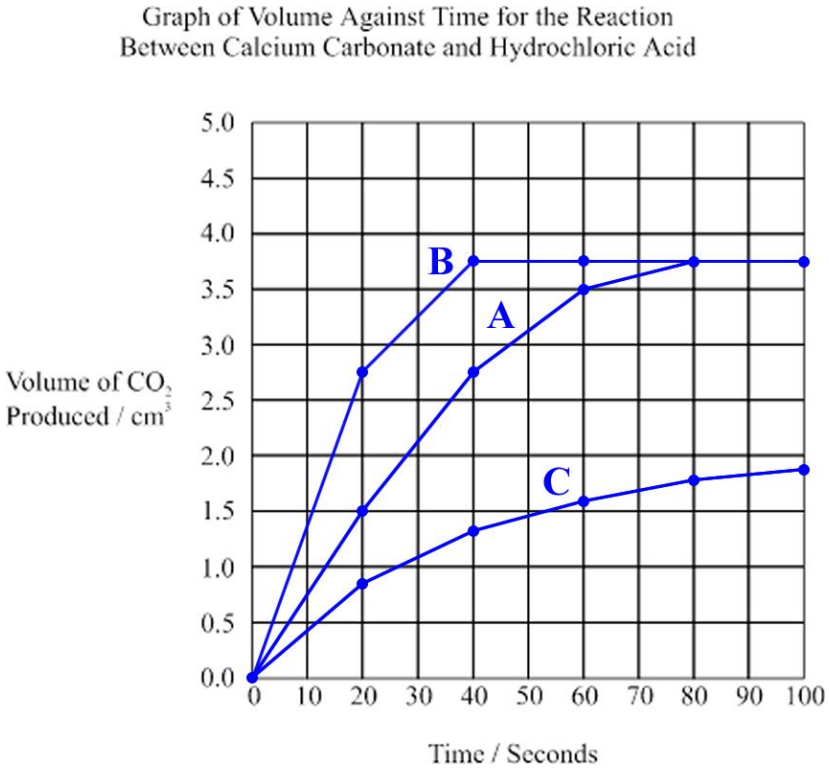
Rate of Reaction – Assignment Two – Answers

1. B	**2. D**	**3. B**	**4. D**
5. D	**6. D**	**7. A**	**8. D**
9. D	**10. C**	**11. D**	

Question 12.

a) c) and **d) Note:** *Smooth curves* should be drawn through the points.



b) i) $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

ii) Relative molecular mass of $CaCO_3(s)$ = Ca + C + (3 × O)

= 40.0 + 12.0 + (3 × 16.0)

= 100

Amount of $CaCO_3(s)$ = mass in grams ÷ relative molecular mass

= 5.0 ÷ 100

= 0.0500 mol

Amount of $HCl(aq)$ = concentration (mol / dm^3) × volume (cm^3) × 10^{-3}

= 1.0 × 20.0 × 10^{-3}

= 0.0200 mol

From the balanced chemical equation, 1 mol of $CaCO_3(s)$ reacts with 2 mol of HC*l*(aq)

$\therefore$ 0.0500 mol of $CaCO_3(s)$ reacts with 2×0.0500 mol HC*l*(aq)

$\therefore$ 0.0500 mol of $CaCO_3(s)$ reacts with 0.100 mol HC*l*(aq)

There are only 0.0200 mol of HC*l*(aq) available, $\therefore$ HC*l*(aq) is the limiting reagent

e) Increasing the temperature increases the rate of the chemical reaction because it increases the frequency of effective collisions between the reactants. At a higher temperature, the reactants possess more kinetic energy and therefore move faster, colliding more frequently and with more energy.

f) Method #1: Measure how the mass of the reaction varies against time.
Observed Trend: Place the reaction on a weighing machine and measure a change in mass against time as carbon dioxide gas is released. The mass of the reaction will decrease, eventually reaching a constant value once the reaction is complete.

Method #2: Measure how the pH of the solution varies against time.
Observed Trend: The pH of the solution will increase against time (as the acid is neutralised), eventually reaching a constant value once the reaction is complete.

Question 13:

a) D

b) The solutions that are used in Experiment 2 are four times more concentrated than those used in Experiment 1 (4.00 mol dm^{-3} as opposed to 1.00 mol dm^{-3}). Because the solutions in Experiment 2 are more concentrated, the average separation of the particles of the two reacting chemicals is smaller. This increases the probability of the particles colliding, which increases the frequency of effective collisions between them.

The amount of each reagent used is the same for both Experiment 1 and Experiment 2:
Amount of HC*l*(aq) used in Experiment 1 = $c \times v \times 10^{-3} = 1.00 \times 400 \times 10^{-3} = 0.400$ mol
Amount of $Na_2S_2O_3$(aq) used in Experiment 1 = $c \times v \times 10^{-3} = 1.00 \times 400 \times 10^{-3} = 0.400$ mol
Amount of HC*l*(aq) used in Experiment 2 = $c \times v \times 10^{-3} = 4.00 \times 100 \times 10^{-3} = 0.400$ mol
Amount of $Na_2S_2O_3$(aq) used in Experiment 2 = $c \times v \times 10^{-3} = 4.00 \times 100 \times 10^{-3} = 0.400$ mol
Both reactions will therefore produce the same amount of sulphur.