Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014

GCSE Chemistry

Unit 1

Foundation Tier

[GCH11]

GCH11

TUESDAY 10 JUNE, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

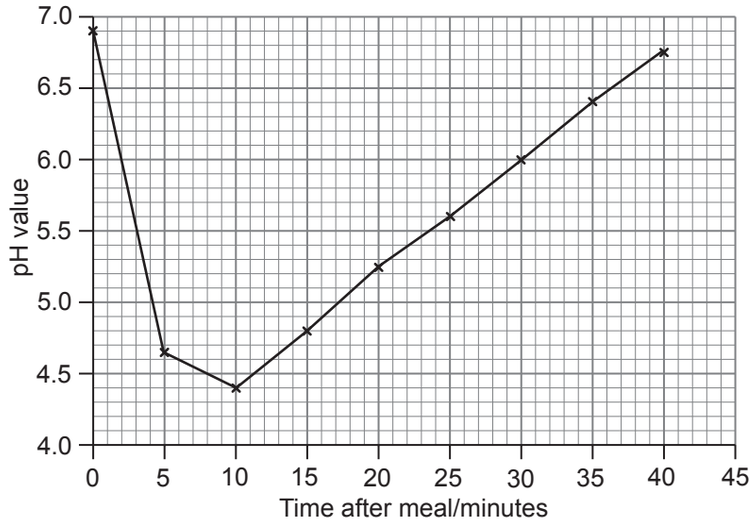
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all five** 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 **1(d)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

Examiner Only	
Marks	Remark

1 **(a)** In an experiment a sample of human saliva was removed from the mouth every five minutes after a meal and the pH values were determined. The graph below shows how the pH values of the saliva changed.



(i) How were the pH values of the saliva determined in this experiment?

_____ [1]

(ii) A sample of saliva was tested with phenolphthalein indicator 30 minutes after the meal. State the colour observed when the saliva was tested with phenolphthalein.

_____ [1]

(iii) When the pH in the mouth is 5.5 or less tooth decay occurs. Use the graph to find the time after the meal at which teeth would start to decay.

_____ [1]

(b) In the stomach food is digested by the action of hydrochloric acid. Hydrochloric acid has a pH value between 0 and 2. Excess stomach acid can cause a burning sensation called indigestion which is treated using antacid tablets to neutralise some of the acid.

Examiner Only	
Marks	Remark

(i) Explain why hydrochloric acid is a strong acid.

_____

_____

_____ [1]

(ii) Calcium carbonate is often present in antacid tablets. It reacts with hydrochloric acid to produce carbon dioxide gas.
Describe a chemical test for carbon dioxide. State what you would observe for a positive test.

_____

_____

_____

_____

_____ [3]

(iii) Write a balanced symbol equation for the reaction of hydrochloric acid with calcium carbonate.

_____ [3]

[Turn over

(c) The digested food from the stomach is passed into the small intestine. Sodium chloride is a salt which is absorbed in the small intestine. Some tests were carried out to prove that a salt is sodium chloride. Complete the table below.

Test	Result for a positive test
1. Flame test	
2. Add 5 drops of silver nitrate solution to a solution of the salt.	

[1]

[2]

Examiner Only	
Marks	Remark

(d) Hydrochloric acid reacts with calcium hydroxide solution and with solid calcium. **Compare and contrast** the reaction of hydrochloric acid and calcium hydroxide solution with the reaction of hydrochloric acid and solid calcium. In your answer you must include:

- the **names** of all products for each reaction
- the observations for each reaction.

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

[6]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

Examiner Only	
Marks	Remark

2 The modern Periodic Table contains over 100 elements.

(a) At room temperature and pressure most of these elements are solids, a few are gases and two are liquids.

(i) Write the symbol for the metallic element which is a liquid at room temperature and pressure.

_____ [1]

(ii) Name two elements which exist as gases at room temperature and pressure.

1. _____

2. _____ [2]

(b) On heating, the element iodine undergoes sublimation.

(i) Explain what you understand by sublimation.

_____

_____ [1]

(ii) What would be observed when a sample of iodine is heated?

_____

_____ [2]

(c) The elements in Group 1 of the Periodic Table are very reactive metals.

Examiner Only	
Marks	Remark

(i) Complete the following table.

Group number	Name of group	Number of electrons in the outer shell of an atom
1		

[2]

(ii) State the trend in reactivity in Group 1.

_____

_____ [1]

(iii) What would be observed when a piece of potassium is added to cold water?

_____

_____

_____

_____ [3]

(iv) Complete the word equation below for the reaction between potassium and water.

potassium + water → _____ + _____

[2]

(d) Elements and compounds may be detected using modern instrumental analysis. Name **two** methods of modern instrumental analysis.

1. _____

2. _____ [2]

Total Question 2

[Turn over

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Examiner Only	
Marks	Remark

3 **(a)** The photograph below shows “Seizure”, an artwork by Roger Hiorns which won the Turner Prize in 2009. An apartment was made watertight and filled with hot **saturated** copper(II) sulfate solution. The solution was allowed to cool and crystallise leaving the walls, floor and ceiling covered in **hydrated** copper(II) sulfate crystals.

An image of an apartment with the walls, floor and ceiling covered in hydrated copper(II) sulphate crystals has been removed due to copyright restrictions

(i) What is meant by the term hydrated?

_____

_____ [1]

(ii) What colour is hydrated copper(II) sulfate?

_____ [1]

(iii) What is meant by a saturated solution?

_____

_____ [1]

[Turn over

(b) The table below shows values for the solubility of copper(II) sulfate.

Temperature (°C)	0	20	40	60	80	100
Solubility (g/100 g water)	14	20	28	40	56	77

(i) Explain what is meant by the term solubility.

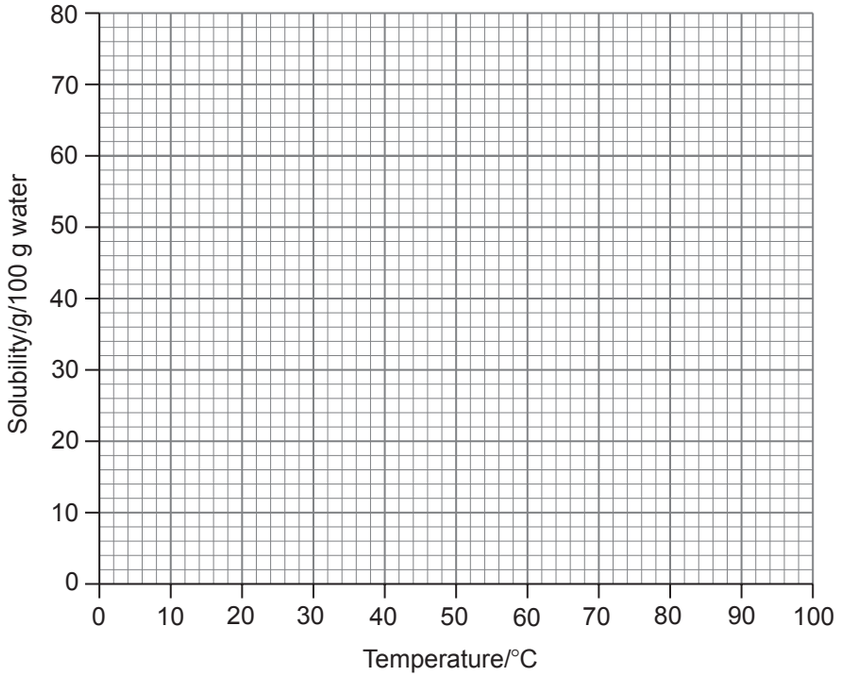
_____

_____

_____

_____ [4]

(ii) Use the data in the table to plot a solubility curve for copper(II) sulfate on the axes below.



[3]

Examiner Only

Marks	Remark

(c) Use the graph in **(b)(ii)** to answer the following questions.

Examiner Only	
Marks	Remark

(i) What is the solubility of copper(II) sulfate at 50 °C?

Solubility of copper(II) sulfate = _____ g/100 g water [1]

(ii) Calculate the mass of copper(II) sulfate which will saturate 10 g of water at 30 °C.

Mass of copper(II) sulfate = _____ g [2]

(iii) At what temperature will 60 g of copper(II) sulfate saturate 100 g of water?

Temperature = _____ °C [1]

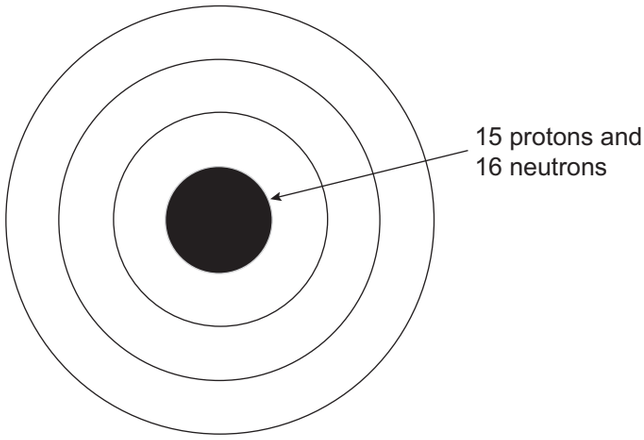
(iv) A sample of 10 g of copper(II) sulfate is added to a saturated solution of copper(II) sulfate in 100 g of water at 60 °C. What mass from the 10 g sample of copper(II) sulfate would dissolve?

_____ [1]

Total Question 3

[Turn over

4 The diagram below represents an atom of an element. The electrons are missing from the diagram.



(a) (i) State the atomic number of this element.

_____ [1]

(ii) State the mass number of this element.

_____ [1]

(iii) Name the part of the atom in which the protons and neutrons are found.

_____ [1]

(iv) Complete the diagram above to show the electronic configuration of the atom, using × to represent an electron. [1]

Examiner Only	
Marks	Remark

(b) The atoms of the Group 8 elements have a full outer shell of electrons.

Examiner Only	
Marks	Remark

(i) What name is given to Group 8 of the Periodic Table?

_____ [1]

(ii) Complete the table below for some Group 8 elements.

Name of element	Electronic configuration of an atom of the element
	2, 8
	2
argon	

[3]

(c) The box below contains examples of chemical symbols and formulae.

CO_2	NO_3^-	S^{2-}
SO_4^{2-}	Br_2	Ne
O^{2-}	S	O_2

From the box above select the formula or symbol for:

(i) a diatomic molecule _____ [1]

(ii) a molecular ion _____ [1]

(iii) the sulfide ion _____ [1]

[Turn over

(d) Substances have different types of bonding and structure. A variety of substances is shown in the table below.

aluminium	carbon dioxide	diamond
graphite	iron	lithium oxide
potassium sulfide	iodine	water

Using ONLY the substances in the table, answer the following questions.

(i) Name one substance in which the bonding is ionic.

_____ [1]

(ii) Name one substance in which the structure is described as giant covalent.

_____ [1]

(iii) Which substance has the lowest melting point?

_____ [1]

(iv) Name one substance which will conduct electricity at room temperature.

_____ [1]

(e) Diamond is an allotrope of which element?

_____ [1]

Examiner Only	
Marks	Remark
Total Question 4	

Examiner Only	
Marks	Remark

5 Potassium permanganate, $KMnO_4$, dissolves in water to form a purple solution. The solution can be used to counteract the lethal effects of strychnine, $C_{21}H_{22}N_2O_2$.

Relative atomic masses: H = 1; C = 12; N = 14; O = 16; K = 39; Mn = 55

(a) Calculate the relative formula mass (RFM) of potassium permanganate and strychnine.

(i) Potassium permanganate

RFM _____ [1]

(ii) Strychnine

RFM _____ [1]

(b) Strychnine, $C_{21}H_{22}N_2O_2$, is a compound.

(i) Using the formula explain why strychnine is a compound.

_____

_____

_____ [2]

(ii) Write the empirical formula for strychnine.

_____ [1]

[Turn over

Examiner Only	
Marks	Remark

(iii) The masses of all atoms are compared relative to the mass of one isotope of a particular element. Name the element and state the mass of the isotope.

Element: _____

Mass: _____ [2]

(iv) A bottle of strychnine would show the following symbol.

What do you understand by this symbol?

_____ [1]

(c) A sample of potassium permanganate, $KMnO_4$, was heated to constant mass in a crucible and the following reaction occurred:

$$2KMnO_4(s) \rightarrow K_2MnO_4(s) + MnO_2(s) + O_2(g)$$

(i) 0.035 moles of potassium permanganate were used in this experiment. Calculate the mass of potassium permanganate used.

Mass of $KMnO_4$ _____ g [1]

(ii) Explain why the mass of the solid sample decreases during heating.

_____

_____

_____ [2]

(iii) Draw a labelled diagram of the assembled apparatus used to heat the sample of solid potassium permanganate in a crucible.

[3]

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Examiner Only	
Marks	Remark
Total Question 5	

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Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

Examiner Number