Static Electricity & Charge

12PHYS - Electricity

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Starter

Brainstorm with the people around you what you know about electricity from Year 9 and 10.

Write it on the board when ready!

Static Electricity

Static electricity has many hilarious effects, from Tesla coils, to lightning & making your hair stand on end. But it all depends on charge!

Figure 1: Static Electricity

Charges: Positive & Negative

We should all remember that, much like magnets, opposites attract and likes repel.

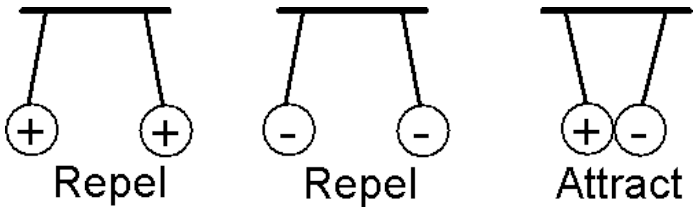
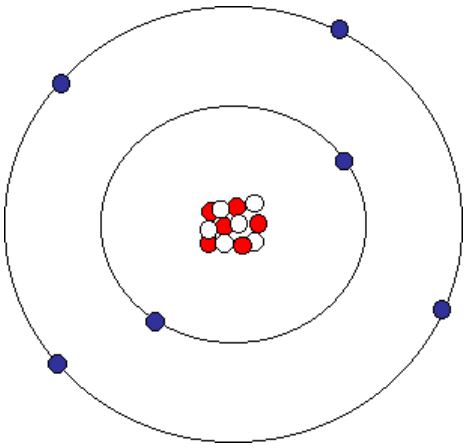


Figure 2: Electric Charges

Charge Carriers

Recall: **the atom**. What element is this? What are the three subatomic particles that make it up?



- **Electrons**: Negatively charged
- **Protons**: Positively charged
- **Neutrons**: No charge

Question: What happens when an atom loses or gains electrons?

Ions

Electrons are extremely light and move very fast. Therefore they can sometimes escape an atom.

- An ion is formed when an atom gains or loses electrons.
- Losing one or more electrons makes you **positively charged** and is called a **cation**.
- Gaining one or more electrons makes you **negatively charged** and is called an **anion**.

Question 1

What did we do in Year 10 Science to remove charges from one object and put them onto another?

Question 1: Answer

We applied friction!

Van der Graaf Generator

What is Charge?

In Physics the symbol for charge in equations is q or Q.

Unit: Coulomb (C)

We use it to describe how positive or negative an object is.

What's a Coulomb?

We know that electrons are negatively charged. In fact, they have a charge of $-0.00000000000000000016 Coulomb$ also written as $-1.6 \times 10^{-19} C$.

Therefore we can calculate that if an object has a charge of +1C, is has lost $6,250,000,000,000,000,000$ electrons.

$6.25 \times 10^{18} electrons = -1C$

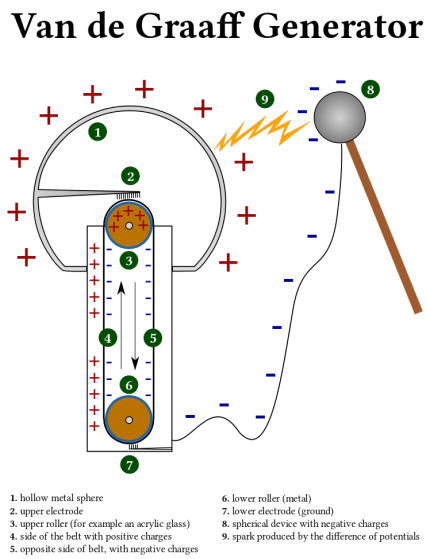


Figure 3: Van der Graaf Generator

Question 2 & 3

1. If a balloon has charge of $-3C$: did the balloon lose or gain electrons, and how many?
2. If Charlotte has charge of $0.2C$ did she lose or gain electrons and how many?

Question 2 & 3 Answers

1. If a balloon has charge of $-3C$: did the balloon lose or gain electrons, and how many?

Negative C means electrons are gained (negative charge)

$num_e = 3 \times (6.25 \times 10^{18})$

$num_e = 1.875 \times 10^{19}$ electrons gained

2. If Charlotte has charge of $0.2C$ did she lose or gain electrons and how many?

Positive C means electrons are lost (positive charge)

$num_e = 0.2 \times (6.25 \times 10^{18})$

$num_e = 1.25 \times 10^{18}$ electrons lost