Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

GCH12

TUESDAY 10 JUNE, AFTERNOON

TIME

1 hour 30 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

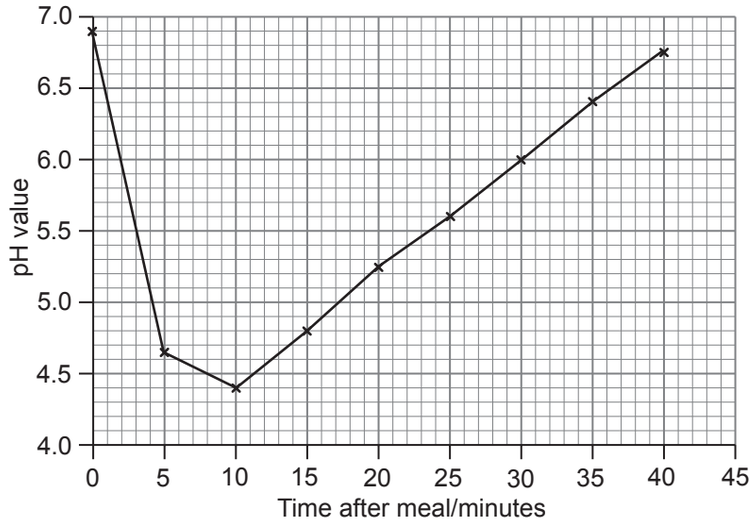
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **1(d)** and **2(b)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

8565

20GCH1201

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 is a strong acid. 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 what is meant by the term **strong** acid.

_____

_____

_____ [1]

(ii) Write an ionic equation for neutralisation. Include state symbols.

_____ [3]

(iii) Calcium carbonate is often present in antacid tablets. Write a balanced symbol equation for the reaction of hydrochloric acid with calcium carbonate.

_____ [3]

(iv) Describe a chemical test for the gas produced during the reaction between calcium carbonate and hydrochloric acid. State what you would observe for a positive test.

_____

_____

_____

_____

_____ [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.

Examiner Only	
Marks	Remark

(i) What is meant by the term salt?

_____

_____

_____

_____ [3]

(ii) Describe how you would test the salt to prove that it contained chloride ions.

_____

_____

_____

_____ [3]

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

(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]

(b) During the reaction of potassium with water a potassium atom forms a potassium ion.

Compare a potassium atom with a potassium ion in terms of:

- electronic configurations
- the half equation for the formation of a potassium ion from a potassium atom
- relative stability (include an explanation).

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

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

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark
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.

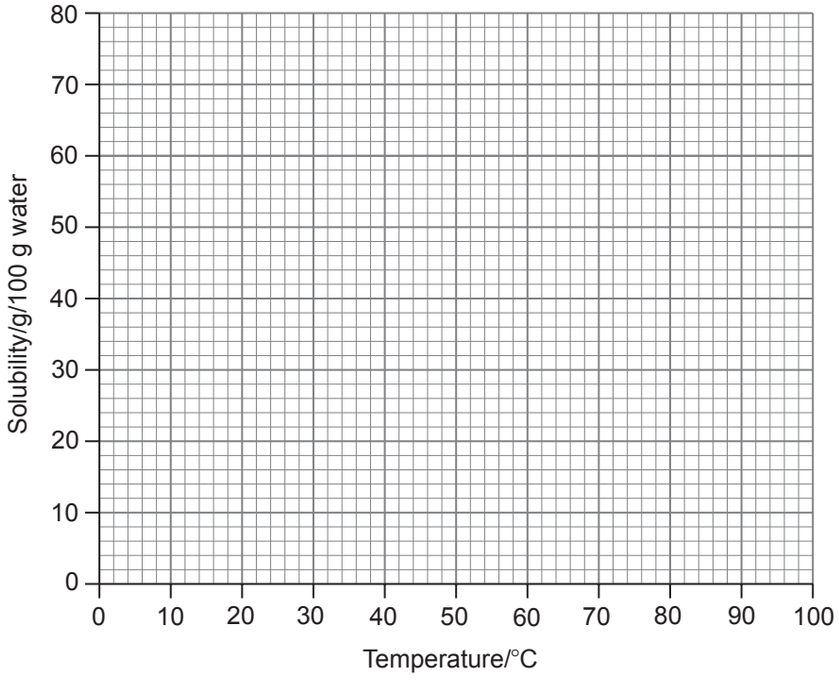
_____

_____

_____

_____ [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 maximum mass of copper(II) sulfate which will dissolve in 10 g of water at 70 °C?

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

(ii) Calculate the mass of copper(II) sulfate which will crystallise out of solution if a saturated solution of copper(II) sulfate containing 200 g of water is cooled from 75 °C to 45 °C.

Mass of copper(II) sulfate = _____ g [4]

Total Question 3

[Turn over

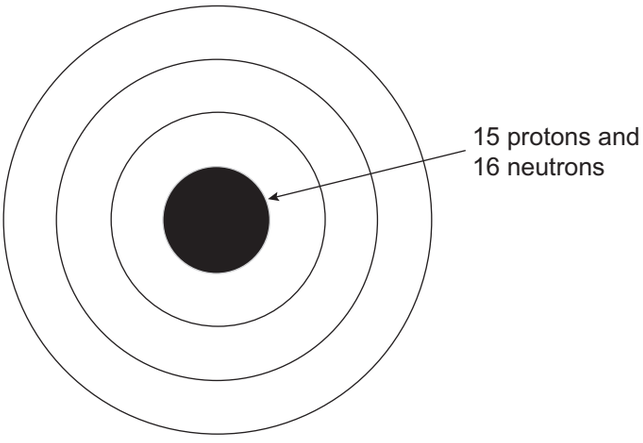
Examiner Only	
Marks	Remark

4 Many scientists have contributed to the development of theories concerning the structure of the atom. The work of these scientists has led to the structural model of the atom we use today.

(a) Describe the differences between the "Plum Pudding" model of the atom and the model of the atom we use today.

[4]

(b) The diagram below represents an atom of an element. The electrons are missing from the diagram.



(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

[Turn over

(c) The table below shows some information for several atoms and simple ions. Complete the table.

Atom/Ion	Number of protons	Electronic configuration
	7	2, 5
O^{2-}		
Al^{3+}		
	12	2, 8

[6]

(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 bonding is metallic.

_____ [1]

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

_____ [1]

Examiner Only

Marks	Remark

(iv) Name one substance in which van der Waals forces of attraction exist.

_____ [1]

(v) Which substance has the lowest melting point?

_____ [1]

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

_____ [1]

(e) Diamond is an allotrope of which element?

_____ [1]

(f) Ammonia gas is a covalent compound formed from the reaction between hydrogen and nitrogen.

(i) Draw a **dot and cross** diagram to show the bonding in a molecule of nitrogen.
You should show outer shell electrons only.

[3]

Examiner Only	
Marks	Remark

[Turn over

(ii) Write a balanced symbol equation for the formation of ammonia from hydrogen and nitrogen.

_____ [3]

(iii) Draw a **dot and cross** diagram to show the bonding in a molecule of ammonia.
You should show outer shell electrons only.

[3]

Examiner Only	
Marks	Remark
Total Question 4	

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, $C_{21}H_{22}N_2O_2$.

Examiner Only	
Marks	Remark

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

(i) Write the empirical formula for strychnine.

_____ [1]

(ii) 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]

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

What do you understand by this symbol?

_____ [1]

[Turn over

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

[3]

(ii) 5.53 g of potassium permanganate were used in this experiment. Calculate the mass of oxygen, O_2, which forms.

Relative atomic masses: O = 16; K = 39; Mn = 55

Mass of O_2 _____ g [5]

Examiner Only	
Marks	Remark

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

_____

_____

_____ [2]

(iv) Calculate the total mass of solid which remains in the crucible after heating the sample of $KMnO_4$ to constant mass.

Mass of solid remaining _____ g [1]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 5	

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

Examiner Number