**Tiny the Elephant Needs More Toothpaste**



Demonstration/Photo Description

The prepared graduated cylinder contains dishwashing detergent, water, and food dye. Highly concentrated hydrogen peroxide (30% H2O2) will be added to start the reaction. Because the reaction rate is so slow, potassium iodide (KI) is added as a catalyst. As soon as the KI makes contact with the hydrogen peroxide, bubbles are rapidly formed and spill out of the graduated cylinder forming what looks like toothpaste made for elephants.

**Directions:** Answer the following 8 questions based on the demonstration and photo description.

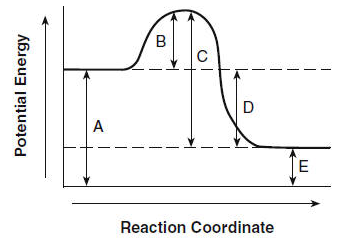
**Base your answers to questions 1 through 4 on the information below.**

At standard pressure, hydrogen peroxide, H2O2, melts at – 0.4 °C, boils at 151 °C, and is very soluble in water. A bottle of aqueous hydrogen peroxide, H2O2 (*aq*), purchased from a pharmacy has a pressure-releasing cap. Aqueous hydrogen peroxide decomposes at room temperature, as represented by the **unbalanced** equation: \_\_\_H2O2(*aq*) 🡪 \_\_\_H2O(*l*) + \_\_\_O2(*g*) + 196.0 kJ

1. State, in terms of *both* melting point and boiling point, why H2O2 is a liquid at room temperature.
2. State evidence that indicated that the decomposition of H2O2(*aq*) is exothermic.
3. Explain why a hydrogen peroxide bottle needs a pressure-releasing cap.
4. The decomposition equation above is unbalanced. Add the proper coefficients where needed to balance the equation.

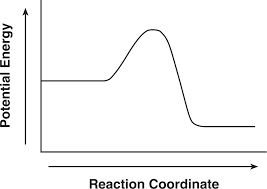
\_\_\_H2O2(*aq*) 🡪 \_\_\_H2O(*l*) + \_\_\_O2(*g*) + 196.0 kJ

**Base your answers to questions 5 and 6 on the diagram below.**

1. Fill in the table below according to the diagram above.

|  |  |
| --- | --- |
| **Letter** | **Label** |
|  | Potential Energy of Reactants |
| B |  |
|  | Activation Complex |
| D |  |
| E |  |

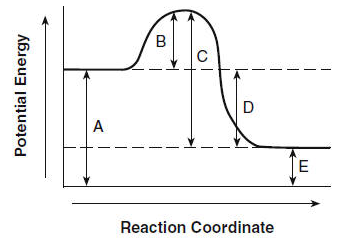
1. Given the potential energy diagram above, determine whether the reaction is endothermic or endothermic. Explain your answer.



1. On the diagram to the right, draw a line representing how the addition of catalyst would affect the reaction.
2. Explain what a catalyst does and how it does works.

**Base your answers to questions 9 and 10 on the information below.**

Given the equation or a reversible CO*(g)* + 2H2*(g)* = CH3OH*(g)* + energy :

1. Sketch a potential energy diagram of this reaction.
2. State the effect on the rates of both the forward and reverse reactions if no catalyst is used in the system.