

Changes of state

Learning objectives

- 1 Define the terms melting point and boiling point.
- 2 Explain how the amount of energy a substance has relates to its temperature.
- 3 Describe the link between purity and melting point.
- 4 Write independently about melting and boiling points.

Introduction

The physical state (solid, liquid or gas) of a substance depends on the melting point and boiling point of that substance. Different substances have different melting and boiling points.

Instructions

1. Stick the structure strip in the margin of your exercise book/paper.
2. Reflect on what you already know about melting and boiling points and where you have seen the key terms before. Follow the prompts and use your knowledge to write a summary of melting and boiling points. If you'd like more support, what other sources could you use to find the information, e.g. a textbook, online?
3. Answer the extension question to apply your knowledge of melting and boiling points to a new context.

Key terms

Use these key terms in your responses:

- boil • melt • boiling point • melting point • solid • liquid • gas • volume

Structure strip Changes of state	Structure strip Changes of state	Structure strip Changes of state	Structure strip Changes of state	Structure strip Changes of state
Define the state changes that happen at the: <ul style="list-style-type: none"> • melting point • boiling point. 	Define the state changes that happen at the: <ul style="list-style-type: none"> • melting point • boiling point. 	Define the state changes that happen at the: <ul style="list-style-type: none"> • melting point • boiling point. 	Define the state changes that happen at the: <ul style="list-style-type: none"> • melting point • boiling point. 	Define the state changes that happen at the: <ul style="list-style-type: none"> • melting point • boiling point.
Explain how a thermometer works to measure an increase in temperature.	Explain how a thermometer works to measure an increase in temperature.	Explain how a thermometer works to measure an increase in temperature.	Explain how a thermometer works to measure an increase in temperature.	Explain how a thermometer works to measure an increase in temperature.
State the usual scale for temperature and give the melting and boiling points for water.	State the usual scale for temperature and give the melting and boiling points for water.	State the usual scale for temperature and give the melting and boiling points for water.	State the usual scale for temperature and give the melting and boiling points for water.	State the usual scale for temperature and give the melting and boiling points for water.
Sketch a graph to show what happens to the temperature as the energy of a substance is increased. Your graph should have: <ul style="list-style-type: none"> • Energy as the x axis • Temperature as the y axis • The melting point labelled • The boiling point labelled • The different states (solid, liquid and gas) labelled. 	Sketch a graph to show what happens to the temperature as the energy of a substance is increased. Your graph should have: <ul style="list-style-type: none"> • Energy as the x axis • Temperature as the y axis • The melting point labelled • The boiling point labelled • The different states (solid, liquid and gas) labelled. 	Sketch a graph to show what happens to the temperature as the energy of a substance is increased. Your graph should have: <ul style="list-style-type: none"> • Energy as the x axis • Temperature as the y axis • The melting point labelled • The boiling point labelled • The different states (solid, liquid and gas) labelled. 	Sketch a graph to show what happens to the temperature as the energy of a substance is increased. Your graph should have: <ul style="list-style-type: none"> • Energy as the x axis • Temperature as the y axis • The melting point labelled • The boiling point labelled • The different states (solid, liquid and gas) labelled. 	Sketch a graph to show what happens to the temperature as the energy of a substance is increased. Your graph should have: <ul style="list-style-type: none"> • Energy as the x axis • Temperature as the y axis • The melting point labelled • The boiling point labelled • The different states (solid, liquid and gas) labelled.
Suggest how this graph might be different for a substance that isn't pure. Explain your answer.	Suggest how this graph might be different for a substance that isn't pure. Explain your answer.	Suggest how this graph might be different for a substance that isn't pure. Explain your answer.	Suggest how this graph might be different for a substance that isn't pure. Explain your answer.	Suggest how this graph might be different for a substance that isn't pure. Explain your answer.

Extension question: correcting Chef George

The table shows some data about different types of chocolate. Chocolate is a mixture containing cocoa solids, sugar, milk powder and cocoa fat in different proportions. When chocolate goes above its melting point the mixture can start to split and go grainy.

Type of chocolate	% cocoa solids	% cocoa fat	Melting range (°C)
Dark	85+		46–48
Milk	20–50		40–45
White	0	20–30	37–43

Chef George wants to use a mixture of white, milk and dark chocolate to put on top of a special cake. He has decided to mix the chocolate chips together and heat it strongly to 50°C to make sure it is all melted.

Write a brief note to Chef George to suggest a better way for him to get his melted chocolate mixture. Explain why his method is not ideal.