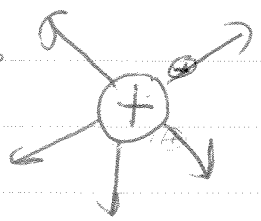
Do Now: A $+5\times10^{-6}$ C B 7×10^{-6} C

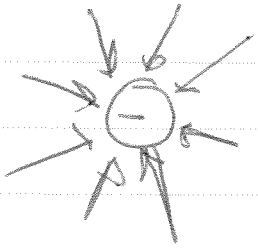
After Contact & Separation, what is the charge on A
6×10^{-6} C

Electric Field - Region of Space that attracts/repels electric charge

Field Lines - Path of a small positive charge (test charge) takes while in the field. We use arrow to indicate proper direction

How a positive charge would

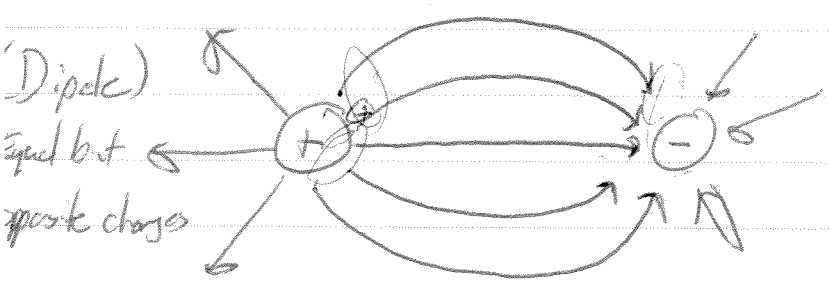




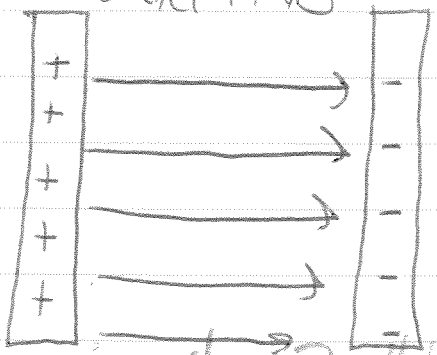
- Spacing/Concentration of field lines indicate the strength of the electric field

- Where the lines are closely spaced, the field is strong

(Dipole) Equal but opposite charges

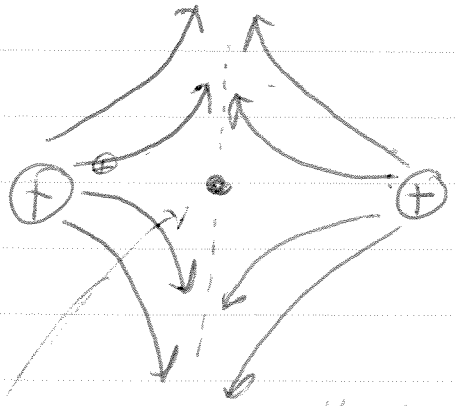


Parallel Plates



Capacitor - Parallel Plates

- Field lines are parallel
- Electric field is uniform



No field lines pass through midway between charges. Result No net force, field strength = 0

- Result would be the same for a negative charge

Aim: Electric Field Strength

Electric Field strength is measured by place a positive test charge in the field and measure the force acting upon it

$$E = \frac{F_e}{q}$$

E = Electric Field Strength F_e = Force in electric field

q = Test Charge

Ex) A 2.0×10^{-6}C test charge experiences a force of 2.4×10^{-3} N East when placed in an electric field. Determine the magnitude & Direction of the electric field

$$E = \frac{F_e}{q} = \frac{2.4 \times 10^{-3} N \text{ (East)}}{2.0 \times 10^{-6} C} = 1.2 \times 10^{+3} \frac{N}{C} \text{ (East)}$$

Expressing Field Strength in terms of Work & Energy

Assume direction of electric field approx motion

q_{Test} at A → B

What is the work done to move the Charge from A to B

↑ Work → ↑ PE

Volt = Joules per coulomb charge

$$V = \frac{W}{q}$$

V = Potential Difference (Joules/Volts) Q = Charge

W = Work (Electrical Energy)

- When a -4×10^{-3}C charge is moved between two charges in an electric field, 0.8 J of work is done by the charge. Calculate the potential difference between the two charges

$$V = \frac{W}{Q} \qquad V = \frac{0.8 J}{4 \times 10^{-3} C} \qquad V = 200 V$$

ELECTRIC FIELDS, FORCES, AND POTENTIAL REVIEW QUESTIONS

1. When charge is transferred from one object to another, which of the following are actually transferred?

   (A) electrons
   (B) protons
   (C) neutrons
   (D) quarks
   (E) photons

2. Two conducting spheres of equal size have a charge of –3 C and +1 C, respectively. A conducting wire is connected from the first sphere to the second. What is the new charge on each sphere?

   (A) –4 C
   (B) +4 C
   (C) –1 C
   (D) +1 C
   (E) zero

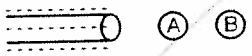
3. According to Coulomb's law, if the electric force between two charges is positive, which of the following must be true?

   (A) One charge is positive and the other charge is negative.
   (B) The force between the charges is repulsive.
   (C) The force between the charges is attractive.
   (D) The two charges must be equal in magnitude.
   (E) The force must be directed toward the larger charge.

4. Two charges q_1 and q_2 are separated by a distance r and apply a force F to each other. If both charges are doubled, and the distance between them is halved, the new force between them is

   (A) $\frac{1}{2}F$
   (B) $\frac{1}{4}F$
   (C) $4F$
   (D) $8F$
   (E) $16F$

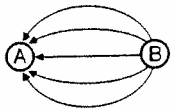
5. Two uncharged spheres A and B are near each other. A negatively charged rod is brought near one of the spheres.



   The far right side of sphere B is

   (A) uncharged.
   (B) neutral.
   (C) positive.
   (D) negative.
   (E) equally positive and negative.

6. Two charges A and B are near each other, producing the electric field lines shown.



   What are the two charges A and B, respectively?

   (A) positive, positive
   (B) negative, negative
   (C) positive, negative
   (D) negative, positive
   (E) neutral, neutral

7. A force of 40 N acts on a charge of 0.25 C in a region of space. The electric field at the point of the charge is

   (A) 10 N/C
   (B) 100 N/C
   (C) 160 N/C
   (D) 40 N/C
   (E) 0.00625 N/C

8. Electric potential

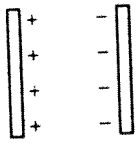
   (A) is a vector quantity.
   (B) is proportional to the work done in an electric field.
   (C) is always equal to the electric field.
   (D) is zero when a charge is in an electric field.
   (E) is measured in N/C.

9. Two conducting plates are separated by a distance of 0.001 m. A 9 V battery is connected across the plates. The electric field between the plates is

   (A) 9,000 V/m
   (B) 900 V/m
   (C) 9 V/m
   (D) 0.009 V/m
   (E) 0.00011 V/m

$E = \frac{V}{d}$

Questions 10–11:
Two charged parallel plates are oriented as shown.



The following particles are placed between the plates, one at a time:

I. electron
II. proton
III. neutron

10. Which of the particles would move to the right between the plates?

    (A) I and II only
    (B) I and III only
    (C) II and III only
    (D) II only
    (E) I only

11. Which of the particles would not experience a force while between the plates?

    (A) I and II only
    (B) II and III only
    (C) I only
    (D) III only
    (E) I, II, and III