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Teacher Instruction KIT

Electric current and its effects

Syllabus: NCERT
Subject: Science
Grade: 7
Textbook Name: NCERT- Science Textbook for class VII
Chapter Number & Name: 14. Electric Current and its effects

1. OVERVIEW

1.1 OBJECTIVES AND PREREQUISITES

Objective

- To learn the symbols of electrical components used in an electric circuit
- To study the heating effect of electric current and its application
- To learn the hazards and safety measures to be taken.
- To comprehend the magnetic effect of electric current and its uses.

Prerequisite Concept

- Electric circuit, Grade 6 – chapter 12**;** Electricity and Circuits
- Electric cell and electric bulb, Grade 6 -chapter 12; Electricity and Circuits
- Electric switch, Grade 6 – chapter 12; Electricity and Circuits
- Compass, Grade 6 -chapter 13; Fun with Magnets

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*Kindly Note: Activities marked with * are mandatory*

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4.1 EXERCISES & REINFORCEMENT

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2. LEARN

2.1 KEY POINTS

Electric circuit-It is the path along which electric current flows

Electric circuit diagram A standard method of drawing an electric circuit is called **electric circuit diagram.** Symbols of various electric components like cell, wire, battery, and switch are used to draw these diagrams.

Electric cell is represented by two parallel lines, the longer line represents positive terminals while the shorter, thicker line represents negative terminals. Connecting wires are represented by lines. Symbols for switch in on and off positions are also studied.

Battery is a combination of two or more cells. The **positive terminal (**marked as **+)** of one cell is connected to the **negative terminal**(marked as **-**) of the next cell using thick wire or metal strips. Electric cells are used in many devices like torches, toys, TV remotes etc. Cells are placed one after the other or side by side in the **battery compartment** or **cell holder.** A wire is connected to the metal plates in the cell holder to use in the devices.

A **switch** is an electrical component that can disconnect or connect the conducting path in an electrical **circuit**. When the switch is **closed (ON position)**, the circuit is complete. The

electric current flows from through the circuit instantly. When the switch is **open** (**OFF position**), the circuit is incomplete. No electric current flows through any part of the circuit.

Heating effect of electricity- When current flows through a conductor, some of the electrical energy is converted into **heat energy** Household appliances like electric bulb, hot plates, geysers, hair dryers electric heater, iron, electric oven etc. work on this principle.

A coil of wire called elements becomes red hot and gives out heat, when current passes through it. The amount of heat produced in a wire depends on its **Material, length and thickness**

The filament in an electric bulb gets heated up to such an extent and starts glowing. In incandescent electric bulbs, a part of electricity is used up in producing heat which results in waste of electricity. Fluorescent bulbs and CFLS are electricity efficient but LED bulbs are preferred as they consume the least compared to the other two.

Electric fuse is a safety device which helps to prevent the circuit damage and possible fires. **Miniature circuit breakers** (MCB) are switches which automatically turn off when electric current exceeds the safe limit.

Magnetic effects of electricity -Hans Christian Oersted discovered the magnetic effect of electricity.

Magnetism produced by current is called electromagnetism. A current carrying conductor around a piece of iron is called an electromagnet. Electromagnets are used in cranes, toys, speakers, electric bells etc.

Electric Bell An electric bell has an electromagnet when the switch is on, the electromagnet is powered and the iron strip is pulled towards it and the hammer strikes the gong. At this stage the contact is broken and current stops flowing through the circuit. The iron strip moves back to its original position as the electromagnetism is lost. This completes the circuit again and the process keeps repeating.

2.2 LEARN MORE

None

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Electric Circuit

Activity 1: Electric circuit

– Prepare the students for the day's lesson with this game

Materials Required: A (large) loop of lightweight rope.

Prerequisites: None

Activity Flow

- Ask the students whether they have wondered how the fans and light work when they switch it on.
- Tell them that they will play a game to understand the flow of electric current.
- Divide the class into groups. Ask the groups to form a circle and hold the rope loop with curled fingers.
- Ask one student to move the rope by passing it hand to hand. Everyone else should grip the rope very lightly as it moves round.
- Now ask another student (standing away for the first student) to grip more tightly than the others.
- Ask the questions to elicit the answers that

  The student moving the rope is the battery.
  The moving rope is the electric current or charge moving round the circuit.
  The person gripping the rope is like a bulb, fan or any appliance.
  When someone grips the rope more tightly, they feel their hands getting warmer, and the rope gets harder to pull. The person's hands being warmed is like energy being transferred out of the circuit.
- Explain that a circuit is a loop connecting various components.
- Lead the discussion to make the students recall that current flows in a closed loop called the circuit, having components like cells, conducting wires etc.

Tell them that this chapter will deal with electric current and its effects.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Symbols of electric components

Activity 2: Symbols of electric components

Materials Required: Basic circuit components, Cardboard template, tactile flash card of electrical components and their symbols, tactile circuit diagram.

Prerequisites: Components with lead wires attached to each with alligator clips on ends Velcro to stabilize each component atop a template board with Velcro patches where the components can be placed. (as in video)

Activity Flow

- Examine and identify each component.
- With the switch in OFF position, place components on the template and attach the wires.
- Move the switch to ON position and observe the circuit.
- When the switch is on, the circuit is closed (complete) and the current flows through it and the appliance (bulb/motor) will start working. When the switch is off, the circuit is open (broken), the current will not flow through it.

- Tell them that a circuit can be represented by a diagram using the symbols of the components. (like the code used for each letter of the alphabet)
- Explain the symbols with the help of a tactile flash card.

  The **cell** is represented by **two parallel lines**, a long and a thick short one. The **long** line represents the **positive** terminal of the cell and the **short** one the **negative** terminal. When two or more cells are combined, it is called a battery.

  The **connecting wires** are represented by **straight lines**. Guide them to identify the symbols of switch on and off position using the tactile card.
- Now ask them to draw the circuit with the help of the tactile diagram

Battery

Activity 3: Battery-combinations of cells

Materials Required: Cells, battery/cell holders, conducting wires, bulb/buzzer/motor, light probe, tactile circuit diagram (2)

Prerequisites: The components to be fixed on a cardboard, shaped in the form of the symbols and with magnetic ends, connecting wires with U clips at the end.(as in the video)

Activity Flow

- Ask the students if they have seen the batteries in the TV remote control or in a torch. How are they connected?
- Ask the students to make 2 groups and ask them to stand in a straight line holding their hands. Tell them that they are the cells and their right hand is a positive terminal and the left hand is negative. The teacher will squeeze the left hand of the first student of both the teams and they will pass on the squeeze to the person standing to their right. The last student will tap a table kept near him. The team finishing first will be the winner.
- Tell the students that each team represented a battery. Battery is a combination of two or more cells. Cells should be placed with the positive terminal of one connected to the negative terminal of the other (represented by right hand and left hand respectively in the game)
- Cell holders can be used to connect the cells in a circuit.
- They are of two types-a) cells are arranged one after the other.

  b) Cells are arranged side by side
- Let them feel the metallic clips at the end of the cell holder to which wires are connected in a circuit.
- Now ask the students to connect the circuit with the help of a tactile diagram of the circuit. Emphasize that the devices will work only if the cells are connected in the correct order.

Heating effect of electricity

Activity 4: Heating effect of electricity-types of bulbs

Materials Required: one cell, switch, bulb, connecting wires, tactile diagram of the circuit (1), 3DModel of a bulb, Light probe
Prerequisites: None

Activity Flow

- With the 3D model of a bulb, explain its parts and the associated terms like terminals of the bulb, filament etc. Let the students feel the parts of the bulb.
- Now guide the students to connect the circuit with the help of the tactile diagram used in Activity 2.
- Switch it ON, the bulb glows (light probe can be used to detect it). Ask the student to touch the bulb after a minute and check if it is hot. Discuss their observation.
- Lead the discussion to explain that the filament of the bulb (made up of tungsten) gets heated up and gives out light. Such bulbs are called **incandescent bulbs**. They are not electricity efficient as some current is wasted in heating.
- Fluorescent tube lights, Compact fluorescent lamps (CFL) which use mercury vapours are electricity efficient lamps.
- Light emitting diodes (LED) bulbs consume less electricity compared to other bulbs hence we should try to use LED bulbs wherever possible.

Activity 5: Using heating effect of electricity in appliances

Materials required: 10cm long nichrome wire, 2 nails, connecting wires, cell, switch, and wooden board.
Prerequisites: None

Activity Flow

- Connect a nichrome wire between two nails fixed on the wooden board. Now complete the circuit by adding a cell, switch and connecting wires.
- With the switch in OFF position, ask the students to touch the nichrome wire.
- Move the switch to ON position, ask the students to touch the nichrome wire. (They should not hold it for long)
- Switch off the current and touch the wire again. Students understand that wire gets heated when an electric current passes through it.
- Ask the students to name the appliances where the heating effect is used.
- While eliciting the answers like geysers, oven, kettles, explain that they contain an element (coil of wire), which becomes red hot and gives out heat.
- The amount of heat produced in a wire depends on its **material**, **length** and **thickness**.

Electric fuse and circuit breakers

Activity 6: Electric fuse and circuit breakers

Materials Required: Model of electric fuse & miniature circuit breaker (MCB), circuit made in activity 5, steel wool, battery of 4 cells.
Prerequisites: None

Activity Flow

- Ask the students if they have heard about fire due to short circuits. Why does it happen?
- Tell them that a short-circuit may occur when excessive current flows due to touching of wires without insulation. Lead the discussion to bring out the other causes of excessive current like Overload. (connecting many devices to a single socket)
- Ask the student to suggest some ways to prevent these. The answers may include - not to connect many devices, to check the insulating wires etc. Lead the discussion to the use of fuse in the circuit. Show the model of fuse.
- Tell them that this activity will help them learn about the principle of fuse.
- The nichrome wire is replaced with steel wool (a very thin steel wire) and the cell with a battery of 4 cells in the circuit used in Activity 5.
- Switch on the current and ask the students to check the steel wool.
- The students will find the steel wool broken.
- Lead the discussion to highlight that some special metals melt when excessive current flows through them. Such a wire is used in a fuse so that it breaks the circuit when excessive current flows through it. The appliance is protected from damage and possible fire. On changing the fuse wire, the circuit will be complete again.
- An **MCB (Miniature Circuit Breaker)** is another safety device which automatically turns off (called tripping) when current exceeds a safe limit. Tripping stops the flow of current in the circuit. When the switch is turned on, current starts flowing in the circuit.
- Ask the students to find out where fuse or MCB is used in their houses.

Magnetic effect of electricity

Activity 7: Magnetic effect of electricity

Materials Required: Compass, bar magnet, iron nails, matchbox, insulated flexible wires, 6-10 cm long nail, switch, pins
Prerequisites: concept of compass

Activity Flow

- Ask the students to name the device used to find the direction. What will happen if a bar magnet is brought near it?
  Lead the discussion so that students recall that
  -compass is used to find the direction
  -it is made up of a magnetic needle, which comes to rest in the north south direction.
  -When a bar magnet is brought near the compass, the needle gets deflected.
- The scientist Hans Christian Oersted observed that when an electric current passes through a wire, it behaves like a magnet.
- Ask the students to wind an insulated wire on the nail and connect the two free ends of the wire to a cell through a switch. Place some pins near the nail.
- Switch ON the current. Ask the students to touch the tip of the nail to check if any pins were clinging to it.
- Ask them to switch OFF, the current and repeat the same.
- Ask them why the pins which were clinging to the nail fell off when the current stopped flowing through it.
- Lead the discussion to elicit the fact that the nail behaved as a magnet when the current was flowing through it and attracted the pins. It lost the magnetism when the current stopped flowing through it. Such coils are called electromagnet.
- They are used in toys, cranes, speakers etc. Some doctors use it to remove tiny iron particles from the eye.

Electric bell

Activity 8: Electric bell- construction and working

Materials Required: Working model of an electric bell and the tactile diagram.
Prerequisites: None

Activity Flow

- Switch on the circuit and ask the students to listen.
- Ask the students what type of sound they hear.
- Explain that the electric bell works on the principle of electromagnetism and that it consists of a battery, an electric switch, an electromagnet (a coil of wire wound on an iron piece), a contact screw, and an iron strip with a hammer and a gong. Let the students describe the parts by touching the model.
- With the help of the tactile diagram, explain the working of the bell. When the current flows through the coil, it acts as an **electromagnet** and attracts the iron strip to it. When the **strip** is pulled towards it, the hammer on the strip hits the **gong** of the bell and produces a sound. At the same time the circuit is **broken**. The

electromagnet **loses** its magnetism and the iron strip is pulled back to the original position. It touches the **contact screw** and so the circuit is again closed. The process is repeated in quick succession and the bell rings.

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

- Ask the students to find out if the appliances in their houses have the ISI mark . Lead the discussion to give its importance and certain safety measures to be taken while handling electrical equipment.
- Also mention the importance of conserving electricity at home and in school.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 9: Circuit diagram

Materials Required: rubber board, parchment paper, stylus, pins, tactile diagram of electric circuit

Prerequisites: circuit diagram

Activity Flow

- Ask the students to draw the circuit diagrams on parchment paper.
- Allow the student to explore and see the tactile diagram well enough to make a mental picture as well as recognize the diagram independently at a later time.
- While drawing they can refer to the tactile diagram.

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently.

References:

Activity 2: https://www.youtube.com/watch?v=6Qk59o87I6w
Activity3:
https://www.perkinselearning.org/accessible-science/activities/building-basic-series-circuit

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