

# Chemical Reactions

## OVERVIEW:

In this activity, students will observe endothermic and exothermic reactions as they conduct a laboratory investigation.

## CONCEPTS:

### National Science Foundation Standards:

#### Standard A: Science as Inquiry

##### Abilities Necessary to do Scientific Inquiry:

- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Use mathematics in all aspects of scientific inquiry.

#### Standard B: Physical Science

##### Properties Changes of Properties in Matter

- Characteristic properties of substances.
- Separating the components of mixtures.
- Chemical reactions, grouping of substances with common chemical properties, and the conservation of mass.

## Benchmark 1: The Nature of Science

### A: The Scientific World View

- Scientists differ greatly in what phenomena they study and how they go about their work. Although there is no fixed set of steps that all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.

## Benchmark 4: The Physical Setting

### D: The Structure of Matter

- All matter is made up of atoms, which are far too small to see directly through a microscope. The atoms of any element are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances.
- No matter how substances within a closed system interact with one another, or how they combine or break apart, the total weight of the system remains the same. The idea of atoms explains the conservation of matter: If the number of atoms stays the same no matter how they are rearranged, then their total mass stays the same.

### E: Energy Transformations

- Energy cannot be created or destroyed, but only changed from one form into another.

## OBJECTIVES:

### Students will:

- Observe endothermic and exothermic reactions.
- Practice basic laboratory procedures.

- Graph the results from their experiments

**PROCEDURES:**

- Allow 1 hour to present the background information and to complete the activity.
- Present the background information.
- Complete the activities: (Part A.) Experiment 1 and Experiment 2
- Follow up activity with discussion questions (see Part B.) These questions may be used for assessment purposes

**MATERIALS:**

- Background information
- (Materials are based on a grouping of 4 students.)
- Test tube rack
- 2 test tubes
- Beaker with 250ml Vinegar
- Beaker with 250ml Hydrogen Peroxide
- Thermometer, Graduated Cylinder
- Waxed paper
- Yeast
- Baking Soda

**BACKGROUND:**

Energy is all around us. But one thing we should always remember is that we cannot create or destroy energy. You can only change the form from one to another form of energy.

A chemical change occurs when the actual composition changes—that is, when one substance is transformed into another. Chemical change requires a chemical reaction, a process whereby the chemical properties of a substance are altered by a rearrangement of the atoms. Chemical reactions may involve changes in color, temperature, color, and the bubbling of a substance (not boiling). Chemical reactions happen when two or more molecules interact and something happens. The rate of reaction is the speed at which a reaction happens. Reactions happen no matter what. Chemicals are always combining and breaking down. The reactions happen over and over but not always at the same speed.

We will be working with and observing chemical energy in chemical reactions. A good example of a chemical reaction is found in the production of ethanol. The chemical reaction occurs when yeast and sugar are put together to form ethanol.

**Activity:****Part A: Experiment 1****Directions:**

1. Measure out 6ml of Hydrogen Peroxide and place in the test tube.
2. Measure the temperature at time = 0
3. Add Yeast to the Hydrogen Peroxide.
4. Measure the Temperature at 10 second intervals.
5. Record you observations below.
6. Graph your data.

Observations:

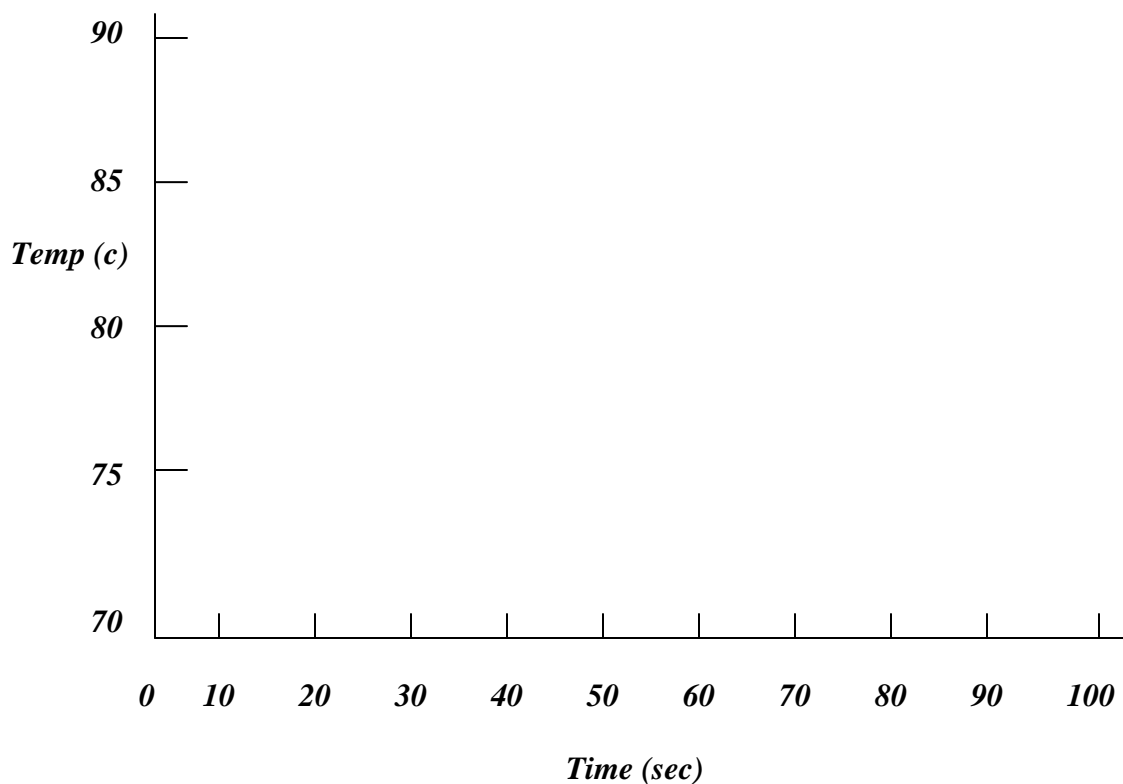
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Graph 1

Time (sec)	0	10	20	30	40	50	60	70	80	90	100
Temp (c)											



**Explanation of Activity:** In the first experiment, there was a chemical reaction that made the temperature rise slowly. Less yeast would yield a slower reaction. This is an **exothermic reaction**.

Experiment 2

**Directions:**

1. Measure out 6ml of Vinegar and place in the test tube.
2. Measure the temperature at time = 0
3. Add Sodium Bicarbonate (baking soda) to the vinegar..
4. Measure the Temperature every 3 seconds.
5. Record you observations.
6. Graph your data

**Observations:**

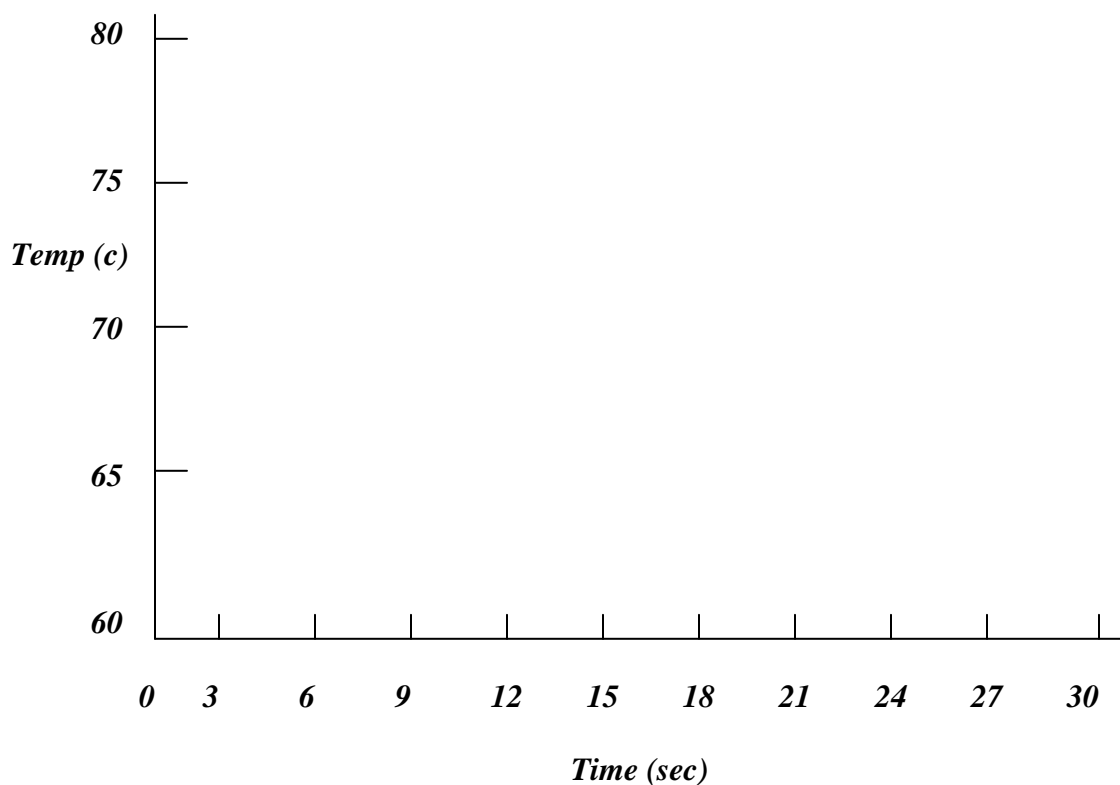
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**Graph 2**

Time (sec)	0	3	6	9	12	15	18	21	24	27	30
Temp ( F )											



**Explanation of Activity:** The second experiment had a chemical reaction in which the temperature decreased. This was an **endothermic reaction**.

**Part B:**

**Ask the following questions and allow time for discussion.**

**Share:**

Share the results of your investigation.

**Process:**

Why are exothermic reactions important?

**Generalize:**

What laboratory safety procedures did you use as you conducted the investigation?

**Apply:**

Where do you observe exothermic and endothermic reactions?