Hpc-Online

Muz

HPC-ONLINE-A22+B22

Class 12 - Physics

Time Allowed: 1 hour **Maximum Marks: 150**

General Instructions:

1. A long string of charge per unit length λ passes through an imaginary cube of edge **a**. The maximum flux of the electric field will be **[5]**

   a) $\sqrt{3}\frac{a^2\lambda}{\epsilon_0}$ b) $\sqrt{3}\frac{a\lambda}{\epsilon_0}$

   c) $\frac{a\lambda}{\epsilon_0}$ d) None of the Above.

2. A wire is bent into a ring of radius R is given a charge q. The magnitude of the electrical field at the centre of the ring is: **[5]**

   a) None of the Above. b) Zero

   c) $\frac{1}{2}$ d) Two

3. Electric charge between two bodies can be produced by: **[5]**

   a) sticking b) passing AC current

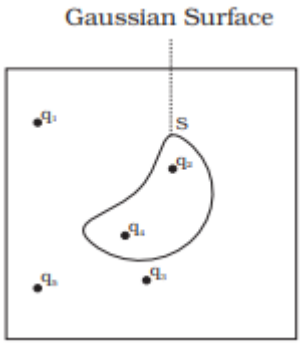
   c) oiling d) rubbing

4. Each of the two-point charges are doubled and their distance is halved. Force of interaction becomes n times, where n is **[5]**

   a) 16 b) 18

   c) 1 d) None of the above.

5. Five charges q_1 , q_2 , q_3 , q_4, and q_5 are fixed at their positions as shown in Fig., S is a Gaussian surface. The Gauss's law is given by $\oint_S \mathbf{E} \cdot d\mathbf{s} = \frac{q}{\varepsilon_0}$ **[5]**



Which of the following statements is correct?

   a) Both **E** on the LHS and *q* on the RHS will have contributions

   b) **E** on the LHS of the above equation will have a contribution from all

from q_2 and q_4 only.

charges while q on the RHS will have a contribution from q_1, q_3, and q_5 only.

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

d) **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_4 only.

6. A hollow conducting sphere is given a positive charge of 10μC. What will be the electric field at the centre of the sphere if its radius is 2 metres? **[5]**

a) 32 μCm^{-2}

b) 20 μCm^{-2}

c) Zero

d) 5 μCm^{-2}

7. When a negatively charged conductor is connected to earth **[5]**

a) No charge flow occurs

b) Electrons flow from the conductor to the earth

c) Protons flow from the conductor to the earth

d) Electrons flow from the earth to the conductor

8. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released, the kinetic energy attained by the particle after moving a distance y, will be **[5]**

a) qEy^2

b) q^2Ey

c) qEy

d) qE^2y

9. Two equal and opposite charges of 2×10^{-10} C are placed at a distance of 1 cm forming a dipole and are placed in an electric field of 2×10^5 N/C. The maximum torque on the dipole is **[5]**

a) $2\sqrt{2} \times 10^{-6}$ Nm

b) 4×10^{-9} Nm

c) 4×10^{-7} Nm

d) 8×10^8 Nm

10. 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 the force (if all conditions are same) is **[5]**

a) $\frac{F}{2}$

b) F

c) 2F

d) 4F

11. Law stating that force is directly proportional to the product of charges and inversely proportional to the square of the separation between them is called: **[5]**

a) Coulomb's law

b) Newton's law

c) Ohm's law

d) Gauss's law

12. Eight dipoles of charges of magnitude **e** are placed inside a cube. The total electric flux coming out of the cube will be- **[5]**

a) $\frac{16e}{\epsilon_o}$

b) $\frac{e}{\epsilon_o}$

c) $\frac{8e}{\epsilon_o}$ d) Zero

13. In a regular polygon of n sides, each corner is at a distance of r from the center. Identical charges of magnitude Q are placed at (n -1) corners. The field at the center is **[5]**

a) $(n-1)\frac{kQ}{r^2}$ b) $\frac{kQ}{r^2}$

c) $\frac{n}{(n-1)}\frac{kQ}{r^2}$ d) $\frac{n-1}{n}\frac{kQ}{r^2}$

14. A charge Q is placed at the corner of a cube. The electric flux through all the six faces of the cube is **[5]**

a) $\frac{Q}{8\varepsilon_0}$ b) $\frac{Q}{6\varepsilon_0}$

c) $\frac{Q}{\varepsilon_0}$ d) $\frac{Q}{3\varepsilon_0}$

15. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is **[5]**

a) 10^{-19} C b) -1.6 C

c) 10^{+19} C d) +1.6 C

16. A solid sphere of radius R is uniformly charged so that volume charge density is p. The electric field at a distance r(r < R) is **[5]**

a) $\frac{\rho r}{3\varepsilon_0}$ b) $\frac{\rho r^2}{3\varepsilon_0 R^3}$

c) $\frac{\rho r^2}{\varepsilon_0 R^3}$ d) $\frac{\rho r}{\varepsilon_0 R^2}$

17. A charge Q is placed at the mouth of a conical flask. The flux of the electric field through the flask is **[5]**

a) zero b) $\frac{Q}{2\epsilon_0}$

c) $\frac{Q^2}{2\epsilon_0}$ d) $\frac{Q}{\epsilon_0}$

18. When air is replaced by a dielectric medium of dielectric constant κ, the maximum force of attraction between two charges separated by a distance: **[5]**

a) remains unchanged b) increases κ times

c) decreases κ^2 times d) decreases κ times

19. A point charge Q is placed at the mid point of a line joining two charges, 4q and q. If the net force on charge q is zero, then Q must be equal to: **[5]**

a) -2q b) -q

c) +4q d) +q

20. If σ = surface charge density, ε = electric permittivity, the dimensions of $\frac{\sigma}{\varepsilon}$ are the same as **[5]**

a) electric field intensity b) electric charge

c) electric force d) pressure

21. 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 $\frac{Q}{q}$ should be **[5]**

a) 2

b) $\frac{1}{2}$

c) 4

d) $\frac{1}{4}$

22. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. Then the net charge on the sphere is - **[5]**

a) Negative and appears only at the point on the sphere closest to the point charge

b) Negative and distributed non–uniformly over the entire surface of the sphere

c) Negative and distributed uniformly over the surface of the sphere

d) Zero

23. Gauss's law is valid for **[5]**

a) only regular closed surfaces

b) any open surface

c) any closed surface

d) only irregular open surfaces

24. If E_1 be the electric field strength of a short dipole at a point on its axial line and E_2 that on the equatorial line at the same distance, then **[5]**

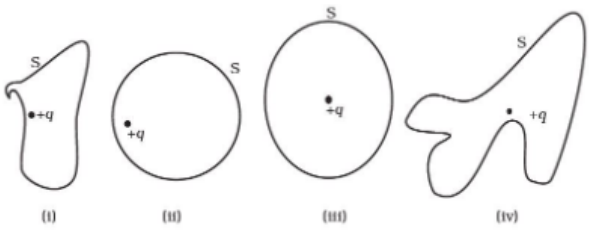
a) none of these

b) $E_1 = E_2$

c) $E_1 = 2E_2$

d) $E_2 = 2E_1$

25. The Electric flux through the surface **[5]**



a) in Fig (iv) is the largest.

b) is the same for all the figures

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

d) in Fig. (iii) is the least

26. The number of electrons for one coulomb of charge is **[5]**

a) 6.25×10^{18}

b) 6.25×10^{23}

c) 6.25×10^{19}

d) 6.25×10^{21}

27. What is the flux through a cube of side a if a point charge q is at one of its corners? **[5]**

a) $\frac{2q}{\varepsilon_0}$

b) $\frac{q}{8\varepsilon_0}$

c) $\frac{q}{2\varepsilon_0}$

d) $\frac{q}{\varepsilon_0}$

28. Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l. The relation between E_a and E_q is: **[5]**

a) $E_q = 2E_a$

b) $E_a = 2E_q$

c) $E_a = E_q$

d) $E_a = 3E_q$

29. Out of the following which one is not a property of field lines: **[5]**

a) Field lines start at positive charges and end at negative charges

b) Two field lines cannot cross each other

c) Field lines are continuous curves without any breaks

d) They form closed loops

30. Consider a uniform electric field $\mathrm{E} = 3 \times 10^3 \mathrm{N/C}$. What is the flux of this field through a square of 10 cm on a side whose plane is parallel to the yz plane? **[5]**

a) $20 \mathrm{Nm^2/C}$

b) $25 \mathrm{Nm^2/C}$

c) $30 \mathrm{Nm^2/C}$

d) $40 \mathrm{Nm^2/C}$