

Matter

Teaching Ideas—Metals and Non-Metals

Grade: VIII

Objective: To make the students be able to differentiate between metals and non-metals through hands-on inquiry.

Learning Outcome:

After the completion of the lesson, the students will be able to do the following:

- Classify metals and non-metals based on their physical properties.
- Compare the properties of metals and non-metals.

Pre-requisites:

Before learning this, the students should have prior knowledge about the following:

- Atoms—the building blocks of matter.
- Construction of a simple circuit.

Elements of a Good Science Classroom

A science classroom should have the following elements: science skills, a classroom culture, and a connection to the life around the students. This year, we will be focusing on the following specific elements:

1. Science skills:
The students should understand, at their level, the following elements of the scientific method: generation of a hypothesis, experimentation, observation, analysis, and inference.
2. Classroom conducive for learning science:
Self-motivation, self-awareness, working in a team, and social/civic awareness and consciousness are key qualities to learn science. The students should be allowed to interact with each other and learn from each other to improve their communication skills through peer-learning.
3. Connection with life around:
The students will be able to learn and apply scientific concepts in simple real-life situations.
4. Removal of gaps in learning:
The gaps in numeracy, literacy, and conceptual understanding of science should be addressed.

In the context of this module, the following elements of a good science classroom can be demonstrated:

Classroom Element	Specific Type	Context	Teacher's Actions	Students' Actions
Classroom engagement	Student participation	Providing opportunities to the students (individuals/groups) to share their findings and discuss them with the whole class.	The teacher should engage the students in the activity and provide them the opportunity to express their ideas about metals and non-metals	The students should present their ideas and engage in a discussion in case there are any conflicting notions about the topic.
Conceptual Understanding	Assessment	Multiple-choice and higher-order questions (application level)		

		questions) to check the understanding of the students		
Science Skills	Observation	There are different observables associated with each test, such as sonorous property, electrical conductivity, malleability, and ductility.	The teacher should guide the students to observe the different observables and fill them in the observation sheet.	The students are to observe the differences between the behavior of objects. They should ideally come up with two categories of behavior (metals and non-metals).
Science Skills	Inference	Metals are sonorous, conductors, and hard as compared to the non-metals.	The teacher should guide the students to define metals and non-metals on the basis of their physical properties.	The students should be able to come up with the physical properties of metals and non-metals.

Materials required:

- Piece of coal
- Iron nails
- Copper wire
- Sulphur powder
- Hammer
- Wires
- Bulbs
- Battery

Note to the Teacher:

- The intent behind this module is to help the students be able to differentiate between metals and non-metals based on their physical properties, which have been mentioned before. Hence, it is important to let the students know that they will not be looking into the chemical properties (which will be dealt with in the higher grades).
- Chemistry is a subject that has a lot of exceptions to its rules. Hence, this concept must also be introduced to the students. The teacher can show the students that even though graphite is a non-metal, it still conducts electricity. It should be explained that exceptions are present because of different chemical properties.
- The students are to be divided into groups of five. Thus, there will be 6 groups in a class of 30 students. Each group will be provided three materials to test. After having tested them, the students should be allowed to discuss within their group and come up with a classification for the material. They should be allowed to present their inference to the whole class.
- Questions should be asked in a manner that will elicit answers from the students.

- The teacher must communicate the observables clearly to the students and help and guide them while filling up the observation table.
- In the Engage Activity 2, the students might come up with different types of classifications for some objects. If any group comes up with a classification based on a particular physical property, such as hardness, lustre, etc., the teacher should leverage that group to teach the rest of the class.

Activity:

Engage Activity 1: Before commencing with the activity, provide the students with 2 materials and ask them to write 5 points about the properties of those materials. There is a good chance that the students might come up with their applications and physical properties, such as hardness and other things. Allow the students to share it with the whole class. (If the students are unable to come up with any applications of the same, the teacher should try to elicit responses from them.)

Engage Activity 2: Show 10 different types of materials (charcoal, iron nail, copper wire, wood, plastic, chalk, pencil lead, aluminum sheets (higher thickness)) to the students and ask them to separate them into two segments based on any particular criteria.

1. Malleability and Hardness

Take a hammer and beat the samples with it. Observe the changes in the samples and record your observations in the table given below.

Observables: How does the texture change? Breaks into fine powder/stretches/no change/etc.

Is the test sample hard or soft?

2. Conductivity

Prepare an open circuit using a battery, a wire, and a bulb. Make sure to connect all the components in a series circuit. Look at the image on Pg. 50 in the Samacheer textbook.

Observables: Is the bulb glowing or not?

3. Sonorousness

Strike the different test samples with a metal spoon. Note the kind of sound that is emitted.

Observables: Type of sound produced: ringing sound/breaking sound/etc.

4. Lustrousness

Observe the test sample and describe its surface.

Observables: How does the surface look? Is it shining or is it dull?

5. Density

The density data of different elements should be shown to the students, and they should be asked whether they can predict which of the elements will float on water and which will sink. After the students have made their predictions, the teacher should simulate the experiment to show them whether their predictions were correct or wrong. After having simulated the experiment, the teacher should ask the students to guess which of materials are metals.

SIM: https://phet.colorado.edu/sims/density-and-buoyancy/density_en.html

Worksheet: The worksheet contains an observation table that has multiple-choice questions based on the observables mentioned above **Tab. 1. Observation Table**

Sample Properties	Sample 1	Sample 2	Sample 3
Hardness and Lustre	<input type="checkbox"/> Dull appearance <input type="checkbox"/> Shining appearance <input type="checkbox"/> Hard to feel <input type="checkbox"/> Soft to feel Other observations:	<input type="checkbox"/> Dull appearance <input type="checkbox"/> Shining appearance <input type="checkbox"/> Hard to feel <input type="checkbox"/> Soft to feel Other observations:	<input type="checkbox"/> Dull appearance <input type="checkbox"/> Shining appearance <input type="checkbox"/> Hard to feel <input type="checkbox"/> Soft to feel Other observations:
Conductivity	Bulb glows <input type="checkbox"/> Yes <input type="checkbox"/> No Other observations:	Bulb glows <input type="checkbox"/> Yes <input type="checkbox"/> No Other observations:	Bulb glows <input type="checkbox"/> Yes <input type="checkbox"/> No Other observations:
Malleability	<input type="checkbox"/> Breaks into fine powder <input type="checkbox"/> No change <input type="checkbox"/> Stretches in area Other observations:	<input type="checkbox"/> Breaks into fine powder <input type="checkbox"/> No change <input type="checkbox"/> Stretches in area Other observations:	<input type="checkbox"/> Breaks into fine powder <input type="checkbox"/> No change <input type="checkbox"/> Stretches in area Other observations:
Sonorous property	<input type="checkbox"/> Ringing sound <input type="checkbox"/> Breaking sound <input type="checkbox"/> Non-ringing sound Other observations:	<input type="checkbox"/> Ringing sound <input type="checkbox"/> Breaking sound <input type="checkbox"/> Non-ringing sound Other observations:	<input type="checkbox"/> Ringing sound <input type="checkbox"/> Breaking sound <input type="checkbox"/> Non-ringing sound Other observations:

Assessment

1. The school bell has been gone for repair, and you have to find an alternative for the setup. Which of the following materials will you use?

 Iron plate Wooden plate Plastic plate Cardboard plate

2. In the given circuit, which of the following materials will make the bulb glow?

 Aluminum Plastic Sulphur Wood

3. Which of the following can be pressed into sheets?

 Iron Aluminum Plastic Coal

4. Classify the following set of materials into metals and non-metals and write down their applications.

a. Aluminum

e. Graphite

b. Iron

f. Oxygen

c. Plastic

g. Nitrogen

d. Wood

h. Glass

5. Name a non-metal that can conduct electricity?

6. Discuss and present the following in groups:

The way materials are used can change with time. Cooking was carried out in clay pots a few decades back. But now, aluminum utensils are used. List a few factors that led to these changes. Can you name any other such changes that you have seen around you?