# The Rate and Extent of Chemical Change
# Multiple Choice Questions
## Set 4 (HT)

Tick **one** box.

The thermal decomposition of hydrogen peroxide is shown in **Equation 1**.

**Equation 1**

$$2H_2O_2(l) \longrightarrow 2H_2O(l) + O_2(g)$$

A group of students carried out an investigation to find a suitable catalyst for this reaction. They measured the rate of reaction by recording the volume of oxygen gas produced after 30 seconds. Their results are shown in **Table 1**.

**Table 1**

| Substance Added to Reaction | Volume of Oxygen Produced in 30 Seconds ($cm^3$) |
|---|---|
| A | 11 |
| B | 10 |
| C | 21 |
| D | 8 |

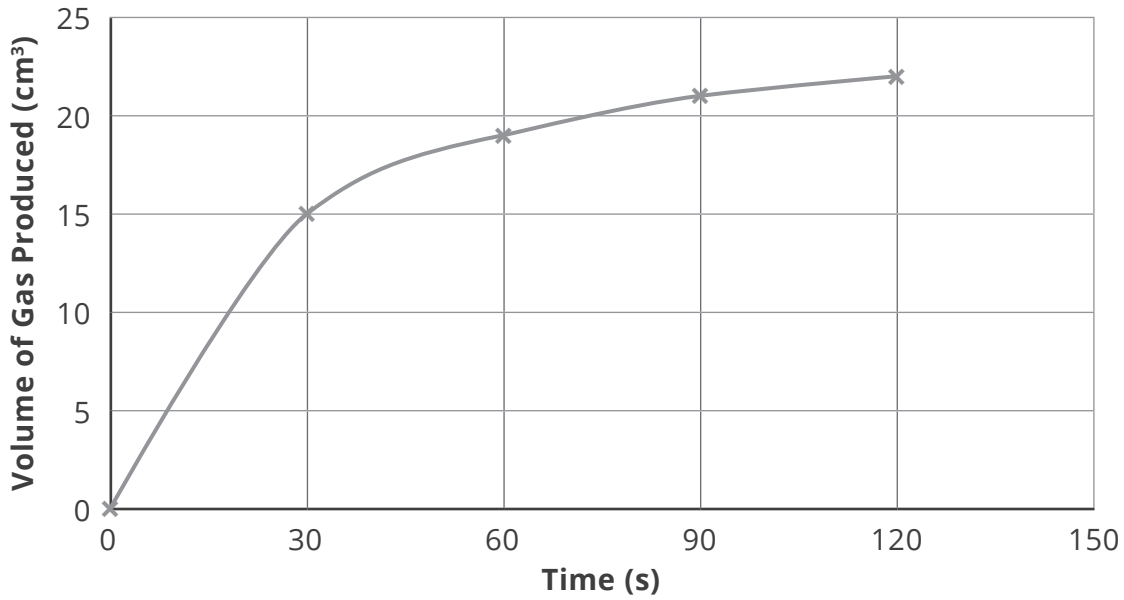
1. Which substance in **Table 1** is the most suitable catalyst for the reaction shown by **Equation 1**.
   - A. A ☐
   - B. B ☐
   - C. C ☐
   - D. D ☐

2. In addition to using a catalyst, how else could the rate of reaction in **Equation 1** be increased?
   - A. by increasing the pressure ☐
   - B. by increasing the surface area ☐
   - C. by increasing the temperature ☐
   - D. all of the above ☐

3. Which of the following is **not** a unit for measuring the rate of a chemical reaction?
   A. $cm^3/s$
   B. g/s
   C. m/s
   D. mol/s

**Figure 1** is a graph showing the volume of gas produced in a chemical reaction over time.

**Figure 1**




4. What was the rate of reaction in the first 30 seconds?
   A. $0.5cm^3/s$
   B. $1.5cm^3/s$
   C. $2.0cm^3/s$
   D. $15cm^3/s$

5. Why does the rate of reaction decrease over time?
   A. because the activation energy increases
   B. because the concentration of the reactants decreases
   C. because the particles have less energy
   D. because the temperature decreases

6. What is used to predict the effect of changing conditions in a system at equilibrium?
   A. Atomic Theory ☐
   B. Collision Theory ☐
   C. Haber Process ☐
   D. Le Chatelier's Principle ☐

**Equation 2** shows how sulfur trioxide can be made from sulfur dioxide and oxygen.

**Equation 2**

$SO_2(g) + O_2(g) \rightleftharpoons SO_3(g)$

7. Which gas or gases are present in the equilibrium mixture of the reaction shown by **Equation 2**?
   A. $O_2$ only ☐
   B. $O_2$ and $SO_2$ ☐
   C. $SO_3$ only ☐
   D. $SO_3$, $O_2$ and $SO_2$ ☐

8. The reaction shown by **Equation 2** is exothermic in the forward direction. Which conditions would give the highest yield of $SO_3$?
   A. a high temperature and a high pressure ☐
   B. a high temperature and a low pressure ☐
   C. a low temperature and a high pressure ☐
   D. a low temperature and a low pressure ☐

9. Vanadium (V) oxide, $V_2O_5$, is used as a catalyst in the reaction shown by **Equation 2**. What effect does this catalyst have on the yield of $SO_3$?
   A. it decreases the yield ☐
   B. it increases the yield ☐
   C. it depends on the catalyst used ☐
   D. it has no effect on the yield ☐

10. Why does $V_2O_5$ **not** appear in **Equation 2**?
   A. including the catalyst in the equation would make it unbalanced ☐
   B. the catalyst is a solid ☐
   C. the catalyst has no effect on the rate of the chemical reaction ☐
   D. the catalyst is not changed into something different during the chemical reaction ☐