Vision Empower & XRCVC

Teacher Instruction KIT

Nature of Matter

Syllabus: Karnataka State Board
Subject: Environmental studies
Grade: 5
Textbook Name: Environmental Studies- Text cum work book-English medium- Fifth standard
Chapter Number & Name: 11. Nature of Matter

1. OVERVIEW

1.1. OBJECTIVE & PREREQUISITES

Objective

- To understand matter and its characteristics.
- To know different states of matter.
- To understand the types of changes in states of matter.
- To understand about mass, density, pressure, solubility and buoyancy.

Prerequisite Concept

- Familiarity with the objects around them.
- Concept of float and sink.

Content Index

*Kindly Note: Activities marked with * are mandatory*

2. LEARN

2.1 KEY POINTS

- Matter is anything which occupies space and has mass. Example: wood, water, etc.
- Sublimation: some solids on heating directly convert into their vapour state and vice versa without passing through the liquid state and this is called sublimation. Example: camphor, iodine.
- Density: how tightly packed the particles are in an object. It is the amount of mass contained in a unit volume. Generally the density of the solid is more than that of the liquid and the density of the liquid is more than that of the gas.
- Pressure: Pressure is the force experienced by an object divided by the area of the surface on which the force acts.
- Buoyancy: The upward force exerted by a fluid upon a body placed in it.

2.2 LEARN MORE

None

3 ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Interest generation activity

Activity 1: Sort the things

Materials required: Glass of water, book, stylus, oil, balloon filled with air, burning incense stick

Prerequisites: None

Activity Flow

- Place all the materials on the table with some distance between each other.
- Call a group of 2 students and ask them to sort/group the materials into categories which they feel is appropriate and ask them to name it.
- Later ask them, how did they grouped the things and into how many categories and why?
- Then based on their ideas and understanding, start the concept of nature of matter.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Matter

Activity 2: Matter

Materials required: Materials around them, chalk

Prerequisites: None

Activity Flow

- Ask the children to list down the materials they have seen or touched around them.
- Can they arrange these listed materials into some categories? (Based upon feature, characteristics, etc.)
- Collect some material around you such as slate, stylus, water bottle, tables, chairs, etc. And tell students that everything around us is called matter.
- Matter is anything which occupies space and has mass. Example: wood, water, etc.
- The smallest piece of matter is called a particle.

Experiment from the textbook (Karnataka textbook, print page number 132)

- Give pieces of chalk to the children and ask them to crush the chalk to form power on their tables.
- Ask them if there is any difference in this powder form and chalk.
- So these minute chalk powders are particles.
- Similar to this, all the matter is made up of small particles. And the smallest piece of matter is called a particle.

Properties of matter

Activity 3: Matter occupies space

Materials required: different materials around them (books, slate, taylor frame, bottle), broad plate, beaker, water, stone, thread
Prerequisites: None

Activity Flow

- Give them different materials (books, slate, taylor frame, bottle, etc.) and ask them to put everything on the table.
- Then see if their tables are already full with these objects. If yes, then give them one extra object and ask them to place it on the table.
- As the table is already full, either they have to shift something or remove.
- So all the space on the table is being occupied by all these objects/materials.
- This shows that matter occupies space.

Experiment:

- Let the children do the experiment and the container/beaker filled with water should be kept in a broad plate with raised sides/container.
- Let the children touch the beaker filled with water and the broad container with no water.
- Ask them to slowly immerse a stone tied with a thread into the beaker filled with water.

- Now if they touch the broad container they would feel some water is there now.
- This shows that water spilled from the beaker when the stone was immersed in it.
- Further this indicates that the stone has occupied some space in the beaker and that water is being spilled out, therefore every matter occupies space.

Activity 4: Matter has mass

Materials required: weighing balance, objects with different mass.
Prerequisites: None

Activity Flow
Mass is the amount of matter in an object.

- Show them the weighing balance and then ask them to put some objects on one part/side of it. They would touch the balance as one side of it would be up and the other side with an object would be lower.
- Then tell them that the level of one side of beam balance is low because of the object and its mass.
- Ask the children what it means when both sides of the balance are at the same level. Then explain to the children that this means that the masses of each object are equal.
- Mass is a measure of how much matter an object contains. A metal teaspoon, for example, contains more matter than a plastic teaspoon. Therefore, a metal teaspoon has a greater mass than a plastic teaspoon.

States of matter

Activity 5: Solid, liquid and gases

Materials required: wood, water in a bottle, a blown balloon, tactile diagram of states of matter, 2 beaker, 3-4 marbles, sugar powder
Prerequisites: None

Activity Flow
Give three different matters to them: wood, water in a bottle, a blown balloon.

- Now ask them the differences between these three.
- You can also show them by changing the container of water.
- And then explain these three categories:
  - Solid: hard material. Ask them if they can break the wood easily.
  - Liquid: Flows and gets the shape of the container. Show them by changing the container that has water.
  - Gas: Cannot be held and is invisible. Use an incense stick so that they will smell the fragrance but cannot hold the gas.

- Now ask them to name some materials and differentiate them as per these three categories. Example: milk, honey, smoke, table, bag, etc.
- Matter is identified in its three forms/states: Solid, Liquid and Gas.
- By showing the tactile of states of matter, explain to them that
    - In solids, particles are densely and orderly arranged. Example: stone, iron etc.
    - In liquids, the particles are loosely arranged when compared to solids. Example: water, milk etc. For this conduct the activity (from the textbook)
      -Take a beaker completely filled to the brim with water. Drop three marbles into it. Now water spills out. Why?
      -Take another beaker of the same size completely filled with water. Add some sugar powder equal to the weight of the three marbles. Ask them, did they find any difference in the water level?
    - In gases, the particles are rarely arranged. Example: air, smoke etc.

Changes in the state of Matter

Activity 6: Effect of heat on matter

Materials required: Ice cube, plate
Prerequisites: None

Activity Flow

- Place an ice cube on a plate, let them first touch the ice cube.
- Ask them if it is solid, liquid or gas?
- Then place it on a plate for 10 min, after that show them again.
- Ask students do they see any difference/ change?
- Now in this, solid has been being changed in liquid.
- This shows that matter gets changed when heated.
- Similarly, teachers can do other activities with the help of candles, heating the water, keeping the water outside in sunlight.

Changes in the states of a matter:

- When we heat an object there is a rise in temperature. And the states of matter change due to this.
- For this teacher can show the same experiment.
- First show them the ice cubes, after 1o minutes it would change to water and then if we heat the liquid it would change to vapour (gas).
- Solid (ice cube) changed into liquid (water) and liquid changed into gas (vapours) on heating.

Mass

Activity 7: Mass

Materials required: Objects of different mass
Prerequisites: None

Activity Flow

- Mass is a measure of the amount of matter in an object. It is usually measured in kilograms or grams.
- Give them two objects, one should be heavy and one should be light in weight.
- Ask them the same question: which one from the two do you think has more mass? And why?
- If there is a weighing balance, teachers can even use that to show them the mass of different objects.

Density

Activity 8: Density

Materials required: 1-2 broad water containers, apples, pins, wood, marbles
Prerequisites: None

Activity Flow

- Have 1-2 broad and large water containers.
- Give the children apples, pins, wood, and marbles and ask them which one is heavy and one is light.
- Which one do they think will sink and which one will float in water.
- To check whether their answers are correct or not, we would do an activity. For that put pins and apples in one container, wood and marbles in another container.
- So if you put an object in water and it floats then it is less dense than the water. If you put an object in the water and it sinks it is denser than the water. Mainly if an object floats it is less dense, and if it sinks it is denser.
- Then explain to them that objects which have more particles (tightly packed) will sink and objects with less particles (will float) .

Pressure and Buoyancy

Activity 9: Pressure

Materials required: None
Prerequisites: None

Activity Flow

- Explain to them what pressure is.

- A simple example of pressure may be seen by holding a knife to a piece of fruit. If you hold the flat part of the knife against the fruit, it won't cut the surface. The force is spread out of a large area (low pressure). If you turn the blade so the cutting edge is pressed into the fruit, the same force is applied over a much smaller surface area (vastly increased pressure), so the surface cuts easily.
- Teacher can also explain the activity(from the textbook)
  -Take a tumbler containing water. Place a blade horizontally. It floats. Place the same blade perpendicular to the surface of water. It sinks.
  -When the blade is placed horizontally, its mass is distributed over a wider area. Therefore mass per unit area is less and hence it floats. When the blade is kept perpendicular to the water surface, it sinks since the mass is distributed over a smaller area. Therefore the consequence depends upon mass per unit area. This is called pressure. Pressure is the force exerted on a unit area.

Activity 10: Buoyancy
Materials required: 2 beaker, stone, wooden plank
Prerequisites: None

Activity Flow
For buoyancy conduct the following activity (from the textbook):

- Ask the students to immerse a stone gently into a glass beaker containing water.
- In another beaker ask them to immerse a wooden plank into the beaker containing water.
- Let them put their hand inside the beaker and check the position of the stone and wooden plank.
- Explain to the students that when an object is immersed in water, it exerts a downward force on water and the water in turn exerts an upward force or upward thrust on the objects. If the upward force exerted on the object is more than the downward force, then the objects float. This upward force exerted is called buoyancy.

Solubility

Activity 11: Solubility
Materials required: Two broad containers, salt, sand
Prerequisites: None

Activity Flow
Solubility: Some objects dissolve in water which is called solubility.

- Fill water in two broad containers.
- In one of them put salt and stir it.

- In the second container put sand and try to stir it.
- Then ask the children to check both the beakers (they can put their finger in the water).
- They will see the difference that salt is completely dissolved in water whereas sand isn't dissolved.
- Then ask them what objects they know which dissolves in water and which don't.
- And as per their answer, try to check if that material is available and if possible they can use those materials to check whether they dissolve in water or not.

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

- Everything present in the universe is made of matter. Even we, the human beings, are made of matter.
- Matter has atoms and molecules. So the food that we eat everyday consists of atoms as well as molecules. Therefore, food is also a kind of matter without which we cannot survive.
- The clothes that we wear, all the necessary things like pencil, brush, utensils all are made of matter.

4 EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 12: Discussion on Matter

Materials required: None

Prerequisites: Matter

Activity Flow

- Discuss the following question in the class.
  Is fire matter?
  Matter is anything that has mass and occupies space. The flame itself is a mixture of gases (vaporized fuel, oxygen, carbon dioxide, carbon monoxide, water vapor, and many other things) and so is matter. The light produced by the flame is energy, not matter. The heat produced is also energy, not matter.

Activity 13: Story- Eureka

Materials required: None

Prerequisites: Buoyancy

Activity Flow

- Tell the following story in the class and see if they were able to connect this story with the concept of buoyancy.

Eureka! Eureka!'

Archimedes has gone down in history as the guy who ran naked through the streets of Syracuse shouting "Eureka!" — or "I have it!" in Greek. The story behind that event was that Archimedes was charged with proving that a new crown made for Hieron, the king of Syracuse, was not pure gold as the goldsmith had claimed.

Archimedes thought long and hard but could not find a method for proving that the crown was not solid gold. Soon after, he filled a bathtub and noticed that water spilled over the edge as he got in and he realized that the water displaced by his body was equal to the weight of his body. Knowing that gold was heavier than other metals the crown maker could have substituted in, Archimedes had his method to determine that the crown was not pure gold. Forgetting that he was undressed, he went running naked down the streets from his home to the king shouting "Eureka!"

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

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