Do not write outside the box

0 2 This question is about salts.

Ammonium nitrate solution is produced when ammonia gas reacts with nitric acid.

0 2 . 1 Give the state symbol for ammonium nitrate solution.

[1 mark]

_____

0 2 . 2 What is the formula of nitric acid?

[1 mark]

Tick (✓) **one** box.

HCl ☐

HNO_3 ☐

H_2SO_4 ☐

NH_4OH ☐

0 2 . 3 Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, OH^-

A student adds universal indicator to solutions of nitric acid and ammonia.

What colour is observed in each solution?

[2 marks]

Colour in nitric acid _____

Colour in ammonia solution _____

Do not write outside the box

0 2 . 4 The student gradually added nitric acid to ammonia solution.

Which row, **A**, **B**, **C** or **D**, shows the change in pH as the nitric acid is added until in excess?

[1 mark]

Tick (✓) **one** box.

	pH of ammonia solution at start	pH after addition of excess nitric acid	
A	10	7	
B	2	10	
C	7	1	
D	10	2	

0 2 . 5 Calculate the percentage by mass of oxygen in ammonium nitrate (NH_4NO_3).

Relative atomic masses (A_r): H = 1 N = 14 O = 16

Relative formula mass (M_r): NH_4NO_3 = 80

[3 marks]

Percentage by mass of oxygen = _____ %

Question 2 continues on the next page

Do not write outside the box

0 2 . 6 Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

You do **not** need to write about safety precautions.

[6 marks]

14

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(aq)	allow aq ignore aqueous ignore formulae	1	AO1 5.2.2.2
02.2	HNO_3		1	AO1 5.1.1.1 5.4.2.2
02.3	red purple **or** blue	allow orange or yellow do **not** accept green allow shades of purple eg violet	1 1	AO1 5.4.2.4
02.4	D		1	AO3 5.4.2.4
02.5	 3 × 16 **or** 48 $\frac{48}{80}$ (×100) 60 (%)	an answer of 60 (%) scores **3** marks an answer of 20 (%) scores **2** marks for: $\frac{16}{80}$ (× 100) (1) = 20 (%) (1)	 1 1 1	AO2 5.3.1.2

Question	Answers	Mark	AO/ Spec. Ref
02.6	**Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 AO2
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	5.5.1.1
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content **Steps** • use a suitable container eg test tube • use insulation • add water • measure the initial water temperature (with a thermometer) • add stated mass eg 1g **or** 1 spatula • stir (to dissolve the solid) • measure the final (allow lowest or highest) temperature of the solution • calculate the temperature difference **or** determine graphically • repeat with different masses • repeat with the same volume of water to access level 3 there must be an indication of how the temperature change is determined using different masses dissolved in the same quantity of water		

Total			**14**