

Name: _____

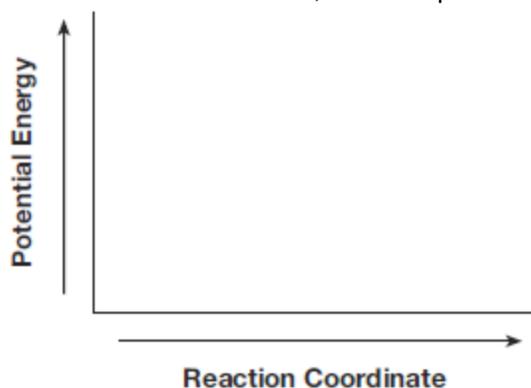
Chapter 12 Additional Constructed Response

Base your answers to questions 1 and 2 on the information below and on your knowledge of chemistry.

Carbon monoxide, $\text{CO}(\text{g})$, is a toxic gas found in automobile exhaust. The concentration of $\text{CO}(\text{g})$ can be decreased by using a catalyst in the reaction between $\text{CO}(\text{g})$ and $\text{O}_2(\text{g})$. This reaction is represented by the balanced equation below.



1. On the labeled axes below, draw the potential energy curve for the reaction represented by this equation.



2. Explain, in terms of collision theory, why an increase in temperature increases the rate of the reaction.

3. Base your answer to the following question on the information below and on your knowledge of chemistry.

During photosynthesis, plants use carbon dioxide, water, and light energy to produce glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, and oxygen. The reaction for photosynthesis is represented by the balanced equation below.



State evidence that indicates photosynthesis is an endothermic reaction.

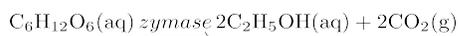
4. Base your answer to the following question on the information below and on your knowledge of chemistry.

A few pieces of dry ice, $\text{CO}_2(\text{s})$, at -78°C are placed in a flask that contains air at 21°C . The flask is sealed by placing an uninflated balloon over the mouth of the flask. As the balloon inflates, the dry ice disappears and no liquid is observed in the flask.

Compare the entropy of the CO_2 molecules in the dry ice to the entropy of the CO_2 molecules in the inflated balloon.

5. Base your answer to the following question on the information below and on your knowledge of chemistry.

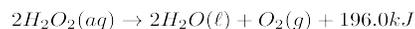
Many breads are made by adding yeast to dough, causing the dough to rise. Yeast is a type of microorganism that produces the catalyst zymase, which converts glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, to ethanol and carbon dioxide gas. The balanced equation for this reaction is shown below.



Describe how the catalyst, zymase, speeds up this reaction.

Base your answers to questions 6 and 7 on the information below.

At standard pressure, hydrogen peroxide, H_2O_2 , melts at -0.4°C , boils at 151°C , and is very soluble in water. A bottle of aqueous hydrogen peroxide, $\text{H}_2\text{O}_2(\text{aq})$, purchased from a pharmacy has a pressure-releasing cap. Aqueous hydrogen peroxide decomposes at room temperature, as represented by the balanced equation below.

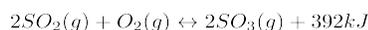


_____ 6. Explain why a hydrogen peroxide bottle needs a pressure-releasing cap.

_____ 7. State evidence that indicates the decomposition of $\text{H}_2\text{O}_2(\text{aq})$ is exothermic.

_____ 8. Base your answer to the following question on the information below.

Several steps are involved in the industrial production of sulfuric acid. One step involves the oxidation of sulfur dioxide gas to form sulfur trioxide gas. A catalyst is used to increase the rate of production of sulfur trioxide gas. In a rigid cylinder with a movable piston, this reaction reaches equilibrium, as represented by the equation below.



State, in terms of the concentration of $\text{SO}_3(\text{g})$, what occurs when more $\text{O}_2(\text{g})$ is added to the reaction at equilibrium.

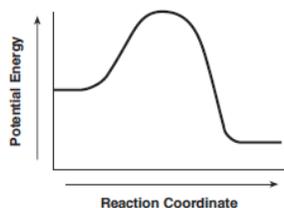
_____ 9. Determine the amount of heat released by the production of 1.0 mole of $\text{SO}_3(\text{g})$.

_____ 10. Explain, in terms of collision theory, why increasing the pressure of the gases in the cylinder increases the rate of the forward reaction.

Answer Key

Chapter 12 Constructed Response

1.



2. – The rate of the chemical reaction increases because the reactant molecules move faster and collide with more kinetic energy. – Increasing the temperature causes more frequent collisions. – As molecules acquire more kinetic energy, the probability of effective collisions increases. – More reactant molecules collide with sufficient energy.

3. — Photosynthesis is an endothermic reaction because light energy is absorbed. — The energy term is on the left side of equation. — ΔH is positive. — The reaction requires light.

4. — The CO_2 molecules in the dry ice have less entropy than the CO_2 molecules in the inflated balloon. — The CO_2 gas in the balloon is more disordered. — less for $\text{CO}_2(\text{s})$

5. — Zymase is a catalyst that provides an alternative pathway, which requires less energy. — decreases the activation energy — changes the reaction mechanism

6. ¶ The excess pressure due to the production of oxygen gas in the bottle needs to be gradually released. ¶ As $\text{O}_2(\text{g})$ is produced, the pressure inside of the bottle might increase and the bottle might burst without the pressure-releasing cap.

7. ¶ More energy is released than absorbed. ¶ Heat is a product of the reaction.

8. The concentration of $\text{SO}_3(\text{g})$ increases.

9. 196 kJ

10. When the pressure in the cylinder is increased, the $\text{SO}_2(\text{g})$ molecules and $\text{O}_2(\text{g})$ molecules collide more frequently, producing more $\text{SO}_3(\text{g})$.