Unit 3 – Electricity – TEST ON THURSDAY DEC. 15 KEY

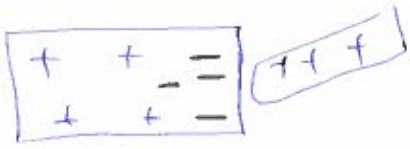
Static Electricity:

- Charges that stay in place
- When two **insulators** are rubbed together electrons are transferred from one to the other. The one that gains electrons is negatively charged and the one that looses electrons is positively charged.
- **Static charge** can be detected using an **electroscope** and generated using a **Van de Graaff Generator**
- **The laws of static charge**: 1. Like charges repel 2. Opposite charges attract 3. Neutral and charged attract
- Neutral objects can be attracted by a charged object coming near and forcing its electrons to re-arrange either by **conduction** (touching) or **induction** (coming close)
- Static electricity producing lightning and is used in photocopiers

1. Describe one way to produce static electricity. Describe what is happening to the electrons. Draw a picture!

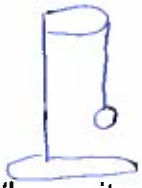
e- transfer due to friction

2. Draw a picture of a neutral object when a positively charged object is brought near. Show the re-arrangement of the electrons.



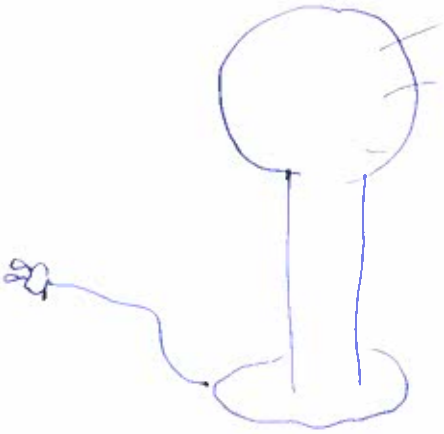
3. Draw an electroscope. Explain how it works with an example.

OR



detects static charge.

4. Draw a Van de Graaff generator. Why can it make peoples' hair stand on end?



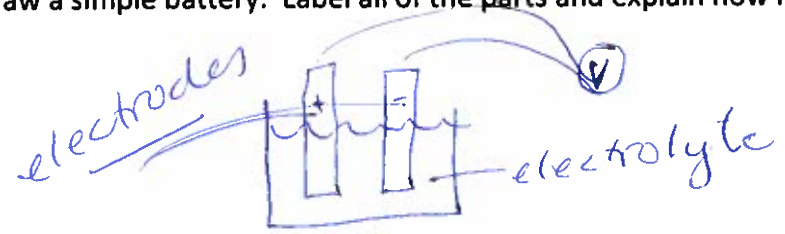
→ Generates static charge

→ hairs repel

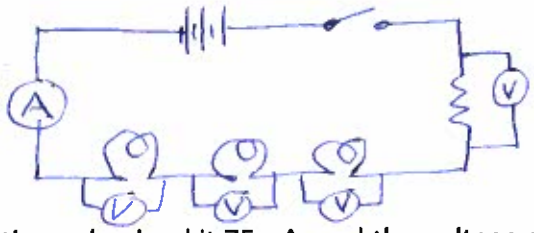
Current Electricity:

- **Batteries (electrochemical cells)** are made of two different metal electrodes (terminals) and an acidic electrolyte
- Batteries supply a circuit with **voltage (potential difference)** which is the amount of electric potential energy per coulomb of charge. Voltage is measured in volts (V) with a voltmeter.
- A current is a complete **circuit** made from a source such as a battery, a load, a switch, and conducting wire. The electrons flow around the circuit from the negative terminal of the battery to the positive terminal of the battery.
- **Electric current** is the amount of charge passing a point in a conducting wire per second. It is measured in amperes (A) with an ammeter.
- **Resistance** is the property of any material that slows the flow of electrons (a load or a resistor). Resistance is measured in ohms ( ) and can be measured with an ohmmeter.
- Resistance (R), voltage (V), and current(I) are related through **ohms law**: R = V/I If you know 2 of the values, the third can be calculated.

1. Draw a simple battery. Label all of the parts and explain how it works.



2. Draw a circuit using symbols which has a switch, a battery, 2 light bulbs, 1 resistor, a voltmeter over each load, an ammeter and conducting wire.



3. If the current through a load it 75mA, and the voltage drop across the load is 12 V, what it the resistance of the load?

$$R = \frac{V}{I} = \frac{12\,V}{0.075\,A} = 160\,\Omega$$

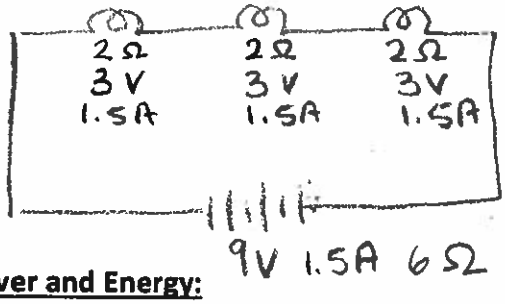
4. If you were to attach a voltmeter across a battery as you got a negative reading what did you connect incorrectly? Explain.

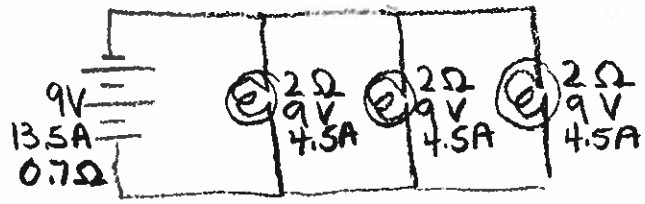
leads on wrong terminal of battery

Series and Parallel Circuits:

- In a **series circuit**, electrons in the current only have one path to follow. As a result, the current (I / amps) is the same everywhere, the voltage (V)of the battery is shared among and adding additional loads will increase the resistance.
- In a **parallel circuit**, electrons in the current have more than one path to follow. As a result, the current across individual paths will add up to that of the total current. The voltage reaching each path will still have the total voltage of the battery. Adding more pathways will decrease the total resistance.

1. Draw a series and a parallel circuit with three light bulbs each. Give both a 9V battery. The lights have a resistance of 2 ohms. Calculate the voltage, and current across each light bulb.





Power and Energy:

- **Electrical power** is the rate of change of energy in Joules per second = Watt (W). Power can be calculated using two formulas: P=V x I or P = E / t
- **Electrical energy** is how many Joules or Kilowatt hours a device consumes. It is calculated using E = P x t (If the units W and s are used the energy is in J, if the units KW and h are used the energy is in KWh)
- We pay for electricity per KWh, so to find the cost multiply KWh by the rate.

1. A flashlight bulb operates on 3.0V and draws a current of 4.0A. What is the power of the bulb? $P = V \times I = 3.0V \times 4.0A = 12W$

2. The Brighter the bulb, the more watts!