Designing a Catalytic Converter

**Background**
Catalytic converters have been used in automobiles since the 1970’s. They are used to rapidly convert toxic byproducts of the internal combustion engine into less harmful gases released into the environment. A new type of fuel has just been discovered and the combustion of the fuel unfortunately creates toxic hydrogen peroxide which cannot be released into the environment. Your team’s task is to design a catalytic converter that will convert the toxic hydrogen peroxide into the less harmful oxygen gas and water. Your catalytic converter will be judged based on the amount of oxygen gas produced.

**Prelab Questions**
1. If 10 mL of 3% hydrogen peroxide is used, how many milliliters of oxygen gas can be produced? (Assume STP and the gas is collected dry).

2. Design a converter and a procedure to test your catalytic converter using 10 mL of hydrogen peroxide. Brainstorm your ideas below:

**Objective**
Design a catalytic converter for the new fuel that produces hydrogen peroxide as a byproduct of its combustion. Collect the oxygen gas to measure how well your catalytic converter operates.

**Materials**
- Make a list of materials that will be needed for your design and have them approved by the instructor.
- Create a means of collecting the oxygen gas created from your catalytic converter.

**Safety**
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow teacher instructions for how to clean up materials and dispose of any chemicals.
- Do not consume lab solutions, even if they’re otherwise edible products.
- Food in the lab should be considered a chemical not for consumption.
Procedure
- All procedures must be approved by the instructor before you begin your work.
- All catalytic converters should be run through multiple trials using 10 mL hydrogen peroxide as the amount of byproduct to remove.

Data
- Create a data table to show all measurements recorded during your trials.

Calculations
1. For each trial, calculate and record the following:
   a. The actual yield of oxygen gas.
   b. The percent yield of oxygen gas.

Analysis
1. Based on your percent yield, would you suggest your design for a catalytic converter of hydrogen peroxide?

2. What might you change about your design after the trials?

3. What was the catalyst in your design and why did you choose it?

4. If you did not achieve 100% yield, what factors affected your results?

Conclusion
1. How would your design be affected if the catalyst was removed?

2. If the hydrogen peroxide was left for a considerable amount of time in your converter with no catalyst what would happen?
3. How does a catalyst affect the rate of reaction?

4. What is the difference between a reactant and a catalyst?