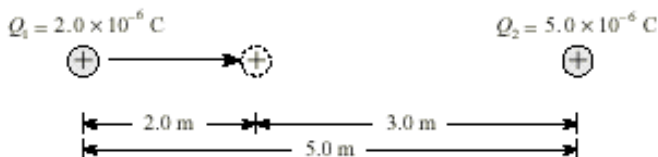


Electrostatics Review

1. An electron orbits a nucleus which carries a charge of $+9.6 \times 10^{-19} \text{ C}$. If the electron's orbital radius is $2.0 \times 10^{-10} \text{ m}$, what is its electric potential energy?

- A. $-6.9 \times 10^{-18} \text{ J}$
- B. $-3.5 \times 10^{-8} \text{ J}$
- C. 43 J
- D. $2.2 \times 10^{11} \text{ J}$

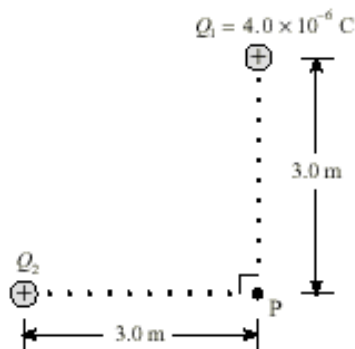
2. Charge Q_1 is located 5.0 m from charge Q_2 as shown.



How much work must be done to move charge Q_1 2.0 m closer to charge Q_2 ?

- A. $7.2 \times 10^{-3} \text{ J}$
- B. $1.1 \times 10^{-2} \text{ J}$
- C. $1.2 \times 10^{-2} \text{ J}$
- D. $2.0 \times 10^{-2} \text{ J}$

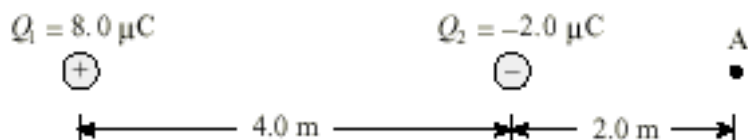
3. The magnitude of the net electric field at P in the diagram below is $5.0 \times 10^3 \text{ N/C}$.



Find the magnitude of charge Q_2 .

- A. $1.0 \times 10^{-6} \text{ C}$
- B. $3.0 \times 10^{-6} \text{ C}$
- C. $6.4 \times 10^{-6} \text{ C}$
- D. $1.0 \times 10^{-5} \text{ C}$

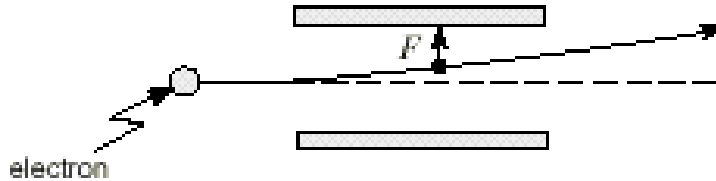
4. Two charges are positioned as shown in the diagram below.



a) Find the magnitude and direction of the electric field at A. (Note: $1.0 \mu\text{C} = 1.0 \times 10^{-6} \text{ C}$)
(4 marks)

b) A charge placed at A experiences a force of $4.0 \times 10^{-3} \text{ N}$ towards the right. What are the magnitude and polarity of this charge? (3 marks)

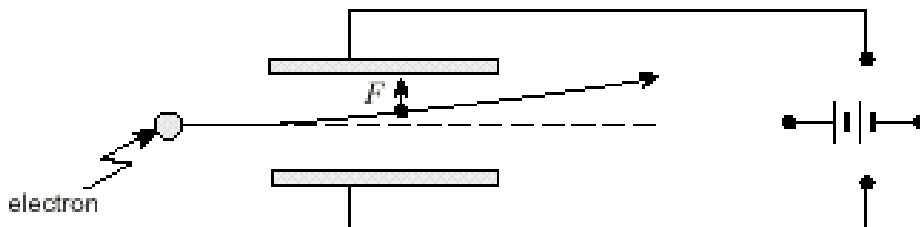
5. An electron passing between parallel plates 0.025 m apart experiences an upward electrostatic force of $5.1 \times 10^{-16} \text{ N}$.



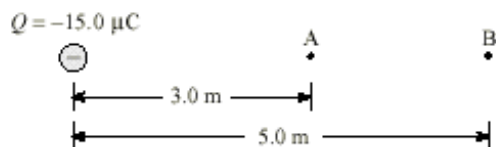
a) What is the magnitude of the electric field between the plates? (3 marks)

b) What is the potential difference between the plates? (2 marks)

c) On the diagram below draw in the connections to the power supply necessary for the electron to experience this upward force. (2 marks)

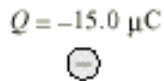


6. a) Find the electric potential at point A and at point B. (3 marks)



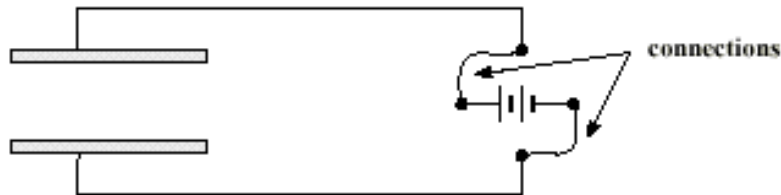
b) What is the potential difference between A and B? (1 mark)

c) 0.036 J of work must be done to move a charge q from A to B. Find the magnitude and polarity of this charge. (3 marks)



Answers To Electrostatics Review

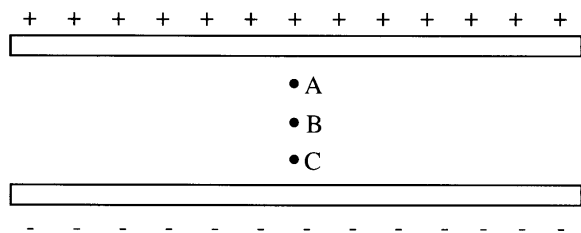
1. A
2. C
3. B
4. a) $2.5 \times 10^3 \text{ N/C}$ to the left
b) $-1.6 \times 10^{-6} \text{ C}$
5. a) $3.2 \times 10^3 \text{ N/C}$
b) 80V
c)



6. a) -27000 V

- b) +/- 18000 V
- c) $+2.0 \times 10^{-6} \text{ C}$

Assignment: Multiple Choice



1. What is the *direction* of the electric field at **B**, which is located between a pair of oppositely charged plates?
A. \uparrow B. \rightarrow C. \leftarrow D. \downarrow
2. The electric field strength between the plates is
A. strongest at A, weakest at B.
B. strongest at B.
C. strongest at C, weakest at A.
D. strongest at A and C, weakest at B.
E. the same at A, B and C.

3. What is the direction of the electric field at **P** due to point charges Q_1 and Q_2 ?

• P

A. \uparrow B. \rightarrow C. \leftarrow D. \downarrow

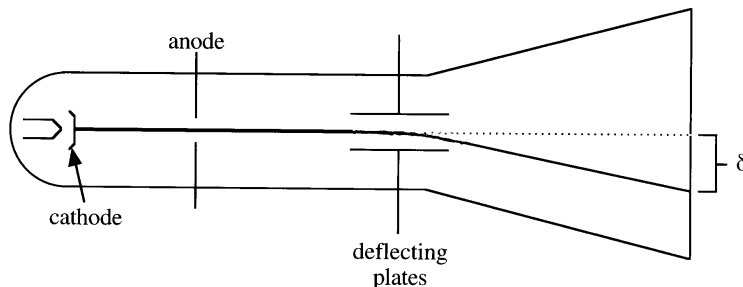


4. Electric field strength can be measured in

A. N/A.
 B. J/C.
 C. N/A·m.
 D. N/kg.
 E. V/m.

5. The electric field strength at a distance of 1.0 m from a point charge is 4.0×10^4 N/C. What will the electric field strength be at a distance of 2.0 m from the same point charge?

A. 1.0×10^4 N/C
 B. 2.0×10^4 N/C
 C. 4.0×10^4 N/C
 D. 8.0×10^4 N/C
 E. 16×10^4 N/C



6. A beam of electrons in a cathode ray tube is accelerated toward the anode by an accelerating voltage of 100 V. After passing through the anode, the electrons are deflected as they pass through two oppositely charged parallel deflection plates. On the screen, the observed deflection is δ . If the accelerating voltage is increased to 400 V, what deflection will be observed on the screen?

A. δ B. $\frac{1}{4} \delta$ C. $\frac{1}{2} \delta$ D. 2δ E. 4δ

7. An atom carrying an excess charge of 1.60×10^{-19} C is accelerated from rest by a potential difference of 750 V. It reaches a peak speed of 8.50×10^4 m/s. What is the mass of the atom?

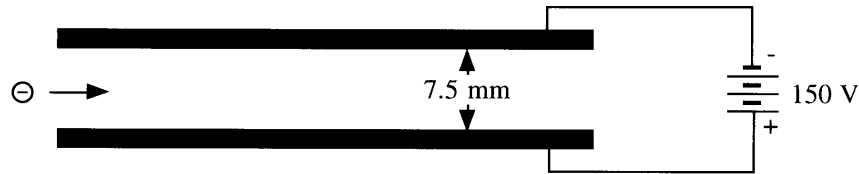
A. 1.67×10^{-27} kg
 B. 3.32×10^{-26} kg
 C. 4.84×10^{-20} kg
 D. 9.11×10^{-31} kg

8. What increase in electrical potential energy occurs when an alpha particle with a charge of 3.2×10^{-19} C is brought from infinity to a distance of 5.0×10^{-10} m of a stationary charge of 7.5×10^{-18} C?

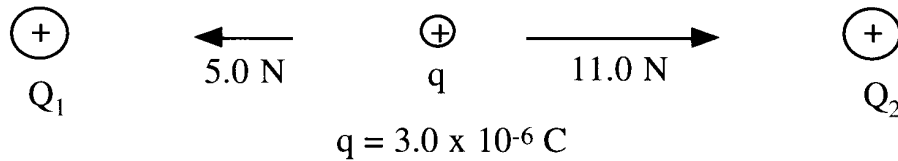
A. 4.3×10^{-17} J
 B. 8.6×10^{-8} J
 C. 5.8 J
 D. 1.4×10^2 J

Open-Ended Questions

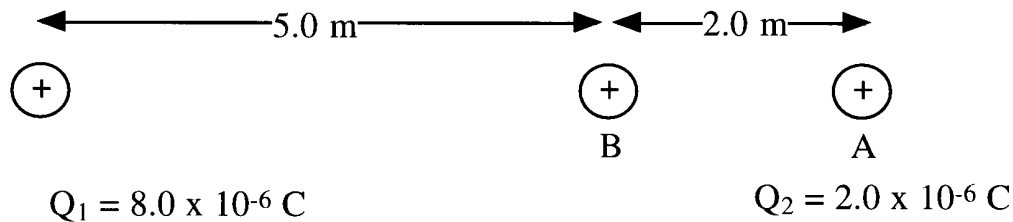
9. Calculate the electrostatic force of attraction between a positive charge of $8.0 \times 10^{-6} \text{ C}$ and a negative charge of $5.0 \times 10^{-6} \text{ C}$, when they are 0.30 m apart.
10. When a charged object is accelerated through a potential difference of 500 V , its kinetic energy increases from $2.0 \times 10^{-5} \text{ J}$ to $6.0 \times 10^{-5} \text{ J}$. What is the magnitude of the charge on the object?
11. How fast will an electron be moving if it is accelerated from rest, in a vacuum, through a potential difference of 200 V ?
12. Two parallel plates are 4.0 mm apart. If the potential difference between them is 200 V , what is the magnitude of the electric field strength between the plates?



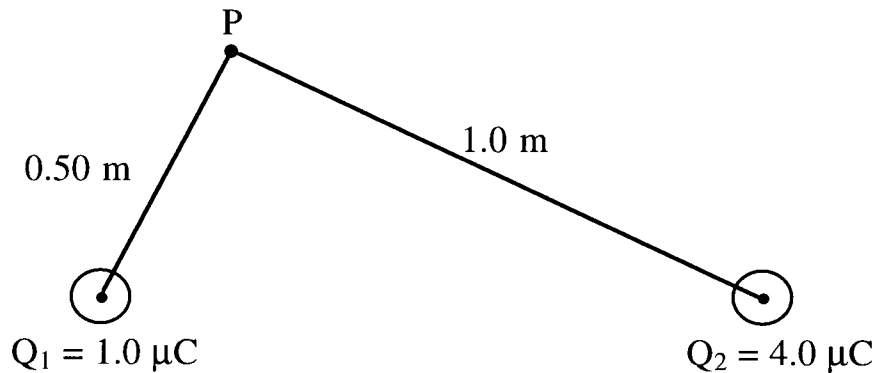
13. An electron enters the space between two oppositely charged, parallel plates. What is the magnitude and direction of the electrostatic force that acts on the electron when it is between the two plates?



14. The $3.0 \times 10^{-6} \text{ C}$ charge, q , experiences opposing forces exerted by Q_1 and Q_2 of 5.0 N and 11.0 N respectively. What is the magnitude and direction of the electric field strength at the location of q ?



15. How much work must be done to move charge $Q_2 = 2.0 \times 10^{-6} \text{ C}$ from A to B? The other charged object has a charge $Q_1 = 8.0 \times 10^{-6} \text{ C}$.
16. What is the electric potential energy, relative to infinity, of an electron located $5.3 \times 10^{-11} \text{ m}$ from the proton in a hydrogen atom?



17. What is the electric potential at **P** due to charges Q_1 and Q_2 ?

Assignment Answers

1. D 2. E 3. B 4. E 5. A 6. B 7. B 8. A

9. 4.0 N

10. 8.0×10^{-8} C

11. 8.4×10^6 m/s

12. 5.0×10^4 V/m, or 5.0×10^4 N/C

13. 3.2×10^{-15} N (down)

14. 2.0×10^6 N (to the right)

15. 8.2×10^{-3} J

16. -4.3×10^{-18} J

17. 5.4×10^4 V (total)