Noaman Masoud and Behjet Ansari

Teaching Science to the Differently-abled

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Contents

Introduction - Why teach Electricity?

The benefits of teaching Physical Sciences to special needs students are the magic and awe that surrounds the activities, in addition to the inherent and valuable life skills that are imparted subsequently to the children.

For example in the very first experiment for electricity, students will develop skills and concepts about a simple circuit. When they join two wires together, they would be required to strip a piece of wire and twist it with another wire and make a connection.

Here the verbal cue "strip, pinch and twist" is used. Strip the wires, pinch them together and twist them.

Another extremely valuable life lesson and skill is the ability to correctly insert the batteries according to the polarity in the battery compartment. This skill is vital for making the circuit work. The correct insertion of batteries also gives a certain level of independence as the longer-term goal and as a short term a very high sense of achievement.

What are the main prerequisites to conduct these experiments? Essentially science experiments require data to be collected and some sort of data interpretation for conclusions to be made. But at this level, we use science experiments to engage the students instead of embroiling them in the daunting tasks.

CHAPTER 1

Simple Circuit

1.1 Learning Objectives

1. Understand the concept of a simple circuit.
2. Understand how chemical energy from the battery is converted to electrical energy and then to light.
3. Be able to identify the basic components of a circuit; batteries, wires and bulb with holder.
4. Familiarize with tools needed; screwdriver and wire stripper.

1.2 Materials

To perform this activity, you will need the following items

1. Bulb Holder (E-10) and Bulb
2. AA size Batteries x2
3. Battery Case
4. Wires
5. Screwdriver
6. Wire Stripper

1.3 Procedure

Initially, it would be advisable to conduct the activity in a more guided scheme. Every step of the activity must be orchestrated and conducted in plain view of the child. The child must be given the opportunity to try every step themselves at least once.

1. First, strip the ends of the wires of the battery holder using the wire stripper.
2. Then, bend the stripped ends to make fish hooks.
3. Loosen the screws on the bulb holder.
4. Wrap the fish hooks around the screws and tighten the screws with the screw driver.
5. Next, twist the bulb into the bulb holder.
6. Finally, insert the batteries observing correct polarity.

And voila! You are done.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

1.4 Assessment

Now it is time to assess how much your child has learned from this lesson.
Here you may pause and ask why the bulb lights up? What does the bulb need to light up?

Energy!
The batteries have chemical energy stored in them which is converted to electrical energy and then to light.

You may have a set of responses ready as flashcards to select. This is particularly helpful if your child has difficulty processing verbal instructions.

1.4.1 Core concepts

Core concepts will be tested when your child correctly responds to your questions regarding the activity. Test them using the following fill in the blanks too:

1. A simple circuit has battery, wires, and a _____ .
2. Battery has chemical energy which is converted to _____ energy.
3. Electrical energy flows through the wire and goes to the _____ .
4. Bulb converts the electrical energy to _____ energy.
5. The _____ provides the voltage across the bulb and drives an electric current through it.
6. Current flows from the _____ end of the battery, through the bulb, and then back to the _____ end of the battery.

1.4.2 Ability to make the circuit independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. In this case, they can be tested on their ability of building a circuit independently after multiple repetitions.

Answer key: {1. bulb, 2. electrical, 3. bulb, 4. light, 5. battery, 6. positive, negative}

CHAPTER 2

Open and Closed Circuits

2.1 Learning Objectives

1. Understand that electricity needs a path to flow.
2. To be able to differentiate between open and closed circuits, and understand how they work.

2.2 Materials

To perform this activity, you will need the following items

1. Bulb Holder (E-10) and Bulb
2. AA size Batteries x2
3. Battery Case
4. Wires
5. Screwdriver
6. Wire Stripper
7. Gem Paper Clips x2

2.3 Procedure

We begin this experiment by reusing the setup of the first experiment.

1. Get the Simple Circuit setup from experiment one.
2. Disconnect one wire of the battery case from the bulb holder and wrap it around a gem clip.
3. Connect one stripped end of a new piece of wire to the bulb holder, and tie its other stripped end to the second gem clip.
4. Connect the gem clips. The bulb lights up - we have a Closed Circuit.
5. Disconnect the gem clips. The bulb stops glowing - we now have an Open Circuit.

Congratulations! You made it through the second experiment as well.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

2.4 Assessment

For assessing how much your child has learned from this experiment, you may ask why the bulb lights up when the paper clips are touching? Or why doesn't the bulb light up when the paper clips are not in contact?

The answer simply lies in the fact that electricity needs a path to flow. When that path gets broken i.e. paper clips are disconnected, electricity stops flowing and the bulb does not light up.

Once again, you may have a set of flashcards to question your child about the steps of the experiment performed. Arrange a kind of trivia and reward your child with points to keep them interested and engaged!

2.4.1 Core concepts

Core concepts will be tested when your child correctly responds to your questions regarding the activity. Test them using the following fill in the blanks too:

1. The circuit which has a complete conducting path is a _____ circuit.
2. The circuit which does not have a complete conducting path is an _____ circuit.

2.4.2 Ability to make the circuit independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. In this case, they can be tested on their ability of building both open and closed circuit independently after multiple repetitions.

Answer key: {1. closed, 2. open}

CHAPTER 3

Conductors and Insulators

3.1 Learning Objectives

1. Understand the concept that electricity can only flow through conductors.
2. To be able to differentiate between Insulators and Conductors.

3.2 Materials

To perform this activity, you will need the following items

1. All items used in experiment 2
2. Wooden Block
3. Foil Aluminium
4. Sharpie
5. Coins
6. Marbles
7. Rubber Bands
8. Sponge

3.3 Procedure

We begin this experiment by reusing the setup of the second experiment.

1. Get the circuit setup from experiment two.
2. Gather all materials on one side.
3. One by one, touch the two paper clips to each object and see if the bulb lights up.
4. If it does, that means that object is a conductor. Place it in the conductor basket.
5. If it does not, that means that object is an insulator. Place it in the insulator basket.
6. When all the items are sorted, we present the definitions of conductors and insulators.

Well done! You now have a sound understanding of what conductors and insulators are.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

3.4 Assessment

For assessing your child's learning from this experiment, you may first ask them to classify objects on the basis of the material they are made from. Use objects like eraser (made of rubber), scissors (steel), plastic scale etc.

Once they establish correctly the materials used, you can move on to the next phase which is to deduce whether the material is a conductor or insulator. You may further ask your child to think of more examples of what materials could be conductors and insulators.

3.4.1 Core concepts

Core concepts will be tested when your child correctly identifies conductors and insulators and can differentiate between the two. Test them using the following fill in the blanks too:

1. All materials which allow electric current to flow through them are called _____.
2. All materials which do not allow electric current to flow through them are called _____.

3.4.2 Ability to make the circuit independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. In this case, they can be tested on their ability of building the circuit and separating conductors from insulators independently after multiple repetitions.

Answer key: {1. conductors, 2. insulators}

CHAPTER 4

Magnetic Materials

4.1 Learning Objectives

1. Introduce the concept of magnetic and non-magnetic materials.

4.2 Materials

This experiment requires the following items

1. Bar magnet
2. Wooden Block
3. Foil Aluminium
4. Sharpie
5. Coins
6. Marbles
7. Rubber Bands
8. Sponge
9. Nails

4.3 Procedure

1. Make two labels for Magnetic and Non-Magnetic materials.
2. One by one, bring each item close to the magnet and observe.
3. If it is attracted to the magnet, place it in the pile labeled Magnetic.
4. If it is not, place it in the pile labeled Non-Magnetic.
5. When all the items are sorted, allow your child to repeat the activity.

Way to go! You now know what magnetic materials are. Feel free to let your child explore more magnetic materials in the house.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

4.4 Assessment

For assessing your child's learning from this experiment, ask your child what they know about the properties of magnetic materials. How does one identify magnetic materials? And how are they different from non-magnetic materials?
Remember, patience is key.

4.4.1 Core concepts

Core concepts will be tested when your child correctly identifies magnetic materials and understands the learning objectives. Test them using these fill in the blanks too:

1. Magnets are formed _____ and are called magnetite or lodestones.
2. This ore is a compound of _____ and Oxygen.
3. _____ attract Iron and other magnetic materials.
4. Magnets can attract or _____ other magnets.

4.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. In this case, they can be tested on their ability of separating magnetic materials from non-magnetic materials independently after multiple repetitions.

Answer key: {1. naturally, 2. Iron, 3. magnets, 4. repel}

CHAPTER 5

Poles of Magnet

5.1 Learning Objectives

1. Understand that a magnet has two poles; North and South.
2. Appreciate the fact that magnetic field is strongest at the poles.

5.2 Materials

This experiment requires the following items

1. Bar magnet
2. U-shaped magnet
3. Paper pins
4. Small nuts

5.3 Procedure

1. Spread the nuts on a plain surface.
2. Bring the magnet in contact with the nuts.
3. Lift the magnet.
4. Observe that the nuts only stick to the ends of the magnet!

From our observation, we can deduce that magnetic field is strongest at the poles of a magnet.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

5.4 Assessment

For assessing your child's learning from this activity, ask them what they know about the poles of magnets. What are the names of the poles? You can further ask them where the magnetic field is weak in a magnet. Give them some time to figure out the answer to this question by experimenting more with the nuts and magnet.
You can also draw a bar magnet and a U-shaped magnet on a paper and ask your child to label the north and south poles on them. Good luck!

5.4.1 Core concepts

Core concepts will be tested when your child answers your questions correctly and fills in these blanks:

1. The _____ of the magnet attract the most magnetic materials (nuts, iron fillings and nails).
2. Middle of the bar magnet attracts the _____ number of magnetic materials.

Label the poles on the following magnets and color the magnet sections red and blue accordingly.

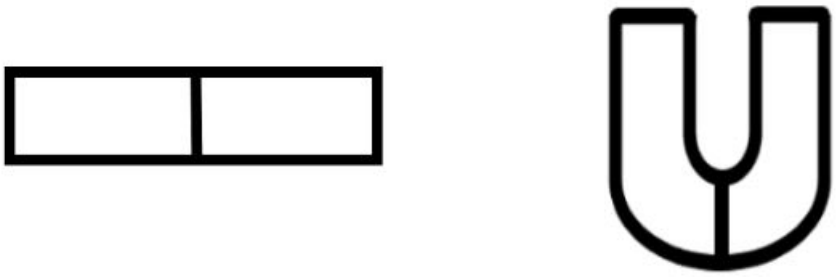

Figure 5.1: Bar Magnet and U-shaped Magnet

5.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. In this case, they can be tested on their ability of identifying magnetic poles as the points with strongest field independently after multiple repetitions.

Answer key: {1. poles, 2. least}

CHAPTER 6

Attraction and Repulsion

6.1 Learning Objectives

1. Explore repulsion and attraction of magnets.
2. Understand that like poles repel and unlike poles attract.

6.2 Materials

This experiment requires the following items

1. Bar magnet x2
2. U-shaped magnet (optional)

6.3 Procedure

1. Set the magnets on a flat and smooth surface.
2. Gently bring together South and North of two magnets.
3. Observe that they stick together - unlike poles attract.
4. Now reverse one magnet, i.e. bring South and South, or North and North poles together.
5. Observe that they push away from each other - like poles repel.
6. Let your child play and feel the sensations of attraction and repulsion!

From our observation, we learn that like poles repel and unlike poles attract.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

6.4 Assessment

For assessing your child's learning from this activity, ask them what they know about the poles of magnets. Which poles repel? Which attract?
You may hand them the magnets to answer your questions, or draw two magnets with like poles together, and then unlike poles together as ask them to write down which pair would attract and which would repel.

6.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter. Test them by giving them the following blanks to fill:

1. Opposite poles of magnets _____.
2. _____ poles of magnets repel when brought together.

6.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the task by themselves. Here, their learning can be tested on their ability of detecting the nature of attraction and repulsion between poles of magnet independently after multiple repetitions.

Answer key: {1. attract, 2. like}

CHAPTER 7

Earth's Magnetic Field

7.1 Learning Objectives

1. Develop an understanding of Earth's Magnetic Field
2. Reiterate that like poles repel and unlike poles attract.

7.2 Materials

This experiment requires the following items

1. Bar magnet
2. Non-elastic string
3. Sellotape
4. Compass (optional)

7.3 Procedure

1. Tie a piece of string to the bar magnet.
2. Adjust the string knot to balance the magnet. Attach sellotape to secure.
3. Suspend the magnet from a reasonable height.
4. Let it become stationary (at rest).
5. Note where the poles of the magnet are pointing.

From this experiment, we learn that the north pole of magnet points to the Geographic North, and south pole to the Geographic South!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

7.4 Assessment

For assessing your child's learning from this activity, ask them short questions from the activity you just performed. Where should the north and south poles of magnet point?

7.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter. Test them using the following fill in the blanks:

1. Upon suspending a bar magnet in the air, the magnet aligns itself with the _____ direction.
2. The _____ has a magnetic field with geographical north and south poles.
3. Earth's north pole is where the compass points _____.

7.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can gauge their learning on their ability of correctly balancing and suspending the magnet from a string.

Answer key: {1. North-South, 2. earth, 3. north}

CHAPTER 8

Compass Rose and Cardinal Directions

8.1 Learning Objectives

1. Introduce the concept of Cardinal Directions; North, East, South and West.
2. Develop an understanding of Compass Rose.
3. Learn how to magnetize a needle to make a compass.

8.2 Materials

This experiment requires the following items

1. Compass
2. Needle (steel)
3. Pieces of card
4. Sellotape
5. Scissors
6. Plastic bowl filled with water
7. Sticky notes (optional)

8.3 Procedure

1. Label the cardinal directions on the room wall using a compass.
2. Identify the rose on the compass.
3. Place the bowl filled with water on flat surface.
4. Carefully stroke the needle with a magnet.
5. Place the needle on the card, and gently place it on the surface of the water.
6. The needle is aligned in the north-south direction!

Good job! You've learned how to make a compass from scratch!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

8.4 Assessment

For assessing your child's learning from this activity, ask them short questions from the activity you just performed. You may draw a four-point compass and an eight-point compass on paper and ask your child to label the directions on them.

8.4.1 Core concepts

Core concepts will be tested from the following fill in the blanks from this chapter:

1. A compass rose is the picture inside the compass with the cardinal _____.
2. A four-point _____ has North, South, East and West directions.
3. An eight-point compass has North, South, East, West, North-East, North-West, South-East, and _____ directions.

Label the cardinal directions on the following figure.

Figure 8.1: Compass rose

8.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can gauge their learning on their ability of successfully making a compass independently after multiple repetitions.

Answer key: {1. directions, 2. compass, 3. South-West}

CHAPTER 9

Electric Current

9.1 Learning Objectives

1. Provide an understanding of Electric Current as the flow of charges.
2. Learn that charges flow around the circuit in a closed path to light up the bulb.

9.2 Materials

This experiment requires the following items

1. Beads/Marbles
2. Clear Pipe
3. Cards
4. Coloured Markers

9.3 Procedure

1. Draw the symbols for Battery, and Bulb.
2. Make the switch symbols ON and OFF on the flip side.
3. Make ring of card and colour it yellow.
4. Dissect tube rails into half and place the two halves to form a circle (refer to video).
5. Fill the rails with beads.
6. Flip to the ON switch and place the yellow card on the bulb!

Awesome! Now you know how to demonstrate how charges flow around the circuit in a closed path to light up a bulb!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

9.4 Assessment

For assessing your child's learning from this activity, ask them short questions from the activity you just performed. What is electric current?
How is electrical energy transferred from the battery to the bulb?

It's simple; electric current is the flow of charges and electrons (negative charges) go from the negative terminal of the battery through the wire to the bulb and return to the positive terminal of the battery.

9.4.1 Core concepts

Core concepts will be tested from the following fill in the blanks from this chapter:

1. In a simple electric circuit, energy goes from the _____ to the bulb and lights it up.
2. Electric charges carry _____ around the circuit.
3. Charges flow from _____ potential to _____ potential.
4. There are two main kinds of charges; _____ charges and _____ charges (electrons).
5. The flow of charges is called _____.
6. Electrons flow from the _____ terminal of battery through the circuit and return to the _____ terminal of the battery.

9.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can gauge their learning on their ability of successfully creating the circuit representation independently after multiple repetitions.

Answer key: {1. battery, 2. energy, 3. higher,lower, 4. positive, negative, 5. electric current, 6. negative, positive}

CHAPTER 10

Fuses

10.1 Learning Objectives

1. Understand that fuses are safety devices made of materials with low melting points.
2. Learn about the heating effect of current.

10.2 Materials

This experiment requires the following items

1. Thin wire strands
2. AA batteries or 9V battery
3. Fuses
4. Low resistance resistor
5. Electric iron

10.3 Procedure

1. Touch the cold iron surface.
2. Switch on the Iron on low setting. Touch the hot surface via heat resistance oven.
3. Switch the iron off.
4. Note that passing current makes the iron hot.

10.4 Optional Activity

1. Caution: This must be conducted in a safe environment and outdoor, where fire hazards are minimum.
2. You must have an electricians solder and a 12V Car Battery to perform this activity.
3. Carefully connect the solder wire on both terminals of the car battery.
4. The solder will melt because of the heat effect.
5. The fuses in electrical appliances have low melting point.

Note: Use low melting point soldering wire.

Great job! Now you know that electric current produces heat when it passes through a wire, and that fuses are made of a material that melts at a low temperature.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

10.5 Assessment

For assessing your child's learning from this activity, ask them short questions from the activity you just performed. How do fuses prevent damage to appliances?
Why do we need a fuse?

When electric current passes through a conductor or wire, it causes the conductor to heat up. The fuse has a special low-melting point piece of wire. When current overheats the fuse wire, the wire melts and breaks the circuit. This is how fuse wire acts as a safety device to the circuit. We need fuses so that the circuit doesn't catch fire or overheat.

10.5.1 Core concepts

Core concepts will be tested from the following fill in the blanks from this chapter:

1. A _____ prevents damage to an appliance.
2. The _____ fuse is a small glass tube encapsulating a fuse wire, with metal caps at each end.
3. When _____ passes through a circuit, the circuit slowly heats up. This is known as the heating effect.
4. The _____ effect has many applications; sandwich maker, electric kettle, heater, iron etc.

10.5.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can gauge their learning on their ability of successfully creating the circuit representation independently after multiple repetitions.

Answer key: {1. fuse, 2. cartridge, 3. current, 4. heating}

CHAPTER 11

Electric Circuits

11.1 Learning Objectives

1. Introduce different configurations of Electric Circuit.
2. Introduce the concept of Nets or numbered connection.
3. Learn how to trace a fault in the circuit.

Caution: If the batteries or switch are not connected properly, these circuits can produce anomalies or even harmful results.

11.2 Materials

This experiment requires the following items

1. Multiple bulbs with holder
2. AA batteries with holder x2
3. Connecting Wire
4. Wire Stripper
5. Screwdriver
6. Switches

11.3 Procedure

1. Draw the circuits on a paper.
2. Number the connections.
3. Make the connections one by one.
4. Flick the switch!
5. The bulb should light.
6. Now trace the path of current through the wires and around the circuit.

Awesome! Now you know how to demonstrate how charges flow around the circuit in a closed path to light up a bulb!

For better learning and understanding, watch Sir Noaman conducting the experiment (highly recommended for this activity): dummy video.

11.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed.

11.4.1 Core concepts

Core concepts will be tested when your child identifies the following circuits. Circle the correct answer below the circuits. Also, label each component of the circuits on the figures.

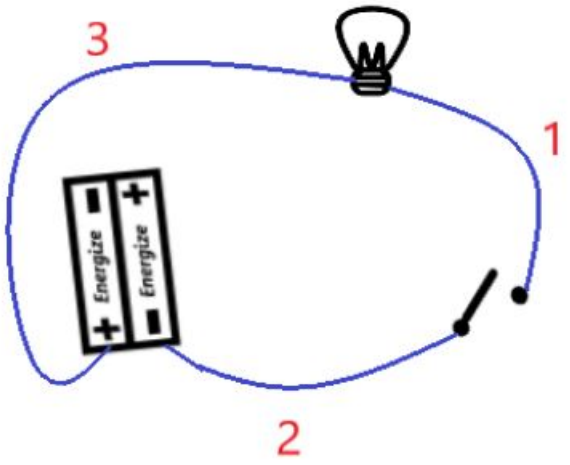

Figure 11.1: Open Circuit / Closed Circuit

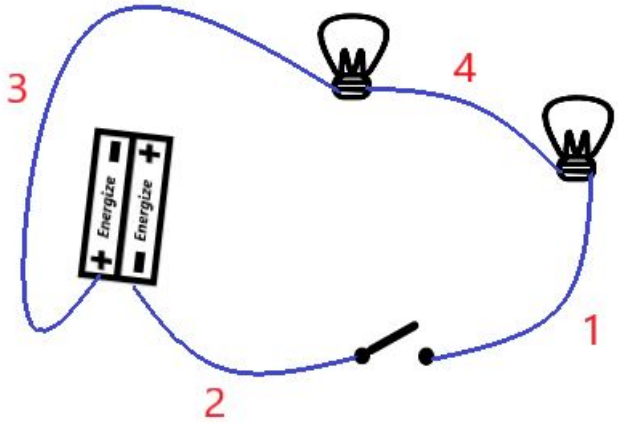

Figure 11.2: Series Circuit / Parallel Circuit

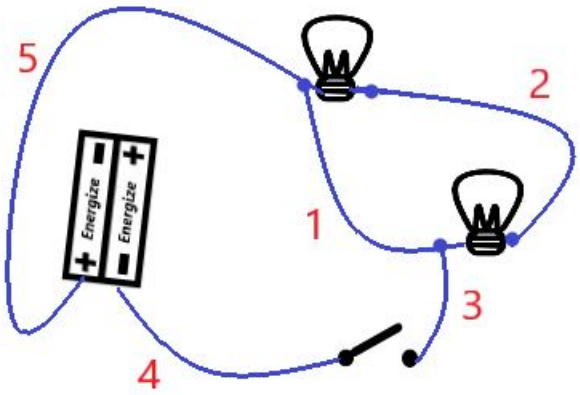

Figure 11.3: Series Circuit / Parallel Circuit

11.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can assess their learning on their ability of successfully creating the circuit independently after multiple repetitions.

CHAPTER 12

Static Electricity

12.1 Learning Objectives

1. Introduce the concept of static charges on insulators.
2. Learn that charges have polarity like charges repel and unlike charges attract.

12.2 Materials

This experiment requires the following items

1. Plastic pipe / Comb
2. Microfiber cloth (dry), eg: towel
3. Tissue paper

12.3 Procedure

Note: Humidity should be low, i.e: dry atmosphere, for this experiment to work perfectly.

1. Wrap the cloth around the pipe/comb.
2. Vigorously rub the cloth on the pipe/comb.
3. Bring the pipe/comb close to the shredded tissue pieces.
4. If nothing happens, shred the tissue into even smaller pieces.
5. Repeat step 2.
6. Bring the pipe/comb to the tissue pieces again. Watch the magic of static charges!

Very good! You've learned how to create static charges!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

12.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. How does rubbing two objects lead to creating charges?

The answer to that lies in the fact that friction cause charges to appear on the surface on non-metallic objects.
One object acquires a negative charge and the other acquires a positive charge, thus creating attraction or repulsion between non-metal objects.

12.4.1 Core concepts

Core concepts will be tested when your child fills in the following blanks from this chapter:

1. When certain elements such as glass, ebonite, resin, and sulphur are rubbed with suitable materials, they acquire _____ properties.
2. These materials are charged with _____ electricity.
3. _____ charges do not move from one point to another.

12.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can assess their learning on their ability of successfully creating static electricity in non-metals independently after multiple repetitions.

Answer key: {1. attractive, 2. static, 3. static}

CHAPTER 13

Electromagnets

13.1 Learning Objectives

1. Establish a link between Electricity and Magnetism.
2. Learn how to magnetize an iron nail.
3. Understand that iron makes soft or non-permanent magnet, and steel makes hard or permanent magnets.

13.2 Materials

This experiment requires the following items

1. Iron Nails
2. Enamelled copper wire
3. AA batteries (x2) with holder
4. Sandpaper
5. Gem clips
6. Compass

13.3 Procedure

1. Carefully wrap the wire on the nail.
2. Leave at least 5 inches of wire and wrap 50 turns on the nail.
3. Strip the ends of the wires using sandpaper.
4. Connect the wire to the battery holder.
5. Bring the nail head close to the gem clips.
6. Bring the nail head close to the compass.

Neat! Now you know how to make an electromagnet.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

13.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. Why did we use soft iron instead of steel?

The reason is that electromagnets work best with soft iron. Steel nail once magnetized, retain their strength.

13.4.1 Core concepts

Core concepts will be tested when your child fill in the following blanks from this chapter:

1. We make an _____ by passing electric current in a coil of wire wrapped around the material we want to magnetize (iron core).

2. _____ magnets are non-permanent magnets and _____ magnets are permanent magnets.

13.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can assess their learning on their ability of successfully creating an electromagnet independently after multiple repetitions.

Answer key: {1. electromagnet, 2. soft, hard}

CHAPTER 14

Magnetic Fields

14.1 Learning Objectives

1. Appreciate that magnetic field is the region in which a magnet can attract or repel magnetic materials.
2. Reiterate that magnetic fields are strongest at the poles.
3. Magnetic field lines go from North to South pole.

14.2 Materials

This experiment requires the following items

1. Bar Magnet
2. U Shaped Magnet
3. Iron Fillings
4. Paper sheet

14.3 Procedure

1. Place the bar magnet on flat surface.
2. Cover it with the sheet of paper.
3. Sprinkle the iron fillings on top.
4. Spread the fillings with your fingers.
5. Can you see the field patterns? Join the lines with a pencil to complete the pattern.
6. Do the same with U shaped magnet!

How cool was that? Not only can you feel magnetic field working its magic, you can also track the field lines!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

14.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. What exactly is a magnetic field?

Simply defined, magnetic field is the area around the magnet where other magnets or magnetic materials will experience an attraction or repulsion force.

14.4.1 Core concepts

Core concepts will be tested when your child fills in these blanks from this chapter:

1. Magnets have an invisible magnetic field in which _____ materials get attracted or repelled.
2. Magnetic _____ can be seen by placing tiny iron fillings around the magnet.
3. Magnetic field's direction goes from _____ pole to _____ pole.
4. Magnets attract or repel the strongest at the _____.

14.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can assess their learning on their ability of successfully tracing magnetic field lines independently after multiple repetitions.

Answer key: {1. magnetic, 2. field, 3. north, south, 4. poles}

CHAPTER 15

Direction of Current Flow - Ammeter

15.1 Learning Objectives

1. Understand that current flows in a direction from high potential to lower potential.
2. Learn that ammeter is used to measure the amount and direction of current.

15.2 Materials

This experiment requires the following items

1. Ammeter
2. Bulb with Holder
3. AA cells with holder
4. Switch
5. Wires
6. Screwdriver

15.3 Procedure

1. Draw the circuit.
2. Number the Net or Connections.
3. Carefully connect the circuit as done in the video.
4. Make sure Ammeter needle is at zero.
5. Plug in the switch to turn the bulb ON.
6. Trace the path of current on the circuit and state “current goes higher potential to lower potential.”
7. Unplug and plug the switch to show a few times.
8. Now read the scale!

Great work!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

15.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. What direction does current flow in a circuit?

Current flow takes place in a closed path from higher potential to lower potential, and that can be determined with the help of numbered connections in this experiment.

15.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

15.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this chapter, you can assess their learning on their ability of successfully measuring current and its direction of flow in a circuit independently after multiple repetitions.

CHAPTER 16

Voltage - Voltmeter

16.1 Learning Objectives

1. Learn that voltage is the force that pushes the charges around the circuit.
2. Understand that voltage or "potential difference" is necessary for current to flow.
3. Understand that voltage is divided amongst all the bulbs.

16.2 Materials

This experiment requires the following items

1. Voltmeter
2. Ammeter
3. Bulbs with holders
4. Batteries with holder
5. Switch
6. Wires

16.3 Procedure

1. Connect the Circuit from previous Ammeter experiment.
2. Connect the wires to the voltmeter.
3. Connect the voltmeter to the bulb.
4. Record the reading.
5. Now connect the voltmeter to the battery box terminals.
6. Record the reading.

Way to go!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

16.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. What is the element that provides energy to different components in a circuit?

The simple explanation to it would be that in a circuit, voltage is the force that pushes the charges around the circuit to provide energy to different elements in the circuit.

16.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

16.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this activity, you can assess their learning on their ability of successfully connecting all the components independently after multiple repetitions, and reading out the voltage from the voltmeter.

CHAPTER 17

Series and Parallel Circuits - 1

17.1 Learning Objectives

1. Investigate the current and voltage in series and parallel circuits.

17.2 Materials

This experiment requires the following items

1. AA Batteries
2. Bulbs with bulb holder
3. Batteries with battery holder
4. Wires
5. Switch
6. Ammeter
7. Voltmeter

17.3 Procedure

1. Connect the bulb in Series starting with 2 bulbs.
2. Connect the ammeter, switch and batteries.
3. Switch ON and record the Ammeter reading.
4. Check the voltage across each bulb and the battery.
5. Record the reading.
6. State that in series the current remains same and voltage is divided.

Well done!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

17.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. How are current and voltage divided in series circuit?

The correct answer is that in series the current is the same and voltage gets divided.

17.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

17.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this activity, you can assess their learning on their ability of successfully making a series circuit independently after multiple repetitions.

CHAPTER 18

Series and Parallel Circuits - 2

18.1 Learning Objectives

1. Investigate the current and voltage in series and parallel circuits.

18.2 Materials

This experiment requires the following items

1. Bulbs with bulb holder
2. AA Batteries with battery holder
3. Wires
4. Switch
5. Ammeter
6. Voltmeter

18.3 Procedure

1. Connect the bulb in parallel as shown.
2. Connect the ammeter, switch and battery holder.
3. Switch it ON.
4. Check the voltage across each bulb.
5. Check the ammeter and record the reading.
6. State that in series the voltage remains same and current is divided.

Awesome! Now you know the difference between series and parallel circuits.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

18.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. How are current and voltage divided in parallel circuit?

The correct answer is that in parallel the voltage across the components is same and current get divided, which is the opposite of what happens in series circuit.

18.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

18.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this activity, you can assess their learning on their ability of successfully making a parallel circuit independently after multiple repetitions.

CHAPTER 19

Resistance to Flow of Current

19.1 Learning Objectives

1. Learn how resistance controls the amount of current passing in the circuit.
2. Develop an understanding of Ohm's Law.

19.2 Materials

This experiment requires the following items

1. AA Batteries x5
2. Resistor 100 ohms
3. Wires
4. Switch
5. Ammeter
6. Voltmeter
7. Gem Clips
8. Pencils
9. Masking tape

19.3 Procedure

1. Setup the pencils and make battery train.
2. Connect the ammeter, voltmeter and gem clips.
3. Place one and record the values.
4. Add another cell and record the value.
5. Plot a graph on grid paper, with voltage on horizontal axis and current on the vertical axis.
6. Draw the best fit line.
7. Find the value of the resistance using the rise over run method
   (Resistance = Change in Voltage / Change in Current).

Perfect! You now have an understanding of how resistance plays a role in controlling the passage of current in circuits.

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

19.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. Make sure they know the definition of Ohm's Law:

Ohm's law state that "Current is proportional to voltage for any resistance as long as temperature remains constant."

19.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

19.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this activity, you can assess their learning on their ability of successfully making the circuit and adding more batteries to it independently after multiple repetitions.

CHAPTER 20

Types of Resistors and Ohmmeters

20.1 Learning Objectives

1. Get familiarized with different resistor types and ohmmeter.
2. Learn how Ohmmeters are used.

20.2 Materials

This experiment requires the following items

1. Resistor Assortments
2. Ohmmeter

20.3 Procedure

1. Measure the values of resistors using the ohmmeter.
2. Record the values in a table.

And you're done!

For better learning and understanding, watch Sir Noaman conducting the experiment: dummy video.

20.4 Assessment

For assessing your child's learning from this experiment, ask them short questions from the activity you just performed. This experiment is short, but there are multiple takeaways; Resistors control current, Resistance is measured in Ohms, Ohmmeter is the instrument used to measure resistance.

20.4.1 Core concepts

Core concepts will be tested when your child grasps the learning outcomes from this chapter, and answers your questions correctly.

20.4.2 Performing the experiment independently

One way to ensure that your child fully grasps the lesson is to test if they can perform the experiment by themselves. For this activity, you can assess their learning on their ability of successfully making the circuit and measuring resistance independently after multiple repetitions.