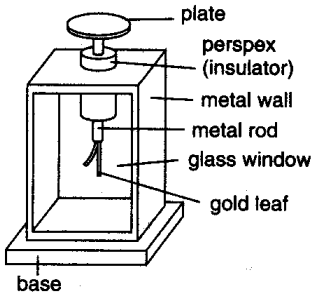
CHAPTER 7: ELECTRICITY AND MAGNETISM

7.1 Electrostatics

1. Electrostatics is the study of static electrical charges.
2. There are two types of electric charge: positive charge and negative charge.
3. Positive charges consist of protons and negative charges consist of electrons.
4. A neutral object has the same number of positively and negatively charged particles.
5. An object that loses electrons becomes positively charged because there are more protons than electrons.
6. The transfer of charged particles happens when two different substances are rubbed. The charge formed by friction is known as electrostatic charge.

7. **The Detection of Electrostatic Charge**

Electrostatic charge can be detected by using an electroscope.



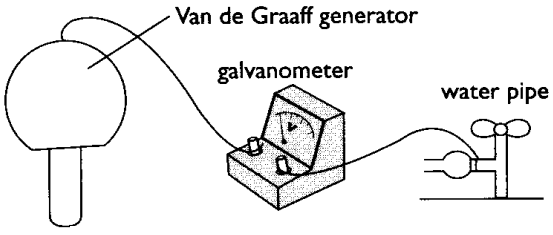
Gold leaf electroscope

Charge on the electroscope	Charge on the object	Gold leaf
Positive	Positive	Diverge
Negative	Negative	Diverge
Positive	Negative	Converge
Positive	Neutral	No change
Negative	Positive	Converge
Negative	Neutral	No change

8. Everyday phenomena caused by static electrical charges:
   - Lightning
   - Spark plug
   - Combing hair

7.2 Electricity

1. Some sources of electrical energy are the solar cell, dry cell, wet cell, power generator, lithium ion battery and cadmium battery.
2.

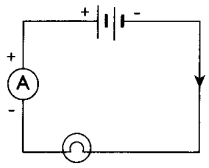
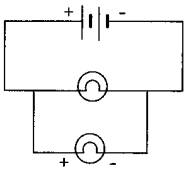
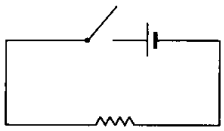


Van de Graff generator

A Van de Graff generator is an apparatus that can generate and collect a large amount of electric charge in a short time.

3. An **electric current (I)**, is defined as the rate of flow of electrons.
4. The electrical force needed to move electrons between two points is called the **voltage (V)** or potential difference between the two points.
5. The property of a materials that prevents or resists the flow of electrons through the material is called the **resistance (R).**

7.3 Electric Current, Voltage and Resistance

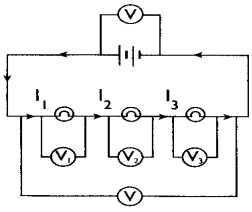
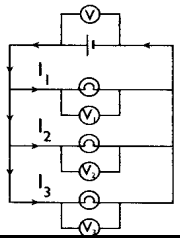
Electrical	Current	Voltage	Resistance
Definition	Quantity of electric charge that flows through a conductor in	The potential difference between two points in an electric circuit	The opposition to the flow of electric charge
Measuring instrument	Ammeter	Voltmeter	Using Ohm's Law $R = \frac{V}{I}$
Symbol	I	V	R
Simple circuit			
Method of connection	Series	Parallel	Resistance of wire depends on: • length • diameter • type of metal

7.4 Relationship between current, voltage and resistance

1. **Ohm's Laws** states that the current flowing through a conductor is directly proportional to its voltage.
2. Ohm's law is given by the following formula,

$$\frac{\text{Voltage (V)}}{\text{Currents (A)}} = \text{Resistance } (\Omega) \quad , \quad \frac{V}{I} = R$$

7.5 Parallel and Series Circuits

Series circuit	Difference in term	Parallel circuit
	Type of circuit	
The electrical components are connected end to end	Method of connection	The electrical components are connected side by side
The current flows in one channel only	Number of channels	The current flows in more than one channel
The other bulbs will not light up	If one bulb burns out	The other bulbs will still light up
Same in every resistance $I = I_1 = I_2 = I_3$	Amount of current	Same as the total amount of current in every channel $I=I_1 + I_2 + I_3$
Same as the amount of voltage through every bulb $V = V_I + V_2 + V_3$	Amount of voltage	Voltage is the same as the voltage supply $V_1 = V_2 = V_3 = V$
Total resistance (R) is the same as total of all resistances $R=R_I+R_2+R_3$	Amount of resistance	Total resistance (R) is calculated as follows: $\frac{1}{R} = \frac{1}{R_I} + \frac{1}{R_2} + \frac{1}{R_3}$
Does not last long	Lifespan	Lasts long
Increases if the number of cells increases	Current	Same even though the number of cells increases

7.6 Magnetism

1. Magnetism is a group of phenomena associated with magnetic fields.
2. The characteristics of a magnet are:
   (a) A magnet has two poles – the north and the south poles.
   (b) The same poles repel, different poles attract each other.
   (c) A free hanging magnet always points in the north-south direction.
   (d) A magnet can attract iron, steel, cobalt and nickel.
3. A magnetic field is a field of force surrounding a magnetic body.

7.7 Electromagnetism

1 An electromagnet is a temporary magnet formed when an electric current is passed Through a coil of conductor wire.

2 The current that flows through the conductor produces a magnet field around it

3 The direction of the magnetic field of a straight wire can be determined by using the RIGHT HAND GRIP RULE.

   a. The thumb represents the direction of the current flow
   b. The curved fingers represent the direction of the magnetic field

4. The strength of a solenoid magnetic field can be increased by

   a. increasing the number of turns in the coiled wire.
   b. Inserting a laminated iron bar into the solenoid.
   c. Increasing the current flow.

5. Electromagnets are used in loud speakers, electric bells, telephone receivers and telegraph machines.
6. The strength of a solenoid magnetic field can be increased by

   d. increasing the number of turns in the coiled wire.
   e. Inserting a laminated iron bar into the solenoid.
   f. Increasing the current flow.