

Subject : Physics  
Standard : 12  
Total Mark : 62

## Electrostatic -1

Paper Set : 1  
Date : 24-03-2023  
Time : 0H:0M

### Physics - Section A - MCQ

[1] The law, governing the force between electric charges is known as

- (A) Ampere's law (B) Ohm's law  
(C) Faraday's law (D) Coulomb's law

[2] When the distance between the charged particles is halved, the force between them becomes

- (A) One-fourth (B) Half  
(C) Double (D) Four times

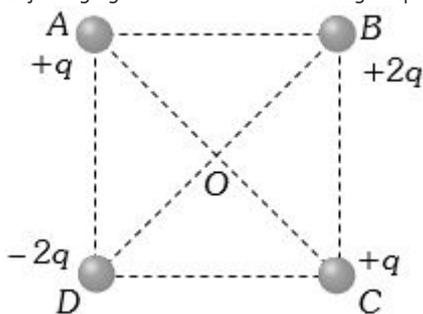
[3] There are two charges  $+1$  microcoulombs and  $+5$  microcoulombs. The ratio of the forces acting on them will be

- (A) 1 : 5 (B) 1 : 1  
(C) 5 : 1 (D) 1 : 25

[4] A charge  $q_1$  exerts some force on a second charge  $q_2$ . If third charge  $q_3$  is brought near, the force of  $q_1$  exerted on  $q_2$

- (A) Decreases  
(B) Increases  
(C) Remains unchanged  
(D) Increases if  $q_3$  is of the same sign as  $q_1$  and decreases if  $q_3$  is of opposite sign

[5] Four charges are arranged at the corners of a square  $ABCD$ , as shown in the adjoining figure. The force on the charge kept at the centre  $O$  is



- (A) Zero (B) Along the diagonal  $AC$   
(C) Along the diagonal  $BD$  (D) Perpendicular to side  $AB$

[6] Two small spheres each having the charge  $+Q$  are suspended by insulating threads of length  $L$  from a hook. This arrangement is taken in space where there is no gravitational effect, then the angle between the two suspensions and the tension in each will be

- (A)  $180^\circ, \frac{1}{4\pi\epsilon_0} \frac{Q^2}{(2L)^2}$  (B)  $90^\circ, \frac{1}{4\pi\epsilon_0} \frac{Q^2}{L^2}$   
(C)  $180^\circ, \frac{1}{4\pi\epsilon_0} \frac{Q^2}{2L^2}$  (D)  $180^\circ, \frac{1}{4\pi\epsilon_0} \frac{Q^2}{L^2}$

[7] Two charges each of  $1$  coulomb are at a distance  $1$  km apart, the force between them is

- (A)  $9 \times 10^3$  Newton (B)  $9 \times 10^{-3}$  Newton  
(C)  $1.1 \times 10^{-4}$  Newton (D)  $10^4$  Newton

[8] Dielectric constant of pure water is 81. Its permittivity will be

- (A)  $7.12 \times 10^{-10}$  MKS units (B)  $8.86 \times 10^{-12}$  MKS units  
(C)  $1.02 \times 10^{13}$  MKS units (D) Cannot be calculated

[9]  $ABC$  is a right angled triangle in which  $AB = 3$  cm and  $BC = 4$  cm. And  $\angle ABC = \pi/2$ . The three charges  $+15$ ,  $+12$  and  $-20$  e.s.u. are placed respectively on  $A$ ,  $B$  and  $C$ . The force acting on  $B$  is.....dynes

- (A) 125 (B) 35  
(C) 25 (D) 0

[10] When  $10^{14}$  electrons are removed from a neutral metal sphere, the charge on the sphere becomes..... $\mu C$

- (A) 16 (B)  $-16$   
(C) 32 (D)  $-32$

[11] A force  $F$  acts between sodium and chlorine ions of salt (sodium chloride) when put  $1$  cm apart in air. The permittivity of air and dielectric constant of water are  $\epsilon_0$  and  $K$  respectively. When a piece of salt is put in water electrical force acting between sodium and chlorine ions  $1$  cm apart is

- (A)  $\frac{F}{K}$  (B)  $\frac{FK}{\epsilon_0}$   
(C)  $\frac{F}{K\epsilon_0}$  (D)  $\frac{F\epsilon_0}{K}$

[12] Two similar spheres having  $+q$  and  $-q$  charge are kept at a certain distance.  $F$  force acts between the two. If in the middle of two spheres, another similar sphere having  $+q$  charge is kept, then it experience a force in magnitude and direction as

- (A) Zero having no direction (B)  $8F$  towards  $+q$  charge  
(C)  $8F$  towards  $-q$  charge (D)  $4F$  towards  $+q$  charge

[13] Number of electrons in one coulomb of charge will be

- (A)  $5.46 \times 10^{29}$  (B)  $6.25 \times 10^{18}$   
(C)  $1.6 \times 10^{19}$  (D)  $9 \times 10^{11}$

[14] Two spherical conductors  $B$  and  $C$  having equal radii and carrying equal charges in them repel each other with a force  $F$  when kept apart at some distance. A third spherical conductor having same radius as that of  $B$  but uncharged is brought in contact with  $B$ , then brought in contact with  $C$  and finally removed away from both. The new force of repulsion between  $B$  and  $C$  is

- (A)  $F/4$  (B)  $3F/4$   
(C)  $F/8$  (D)  $3F/8$

[15] Equal charges  $q$  are placed at the four corners  $A, B, C, D$  of a square of length  $a$ . The magnitude of the force on the charge at  $B$  will be

(A)  $\frac{3q^2}{4\pi\epsilon_0 a^2}$

(B)  $\frac{4q^2}{4\pi\epsilon_0 a^2}$

(C)  $\left(\frac{1+2\sqrt{2}}{2}\right) \frac{q^2}{4\pi\epsilon_0 a^2}$

(D)  $\left(2 + \frac{1}{\sqrt{2}}\right) \frac{q^2}{4\pi\epsilon_0 a^2}$

[16] Five balls numbered 1 to 5 are suspended using separate threads. Pairs (1, 2), (2, 4) and (4, 1) show electrostatic attraction, while pair (2, 3) and (4, 5) show repulsion. Therefore ball 1 must be

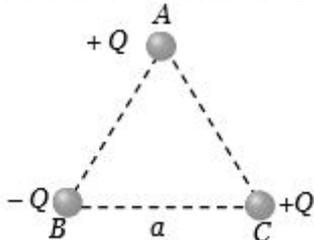
(A) Positively charged

(B) Negatively charged

(C) Neutral

(D) Made of metal

[17] Three charges are placed at the vertices of an equilateral triangle of side 'a' as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



(A)  $Q^2/(4\pi\epsilon_0 a^2)$

(B)  $-Q^2/(4\pi\epsilon_0 a^2)$

(C) Zero

(D)  $Q^2/(2\pi\epsilon_0 a^2)$

[18] Two charges placed in air repel each other by a force of  $10^{-4} N$ . When oil is introduced between the charges, the force becomes  $2.5 \times 10^{-5} N$ . The dielectric constant of oil is

(A) 2.5

(B) 0.25

(C) 2

(D) 4

[19] Two charges are at a distance 'd' apart. If a copper plate (conducting medium) of thickness  $\frac{d}{2}$  is placed between them, the effective force will be

(A)  $2F$

(B)  $F/2$

(C) 0

(D)  $\sqrt{2}F$

[20] Two small conducting spheres of equal radius have charges  $+10 \mu C$  and  $-20 \mu C$  respectively and placed at a distance R from each other experience force  $F_1$ . If they are brought in contact and separated to the same distance, they experience force  $F_2$ . The ratio of  $F_1$  to  $F_2$  is

(A) 1 : 8

(B) -8 : 1

(C) 1 : 2

(D) -2 : 1

[21] Electric charges of  $1 \mu C$ ,  $-1 \mu C$  and  $2 \mu C$  are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side 10 cm. The resultant force on the charge at C is.....N

(A) 0.9

(B) 1.8

(C) 2.7

(D) 3.6

[22] Two point charges  $+3 \mu C$  and  $+8 \mu C$  repel each other with a force of 40 N. If a charge of  $-5 \mu C$  is added to each of them, then the force between them will become.....N

(A) -10

(B) +10

(C) +20

(D) -20

[23] Two charged spheres separated at a distance d exert a force F on each other. If they are immersed in a liquid of dielectric constant 2, then what is the force (if all conditions are same)

(A)  $\frac{F}{2}$

(B) F

(C) 2F

(D) 4F

[24] The force between two charges 0.06 m apart is 5 N. If each charge is moved towards the other by 0.01 m, then the force between them will become.....N

(A) 7.20

(B) 11.25

(C) 22.50

(D) 45

[25] When air is replaced by a dielectric medium of constant k, the maximum force of attraction between two charges separated by a distance

(A) become  $k^{-1}$  times

(B) Remains unchanged

(C) Increases k times

(D) become k times

[26] Sure check for presence of electric charge is

(A) Process of induction

(B) Repulsion between bodies

(C) Attraction between bodies

(D) Frictional force between bodies

[27] Two identical metallic spheres A and B when placed at certain distance in air repel each other with a force of F. Another identical uncharged sphere C is first placed in contact with A and then in contact with B and finally placed at midpoint between spheres A and B. The force experienced by sphere C will be.

(A)  $3F/2$

(B)  $3F/4$

(C) F

(D)  $2F$

[28] A charge of  $4 \mu C$  is to be divided into two. The distance between the two divided charges is constant. The magnitude of the divided charges so that the force between them is maximum, will be.

(A)  $1 \mu C$  and  $3 \mu C$

(B)  $2 \mu C$  and  $2 \mu C$

(C) 0 and  $4 \mu C$

(D)  $1.5 \mu C$  and  $2.5 \mu C$

Physics - Section B - SUBJECTIVE

VSQ [1 Mark]

[29]  $F_g$  and  $F_e$  represents gravitational and electrostatic force respectively between electrons situated at a distance 10 cm. The ratio of  $F_g/F_e$  is of the order of

[30] The ratio of the forces between two small spheres with constant charge (a) in air (b) in a medium of dielectric constant K is

[31]  $+2 C$  and  $+6 C$  two charges are repelling each other with a force of 12 N. If each charge is given  $-2 C$  of charge, then the value of the force will be

[32] If two charges of 1 coulomb each are placed 1 km apart, then the force between them will be ..... N

S.A [2 Marks]

[33] A total charge  $Q$  is broken in two parts  $Q_1$  and  $Q_2$  and they are placed at a distance  $R$  from each other. The maximum force of repulsion between them will occur, when

[34] Three point charges of magnitude  $5\mu C$ ,  $0.16\mu C$  and  $0.3\mu C$  are located at the vertices  $A, B, C$  of a right angled triangle whose sides are  $AB = 3\text{ cm}$ ,  $BC = 3\sqrt{2}\text{ cm}$  and  $CA = 3\text{ cm}$  and point  $A$  is the right angle corner. Charge at point  $A$  experiences  $N$  of electrostatic force due to the other two charges.

[35] The charges on two sphere are  $+7\mu C$  and  $-5\mu C$  respectively. They experience a force  $F$ . If each of them is given an additional charge of  $-2\mu C$ , the new force of attraction will be

Below question is for 3 marks

[36] An infinite number of charges, each of charge  $1\mu C$  are placed on the  $x$ -axis with co-ordinates  $x = 1, 2, 4, 8, \dots, \infty$ . If a charge of  $1\text{ C}$  is kept at the origin, then what is the net force acting on  $1\text{ C}$  charge.... $N$

Below question is for 4 marks

[37] An infinite number of point charges, each carrying  $1\mu C$  charge, are placed along the  $y$ -axis at  $y = 1\text{ m}, 2\text{ m}, 4\text{ m}, 8\text{ m}, \dots$ . The total force on a  $1\text{ C}$  point charge, placed at the origin, is  $x \times 10^3\text{ N}$ . The value of  $x$ , to the nearest integer, is .....  
[Take  $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\text{ Nm}^2/\text{C}^2$ ]

EXAMOPEDIA



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## Electrostatic -1 (Answer Key)

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### Physics - Section A - MCQ

1 - D	2 - D	3 - B	4 - C	5 - C	6 - A	7 - A	8 - A	9 - C	10 - A
11 - A	12 - C	13 - B	14 - D	15 - C	16 - C	17 - C	18 - D	19 - C	20 - B
21 - B	22 - A	23 - A	24 - B	25 - A	26 - B	27 - B	28 - B		

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