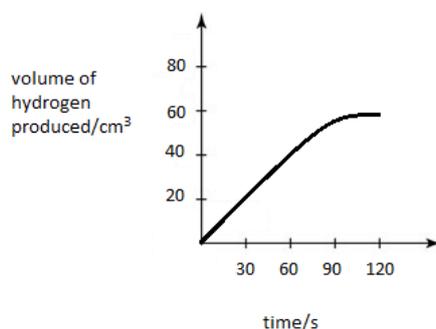


## Following the course of a reaction

1. Are these true or false?

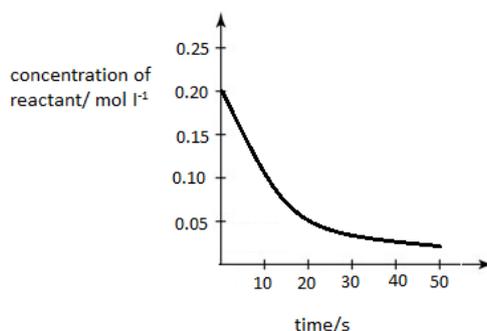
- The unit for average rate of reaction could be  $\text{mol l}^{-1} \text{s}^{-1}$ .
- The unit for average rate of reaction could be  $\text{cm}^3 \text{s}^{-1}$ .
- The unit for average rate of reaction could be  $\text{mol l}^{-1}$ .
- The unit for average rate of reaction could be  $\text{g s}^{-1}$ .
- The unit for average rate of reaction could be  $\text{g l}^{-1}$ .
- For a fixed change in concentration of a reactant, the shorter the time taken, the faster the rate of reaction.
- The rate of a reaction is likely to be fastest nearer the end of the reaction.
- For some reactions, the reaction rate can double for every temperature rise of ten degrees Celsius.

2. The graph shows data obtained from the reaction of zinc with hydrochloric acid.



- What was the total volume of hydrogen produced in the reaction?
- How long did it take for the reaction to go to completion?
- What was the average rate at which hydrogen was produced in the first 30s?

3. The graph below shows how the concentration of a reactant in a reaction varied with time.



- What was the initial concentration of the reactant?
- What was the average rate at which the reactant was used up in the first 20s?
- What was the average rate at which the reactant was used up in the period 20s to 40s?

## Rates of reaction

4. Are these true or false?
- Increasing the temperature increases the rate of reaction.
  - Lumps of calcium carbonate react faster with acid than calcium carbonate powder.
  - A dilute acid usually reacts faster than a concentrated acid.
  - Milk is more likely to turn sour at  $0^{\circ}\text{C}$  than at  $10^{\circ}\text{C}$ .
  - Small potatoes take longer to cook than large potatoes.
  - Plants grow faster in warm weather than in cold weather.
  - Compared with coal dust, lumps of coal burn very rapidly.
  - Acetylene burns less rapidly in pure oxygen than in air.
  - Chips cook faster in oil at  $300^{\circ}\text{C}$  than in oil at  $200^{\circ}\text{C}$ .
  - Reactions involving gases go faster when the pressure is increased.
5. One mole of hydrogen gas reacts with one mole of iodine vapour. After  $t$  seconds, 0.8 mol of hydrogen remains. What is the number of moles of hydrogen iodide formed at  $t$  seconds?
6. The results of an experiment carried out at  $19^{\circ}\text{C}$  involving the reaction between equal volumes of  $0.5\text{ mol l}^{-1}$  nitric acid and sodium thiosulphate solution of different concentrations are shown.

<b>Concentration of sodium thiosulphate solution / <math>\text{mol l}^{-1}</math></b>	0.5	0.25	0.125	0.064
<b>Time for the appearance of sulphur / s</b>	13	25	51	104

On the evidence of these results alone, which statement is correct?

- The more concentrated the thiosulphate solution, the longer the time before the sulphur appears.
  - The more concentrated the nitric acid, the faster the reaction proceeds.
  - The more concentrated the thiosulphate solution, the faster the reaction proceeds.
  - The higher the temperature, the faster the reaction proceeds.
7. Two identical samples of zinc are placed in open vessels. Excess of  $2\text{ mol l}^{-1}$  sulphuric acid is added to one and excess of  $1\text{ mol l}^{-1}$  sulphuric acid is added to the other. All other conditions are the same. Which of the following is the same for the two samples?
- The mass lost from the vessels;
  - The total time for the reaction;
  - The initial reaction rate;
  - The average rate of evolution of gas.
8. During the addition of magnesium to an excess of dilute hydrochloric acid each of the following was measured and plotted against time on a graph.
- The temperature of the solution;
  - The volume of hydrogen produced;
  - The pH of the solution;
  - The concentration of the solution.

If the reaction was completed in 5 minutes, which of the above was measured to give the graph?

