Question Bank

Class: B.Sc. 2nd Year (Physics)

Section A: Multiple Choice Questions

Choose the correct answer:

1. **Electric field lines due to a positive point charge are:**
   a) Circular
   b) **Radially outward** ✅
   c) Radially inward
   d) Parallel lines
2. **The SI unit of electric flux is:**
   a) Newton
   b) Coulomb
   c) **Volt-meter (V·m)** ✅
   d) Tesla
3. **Gauss's law is most useful in calculating electric field for:**
   a) Any arbitrary charge distribution
   b) **Highly symmetric charge distributions** ✅
   c) Only point charges
   d) Only dipoles
4. **The differential form of Gauss's law is:**
   a) $\oint E \cdot dA = Q/\varepsilon_0$
   b) $\nabla \cdot \mathbf{E} = \rho/\varepsilon_0$ ✅
   c) $\nabla \times E = 0$
   d) $E = -\nabla V$
5. **An electrostatic field is conservative because:**
   a) It has zero curl ($\nabla \times E = 0$) ✅
   b) It has non-zero divergence
   c) It follows Biot-Savart's law
   d) It is produced by moving charges

6. **Electric potential due to a point charge at a distance r is given by:**
   a) $V = q/(4\pi\varepsilon_0 r^2)$
   b) **$V = q/(4\pi\varepsilon_0 r)$** ✅
   c) $V = qr/(4\pi\varepsilon_0)$
   d) $V = q/(4\pi\varepsilon_0 r^3)$
7. **The work done in moving a charge in an electric field depends on:**
   a) The path taken
   b) **Only the initial and final positions** ✅
   c) The speed of movement
   d) The time taken
8. **Energy density in an electric field is given by:**
   a) **$\frac{1}{2}\varepsilon_0 E^2$** ✅
   b) $\varepsilon_0 E$
   c) $\frac{1}{2} E^2/\varepsilon_0$
   d) E^2/ε_0
9. **The potential inside a uniformly charged spherical shell is:**
   a) Zero
   b) **Constant (same as on the surface)** ✅
   c) Increases with distance
   d) Decreases with distance
10. **The relation between electric field (E) and potential (V) is:**
    a) $E = \nabla V$
    b) **$E = -\nabla V$** ✅
    c) $E = \partial V/\partial t$
    d) $E = V/r$
11. **What does the Biot-Savart law help us calculate?**
    a) Electric field from charges
    b) Magnetic field from currents
    c) Gravity from masses
    d) Light intensity

    Answer: b) Magnetic field from currents

12. **If you point your thumb in the direction of current in a wire, your fingers curl in the direction of:**

    a) Electric field

    b) Magnetic field

    c) Heat flow

    d) Light waves

    Answer: b) Magnetic field

13. **A charged particle moves through a magnetic field. The force on it is greatest when it moves:**

    a) Parallel to the field

    b) Perpendicular to the field

    c) At 45° to the field

    d) It always feels no force

    Answer: b) Perpendicular to the field

14. **Inside a long straight solenoid, the magnetic field is:**

    a) Zero

    b) Strong at the ends only

    c) Same everywhere inside

    d) Circular

    Answer: c) Same everywhere inside

15. **Two parallel wires carrying current in the same direction will:**

    a) Repel each other

    b) Attract each other

    c) Not affect each other

    d) Create light

    Answer: b) Attract each other

16. **The energy stored in a magnetic field depends on:**

    a) Only current

    b) Only magnetic field strength

    c) Both current and field strength

    d) Neither

Answer: c) Both current and field strength

17. **A galvanometer measures:**

    a) Temperature

    b) Electric current

    c) Sound waves

    d) Pressure

    Answer: b) Electric current

18. **When a current loop is placed in a magnetic field, it experiences:**

    a) Only linear motion

    b) Only rotation (torque)

    c) Both linear and rotational motion

    d) No effect

    Answer: b) Only rotation (torque)

19. **The magnetic field inside a current-carrying toroid is:**

    a) Zero

    b) Uniform

    c) Strongest at the center

    d) Circular

    Answer: b) Uniform

20. **Critical damping in a galvanometer means the needle:**

    a) Oscillates forever

    b) Stops instantly without swinging

    c) Moves very slowly

    d) Breaks

    Answer: b) Stops instantly without swinging

Section B: Fill in the Blanks

Fill in the blanks with the correct answer:

1. **Electric field lines never _____ each other.** (**cross**)
2. **Gauss's law in integral form is _____.** ($\oint E \cdot dA = Q/\varepsilon_0$)
3. **The divergence of an electrostatic field ($\nabla \cdot E$) is equal to _____.** (ρ/ε_0)

4. **An irrotational field satisfies the condition _____. (∇×E = 0)**
5. **Electric potential is a _____ quantity (scalar/vector). (scalar)**
6. **The potential difference between two points A and B is given by V_B - V_A = -∫_____·dl. (E)**
7. **The energy stored in a system of charges is called _____ energy. (potential)**
8. **For a uniformly charged infinite plane sheet, the electric field is _____. ($\sigma/2\varepsilon_0$)**
9. **The potential at infinity due to a point charge is taken as _____. (zero)**
10. **The electric field inside a conductor in electrostatic equilibrium is _____. (zero)**
11. **The magnetic field around a straight wire decreases as _____ increases.**

    Answer: distance
12. **Magnetic flux is calculated as field strength × _____.**

    Answer: area
13. **A field with zero divergence is called _____.**

    Answer: solenoidal
14. **Ampere's law relates magnetic field to _____.**

    Answer: current
15. **Energy stored in an inductor = ½ × _____ × current².**

    Answer: inductance
16. **The force between two wires depends on their _____ and distance apart.**

    Answer: currents
17. **H = B/μ_0 - _____ (complete the equation).**

    Answer: M
18. **Galvanometer sensitivity measures deflection per unit _____.**

    Answer: current
19. **Damping in galvanometers is caused by _____ currents.**

    Answer: eddy
20. **Critical damping resistance prevents _____ of the needle.**

    Answer: oscillations

Answer in 1-2 lines:

1. **Define electric flux.**

   Ans: Electric flux is the total number of electric field lines passing through a given area ($\Phi = E \cdot A \cdot \cos\theta$).
2. **State Gauss's law in integral form.**

   Ans: $\oint E \cdot dA = Q_{enclosed}/\varepsilon_0$.
3. **Why is an electrostatic field conservative?**

   Ans: Because the work done in moving a charge is path-independent ($\nabla \times E = 0$).
4. **Write the relation between electric field (E) and potential (V).**

   Ans: $E = -\nabla V$ (Electric field is the negative gradient of potential).
5. **What is the energy density in an electric field?**

   Ans: Energy per unit volume = $\frac{1}{2} \varepsilon_0 E^2$.
6. **What creates a magnetic field?**

   Answer: Moving charges (current)
7. **How is magnetic flux different from magnetic field?**

   Answer: Flux is field × area (total "flow"), field is strength at a point
8. **Why do parallel currents attract?**

   Answer: Their magnetic fields interact to pull wires together
9. **What does a solenoid do?**

   Answer: Creates strong uniform magnetic field when current passes through
10. **How does a galvanometer work?**

    Answer: Current creates magnetic force that moves a needle