Electric Flux and Electric Flux through a Sphere

Basic Concept of Electric Flux

1. Electric flux is defined as:
   a) Number of electric field lines passing through a surface
   b) Total charge enclosed by a surface
   c) The force exerted by an electric field
   d) The potential difference between two points
   (Answer: a)
2. Mathematically, electric flux (Φ) is expressed as:
   a) $\Phi = E \times A$
   b) $\Phi = E \times A \times \cos\theta$
   c) $\Phi = E \times A \times \sin\theta$
   d) $\Phi = E/A$
   (Answer: b)
3. SI unit of electric flux is:
   a) $N \cdot m^2/C$
   b) N/C
   c) C/m^2
   d) J/C
   (Answer: a)
4. If the electric field is parallel to a surface, the electric flux through the surface is:
   a) Maximum
   b) Minimum
   c) Zero
   d) Infinite
   (Answer: c)
5. Electric flux depends on:
   a) Magnitude of the electric field
   b) Area of the surface
   c) Orientation of the surface
   d) All of the above
   (Answer: d)

Electric Flux Through a Sphere

6. Electric flux through a spherical surface enclosing a charge qqq is given by:
   a) q/ε_0
   b) $q\varepsilon_0$
   c) Zero
   d) $q/4\pi\varepsilon_0$
   (Answer: a)
7. If a charge qqq is placed at the center of a sphere, the flux through the sphere is:
   a) q/ε_0
   b) Zero

c) Depends on the radius of the sphere
d) Depends on permittivity of medium
(Answer: a)

8. According to Gauss's Law, the electric flux through a closed spherical surface depends on:
    a) The charge inside the sphere
    b) The radius of the sphere
    c) The external field
    d) The shape of the surface
    (Answer: a)

9. If the charge enclosed within a sphere doubles, the electric flux through the sphere will:
    a) Remain the same
    b) Double
    c) Halve
    d) Become zero
    (Answer: b)

10. Flux through a sphere enclosing a charge is independent of:
    a) Charge enclosed
    b) Radius of the sphere
    c) Position of charge inside
    d) Dielectric constant
    (Answer: b)

Electric Flux and Gauss's Law

11. Gauss's law states that the total electric flux through a closed surface is proportional to:
    a) Charge enclosed within the surface
    b) Surface area
    c) Volume enclosed
    d) External electric field
    (Answer: a)

12. Gauss's law is mathematically represented as:
    a) $\oint E \cdot dA = q/\varepsilon_0$
    b) $\oint E \cdot dA = q\varepsilon_0$
    c) $\oint E \cdot dA = q^2/\varepsilon_0$
    d) $\oint E \cdot dA = q/2\varepsilon_0$
    (Answer: a)

13. If no charge is enclosed within a sphere, the net flux through the sphere is:
    a) Zero
    b) q/ε_0
    c) Depends on the radius of the sphere
    d) Infinite
    (Answer: a)

14. If the charge enclosed by a sphere is negative, the electric flux through the sphere is:
    a) Positive

b) Negative
c) Zero
d) Depends on the medium
(Answer: b)

15. Electric flux through a Gaussian sphere containing multiple charges depends on:
    a) Total charge enclosed
    b) Shape of the surface
    c) Charge outside the surface
    d) None of the above
    (Answer: a)

Electric Flux Through Different Spherical Surfaces

16. Electric flux through a non-conducting spherical shell enclosing charge q is:
    a) q/ε_0
    b) Zero
    c) $q\varepsilon_0$
    d) $q/4\pi\varepsilon_0$
    (Answer: a)

17. If the radius of a sphere doubles, the electric flux through it:
    a) Remains the same
    b) Doubles
    c) Halves
    d) Increases four times
    (Answer: a)

18. The electric flux through a hemisphere enclosing a charge qqq is:
    a) $q/2\varepsilon_0$
    b) q/ε_0
    c) Zero
    d) Depends on the hemisphere's orientation
    (Answer: a)

19. Flux through a spherical shell of charge q on its outer surface is:
    a) q/ε_0
    b) Zero
    c) Depends on radius
    d) Infinite
    (Answer: a)

20. If the charge is placed outside the sphere, the flux through the sphere is:
    a) Zero
    b) q/ε_0
    c) Infinite
    d) Depends on charge location
    (Answer: a)

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Conceptual and Advanced Questions

21. A point charge q is at the center of a sphere. If the charge is shifted slightly inside the sphere, the flux through the sphere:
    a) Remains the same
    b) Changes
    c) Becomes zero
    d) Becomes infinite
    (Answer: a)
22. If a spherical surface encloses multiple charges, the total flux depends on:
    a) The net charge inside
    b) Individual charge magnitudes
    c) The charge outside the sphere
    d) The shape of the surface
    (Answer: a)
23. Electric flux is maximum when the surface is:
    a) Perpendicular to the field
    b) Parallel to the field
    c) At 45° to the field
    d) At any angle
    (Answer: a)
24. Gauss's law holds true for:
    a) Any closed surface
    b) Only spherical surfaces
    c) Only uniform fields
    d) Only conductors
    (Answer: a)
25. Flux through a cube enclosing a charge qqq is:
    a) q/ε_0
    b) Zero
    c) $q/6\varepsilon_0$
    d) Depends on cube size
    (Answer: a)

Additional Questions for Practice

26. The electric field inside a uniformly charged sphere is (Answer: Zero)
27. If a charge inside a sphere is doubled, the flux through the sphere (Answer: Doubles)
28. Flux through a sphere depends only on (Answer: Charge enclosed)
29. Electric flux can be negative when (Answer: Charge is negative)
30. Gauss's law is useful for (Answer: Symmetric charge distributions)