cea

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017

GCSE Chemistry

Unit 1

Foundation Tier

ML

[GCH11]

WEDNESDAY 14 JUNE, MORNING

TIME

1 hour 15 minutes, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only.
Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **5(b)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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1 **(a)** Look at the table below. It gives the melting points and boiling points of four elements.

Element	Melting point (°C)	Boiling point (°C)	Physical state at room temperature
magnesium	650	1090	solid
mercury	−39	357	
phosphorus	44	277	
xenon	−112	−108	

(i) Complete the table. [3]

(ii) Write the symbol for an element which is a liquid at room temperature. Do not use any of the elements in the table above.

_____ [1]

(b) When iodine is heated it changes from a solid to a gas.

(i) What name is given to this change of state?

_____ [1]

(ii) What is the colour change when iodine is heated?

From _____ to _____ [2]

(c) Group 1 of the Periodic Table is a group of reactive metals.

(i) What is the name of the Group 1 metals?

_____ [1]

(ii) A piece of sodium metal is cut with a knife. Describe the appearance of the metal when it is freshly cut and a few minutes after it is cut.

_____

_____

_____ [2]

(iii) Write the symbol for the least reactive element in Group 1.

_____ [1]

(d) An atom of an element has the electronic configuration 2,8,5.

(i) What group of the Periodic Table is this element found in?

_____ [1]

(ii) What period of the Periodic Table is this element found in?

_____ [1]

(e) Group 0 of the Periodic Table is a group of unreactive non-metals.
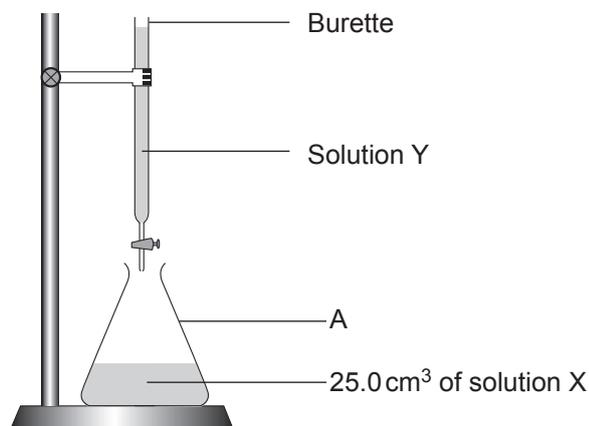
(i) What is the name of the Group 0 elements?

_____ [1]

**(ii)** The elements of Group 0 are unreactive. Explain why.

_____

_____

_____ [2]

[Turn over

2 **(a)** Look at the diagram below. A student slowly added solution Y in 0.5 cm³ portions to 25.0 cm³ of a solution X and swirled the solution. The apparatus for the experiment is shown below.

The pH after each addition of solution Y was measured and recorded. A graph of pH against volume of solution Y added was drawn.

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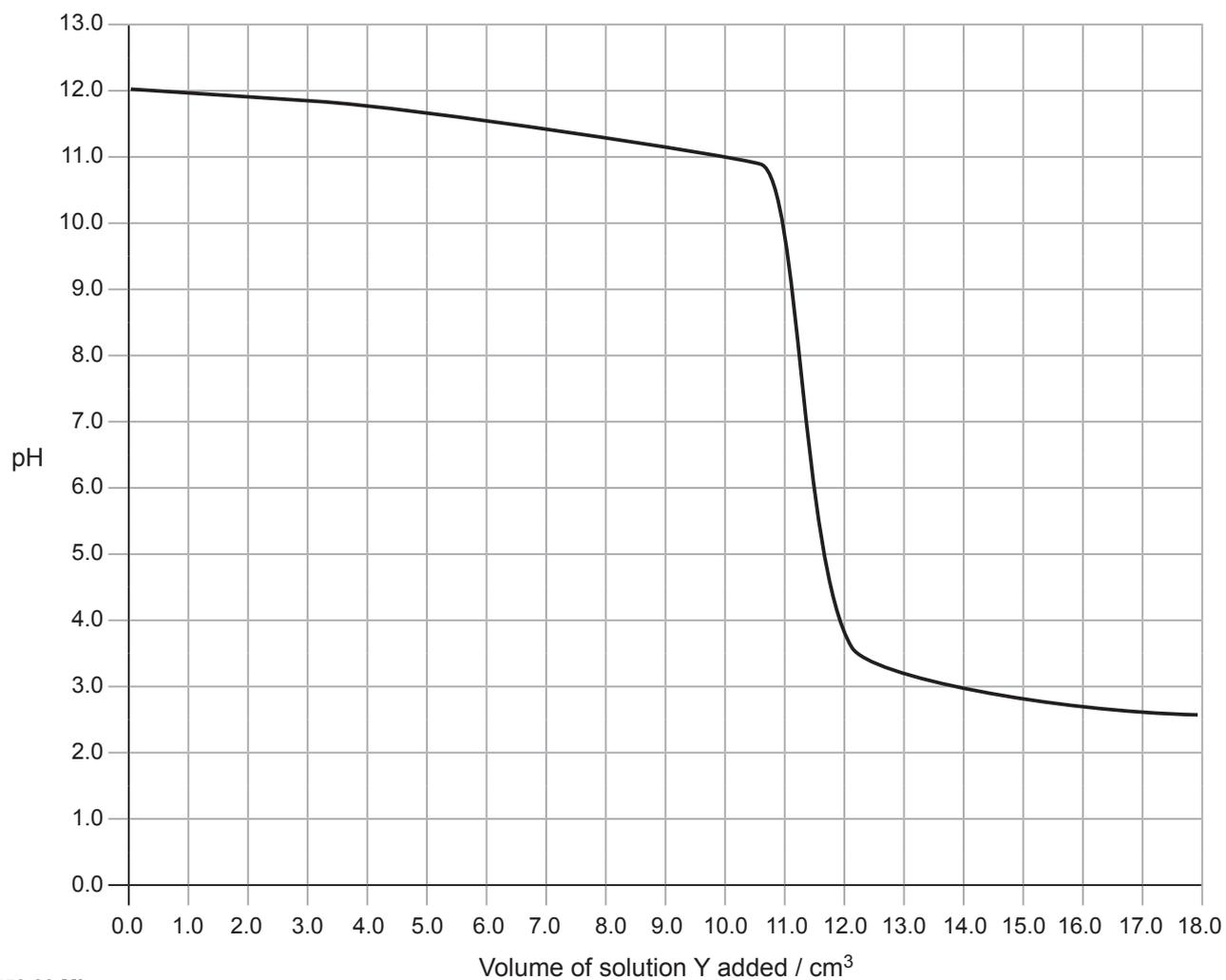
(i) Name the piece of apparatus labelled A.

_____ [1]

(ii) Suggest how the pH of the solution was measured.

_____

_____ [1]

(iii) Why was the flask swirled after each addition of $0.5\,cm^3$ of solution Y?

_____ [1]

(iv) Use the graph to explain if solution X is an acidic, alkaline or neutral solution.

_____

_____

_____

_____ [2]

(v) What is the pH when $14.0\,cm^3$ of solution Y have been added?

_____ [1]

[Turn over

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(b) Solution Z contains a mixture of two compounds. The mixture was tested to identify the cations and anions present in the mixture.

(i) Complete the table to give the expected observations.

Test	Observation	Deduction
1. flame test		sodium ions present
2. (i) add $1\,cm^3$ of sodium hydroxide solution (ii) add excess sodium hydroxide solution		zinc ions present
3. add some barium chloride solution		sulfate ions present
4. add some silver nitrate solution		chloride ions present

[5]

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(ii) Write the formula for silver nitrate.

_____ [1]

(iii) Suggest the names of two different compounds which could be present in solution Z.

_____

_____ [2]

[Turn over

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3 **(a)** Some covalent substances are shown below. They are labelled A, B, C, D, E and F.

$$H—Cl \qquad H—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—H \qquad \underset{H}{\overset{O}{}} \underset{}{H} \qquad \underset{\underset{H}{|}}{\overset{N}{}}\underset{H}{H} \qquad O=C=O \qquad N\equiv N$$
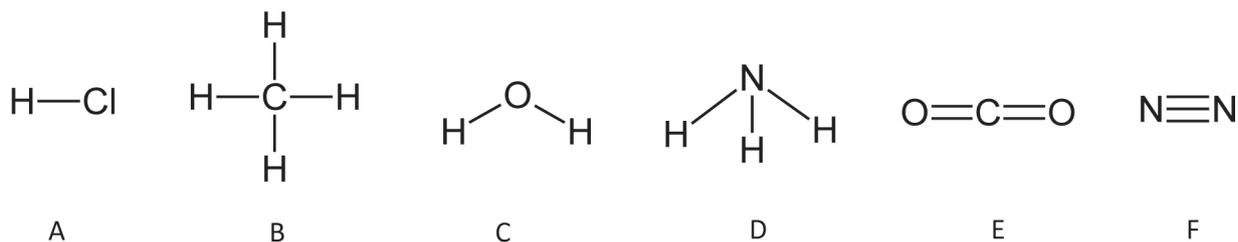
A B C D E F

(i) Which letter (A, B, C, D, E or F) represents methane? _____ [1]

(ii) Which letter (A, B, C, D, E or F) represents ammonia? _____ [1]

(iii) Which letter (A, B, C, D, E or F) represents a diatomic element? _____ [1]

(iv) Write the chemical formula of D. _____ [1]

(v) Draw a dot and cross diagram to show the bonding in A. Only outer shell electrons should be shown.

[1]

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(vi) What is a covalent bond?

_____

_____

_____ [2]

(vii) Substance A can be formed from the reaction between hydrogen and chlorine. Write a balanced symbol equation for the reaction.

_____ [3]

(viii) Substance D reacts with substance A to form ammonium chloride. Write the formula for ammonium chloride.

_____ [1]

[Turn over

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(b) When atoms form ions they lose or gain electrons.

The table below shows some information about four different ions.
Complete the table.

Ion	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
Mg^{2+}	12	24	12	10	12
O^{2-}	8				8
	19	39		18	
			30	28	35

[6]

(c) Mg^{2+} and O^{2-} ions are attracted to each other and form a compound.

(i) Name the compound.

_____ [1]

(ii) State the type of bonding and structure present in this compound.

Bonding: _____

Structure: _____ [2]

(iii) State two physical properties this compound would have.

1. _____

2. _____ [2]

4 Salts are ionic compounds which form during reactions of acids.

(a) Complete the table below.

Acid	Base	Name of salt formed	Formula of salt
nitric acid	potassium hydroxide		
	sodium hydroxide	sodium chloride	
sulfuric acid	copper(II) oxide		

[6]

(b) Write a balanced symbol equation for the preparation of the salt potassium chloride from potassium hydroxide and hydrochloric acid.

_____ [2]

(c) Describe how you would produce pure dry crystals of potassium chloride from a solution of potassium chloride.

_____

_____

_____

_____

_____ [3]

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(d) To determine the solubility of copper(II) sulfate in water at 20°C a saturated solution of copper(II) sulfate was evaporated to dryness.

The following results were obtained:

mass of evaporating basin = 21.45 g
mass of evaporating basin and saturated solution = 47.85 g
mass of evaporating basin and copper(II) sulfate after heating = 27.85 g

(i) Calculate the mass of copper(II) sulfate obtained after heating.

Show your working out.

_____ g [1]

(ii) Calculate the mass of water in the saturated solution.

Show your working out.

_____ g [1]

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(iii) Using your answers to **(d)(i)** and **(ii)** calculate the solubility of copper(II) sulfate at 20°C in g/100 g water.

Show your working out.

solubility _____ g/100 g water [1]

(iv) State the trend in solubility of copper(II) sulfate as temperature increases.

_____

_____ [1]

5 Calcium compounds have many uses, some of which are shown below.

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(a) The following table shows details of two different calcium compounds. Complete the table.

(Relative atomic masses: H = 1; C = 12; O = 16; Ca = 40)

Substance	Mass	Relative formula mass	Moles
$CaCO_3$	g		0.200
$Ca(OH)_2$	0.185 g		

[4]

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(b) Explain, giving experimental detail, how you would determine the mass of water of crystallisation present in a sample of hydrated calcium chloride. Include details of any mass measurements you would make and the equipment you would use.

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

_____

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_____

_____

_____ [6]

[Turn over

(c) Calculate the percentage of water of crystallisation, by mass, in hydrated calcium chloride, $CaCl_2.6H_2O$.

(Relative atomic masses: H = 1; O = 16; Cl = 35.5; Ca = 40)

Show your working out.

Percentage = _____ % [3]

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