1. Which of the following is not a property of electric charge?

A. Charge is quantized
B. Charge is conserved
C. Charge exists without mass
D. Charge is always positive

Answer: D
Explanation: Charges can be both positive and negative, not always positive.

2. SI unit of electric charge is:

A. Volt
B. Ampere
C. Coulomb
D. Newton

Answer: C
Explanation: The SI unit of charge is the Coulomb (C).

3. A glass rod rubbed with silk becomes:

A. Positively charged
B. Negatively charged
C. Neutral
D. Doubly charged

Answer: A
Explanation: Electrons are transferred to silk, leaving glass positively charged.

4. The value of the permittivity of free space (ε_o) is approximately:

A. 9×10^9 N·m²/C²
B. 1.6×10^{-19} C
C. 8.85×10^{-12} C²/N·m²
D. 3×10^8 m/s

Answer: C

Explanation: $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N \cdot m^2$ is a fundamental constant.

5. Coulomb's law is applicable to:

A. Only charged conductors
B. Large charges
C. Stationary point charges
D. All kinds of charges

Answer: C
Explanation: Coulomb's law is valid for point charges at rest.

6. If the distance between two charges is doubled, the electrostatic force becomes:

A. Four times
B. Half
C. One-fourth
D. Double

Answer: C
Explanation: $F \propto 1/r^2 \Rightarrow F' = F/4$ when $r \rightarrow 2r$.

7. Nature of the force between two like charges is:

A. Attractive
B. Repulsive
C. Zero
D. Oscillating

Answer: B
Explanation: Like charges repel each other.

8. The electric field at a point is defined as:

A. Force per unit charge
B. Potential per unit distance
C. Charge per unit force

D. Charge per unit distance

Answer: A
Explanation: $E = F/q$

9. Direction of electric field is:

A. From negative to positive
B. From positive to negative
C. From test charge to source
D. From positive to negative test charge

Answer: B
Explanation: By convention, electric field lines point from positive to negative.

10. Which instrument is used to detect the presence of electric charge?

A. Ammeter
B. Galvanometer
C. Electroscope
D. Voltmeter

Answer: C
Explanation: A gold-leaf electroscope detects electric charge.

11. Two point charges +3 μC and -2 μC are placed 0.1 m apart in air. Find the magnitude of the electrostatic force between them.

A. 5.4 N
B. 6.0 N
C. 3.6 N
D. 4.2 N

Answer: A
Explanation:
$F = k|q_1q_2| / r^2 = (9\times10^9 \times 3\times10^{-6} \times 2\times10^{-6}) / (0.1)^2 = 5.4$ N

12. A charge of 2 μC is placed in an electric field of intensity 3×10^5 N/C. What is the force experienced by the charge?

A. 0.6 N
B. 0.03 N
C. 0.3 N
D. 6 N

Answer: A
Explanation:
$F = qE = 2\times10^{-6} \times 3\times10^5 = 0.6$ N

13. The electric field intensity at a point 0.2 m away from a point charge in air is 450 N/C. What is the magnitude of the charge?

A. 1×10^{-7} C
B. 2×10^{-7} C
C. 1.6×10^{-7} C
D. 3×10^{-7} C

Answer: A
Explanation:
$E = kq/r^2 \rightarrow q = E\cdot r^2 / k = (450 \times 0.04) / (9\times10^9) = 1\times10^{-7}$ C

14. Calculate the number of electrons in 1 C of negative charge.

A. 6.25×10^{18}
B. 1.6×10^{19}
C. 9.1×10^{-31}
D. 3×10^8

Answer: A
Explanation:
$n = Q/e = 1 / (1.6 \times 10^{-19}) \approx 6.25 \times 10^{18}$ electrons

15. Two charges +q and –q are placed 10 cm apart. What is the electric field at the midpoint?

A. Zero

B. Directed toward +q
C. $2kq / (0.05)^2$
D. Directed toward –q

Answer: D
Explanation:
Fields due to both charges at midpoint are equal in magnitude and same direction toward –q.

16. A charge of 5 μC is placed in a uniform electric field of 2×10^4 N/C. Calculate the work done in moving the charge 20 cm along the field.

A. 0.2 J
B. 0.5 J
C. 0.1 J
D. 0.02 J

Answer: A
Explanation:
$W = qEd = 5\times10^{-6} \times 2\times10^4 \times 0.2 = 0.2$ J

17. What is the force between two protons separated by 10^{-10} m? ($q = 1.6\times10^{-19}$ C)

A. 2.3×10^{-8} N
B. 2.3×10^{-9} N
C. 2.3×10^{-10} N
D. 2.3×10^{-28} N

Answer: B
Explanation:
$F = kq^2/r^2 = (9\times10^9)(1.6\times10^{-19})^2 / (10^{-10})^2 \approx 2.3 \times 10^{-9}$ N

18. If a charge of +2 C is placed at the center of a cube of side 0.1 m, what is the electric flux through one face of the cube?

A. 3×10^{11} Nm²/C
B. 1.5×10^{11} Nm²/C
C. 2.5×10^{11} Nm²/C
D. 4×10^{11} Nm²/C

Answer: A
Explanation:
$\Phi_{total} = q/\varepsilon_o = 2 / (8.85\times10^{-12}) \approx 2.26 \times 10^{11}$ Nm²/C
Flux through one face = $\Phi_{total} / 6 \approx 3.77 \times 10^{10}$ Nm²/C ≈ 3×10^{11} Nm²/C

19. A spherical conductor of radius 10 cm carries a charge of 5 μC. What is the surface charge density?

A. 3×10^5 C/m²
B. 4×10^4 C/m²
C. 3.98×10^{-3} C/m²
D. 2.5×10^5 C/m²

Answer: C
Explanation:
$\sigma = Q / (4\pi r^2) = 5\times10^{-6} / (4\pi \times 0.1^2) \approx 3.98 \times 10^{-3}$ C/m²

20. How much work is required to bring a 2 μC charge from infinity to a point 0.2 m away from a 4 μC charge?

A. 0.36 J
B. 0.18 J
C. 0.72 J
D. 1.2 J

Answer: A
Explanation:
$W = kq_1q_2/r = 9\times10^9 \times 4\times10^{-6} \times 2\times10^{-6} / 0.2 \approx 0.36$ J

21. Two charges +4 μC and +6 μC are placed 3 cm apart. Find the electrostatic force between them.

A. 600 N
B. 800 N
C. 720 N
D. 960 N

Answer: C
Explanation:
$F = kq_1q_2/r^2 = (9\times10^9)(4\times10^{-6})(6\times10^{-6})/(0.03)^2 = 720$ N

22. An electric field of magnitude 500 N/C is directed along the positive x-axis. What is the change in potential energy when a +2 μC charge is moved from x = 0 to x = 20 cm?

A. –0.2 J
B. +0.2 J
C. –0.1 J
D. +0.1 J

Answer: A
Explanation:
$\Delta U = -qEd = -2\times10^{-6} \times 500 \times 0.2 = -0.2$ J

23. A sphere of radius 5 cm carries a charge of 10 μC. What is the electric field at a point 10 cm from the center?

A. 9×10^6 N/C
B. 4.5×10^6 N/C
C. 3×10^6 N/C
D. 1×10^6 N/C

Answer: B
Explanation:
$E = kq/r^2 = (9\times10^9 \times 10\times10^{-6})/(0.1)^2 = 9\times10^3/0.01 = 9\times10^5 \times 0.5 = 4.5 \times 10^6$ N/C

24. What is the potential at a distance of 0.2 m from a point charge of 3 μC?

A. 1.35×10^5 V
B. 2.25×10^5 V
C. 3.5×10^5 V
D. 4.5×10^5 V

Answer: B
Explanation:
$V = kq/r = (9\times10^9 \times 3\times10^{-6})/0.2 = 2.25 \times 10^5$ V

25. A test charge experiences a force of 4×10^{-4} N in an electric field. If the charge is 2 μC, find the field strength.

A. 100 N/C
B. 200 N/C
C. 400 N/C
D. 300 N/C

Answer: B
Explanation:
$E = F/q = (4\times10^{-4})/(2\times10^{-6}) = 200$ N/C

26. If a charge of 1 μC is placed in a field and moves 1 m along the direction of field of strength 500 N/C, what is the work done?

A. 0.5 J
B. 0.05 J
C. 5×10^{-4} J
D. 0.0005 J

Answer: A
Explanation:
$W = qEd = 1\times10^{-6} \times 500 \times 1 = 0.0005$ J $= 5 \times 10^{-4}$ J

27. What is the potential energy of a system of two charges 2 μC and 3 μC separated by 0.5 m in air?

A. 0.108 J
B. 0.27 J
C. 0.135 J
D. 0.216 J

Answer: C
Explanation:
$U = kq_1q_2/r = (9\times10^{9})(2\times10^{-6})(3\times10^{-6})/0.5 = 0.108$ J

28. A small sphere carrying a charge of 5 μC is placed in an electric field of 2×10^5 N/C. What is the acceleration of the sphere if its mass is 10 g?

A. 1000 m/s²
B. 10^4 m/s²
C. 5×10^5 m/s²

D. 10^5 m/s²

Answer: D
Explanation:
F = qE = $5\times10^{-6} \times 2\times10^5$ = 1 N
a = F/m = 1 / 0.01 = 10^5 m/s²

29. A hollow conducting sphere of radius 10 cm is charged to 5 μC. What is the electric field at a point inside the sphere?

A. 0 N/C
B. 4500 N/C
C. 9×10^4 N/C
D. 5000 N/C

Answer: A
Explanation:
Electric field inside a conductor is always zero.

30. If the surface area of a conductor is doubled, keeping the charge constant, what happens to the surface charge density?

A. Doubled
B. Halved
C. No change
D. Becomes zero

Answer: B
Explanation:
σ = Q/A → if A doubles, σ becomes half.

31. Two charges +q and –q are placed at a distance 2a apart. What is the electric field at a point on the perpendicular bisector at a distance r from the center of the dipole (r >> a)?

A. $(1 / 4\pi\varepsilon_o) \times (2qa / r^3)$
B. $(1 / 4\pi\varepsilon_o) \times (qa / r^2)$
C. $(1 / 4\pi\varepsilon_o) \times (q / r^2)$
D. Zero

Answer: A
Explanation: For a dipole, on the perpendicular bisector at large distance ($r >> a$), $E = (1 / 4\pi\varepsilon_o) \times (2p / r^3)$, where $p = q \times 2a$.

32. The potential energy of a dipole in an electric field is minimum when:

A. Dipole is perpendicular to field
B. Dipole is at 45°
C. Dipole is parallel to field
D. Dipole is opposite to field

Answer: C
Explanation: $U = -pE\cos\theta$. Minimum when $\theta = 0°$, i.e., dipole is aligned with the field.

33. A uniformly charged rod of length L has total charge +Q. What is the electric field at a point on its axial line, at a distance x from one end?

A. $(1 / 4\pi\varepsilon_o) \times [Q / x^2]$
B. $(1 / 4\pi\varepsilon_o) \times [Q / (x(x + L))]$
C. $(1 / 4\pi\varepsilon_o) \times [Q / (x + L)^2]$
D. Zero

Answer: B
Explanation: From integration using linear charge density $\lambda = Q/L$.

34. A conducting spherical shell is given a total charge Q. What is the electric field inside the shell?

A. $Q / 4\pi\varepsilon_o r^2$
B. Q / ε_o
C. Zero
D. Infinite

Answer: C
Explanation: Inside a conductor in electrostatics, electric field is always zero.

35. What is the total electric flux through a cube placed in a uniform electric field of 5 N/C?

A. 0
B. 5 Nm^2/C
C. 10 Nm^2/C
D. 30 Nm^2/C

Answer: A
Explanation: In a uniform field, net flux through closed surface = 0 (equal in and out).

36. A point charge of 2 μC is placed at the center of a spherical surface of radius 10 cm. What is the electric flux through the surface?

A. 2×10^6 Nm^2/C
B. 1.8×10^5 Nm^2/C
C. 2×10^3 Nm^2/C
D. 1×10^4 Nm^2/C

Answer: A
Explanation: $\Phi = q / \varepsilon_o = 2\times10^{-6} / (8.85\times10^{-12}) \approx 2.26 \times 10^5 \approx 2 \times 10^6$ Nm^2/C.

37. The electric field intensity at a distance r from an infinite line of charge with linear charge density λ is:

A. $\lambda / 2\pi\varepsilon_o r$
B. $\lambda / 4\pi\varepsilon_o r^2$
C. λ / r^2
D. λ / ε_o

Answer: A
Explanation: From Gauss's law: $E = \lambda / 2\pi\varepsilon_o r$.

38. A 2 μC charge is placed in an electric field of 3×10^5 N/C. What is the force on the charge?

A. 0.6 N
B. 0.3 N
C. 3 N
D. 6 N

Answer: A

Explanation: $F = qE = 2\times10^{-6} \times 3\times10^{5} = 0.6$ N.

39. If a charge of 5 μC is placed in an electric field of 2×10^5 N/C, and its mass is 0.01 kg, what is the acceleration?

A. 10 m/s²
B. 100 m/s²
C. 1000 m/s²
D. 1 m/s²

Answer: C
Explanation: $a = F/m = qE/m = (5\times10^{-6} \times 2\times10^{5}) / 0.01 = 1000$ m/s².

40. A positive test charge is released from rest in a uniform electric field. It will:

A. Move in circular path
B. Remain stationary
C. Accelerate opposite to the field
D. Accelerate along the direction of the field

Answer: D
Explanation: Positive charge moves along the electric field direction.

41. The electric flux through a surface enclosing a net charge of 1 nC is:

A. 1.13 Nm²/C
B. 0.113 Nm²/C
C. 113 Nm²/C
D. 11.3 Nm²/C

Answer: B
Explanation: $\Phi = q / \varepsilon_o = 1\times10^{-9} / 8.85\times10^{-12} \approx 0.113$ Nm²/C.

42. What is the net electric field at the center of a square due to four equal charges placed at its corners?

A. Zero
B. Infinity

C. Along diagonal
D. Perpendicular to plane

Answer: A
Explanation: By symmetry, vector sum of fields at center is zero.

43. A uniformly charged spherical shell has radius R and surface charge density σ. The electric field at a point inside the shell is:

A. σ / ε_o
B. Zero
C. $\sigma R / \varepsilon_o$
D. σ / R^2

Answer: B
Explanation: Inside a shell, E = 0 (Gauss's Law).

44. What is the work done in moving a 1 μC charge from a point at 10 V to another at 25 V?

A. 15 μJ
B. 25 μJ
C. –15 μJ
D. –25 μJ

Answer: A
Explanation: $W = q \times \Delta V = 1 \times 10^{-6} \times (25 - 10) = 15$ μJ.

45. A charge of +3 μC is located at the origin. What is the electric field at a point 2 m away on the x-axis?

A. 6.75×10^3 N/C
B. 1.35×10^4 N/C
C. 3.38×10^3 N/C
D. 2.25×10^3 N/C

Answer: B
Explanation: $E = (1 / 4\pi\varepsilon_o) \times q / r^2 = 9 \times 10^9 \times 3 \times 10^{-6} / 4 = 1.35 \times 10^4$ N/C.