ **(C)** $\frac{F}{8}$ **(D)** $\frac{F}{16}$

Q.9 Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)



(A) $\frac{4\pi\epsilon_0 Fd^2}{e^2}$ **(B)** $\sqrt{\frac{4\pi\epsilon_0 Fe^2}{d^2}}$ **(C)** $\sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$ **(D)** $\frac{4\pi\epsilon_0 Fd^2}{q^2}$

Q.10 A charge Q is divided into two parts q and Q − q. Find the relationship between Q and q , if the two parts placed at a given distance r apart have the maximum Coulomb repulsion force?



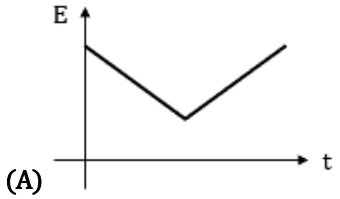
(A) $q = \frac{Q}{2}$ **(B)** $q = \frac{Q}{3}$ **(C)** $q = \frac{2Q}{2}$ **(D)** $q = \frac{Q}{4}$

WORK SHEET

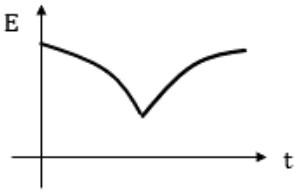
Q.1 If a composite physical quantity in terms of moment ofinertia (I), force (F), velocity (v), work (W) and length (L) is defined as $Q = \frac{IFv^2}{WL^3}$, then Q may be

(A) Surface tension **(B)**Surface energy **(C)**Both (a) and (b) **(D)**None of these

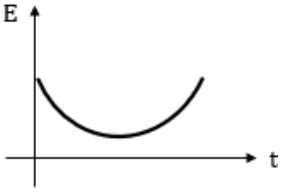
Q.2 A particle is thrown up with a certain velocity and at an angle θ with the horizontal. The variation of kinetic energy (E) with time (t) is given by



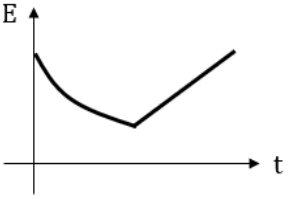
(A)



(B)

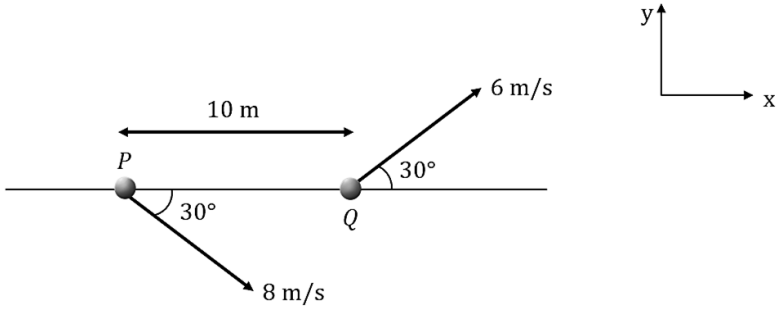


(C)



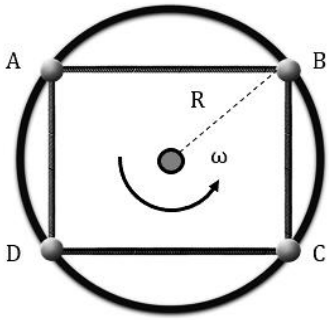
(D)

Q.3 Two moving particles P and Q are 10 m apart at a certain instant. The velocity of P is 8 m/s making an angle of 30° with the line joining P and Q. The velocity of Q is 6 m/s making an angle 30° with the line joining P and Q as shown in figure. The angular velocity of P with respect to Q is



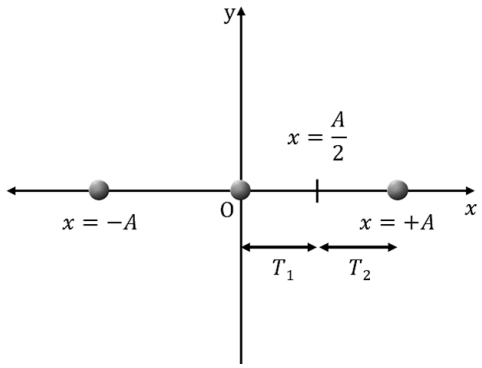
(A) 0 rad/s **(B)**0.1 rad/s **(C)**0.4 rad/s **(D)**0.7 rad/s

Q.4 Four particles of equal masses of 1 kg are connected by a light inextensible string of equal length to form a square. These are constrained to move along a frictionless ring of radius 2 m in horizontal plane with a uniform speed speed of 2 m/s as shown in figure. The tension in the string connecting them is



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

Q.5 A particle executes simple harmonic motion between $x = -A$ and $x = +A$. The time taken for it to go from the mean position O to A/2 is T_1 and to go from A/2 to A is T_2. Then

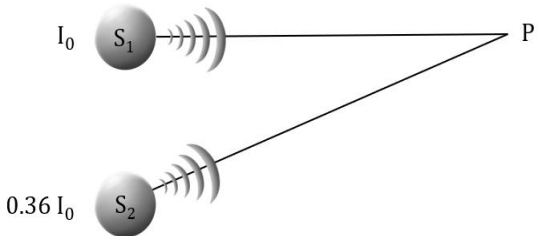


(A) $T_1 < T_2$ **(B)** $T_1 > T_2$ **(C)** $T_1 = T_2$ **(D)** $T_1 = 2T_2$

Q.6 A vessel containing 100 g water at 0°Cis left in the middle of a room. In 15 minutes, the temperature of the water rises by 2°C. When an equal amount of ice is placed in the vessel, it melts in 10 hours. The specific heat of fusion of ice is
(Take specific heat capacity of water as 1 cal/g. deg)

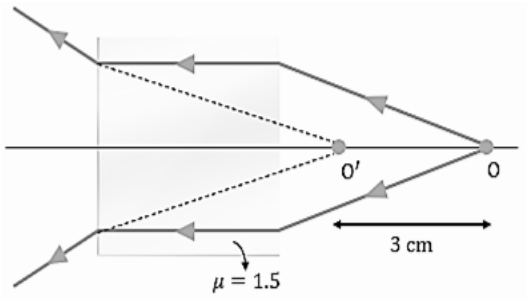
(A) 40 cal/g **(B)** 50 cal/g **(C)** 70 cal/g **(D)** 80 cal/g

Q.7 Sound from 2 identical sources S_1 and S_2 reach a point P. When both sounds reach in the same phase, the intensity at P due to each source is I_0. The power of S_1 is now reduced by 64% and the phase difference between S_1 and S_2 is varied continuously. The ratio of maximum to minimum intensity at P is



(A) 8:1 **(B)** 12:1 **(C)** 16:1 **(D)** 20:1

Q.8 An object is placed at O and the image obtained at O′ as shown below. If the refractive index of glass slab is 1.5, then the thickness of the slab is



(A) 3 cm **(B)** 6 cm **(C)** 9 cm **(D)** 12 cm

Q.9 Dispersion without deviation is produced by two thin (small angled) prisms which are combined. One prism has angle 6° and refractive index 1.52. If the other prism has an angle 4°, what is its refractive index?

(A) 1.17 **(B)** 1.48 **(C)** 1.64 **(D)** 1.78

Q.10 For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index:

(A) Lies between $\sqrt{2}$ and 1 **(B)** Lies between 2 and $\sqrt{2}$

(C) Is less than 1 **(D)** Is greater than 2

Q.11 A neutral metal sphere is touched by a negatively charged metal rod. During the process, electrons are transferred from the _____ to the _____ and the sphere acquires a _____ charge

(A) Neutral sphere, charged rod, negative **(B)**Neutral sphere, charged rod, positive

(C) Charged rod, neutral sphere, negative **(D)**Charged rod, neutral sphere, positive

Q.12 It has been observed that after rubbing the comb with hair, it starts to attract tiny pieces of paper. Identify the correct statement which explains the above phenomenon

(A) Combing the hair leads to charging it by induction

(B) The comb became charged by friction, and it caused redistribution of charges in pieces of paper when brought close to them

(C) Comb gets charged and attracts the tiny pieces of paper by conduction

(D) It attracted tiny pieces of paper due to cohesive forces

Q.13 If a charged body is placed near a neutral conductor, then

(A) It will repel the conductor

(B) It will attract the conductor

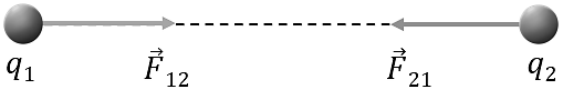
(C) It will not exert either attractive or repulsive force on conductor

(D) It may repel or attract conductor, depending on its shape

Q.14 Consider three charged bodies P, Q and R. If P and Q repel each other, while P and R attract. What is the nature of force between Q and R ?

(A) Repulsive force **(B)**Attractive force **(C)**No force **(D)**None of these

Q.15 Force acting on charges separated by some distance is shown in the figure. Select the correct relation between given parameters



(A) $q_1q_2 > 0,\ \vec{F}_{12} = -\vec{F}_{21}$ **(B)**$q_1q_2 < 0,\ \vec{F}_{12} = -\vec{F}_{21}$

(C)$q_1q_2 > 0,\ \vec{F}_{12} \neq \vec{F}_{21}$ **(D)**$q_1q_2 < 0,\ \vec{F}_{12} = -2\vec{F}_{21}$

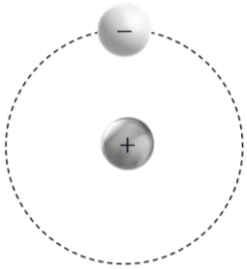
Q.16 The electric force on a charge q_1 due to q_2 is $(4\hat{i} - 3\hat{j})$ N. The unit vector in the direction of electric force on q_2 due to q_1 will be:

(A)$-4\hat{i} + 3\hat{j}$ **(B)**$-\frac{4}{5}\hat{i} + \frac{3}{5}\hat{j}$ **(C)**$-\frac{4}{5}\hat{i} - \frac{3}{5}\hat{j}$ **(D)**$\frac{4}{5}\hat{i} + \frac{3}{5}\hat{j}$

Q.17 Twelve equal charges (q), are situated at the corners of a regular 12−sided polygon (for instance, one on each numeral of a clock face). What is the net force on a test charge Q at the centre?
(Assume the distance between q and Q pair(s) to be L)

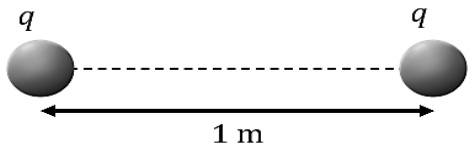
(A)$\frac{Qq}{4\pi\epsilon_0 L^2}$ **(B)**$\frac{Qq}{2\pi\epsilon_0 L^2}$ **C)** $\frac{Qq}{3\pi\epsilon_0 L^2}$ **(D)**Zero

Q.18 An electron of charge *e* is moving round the nucleus of a hydrogen atom in a circular orbit of radius *r*. The Coulomb's force F between the two is:



(A)$-\frac{2ke^2}{r^3}\vec{r}$ **(B)**$\frac{ke^2}{r^2}\vec{r}$ **(C)**$\frac{-ke^2}{r^3}\vec{r}$ **(D)**$\frac{-ke^2}{r^2}\vec{r}$

Q.19 What is the smallest electric force between two charges placed at a distance of **1 m** ?



(A) 2.5×10^{-25} N **(B)** 2.75×10^{-28} N **(C)** 2.30×10^{-28} N **(D)** 1.5×10^{-24} N

Q.20 Two equal charges are placed at a separation of 1 m. What should be the magnitude of the charges so that the force between them equals the weight of a 50 kg person?
(Take g = 10 m/s^2)

(A) 3×10^{-4} C **(B)** 2.3×10^{-4} C **(C)** 3.2×10^{-4} C **(D)** 5×10^{-5} C

ANSWER KEY

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