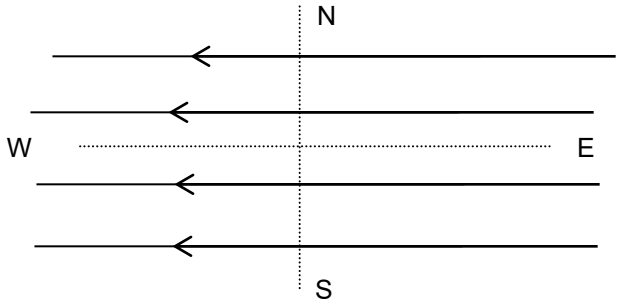
Practice Common Exam 1, Physics 121

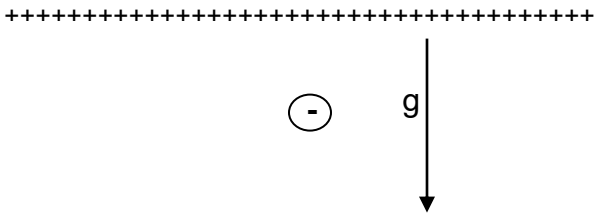
1. A negatively charged particle is placed in a uniform electric field directed West. What are the magnitude and direction of the particle's acceleration if its charge is q= -6 μC, its mass m = 2 grams, and the value of electric field E is 6 x10^{-6} N/C? Select the closest answer:

A) West. a = 1.8 x10^{-8} m/s^2
B) East. a = 1.8 x10^{-3} m/s^2
C) West. a = 1.8 x10^{+3} m/s^2
D) **East. a = 1.8 x10^{-8} m/s^2**
E) East. a = 1.8 x10^{-5} m/s^2

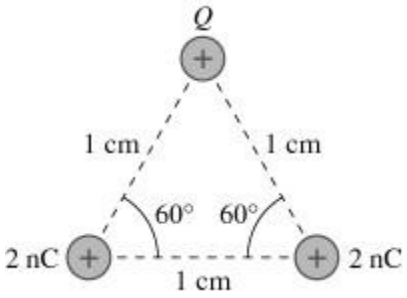


2. An electron with mass m = 9.11 x 10^{-31} kg is released at rest above very large positively charged non-conducting charged sheet lying horizontally as shown. What should the surface charge density σ on this sheet be to keep the electron balanced at rest above the ground?

A) 8.55 x 10^{-1} C/m^2
B) 2.35 x 10^{-6} C/m^2
C) 1.8 x 10^{-18} C/m^2
D**) 9.88 x 10^{-22} C/m^2**
E) 1.84 C/m^2



3. In the figure $Q = 5.8$ nC. What is the magnitude and direction of the force on the charge Q? ($k = 1/4\pi\varepsilon_0 = 8.99 \times 10^9$ N · m^2/C^2)



A) 1.8 × 10^{-3} N up
B) 9.0 × 10^{-4} N, up
C) 9.0 × 10^{-4} N, up
D) 9.0 × 10^{-4} N, down
E) 9.0 × 10^{-4} N, right

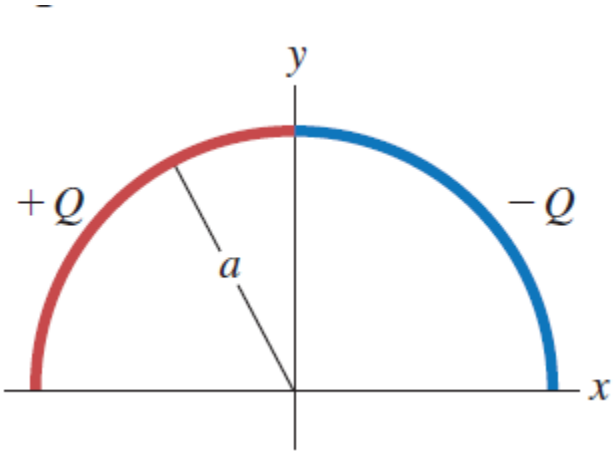
4. A large non-conducting disk with radius 5.0 m is negatively charged. The charge is uniformly distributed across the surface of the disk. The electric field, on the axis of the disk, 1 mm away from its surface is 10 N/C. Find the total charge on the disc?

A) 6nC
B) 9nC
C) 14nC
D) 22nC
E) 23nC

5. A very long uniform line of charge has charge per unit length $\lambda_1 = 4.78$ μC/m and lies along the x-axis. A second-long uniform line of charge has charge per unit length $\lambda_2 = -2.46$ μC/m and is parallel to the x-axis at $y_1 = 0.400$ m. What is the magnitude of the net electric field at point $y_2 = 0.200$ m on the y-axis?

A. 6.51×10^5 N/C

6. A semicircle of radius a is in the first and second quadrants, with the center of curvature at the origin. Positive charge +Q is distributed uniformly around the left half of the semicircle, and negative charge -Q is distributed uniformly around the right half of the semicircle (Fig. below). What are the magnitude and direction of the net electric field at the origin produced by this distribution of charge?



Ans.

$$E_x = +\frac{Q}{\pi^2 \epsilon_0 a^2}$$ in the +x direction.

7. Determine the angle between **A** = 3.00**i** + 1.00**j** +0**k** and the **B** = -3.00**i** +3.00**j** + 0**k**.

A) 26.6°
B) 30.0°
C) 88.1°
D) 117°
E) 45.2°

8. Vectors **A** = 3.00**i** + 1.00**j** +0.00**k** and the **B** = -3.00**i** +3.00**j** + 0.00**k**. **C** = **A x B**. What is the z-components of the vector **C**?

A) 12.00k
B) 7.00**k**
C) -7-00**k**
D) 1.00**k**
E) -1.00**k**

9. The electrostatic force between two negatively charged cubes, 10 cm. on each side, with Q_1= -7 μC and Q_2= -4 μC is:

A) Attractive. The force on cube 1 is twice as large as the force on cube 2.
B) Attractive. The force on cube 1 is equal to the force on cube 2.
C) Zero.
D) Repulsive. The force on cube 1 is twice as large as the force on cube 2.
E) **Repulsive. The force on cube 1 is equal to the force on cube 2**.

10. A particle of charge $Q1 = +40.0\ \mu\ C$ is located on the x-axis at the point $x = 20.0\ cm$, and a second particle of charge $Q2 = -50.0\ \mu C$ is placed on the x-axis at $x = 30.0\ cm$. What is the magnitude of the total electrostatic force on a third particle of charge $Q3 = -4.0\ \mu C$ placed at the origin ($x = 0$)?

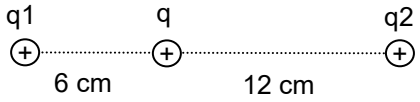
A) 16N i
B) 0N**i**
C) 10N**i** + 5N**j**
D) -16N**i**
E) -16N**j**

11. The force acting on an electron 100 cm from a positive 0.1 μC point charge in a vacuum is:

A) $2.81 \times 10^{+10}$ N. Repulsive
B) 1.0×10^{-19} N. Attractive
C) 1.41×10^{-12} N. Repulsive
D) **1.44×10^{-16} N. Attractive**
E) 1.80×10^{-16} N. Attractive

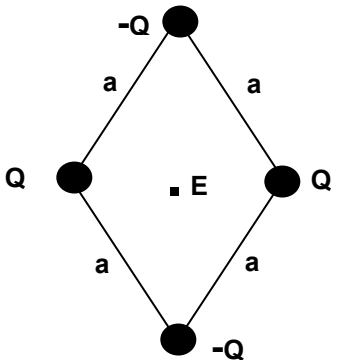
12. A positively charged particle with q= 2 μC is placed between two other positively charged particles with $q_1 = 9 \times 10^{-3}$ C and $q_2 = 3 \times 10^{-3}$ C as shown on the figure. The distance between q_1 and q is 6 cm and the distance from q to q_2 is 12 cm. What is the magnitude and direction of the total force acting on the middle particle?

A) $4.1 \times 10^{+4}$ N. right
B) $2.8 \times 10^{+9}$ N, right
C) $4.9 \times 10^{+4}$ N, left
D) $4.9 \times 10^{+4}$ N, right
E) $9.0 \times 10^{+9}$ N, left



13. The magnitude Q of the charge on four balls is 12 μC distributed uniformly on the surface of each one. Two are positive and two are negative as shown in the sketch. They are placed at the corners of the diamond as shown in the diagram. Each of the sides has length a = 3 cm. What is the magnitude and direction of the electric field at the center of the diamond shape?

A) 24.1×10^{13} N/C. Down
B) 1.6×10^{12} N/C. Up
C) 7.9×10^{19} N/C. Left
D) 1.4×10^{10} N/C. Right
E) **Zero**

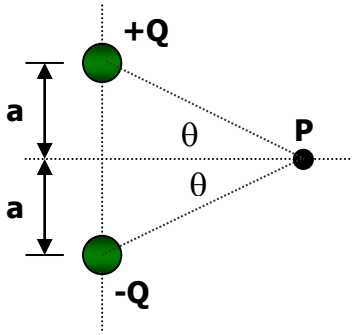


14. A proton is moving with constant acceleration east in a uniform electric field of 1.50 N/C directed to the west. At point *A*, the velocity of the proton is 1.90 x10^4 m/s, east. What is the speed of the proton at point B which is a distance of 0.395 m east of point A?

A) 4.25 x 10^4 m/s
B) 7.32 x 10^3 m/s
C) 1.59 x 10^4 m/s
D) 8.35 x 10^8m/s
E) 1.09 x 10^3 m/s

15. An electric dipole consists of two equal and opposite charges located on the vertical axis, as shown in the figure. The direction of the electric field at point P is:

A) ↑
B) ↓
C) →
D) ←



E) The electric field is zero at point P.

16. In the figure, all the charges are point charges and the charge in the middle is Q = -3.1 nC. For what charge q_1 will charge q_2 be in static equilibrium?

A) 12 nC
B) 6.2 nC
C) 3.1 nC
D) 25 nC
E) 6.0 nC