Self-test Questions

**Topic 6 (SL)**

1. Which of the following factors will **not** increase the rate of the reaction between calcium carbonate and excess dilute hydrochloric acid?

\[
\text{CaCO}_3(s) + 2\text{HCl(aq)} \rightarrow \text{CaCl}_2(aq) + \text{H}_2\text{O(l)} + \text{CO}_2(g)
\]

   A. increasing the concentration of the HCl(aq)
   B. increasing the temperature
   C. increasing the surface area of the CaCO\(_3(s)\)
   D. increasing the volume of HCl(aq)

2. In which region of this graph is the rate of reaction fastest?

![Graph](image)

A. I
B. II
C. III
D. IV

3. Which of the following is the main reason that increasing the temperature increases the rate of a reaction?

   A. The activation energy increases.
   B. More particles have energy greater than the activation energy.
   C. The particles collide more.
   D. The collision frequency increases.

4. Which line on the graph shows the Maxwell–Boltzmann distribution at the lowest temperature?

![Graph](image)

A. A
B. B
C. C
D. D
5 Which of the following best describes how a catalyst works?
A It causes an increase in the collision frequency.
B It provides a surface on which the reaction can occur.
C It provides an alternative pathway of lower activation energy.
D It allows molecules to collide in the correct orientation.

6 Which of the following is likely to cause the greatest increase in the rate of reaction?
A Increasing the temperature from 50°C to 100°C.
B Doubling the concentration of one of the reactants.
C Doubling the temperature from 200 K to 400 K.
D Doubling the surface area of a solid reactant.

7 Which of the following is true?
A A catalyst is not used up in a chemical reaction.
B All collisions with $E > E_a$ result in reaction.
C $E_a$ for an endothermic reaction is higher than that for an exothermic one.
D The rate of all reactions doubles as the temperature is increased by 10 K.

8 Sodium hydrogen carbonate reacts with dilute hydrochloric acid:
\[ 2\text{NaHCO}_3(s) + 2\text{HCl}(aq) \rightarrow 2\text{NaCl}(aq) + 2\text{H}_2\text{O}(l) + 2\text{CO}_2(g) \]
If 80 cm$^3$ of carbon dioxide were collected in 60 s, what was the average rate of reaction?
A 0.75 cm$^3$ s$^{-1}$
B 2.7 cm$^3$ s$^{-1}$
C 1.3 cm$^3$ s$^{-1}$
D 0.75 cm$^3$ s$^{-1}$

9 On the graph below, the line marked X is for the reaction of 1.0 g powdered CaCO$_3$ with 25 cm$^3$ of 1.0 mol dm$^{-3}$ HCl at 20°C. Which line(s) could represent the reaction of 1.0 g powdered CaCO$_3$ with 25 cm$^3$ of 1.0 mol dm$^{-3}$ HCl at 30°C?

![Graph with lines X, II, III, and IV]

A III and IV only
B II only
C II and III only
D I only
On the graph below, the line marked X is for the reaction of 1.0 g powdered CaCO₃ with 25 cm³ of 1.0 mol dm⁻³ HCl at 20 °C. Which line(s) could represent the reaction of 1.0 g powdered CaCO₃ with a higher concentration of HCl at the same temperature?

A  IV only
B  II and III only
C  III and IV only
D  I only