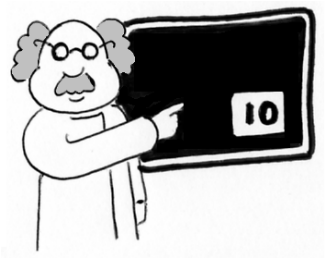


STARTER FOR 10...

1.3. Measuring reaction rate in the lab

The rate of a reaction is defined as *the change in concentration of reactants or products per unit time.* The units of rate are mol dm^{-3} s^{-1}.

The method chosen to measure the rate of a reaction depends on the individual reaction.

For each of the reactions below, use the observations made to **calculate the initial rate of the reaction**.

1. Measuring the rate of a reaction when a precipitate is formed;

$$Na_2S_2O_3(aq) + 2\ HCl(aq) \rightarrow 2\ NaCl(aq) + H_2O(l) + S(s) + SO_2(g)$$

A student wished to investigate how temperature affected the rate of the reaction between sodium thiosulfate and acid. He reacted 10 cm^3 of a 0.02 mol dm^{-3} solution of sodium thiosulfate with 40 cm^3 of hydrochloric acid (excess) at 22 °C. The time taken to produce a precipitate of 1×10^{-4} mol of sulfur was found to be 56 s.

Initial rate of production of sulfur = ... mol dm^{-3} s^{-1}

(2 marks)

2. Measuring the rate of a reaction in which there is a change in colour;

$$CH_3COCH_3(aq) + I_2(aq) \rightarrow CH_3COCH_2I(aq) + H^+(aq) + I^-(aq)$$

colourless brown colourless colourless

A student followed the reaction between iodine and propanone to produce iodopropanone. She set up the first experiment as described in the table below and found it took 279 s for the brown colour of the iodine to disappear.

2.0 mol dm^{-3} propanone / cm^3	1.0 mol dm^{-3} HCl / cm^3	0.005 mol dm^{-3} I_2 / cm^3	H_2O / cm^3	Time / s
5	5	2	13	279

Initial rate of loss of iodine = ... mol dm^{-3} s^{-1}

(3 marks)

3. Measuring the rate of a reaction in which a gas is produced;

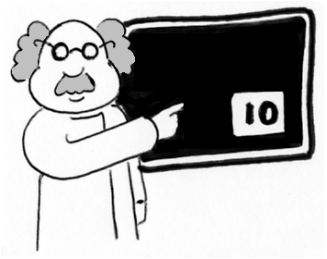
$$Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

The student reacted a 3 cm strip of magnesium ribbon with 25 cm^3 of 2.0 mol dm^{-3} HCl (an excess). He found that 14 cm^3 of gas was produced in the first 10 seconds of the reaction.

(You may assume the reaction was carried out at RTP where 1 mole of gas has a volume of 24 dm^3.)

Initial rate of loss of hydrochloric acid = ... mol dm^{-3} s^{-1}

(4 marks)



STARTER FOR 10...

1.4. Determining the rate equation

For each of the following sets of experimental data determine;

(a) The rate equation for the reaction,

(b) The value of the rate constant, *k* including its units.

1.

Experiment	[A] / mol dm^{-3}	[B] / mol dm^{-3}	Initial rate of loss of [A] / mol dm^{-3} s^{-1}
1	1.20×10^{-3}	3.30×10^{-3}	4.02×10^{-4}
2	1.20×10^{-3}	6.60×10^{-3}	4.02×10^{-4}
3	2.40×10^{-3}	6.60×10^{-3}	1.61×10^{-3}

Rate = ...

k = ... (3 marks)

2.

	Run 1	Run 2	Run 3
[A] / mol dm^{-3}	0.15	0.30	0.45
[B] / mol dm^{-3}	0.10	0.10	0.20
$\frac{-d[B]}{dt}$ **/ mol dm^{-3} s^{-1}**	2.5×10^{-4}	2.5×10^{-4}	5.0×10^{-4}

Rate = ...

k = ... (3 marks)

3.

Experiment	[X] / mol dm^{-3}	[Y] / mol dm^{-3}	[Z] / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.05	0.10	0.15	5.20×10^{-4}
2	0.10	0.10	0.15	2.08×10^{-3}
3	0.05	0.10	0.30	5.20×10^{-4}
4	0.15	0.05	0.15	2.34×10^{-3}

Rate = ...

k = ... (4 marks)