DEVELOPMENT OF GENERAL SECONDARY SCHOOL STUDENTS' KNOWLEDGE ON THE SUBJECT OF THE FIRST LAW OF THERMODYNAMICS IN FAMILY CONDITIONS

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Abstract

This article examines the role of family involvement in enhancing general secondary school students' understanding of the topic of the first law of thermodynamics. It explores effective strategies for creating an enriched home learning environment for parents and other caregivers, and provides a deeper understanding of this fundamental scientific principle.

Keywords. Thermodynamics, first law, high school, student learning, family environment, science education, parent involvement.

Аннотация

В данной статье рассматривается роль участия семьи в расширении понимания учащимися средних школ темы первого закона термодинамики. В нем исследуются эффективные стратегии создания обогащенной среды домашнего обучения для родителей и других лиц, осуществляющих уход, а также обеспечивается более глубокое понимание этого фундаментального научного принципа.

Ключевые слова. Термодинамика, первое право, средняя школа, обучение учащихся, семейная среда, естественнонаучное образование, участие родителей.

INTRODUCTION

The first law of thermodynamics is a key concept in the study of conservation of energy and is crucial in teaching science to students. However, understanding this law can be difficult for the average high school student. This article aims to highlight the importance of family involvement in supporting students' understanding of the first law of thermodynamics.

LITERATURE ANALYSYS AND METHODOLOGY

Complexity of the First Law of Thermodynamics: The First Law of Thermodynamics is often perceived as abstract and difficult to understand due to its mathematical nature and theoretical aspects. Research shows that family involvement in a student's education can have a significant impact on their academic success. If parents are actively involved in their child's learning, it helps to better understand and remember difficult topics.

The following strategies can be used to develop children's knowledge of the first law of thermodynamics in a family setting:

- Interactive Discussions: Encourage open discussion, questions and problem solving on the First Law.

- Practical experiments: Carrying out simple experiments at home to demonstrate energy saving.

- Educational resources: Using textbooks, online materials and educational videos to help children better understand the subject.

- Problem Solving: Working together on thermodynamics problems to improve problem solving skills.

- Real-life examples: Relate the First Law to everyday events and emphasize its relevance.

RESULTS

Teaching the first law of thermodynamics through simple experiments at home is a fun and effective way to help general high school students understand this basic concept. A few simple experiments to develop knowledge of the first law of thermodynamics in a family setting (All experiments should be conducted with the participation of parents):

1. Insulation and Heat Transfer:

- Materials Needed: Two identical cups, one with a lid (or a piece of aluminum foil), a thermometer, hot water, and a timer.

- Procedure:

1. Fill both cups with hot water at the same temperature.

2. Cover one cup tightly with a lid or aluminum foil.

3. Use a thermometer to measure and record the temperature of both cups at regular intervals (e.g., every 5 minutes).

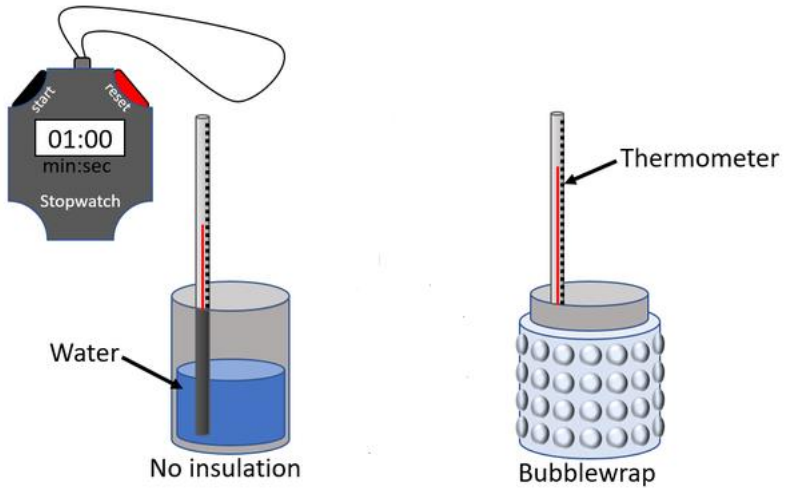

Figure 1. Insulation and Heat Transfer experience

- Observation: The covered cup retains its temperature longer than the uncovered one, demonstrating how insulation reduces heat transfer, in line with the First Law of Thermodynamics.

2. Boiling Water and the First Law:

- Materials Needed: A pot, water, a thermometer, a stove, and a timer.

- Procedure:

1. Fill the pot with water and place it on the stove.

2. Heat the water until it starts to boil.

3. Measure and record the temperature of the boiling water.

4. Allow the water to continue boiling while monitoring the timer.

Figure 2. Boiling Water and the First Law experience

- Observation: The temperature of the boiling water remains constant even as it boils, illustrating that the energy supplied (heat) causes a phase change (from liquid to gas) rather than a temperature increase, aligning with the First Law.

3. Thermal Expansion and Contraction:

- Materials Needed: A metal or glass container, hot water, cold water, a small hole punch, a paperclip, and a plastic bottle with a screw cap.

- Procedure:

1. Fill the container with hot water and the plastic bottle with cold water.

2. Submerge the paperclip in the hot water for a few minutes.

3. Use the hole punch to make a small hole in the cap of the plastic bottle.

4. Quickly screw the cap onto the bottle and place it in the hot water.

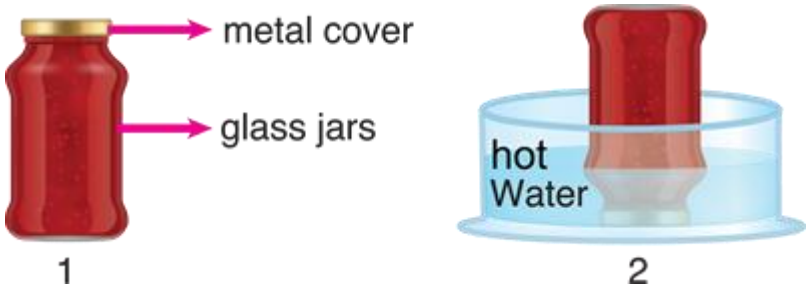

Figure 3. Thermal Expansion and Contraction experience

- Observation: The bottle's cap will tighten as the hot water heats the air inside the bottle, demonstrating how thermal expansion can do work (tighten the cap) in accordance with the First Law.

4. Adiabatic Compression and Expansion:

- Materials Needed: A balloon, a small plastic bottle with a screw cap, a syringe (without the needle), and a heat source (like a hairdryer).

- Procedure:

1. Partially inflate the balloon and attach it to the syringe's nozzle.

2. Seal the syringe with the balloon using the cap.

3. Heat the sealed syringe with the hairdryer for a few seconds.

- Observation: As the air inside the syringe heats up, the balloon inflates, demonstrating adiabatic expansion in line with the First Law.

These simple experiments help students visualize and understand the concepts of heat transfer, phase change, thermal expansion, and adiabatic processes that are the basis for the first law of thermodynamics.

Implementing these strategies in a family environment can have positive results. Children who receive active support from their families tend to develop a better understanding of the first law of thermodynamics, greater self-confidence, and better problem-solving skills.

CONCLUSION

The development of general secondary school students' understanding of the first law of thermodynamics is significantly enhanced by family involvement. Parents and other close relatives who are actively involved in their children's learning contribute to their academic success and help them understand difficult scientific concepts. Families play a crucial role in nurturing young scientists by supporting and enriching the home environment.

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