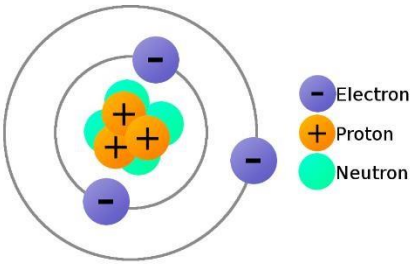
Gr8 Physics Term 3

Contents

TOPIC 7 ELECTROSTATICS (p125 – 134) p126 -129

Lesson 1 & 2 p126-129

eg. Lithium



Activity Class Discussion on p125 after reading the opening paragraph.

Normally atoms are Neutral, i.e. they have equal number of

– positively charged protons, p+ , in nucleus &

– negatively charged electrons, e- , occupying the rest of the atom.

Static electricity is the build-up of electric charges on the surface of a material, usually non-metals which do not conduct electricity. It works best in dry conditions.

Charging by friction: p126 & 127

When two different substances (usually non-metals) are rubbed against each other, electrons are rubbed off the one and onto the other.

The object losing the electrons (e-) becomes positively charged because they are losing negatively charged electrons.

The object gaining electrons (e-) becomes negatively charged.

Only the electrons move. The protons and neutrons are stuck in the nuclei of the atoms.

Forces between charged objects: (p128-129)

Charged objects exert forces on each other: (p128-129)

- Like charges repel and
- Unlike / opposites charges attract.

Activity 1: SEE VIDEO 8 Charging by Friction.

Your teacher will hand out the same equipment. Now try do the same thing yourselves in your group.

Discharge and sparks p130-131

Charged objects can be discharged. It can occur through solid, liquid or gas if the charge build up is big enough. Through air it is seen as a spark. The air particles glow when collided by electrons. It makes a snapping sound. A small spark is not dangerous. If you feel it with your finger it causes a reflex response, i.e. your muscles contract because of the electricity flowing through your body.

Examples of electric discharge:

- Sparks between hand and metal doorknob.
- Lightning – dramatic example in nature.
- Van Der Graaff generator.

Sparks can be dangerous when surrounded by flammable gases like petrol vapours or cooking gas.

Activity 2 SEE VIDEO: 8 VID Electro-statics demos 200421 PE. On M Drive, vip.arhs &

YouTube https://youtu.be/4NnhG9ciseU

SEE the following two pages for explanations

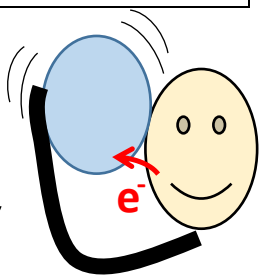
- Copy the annotated schematic drawings in your notebook. Even though they are given here in the notes, it's the attention to detail that you must make when you draw it, that helps you most to understand and remember it.
- HW L1 : Finish drawings & Try Activities 2 & 3: (p126 & 127) & Activities 4 & 5 (p129) on your own.

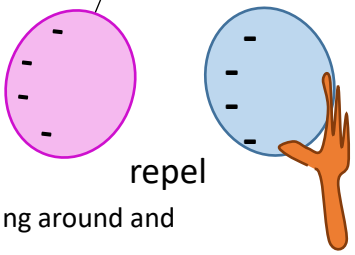
Demonstrations from the videos:

1. Balloons rubbed with your hair:
   Electrons transfer from the hair onto the balloon.
   Balloon becomes negatively charged 'cos it gained electrons (e^-)
   & hair becomes positively charged 'cos it lost electrons

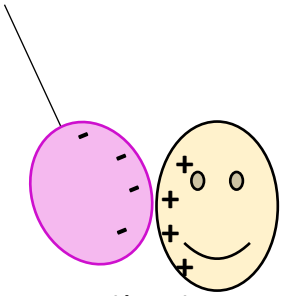
   Now like charges repel and unlike charges attract
   (similar to the poles of a magnet)

So, since like charges repel e.g both balloons are negatively charged and repel each other.





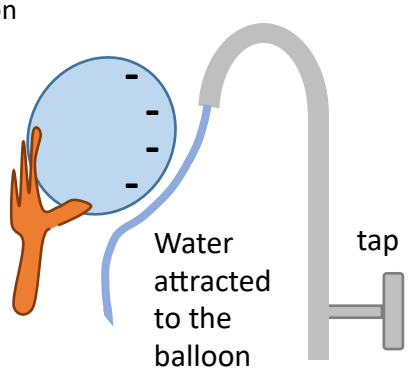
In video the balloon swung around and attracted to his hair

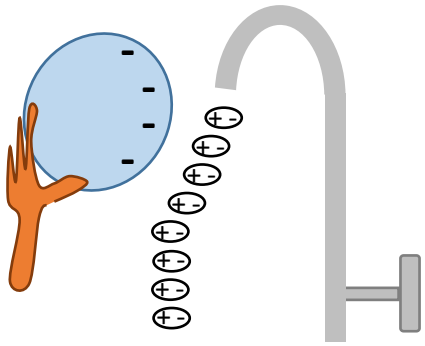


2. Balloon and water

Water molecules have a slightly positive side and slightly negative side

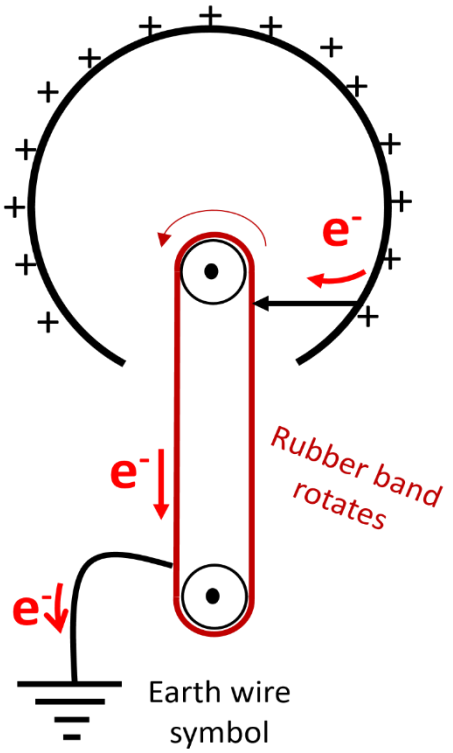
The particles of water all align themselves so that their positive sides are closest to the balloon and hence are attracted to the balloon





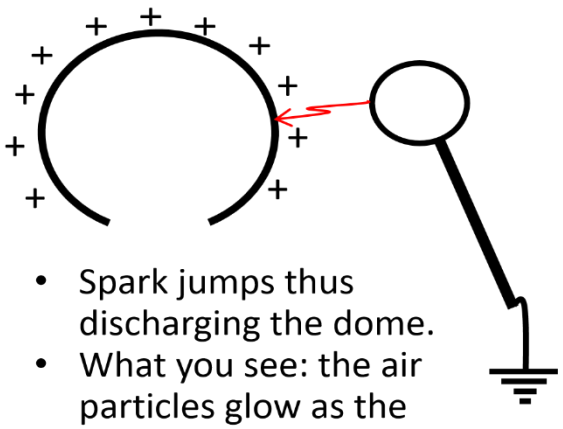
It's a similar argument for the balloon and little pieces of paper

3. Van Der Graff Generator.



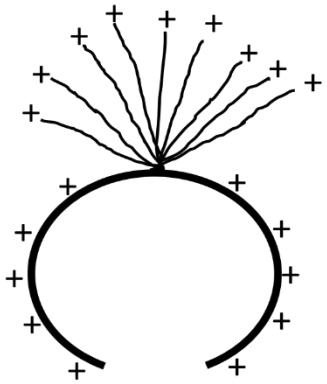
- Rubber band rotates. It rubs **e⁻s** off the dome & takes them to earth.
- This leaves a build-up of positive (+ve) charge on the dome

4. Discharge sphere

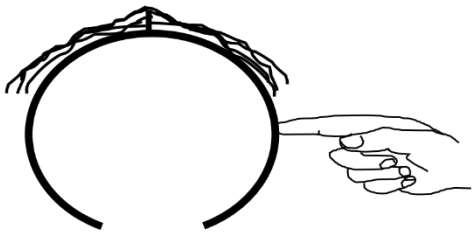


- Spark jumps thus discharging the dome.
- What you see: the air particles glow as the jumping **e⁻s** collide with them.

5. Head of hair



The strands of string stand up as they are all positively charged and repel each other



When the dome is discharged the hair strands collapse again

Note: Schematic diagrams only show a few of the charges in excess. In reality there are trillions of positive (p^+) and negative charges (e^-)

PRACTICE QUESTIONS **SET 1** for L1 & 2 [20]

1. True or False: Atoms are normally neutral? Explain your answer (2)
2. Define the term "static electricity". (2)
3. Based on your knowledge of charging by friction, answer the following:
   i) Briefly explain what happens when two non-metals are rubbed against each other. (2)
   ii) Briefly explain why the one object can now be referred to as "positively charged". (2)
   iii) Why can only the electrons move between two objects being rubbed together? (1)
4. Differentiate between the forces that two like charges exert on each other and two unlike charges exert on each other. (Simply answer with attract and repel in each case). (2)
5. Explain why a spark is seen when charged objects are discharged. (2)
6. Give ONE example of an electric discharge. (1)
7. By rubbing a ruler against a cloth, the cloth gains electrons. Briefly explain how this has occurred and which object is now positively charged and which is negatively charged. (3)
8. Draw a fully labelled diagram to represent your end result (i.e. after rubbing the ruler against the cloth) from question 7 above. (3)

L3: Discharges & Lightning

Discharges were explained on p2 of these notes.

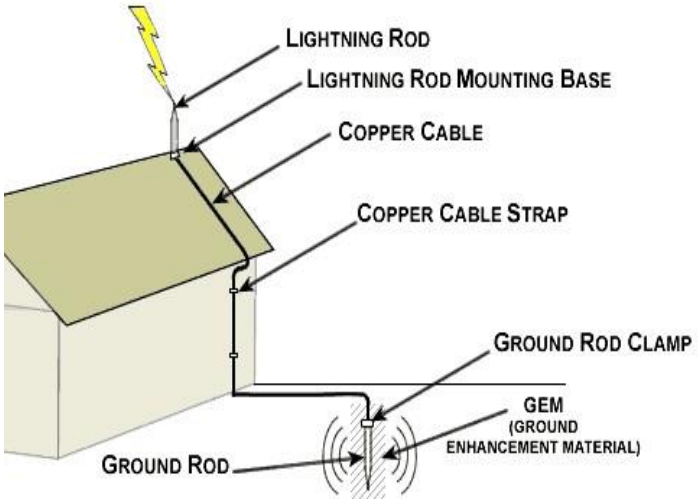
Activity: Classroom Discussion *READ p132-133 and the summary notes below.*

Lightning is a dramatic discharge in nature.

- Clouds become charged due to the collision of liquid water and ice particles within the cloud.
- Electric discharge (lightning) then occurs either between two clouds, called sheet lighting, or the cloud and the ground, called fork lighting.
- We hear the lightning as thunder.
- Sound travels at ≅ 300 $m.s^{-1}$ (metres per second), whilst light travels at 300 million $m.s^{-1}$
- By counting the number of seconds between lightning & thunder you can estimate how far away the storm is. E.g. 10 second delay ⇨ 3000m = 3 km away.

Dangers:

- A lightning bolt can be hotter than surface of sun > 20,000^{0}C
- When it strikes a tree the liquid and gas in the tree explodes blowing parts of the tree away. These projectiles can hurt you.
- Also, lightning can jump from the tree to a person under the tree.



Prevention:

There are all sorts of traditional ideas about lightning. Science understands the above explanation.

A building can be protected by a **lighting conductor** which is metallic with sharp points mounted above the roof and attached to a thick copper cable that goes into the earth. Lightning will always strike the highest object in the area if it is made of metal.

Things to do and avoid:

- Stay away from trees.
- Remain inside a building or a car - A safe place is inside a closed metal container.
- Do not run – causes friction which could attract the lightning.
- Avoid using water – it conducts electricity. If swimming get out.
- Avoid using landline telephones.
- Unplug & switch off electronic devices. They can be damaged
- Switch all appliances off and remove their plugs from the wall sockets.

HW L3: *In your notebook do the revision exercises on p134 – Scientific language and Test Yourself Questions (textbook)*

Answers: to HW L3 Revision Exercises p134

1 Scientific language

a) An electron has a negative charge

b) The positive particle in an atom is called a proton

c) Like charges repel each other and unlike. charges attract each other

d) The build up of electrons in an object is called static electricity

e) Friction does not create charges, but separates them.

f) Lightning is a form of natural static electric discharge.

g) Discharge of electrons can cause shocking or shocks of static electricity.

Test Yourself

1. Electrons are negatively charged and occupy space round the nucleus of an atom. They can be rubbed on or off. Protons are heavy positive charged particles in the nucleus of atoms. They cannot be rubbed on or off.
2. Friction can rubbed electrons on or off they charging an object.
3. Discharge causes a spark. It's when electrons return to neutralize any charge.
4. A charge object will induce a charge in another such that opposites attract. Same for small pieces of paper that stick to a charged ruler.
5. If lightning strikes the tree it can explode and the lightning can jump onto you.
6. It will attract the can so that it rolls along a smooth surface.
7. They repel each other.

NOT examinable – for enrichment only: A rubbed balloon becomes charged. Why it sticks to the wall is the same reason the small pieces of paper stuck to it in the Demos Video Mr Mac made.

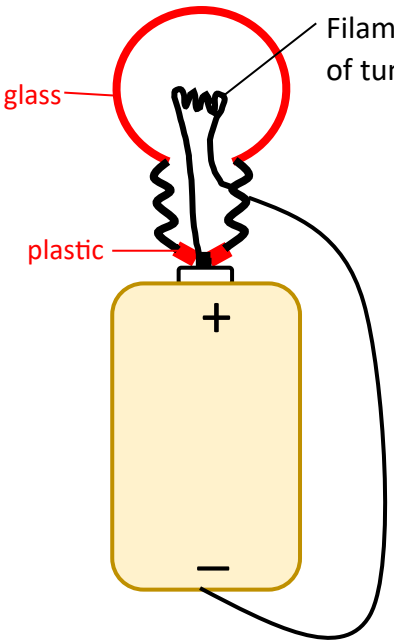
> *It's quite hard to explain. Usually, we focus on it in higher grades. The charged balloon induces a dipole effect in the molecules of the paint on the walls. A dipole means two poles: one side slightly positive and the other slightly negative. Then the balloon is attracted to the side of the molecule oppositely charged to itself. This is similar to the demo's in the video of the water stream bending to the balloon and the pieces of paper sticking to the balloon NOTE: QUESTION 4 & 6 ARE TOO HARD FOR A TEST SITUATION IN Gr8.*

TOPIC 8 CIRCUITS & CURRENT ELECTRICITY (p135-152)

L4: *INVESTIGATION:*

Part 1. *You are supplied with a torch cell, bulb and single piece of wire. Try to get the light bulb to shine / glow / burn / light up. When successful draw the arrangement in pencil in the space below.*

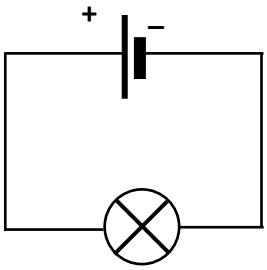
Schematic drawing of a simple circuit that will get a bulb to glow / burn / shine.



Filament. Traditional **incandescent** bulbs have filaments made of tungsten that glows white hot.

Key: **Red Parts** are insulators / non-conductors
Black Lines are conductors (metal)

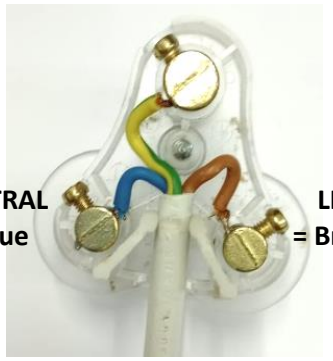
Notice how the current exits out the top (+) of the battery, goes up through the filament, out the side of the bulb and down the wire back into the bottom (-) side to the battery
There are chemicals in the cell / battery. When the chemicals react, they give the charges energy to move around the circuit.



Same circuit using symbols

Part 2. *You are supplied with a 3 prong plug with wires attached. It is probably incorrectly wired. Try to figure out which wire is attached to which plug. Once you've made your prediction you can open the plug to see if you were correct. The correct wiring is:*

EARTH = Green/Yellow



NEUTRAL = Blue

LIVE = Brown

Current Electricity

Electric current is the flow of charges through a conductor (pathway). This is very useful electricity that we use every day.

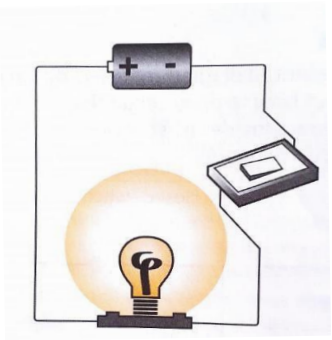
In metal conductors it is the electrons that move from atom to atom in the conducting wire. The protons are stuck in the nuclei. Protons can't move.

In science we often use **analogies**. An analogy is a comparison with something simple that we do understand. We use them to understand more difficult concepts.

A good **analogy** for electric current is water flowing in a hose pipe Current is the flow of charges (electrons) in a conductor.

SEE figures 4 & 5 p137 that shows how a cell or battery is connected to a bulb and a switch with connecting wires.

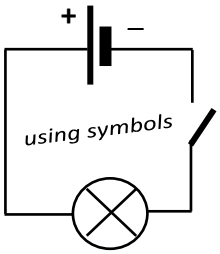
Circuits:



- Components are connected to form a circuit (pathway) through which current flows.
- Requirements:

1. There must be a source of energy e.g. a torch cell in the circuit alongside.
2. Current can only flow when the circuit is complete / a closed circuit

- A switch is used to control the current. It does so by completing or breaking the circuit.
- When the switch is:
  - closed / ON the circuit is completed / closed and current does flow.
  - open / OFF the circuit is incomplete / broken and the current NOT flow.



Components of circuits p138-143

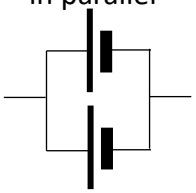
Instead of drawing what the components look like we use **symbols**. It makes circuits easier to draw and understand.

Cell + –

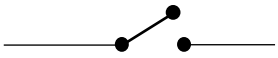
A **Battery** is a combination of cells.
They can be connected in two ways:

in series

in parallel



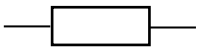
Switch



open

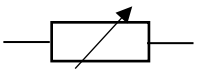
closed

Resistor



A resistor resists current, limits its flow. All appliances have resistance. The bigger the resistance the lower the current strength.

Variable Resistor



called a rheostat

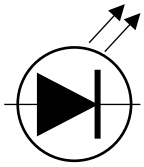
Eg. Temperature control on stove. Volume control on radio. Dim switch on a light.

Bulb

A bulb is a type of resistor. Old style bulbs, called incandescent bulbs, make light by glowing white hot. More than half the energy is lost as heat.

More common now-a-days

LED



Light Emitting Diode

PRACTICE QUESTIONS SET 2 **TOTAL: [21]**

1. Briefly explain the cause of lightning. (3)
2. What can be used to protect a building during a lightning storm? (1)
3. Provide the function of this object in question 2 above. (2)
4. Mention two things to do or avoid during a lightning storm. (2)

Circuit Questions

5. Give the function of the filament in a light bulb. (1)
6. Explain how a battery or cell works in a circuit by referring to the chemicals within the battery or cell. (2)
7. Provide the definition for current electricity. (2)
8. Provide two requirements for current to flow through a circuit. (2)
9. What is the function of a switch in a circuit? (1)
10. Draw the circuit symbols for the following:
    i) An open switch
    ii) Two cells in parallel
    iii) A light bulb (3)
11. Differentiate between the function of a resistor and a rheostat. (2)

L5: Conductors, Insulators & Resistors

Conductors allow charges to flow through them. i.e. they conduct electric current.

Recall the Analogy: Electric current is like water flowing through a pipe.

All metals are conductors. Copper is most commonly use because it doesn't rust easily.

- Semi metals conduct under certain conditions. These are used in electronic components.
- Graphite, a form of carbon (pencil lead), is the **only non-metal** solid element that is a conductor.
- All salt solutions (dissolved in water) are conductors. This is why electricity can flow through your body and why it is potentially dangerous.

Insulators do NOT conduct electricity. Examples are: plastic, rubber, ceramics, glass etc...
This is why electrical wires are covered with plastic thus insulating them to prevent them from making contact with the wrong things.

Resistors are conductors that limit the flow of charges to some extent. They are useful for controlling the current strength and convert the energy into other forms. E.g. The element of a kettle converts electricity into heat. The filament of a bulb converts it into heat and light and a motor into motion / kinetic energy

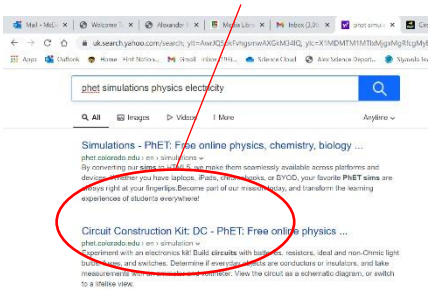
Analogy: squeezing or kinking a hosepipe is like adding a resistor to a circuit. It slows the flow of water through the hose pipe.
A resistor lowers the current, i.e. it slows the flow of charges through the conductor

CIRCUIT BUILDING TASK *(in notebook): Draw a circuit containing two cells in series, two light bulbs in parallel each with their own open switch and another main closed switch that can turn both bulbs off & on. Now* ***build and test*** *your circuit design. Options:* ***circuit boards*** *if available / teacher demo / PhET simulation*

Try this on your own device and for HW using Phet Simulation

"Virtual Electricity Lab" *click on the following URL or Google "phet simulations" and follow the instructions below https://phet.colorado.edu/en/simulation/circuit-construction-kit-dc*

- *Google "phet simulations physics electricity"*
- *then click "Circuit Construction Kit: DC…" then Click "play arrow" or "DOWNLOAD"*



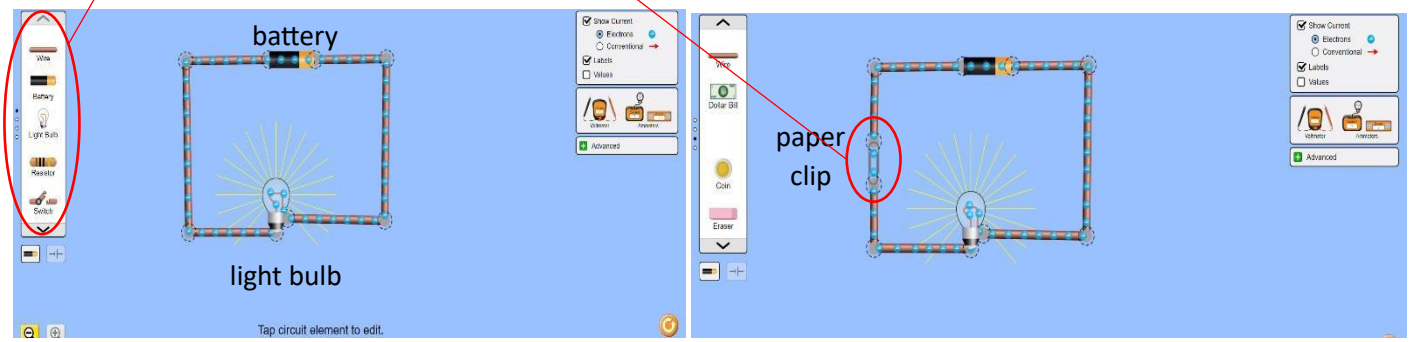
then choose _____ *"lab" option*

- *"DOWNLOAD" means being able to do it again and again without using data. The files are surprizing small, 2 Mb.*
- *Now you can start dragging components into the space and build circuits*

- ***INVESTIGATION: for PhET Simulation or circuit-board***

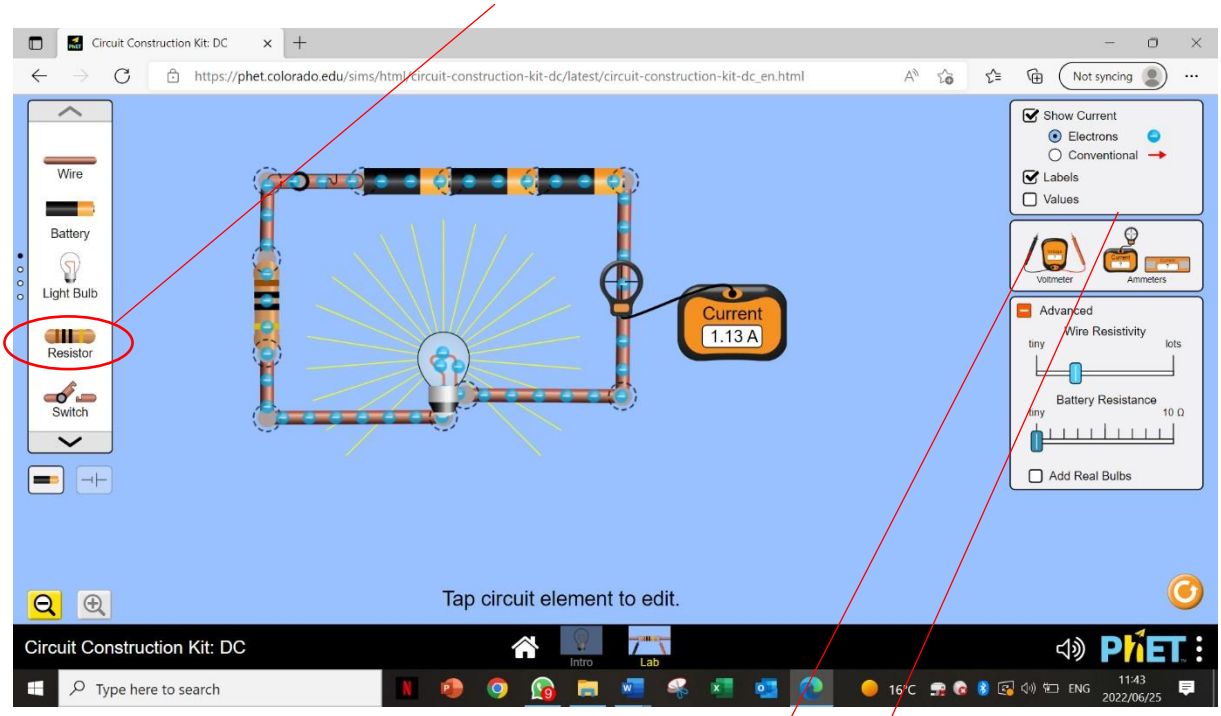
1 *Build a **circuit** with a cell and a bulb only and see how the current flows.*

2 *Now you can try different components / things by scrolling the menu on the left hand side (LHS), to see if they conduct or not, like the paper **clip** in this drawing.*
Try the coin, dollar bill, paper clip, rubber, hand, dog, pencil



3 *What conclusions can you draw about the types of substances that conduct electricity? Compare this with the notes p8.*

4 *SEE Activity 4 p140 (textbook). Build the circuit described (as seen below). **"Nichrome"** is a type of resistance wire. So, choose the **resistor** component.*



5 *Vary the resistance of the resistor by clicking on **"Advanced"** on the RHS and see how varying its "wire resistivity" affects the brightness of the bulb. Also use the **ammeter** which measures current strength. What can you conclude?*

***Complete** the **CONCLUSION** (by filling in the missing words)*

Increasing the **resistance** causes the **current** strength to decrease causing the bulb burns dimmer And, Decreasing the **resistance** causes the **current** strength to increase causing the bulb to burn brighter.

Energy Transfers & Effects of Electricity

Sources of electricity

1. **Cells** use stored chemical potential energy to make electricity. They make electricity that moves in one direction. This is called Direct Current, DC.

   Batteries are a combination of more than one cell. E.g. a car battery has 6 cells of 2 volts each, making a 12-volt battery.

2. **Generators** – use spinning magnets to make electricity. Some generators like Eskom's make alternating current (AC) that changes direction 50 times per second. Others can make direct current (DC) like those in wind turbines.

> *Whilst you are not required at this stage to know about the difference, between AC and DC, it is important to know that all electronic appliances only work with DC. In your cell phone charger, there is a transformer and rectifier that converts Eskom's electricity to the correct strength DC. So don't plug the wrong things into mains electricity.*

3. **Solar panels** - are lots of photovoltaic (PV) cells joined together. We have these on the roof of the school. They convert light into electric current. Suitable for low powered appliances.

Energy Changes

Cells are the 'providers' of energy for the circuit. They convert chemical potential energy into electrical energy. Electrical energy is actually the kinetic (moving) energy of the charges that flow through the circuit. Appliances and resistors are the 'users' of electrical energy. They convert electrical energy into other forms, e.g:

- Kettle element (electrical energy is converted to) ⇉ heat
- Bulb filament " " ⇉ heat & light
- Motor " " ⇉ motion which is kinetic energy
- Speaker and buzzer " " ⇉ sound

Effects of an Electric Current p144-152

1 Heating effect p144

The filament of an incandescent bulb is made of tungsten, a hard metal with very high melting point. It glows white hot when electricity flows through it.

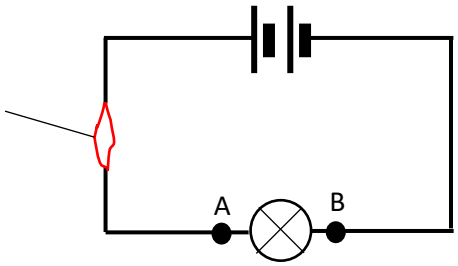
Now-a-days it is wise to install low powered LEDs instead. They are electronic components that make light in a completely different way. They don't make heat thus saving energy. They are up to 20 x more efficient. Appliances that 'use' the most electricity are those that make things hot like: geysers, stoves, ovens, kettles & heaters and also making things cold like: fridges, freezers and air conditioners.

A lot of electricity can be saved at home by installing a solar geyser.

Short Circuits

Apart from appliances that make heat, it is important to mention what happens when a short circuit occurs because this can be dangerous.
The current is controlled by the resistance in the circuit. If, however, a short circuit occurs the current surges (gets very big). This can cause problems, sparks and even an electrical fire.
To protect the circuit fuse or trip switch (circuit breaker) is included in the circuit.

Demo: Build the following circuit.
Once the bulb is shining add a connector between point A and B thus creating a short circuit around the resistance of the bulb.
Ques. What happens and why?



SEE Demo VID: How a Fuse Works *on MDrive* & https://youtu.be/xuCQ4eZmRSw

Lesson 7: Effects of an Electric Current continued p144-152

2 Magnetic effect p145-146

Electric current (moving charges) induces a magnetic field around the conductor.

SEE Video on Magnetic Fields

PRACTICAL INVESTIGATION: *Making an electromagnet (read p150-151)*

- *You performed this prac last term Re-do the following in your notebook.*
- Remember the scientific process:
- Investigative Question (or Aim) → Hypothesis → Method → Results → Conclusion.

1. Write a Hypothesis for the investigation for the effect of both the number of coils (windings) and the number of cells. (2,2)

2. Variables: What is/are the:

2.1 Independent variables? (2)

2.2 Dependant variable? (1)

Results Table:

No. cells			1 cell	2 cells	1 cells	2 cells
No. coils / turns around the rod			20 turns	20 turns	40 turns	0 turns
No. nails held	trial	1	10	15	16	38
		2	13	15	22	43
		3	9	17	27	42
	ave		11	16	23	41

Conclusions

1. *The more cells (the ……..the current) the more nails are held (the ……. the electromagnet)*
2. *The more the coils the more nails are held (the …… the electromagnet)*

An Electromagnet can easily be made by winding a copper wire around a soft iron rod and passing electricity through the wire. Advantages of an electromagnet over a permanent magnet are that:

a) It can be switched ON and OFF

b) Its strength can be varied / adjusted. Adding more coils or increasing the current (e.g. adding batteries), makes it stronger.

c) Its poles can be swopped i.e. north pole can become south pole and vice versa

Application:

A circuit breaker (trip switch) contains and electromagnet. When the current gets too big the electromagnet pulls the lever in the circuit breaker down thus breaking the circuit and switching it off.

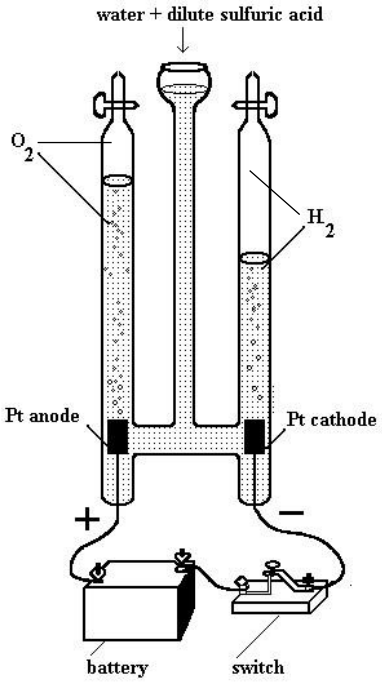
L8: Effects of an Electric Current continued

3 Chemical effect p147

- Electricity can cause a chemical reaction to occur and is called …electrolysis.
- Recall the electrolysis of copper chloride and water (Hofmann Apparatus) when electrodes are place in solutions. In each case the compound was decomposed into its elements.

P147 shows how water (H_2O) is decomposed into its elements hydrogen (H_2) and oxygen (O_2) which are both gases.

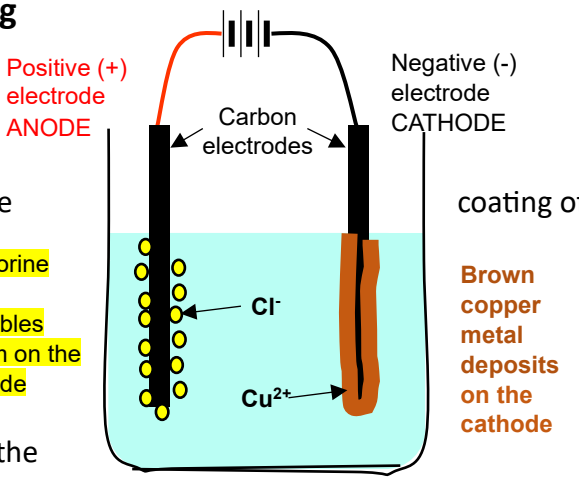
- We used the Hoffman Apparatus because it collects the gases separately &
- Easy to see the 2:1 ratio of H_2 : O_2



Electroplating

Precious metals are often coated onto cheaper metals to keep costs down.

This is like the coating of copper on the carbon electrode in the diagram above.



Chlorine gas bubbles form on the anode

Brown copper metal deposits on the cathode

P147 shows how the compound decomposed into its elements solid metal and chlorine (Cl_2) which is a gas

Examples:

- Chrome plated exhaust pipes and fittings on motor bikes and old cars.
- Silver- and Gold-plated objects & jewellery.
- Copper and Nickel coated coins.

PRACTICE QUESTIONS SET 3

1. Give the function of a conductor. (1)
2. True or False: All metals are conductors. (1)
3. Give one example of a non-metal that can function as a conductor. (1)
4. Differentiate between a resistor and an insulator. (2)
5. Give one example of an insulator. (1)
6. Draw a circuit containing three cells in series, two light bulbs in parallel each with their own closed switch and another main open switch that can turn both bulbs off & on. (4)
7. Complete the following statement:
   _____ the **resistance** cause the **_____** strength to **decrease**

   causing the bulb burns **dimmer**. And **decreasing** the **_____** causes the

   current strength to _____ causing the bulb to burn **brighter**. (4)
8. Provide three sources of electricity. (3)
9. Provide the energy conversion that occurs in cells. (1)
10. Provide the energy conversion that occurs in a speaker. (1)
11. Describe what is meant by a short circuit? And how do we protect the circuit when there is a short circuit? (2)
12. Describe how to make an electromagnet. (2)
13. Give THREE advantages of using an electromagnet. (3)
14. Define the term “electrolysis” (1)
15. What is the function of the Hoffman apparatus? (1)
16. Provide the products of copper chloride decomposition. (1)
17. Provide the definition of electroplating and provide an example of a substance that can be used to electroplate coins. (2)

_____

Series and Parallel Circuits p153-162

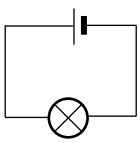
A **series circuit** has only one pathway. When resistors are added in series the total resistance of the circuit increases.

Analogy: It's like kinking the hose pipe twice there is even more resistance and less water flows. This is like having two resistors in series. If the resistors are light bulbs, then they will burn less brightly when the second bulb is added in series.

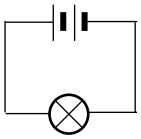
Practical Circuit-Board INVESTIGATION

Build the following circuits and note the brightness of the bulbs each time

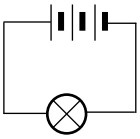
1. Adding Cells in Series



…dim..



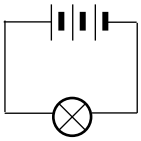
…brighter.



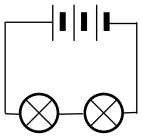
..brightest..

Adding **Cells in SERIES** increases the energy given to the charges (called voltage) thus, the **current** increases, thus the **bulbs burn** brighter

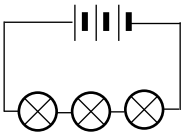
2. Adding Bulbs (Resistors) in SERIES



…bright...



…dimmer..

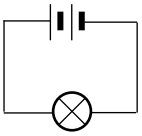


…dimmest..

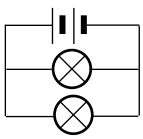
Adding **bulbs in SERIES:**

increases the **resistance** thus, the **current** decreases, thus, the bulbs burn dimmer.

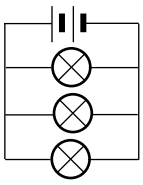
3. Adding Bulbs (resistors) in PARALLEL



bright



bright



bright

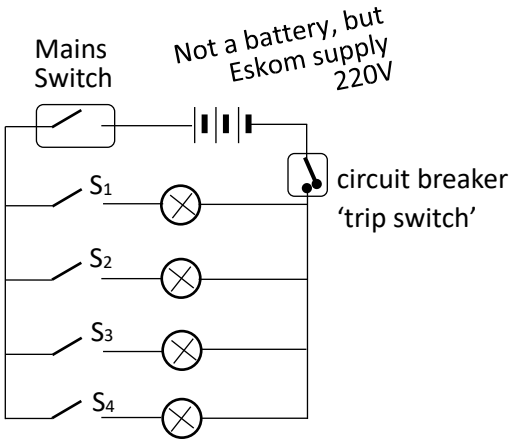
Adding **bulbs in PARALLEL:**

The bulbs stay bright. The **total resistance** decreases (because we're adding extra pathways) thus causing the **total current** to increase.

Analogy: its like adding extra check-out counters at supermarket

In your House:

The circuits in your home are all parallel circuits. Usually, your lights are all on the same circuit with separate switches for each light and a mains switch at the distribution board (DB board). The danger in adding too many high powered appliances on one circuit is that the current can get too big. This is the reason for the circuit breaker that 'trips' and protects the circuit.



Consider 4 lights in a home: the circuit looks like this one.

- The mains switch must be on for bulbs to shine.
- The other switches each control separate bulbs.

Prac: Using the circuit boards

Build a circuit with 2 cells in series & 2 bulbs in parallel, each with their own switch and a mains switch.

Then insert an ammeter and see what happens to the reading when the second bulb is switch on.

***NB COMPULSORY ACTIVITY - Do Topic 9 Revision p162* in your notebook**

Home* INVESTIGATON – *use the same Phet Simulation as before

Before starting some further information: (not for assessment but useful for understanding the investigation)

- *The 'power' of a battery is called **voltage** and is measured in **volts** by a voltmeter connected in parallel (Analogy: pressure causing water to flow)*
- *The **current** strength is measured in **'amps'** by an ammeter, connected in series (Analogy: rate of flow of water in a hose)*

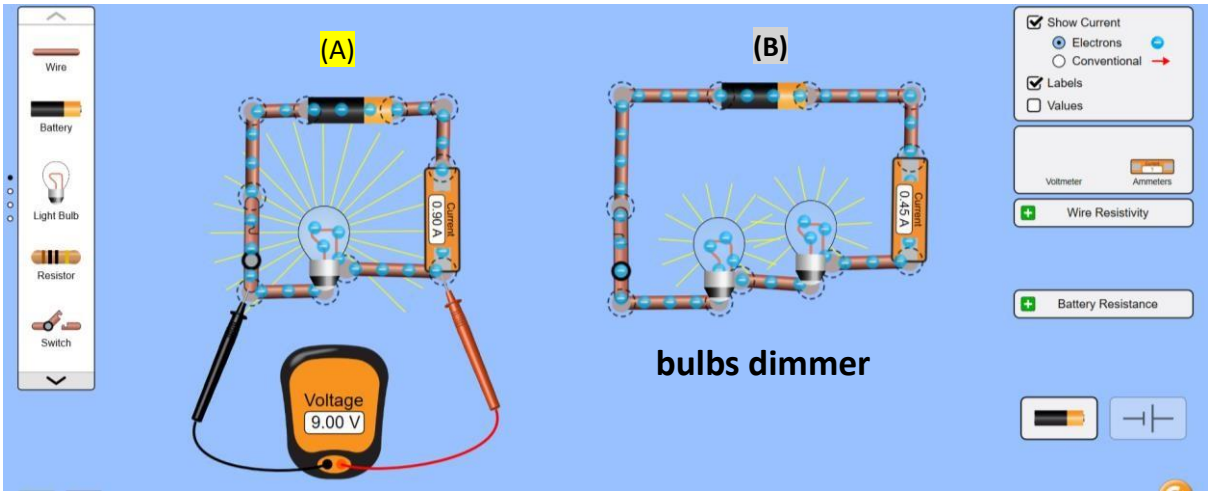
***Aim:** To compare adding bulbs in SERIES with adding bulbs in PARALLEL*

1 BULBS in SERIES

i. Build the two circuits shown below:

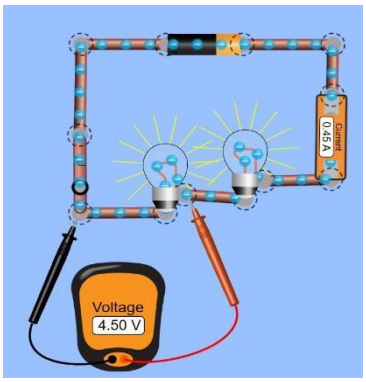
- *circuit (A) has only 1 bulb* *(B) has 2 bulbs in series*

ii. Compare the brightness of the bulbs, the ammeter readings and the voltmeter readings each time



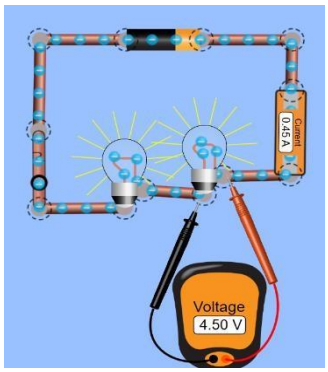
iii. Measure the voltage across each bulb and both together. What do you notice?

- To measure the voltage in circuit (B) you need to move the two electrodes of the voltmeter each time like those shown in the diagrams below



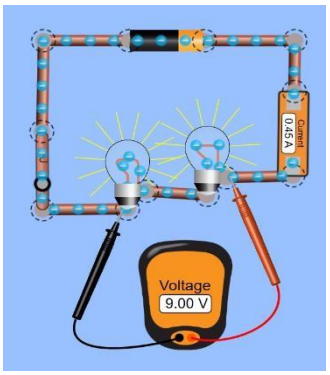
voltage across LEFT bulb

V = 4.5 V



voltage across RIGHT bulb

V = 4.5 V



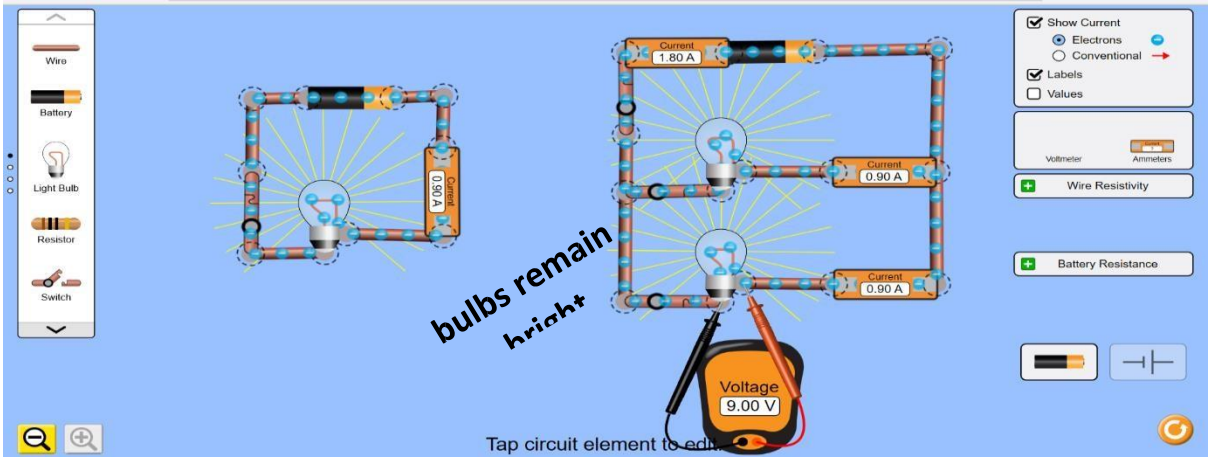
voltage across BOTH bulbs

V = 9.0 V

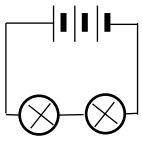
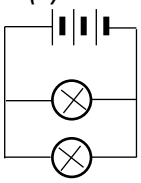
2 BULBS in PARALLEL

i. *Delete circuit **(B)** and create circuit (C).*
   - *It has 2 bulbs in parallel*
   - *3 switches (a main switch, and one for each bulb)*
   - *3 ammeters (one between the main switch and battery. The other two for each bulb's separate pathway)*

ii. *Compare the ammeter readings and brightness of the bulbs. What do you notice? iii. You'll notice that the voltmeter reading across each bulb is the same as across the battery.*



L11: SUMMARY of comparison between SERIES and PARALLEL (do your table like this)

Connection resistors in:	
SERIES	*PARALLEL*
e.g. only 1 pathway • *current everywhere the same*  • *Bulbs get brighter or dimmer or stay the same????* • *Etc….*	• *multiple pathways* • *current splits – some charges flow through the one appliance whilst others flow through the other appliance(s)* 

(IMPORTANT TABLE TO KNOW)

When you are done with the Phet Simulation Investigation make a summary in the form of a table
contrasting series and parallel connections of light bulbs (which are a type of resistor. All appliances are types of resistors). Include drawings of circuits using symbols. SEE example below

Leave space below the table to add or correct things when back in class with your teacher, i.o.w. do the table on the top half of the page and leave the rest blank.

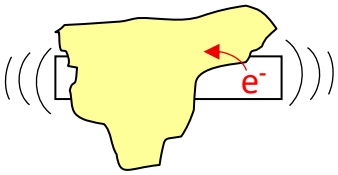
Answers: TO PRACTICE QUESTION SET 1

1. True – neutral atoms have an equal number of protons (positively charged particles in the nucleus) and electrons (negatively charged, occupying all the space in the atom).
2. Build up of charge (electrons and protons) on the surface of a material, usually a non metal.
3. i) electrons are transferred from one object to another

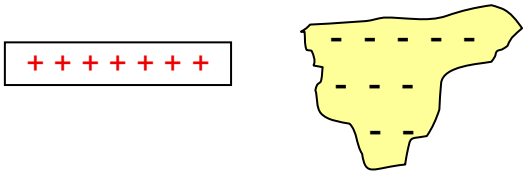
   ii) The one losing electrons becomes positively charged. The one gaining electrons becomes negatively charged

   iii) Protons are stuck in the nucleus of atoms. When touching atoms you can't get past the electrons.
4. Like charges repel. Unlike charges attract.
5. If the charge build up is big enough Electrons can jump a gap. In the air they bump into air particles causing them to glow.
6. Lightning. Getting a small shock after dragging your feet on a carpet and touching a metal door handle.
7. Electrons are negatively charged. Cloth rubs electrons off the ruler. Cloth thus gained electrons and is negative. The rule has lost electrons and is positive.

Rubbing



End results after rubbing



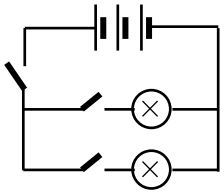
Answers to PRACTICE QUESTIONS SET 2

1. Clouds become charged due to the collision of liquid water and ice particles within the cloud and electric discharge (lightning) then occurs either between two clouds (2)
2. A lighting conductor / lightning rod (1)
3. It is a sharp metallic conductor mounted on the roof of a building that transfers the lightning into the earth. Lightning strikes the highest point – provided by the rod (2)
4. Stay away from trees.
   - Remain inside a building or a car - A safe place is inside a closed metal container.
   - Do not run – causes friction which could attract the lightning.
   - Avoid using water – it conducts electricity. If swimming get out.
   - Avoid using landline telephones.
   - Unplug & switch off electronic devices. They can be damaged
   - Switch all appliances off and remove their plugs from the wall sockets. (any 2) (2)
5. It is a conductor that glows white hot in the bulb to give off light (1)
6. There are chemicals in the cell / battery. When the chemicals react, they give the charges energy to move around the circuit. (2)
7. Electric **current** is the flow of charges through a circuit (pathway). (2)
8. There must be a source of energy
   Current can only flow when the circuit is complete / closed (2)
9. To complete / close the circuit (if it's a closed switch) OR it is used to control the flow of current. (1)
10. See page 9 of teacher's guide OR page 8 and 9 of pupil's guide. (3)
11. A resistor slows down the flow of current
    A rheostat controls the resistance (either increase it or decrease it) (2)

Answers PRACTIC QUESTION SET 3

1. Conductor allows current to flow in a circuit
2. True – all metals are conductors
3. Graphite is only non-metal element that conducts electricity. Salt water also conducts.
4. Resistor is a conductor that limits the current. An insulator does not conduct electricity at all.
5. Examples of insulators: plastic, glass, rubber.

Ques 6.



7. INCREASING the **resistance** cause the CURRENT strength to **decrease**

   causing the bulb burns **dimmer**. And **decreasing** the RESISTANCE causes the

   current strength to INCREASE causing the bulb to burn **brighter**.

8. Electrochemical cells / battery, solar panels made of PV (Photo-Voltaic) cells – both make DC (Direct current)

   Generator – eg. Wind turbine, ESKOM, car alternator that re-charges the battery.

9. Chemical potential energy is converted to electrical energy (which is kinetic energy of the moving charges).
10. Speaker: electrical energy → sound energy
11. When wires touch by-passing the resistors (appliance) in the circuit. Usual occurs by mistake. It causes the current to surge suddenly. We protect the circuit with a fuse (which melts) OR a circuit breaker (which "trips") which breaks the circuit.
12. Wind insulated conductor wire around an iron core and connect to a battery.
13. Advantages of an electromagnet: 1. Can turn it on and off, 2. can swop its poles (north becomes south), 3. Can vary its strength by changing the current strength.
14. Electrolysis – A chemical reaction caused by electricity. Examples done: Decomposition of: copper chloride and water.
15. Hoffman apparatus – to demonstrate the electrolysis of water. The hydrogen and oxygen gases are collected separately.
16. Copper chloride reacts to form → copper and chlorine.
17. Electroplating uses electrolysis to coat metal things with more precious metals. Eg. Nickel coated coins (the silvery ones like R1-00 and R2-00 and R5-00)