



Q.1. Answer the following short questions: (15x2=30)

- (1)-A proton is released from rest in uniform electric field. Does electric potential energy increases?
- (2)-If a metallic object receives positive charge by losing electrons, does its mass remain same? What happens to mass if object receives negative charge?
- (3)-Two capacitors are identical. They can be connected in series or in parallel. If we want the smallest equivalent capacitance for the combination, do you connect them in series?
- (4)-A dielectric slab is inserted between the plates of a capacitor. Describe what happened? Explain why the introduction of a dielectric changes its capacitance?
- (5)-The relation $R = V/i$ shows that resistance of a conductor is directly proportional to potential difference. What do you think of this proportionality?
- (6)-Can we use Kirchoff's rules (junction and loop rules) to a circuit containing a capacitor?
- (7)-A beam of electrons can be deflected either by an electric field or by a magnetic field. Is one method better than the other?
- (8)-What type of magnetic field exists around a current carrying straight conductor?
- (9)-Is an emf induced in a long solenoid by a bar magnet that moves inside it along the solenoid axis?
- (10)-You want to wind a coil so that it has the resistance but essentially no inductance. How would you do it?
- (11)-How do you distinguish between ϵ_0 and μ_0 ? How are they related with velocity of electromagnetic waves in free space?
- (12)-What is physical significance of the Poynting vector?
- (13)-Could the alternating current resistance of a device depend on the frequency?
- (14)-What is meant by ideal diode? Give one drawback of diode.
- (15)-Can two separate pn-junction diodes placed back to back be used to form pnp transistor?

Answer the following questions. (3x10=30)

Q. 2: (a)-Consider the case of a dipole in a uniform electric field and derive expressions for torque acting on it and potential energy. 05 + 05

(b)-Show that electric field intensity just outside an isolated charged conductor is,

$$E = \frac{\sigma}{\epsilon_0}$$

σ is surface charge density.

Q. 3: (a)-State and prove Ampere's circuital law. Deduce Ampere's law in form, 05 + 05

$$\oint_C \vec{B} \cdot d\vec{l} = \mu_0 i$$

(b)-Derive equation for growth of electric current in a circuit with resistance and inductance. What is meant by time constant of circuit?

Q. 4: (a)-Derive Maxwell equations using basic principles of electromagnetism. 05 + 05

(b)-Define Poynting vector? Find its value for a plane electromagnetic wave. Also, relate electromagnetic energy to intensity of wave.