



## Introduction (5 minutes)

Welcome to this worksheet on designing and conducting investigations into changes of state! This activity is designed for 9-year-old students and aims to help you understand the scientific principles behind melting, freezing, and boiling.

Read the following text and answer the questions that follow:

Changes of state occur when a substance changes from one state of matter to another. The three main states of matter are solid, liquid, and gas. Melting, freezing, and boiling are examples of changes of state.

## Activity 1: Matching Game (10 minutes)

Match the following words with their correct definitions:

1. Solid
2. Liquid
3. Gas
4. Melting
5. Freezing
6. Boiling
7. Condensation

Definitions:

- A state of matter with a fixed shape and volume
- A state of matter with a fixed volume but no fixed shape
- A state of matter with neither a fixed shape nor a fixed volume
- The process of a solid changing to a liquid
- The process of a liquid changing to a solid
- The process of a liquid changing to a gas
- The process of a gas changing to a liquid

## Activity 2: Investigation Design (15 minutes)

*Design an experiment to investigate the effect of temperature on the melting point of ice. Consider the following questions:*

- What materials will you need?
- How will you measure the temperature?
- What will you do to ensure a fair test?
- What do you predict will happen?

## Activity 3: Changes of State Diagram (10 minutes)

*Complete the following diagram to show the changes of state of water:*

Solid → ? → ? → Gas

#### Activity 4: Real-Life Applications (15 minutes)

*Think about how changes of state are used in everyday life. Give examples of:*

- How melting is used in cooking
- How freezing is used in refrigeration
- How boiling is used in steam engines

#### Activity 5: Critical Thinking (10 minutes)

*A container of water is left outside on a cold day. What will happen to the water? Explain your answer using the concepts of changes of state.*

### Activity 6: Group Discussion (15 minutes)

*Discuss the following questions with your group:*

- What are some examples of changes of state in nature?
- How do changes of state affect our daily lives?
- What are some potential risks or challenges associated with changes of state?

### Activity 7: Reflection (10 minutes)

*Reflect on what you have learned about changes of state. What did you find most interesting or surprising? What would you like to learn more about?*

### Activity 8: Design a System (20 minutes)

*Design a system that uses changes of state to solve a real-world problem. Consider the following questions:*

- What problem do you want to solve?
- How will you use changes of state to solve the problem?
- What materials will you need?
- How will you test your system?

### Activity 9: Quiz (10 minutes)

*Test your knowledge of changes of state with the following quiz:*

1. What is the process of a solid changing to a liquid called?
  - a) Melting
  - b) Freezing
  - c) Boiling
  - d) Condensation
2. What is the state of matter with a fixed shape and volume called?
  - a) Solid
  - b) Liquid
  - c) Gas
  - d) Plasma
3. What is the process of a gas changing to a liquid called?
  - a) Condensation
  - b) Evaporation
  - c) Melting
  - d) Freezing

## Activity 10: Conclusion (10 minutes)

*Congratulations on completing this worksheet on designing and conducting investigations into changes of state! You have learned about the different states of matter, how to design and conduct simple investigations, and how to apply your knowledge to real-life situations.*

Remember to always think critically and creatively when approaching scientific problems, and don't be afraid to ask questions or seek help when you need it.

## Differentiated Activities for Mixed-Ability Groups

*For students who need extra support:*

- Provide additional guidance and scaffolding for each activity
- Offer one-to-one support and feedback
- Use visual aids and diagrams to help students understand complex concepts

*For students who need a challenge:*

- Provide additional complexity and depth to each activity
- Encourage students to design and conduct their own investigations
- Use real-world examples and case studies to apply scientific concepts

