

Teacher Guide: Phase Changes



Learning Objectives

Students will...

- Describe and compare the molecular properties of solids, liquids, and gases.
- Observe how heating affects molecular motion.
- Create and explain a graph of temperature change during phase changes.
- Explain why temperature does not change much during a phase change.
- Determine the boiling, freezing, and melting points of water.
- Find how altitude affects the boiling, freezing, and melting points. (Extension)



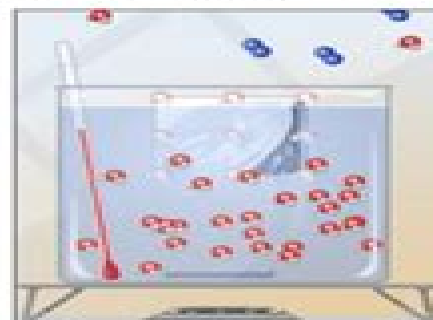
Vocabulary

altitude, boil, boiling point, freeze, freezing point, gas, liquid, melt, melting point, phase, solid



Lesson Overview

The *Phase Changes Gizmo* illustrates how molecular motion is related to phase changes. As students add heat to the system, molecules move faster and phase changes occur—ice melts and water boils. When heat is taken away, condensation and freezing occur. Students can create a graph of temperature vs. time, and the altitude can be changed as well.



The Student Exploration sheet contains two activities and an extension:

- **Activity A** – Students determine the temperatures at which phase changes occur.
- **Activity B** – Students discover that adding heat energy causes molecules to move faster. The movement of molecules explains why ice melts and water boils.
- **Activity C** – Students discover how altitude affects phase changes.



Suggested Lesson Sequence

1. Pre-Gizmo activity: Phase change graph

Before class, create an ice-water bath by placing a bag of ice and a small amount of water into a tub. The temperature should be close to 0 °C. Divide the class into lab groups, and ask students to put on goggles and aprons for safety.

Have each group set up an apparatus to heat the ice water as shown. Stir the water constantly, and record the temperature every two minutes. Once the water is boiling, record 4 more temperature readings before turning off the burners. Graph the results, and discuss. Why does the temperature rise very slowly (or not at all) at first? Why does the temperature stop rising once the water starts to boil?

(⌚ 45 – 60 minutes)



Gizmo Guide Phase Changing

Scott C. Dulebohn

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the author's name.

Gizmo Guide Phase Changing:

The book delves into Gizmo Guide Phase Changing. Gizmo Guide Phase Changing is an essential topic that needs to be grasped by everyone, ranging from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Gizmo Guide Phase Changing, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
 - Chapter 1: Introduction to Gizmo Guide Phase Changing
 - Chapter 2: Essential Elements of Gizmo Guide Phase Changing
 - Chapter 3: Gizmo Guide Phase Changing in Everyday Life
 - Chapter 4: Gizmo Guide Phase Changing in Specific Contexts
 - Chapter 5: Conclusion
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3. In chapter 2, the author will delve into the foundational concepts of Gizmo Guide Phase Changing. This chapter will elucidate the essential principles that need to be understood to grasp Gizmo Guide Phase Changing in its entirety.
4. In chapter 3, the author will examine the practical applications of Gizmo Guide Phase Changing in daily life. The third chapter will showcase real-world examples of how Gizmo Guide Phase Changing can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Gizmo Guide Phase Changing in specific contexts. The fourth chapter will explore how Gizmo Guide Phase Changing is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, this book will draw a conclusion about Gizmo Guide Phase Changing. This chapter will summarize the key points that have been discussed throughout the book.

The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Gizmo Guide Phase Changing.

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