Physics Grade 12 Unit 4

Electrostatics (37 Questions)

6. Two negative point charges are 2 meters apart and repel each other with a force of 2 Newton. When the distance between the charges is doubled, the force between them is

(A) one fourth as great.
(B) one half as great.
(C) twice as great
(D) four times as great.

21. An air-filled parallel-plate capacitor has a capacitance of 1pF. The plate separation is doubled and the space between them is completely filled with wax. If the capacitance increases to 2pF, what is the dielectric constant of wax?

(A) 2.0 (B) 4.0 (C) 6.0 (D) 8.0

35. An object having a net charge of 24 μC is placed in a uniform electric field of 610 N/C directed vertically. What is the mass of the object if it floats in this electric field?

(A) 14.640kg
(B) 1.464gm
(C)14.460gm
(D) 14.460kg

36. Which of the following is **NOT** property of a conductor in electrostatic equilibrium?

(A) The electric field is zero everywhere inside the conductor.
(B) Any net charge on the conductor resides entirely on its surface.
(C) On an irregularly shaped conductor, the surface charge density is greatest where the radius of curvature of the surface is the smallest.
(D) The electric field just outside the conductor is tangent to its surface.

44. Coulomb's law for the force between electric charges most closely resembles

(A) the law of conservation of energy.
(B) Newton's second law of motion.
(C) Newton's law of gravitation.
(D) the law of conservation of mass.

48. Consider a long cylindrical charge distribution of radius R with a uniform charge density ρ. What is the magnitude of electric field at distance r from the axis where r < R?

(A) $\frac{\rho r}{3\varepsilon_0}$ (B) $\frac{\rho r}{2\varepsilon_0}$ (C) $\frac{\rho r}{7\varepsilon_0}$ (D) $\frac{\rho r}{5\varepsilon_0}$

36. Two small charged objects attract each other with a force F when separated by a distance *d*. If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to $\frac{d}{2}$ the force becomes:

A) $\frac{F}{16}$ C) $\frac{F}{4}$

B) $\frac{F}{8}$ D) $\frac{F}{2}$

38. A charged particle produces an electric field of magnitude E at a point 2 m away. At a point 1m from the particle the magnitude of the field is:

A) 4E C) 2E

B) ¼ E D) ½ E

37. A particle with charge Q is on the y-axis a distance d from the origin and a particle with charge q is on the x-axis a distance x from the origin. What is the value of x for which the x-component of the force on the second particle is the greatest?

A) ½ d C) 2d

B) $\frac{1}{\sqrt{2}}d$ D) $\sqrt{2}\,d$

4. What is the SI unit of Electric field?

(A) Am^{-1} (C) Cm

(B) Vm^{-1} (D) NC^{-1}

9. What is the magnitude of the electric force between two protons separated by $2\times10^{-15}m$? (charge of proton is $1.6\times10^{-19}C$)

(A) 67.5N (B) 115.0N (C) 57.5 N (D) 83.4N

10. An ion accelerated through a potential difference of 115 V experiences an increase in kinetic energy of $7.37\times10^{-17}J$. What is the charge on the ion?

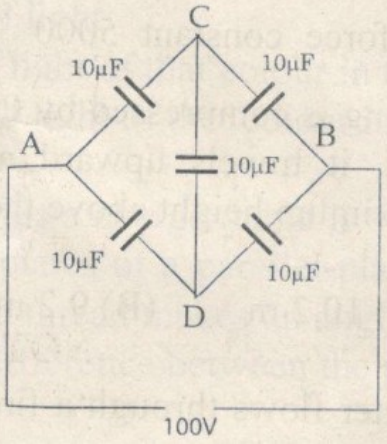
(A) $6.41\times10^{-19}C$
(B) $2.32\times10^{-15}C$
(C) $4.51\times10^{-15}C$
(D) $2\times10^{-21}C$

31. When a potential difference of 150 V is applied to the plates of a parallel-plate capacitor, the plates carry a surface charge density of $30\frac{nC}{cm^2}$. What is the spacing between the plates?

(A) $2.24\mu m$ (B) $5.32\mu m$ (C) $12.24\mu m$ (D) $4.42\mu m$

42. Five capacitors 10 μF capacity each is connected to A, D, and C potential of 100 volt as shown in the next figure. What is the equivalent capacitance between A and B?

(A) $10\mu F$
(B) $20\mu F$
(C) $30\mu F$
(D) $60\mu F$



49. A small object of mass m carries a charge q and is suspended by a thread between the vertical plates of a parallel-plate capacitor. The plate separation is d. If the thread makes an angle θ with the vertical, what is the potential difference between the plates?

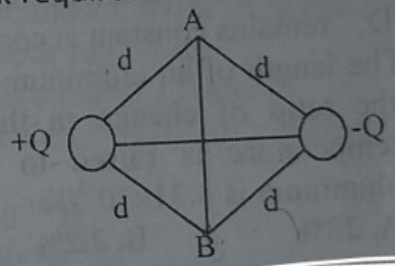
(A) $\frac{mgd\tan\theta}{q}$

(B) $\frac{md\tan\theta}{q}$

(C) $\frac{mgd\sin\theta}{q}$

(D) $\frac{md\sin\theta}{q}$

12. Points A and B are each a distance d from each of two equal and opposite charges as shown below. What will be the work required to move a negative charge q from A to B?



A. Zero

B. $\frac{qQ}{4\pi\varepsilon_o d^2}$

C. $\frac{qQ}{4\pi\varepsilon_o d}$

D. $\frac{qQ}{4\pi\varepsilon_o(4d^2)}$

13. An air-filled parallel-plate capacitor has a capacitance of 1Pf. The plate separation is then doubled and a wax dielectric is inserted, completely filling the space between the plates. As a result, the capacitance becomes 2 Pf. What is the dielectric constant of the wax?

A. 8.0 B. 4.0 C. 2.0 D. 0.5

29. An electron enters a region of uniform electric field of 5×10^{3}N/C. What is the force on the electron?

A. 8×10^{-22} N

B. 5.3×10^{-22} N

C. 8×10^{-16} N

D. 1.88×10^{22} N

37. What is the capacitance of a capacitor that should be connected with 2 other capacitors having capacitance of 4μFand8μFall in series to produce an effective capacitance of $\frac{24}{11}\mu F$?

A. 12 μF B. 10 μF C. 8 μF D. 4 Mf

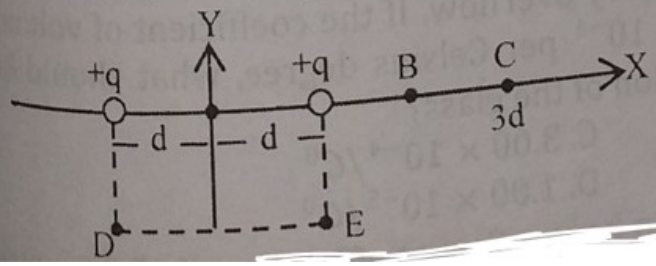
42. Which one of the following changes to parallel plate capacitor would not increase energy stored in the capacitor at a fixed voltage across the plates?
A. increasing the area of the plates
B. increasing the dielectric constant
C. decreasing the charges on the pates
D. increasing the distance between the plates

1. The distance between two point charges is doubled. What will happen to the force of interaction between the charges?
A. The force will be doubled.
B. The force will be reduced by calf.
C. The force will be reduced by a factor of ¼.
D. The force will not be affected.

3. Moving 2.5×10^{-6} coulomb of charge from point A to point B in an electric field requires 6.3×10^{-4} joule of work. The potential difference between points A and B is approximately
A. $4.0 \times 10^{-3} V$
B. $2.5 \times 10^{-2} V$
C. $1.6 \times 10^{-19} V$
D. $1.0 \times 10^{-14} V$

7. A capacitor made of parallel plates is charged by connecting it to a battery. The distance between the plates is much less than the surface area of each plate. After fully charged if the plates are disconnected from the battery and then pulled apart a little, what will happen to the total stored energy, the electric field, and the potential difference between the plates?
A. The electric field between the plates increase.
B. The potential difference between the plates decrease.
C. The total energy stored in the capacitor increase.
D. The electric field, the potential difference and the stored energy remain the same.

38. Two positive charges of magnitude q are each a distance d from the origin A of a coordinate system as shown below



The magnitude of the electric field is minimum at point .

A. A
B. B
C. C
D. D

45. Two different capacitors of capacitances $C_1 = 2\mu F$ and $C_2 = 3\mu F$ connected in series across a 120V supply line. The charged capacitors are disconnected from the line and from each other, and reconnected with terminals of like sign together. What will be the final charges on C_1 and C_2 respectively?

A. $57.63\mu C$ *and* $86.4\mu C$
B. $115.2\mu C$ *and* $127.8\mu C$
C. $144\mu C$ *across each*
D. $288\mu C$ *across each*

36. Which one of the following statement is correct?

A. The electric field strength due to two point charges of equal magnitude and the same sign is zero only at one point on the line joining the two charges.
B. If a point charge of mass m is released from the rest in uniform electric field, it will move along a line of force with uniform speed.
C. The variation of the strength of the electric field due to an electric dipole is inversely proportional with the square of the distance from its center of mass.
D. An electric dipole moment p in a uniform external electric field E is in stable equilibrium if p and E are in opposite directions.

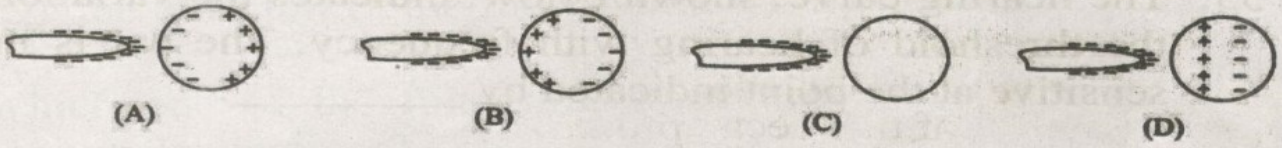
37. In a certain region of space, a uniform electric field is directed in the positive x direction. If a particle with negative charge is carried from x = 20cm to x = 60 cm, what can we conclude about the electric potential and the electric potential energy of the charge-field system?

A. The electric potential at x = 20 cm is larger than that at x = 60cm.
B. The electric potential at x = 20 cm is the same as that at x = 60 cm.
C. The electric potential energy decrease.
D. The electric potential energy increase.

38. A parallel plate capacitor has a capacitance of $10\mu F$. If the distance between the plates is doubled, keeping all other quantities constant, what is the new capacitance of the capacitor?

A. $0.2\ \mu F$ B. $5\ \mu F$ C. $10\ \mu F$ D. $20\ \mu F$

38. **In the sketches below, which best describes the location of the negative charges (electrons) when a negatively charged rod is brought near but not touching the conducting sphere?**

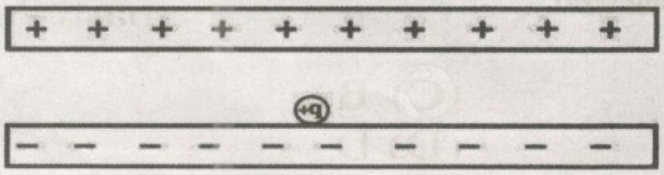


(A) C
(B) D
(C) A
(D) B

39. **What is the potential (V) at a distance of 10m from a charge of +5.0C?**

(A) -4.45×10^9 V
(B) –0.5V
(C) $+4.45\times10^9$ V
(D) +0.5V

40. A positive charge of 1.0×10^{-4}C is on the negatively charged plate of a parallel plate capacitor as shown below.

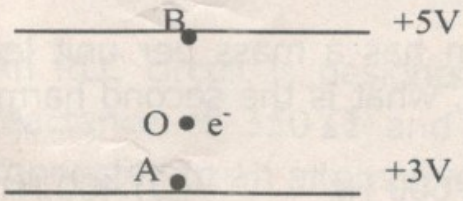


If the potential (V) on the top plate is +10,000 V and that of the bottom plate is −10,000 V, how much work (W) is required to move the charge from the bottom to the top plate?

(A) 2.0J
(B) 1.0J
(C) Zero
(D) 2.0×10^{4}J

31. Suppose that three point charges are placed along a straight line and the electrostatic force exerted on the middle charge is zero. What can we conclude about the charges?
(A) The charges at the ends must have the same sign.
(B) The signs of the three charges should be the same.
(C) The middle charge should be placed at the center between the two charges
(D) The charge at the middle and at the left end should have the same sign

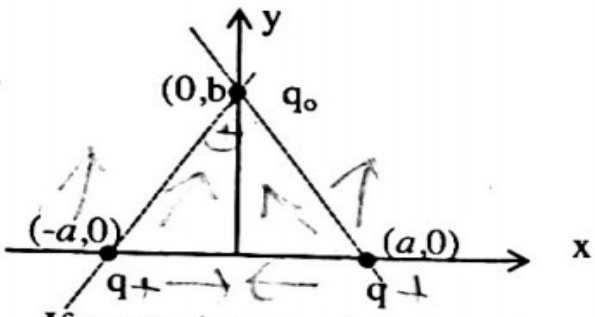
32. Two parallel plates are kept at 3 V and 5 V as shown in the diagram below. If an electron is released at O, then which way will the electron move?



(A) towards A
(B) parallel to the plates
(C) remains at O
(D) towards B

33. A capacitor of 12 μF capacitance can be fully charged after it is connected between a potential difference of 9 V. How much electrical energy is used in charging the capacitor?
(A) 1.0×10^{-3} J (B) 54×10^{-4} J (C) 4.86×10^{-4} J (D) 9.72×10^{-4} J

36. Two like charges of value q are fixed at x= a and x= -a as shown in the diagram below.



If a test charge q_o is released at y = b, which path will it follow?

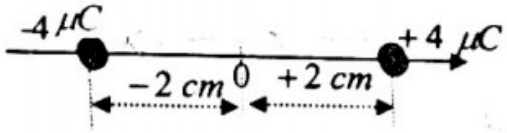
(A) It stays at y = b

(B) along a line $y = -\frac{b}{a}x + b$

(C) along a line $y = \frac{b}{a}x + b$

(D) a long y- axis

37. Two equal and opposite charges are located along x-axis at $-2.0\,cm$ and $+2.0\,cm$ as shown in the figure below. How much would be the electric potential at the origin?



(A) Zero (B) 1.8 MV (C) 3.6 MV (D) 4.5 MV

38. A sheet of polythene (ε_r = 2.3) and 0.25 mm thick is to be used in a capacitor by sandwiching it between two sheets of aluminum foil. What area must the sheets have if the capacitor is to have a capacitance of 0.5 μF?

(A) 12 m^2 (B) 6.14 m^2 (C) 0.6 m^2 (D) 0.12 m^2