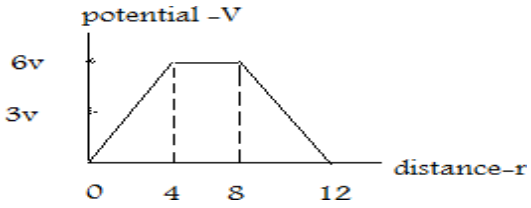
Grade XII

Chapter 2 – ELECTROSTATIC POTENTIAL AND CAPACITANCE

Question Bank

SECTION A[1 marks]

[1] The graph shows the variation of potential with distance from a fixed point charge, find the electric field 3m from the point charge.



E = $-\frac{-dv}{dr}$ = -15v/m

[2] When charge is supplied to a conductor, its potential depends upon:

[a] amount of charge, geometry and size of the conductor

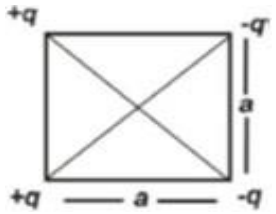
[3] A dipole is placed parallel to electric field .If W is the workdone in rotating the dipole from 0^0 to 60^0 ,then work done in rotating it from o^o to 180^0 is

4W

[4] A parallel plate capacitor is charged by a battery. Once it is charged, battery is removed. Now a dielectric material is inserted between the plates of the capacitor, which of the electrical quantity does not change?

charge on the plates

[5] The potential at the centre of the square is



Zero

SECTION B [2 marks]

[6] A 4μF capacitor is charged by a 200 v supply.It is then disconnected from the supply and is connected to another 2 μF capacitor. How much energy of the first capacitor is lost in the form of radiation?

Energy lost = E1 –E2 = 2.67 x 10^{-2} J

[7]The electric field intensity at a point due to a point charge is 20 N/C and the electric potential is 10 J/C. Find the magnitude of the charge and distance of the point from charge.

V = $\frac{KQ}{r}$, E = V/d

Q = 0.55 x 10^{-9} C

[8]A capacitor with air between the plates has a capacitance of 8F.The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5.Calculate the value of the capacitance of the capacitor in second case.

C = $\frac{\epsilon oA}{d}$

C^1 = 80F

SECTION C[3 marks]

[9] A charge +lμc is placed at a distance of 0.lm from another charge of +4μc in air. At what point on the line joining the charges, is the electric field intensity zero?

[x = 10/3 cm from +1μc]

[10]Two point charges of +3 x 10^{-19} C and +12 x 10^{-19} C are separated by a distance of 2.5m. Find the point on the line joining them where electric field intensity is zero.

[x = 5/3cmfrom 12 x 10^{-19} c]

[11][a]Define electrostatic potential energy[b] Derive the expression for electrostatic potential energy of a system of 3 charges q1, q2 and q3

[12] Derive the expression for the capacitance of a capacitor in presence of a dielectric

Assertion-Reasoning type questions

Read the following questions and choose any of the following four responses.
(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 and the Reason is not a correct explanation of the Assertion.
(C) If Assertion is true but the Reason is false
(D) If both Assertion and Reason are false
[13] Assertion(A):

The potential difference between any two points in an electric field depends only on initial and final position.

Reason(R):

Electric field is a conservative field so the work done per unit positive charge does not depend on path followed.

[a]

[14] Assertion :
If the distance between parallel plates of a capacitor is halved and dielectric having dielectric constant is three inserted between the plates of capacitor, then the capacitance becomes 6 times.
Reason :
Capacity of the capacitor does not depend upon the nature of the material. Ans: C

[15] Case study base question:

Capacitance is the ratio of the change in the electric charge of a system to the corresponding change in its electrical potential. Capacitor consists of two metal plates which are filled with dielectric. When a voltage is applied to these plates an electric current flow charging up one plate with a positive charge with respect to the supply voltage and the other plate with an equal and opposite negative charge. The generalized equation for the charge stored in a capacitor is given by q=CV, where C is the capacitance of the capacitor

1. The capacitance of a capacitor does not depend on
a. Area of plates b. Separation between the plates c. Applied potential difference d. Dielectric constant

2. A parallel plate air capacitor with no dielectric between the plates is connected to the constant voltage source. How would capacitance and charge change if dielectric of

dielectric constant K=2 is inserted between the plates. C0 and Q0 are the capacitance and charge of the capacitor before the introduction of the dielectric.
a. C=C0/2 ; Q=2Q
b. C=2C0 ; Q=Q0/2
c. C=C0/2 ; Q=Q0/2
d. C=2C0 ; Q=2Q0
3. Capacity of a parallel plate condenser can be increased by
(a) increasing the distance between the plates
(b) increasing the thickness of the plates
(c) decreasing the thickness of the plates
(d) decreasing the distance between the plates

4. In a charged capacitor, the energy is stored in
(a) the negative charges
(b) the positive charges
(c) the field between the plates
(d) both (a) and (b)
Ans: 1 – c, 2 – d, 3 – d, 4 – c,

SECTION D [5 marks]

[16] Derive the expression for capacitance of a parallel plate capacitor

[17] Derive the expression for energy stored in a capacitor

[18] What is an electric dipole. Derive an expression for electrostatic potential energy of an electric dipole in an external electric field of strength E.