

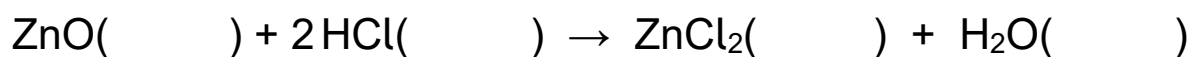
0 4

This question is about acids, alkalis and bases.

A student reacted zinc oxide powder with hydrochloric acid to produce zinc chloride solution.

0 4 . 1

Complete the equation for the reaction by writing the state symbols.

[2 marks]

0 4 . 2

Give **one** way that the student could speed up the reaction between zinc oxide powder and hydrochloric acid.

[1 mark]

Hydrochloric acid was the limiting reactant.

0 4 . 3

How could the student know when all the hydrochloric acid has reacted?

[1 mark]

0 4 . 4

How could the student obtain zinc chloride solution from the reaction mixture when all the hydrochloric acid has reacted?

[1 mark]



0 4 . 5 Describe how zinc chloride crystals are produced from zinc chloride solution.

[2 marks]

Sulfuric acid and sodium hydroxide react to produce sodium sulfate.

0 4 . 6 Sulfuric acid is gradually added to sodium hydroxide solution.

The pH of the mixture changes as the sulfuric acid is added until in excess.

Suggest the pH at:

- the start before sulfuric acid is added
- the end when sulfuric acid is in excess.

[2 marks]

pH at start = _____

pH at end = _____

0 4 . 7 Complete the symbol equation for the preparation of sodium sulfate.

You should balance the equation.

[2 marks]



Question 4 continues on the next page

Turn over ►



0 4 . 8

A solution of hydrochloric acid had a hydrogen ion concentration of 1.0 mol/dm^3

Water was added to the hydrochloric acid until the pH increased by 1

What was the hydrogen ion concentration of the hydrochloric acid after water had been added?

[1 mark]

Tick (✓) **one** box.

100 mol/dm³

10 mol/dm³

0.10 mol/dm³

0.010 mol/dm³

12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$\text{ZnO(s)} + \text{HCl(aq)} \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2\text{O(l)}$	allow 1 mark for 2/3 correct state symbols	2	AO2 5.2.2.2 5.4.2.3 RPA8
04.2	any one from: <ul style="list-style-type: none"> • warm / heat the mixture • increase the concentration of the (hydrochloric) acid 	ignore add a catalyst ignore stir ignore powder ignore add more zinc oxide do not accept volume / amount of (hydrochloric) acid do not accept increase the surface area	1	AO1 5.4.2.2 5.4.2.3 RPA8
04.3	zinc oxide remains or solid remains	ignore colour allow zinc oxide is added until in excess	1	AO1 5.3.2.4 5.4.2.2 5.4.2.3 RPA8
04.4	filtration / filter		1	AO1 5.4.2.2 5.4.2.3 RPA8
04.5	heat leave to crystallise / cool	do not accept heat to dryness allow leave to evaporate some water	1 1	AO1 5.4.2.2 5.4.2.3 RPA8

04.6	(at start) value in range 12–14 (at end) value in range 0–3	must be in this order	1 1	AO1 AO2.2 5.4.2.2 5.4.2.4
04.7	$2 \text{ NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{ H}_2\text{O}$	allow 1 mark for Na_2SO_4 and H_2O	2	AO2 5.1.1.1 5.4.2.2
04.8	0.10 mol/dm ³		1	AO3 5.4.2.2 5.4.2.4
Total			12	