12th Standard CBSE

Physics

Exam Time : 01:30:00 Hrs

Total Marks : 75

1) One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then 1
(a) mass of A and mass of B still remain equal (b) mass of A increases
(c) mass of B decreases (d) mass of B increases

2) In general, metallic ropes are suspended from the carriers to the ground which take inflammable material. The reason is 1
(a) their speed is controlled
(b) to keep the gravity of the carrier nearer to the earth
(c) to keep the body of the carrier in contact with the earth
(d) nothing should be placed under the carrier

3) In charging by induction 1
(a) body to be charged must be an insulator
(b) body to be charged must be a semiconductor
(c) body to be charged must be a conductor
(d) any type of body can be charged by induction

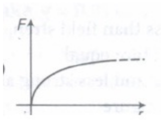
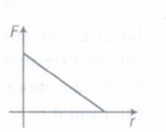
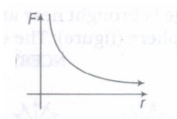
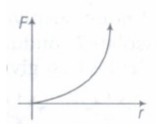
4) Charge on a body is q1 and it is used to charge another body by induction. Charge on second body is found to be q2 after charging. Then 1
(a) $\frac{q_1}{q_2}=1$ (b) $\frac{q_1}{q_2}<1$ (c) $\frac{q_1}{q_2}\leq 1$ (d) $\frac{q_1}{q_2}\geq 1$

5) An object of mass 1kg contains 4 x 10^{20} atoms. If one electron is removed from every atom of the solid, the charge gained by the solid of 1g is ________ 1
(a) 2.8 C (b) 6.4 x 10^{-2} C (c) 3.6 x 10^{-3} C (d) 9.2 x 10^{-4} C

6) Number of electrons present in a negative charge of 8 C is _____________ 1
(a) 5 x10^{19} (b) 2.5 x 10^{19} (c) 12.8 x 10^{19} (d) 1.6 x 10^{19}

7) SI unit of electrical permittivity is 1
(a) N-m ^{2}C^{-2} (b) Am $^{-2}$ (c) NC^{-1} (d) $C^2N^{-1}m^{-2}$

8) Force between two charges varies with distance between them as 1

(a)  (b)  (c)  (d) 

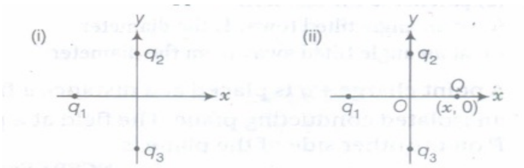
9) Two charges + 1 μ Cand +4μ C are situated at a distance in air. The ratio of the forces acting on them is 1

(a) 1 : 4 (b) 4 : 1 (c) 1 : 1 (d) 1 : 16

10) A charge q is placed at the centre of the line joining two equal charges Q and Q. The system of the three charges will be ill equilibrium, if q is equal to 1

(a) -Q /2 (b) -Q/ 4 (c) +Q/ 4 (d) +Q/ 2

11) In figure two positive charges q_2 and q_3 fixed along the y-axis, exert a net electric force in the + x- direction on a charge q_1 fixed along the x-axis. If a positive charge Q is added at (x, 0), the force on q_1 1



(a) shall increase along the positive x-axis

(b) shall decrease along the positive x-axis

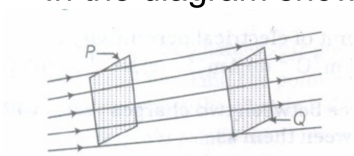
(c) shall point along the negative x-axis

(d) shall increase but the direction changes because of the intersection of Q with q_2 and q_3

12) A force of 2.25 N acts on a chrage of 15 x 10^{-4} C. The intensity of electric field at that point is 1

(a) 150 NC^{-1} (b) 15 NC^{-1} (c) 1500 NC^{-1} (d) 1.5 NC^{-1}

13) In the diagram shown below, 1



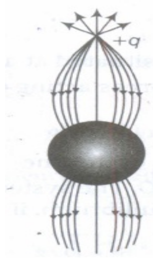
(a) field strength at P is less than field strength at Q

(b) field strength at P and Q are equal

(c) field is more strong at P and less strong at Q

(d) cannot be tell from the figure

14) A point positive charge is brought near an isolated conducting sphere (figure). The electric field is best given by 1

(a) 
(b) 
(c) 
(d) 

15) A hemisphere is uniformly charged. The electric field at a point on a diameter away from the centre is directed 1

(a) perpendicular to the diameter (b) parallel to the diameter
(c) at an angle tilted towards the diameter
(d) at an angle tilted away from the diameter

16) A point charge + q is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is 1

(a) directed perpendicular to the plane and away from the plane.
(b) directed perpendicular to the plane but towards the plane
(c) directed radially away from the point charge
(d) directed radially towards the point charge

17) Two equal and opposite charges each of 2C are placed at a distance of 0.04 m. Dipole moment of the system will be 1

(a) 6×10^{-8} C-m (b) 8×10^{-2} C-m (c) 1.5×10^{2} C-m (d) 8×10^{-6} C-m

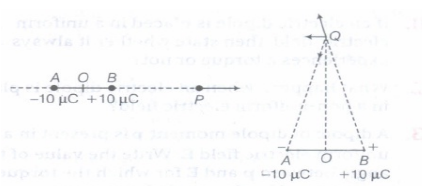
18) What is the angle between the electric dipole moment and the electric field strength due to it on the equatorial line? 1

(a) 0^{o} (b) 90^{o} (c) 180^{o} (d) None of these

19) Electric charges q,q,-2q are placed at the corners of an equilateral $\triangle$ABC of side l. The magnitude of electric dipole moment of the system is 1

(a) ql (b) 2ql (c) $\sqrt{3}$ ql (d) 4ql

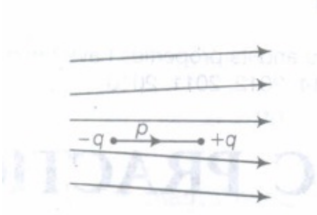
20) 1



In given figures, OP = OQ = 15 cm, OA = OB = 2.5 mm Magnitudes of electric field at P and Q are respectively

(a) 2.6×10^{5} NC^{-1}, 2.6×10^{5} NC^{-1} (b) 1.3×10^{5} NC^{-1}, 1.3×10^{5} NC^{-1}
(c) 2.6×10^{5} NC^{-1}, 1.3×10^{5} NC^{-1} (d) 1.3×10^{5} NC^{-1}, 2.6×10^{5} NC^{-1}

21) Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct? 1



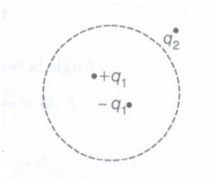
(a) The dipole will not experience any force.
(b) The dipole will experience a force towards right.
(c) The dipole will experience a force towards left.
(d) The dipole will experience a force upwards.

22) In an electric field E, the torque acting on a dipole moment p is 1
(a) p·E (b) p x E (c) zero (d) E x p

23) When an electric dipole p is placed in a uniform electric field E,then at what angle between p and E the value of torque will be maximum? 1
(a) 90^o (b) 0^o (c) 180^o (d) 45^o

24) The SI unit of electric flux is 1
(a) $\frac{\text{volt}}{\text{metre}}$ (b) $\frac{\text{newton}}{\text{coulomb}}$ (c) $\frac{\text{newton} \times \text{metre}^2}{\text{coulomb}}$ (d) $\text{volt} \times \text{metre}^2$

25) Consider the charge configuration and spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to 1



(a) q_2 (b) only the positive charges' (c) all the charges (d) + q_1 and - q_2

26) Total electric flux coming out of a unit positive charge put in air is 1
(a) E_o (b) ε_0^{-1} (c) $(4 pE_0)^{-1}$ (d) 4π E_0

27) In a system, 'n' electric dipole are placed in a closed surface. The value of emergent electric flux from enclosed surface is 1
(a) $\frac{q}{\varepsilon_0}$ (b) $\frac{2q}{\varepsilon_0}$ (c) $-\frac{2q}{\varepsilon_0}$ (d) zero

28) The intensity of electric field at the surface of conducting hollow sphere is 10 NC^{-1} and its radius is 10 cm. The value of electric field at the centre of sphere is 1
(a) zero (b) 10 NC^{-1} (c) 1 NC^{-1} (d) 100 NC^{-1}

29) The surface densities on the surfaces of two charged spherical conductors of radii R_1 and R_2 are equal. The ratio of electric intensities on the surfaces are 1
(a) R_1^2/R_2^2 (b) R_2^2/R_1^2 (c) R_1/R_2 (d) 1:1

30) The electric flux in a charged spherical conductor is 1

(a) zero inside and outside the sphere

(b) maximum inside the sphere and zero outside the sphere

(c) zero inside the sphere and decreases outside the sphere with increase of square of distance.

(d) maximum inside the sphere and decreases outside the sphere with increase of distance.

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31) Radius of a hollow sphere is R and a charge q is placed at the centre of hollow sphere. If the radius of sphere becomes half and charge also becomes half, then the value of emergent total flux from the surface of sphere is 1

(a) $4q/\varepsilon_0$ (b) $2q/\varepsilon_0$ (c) $q/2\varepsilon_0$ (d) q/ε_0

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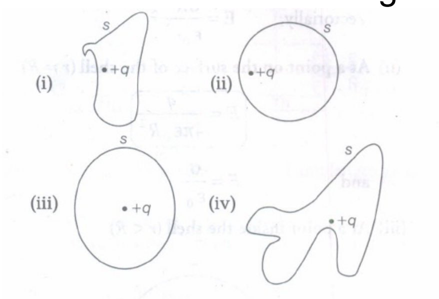
32) The electric flux through the surface 1



(a) in Fig. (iv) is the largest (b) in Fig. (iii) is the least

(c) in Fig. (ii) is same as Fig. (iii) but is smaller than Fig. (iv)

(d) is the same for all the figures

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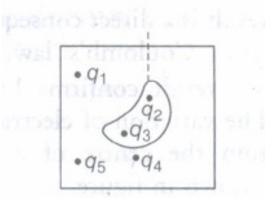
33) Five charges q_1 q_2, q_3, q_4 and q_5 are fixed at their positions as shown in Figure, S is a Gaussian surface. The Gauss' law is given by $\int_s E \cdot dS = \frac{q}{\varepsilon_0}$ Which of the following statements is correct? 1



(a) E on the LHS of the above equation will have a contribution from q_1, q_5 and q_1 ,q_5 and q_3 while q on the RHS will have a contribution from q_2 and q_4 only.

(b) E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_2 and q_3 only

(c) E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_1, q_3, and q_5 only.

(d) Both E on the LHS and q on the RHS will have contributions from q_2 and q_4 only

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34) The number of electrons that must be removed from an electrically neutral silver dollar to give it a charge of + 2.4 C is 1

(a) 2.5×10^{19} (b) 1.5×10^{19} (c) 1.5×10^{-19} (d) 2.5×10^{-19}

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35) Two identical metallic spheres having charges +4q and -2q are placed with their centres r distance apart. Force of attraction between the spheres is F. If the two spheres are brought in contact and then placed at the same distance r apart, the force between them 1

(a) F (b) F/2 (c) F/4 (d) F/8

36) In the following configuration of charges, force on charge q_2 by q_1 is given by (here, $r = r_{21} = (r_2 - r_1)$ 1

(a) $\mathbf{F}_{21}=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\cdot\hat{\mathbf{r}}_{21}$ (b) $\mathbf{F}_{21}=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}(-\hat{\mathbf{r}}_{21})$ (c) $\mathbf{F}_{21}=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^3}\cdot\hat{\mathbf{r}}_{21}$

(d) $\mathbf{F}_{21}=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^3}\cdot(-\hat{\mathbf{r}}_{21})$

37) If charges q, q and -q are placed at vertices of an equilateral triangle of side l. If F_1, F_2 and F_3 are the forces on the charges respectively, then 1

(a) $|\mathbf{F}_1+\mathbf{F}_2+\mathbf{F}_3|=\sqrt{3}\frac{kq^2}{l^2}$ (b) $|\mathbf{F}_1+\mathbf{F}_2+\mathbf{F}_3|=0$

(c) $|\mathbf{F}_1+\mathbf{F}_2+\mathbf{F}_3|=3\sqrt{2}\frac{kq^2}{l^2}$ (d) $|\mathbf{F}_1+\mathbf{F}_2+\mathbf{F}_3|=\sqrt{2}\frac{kq^2}{l^2}$

38) Unit of electric field is 1

(a) N/m (b) C/N (c) N/C (d) J/N

39) Unit of electric field intensity is 1

(a) N/m (b) C/N (c) N/C (d) J/N

40) The unit of intensity of electric field is 1

(a) N/m (b) C/N (c) N/C (d) J/N

41) Electric field of a system of charges does not depend on 1

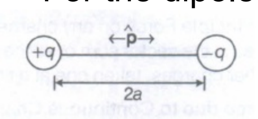
(a) position of charges forming the system

(b) distance of point (at which fieldis being observed) from the charges forming system

(c) value of test charge used to find out the field

(d) separation of charges forming the system

42) For the dipole shown, 1



Dipole moment is given by

(a) p= q x 2a$\hat{p}$ (b) $\mathbf{p}=\frac{1}{2}q\times 2a\hat{\mathbf{p}}$ (c) p=- q x 2a$\hat{p}$ (d) p=4q x 2a$\hat{p}$

43) Gauss' law is true only if force due to charges varies as 1

(a) r^{-1} (b) r^{-2} (c) r^{-3} (d) r^{-4}

44) For a given surface, the $\oint \mathbf{E} \cdot d\mathbf{S} = 0$ From this, we can conclude that 1

(a) E is necessarily zero on the surface.
(b) E is perpendicular to the surface at every point
(c) the total flux through the surfaceis zero
(d) the flux is only going out of the surface

45) A charge on a sphere of radius 2 cm is 2 μC while charge on sphere of radius 5 cm is 5μC. Find the ratio of an electric field on distance of 10 crn from centre of the sphere. 1

(a) 1 : 1 (b) 2 : 5 (c) 5 : 2 (d) 4 : 25

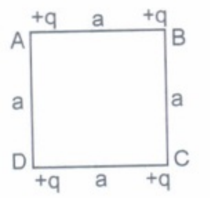
46) When a glass rod is rubbed with silk, it 1

(a) gains electrons from silk. (b) gives electrons to silk
(c) gains protons from silk (d) gives protons to silk.

47) A charge Q is divided into two parts of q and Q - q. If the coulomb repulsion between them when they are separated is to be maximum, the ratio of Q/q should be 1

(a) 2 : 1 (b) 1/2 (c) 4 : 1 (d) 1/4

48) Four 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 1



(a) $\frac{3q^2}{4\pi\varepsilon_0 a^2}$ (b) $\frac{4q^2}{4\pi\varepsilon_0 a^2}$ (c) $\frac{(1+2\sqrt{2})q^2}{2\times 4\pi\varepsilon_0 a^2}$ (d) $\frac{\left(\frac{2+1}{\sqrt{2}}\right)^{q^2}}{4\pi\varepsilon_0 a^2}$

49) Two charges of equal magnitudes kept at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is 1

(a) $\frac{F}{8}$ (b) $\frac{F}{4}$ (c) 4 F (d) $\frac{F}{16}$

50) The electric field inside a spherical shell of uniform surface charge density is 1

(a) zero. (b) constant, less than zero.
(c) directly proportional to the distance from the centre. (d) none of the these

51) A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is given by 1

(a) $2\pi R^2 E$ (b) πr^2 (c) $\frac{\pi \boldsymbol{R}^2 - \pi \boldsymbol{R}}{\boldsymbol{E}}$ (d) Zero

52) Electric field at a point varies as r^o for 1

(a) an electric dipole (b) a point charge (c) a plane infinite sheet of charge
(d) a line charge of infinite length

53) An electric charge q is placed at the centre of a cube of side a. The electric flux on one of its faces will be 1

(a) $\frac{q}{6\varepsilon_0}$ (b) $\frac{q}{\varepsilon_0 a^2}$ (c) $\frac{q}{4\pi\varepsilon_0 a^2}$ (d) $\frac{q}{\varepsilon_0}$

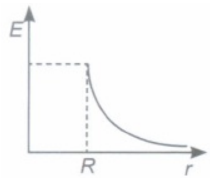
54) The electric field intensity due to an infinite cylinder of radius R and having charge q per unit length at a distance r(r > R) from its axis is 1

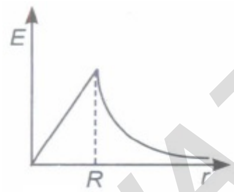
(a) directly proportional to r^2. (b) directly proportional to r^3.
(c) inversely proportional to r. (d) inversely proportional to r^2.

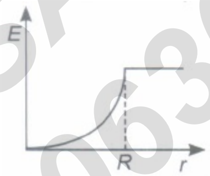
55) A point charge q is placed at a distance a/2 directly above the centre of a square of side a. The electric flux through the square is 1

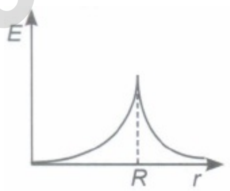
(a) q/ε_0 (b) $\boldsymbol{q}/\pi\varepsilon_0$ (c) $q/4\varepsilon_0$ (d) $q/6\varepsilon_0$

56) Which of the following graphs shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere? 1

(a) 

(b) 

(c) 

(d) 

57) Which of the following statement is correct? The electric field at a point is 1

(a) always continuous (b) continuous if there is a charge at that point.
(c) discontinuous only if there is a negative charge at that point.
(d) discontinuous if there is a charge at that point

58) Gauss's law will be invalid if 1

(a) there is magnetic monopoles (b) the inverse square law is not exactly true.
(c) the velocity of light is not a universal constant. (d) none of these

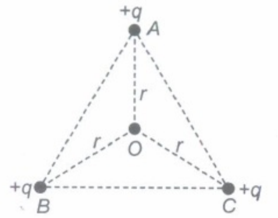
59) An electric dipole of moment p is placed in the position of stable equilibrium in uniform electric field of intensity E. It is rotated through an angle 9 from the initial position. The potential energy of electric dipole in the final position is 1

(a) $pE\cos\theta$ (b) $pE\sin\theta$ (c) $pE(1-\cos\theta)$ (d) $-pE\cos\theta$

60) An electric dipole is kept in a non-uniform electric field. It experiences 1

(a) a force and a torque (b) a force but not a torque
(c) a torque but not a force. (d) neither a force nor a torque

61) ABC is an equilateral triangle. Three charges +q are placed at each comer. The electric intensity at O will be 1

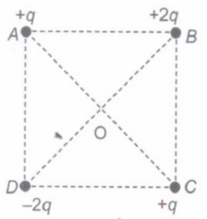


(a) $1.\ q/4\pi\varepsilon_0.r^2$ (b) $1.\ q/4\pi\varepsilon_0 r$ (c) Zero (d) $1.\ 3q/4\pi\varepsilon_0 r^2$

62) There are two charges +1 μC and +5 μC. The ratio of the forces acting on them will be 1

(a) 1 : 5 (b) 1 : 1 (c) 5 : 1 (d) 1 : 25

63) Four charges are arranged at the comers of a square ABCD, as shown. The force on the charge kept at the centre O is 1

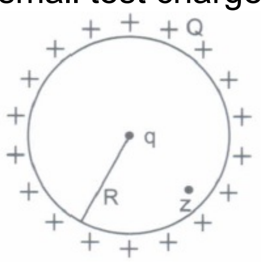


(a) zero (b) along the diagonal AC (c) along the diagonal BD
(d) perpendicular to side AB

64) Which of the following statement is correct? $\int E \cdot ds = 0$ over a surface, then 1

(a) the electric field inside the surface and on it is zero.
(b) the electric field inside the surface is necessarily uniform.
(c) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.
(d) all charges must not necessarily be outside the surface.

65) A positive charge Q is uniformly distributed along a circular ring of radius R. A small test charge q is placed at the centre of the ring. 1



Which of the following statement is not correct?
(a) If q > 0 and is displaced away from the centre in the plane of the ring, it will be pushed back towards the centre.
(b) If q < 0 and is displaced away from the centre in the plane of the ring, it will never return to the centre and will continue moving till it hits the ring.
(c) If q < 0, it will perform SHM for small displacement along the axis.
(d) q at the centre of the ring is in an unstable equilibrium within the plane of the ring for q > 0.

66) Coulomb's law states that the electrostatic force of attraction or repulsion acting between two stationary point charges is given by

$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$

where F denotes the force between two charges q_1 and q_2 separated by a distance r in free space, E_o is a constant known as permittivity of free space. Free space is vacuum and may be taken to be air practically.

If free space is replaced by a medium, then E_o is replaced by (E_ok) or (E_oEr)where k is known as dielectric constant or relative permittivity.

(i) In coulomb's law, F = $k\frac{q_1 q_2}{r^2}$, then on which of the following factors does the proportionality constant k depends?

(a) Electrostatic force acting between the two charges

(b) Nature of the medium between the two charges

(c) Magnitude of the two charges

(d) Distance between the two charges

(ii) Dimensional formula for the permittivity constant E_o of free space is

(a) $\left[\mathrm{ML}^{-3}\,\mathrm{T}^4\,\mathrm{A}^2\right]$ (b) $\left[M^{-1}L^3T^2A^2\right]$

(c) $\left[\mathrm{M}^{-1}\,\mathrm{L}^{-3}\,\mathrm{T}^4\,\mathrm{A}^2\right]$ (d) $\left[ML^{-3}T^4A^{-2}\right]$

(iii) The force of repulsion between two charges of 1 C each, kept 1 m apart in vaccum is

(a) $\frac{1}{9\times10^9}$ N (b) $\left[M^{-1}L^3T^2A^2\right]$

(c) 9×10^7 N (d) $\frac{1}{9\times10^{12}}$ N

(iv) Two identical charges repel each other with a force equal to 10 mgwt when they are 0.6 m apart in air. (g = 10 ms^{-2}). The value of each charge is

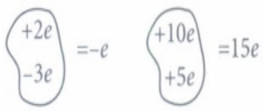
(a) 2 mC (b) 2 x10^{-7} mC (c) 2 nC (d) 2μC

(v) Coulomb's law for the force between electric charges most closely resembles with

(a) law of conservation of energy **(b) Newton's law of gravitation**

(c) Newton's 2^{nd} law of motion **(d) law of conservation of charge**

67) Smallest charge that can exist in nature is the charge of an electron. During friction it is only the transfer of electrons which makes the body charged. Hence net charge on any body is an integral multiple of charge of an electron. 5



[1.6 x 10^{-19} C] i.e.
q = ± ne
where n = 1,2,3,4, ...
Hence no body can have a charge represented as $1.1e, 2.7e, \frac{3}{5}e,$ etc.
Recently, it has been discovered that elementary particles such as protons or neutrons are composed of more elemental units called quarks.

(i) Which of the following properties is not satisfied by an electric charge?

(a) Total charge conservation **(b) Quantization of charge**
(c) Two types of charge **(d) Circular line of force**

(ii) Which one of the following charges is possible?

(a) 5.8 x 10^{-18}C (b) 3.2 x 10^{-18}C
(c) 4.5 x 10^{-19}C (d) 8.6 x 10^{-19}C

(iii) If a charge on a body is 1 nC, then how many electrons are present on the body?

(a) 6.25 x 10^{27} (b) 1.6 x 10^{19}
(c) 6.25 x 10^{28} (d) 6.25 x 10^{9}

(iv) If a body gives out 10^9 electrons every second, how much time is required to get a total charge of 1 C from it?

(a) 190.19 years (b) 150.12 years (c) 198.19 years (d) 188.21 years

(v) A polythene piece rubbed with wool is found to have a negative charge of3.2 x 1O^{-7}C.Calculate the number of electrons transferred.

(a) 2 x 10^{12} (b) 3 x 10^{12} (c) 2 x 10^{14} (d) 3 x 10^{14}

****

1) (d) mass of B increases 1

2) (c) to keep the body of the carrier in contact with the earth 1

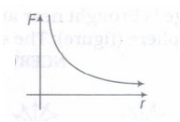
3) (c) body to be charged must be a conductor 1

4) (d) $\frac{q_1}{q_2} \geq 1$ 1

5) (b) 6.4 x 10^{-2} C 1

6) (a) 5 x10^{19} 1

7) (d) $C^2N^{-1}m^{-2}$ 1

8) (c) 

1

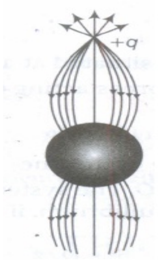
9) (c) 1 : 1 1

10) (b) -Q/ 4 1

11) (a) shall increase along the positive x-axis 1

12) (c) 1500 NC^{-1} 1

13) (c) field is more strong at P and less strong at Q 1

14) (a) 

1

15) (a) perpendicular to the diameter 1

16) (a) directed perpendicular to the plane and away from the plane. 1

17) (b) 8 x 10^{-2} C-m 1

18) (c) 180^o 1

19) (c) $\sqrt{3}$ ql 1

20) (c) 2.6 x 10^5 NC^{-1}, 1.3 x 10^5 NC^{-1} 1

21) (c) The dipole will experience a force towards left. 1

22) (b) p x E 1

23) (a) 90^o 1

24) (c) $\frac{\text{newton} \times \text{metre}^2}{\text{coulomb}}$ 1

25) (c) all the charges 1

26) (b) ε_0^{-1} 1

27) (d) zero 1

28) (a) zero 1

29) (d) 1:1 1

30) (c) 1

zero inside the sphere and decreases outside the sphere with increase of square of distance.

31) (c) $q/2\varepsilon_0$ 1

32) (d) is the same for all the figures 1

33) (b) 1

E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_2 and q_3 only

34) (b) 1.5 x 10^{19} 1

35) (d) F/8 1

36) (a) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2} \cdot \hat{\mathbf{r}}_{21}$ 1

37) (b) $|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3| = 0$ 1

38) (c) N/C 1

39) (c) N/C 1

40) (c) N/C 1

41) (c) value of test charge used to find out the field 1

42) (a) p= q x 2a$\hat{p}$ 1

43) (b) r^{-2} 1

44) (c) the total flux through the surfaceis zero 1

45) (b) 2 : 5 1

46) (b) gives electrons to silk 1

47) (a) 2 : 1 1

48) (c) $\frac{(1+2\sqrt{2})q^2}{2\times4\pi\varepsilon_0 a^2}$ 1

49) (d) $\frac{F}{16}$ 1

50) (a) zero. 1

51) (d) Zero 1

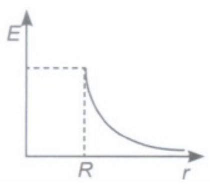
52) (c) a plane infinite sheet of charge 1

53) (a) $\frac{q}{6\varepsilon_0}$ 1

54) (c) inversely proportional to r. 1

55) (d) $q/6\varepsilon_0$ 1

56) (a) 1



57) (d) discontinuous if there is a charge at that point 1

58) (b) the inverse square law is not exactly true. 1

59) (d) $-pE\cos\theta$ 1

60) (a) a force and a torque 1

61) (c) Zero 1

62) (b) 1 : 1 1

63) (c) along the diagonal BD 1

64) (c) 1

the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

65) (c) If q < 0, it will perform SHM for small displacement along the axis. 1

66) 5

(i) (b): The proportionality constant k depends on the nature of the medium between the two charges.

(ii) (c): $As, [\varepsilon_0] = \frac{1}{4\pi F} \cdot \frac{q_1 q_2}{r^2} = \frac{[\mathrm{AT}]^2}{[\mathrm{MLT}^{-2}][\mathrm{L}^2]}$

$= \left[\mathrm{M}^{-1}\ \mathrm{L}^{-3}\ \mathrm{T}^4\ \mathrm{A}^2\right]$

(iii) (b)

(iv) (d): $F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{d^2}$

$\therefore \left(10 \times 10^{-3}\right) \times 10 = \frac{\left(9\times10^9\right)\times q^2}{(0.6)^2}$

or $q^2 = \frac{10^{-1}\times0.36}{9\times10^9} = 4 \times 10^{-12}$

or $q = 2 \times 10^{-6}\mathrm{C} = 2\mu\mathrm{C}$

(v) (b)

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67) 5

(i) (d)

(ii) (b): From, $q = ne, n = \frac{q}{e} = \frac{3.2\times10^{-18}}{1.6\times10^{-19}} = 20$

As n is an integer, hence this value of charge is possible.

(iii) (d): Charge on the body is q = ne

$\therefore$ No. of electrons present on the body is

$n = \frac{q}{e} = \frac{1\times10^{-9}\mathrm{C}}{1.6\times10^{-19}\mathrm{C}} = 6.25 \times 10^9$

(iv) (C): Here, n = 10^9 electrons per second, Charge given per second,

q = ne = 10^9 x 1.6 x 10^{-19}C

q = 1.6 X 10^{-10}C

Total charge, Q = 1 C (given)

$\therefore$ Time required $= \frac{Q}{q} = \frac{1}{1.6\times10^{-10}}\ \mathrm{s} = 6.25 \times 10^9\ \mathrm{s}$

$\therefore \frac{6.25\times10^9}{3600\times24\times365}$ year $= 198.19$ years.

(v) (a): As q = ne, n = $\frac{3.2\times10^{-7}}{1.6\times10^{-19}}$

⇒ n = 2 x 10^{12}electrons.
