**Introduction of Rate of Chemical Reaction**

1. Consider the following reaction:
    $$A(g) + 3B(g) \longrightarrow 2C(g) + D(g)$$
    From the 0th to the 5th minute, the average rate of consumption of $A(g)$ is 1 mol dm^{-3} min^{-1}. What is the average rate of formation of $C(g)$ in the same time interval?
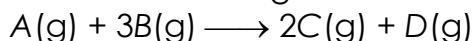
2. Suggest how to follow the progress of the following reactions. Explain briefly.
    (a) Reaction between sodium carbonate and 1 M hydrochloric acid
    (b) Reaction between sodium sulphite solution and acidified potassium permanganate solution

3. An iron nail is put into a test tube containing dilute hydrochloric acid. The absorbance of the reaction mixture is measured and a graph is plotted using the result.
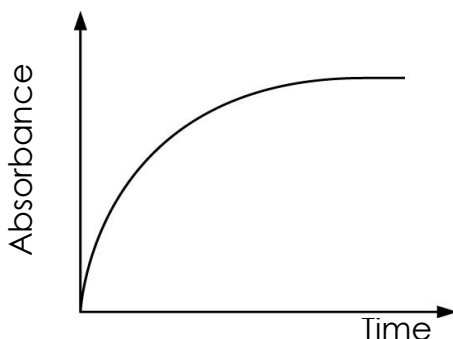
    (a) Explain why the absorbance of the reaction mixture increases gradually.
    (b) State how to obtain the initial rate of the reaction from the graph.
    (c) Explain why the absorbance remains unchanged finally.

4. Which of the following combinations of reactions and methods of investigating reaction rate is INCORRECT?

	Reaction	Method of investigating reaction rate
A.	$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g)$	Measuring the change in colour intensity of the reaction mixture
B.	$N_2(g) + O_2(g) \rightarrow 2NO(g)$	Measuring the change in pressure of the reaction system
C.	$H_2C_2O_4(aq) + Ba(OH)_2(aq) \rightarrow BaC_2O_4(s) + 2H_2O(l)$	Measuring the change in electrical conductivity of the reaction mixture
D.	$NaHCO_3(aq) + HCl(aq) \rightarrow NaCl(s) + CO_2(g) + H_2O(l)$	Measuring the change in mass of the reaction mixture

Suggested Answer

1. When 1 mole of A is consumed, 2 moles of C is produced. Hence, the average rate of formation of $C(g)$ = 1 mol dm^{-3} min^{-1} × 2 = 2 mol dm^{-3} min^{-1}.

2. (a) Since carbon dioxide is the only gaseous product in the reaction, the progress of the reaction can be followed by measuring the volume of carbon dioxide formed / change in pressure of the reaction system / change in mass of the reaction mixture.

   (b) Since acidified potassium permanganate solution is decolorized, the progress of the reaction can be followed by measuring the change in colour intensity of the reaction mixture.

3. (a) As the reaction proceeds, the concentration of green $Fe^{2+}(aq)$ ions increases.

   (b) The initial rate can be obtained by finding the slope of tangent at time zero.

   (c) When the reaction stops, the concentration of $Fe^{2+}(aq)$ ions remains unchanged.

4. B
   The reaction does not involve a change in the number of moles of gas and so the progress of the reaction cannot be followed by measuring the change in pressure of the reaction system.