Physical and chemical changes

Lesson plan and teacher's notes · Form 1 Chemistry · 1 period of 40 minutes

School	(write school name)	**Teacher**	(write name)
Date	(date)	**Class**	Form 1
Subject	Chemistry	**Enrolment**	Boys ___ Girls ___ Total ___
Time	40 minutes	**Topic**	Physical and chemical changes

Learners say what a physical change and a chemical change are, give examples of each, tell the two kinds apart by asking whether a new substance was formed, and describe simple experiments with ice, wax, paper, sugar, baking soda and vinegar. Examples come from tea, candles and paper at school.

Specific outcomes

By the end of the lesson, learners should be able to:

1. Say what a physical change is and give examples
2. Say what a chemical change is and give examples
3. Tell the two kinds of change apart
4. Describe simple experiments that show each kind of change

Prior knowledge

- Matter exists as solids, liquids and gases
- Substances can dissolve in liquids
- Using a balance to weigh a material

Teaching and learning materials

- a piece of ice or a cup of water
- wax or a candle
- paper, scissors and wire
- sugar, salt and water
- baking soda, vinegar and a beaker
- a balance
- chalk and board

References

Ministry of Education (CDC) Form 1 Chemistry syllabus and module; 25Schools learners' note: Physical and chemical changes.

Lesson development

Stage and time	Teacher activities	Learner activities
Introduction 5 min	Ask what happens to ice in a cup, to sugar in tea and to paper that burns. Ask which changes can be turned back and write the title and key words.	Suggest which changes can be reversed and copy the title and key words.
Development: physical changes 9 min	Define physical change, change of state, reversible, solute and solvent. Give the examples of melting, evaporation, condensation, freezing, changes in shape and size, and dissolving. Work the example of melting ice.	Copy the definitions and list four changes of state.
Development: chemical changes 9 min	Explain that in a chemical change a new substance is formed. Use burning paper and baking soda with vinegar, and ask whether the ashes can be turned back into paper.	Copy the definition and give two examples of chemical change.
Development: investigating the changes 10 min	Describe the investigations with ice, wax, paper, wire, salt, sugar, burning paper and baking soda with vinegar. Remind learners to ask whether a new substance formed, whether the change can be reversed and whether the mass changed, and to take extra care when burning paper.	Record observations in a table for each task.
Conclusion 7 min	Ask learners to classify three changes using the question: was a new substance formed. Set the homework.	Answer orally and copy the homework.

Teacher's content notes

Read these before the lesson. They are what you need to know, not what to copy onto the board.

The key question

To tell the two kinds of change apart, ask one question: was a new substance formed. If no new substance is formed the change is physical, and if a new substance is formed it is chemical.

Physical changes

In a physical change a substance keeps its chemical nature and no new substance is formed. Examples are changes of state, changes in shape and size, and the dissolving of a solute in a solvent.

Reversible changes

Physical changes are generally reversible and involve little or no energy. Melted ice can freeze again, and a piece of wire that has been folded is still the same wire.

Chemical changes

In a chemical change the nature of the substance changes and a new substance is formed. Burning paper is an example, and so is mixing baking soda with vinegar.

Changes of state

Melting, evaporation, condensation and freezing are changes of state, which are physical changes.

Investigating safely

Record observations in a table and ask after each task: did the substance change into a different substance, can the change be reversed, and did the mass change. Work carefully, and take extra care when you burn paper.

Questions to ask during the lesson

Question	Expected answer
A learner at a school in Luangwa leaves a piece of ice in a cup and it melts to form water. (a) Is this a physical or chemical change. (b) Say whether a new substance is formed. (c) Can the water freeze again.	(a) Physical. (b) No, the substance only changes state. (c) Yes, because physical changes are generally reversible.
A teacher at a school near Feira burns a piece of paper and asks learners whether the ashes can be turned back into paper. (a) Name the kind of change. (b) Answer the teacher's question. (c) Give the reason for your answer.	(a) Chemical. (b) No. (c) Ash is a new substance.
A learner near Feira stirs sugar into tea and says the sugar has vanished. (a) Name the solute and the solvent. (b) Say what kind of change this is. (c) Explain why it is not a chemical change.	(a) Sugar is the solute and the tea is the solvent. (b) A physical change. (c) No new substance is formed.

Worked examples for the board

Is melting ice a physical or a chemical change

Ice melts to form water, so the substance only changes state. No new substance is formed. So melting ice is a physical change.

Is burning paper a physical or a chemical change

Paper burns and becomes ashes. Ask whether the ashes can be turned back into paper. They cannot, because ash is a new substance. A new substance is formed, so burning paper is a chemical change.

Board plan

Write the title and key words. Left: physical changes with examples. Right: chemical changes with examples. Bottom: the question to ask, was a new substance formed.

Change	New substance formed	Kind of change
Melting ice	No	Physical
Dissolving sugar in water	No	Physical
Grinding salt into powder	No	Physical
Burning paper	Yes, ashes	Chemical
Baking soda mixed with vinegar	Yes	Chemical

Physical and chemical changes compared

Mistakes to expect

Learners often think	Put it right
Dissolving sugar in tea is a chemical change because the sugar disappears.	Dissolving a solute in a solvent is a physical change, because no new substance is formed.
Melting ice makes a new substance.	Ice melts to form water, so the substance only changes state. No new substance is formed, so melting is a physical change.
Burnt paper can be turned back into paper.	The ashes are a new substance and cannot be turned back into paper, so burning paper is a chemical change.
Cutting or folding something makes a new substance.	Changes in shape and size are physical changes. A piece of wire that has been folded is still the same wire.

Differentiation

Learners who struggle

Give learners a list of changes with two columns headed new substance formed and no new substance formed, and let them place each change in a column before naming it physical or chemical.

Learners who finish early

Ask learners who finish early to plan a table of observations for a new change of their choice and the three questions they would ask after the task.

Hearing or visual impairment

For learners with visual impairment, let them feel the ice melting and the sugar dissolving and describe the changes aloud. For learners with hearing impairment, write each key word on the board and use a two-column table to show the two kinds of change.

No projector, no printing

Use water, a piece of ice, sugar, salt and a piece of paper from the school. Describe the baking soda and vinegar change if no beaker or balance is available.

If time is short

Skip the investigations stage and work the two worked examples and the Luangwa tea, candle and paper scenario; set the rest as homework.

Evaluation

Question or task	A correct answer shows
A learner at a school in Luangwa stirs sugar into hot tea, then melts a candle in a dish, and later burns a piece of paper to light a fire. (a) Which of these are physical changes. (b) Which one is a chemical change. (c) Explain how you decided for the chemical change.	(a) Dissolving the sugar and melting the candle wax. (b) Burning the paper. (c) The ashes are a new substance and cannot be turned back into paper, so a new substance was formed.
In a laboratory a group mixes baking soda with vinegar in a beaker standing on a balance and records the mass before and after. (a) Is this a physical or a chemical change. (b) Say what the group should record and why. (c) Name one safety rule the group should follow.	(a) A chemical change, because the two substances react to make new substances. (b) The mass before and after, to check whether the mass changed. (c) Work carefully in the laboratory.
A learner near Feira grinds salt crystals into powder and folds a piece of wire many times, and says both are chemical changes. (a) Do you agree. (b) Say what kind of change each is. (c) Give the reason.	(a) No. (b) Both are physical changes. (c) The salt is still salt and the wire is still the same wire, so no new substance is formed.

Homework

A learner at a school near Feira melts wax in a dish, dissolves sugar in water and burns a piece of paper. (a) Classify each change as physical or chemical. (b) Say whether a new substance is formed in each. (c) Explain which change cannot be turned back and why.

Extra practice with answers

Question	Answer
1. A learner at a school in Luangwa stirs sugar into hot tea, then melts a candle in a dish, and later burns a piece of paper to light a fire. (a) Which of these are physical changes. (b) Which one is a chemical change. (c) Explain how you decided for the chemical change.	(a) Dissolving the sugar and melting the candle wax. (b) Burning the paper. (c) The ashes are a new substance and cannot be turned back into paper, so a new substance was formed.

2. In a laboratory a group mixes baking soda with vinegar in a beaker standing on a balance and records the mass before and after. (a) Is this a physical or a chemical change. (b) Say what the group should record and why. (c) Name one safety rule the group should follow.	(a) A chemical change. (b) The mass before and after, to check whether the mass changed. (c) Work carefully, and take extra care when burning paper.
3. A learner near Feira grinds salt crystals into powder and says this is a chemical change. (a) Do you agree. (b) Say what kind of change it is. (c) Give the reason.	(a) No. (b) A physical change. (c) The salt is still salt and no new substance is formed.
4. A teacher at a school near Feira asks learners to name four changes of state and to say what kind of change each is. (a) Name four changes of state. (b) Say what kind of change they are. (c) Say whether they are generally reversible.	(a) Melting, evaporation, condensation and freezing. (b) Physical changes. (c) Yes, physical changes are generally reversible.

Answers to the learners' check-yourself questions

1. What is a physical change?
   A change in which no new substance is formed.
2. What is a chemical change?
   A change in which a new substance is formed.
3. Name four changes of state.
   Melting, evaporation, condensation and freezing.
4. Classify as physical or chemical: grinding salt into powder.
   Physical, because the salt is still salt and no new substance is formed.
5. Classify as physical or chemical: burning paper.
   Chemical, because ashes are a new substance.
6. A learner at a school in Luangwa stirs sugar into hot tea, then melts a candle in a dish, and later burns a piece of paper to light a fire. (a) Which of these are physical changes? (b) Which one is a chemical change? (c) Explain how you decided for the chemical change.
   (a) Dissolving the sugar and melting the candle wax. (b) Burning the paper. (c) The ashes are a new substance and cannot be turned back into paper, so a new substance was formed.
7. In the laboratory a group mixes baking soda with vinegar in a beaker standing on a balance and records the mass before and after. (a) Is this a physical or a chemical change? (b) Say what the group should record and why. (c) Name one safety rule the group should follow.
   (a) Chemical change. (b) The mass at the start and at the end, and their observations, so they can compare and present the data. (c) Work carefully and safely, for example wear eye protection and keep the beaker away from the edge of the table.

Teacher's reflection

What went well:

What I will change next time:

Learners who need follow-up: