**DAV PUBLIC SCHOOL CHANDRASKHARPUR, BBSR POST SUMMER VACATION TEST (2023-24)**

**CLASS - XII**

**SUBJECT: PHYSICS**

Time Allowed: 1hour 30min Maximum Marks: 35 Marks

**General Instructions:**

1. All questions are compulsory. There are **17** questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. **Section A** contains **EIGHT** questions, 6 MCQ and 2 Assertion Reasoning based of 1 mark each, **Section B** contains **THREE** questions of 2 mark each, **Section C** contains **FOUR** questions of 3 marks each, **Section D** contains **ONE** Case Study Based Question of 4 marks each and **Section E** contains **ONE** long answer questions of 5 marks.

**SECTION – A**

1. A point charge is surrounded symmetrically by six identical charges at distance *r* as shown in the figure. How much work is done by the forces of electrostatic repulsion when the point charge *q* at the centre is removed to infinity

*q*

*q*

*q*

*q*

*q*

*q*

*r*

(a) Zero (b) $6q^{2}/4πε\_{0}r$ (c) $q^{2}/4πε\_{0}r$ (d) $12q^{2}/4πε\_{0}r$

1. An infinite non-conducting sheet has a surface charge density *σ* = 0.10 *μC*/*m*2 on one side. How far apart are equipotential surfaces whose potentials differ by 50 *V*

*C*

*C*

*C*

*C*

*C*

*C*

–

+

*A*

*B*

(a) 8.85 *m* (b) 8.85 *cm* (c) 8.85 *mm* (d) 88.5 *mm*

1. Find equivalent capacitance between *A* and *B*

(a) 6*C* (b) 5*C* (c) 3*C* (d) 2*C*

1. Figure shows a charged conductor resting on an insulating stand. If at the point *P* the charge density is $σ$, the potential is *V* and the electric field strength is *E*, what are the values of these quantities at point *Q* ?

*P*

*Q*

Insulating stand

|  |  |  |  |
| --- | --- | --- | --- |
|  | Charge density | Potential | Electric intensity |
| (a) | $$>σ$$ | $$>V$$ | > *E* |
| (b) | $$>σ$$ | *V* | > *E* |
| (c) | $$<σ$$ | *V* | *E* |
| (d) | $$<σ$$ | *V* | < *E* |

1. Two point charges *A* and *B*, having charges +*q* and –*q* respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of *A* is transferred to *B*, then force between the charges becomes:
2. F (b) 9F/16 (c)16F/3 (d) 4F/3

**6.** If $∮\_{}^{}\vec{E}.\vec{dS}$ = 0 over a surface, then

(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 of the above

**For Questions 7 and 8, two statements are given – one labelled Assertion (A) and other labelled Reason (R), Select the correct answer to these questions from the options as given below.**

(a)If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b)If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c)If assertion is true but reason is false.

(d)If both assertion and reason are false.

**7. Assertion (A):** If a proton and an electron are placed in the same uniform electric field, then they experience same amount of force.

 **Reason (R):** Electric force on any charge is independent of its mass.

**8. Assertion (A):** At a point in space, the electric field points towards north. In the region, surrounding this point the rate of change of potential will be zero along the east and west.

 **Reason (R):** Electric field due to a charge is the space around the charge.

  **SECTION – B**

9. Two concentric conducting thin spherical shells *A*, and *B* having radii $r\_{A}$and $r\_{B}$ $(r\_{B}>r\_{A})$ are charged to $Q\_{A}$ and $-Q\_{B }(|Q\_{B}|>|Q\_{A}|)$. Plot the variation of the electrical field along a line, (passing through the centre). Justify

10. (a) Define electric flux. Write its SI unit.

(b) A spherical rubber balloon carries a charge that is uniformly distributed over its surface. As the balloon is blown up and increases in size, how does the total electric flux coming out of the surface change? Give reason.

11. Derive the expression for electric field just above the surface of a charged conductor of irregular geometric shape.

**SECTION – C**

12. (a) Two isolated metal spheres *A* and *B* have radii *R* and 2*R* respectively, and same charge *q*. Find which of the two spheres have greater energy density just outside the surface of the spheres.

1. Plot graph between electric energy density and square of the electric field.

13. A 600 pF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. How much electrostatic energy is lost in the process?

14. An electrical technician requires a capacitance of 2 µF in a circuit across a potential difference of 1 kV. A large number of 1 µF capacitors are available to him, each of which can withstand a potential difference of not more than 400 V. Suggest a possible arrangement that requires a minimum number of capacitors.

15. A test charge ‘q’ is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in the figure.

 (i) Calculate the potential difference between A

and C.

 (ii) At which point (of the two) is the electric

potential more and why?

**SECTION -D**

**16. Polarisation of Dielectric**

When an insulator is placed in an external field, the dipoles become aligned. Induced surface charges on the insulator establish a polarization field *Ei* in its interior. The net field *E* in the insulator is the vector sum of *E*0 and *Ei* as shown in the figure.



On the application of external electric field, the effect of aligning the electric dipoles in the insulator is called polarisation and the field Ei is known as the polarisation field. The dipole moment per unit volume of the dielectric is known as polarisation (P). For linear isotropic dielectrics, P = χ E. where χ = electrical susceptibility of the dielectric medium.

(i) Which among the followings is the S.I unit of Polarisation?

 (a) C/m2 (b) C/m (c) C/m3 (d) Cm2

(ii) When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance becomes

 (a) K times (b) remains unchanged (c) 1/K times (d) 2K times.

(iii) Which of the following is a dielectric?

 (a) Copper (b) Glass (c) Antimony (Sb) ( d) None of these

(iv) For a polar molecule, which of the following statements is true?

 (a) The centre of charge of electrons and protons coincide.

 (b) The centre of charge of electrons and protons do not coincide.

 (c) The charge distribution is always symmetrical.

 (d) The dipole moment is always zero.

**Section – E**

17. (a) Using Gauss law, derive expression for electric field due to a long wire of uniform charge distribution λ at a point lying at a distance x. Draw a graph between electric field due to wire and distance.

(b)An electric field is uniform and acts along + x direction in the region of positive x. It is also uniform with the same magnitude but acts in – x direction in the region of negative x. The value of the field is E = 200 N/C for x > 0 and E = – 200 N/C for x < 0. A right circular cylinder of length 20 cm and radius 5 cm has its centre at the origin and its axis along the x-axis so that one flat face is at x = + 10 cm and the other is at x = – 10 cm. Find the net electric flux linked with the cylinder and the charged enclosed by it.