



Oxford Cambridge and RSA

A Level Chemistry A

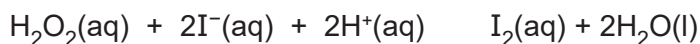
H432/03 Unified chemistry

Question Set 3

1

This question is about reactions of hydrogen peroxide, H_2O_2 .

- (a) Hydrogen peroxide, H_2O_2 , iodide ions, I^- , and acid, H^+ , react as shown in the equation below.



A student carries out several experiments at the same temperature, using the initial rates method, to determine the rate constant, k , for this reaction.

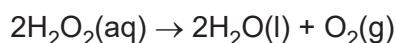
The results are shown below.

Experiment	Initial concentrations			Rate $/10^{-6} \text{mol dm}^{-3} \text{s}^{-1}$
	$[\text{H}_2\text{O}_2(\text{aq})]$ $/\text{mol dm}^{-3}$	$[\text{I}^-(\text{aq})]$ $/\text{mol dm}^{-3}$	$[\text{H}^+(\text{aq})]$ $/\text{mol dm}^{-3}$	
1	0.0100	0.0100	0.100	2.00
2	0.0100	0.0200	0.100	4.00
3	0.0200	0.0100	0.100	4.00
4	0.0200	0.0100	0.200	4.00

- (i) Determine the rate equation and calculate the rate constant, k , including units. [3]
- (ii) The rate constant, k , for this reaction is determined at different temperatures, T .

Explain how the student could determine the activation energy, E_a , for the reaction graphically using values of k and T . [3]

- (b) Solutions of hydrogen peroxide decompose slowly into water and oxygen:



This reaction is catalysed by manganese dioxide, $\text{MnO}_2(\text{s})$.

Standard electrode potentials are shown below.



Using the electrode potentials, explain how MnO_2 is able to act as a catalyst for the decomposition of hydrogen peroxide.

Your answer should include relevant equations. [4]

(c) Peroxycarboxylic acids are organic compounds with the COOOH functional group.

Peroxyethanoic acid, CH₃COOOH, is used as a disinfectant.

(i) Suggest the structure for CH₃COOOH.

The COOOH functional group must be clearly displayed.

[1]

(ii) Peroxyethanoic acid can be prepared by reacting hydrogen peroxide with ethanoic acid.

This is a heterogeneous equilibrium.



A 250 cm³ equilibrium mixture contains concentrations of 0.500 mol dm⁻³ H₂O₂(aq) and 0.500 mol dm⁻³ CH₃COOH(aq).

Calculate the amount, in mol, of peroxyethanoic acid in the equilibrium mixture.

[3]

Total Marks for Question Set 3: 14

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