# Section A

## Answer all questions.

Write your answers in the boxes provided at the end of the Section.

1 Copper(II) sulfate is made by reacting an excess of copper(II) oxide with dilute sulfuric acid. The excess copper(II) oxide is then removed from the solution. Why is excess oxide added and how is the excess oxide removed?

	Why add excess oxide	How to remove excess oxide
Α	To use up all the acid	By filtration
В	To use up all the acid	By heating
С	To produce water	By filtration
D	To produce water	By heating

2 The graph shows how the pH of soil in a field changes over time. At which point was the soil neutral?



**3** Given a supply of magnesium carbonate, zinc carbonate, dilute sulfuric acid and aqueous sodium hydroxide, how many different salts can be prepared?

4 The diagram shows two experiments on a powdered oxide.



In both experiments, the powdered oxide reacts and dissolves.

what could the oxide be?	What	could	the	oxide	be?
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	powdered oxide	reason
Α	potassium oxide	potassium oxide is basic
В	silicon dioxide	silicon dioxide is acidic
С	sodium oxide	sodium oxide is neutral
D	zinc oxide	zinc oxide is amphoteric

5 Ammonium sulfate is heated with solution X and ammonia gas is given off.

A piece of moist red litmus paper and a piece of moist blue litmus paper are held in the gas.



What is solution X and what will be the colour change of the litmus paper?

	solution X	colour change of litmus paper
Α	an acid	blue to red
В	an acid	red to blue
С	an alkali	blue to red
D	an alkali	red to blue

Question	1	2	3	4	5
Answer					

			<b>Section B</b> Answer <b>all</b> questions. Write your answers in the spaces provided.		For Examiner's Use
6	(a)	Expl	ain, in terms of ionisation, the difference between a strong and a weak acid.		
	(b)	 A sa	imple of an acid contains 0.16 g of hydrogen, 0.96 g of carbon and 1.28 g of	[2]	
		оху( (i)	pen. Determine the empirical formula of this acid.		
		(ii)	The relative molecular mass of the acid is 60.	[2]	
				[1]	
			[Tota	al: 5]	

7 The table shows information on some salts and products that contain them.

name of salt	formula of salt	name of one compound to make salt	name of other compound to make salt	use of salt
silver chloride	AgC <i>l</i>		hydrochloric acid	in photographic film
potassium nitrate	KNO <sub>3</sub>	potassium hydroxide		making fertilisers
barium sulfate	BaSO₄	barium nitrate		medical tracer
sodium chloride	NaC <i>l</i>		hydrochloric acid	food additive
lead sulfate	PbSO <sub>4</sub>	lead nitrate		in a car battery

- (a) Complete the table by filling in the missing information. [5]
- (b) Name two salts in the table that can be made by

- (d) Write an **ionic** equation for the reaction used to make any **one** of the salts in the table.
  - [1]

[2]

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[Total: 10]

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# Section C

### Answer **all** questions. Write your answers in the spaces provided.

8 (a) To determine the pH of a sample of farm soil, drops of three indicators below were added to separate parts of the sample. The colours observed are shown in the results table.

## **Experimental results**

indicator	methyl yellow	methyl red	phenolphthalein
colour observed	yellow	red	colourless

## Indicator colour ranges



## Plant response to soil pH

Plant	soil pH range for optimal growth
carrot	5.5 - 6.8
chrysanthemum	6.0 - 6.3
hydrangea blue	4.0 - 5.0
hydrangea white	6.5 - 8.0
potato	5.0 - 5.7

Using the data given, estimate the pH of the soil and select the plant that will grow well at the current soil pH.

 (b) Acid rain, a result of air pollution, sometimes fall on farms and lakes. Limestone in the form of calcium carbonate is often used to neutralise the H<sup>+</sup> ions in the acidic soil or water.

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + CO_2 + H_2O$$

A lake is found to contain 10,500 moles of H<sup>+</sup> ions.



Calculate the mass of calcium carbonate needed to react with all of the H<sup>+</sup> ions in the lake.

[2]

[Total: 4]

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### 9 General Equations

The equations for the neutralisation reaction between a metal hydroxide (base) and hydrochloric acid for the first three elements in Group I are:

 $LiOH + HCl \rightarrow LiCl + H_2O$   $NaOH + HCl \rightarrow NaCl + H_2O$   $KOH + HCl \rightarrow KCl + H_2O$ 

The general equation for such a reaction between a Group I metal hydroxide and hydrochloric acid may be written as:

 $MOH + HCl \rightarrow MCl + H_2O$ 

A general equation is useful because it shows the mole ratios of the reactants and products in that reaction for all the elements in the same group.

The general equation for the neutralisation reaction between a Group II metal hydroxide and hydrochloric acid may be written as:

 $M(OH)_2 + 2HCl \rightarrow MCl_2 + 2H_2O$ 

The general equations for the Group I and II neutralisation reactions are different because the charges on the metal ions (and so the formulae of the hydroxides) are different.

Group II metal carbonates decompose when heated, producing carbon dioxide. For example,

 $BeCO_3 \rightarrow BeO + CO_2$ MgCO\_3  $\rightarrow$  MgO + CO\_2 CaCO\_3  $\rightarrow$  CaO + CO\_2

Group II metal carbonates also react with acids to produce carbon dioxide. For example,

BeCO<sub>3</sub> + 2HCl → BeCl<sub>2</sub> + H<sub>2</sub>O + CO<sub>2</sub> MgCO<sub>3</sub> + 2HCl → MgCl<sub>2</sub> + H<sub>2</sub>O + CO<sub>2</sub> CaCO<sub>3</sub> + 2HCl → CaCl<sub>2</sub> + H<sub>2</sub>O + CO<sub>2</sub>

(a) Why are the general equations for the neutralisation reaction of Group I and II metal hydroxides different?

.....

......[1]

- (b) Using the passage and the Periodic Table, write an equation for the reaction of
  - (i) rubidium hydroxide with hydrochloric acid,
  - ......[1]

.....

(ii) strontium hydroxide with hydrochloric acid.

[1]

(C) Construct the general equation for the decomposition of a Group II metal carbonate, (i) [1] ..... (ii) the reaction of a Group II metal carbonate with hydrochloric acid. [1] ..... (d) A student weighs out 4.86 g of an unknown Group II metal carbonate. To determine its identity, he reacted it fully with hydrochloric acid and found that the mass of carbon dioxide produced is 2.57 g. Using your equation in (c)(ii), calculate the relative molecular mass of the metal carbonate, and hence find the unknown metal.

(e)	Dedu	uce the general equation for	
	(i)	the neutralisation of a Group II metal hydroxide with sulfuric acid,	
			[1]
	(ii)	the reaction of a Group II metal carbonate with <b>nitric</b> acid.	
			[1]
		[Total	: 11]
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[4]