

Unit Test – 1

Class – XII

Time – 90 minutes Subject – Physics M.M. – 40 Section – A (1 Mark Each)

Q.1) If an electric dipole is placed in a non-uniform electric field, it experiences –

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

Q.2) A force of 2.25 N acts on a charge of 15×10^{-4} C . The intensity of electric field at that point is –

- (a) 1.5 N/C (b) 15 N/C (c) 150 N/C (d) 1500 N/C

Q.3) Capacitance depends upon which of the following factors ?

- (a) size & shape of conductor (b) presence of other conductors nearby
- (c) permittivity (d) all of the above

Q.4) Three capacitors of capacitances $2 \mu\text{F}$, $3 \mu\text{F}$ and $6 \mu\text{F}$ are joined in series with each other. The equivalent capacitance is –

- (a) $1/2 \mu\text{F}$ (b) $1 \mu\text{F}$ (c) $2 \mu\text{F}$ (d) $11 \mu\text{F}$

Q.5) The resistance of a metal wire increases with increasing temperature on account of –

- (a) decrease in free electron density (b) decrease in relaxation time
- (c) increase in free electron density (d) increase in relaxation time

Q.6) The electric power consumed by a 200 V – 100 W bulb when operated at 110 V is –

- (a) 26 W (b) 30 W (c) 35 W (d) 15 W

Assertion – Reason Type Questions

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
- (c) Assertion (A) is true but Reason (R) is false.
- (d) Both Assertion (A) and Reason (R) are false.

Q.7) **Assertion (A)** : A negative charge in an electric field move along the direction of the electric field. **Reason (R)** : On a negative charge , a force acts in the direction of the electric field.

Q.8) **Assertion (A)** : For a point charge concentric spheres centered at a location of the charge are equipotential surfaces. **Reason (R)** : An equipotential surface is a surface over which potential has zero value.

Section – B (2 Marks Each)

Q.9) Define electric dipole moment . Write its S.I. unit. Is it scalar or vector quantity ?

Q.10) Define electric flux . Write its S.I. unit. Is it scalar or vector quantity ?

Q.11) Define equipotential surface . Draw the equipotential surfaces due to an electric dipole . Q.12)

Deduce the relation between current flowing through a conductor and drift velocity of free electrons .

Section – C (3 Marks Each)

Q.13) Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time of

electrons. Q.14) State the two laws of Kirchhoff's . Explain briefly how these laws are justified ?

Or

Use Kirchhoff's rules to obtain balanced condition in a Wheatstone bridge.

Section – D (5 Marks Each)

Q.15) State Gauss's law in electrostatics. Derive an expression for the electric field due to an infinitely long straight uniformly charged wire. Also draw the graph between E and r .

Q.16) Define the capacitance of a capacitor. Obtain the expression for the capacitance of a parallel plate capacitor in vacuum in terms of plate area A and separation d between the plates.

Or

Derive an expression for the potential energy of an electric dipole of dipole moment $\mathbf{p}$ in an electric field $\mathbf{E}$. A hollow metal sphere of radius 6 cm is charged such that the potential on its surface is 12 V. What is the potential at the centre of the sphere ?

Section – E (4 Marks Each)

Case Study – 1 (Effect Of Dielectric On Capacitance)

The capacitance of parallel plate capacitors is modified when a dielectric is present . The dielectric constant of a substance is the factor by which the capacitance increases from its vacuum value, when the dielectric is inserted fully between the plates of a capacitor.

Read the above paragraph carefully and answer the following questions.

- Define dielectric constant.
- What is the value of dielectric constant for metal ?
- A slab of material of dielectric constant K has the same area as the plates of a parallel-plate capacitor but has a thickness $(3/4)d$, where d is the separation of the plates. How is the capacitance changed when the slab is inserted between the plates ?

Case Study – 2 (Temperature Dependence Of Resistivity)

The resistivity of a material is found to be dependent on the temperature. Different materials do not exhibit the same dependence on temperatures.

Read the above paragraph carefully and answer the following questions.

- What is the effect on resistivity of metal on increasing the temperature ?
- What is the effect on resistivity of semiconductor on decreasing the temperature ?
- Define the term ' conductivity ' of a metallic wire. Write its S.I. unit.