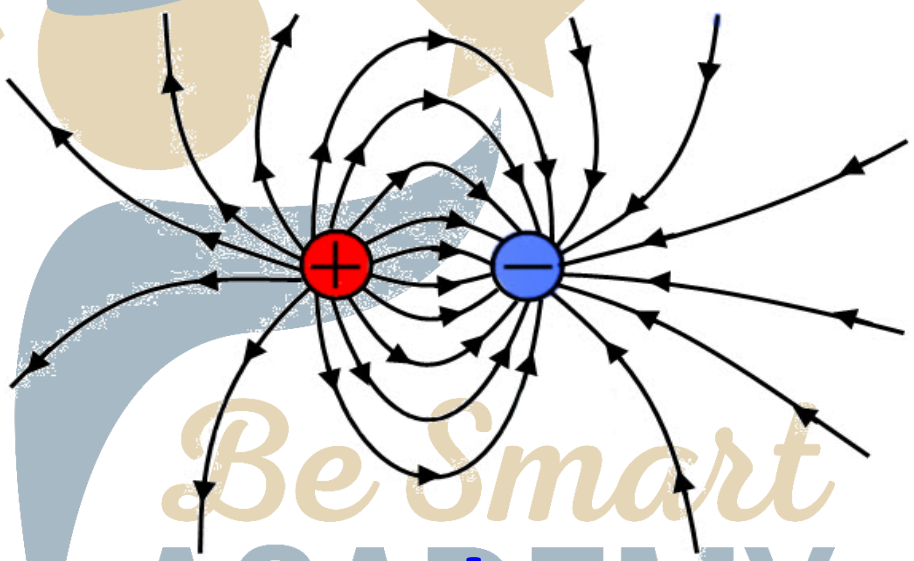
Physics – Grade 10

Unit 1: Electricity



Chapter 1: Electrostatic

Prepared and presented by: Mr. Mohamad Seif

Think then Solve

Exercise 1:

A plastic rod is rubbed against a piece of fur.

1. **Indicate the type of electrification.**
2. **Describe what will happen during rubbing.**
3. **Specify the type of charge on the plastic rod and on the piece of fur after rubbing.**

Exercise 1:

A plastic rod is rubbed against a piece of fur.

1. **Indicate the type of electrification.**

Electrification by friction.

2. **Describe what will happen during rubbing.**

During rubbing a transfer of electrons will take place from fur to plastic.

The fur acquires a deficit of electrons.(positively charge)

The plastic acquires an excess of electrons. (negatively charged)

Exercise 2:

Two identical metallic spheres where (A) has an excess of 10^{15} electrons, and (B) has a deficit of 2×10^{14} electrons, are 20 cm apart.

Given: $K = 9 \times 10^{9} SI$, and the elementary charge is $e = 1.6 \times 10^{-19} C$.

1) Calculate q_A and q_B the charges of (A) and (B) respectively.
2) Calculate the magnitude of the electrostatic force of interaction between (A) and (B).

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Exercise 2:

The previous identical spheres (A) and (B) are now brought in contact then separated after a short time.

3)Calculate the final charges q'_A and q'_B after contact.

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Exercise 2:

(A): excess of 10^{15} electrons, (B): deficit of 2×10^{14} electrons, $d = 0.2m$, $K = 9 \times 10^{9} SI$, $e = 1.6 \times 10^{-19} C$.

1) Calculate q_A and q_B the charges of (A) and (B) respectively.

$$q_A = N \times e \Rightarrow q_A = 10^{15} \times (-1.6 \times 10^{-19})$$

$$q_A = -1.6 \times 10^{-4} C$$

$$q_B = N \times e \Rightarrow q_B = 2 \times 10^{15} \times (1.6 \times 10^{-19})$$

$$q_B = 3.2 \times 10^{-4} C$$

Exercise 2:

(A): excess of 10^{15} electrons, (B): deficit of 2×10^{14} electrons, $d = 0.2m$, $K = 9 \times 10^{9} SI$, $e = 1.6 \times 10^{-19} C$.

2) Calculate the magnitude of the electrostatic force of interaction between (A) and (B)

$$F = \frac{K.|q_1|.|q_2|}{d^2} \Rightarrow F = \frac{9 \times 10^{9}.|-1.6 \times 10^{-4}|.|3.2 \times 10^{-4}|}{(0.2)^2}$$

$$F = 1152N$$

Exercise 2:

3)Calculate the final charges q'_A and q'_B after contact.

$$q_1 + q_2 = q'_1 + q'_2$$

A B

But the two bodies are identical then: $q'_1 = q'_2$

$$q_1 + q_2 = q'_1 + q'_1 \Rightarrow q_1 + q_2 = q'_1 + q'_1 \Rightarrow q_1 + q_2 = 2q'_1$$

$$q'_1 = q'_2 = \frac{q_1 + q_2}{2} = \frac{-1.6 \times 10^{-4} + 3.2 \times 10^{-4}}{2}$$

$$q'_1 = q'_2 = 0.8 \times 10^{-4} C$$

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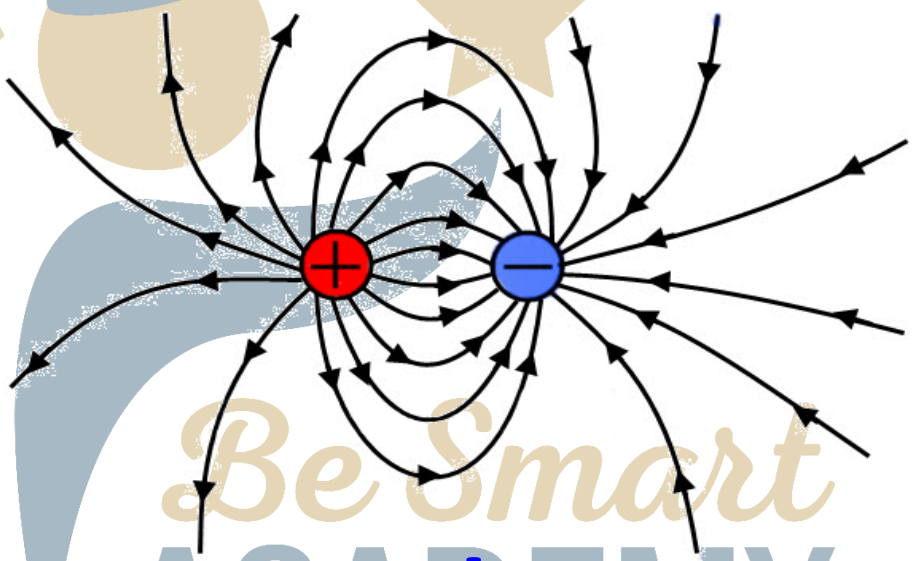

Chapter 1: Electrostatic

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Exercise 3:

A student puts a neutral glass rod in contact with a neutral ball, 10^{13} of electrons transfer from the surface of the glass to the surface of the ball. $e = 1.6 \times 10^{-19} C$

1. Name the method of electrification that is followed.

2. Indicate the charge of each before contact.

3. Determine the sign of each after contact

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Exercise 3:

10^{13} electrons transfer from glass to ball. $e = 1.6 \times 10^{-19} C$

1.Name the method of electrification that is followed.

Electrification by contact.

2. Indicate the value of charge of each before contact.

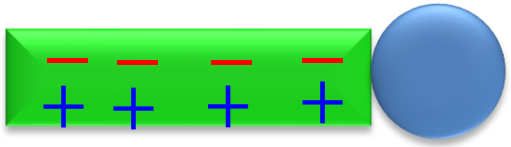
Since both are neutral before contact then:

$$q_1 = 0 \qquad q_2 = 0$$

Exercise 3:

10^{13} electrons transfer from glass to ball. $e = 1.6 \times 10^{-19} C$

3. Determine the sign of each after contact.



- **Since some electrons transfer from glass to ball:**
- **The glass becomes positively charged while the ball becomes negatively charged**

Exercise 3:

4. Determine the charge (q'_1) carried by the ball after rubbing.
5. Determine the charge (q'_2) carried by the glass after contact
6. When the transfer of electrons finish, identify the type of interaction between the two bodies.

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Exercise 3:

10^{13} electrons transfer from glass to ball. $e = 1.6 \times 10^{-19} C$

4. Determine the charge (q'_1) carried by the ball after rubbing

$$q'_1 = N \times e$$

$$q'_1 = 10^{13} \times (-1.6 \times 10^{-19})$$

$$q'_1 = -1.6 \times 10^{-6} C$$

Exercise 3:

10^{13} electrons transfer from glass to ball. $e = 1.6 \times 10^{-19} C$

5. Determine the charge (q'_2) carried by the glass after contact.

$$q_1 + q_2 = q'_1 + q'_2$$

$$0 + 0 = -1.6 \times 10^{-6} + q'_2$$

$$q'_2 = 1.6 \times 10^{-6} C$$

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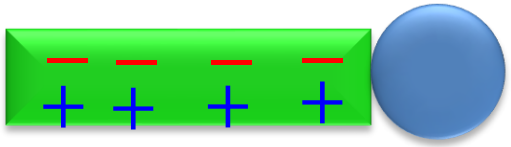
Exercise 3:

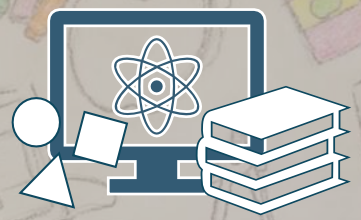
6. When the transfer of electrons is finished, identify the type of interaction between the two bodies

After contact, the glass rod becomes positively charged, and the ball becomes negatively charged.



Since the two bodies are of opposite charges then they attract each other

The End



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