

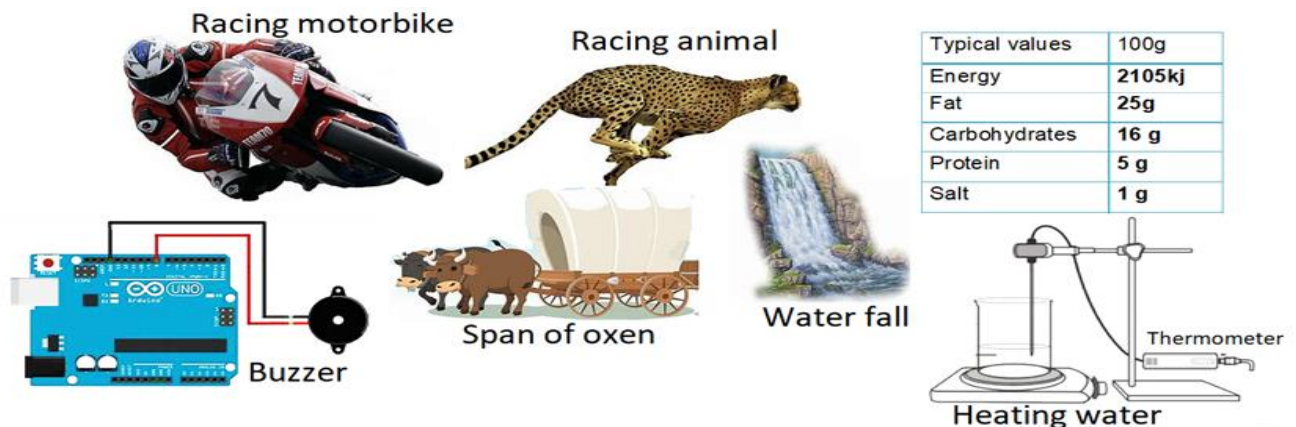


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ENERGY AND CHANGE

POTENTIAL AND KINETIC ENERGY

- (a) Kinetic energy is energy in moving bodies or objects.
- (b) An object only has kinetic energy if it is moving.
- (c) Water falls, running athletes, racing cars, electric current are some of the examples that represent kinetic energy.
- (d) Potential and kinetic energy is also found in thermal (heating) systems, biological systems, e.g. oxen pulling a wagon.
- (e) The oxen (biological system) have potential energy which they use to produce kinetic energy (movement energy).
- (f) According to the law of conservation of energy, energy cannot be created or destroyed but can only be converted (changed) from one form of energy to another, e.g. electrical energy to heat energy, sound energy or kinetic energy (movement energy).
- (g) A motorbike burns fuel (chemical potential energy) to produce kinetic energy (movement energy).



Answer the following questions

1. What is kinetic energy?

- Kinetic energy is the energy in moving bodies / objects.

2. Specify the type of objects that have kinetic energy.

- An object only has kinetic energy if it is moving, e.g. water falls, running athletes, racing cars, electric current etc.

3. What type of system is represented by the span of oxen? Explain how the system works in this case.

-
- Biological system

4. What type of system is represented by the heating of water?

-
- Thermal system

5. The table in the figure is a label from a food package. How much energy is in this food package?

-
- The energy in the package is 2105 kJ

6. Mechanical energy is the sum of potential and kinetic energy in an object. Discuss how the waterfall represents mechanical energy.

-
- When the water falls it has potential energy but that changes to movement (kinetic) energy as the water falls.

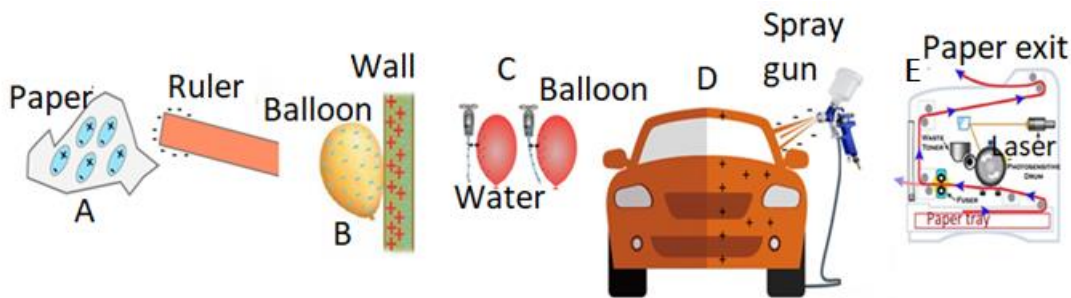
7. State the law of conservation of energy.

-
- The law of conservation of energy, energy cannot be created or destroyed but can only be converted (changed) from one form of energy to another.

STATIC ELECTRICITY

Friction and static electricity

- When materials are rubbed against each other, electrons are transferred from one material to another.
- The material that loses electrons becomes positively charged while the one gaining electrons becomes negatively charged.
- The transfer of effect of electron transfer can be easily observed in materials such as plastic, perplex, glass, wool, nylon and silk materials.
- When charged, materials with the same charge repel while opposite charges attract.
- Laser printer uses static electricity dry ink powder called a toner to produce an image.



Answer the following questions:

- What happens when materials are rubbed against each other?
_____ (Some lose electron while some gain electrons resulting in them being electrically charged)
- Give examples of materials that can easily gain or lose electrons. _____
(Balloon, plastic ruler, perplex, glass, wool, nylon and silk materials)
- How do materials become either positive or negatively charged?_
(Gaining electrons the material becomes negatively charged and losing electron it becomes positively charged)
- Which type of a printer uses electrostatics to make images? _____ (Laser printer)

5. Looking at the diagram, explain what is happening in:

5.1 A

-
- An electrically charged balloon makes the can to move

5.1 D

-
- A paint gun discharges negatively charged paint particles towards a positively body of a car which attracts them.

5.2 E.

-
- Laser printer uses static electricity dry ink powder called a toner to produce an image

5.3 Try and do activities in A, B and C

5.4 An electroscope is an object that can test if an object is charged.

The two leaves open up if a charged object touches the metal knob or ball. Try and design your own electroscope and test it in your class.

5.5 Do a research on how a laser printer works. Present your findings in class with your partner.

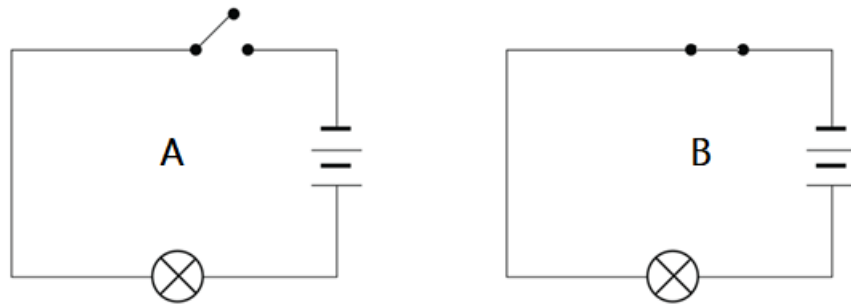


5.6 Explain how a paint gun works._

-
- Converts fluid paint into tiny droplets. The paint is charged and propelled through the gun, rubbing and gaining the same charge on its way out. Since the paint particles are now charged, they can now be attracted to a surface with a different charge.

ENERGY TRANSFER IN ELECTRICAL SYSTEMS

- (a) An electric circuit is a closed loop that helps with the transfer of electrical energy.
- (b) A circuit can at one stage be open (no flow of electric current) or closed.
- (c) A flow of charges in an electric circuit is known as **electric current**.
- (d) For electric current to flow in an electric circuit, there must be a chemical reaction which produces the current.
- (e) The components of an electric circuit include a source of energy, conductors and resistors.



Use the diagram to answer some of the following questions:

1. What is an electric circuit?

-
- An electric circuit is a closed loop that helps with the transfer of electrical energy.

2. Discuss the difference between a closed and an open electric circuit.

-
- A closed electric circuit allows a flow of electric current while an open electric circuit does not.)

3. What are some of the components of an electric circuit?

-
- The components of an electric circuit include a source of energy, conductors and resistors.

4. What is electric current?

-
- A flow of charges in an electric circuit is known as **electric current**

5. Discuss how electric current is produced in an electric circuit?

-
- It is produced from a chemical reaction which produces current

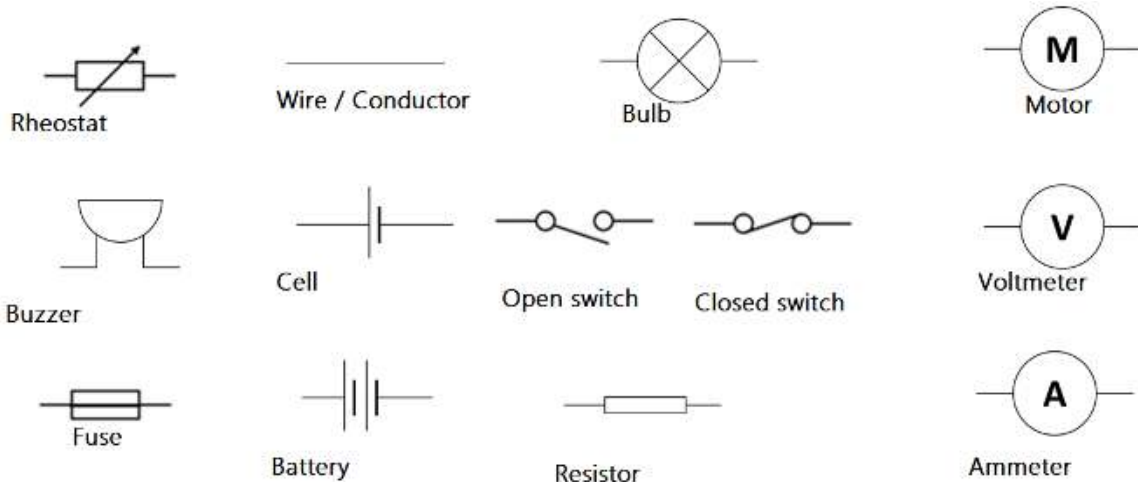
6. Mention and discuss two differences between circuit diagram A and B.

-
- A is an open circuit while B is a closed circuit
 - Current flows in B but not in A

COMPONENT OF AN ELECTRICAL SYSTEM

(a) A circuit comprises energy sources (cell or battery), switch to open or complete the circuit and resistors (bulbs, kettles, stoves etc.).

(b) Symbols are used to represent different components of an electric circuit as shown:



Answer the following questions:

1. What is another name for a rheostat?_

- Variable resistor

2. What is the use of a rheostat?_

- To change the resistance

3. Give an example of where a rheostat is used._

- Radio volume control

4. What is the function of a switch in an electric circuit?_

- To complete or break the flow of electric current)

5. What is the function of a voltmeter in an electric circuit?_

- To measure voltage or potential difference)

6. How is an ammeter and a voltmeter connected in an electric circuit? _

- Ammeter in series and voltmeter in parallel).

7. What is a battery?_

-
- Two or more cells connected in series)

Study the diagram shown and answer the questions that follow:

Electric bulb



1. Which element is used in this electric bulb?

-
- Tungsten

2. What is the property that makes the element suitable to use in an electric bulb?

-
- High resistance

3. Why is glass used in an electric bulb?

-
- Glass is transparent and will allow light to travel through

4. What do you think is the use of the support wires in the bulb?

-
- Support the filament wire

5. Which two parts in this bulb work as the terminals?

-
- Electrical tip and metal cap or base

6. What is the use of the insulation in this bulb?

-
- To prevent short circuiting

7. Discuss how the bulb is able to produce light?

-
- The filament glows as it resists the flow of electrical current

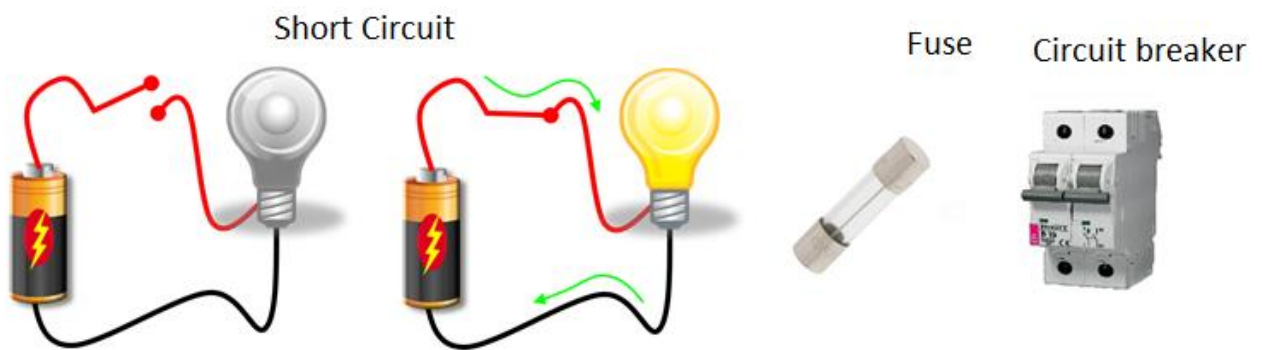
EFFECTS OF ELECTRIC CURRENT

(a) Effects of electric current are about what electric current can do.

(b) Electric current has the following effects:

- Heating effect – produce heat
- Chemical effect – can break down a compound and
- Magnetic effect – can make a material magnetic (magnetic effect).

(c) An electric circuit uses special wire known as a fuse.



(d) A fuse melts when there is a short circuit in the electric circuit.

(e) A short circuit is a path with the lowest resistance taken by electric current.

Answer the following questions:

1. What is the understanding of “the effects of electric current?”

- What electrical current can do / produce

2. Mention and discuss the three effects of electric current?_

- (Heating effect – can produce heat on the conducting material, Magnetic effect – can create a magnetic field on around the conducting material / create a magnet and Chemical effect – can breakdown a compound

3. What is a fuse?_

A fuse is a safety device connected to prevent fire during a short circuit

4. What is the function of a fuse?

-
- To prevent fire during a short circuit

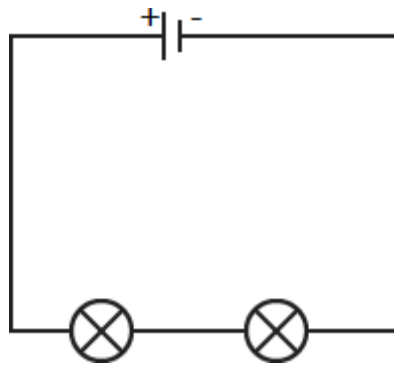
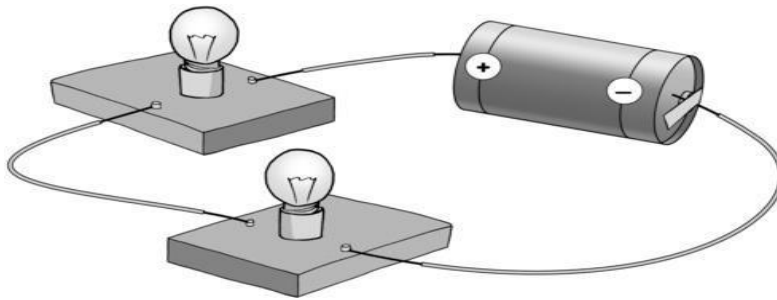
5. Do a research on where fuses are used.

-
- Radios, TVs, Cars etc.)

6. Explain what a short circuit is.

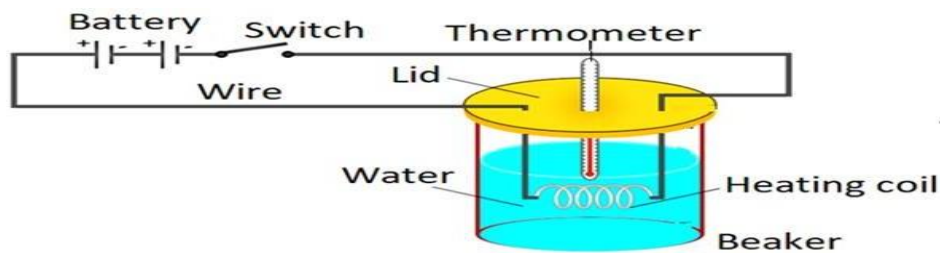
-
- Unintended path followed by electric current

Use the diagram shown to draw a circuit diagram.



EFFECTS OF AN ELECTRIC CURRENT – HEATING EFFECT

- (a) Electric current can generate heat.
- (b) The more resistance a material has, the more heat it will generate.
- (c) In a system below, the temperature of the water keeps increasing as the electric current flows through the coil.
- (d) The temperature of the water is recorded at the beginning and at 3 minutes intervals thereafter.



Answer the following questions:

1. What is the aim of this investigation?_

- To investigate the heating effect of a coil

2. What keeps the temperature increasing?_

- The electric current)

3. How does an open switch affect this investigation?_

- The system will not work

4. What is the purpose of having a thermometer in this investigation?

- To record the temperature changes

5. Why must the temperature be taken at the beginning of the investigation?

- To have a reference

6. What are your variables in this investigation?

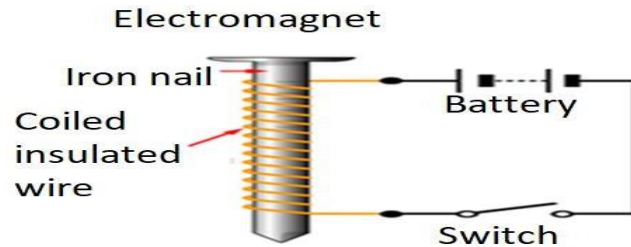
- The temperature

7. Discuss your findings.

- Temperature keeps increasing at each of the 3 minutes intervals.

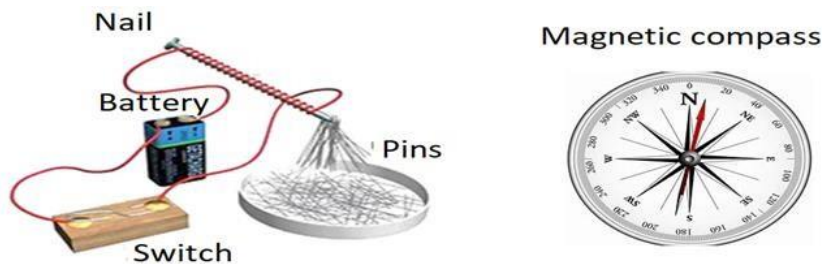
EFFECTS OF AN ELECTRIC CURRENT – MAGNETIC EFFECT

- Electric current can cause a magnetic field by creating temporary magnets.
- Moving electric current across a conductor creates a magnetic field.
- Such magnets are called electromagnets.



DESIGNING AN ELECTROMAGNET

- Look at the following diagram and design your own electromagnet.
- Work with a friend.
- Move a magnetic compass around and observe its effect on the compass.
- Now test it using pins or any magnetic material.



Answer the following questions:

1. What is the aim of this investigation?

- To investigate the magnetic effect of electrical current

2. What happens to the magnetic effect when there is no current flowing?

- The nail loses its magnetism / stops working as a magnet

3. What is your conclusion regarding the electromagnet?

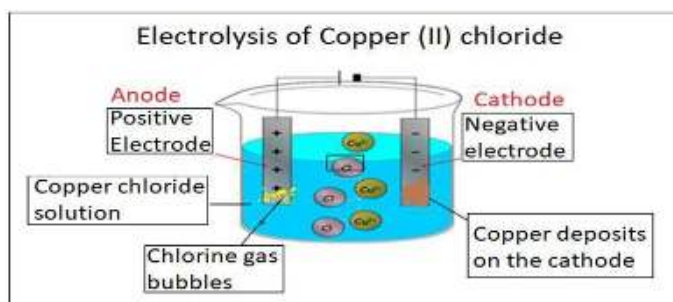
- It is dependent on the flow of electric current

4. Discuss the effect of the electromagnet on the magnetic compass.

- A magnetic deflects the compass

EFFECTS OF AN ELECTRIC CURRENT

- (a) An electric current can cause a chemical reaction.
- (b) When electricity is used in a chemical reaction to break down a compound the process is called **electrolysis**.
- (c) Electrolysis can, for example, break down water into hydrogen and oxygen.
- (d) Similarly copper (II) chloride can be broken into copper and chlorine.



Answer the following questions:

1. What is the aim of this investigation?_

- To investigate the chemical effect of electric current

2. What is your hypothesis?

3. What is the name of the compound used for the investigation?

- Copper chloride

4. Discuss the difference between an anode and a cathode.

- Anode – positive electrode and Cathode – is negative electrode

5. Explain what is observed on the cathode during the investigation._

- The brown coating is observed on the cathode)

6. Explain what is observed on the anode.

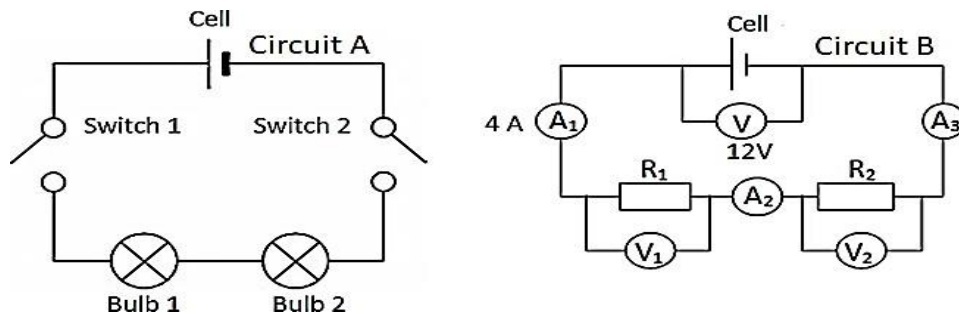
- Chlorine gas bubbles come out / evolve

7. Was your hypothesis correct? Explain.

SERIES AND PARALLEL CIRCUITS

Series Circuits

- A series electrical circuit is a connection in which the electric current has only one path to follow.
- The current in a series circuit is the same at any point in the circuit.
- Adding a resistor in a series circuit decreases the overall current in the circuit.



Answer the following questions:

1. What is a series electrical circuit?

-
- An electrical connection where the electric current follows one path

2. How many switches are in circuit diagram A?

-
- Two switches

3. What will happen if you close one switch?

-
- The electric current will not be able to flow

4. Elaborate if it is necessary for circuit A to have more than one switch.

-
- It is not necessary since the electric current has one path to follow

5. How does adding a resistor in a series circuit affect the resistance?

- Adding a resistor in series increases the resistance

6. What is the reading of the current in the ammeter labelled A1?

-
- 4 A

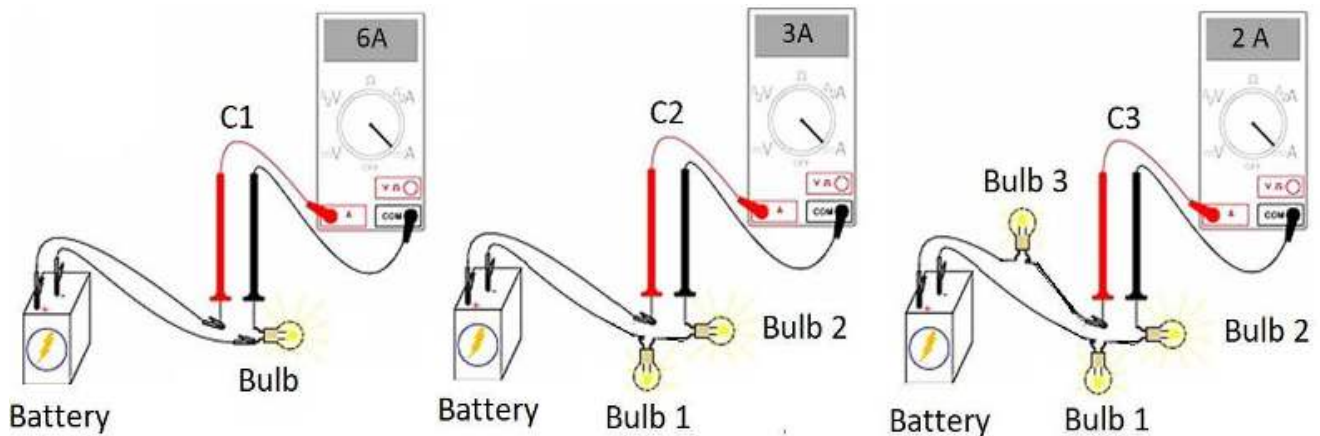
7. What will be the readings in ammeter A2 and A3? (4 A)

8. What is the total voltage in circuit B? (12V)

SERIES CIRCUITS

- (a) The current in a series circuit is the same at any point in the circuit.
 (b) Adding a resistor in a series circuit decreases the overall current in the circuit.

Use the diagram shown to answer some of the questions that follow:



1. What is the reading of the ammeter in C1? ____ (6A)
2. What is the reading of the ammeter in C2? ____ (3A)
3. What is the reading of the ammeter in C3? ____ (2A)
4. How does the ammeter reading change from C1 to C2? ____ (The reading in C1 is double the one in C2 / C2 is half C1)
5. Discuss the cause of the change in the current between C1 and C2. _ (The increase in resistance / Addition of the second bulb / resistor)
6. Discuss the cause of the change in the current from C1 to C3. _ (the increase in resistance / Each time a bulb is added in series, the resistance increases)

Investigation: How does increasing resistance in series affect the current

AIM: To investigate the effect of increasing resistance in a series circuit.

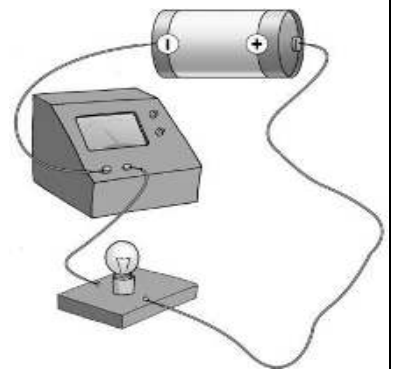
Write a hypothesis for this investigation:

MATERIALS:

1. 1,5 V cell
2. 3 torch bulbs
3. Conductors
4. switch
5. ammeter

INSTRUCTIONS:

1. Build a circuit with a 1.5 V cell, 1 bulb and a switch in series as shown.
2. Close the switch and record the reading in the ammeter in the table.
3. Add another bulb in series, close the switch and record the ammeter reading.
4. Add the third` bulb in series, close the switch and record your reading.



Number of bulbs in series	Brightness of bulbs	Reading on ammeter (A)
One bulb		
Two bulbs		
Three bulbs		

Answer the following questions

1. What is the aim of this investigation?

-
- To investigate the effect of adding a bulb in series on the electric current.

2. What happens to the brightness of the bulbs as you increase the resistance (add a bulb)?

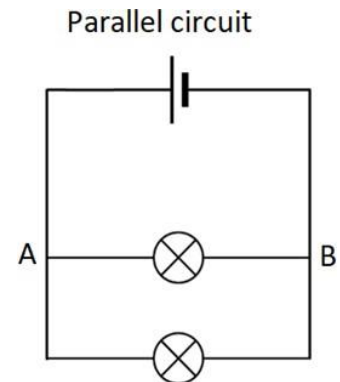
-
- Brightness becomes less / Becomes less bright

3. Discuss how resistance affects the brightness of bulbs connected in series.

-
- Reduces the brightness with each bulb added in series

Parallel circuits

- (a) Electric current in a parallel circuit has multiple paths (more than one) to follow.
- (b) Adding a resistor in a parallel connection decreases the total resistance in that circuit.
- (c) As resistance in a parallel circuit decreases, the current increases.



Answer the following questions:

1. What is a parallel connection?_

-
- A connection in which electric current has multiple paths / more than one to follow

2. What happens to the resistance in a parallel circuit as you add a resistor in parallel?

-
- The total resistance decreases as you add a bulb in parallel.

3. Discuss how the increase in resistance affects current in a parallel circuit.

-
- More current will flow since the resistance is low

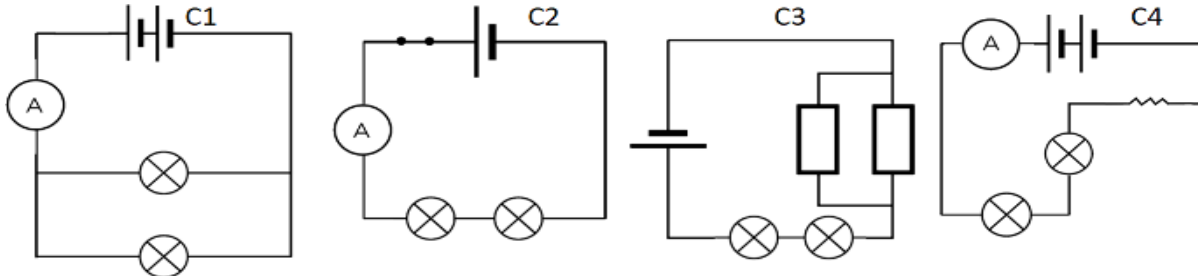
4. In the diagram shown above, what are the points where electric current splits or adds up?_

-
- The current splits at A and B

5. Where is parallel connection mostly used?

- In our homes, office spaces, schools, industries etc.

6. Explain which of the following circuits are parallel or series circuits.



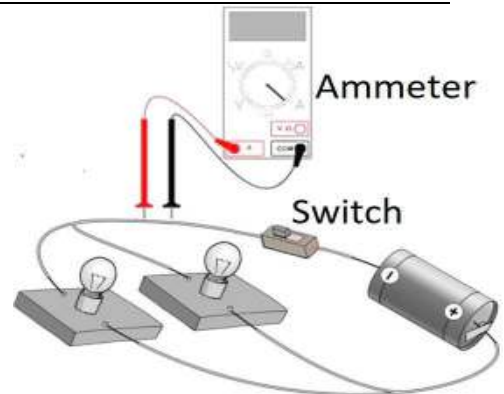
_____ (C1 is a parallel connection, C2 is a series connection, C3 is a parallel connection and C4 is a series connection)



Investigation: What happens to the current strength when adding resistors in parallel**AIM:** To investigate how adding resistors in parallel affect the current strength.**HYPOTHESIS:** What is your hypothesis?

APPARATUS:

1. 1,5 V cell
2. Three identical torch bulbs
3. Conducting wires
4. Switch
5. Ammeter

**METHOD:**

1. Assembly your electric circuit as shown in the diagram.
2. Draw a table as shown to record your readings.
3. Close the switch and take a reading starting with one bulb.
4. Add another bulb in parallel (the second bulb)
5. Record the ammeter reading in the table.
6. Now add the third bulb in parallel and take reading in the ammeter.

Number of bulbs in parallel	Brightness of bulbs	Reading on ammeter (A)
One bulb	Bright	
Two bulbs	Brighter	
Three bulbs	Brightest	

6.1 Which number of bulbs recorded the highest reading in the ammeter?

-
- Three bulbs

6.2 Was the brightness of the bulbs increasing or decreasing as you add a bulb?

-
- Increasing

6.3 Was the reading in the ammeter increasing or decreasing?

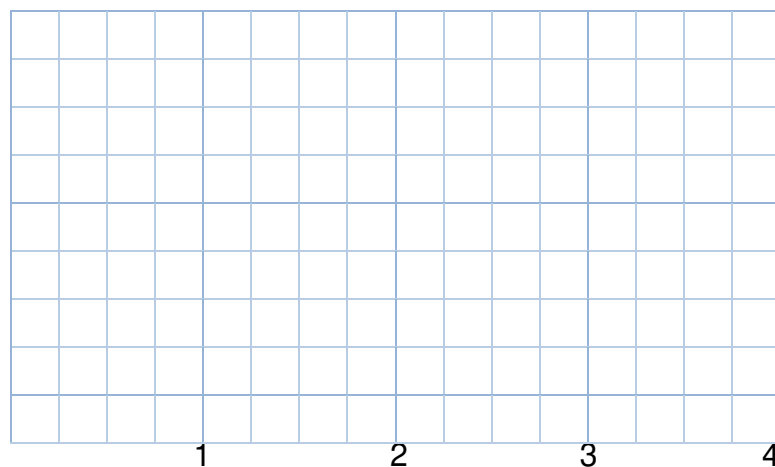
-
- Increasing

7 Use the Use the graph grid to draw a graph of current v/s voltage using the following data:

Number of bulbs in parallel	Reading on ammeter (A)
One bulb	
Two bulbs	
Three bulbs	

Heading: _____

Current I (A)



Number of bulbs

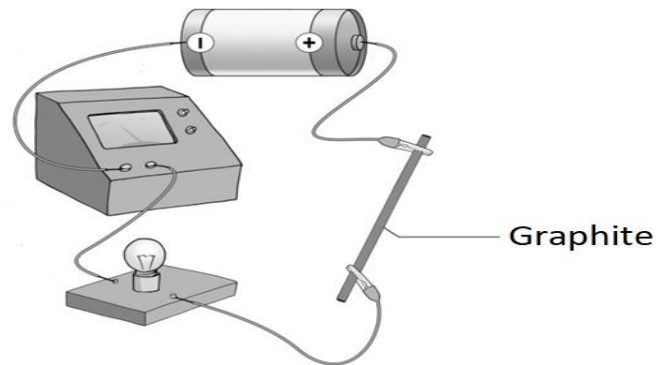
Investigation: Do different materials have different resistances

AIM: To investigate the resistance of different materials.

Write a hypothesis for this investigation: _____

APPARATUS:

1. 1,5 V cell
2. Conductors
3. bulb
4. Nickel wire
5. graphite
6. nichrome wire
7. ammeter



INSTRUCTIONS:

1. Set up your apparatus as shown in the diagram.
2. Make sure that your wires are of the same length.
3. Take a reading on the ammeter and record it in the table shown below.
4. Now replace the graphite with copper followed by chrome while taking the reading.
5. Different materials can also be used in the stead of those given.

Material used	Reading on ammeter (A)
Graphite	
Nichrome wire	
Nickel wire	

Research

- Conduct a research in groups of 4 about the history of electricity in South Africa and elsewhere. Your research should at least be two pages.

Structure your research in the following manner:

1. Topic
2. Introduction (Background)
3. Discussions (make reference to at least three supporting sources).
4. Conclusion



VISIBLE LIGHT - RADIATION OF LIGHT

- (a) Light is transferred by radiation.
- (b) Sources of light include the Sun, stars and light bulbs.
- (c) Light travels at a speed of 300 000 km in one second.
- (d) Light cannot bend around the corner and can only travel in straight lines.

VISIBLE LIGHT

- (a) Visible light is the visible portion of the spectrum which can be seen by the human eye.
- (b) Visible light has a wavelength of 380 to 780nm, depending on individuals.
Ultraviolet is not one of the colours because it is not visible to human eye.

Answer the following questions:

1. How is light transferred?

- By radiation)

2. What is the speed of light?

- 300 000 km in one second

3. Discuss how light travels.

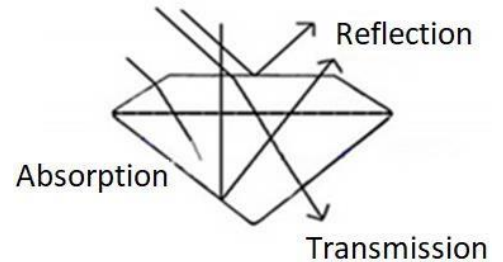
- Light travels in straight lines)

4. Explain what visible light is._

- Light that is visible to the human's naked eye)

Radiation of light

- Objects that emit (produce or discharge) light include the Sun (stars), bulbs etc.
- Light is transferred by radiation and it moves in a straight line at a speed of 300 000 km/s (300 000 kilometers per second).
- Light from the Sun takes 8 minutes and 20 seconds to reach the Earth.
- When light strikes an object, the following three things can happen:
 - It can be absorbed
 - It can be reflected (bounced off)
 - It can be transmitted (pass through)
- Light radiation refers to the way energy, like Sun's energy, travels.
- Radiant energy travels through space as electromagnetic waves.
- Cancer radiation therapy uses high energy wave particles such as x –rays and gamma rays to destroy cancer cells.



Answer the following questions:

1. What are the three things that can happen to light as it strikes an object?

- It can be absorbed, reflected (bounced off) or transmitted (pass through)

2. What is light radiation?

- Light radiation refers to the way energy, like Sun's energy, travels.

3. What is the speed of light?

- The speed of light is 300 000 km/s (300 000 kilometers per second).

4. How long does it take light to reach the Earth?

- It takes 8 minutes and 20 seconds to reach the Earth

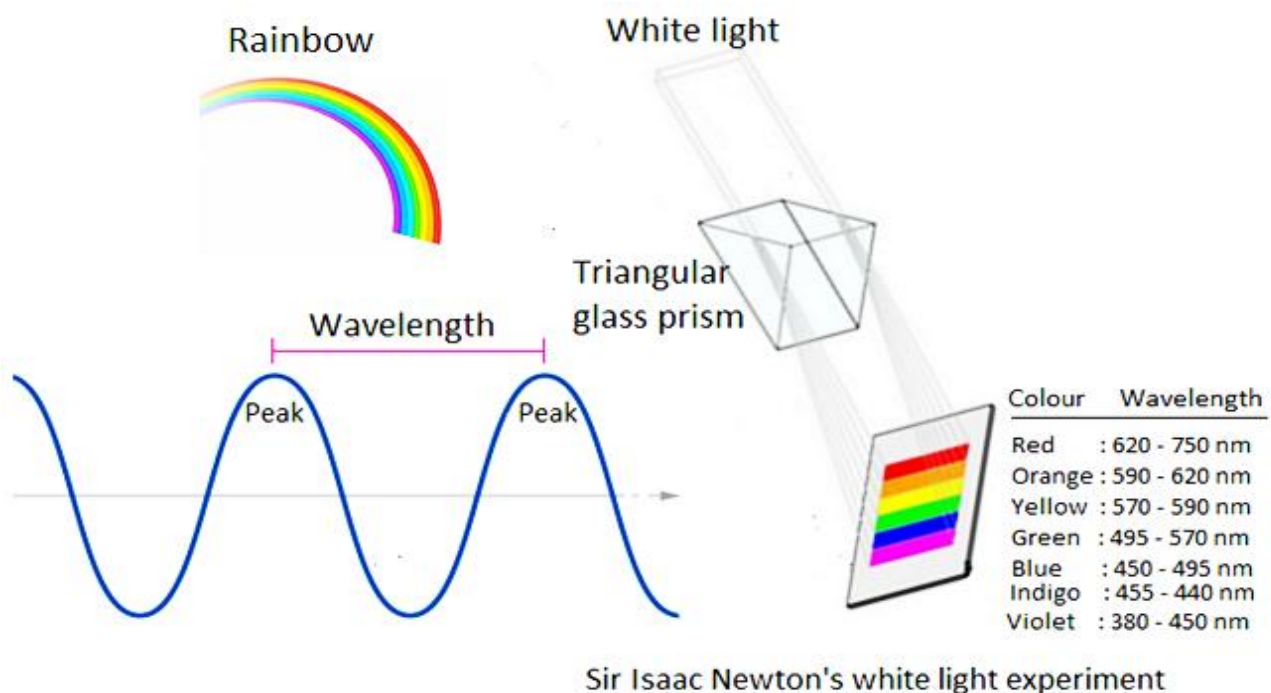
5. How does radiant energy travel through space?

- Radiant energy travels through space as electromagnetic waves.

6. What is cancer radiation and why is it important? _____

Spectrum of visible light

- In white light there is a range of different colours with different frequencies and wavelengths.
- A frequency is the number of vibrations per second while a wavelength is the distance over which the shape of a wave would repeat or distance between two peaks of a wave.
- There are different colours with different frequencies and wavelengths in a beam of visible white light, viz. violet, indigo, blue, green, yellow, orange and red.
- When sunlight strikes rain droplets in front of a viewer, or light falls on drops of water in the air and spreads into different colours a rainbow forms.



Answer the following questions:

- What do we know about white light?

- What is frequency?

- What is wavelength?

- What are the different colours observed in a beam of visible white light?

5. Discuss how a rainbow occurs.

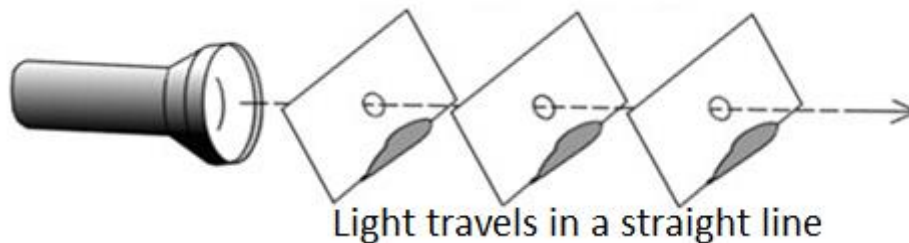
6. Which colour has the longest wavelength?

7. Which colour has the shortest wavelength?

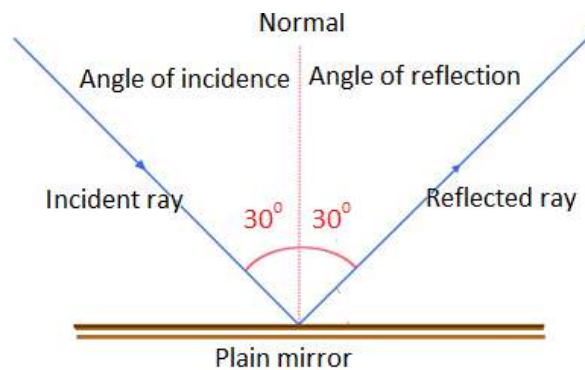
8. Give the wavelengths of all the colours of the white light spectrum as given.

OPAQUE, TRANSLUCENT AND TRANSPARENT MATERIAL

- (a) Opaque material do not allow light to pass through.
- (b) A transparent substance or object allows light to pass through, e.g. house and car windows.



- (c) A translucent objects allows some light to pass through, e.g. bathroom window.
- (d) Reflection is the bouncing off of light as it strikes an object.



- (e) When an object appears **blue**, it means it absorbs all of the colours of the white light spectrum and only reflects the blue colour.
- (f) During the reflection of light, the angle of reflection is equal to the angle of incidence and this is known as **the Law of reflection**.

Answer the following questions:

1. Explain the following:
 - 1.1 Opaque material_____
 - Does not allow light to pass through
 - 1.2 Transparent_____
 - Light rays can pass / travel through
 - 1.3 Translucent_____
 - Some light can pass / travel through
2. What is reflection?_____
 - Bouncing off of light as it strikes an object / surface

3. Explain how reflection works (colours)._____

- Blue reflects blue, yellow reflects yellow etc.

4. Discuss the law of reflection._____

- During the reflection of light, the angle of reflection is equal to the angle of incidence)

SEEING LIGHT AND REFRACTION OF LIGHT

- (a) Only reflected light reaches and enters the eye.
- (b) The light entering the eye is interpreted by the brain.
- (c) Receptor cells on the eyeball convert the light energy into electrical nerve.
- (d) The impulses are carried to the brain through the optic nerve.
- (e) The brain interprets the impulses as sight.
- (a) Refraction is the bending of light as it enters a different medium. The new medium could be air, glass, water etc.
- (b) The bending is caused by different densities of the media involved.
- (c) The new medium makes light to bend and change speed.
- (d) When light enters a new medium through the normal, it does not bend.
- (e) A rainbow is result of light reflection on water droplets in the air.

Rainbow

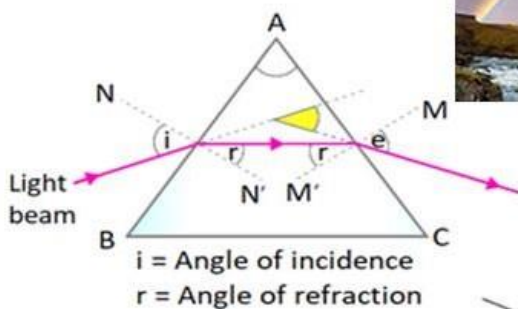


Diagram A

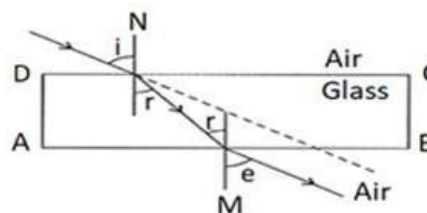


Diagram B

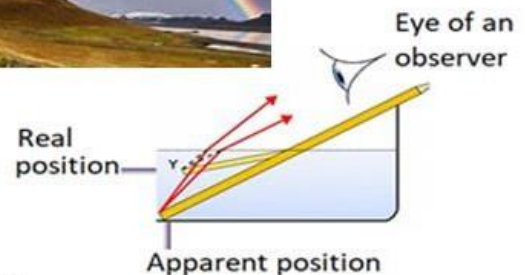


Diagram C

Answer the following questions:

1. Which light reaches the eye? _____

- Reflected light

2. Fully explain how the brain is able to interpret light.

-
- (a) The light entering the eye is interpreted by the brain.
 - (b) Receptor cells on the eyeball convert the light energy into electrical nerve.
 - (c) The impulses are carried to the brain through the optic nerve.
 - (d) The brain interprets the impulses as sight.

3. What is refraction?

-
- The bending of light as it enters a new medium like water, air, glass)

4. Use diagram C to explain refraction._

-
- Due to refraction /bending of light, the object is not where it appears to be

5. What are the three possible media through which light can travel?

-
- Air, Glass and water

6. Explain the law of reflection.

-
- During the reflection of light, the angle of reflection is equal to the angle of incidence

7. Discuss the factors that lead to refraction?_

-
- Change in speed as light enters a new medium and density)