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) $\nabla \cdot E = \rho/\varepsilon_0$ ✅

   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) **½ ε_0 E²** ✓

   b) ε_0 E

   c) ½ E^2/ε_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 _____. ($\nabla \times E = 0$)**

5. **Electric potential is a _____ quantity (scalar/vector). (scalar)**

6. **The potential difference between two points A and B is given by $V\_B - V\_A = -\int \underline{\hspace{1cm}} \cdot dl$. (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. **$H = B/\mu_0 - \underline{\hspace{1cm}}$ (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 $\times$ 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