Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Chemistry

***Catalytic Decomposition of Hydrogen Peroxide***



**PRE-LAB:**

Catalysts are substances that speed up the rate of chemical reactions. It is believed that most catalysts work by providing alternate reaction pathways with lower activation energy than the unanalyzed reaction.

It is possible to divide catalysts into two groups – inorganic catalysts and organic (biological) catalysts. Biological catalysts are called enzymes. Most enzymes are protein molecules (though recent research indicates that nucleic acids have enzymatic capacities), and they specifically catalyze only one reaction. Many genetic diseases are caused either by the body’s inability to manufacture some enzyme, or a mistake in amino acid sequence of the enzyme that causes the enzyme that is produced to work slowly or not at all.

Inorganic catalysts take a wide variety of forms. Metallic surfaces often serve as catalysts for gas phase reactions, such as the conversion of nitrogen oxides back to atmospheric oxygen and nitrogen gas, as occurs in catalytic converters in automobile engines.

In this lab you will investigate the ability of several substances to catalyze the decomposition of hydrogen peroxide, H2O2:

**2 H2O2  🡪 2H2O + O2(g)**

**PURPOSE:**

To identify which substances have the ability to catalyze the decomposition of hydrogen peroxide and to identify differences in the rate of the reaction produced by the catalysts.

**HYPOTHESIS (Which of these substances are catalysts?): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**PROCEDURE:**

1. Clean six medium-sized test tubes. Label them #1- #6.
2. Obtain 6 mL of 3% hydrogen peroxide solution from your instructor. Divide the 6 mL evenly into the six test tubes.
3. Leave the peroxide alone in test tube #1, and record anything that happens to it during the lab time.
4. Into Test tube #2, place 1 spatula of manganese dioxide, MnO2. Record observations.
5. Into test tube #3, place a small sample of KI. Record your observations.
6. Into test tube #4, place a spatula of table salt, NaCl. Record observations.
7. Into test tube #5, place a small sample of CuCl2. Record your observations.
8. Into test tube #6, place a single piece of zinc metal, Zn. Record your observations.
9. After all of your observations are complete, clean your test tubes and return them to the lab drawer. Any unreacted zinc should be returned to your instructor.

**DATA TABLE:**

|  |  |  |
| --- | --- | --- |
| Test Tube | Observations | Catalyst: Yes or No? |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

Analysis and Conclusion:

1. Which substance **catalyzed** the hydrogen peroxide the fastest? Slowest? Describe your reasoning.

Fastest-Copper Chloride

Slowest-KI

*Note: NaCl and the absence of a catalyst shouldn’t be counted in the slowest.*

1. How do catalysts speed up a reaction?

Catalyst works by providing an alternate pathway by which a reaction can take place; this alternate pathway has a lower activation energy.

1. What are the catalysts found in living cells called? Why are these in biological catalysts necessary?

The catalyst found in living cells are called enzymes. They are necessary for life because most of the cells’ chemical processes would be to slow at room temperature without a catalyst.

**RUBRIC**

|  |  |  |
| --- | --- | --- |
| Area | Maximum Point Assigned | Notes |
| Hypothesis | 5 | To receive maximum points, statements must be complete and relevant. |
| Data Table (column 2-observation) | 5 | All observation columns must be completed to get max. points. |
| Data Table (column 3) | 5 | Yes or no must be appropriately labeled. |
| Conclusion and Analysis | 15 | All three questions are worth 5 points each. To get maximum point, students’ responses must be complete and correct. |
| Total | \_\_\_\_\_/30 |  |