

F325 Module 1: HW1

- i The hydrolysis of methyl propanoate was studied in acidic conditions at 25 °C and the rate equation was found to be

$$\text{rate} = k[\text{CH}_3\text{CH}_2\text{COOCH}_3][\text{H}^+]$$

- (a) Use the data below to calculate the value of the rate constant, k , at this temperature. Deduce its units.

Initial rate of reaction / $\text{mol dm}^{-3} \text{ s}^{-1}$	Initial concentration of methyl propanoate / mol dm^{-3}	Initial concentration of hydrochloric acid / mol dm^{-3}
1.15×10^{-4}	0.150	0.555

Rate constant

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Units

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(3 marks)

- (b) The reaction in part (a) was repeated at the same temperature, but water was added so that the volume of the reaction mixture was doubled. Calculate the initial rate of reaction under these conditions.

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(1 mark)

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The initial rate of the reaction between the gases NO and H₂ was measured in a series of experiments at a constant temperature and the following rate equation was determined.

$$\text{rate} = k[\text{NO}]^2[\text{H}_2]$$

(a) Complete the table of data below for the reaction between NO and H₂

Experiment	Initial [NO]/mol dm ⁻³	Initial [H ₂]/mol dm ⁻³	Initial rate/mol dm ⁻³ s ⁻¹
1	3.0×10^{-3}	1.0×10^{-3}	1.8×10^{-5}
2	3.0×10^{-3}		7.2×10^{-5}
3	1.5×10^{-3}	1.0×10^{-3}	
4		0.50×10^{-3}	8.1×10^{-5}

(3 marks)

(b) Using the data from experiment 1, calculate a value for the rate constant, *k*, and state its units.

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(3 marks)