

CLASS XII WORKSHEET MARCH 2020

ELECTRIC CHARGES, ELECTRIC FIELD AND ELECTROSTATIC POTENTIAL

1.If a positive charge is displaced against the electric field in which it was situated then

(a) work will be done by the electric field on the charge (b)the intensity of the electric field decreases (c) energy of the system will decrease (d)energy will be provided by external source displacing the charge.

2.The electric flux emerging from 5C charge is

(a) $1/\epsilon_0$ (b) $5/\epsilon_0$ (c) $4\pi/\epsilon_0$ (d) ϵ_0

3.Two point charges separated by a distance 'd' repel each other with a force of 9N. If the separation between them becomes 3d, then the force of repulsion will be

(a)1N (b)3N (c)6N (d)27N

4.The unit of $1/4\pi\epsilon_0$ is

(a) $C^2 N^{-1} m^{-2}$ (b) $C^{-2} N m^2$ (c) $C^2 N m^2$ (d)none

5.Two charged spheres separated by a distance d exert some force F on each other. If they are immersed in a liquid of dielectric constant 2, then the force exerted by them when all other conditions remain same is

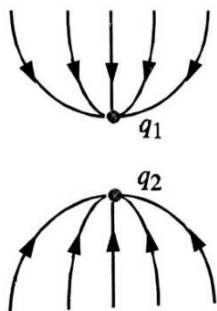
(a) 4F(b)2F (c)F (d)F/2

6.Three identical charges each charge Q are located at the corners of the square of side 'a'. The magnitude of Electric field at the centre of the square is

a) $\frac{3kQ}{a^2}$ b) $\frac{kQ}{a^2}$ c) $\frac{6kQ}{a^2}$ d) $\frac{2kQ}{a^2}$

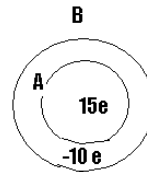
7.

Figure shows electric field lines due to two charges q_1 and q_2 . Find out sign of charges.



- A. both negative
- B. upper positive and lower negative
- C. both positive
- D. upper negative and lower positive

8. Two concentric spherical shells A and B of radius 5cm and 10cm enclosing charges as shown in figure. What is the ratio of electric flux through A to B?
 a) -1.5:1 b) 3:1 c) 1:3 d) 3:5



9. Name the physical quantity whose unit is coulomb per metre

- a) Electric dipole moment
- b) Electric field
- c) linear charge density
- d) capacitance of capacitor

10. An electric dipole of moment p is lying along a uniform electric field E . The work done in rotating the dipole by 90° is

- (a) pE
- (b) $\sqrt{2}pE$
- (c) $pE/2$
- (d) $2pE$

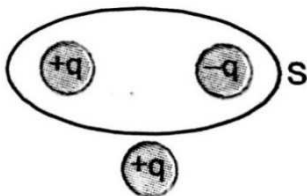
11. An electric dipole is placed at an angle 30° to a non uniform electric field. The dipole will experience

- (a) a torque only
- (b) a translational force only in the direction of field
- (c) a translational force only in the direction normal to the direction of field
- (d) torque as well as translational force.

12. Name the physical quantity whose unit is coulomb per metre

- a) Electric dipole moment
- b) Electric field
- c) linear charge density
- d) capacitance of capacitor

13. Shown below is distribution of charges:



The flux of electric field due to these charges through the surface S is:

- A. $\frac{3q}{\epsilon_0}$
- B. $\frac{2q}{\epsilon_0}$

- C. $\frac{q}{\epsilon_0}$ D. zero

14. Electric potential at a point due to an electric dipole is given by

- (a) $V = p \cos \theta / 4\pi\epsilon_0 r$ (b) $V = p / 4\pi\epsilon_0 r^2$ (c) $V = p \cos \theta / 4\pi\epsilon_0 r^2$
 (d) $V = p \sin \theta / 4\pi\epsilon_0 r$

15. Work done in moving a positive charge on an equipotential surface is

- (a) negative (b) zero (c) positive (d) infinity

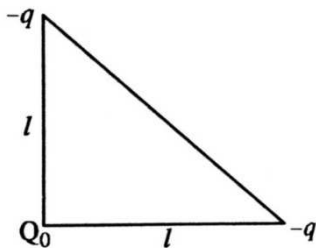
16. A uniform electric field pointing in positive x directions exists in a region.

Let A be the origin, B be a point on the x axis at $x = 1 \text{ cm}$ and C be a point on the y axis at $y = 1 \text{ cm}$, then the potential at the points A B and C satisfy,

- (a) $V_A < V_B$ (b) $V_A > V_B$ (c) $V_A < V_C$ (d) $V_A > V_C$

17. Three charges Q_0 , $-q$ and $-q$ are placed at the vertices of an isosceles triangle as shown in figure. The net electrostatic potential energy is zero if Q_0 is equal to:

- A. $\frac{q}{4}$ B. $\frac{2q}{\sqrt{32}}$
 C. $\sqrt{2q}$ D. $+q$



18. How much work is required to carry a $6 \mu\text{C}$ charge from negative to positive terminal of 9 V battery?

- (a) $54 \times 10^{-3} \text{ J}$ (b) $54 \times 10^{-9} \text{ J}$ (c) $54 \times 10^{-6} \text{ J}$ (d) $54 \times 10^{-12} \text{ J}$

19. A system has two charges $q_A = 2.5 \times 10^{-7} \text{ C}$ and $q_B = -2.5 \times 10^{-7} \text{ C}$ located at points

A: $(0, 0, -15 \text{ cm})$ and B: $(0, 0, +15 \text{ cm})$, respectively. An Electric field is applied of strength E is applied along positive Z axis. Then

- a) Torque is maximum and potential energy stored is minimum
 b) Torque is minimum and potential energy stored is maximum
 c) Torque is zero and potential energy stored is minimum
 d) Torque is zero and potential energy stored is maximum

20. A spherical shell of radius 10 cm carries charge of $10 \mu\text{C}$ on its surface. The ratio of electric potential at 5 cm from centre and $X \text{ cm}$ from centre of the shell is $3:2$. The value of X is

- a) 25cm b) 125 cm c) 15cm d) 225cm

21. A device used to detect charge on a body is known as.....

22. The total charge on a body having n_1 electrons n_2 protons is equal to

23. Electric field due to uniformly charged infinite plane sheet having charge density σ at a distance r is

24. Identical charges $(-q)$ are placed at each corner of a cube of side b . Then the electrostatic potential energy of charge $(+q)$ placed at the centre of the cube will be

25. Represent graphically the variation of electric field due to an infinitely long line of charge with distance

Numericals:

1. Four equal point charges each $16\mu\text{C}$ are placed on the four corners of a square of side 0.2m . Calculate force on any one of the charges.

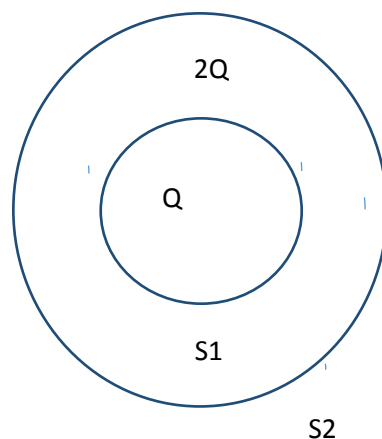
2. Charges $+5\mu\text{C}$, $+10\mu\text{C}$, and $-10\mu\text{C}$ are placed in air at the corners A, B and C of an equilateral triangle having each side equal to 5cm . Determine the resultant force on the charge at A.

3. Two opposite corners of a square carry charge Q each and the other two opposite corners of the square carry q charges each. If the resultant force on the charge Q is zero how are Q and q related?

4. Two point charges $5 \times 10^{-19}\text{C}$ and $20 \times 10^{-19}\text{C}$ are separated by a distance of 2m . Find the point on the line joining them at which electric field intensity is zero.

5. Five thousand lines of force enter a certain volume of space and three thousand lines emerge from it. What is the total charge in coulomb within this volume?

6. S_1 and S_2 are two hollow concentric spheres enclosing charges Q and $2Q$ respectively as shown (i) What is the ratio of the electric flux through S_1 and S_2 ? (ii) How will the electric flux through the sphere S_1 change if the medium of dielectric constant 5 is introduced in the space inside S_1 replacing air.



7. A spherical conductor of radius 12cm has a charge of $1.6 \times 10^{-7} \text{C}$ distributed uniformly over its surface. What is the electric field (i) inside the sphere (ii) just outside the sphere (iii) at a point 18cm from the centre of the sphere?

8. Calculate the potential at the centre of a square ABCD of side $\sqrt{2} \text{m}$ due to charges $2 \mu\text{C}$, $-2 \mu\text{C}$, $-3 \mu\text{C}$ and $6 \mu\text{C}$ placed at four corners of it.

9. A uniform electric field of 20N/C exists in the vertically downward direction. Determine the increase in the electric potential as one goes up through a height of 50cm.

10. Two charges $3 \times 10^{-8} \text{C}$ and $-2 \times 10^{-8} \text{C}$ are located 30cm apart. At what point on the line joining the two charges is the electrical potential zero? Take the potential at infinity to be zero.

11. Give one important difference between charging a body by induction and by conduction?

12. Why electric field lines do not form closed loop? [1]

13. Two spherical shells A and B carrying charge $Q_1 = 10 \mu\text{C}$ and $Q_2 = -8 \mu\text{C}$ respectively which are made to touch each other. What is the new charge present on A if two shells are identical. Justify your answer [1]

14. Two point charges of $25 \mu\text{C}$ and $-36 \mu\text{C}$ of charges are separated by a distance of 4m in air. Determine the position of the point at which the resultant electric field is zero and find the magnitude and sign of charge to be placed at that point so that the system will be in equilibrium?

15. Two point charges $+10 \mu\text{C}$ and $-10 \mu\text{C}$ are separated by a distance of 40cm in air. Calculate (i) the electrostatic potential energy of the system assuming the zero of potential energy to be at infinity (ii) Draw an equipotential surface of the system (iii) How much work is required to separate the two charges infinitely from each other.

16. An electric dipole of length 4cm when placed with its axis making an angle of 60° with uniform electric field experiences a torque of $4\sqrt{3} \text{Nm}$. Calculate the magnitude of electric field and potential energy of the dipole if the dipole has charges of $+8 \text{nC}$ and -8nC