(b) Skis were originally made from wood. Modern skis are often made of layers of graphite with steel edges to help the skis turn easily.

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(i) Steel is an alloy. What is meant by the term alloy?

_____

_____

_____ [2]

(ii) Instead of steel, aluminium can be used on the edges of skis to make a very lightweight ski. State one other use of aluminium.

_____ [1]

(iii) Graphite is one of the allotropes of carbon. Name another allotrope of carbon.

_____ [1]

(iv) Three physical properties of graphite are shown in the table below. Explain these three physical properties of graphite in terms of structure and bonding.

Physical properties of graphite
High melting point
Soft
Good conductor of electricity

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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Marks	Remark
Total Question 2	

[Turn over

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3 Metal compounds are widely used in agriculture, in medicine and as catalysts.

(Relative atomic masses: H = 1; C = 12; N = 14; O = 16; S = 32; Cl = 35.5; Cu = 64)

(a) Complete the table below which gives information on some copper(II) compounds.

Copper compound	Formula	Colour	Relative Formula Mass
Hydrated copper(II) chloride	$CuCl_2.2H_2O$	blue-green	
Copper(II) oxide	CuO		
Copper(II) nitrate		blue	

[5]

(b) Copper(II) sulfate may be prepared by reacting copper(II) carbonate with sulfuric acid. The equation for the reaction is as follows:

$$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$$

4.65 g of copper(II) carbonate were added to a solution of sulfuric acid. The reaction produced 0.02 moles of copper(II) sulfate, $CuSO_4$.

(i) Calculate the number of moles present in 4.65 g of copper(II) carbonate.

Moles of copper(II) carbonate _____ [2]

(ii) How would you know when the reaction was complete?

_____

_____ [1]

(iii) Calculate the mass of copper(II) sulfate, $CuSO_4$, present in 0.02 moles.

Mass of copper(II) sulfate _____ [2]

(c) A metal ore with the formula XO_2 was isolated from the Earth's crust and found to have a relative formula mass of 80. Determine the relative atomic mass and identity of metal X.

You may find your Data Leaflet useful in answering this question.

Relative atomic mass of X _____

Identity of metal X _____ [2]

Examiner Only	
Marks	Remark
Total Question 3	

Examiner Only	
Marks	Remark

4 **(a)** The pH values of four solutions were determined by adding universal indicator and comparing the final colour to the colour chart.

(i) Complete the table below.

Solution	Colour in universal indicator	pH
Deionised water	Green	
Milk		6
Washing soda		12
Sulfuric acid	Red	

[4]

(ii) Select from the table above an example of each of the following:

A weak acid _____

A strong alkali _____ [2]

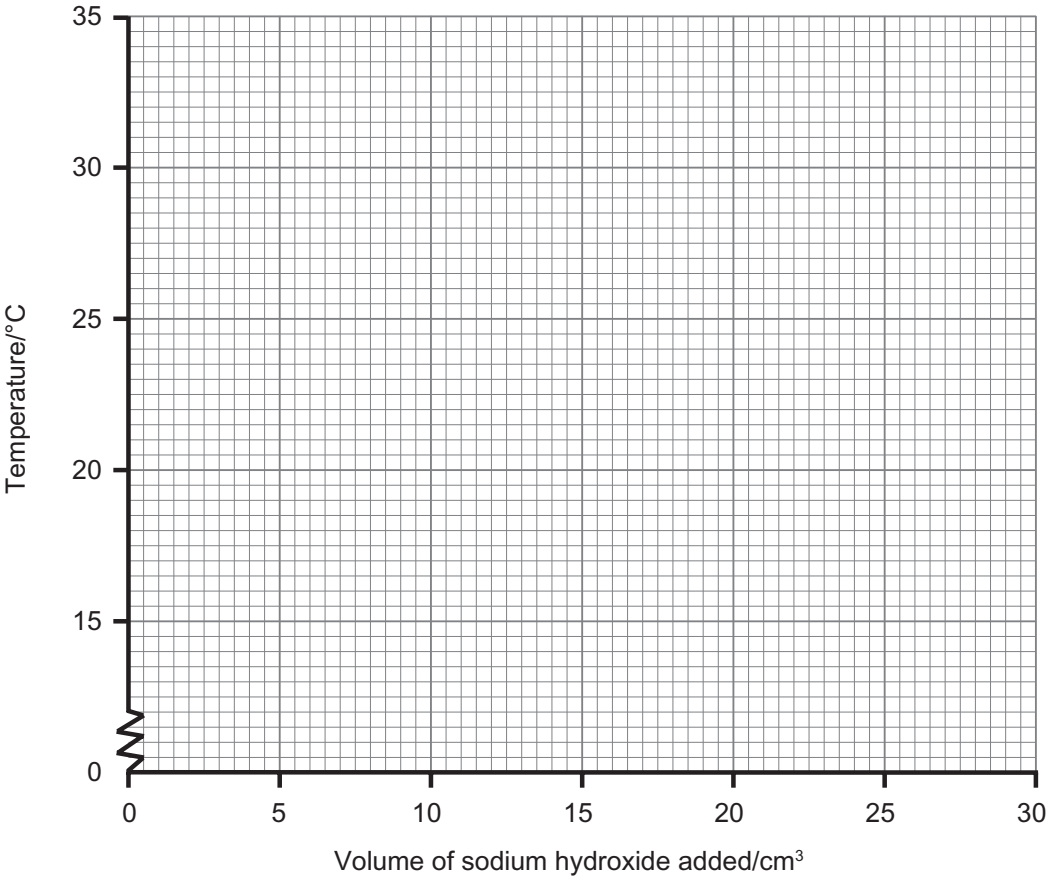
(b) The following experiment was carried out to determine if the reaction between hydrochloric acid and sodium hydroxide was exothermic.

- 25 cm^3 of 1.0 mol/dm^3 hydrochloric acid were measured out and placed in a polystyrene cup.
- The temperature of the hydrochloric acid was recorded.
- 25 cm^3 of 1.0 mol/dm^3 sodium hydroxide solution were then added gradually in 5 cm^3 portions to the hydrochloric acid, stirring after each addition.

The temperature of the reaction mixture was recorded and the results are shown in the table below.

Volume of sodium hydroxide added/cm^3	0	5	10	15	20	25
Temperature of reaction mixture/°C	20.5	21.5	22.5	23.5	25.5	28.0

(i) Use the results in the table to plot a graph of temperature against volume of sodium hydroxide added.



[3]

(ii) How does your graph prove that this reaction is exothermic?

_____

_____ [1]

Examiner Only

Marks	Remark

[Turn over

(iii) Apart from exothermic, what other term is used to describe the type of reaction between an acid and an alkali?

_____ [1]

(iv) Write a balanced symbol equation for the reaction between sodium hydroxide and hydrochloric acid.

_____ [2]

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Marks	Remark
Total Question 4	

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(Questions continue overleaf)

5 A student used the following method to find the solubility of potassium nitrate at room temperature (20 °C).

Place 25 g of deionised water in a beaker and add solid potassium nitrate while stirring until no more will dissolve. Filter the mixture. Place the filtrate in an evaporating basin and heat using a Bunsen burner until all of the water has been removed. Measure the mass of solid obtained.

(a) What is meant by the term solubility?

_____

_____

_____

_____ [4]

(b) Suggest why the mixture was filtered.

_____

_____ [1]

(c) Draw a labelled diagram of the assembled apparatus used to filter the mixture.

[3]

Examiner Only	
Marks	Remark

(d) The student obtained 7.1 g of potassium nitrate. Calculate the solubility of potassium nitrate at 20 °C.

Examiner Only	
Marks	Remark

_____ g/100 g water [1]

Total Question 5	

[Turn over

Examiner Only	
Marks	Remark

6 Hydrochloric acid, hydrobromic acid and hydroiodic acid each contain a Group 7 ion.

(a) (i) Name the ion present in all acid solutions.

_____ [1]

(ii) Complete the table to give the colour observed when hydrochloric acid is tested with red and blue litmus paper.

	Hydrochloric acid
Colour of red litmus paper	
Colour of blue litmus paper	

[2]

(iii) These three acids are all **strong acids**. Describe how you would experimentally determine which of these acids is the strongest.

_____

_____

_____ [2]

(b) In an experiment to determine which Group 7 ion was present in each of the acids, a few drops of silver nitrate solution were added to a sample of each acid solution. Complete the table below to show the results of these tests.

	Hydrochloric acid	**Hydrobromic acid**	**Hydroiodic acid**
Observation on addition of a few drops of silver nitrate solution.			

[4]

(c) Each of the acids reacts with bases to produce salts.

(i) To identify the metal ion present in a salt a flame test can be carried out. Complete the table below to give the flame colour for each of the metal ions listed.

Metal ion	Flame colour
Potassium	
Calcium	
Copper	

[3]

(ii) The metal ion in a salt can also be identified using sodium hydroxide solution. Use the results in the table below to identify the metal ion present in salt A and salt B.

Salt	Observation on adding a few drops of sodium hydroxide solution	Observation on adding an excess of sodium hydroxide solution
A	Blue precipitate	Blue precipitate remains
B	White precipitate	White precipitate remains

Metal ion in salt A _____

Metal ion in salt B _____ [2]

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Total Question 6	

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Question Number	**Marks**
1	
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