

Module 9: States of Matter and Gas Laws

Topic 1 Application: KMT Scientific Investigation

Before you begin the scientific investigation below, make sure to download the KMT Scientific Investigation Report. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, visit the Developmental Module.

Introduction

The kinetic molecular theory operates on five assumptions based on the behavior of an ideal gas. The first assumption is that gases consist of a large number of tiny spherical particles that are spread far apart from one another when compared to their size. The second assumption states that gas particles move in constant motion in random directions. The third assumption states that gases are in constant motion and collide with other gas molecules and the container in which they are held. The fourth assumption states that gas particles do not experience any intermolecular forces. The final assumption is the assumption that you will be investigating in this laboratory activity. The fifth assumption states that the average kinetic energy of gas particles is dependent upon the temperature of the gas.

Objectives

In this scientific investigation, you will:

- observe the kinetic-molecular theory of gases.

Hypothesis

Using the Procedure and Data Collection section below, read through the procedural information for this scientific investigation. After considering the Procedure and Data Collection section, develop your own hypotheses which describe your expected results. Specifically, how do you think temperature will affect the behavior of the gas inside of the balloon? Record your hypotheses in the Hypothesis section of your KMT Scientific Investigation Report.

Equipment and Materials

- 1 balloon
- 600 mL beaker OR 2 quart saucepan
- Hot plate OR gas burner with ring stand and wire gauze OR stove top
- Cold water
- Tongs
- Ice cubes

Procedure and Data Collection

Please note: you will be using a hot plate or gas burner in this scientific investigation. Make sure to use caution when handling hot items. Incorrect handling of hot items may cause burns. If you burn yourself, seek medical attention and notify your instructor or another nearby adult immediately.

1. Fill the 600 mL beaker or 2 quart saucepan with approximately 50 mL of cold water.

Module 9: States of Matter and Gas Laws

Topic 1 Application: KMT Scientific Investigation

2. Slightly inflate the balloon with four to five deep breaths, tie it shut, and place the balloon in the beaker of water or the 2 quart saucepan of water.
3. Heat the beaker on a hot plate or heat the saucepan on the stove top. Bring the water to a boil. Observe the balloon throughout the heating process. In the Data section of your KMT Scientific Investigation Report, record your observations.
4. Remove the beaker from the hot plate or stove top using the tongs or another safe method. Place the beaker or saucepan on a heat-safe surface.
5. Continuously add ice cubes to the water until the water is cold. Observe the balloon throughout the cooling process. In the Data section of your KMT Scientific Investigation Report, record your observations.

Data

Record any observations you had during the heating and cooling portions of this experiment.

Data Analysis

In the Data Analysis section of your KMT Scientific Investigation Report, provide the responses to the following questions:

1. What happened to the air inside the balloon as the conditions changed?
2. At what point in the experiment were the molecules of air inside of the balloon closest together? At what point in the experiment were the molecules of air inside of the balloon farthest apart?
3. During what part of the experiment would the molecules of air within the balloon have traveled the fastest, creating the most collisions?

Conclusion

Using the Conclusion section of your KMT Scientific Investigation Report, compose three to four sentences describing an overall conclusion about effects of a catalyst in the reaction you observed. Base your conclusions on your data. Were your hypotheses true or false, and how do you know? Use the data and notes that you collected from your experiment to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your KMT Scientific Investigation Report, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?



Once you have completed the KMT Scientific Investigation Report, please submit your work to the dropbox.