



Rewarding Learning

General Certificate of Secondary Education
2012

Science: Chemistry

Paper 1
Foundation Tier

[G1401]

TUESDAY 12 JUNE, MORNING

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71

Candidate Number



TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.

Quality of written communication will be assessed in question **3(b)(iii)**.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

Total Marks	
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1 In the Periodic Table elements with similar properties are placed in the same group. In Group I(1) the similarity between elements is very obvious. However the properties of the elements in Group IV(4) vary significantly.

(a) (i) Complete the table for some of the elements of Group IV(4) by inserting the correct **atomic number** and decide if the element is a **metal** or **non-metal**.

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

Element	Atomic number	Metal or Non-metal
Carbon		
Tin		
Lead		

[3]

(ii) What is meant by the term **element**?

_____ [2]

(iii) What do you understand by the term **atomic number**?

_____ [1]

(b) The element carbon has three naturally occurring **isotopes** ^{12}C , ^{13}C and ^{14}C .

(i) Complete the table below to give the number of protons, electrons and neutrons present in one atom of each of the isotopes of carbon.

Isotope	Number of protons	Number of electrons	Number of neutrons
^{12}C			
^{13}C			
^{14}C			

[3]

Examiner Only

Marks Remark

(ii) Explain what you understand by the term **isotopes**.

[2]

(c) Graphite is one of the **allotropes** of carbon and is used as an electrode in the electrolysis of sodium chloride solution.

(i) Explain what you understand by the term **allotropes**.

[2]

(ii) Explain, using full electronic structures, how atoms of sodium and atoms of chlorine form ions and bond to form sodium chloride. You must give the charge on each ion.

[6]

Examiner Only	
Marks	Remark

- 2 Many sodium compounds are added to food to enhance flavour. Salt (sodium chloride) is one of the most commonly used flavour enhancers.



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(a) Sodium reacts directly with chlorine to form sodium chloride.

- (i) Write a balanced symbol equation for the reaction of sodium with chlorine.

_____ [3]

- (ii) Describe the appearance of sodium chloride.

_____ [2]

- (iii) Sodium is a soft metal which is cut easily with a knife. Describe the appearance of a piece of freshly cut sodium.

_____ [1]

- (iv) What is observed when a freshly cut piece of sodium is left exposed to air for a few minutes?

_____ [1]

- (v) How is sodium metal stored safely in the laboratory?

_____ [1]

Examiner Only

Marks Remark

3 A label from a bottle of lemonade is shown below.

Examiner Only

Marks Remark



Ingredients:
 carbonated water
 citric acid
 ascorbic acid
 sucrose
 preservative (sodium benzoate)
 flavourings

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(a) (i) Complete the passage using the words in the box below. Each word may be used once, more than once or not at all.

hydrogen	carbon dioxide	high	low
nitrogen	citric acid	sodium benzoate	ascorbic acid

Carbonated water is made by dissolving _____ gas in water. More of the gas dissolves in water when the temperature is _____. A substance in the ingredients list which produces hydrogen ions when dissolved in water is _____.

[3]

(ii) Sucrose is used in lemonade as a sweetener. Sucrose is a **solute** which dissolves very well in water and is said to have a high **solubility**.

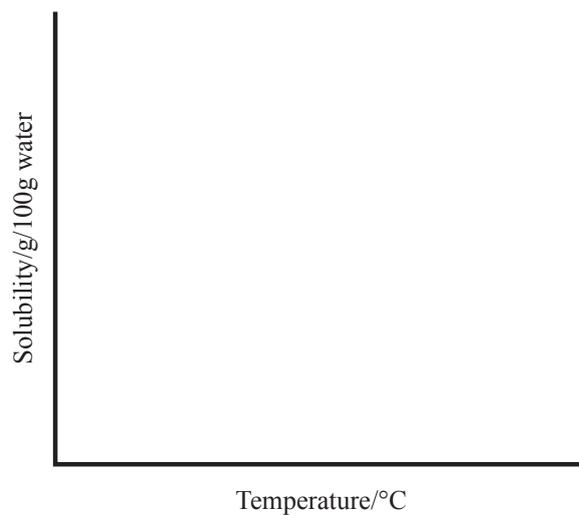
Explain what is meant by the terms **solute** and **solubility**.

Solute: _____
 _____ [1]

Solubility: _____

 _____ [4]

- (iii) On the axes below sketch a graph to show the change in solubility of sucrose with increasing temperature.



[1]

- (b) To prevent tooth decay, it is better to drink mineral water, rather than lemonade. Mineral water may be described as hard water. The table below shows information from the labels of three different mineral waters **A**, **B** and **C**.

Ions present	Composition (mg/dm ³)		
	A	B	C
calcium	47.5	78.0	27.0
magnesium	16.5	24.0	6.9
sodium	5.7	5.0	6.6
potassium	0.4	1.0	0.8
hydrogen carbonate	206.0	357.0	103.0
chloride	9.0	4.5	6.4
sulphate	8.0	10.0	9.6
nitrate	3.5	3.8	2.0
pH	7.8	7.2	4.6

- (i) What is meant by the term **hard water**?

_____ [2]

- (ii) Which mineral water (**A**, **B** or **C**) is the hardest mineral water? Explain your choice.

_____ [2]

Examiner Only

Marks Remark

- 4 The Olympic Torch is ignited several months before the opening ceremony of the Olympic Games at the site of the ancient Olympics in Greece and is then carried by a relay of people to the host city.



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- (a) Different fuels have been used for the Olympic torch. For example, kerosene, obtained from the fossil fuel crude oil, was used in the torch for the 1964 Olympics in Tokyo.

Name two other fossil fuels.

1. _____

2. _____ [2]

- (b) The most recent fuels to be used in the Olympic torch are **hydrocarbon** fuels as they give a strong flame with little smoke, producing mainly carbon dioxide and water. Increased levels of carbon dioxide in the atmosphere may lead to the greenhouse effect.

- (i) What is meant by the term **hydrocarbon**?

_____ [2]

Examiner Only

Marks Remark

(ii) State two environmental problems which are linked to the greenhouse effect.

1. _____

2. _____

[2]

(c) For the Sydney Olympics in 2000 the Olympic flame was carried up Mount Everest where there is less oxygen present in the atmosphere. The fuel used for the torch was propane (C_3H_8).

(i) Complete the word equation below giving the names of the two products of combustion in a **limited supply of oxygen**.

propane + oxygen \rightarrow _____ + _____ [2]

(ii) How many atoms are present in one molecule of propane?

_____ [1]

Examiner Only

Marks

Remark

- (d) At the end of the relay, the last torchbearer enters the stadium and lights the Olympic cauldron, signalling the start of the games. For the London 2012 Olympics, the fuel in the cauldron which undergoes **combustion** will be a **renewable** fuel.



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- (i) What is meant by the term **combustion**?

[3]

- (ii) Explain what you understand by the term **renewable**.

[2]

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Marks	Remark

- (e) During the 2012 Olympics a new range of vehicles which use clean fuels will be used in London. Taxis that run on hydrogen have been developed.



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- (i) Write a balanced symbol equation for the combustion of hydrogen.

_____ [3]

- (ii) Explain why hydrogen is considered to be a clean fuel.

_____ [1]

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Marks Remark

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(Questions continue overleaf)

5 The Periodic Table lists all known elements. Many scientists were involved in its development.

(a) Complete the following paragraph.

The Russian scientist _____ is credited with having made the greatest contribution to the development of the Periodic Table.

He commenced his work in 1869. A few years previous to this, the British chemist John _____ had started to arrange elements in order of increasing atomic _____.

He found that every eighth element was very similar and he called this observation the Law of _____.

The horizontal rows of the Periodic Table are called

_____.

[5]

(b) Part of the Periodic Table is shown below.

Li	Be													O	F	Ne	
Na	Mg													S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr															I	Xe
Cs	Ba															At	Rn

Using ONLY the elements in the table above:

(i) Name the most reactive metal.

_____ [1]

(ii) Name the most reactive non-metal.

_____ [1]

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Marks

Remark

(iii) Name an element which is a liquid at room temperature and pressure.

_____ [1]

(iv) Name **one** colourless gas.

_____ [1]

(v) The elements in the last group of the table are very unreactive. Explain why these elements are unreactive.

_____ [1]

(c) The element astatine, At, is found in the same group of the Periodic Table as fluorine, chlorine, bromine and iodine. Very little is known about astatine as it is radioactive and unstable.

(i) Predict the physical state of astatine at room temperature and pressure.

_____ [1]

(ii) Suggest the number of electrons which are found in the outer shell of an atom of astatine.

_____ [1]

(iii) Astatine forms a simple ion called astatide. What is the charge on the astatide ion?

_____ [1]

(iv) Write the formula of the compound formed when astatine reacts with hydrogen.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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