

Introduction (5 minutes)

Read the introduction to thermal expansion and contraction and answer the following questions:

1. What is thermal expansion, and how does it occur?

2. What is thermal contraction, and how does it occur?

Student Learning Outcomes (sLOs) (5 minutes)

Read the student learning outcomes and answer the following questions:

1. What are the five student learning outcomes for this worksheet?

2. How will you demonstrate your understanding of thermal expansion and contraction?

Resources (5 minutes)

List the resources needed to complete this worksheet:

- Whiteboard and markers
- Diagrams and charts illustrating thermal expansion and contraction
- Materials for experiments (e.g., metal strips, heat sources, thermometers)
- Measuring instruments (e.g., rulers, thermometers)
- Computers or tablets with internet access for research and presentation

Teaching Methodology (5 minutes)

Describe the teaching methodology used in this worksheet:

This worksheet uses a combination of direct instruction, guided practice, and independent practice to help you understand and apply the concepts of thermal expansion and contraction.

Brainstorming (10 minutes)

Take a few minutes to brainstorm examples of how materials change when heated or cooled. Consider the following questions:

1. What happens to a metal ruler when it is heated?

2. How does a balloon change when it is inflated with hot air?

3. What happens to a plastic bottle when it is left in the sun?

Warm-up Activity (15 minutes)

Complete the following warm-up activity to get started:

1. Draw a diagram of a material that expands when heated.

2. Label the diagram with the following terms: thermal expansion, heat source, material.

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3. Write a short paragraph explaining what happens to the material when it is heated.

Activity (30 minutes)

Complete the following activity to demonstrate your understanding of thermal expansion and contraction:

1. Design and conduct an experiment to demonstrate thermal expansion or contraction.

2. Measure and record the changes in length or volume of the material.

3. Analyze and interpret the results of your experiment.

4. Communicate your findings effectively through a presentation or report.

Assessment (10 minutes)

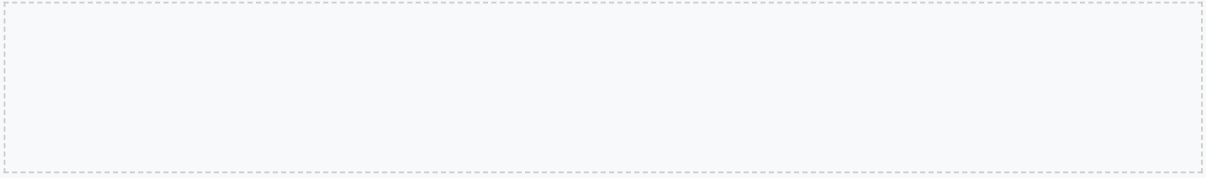
Your understanding of thermal expansion and contraction will be assessed through:

1. Participation in class discussions and activities.

2. Completion of the warm-up activity and experiment.

3. Quality of your presentation or report.

4. Quiz or test to assess your understanding of the concepts.



Homework (20 minutes)

Complete the following homework assignment to reinforce your understanding of thermal expansion and contraction:

1. Research and write a short report on a real-world application of thermal expansion and contraction.

2. Design and propose an experiment to demonstrate thermal expansion or contraction.

3. Create a diagram or model illustrating the effects of thermal expansion and contraction on different materials.

Feedback (10 minutes)

You will receive feedback on your participation, experiment, and presentation or report. Use this feedback to improve your understanding and application of thermal expansion and contraction.

Questions and Activities (20 minutes)

Complete the following questions and activities to demonstrate your understanding of thermal expansion and contraction:

1. What is thermal expansion, and how does it occur?

2. What is thermal contraction, and how does it occur?

3. Give an example of a real-world application of thermal expansion and contraction.

4. Design and conduct an experiment to demonstrate thermal expansion or contraction.

5. Analyze and interpret the results of your experiment.

Extension Activity (20 minutes)

Complete the following extension activity to challenge yourself:

1. Research and write a report on a historical or contemporary example of thermal expansion and contraction in action.

2. Create a multimedia presentation (e.g., video, podcast) to explain the concepts of thermal expansion and contraction to a younger audience.

Conclusion (10 minutes)

In conclusion, thermal expansion and contraction are fundamental concepts in physics that help us understand how materials change when heated or cooled. By completing this worksheet, you have demonstrated your understanding of these concepts and applied them to real-life situations.

Reflection (10 minutes)

Individual Reflection:

1. What was the most surprising thing you learned about thermal expansion and contraction?

2. How will this learning change your actions in the future?

3. What questions do you still have about thermal expansion and contraction?

