



General Certificate of Secondary Education  
2012–2013

## Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]



Centre Number

71

Candidate Number

MONDAY 20 MAY 2013, 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.  
Write your answers in the spaces provided in this question paper.  
Answer **all eleven** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 75.  
Quality of written communication will be assessed in Questions **3** and **9(b)**.  
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 included in this question paper.

For Examiner's  
use only

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Total  
Marks

1 The table below shows properties of some plastics.

Plastic	Melting point/°C	Resistance to alkali	Other properties	Cost per kg /£
A	20	highly resistant	strong and flexible	1.1
B	120	slowly reacts	strong and flexible	1.5
C	200	highly resistant	strong and shatters easily	0.5
D	160	highly resistant	strong and not very flexible	2.4

Use the information in the table and your knowledge to answer the questions below.

- (a) Suggest why plastic **C** is **not** suitable to cover the copper wire in an electrical cable.

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (b) A company has a large warehouse and wants to use plastic sheets to cover the items it stores. Explain why plastic **B** is a better choice than plastic **D**.

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (c) Large plastic containers are needed to transport a corrosive alkali. The containers will be loaded on and off lorries.

Which plastic (**A**, **B**, **C** or **D**) would be most suitable? Explain your answer fully.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

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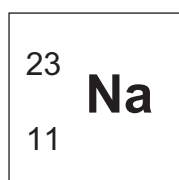
Marks Remark

2 (a) Complete the table below about the particles in an atom.

Particle	Relative charge	Relative mass	Location in an atom
proton	+1		the nucleus
electron		$\frac{1}{1840}$	orbits the nucleus
neutron	0	1	

[3]

(b) Given below is the atomic number and mass number of sodium.



(i) How many protons does an atom of sodium have?

\_\_\_\_\_ [1]

(ii) Calculate the number of neutrons in an atom of sodium.

\_\_\_\_\_ [1]

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Marks Remark



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**(Questions continue overleaf)**

4 The table below gives the colour of four indicators at different pH values.

Indicator	pH value													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Universal	R	R	O	O	Y	Y	G	B	B	I	I	I	V	V
Methyl Red	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Thymol Blue	Y	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B
Alizarin Yellow	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	R	R	R

**Key**

R=Red O=Orange Y=Yellow G=Green B=Blue I=Indigo V=Violet

Use the information above to answer the following questions.

(a) (i) What colour is Methyl Red indicator in a solution of pH 7?

\_\_\_\_\_ [1]

(ii) What colour is Alizarin Yellow indicator in strong alkali?

\_\_\_\_\_ [1]

(iii) What colour is Universal indicator in hydrochloric acid?

\_\_\_\_\_ [1]

(b) A scientist has some acid and is going to add an alkali to it. He needs to stop adding the alkali when the pH value is 7.

(i) What name is given to the reaction of an acid with an alkali?

\_\_\_\_\_ [1]

(ii) From the table above select the most suitable indicator for his experiment. Explain your choice.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

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Marks	Remark

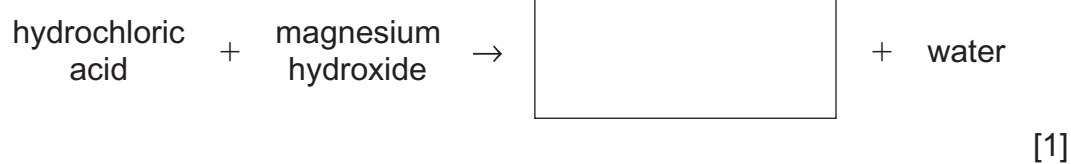
(c) The table shows chemical indicators. Suggest a more accurate way to follow the pH change when an alkali is added to an acid.

\_\_\_\_\_ [1]

(d) Most indicators are made from plants. Describe how you would obtain an indicator from red cabbage.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

(e) Complete the word equation below for the reaction of an acid with an alkali.



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Marks	Remark

- 5 Below is the ingredients label found on a popular indigestion tablet. Each tablet has a mass of 1500 mg.

**Each tablet contains:**

Calcium carbonate (700 mg)  
Magnesium carbonate (80 mg)  
Sucrose (250 mg)  
Glucose (250 mg)  
Peppermint flavour (20 mg)  
**Talc**  
Saccharin sodium (40 mg)  
Magnesium stearate (60 mg)

- (a) Calculate the mass of talc in each tablet.  
(Show your working out.)

\_\_\_\_\_ mg [2]

- (b) The active ingredient in this indigestion tablet is calcium carbonate.

- (i) What is the chemical formula for calcium carbonate?

\_\_\_\_\_ [1]

- (ii) Name the gas produced when calcium carbonate is added to an acid.

\_\_\_\_\_ [1]

- (c) Explain fully how an indigestion tablet works to cure indigestion.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

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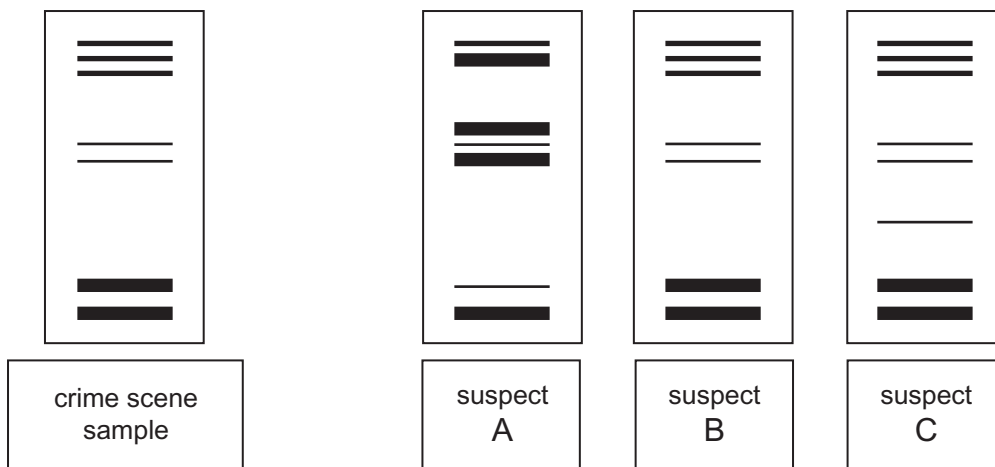


6 Genetic or DNA fingerprinting was introduced by forensic scientists about 30 years ago. It has revolutionised forensic science and crime solving.

(a) This technique only needs small amounts of DNA. Give **two** pieces of evidence that could be collected at a crime scene that could be used for DNA analysis.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

(b) Below are the genetic fingerprints taken from a crime scene and from three police suspects.



Which suspect does the crime scene sample belong to? Explain your answer.

Suspect: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

Examiner Only	
Marks	Remark



8 The modern Periodic Table took a long time to complete.

- Originally the Greek philosopher Aristotle considered there to be just four elements.
- As knowledge of the elements increased John Newlands noticed a repeating pattern. He tried to put the chemical elements into a table.
- In 1869 Dmitri Mendeleev further developed the idea of a table.

Use the information given and your knowledge to answer the following questions.

(a) Air was one of Aristotle's elements. Name the other three.

\_\_\_\_\_ [1]

(b) (i) What was the repeating pattern noticed by John Newlands?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) Give **one** reason why John Newlands' theory was not fully accepted.

\_\_\_\_\_  
\_\_\_\_\_ [1]

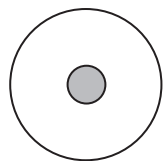
(c) Mendeleev created Groups and Periods. Give **two** other features of his Periodic Table.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

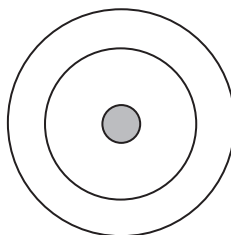
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Marks Remark

- 9 (a) In the space below complete the diagrams to show how **all** of the electrons are arranged in an atom of hydrogen and an atom of oxygen.



hydrogen atom



oxygen atom

[2]

- (b) Explain fully, in terms of the atoms involved and their electrons, how oxygen and hydrogen join to form a molecule of water. You should include the chemical formula for water in your answer.

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

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[6]

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Marks	Remark

10 Aluminium is extracted from aluminium oxide by electrolysis.

(a) Explain the meaning of the term **electrolysis**.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

(b) During the production of aluminium, cryolite is used. The chemical formula of cryolite is **Na<sub>3</sub>AlF<sub>6</sub>**.

(i) How many different elements does cryolite contain?

\_\_\_\_\_ [1]

(ii) Name the non-metal element in cryolite.

\_\_\_\_\_ [1]

(iii) What is the total number of atoms in Na<sub>3</sub>AlF<sub>6</sub>?

\_\_\_\_\_ [1]

The table shows some information about aluminium and copper.

Metal	Relative electrical conductivity	Density g/cm <sup>3</sup>	Relative strength	Cost per kg/£
aluminium	3.8	2.7	0.4	0.95
copper	5.7	8.9	0.6	3.10

(c) Aluminium is used in overhead electrical cables in the National Grid which carries electricity throughout the country. Use the information to explain fully why aluminium is more suitable than copper for this purpose.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

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Marks Remark

11 Hydrocarbons are often used as fuels.

(a) Complete the table below about different hydrocarbons.

Hydrocarbon	Molecular formula	Structural formula
methane	$\text{CH}_4$	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}$
	$\text{C}_2\text{H}_6$	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$
propane	$\text{C}_3\text{H}_8$	
butane		$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$

[3]

(b) Propane is used as a fuel in camping stoves. Write a **balanced symbol** equation for the complete combustion of propane.

\_\_\_\_\_ [3]

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Marks

Remark

(c) Polypropene can be made by the polymerisation of propene.

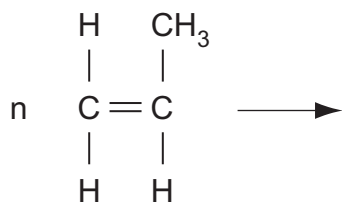
(i) Explain what is meant by the term **polymerisation**.

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[2]

(ii) Complete the balanced symbol equation for the polymerisation of propene.



[3]

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**THIS IS THE END OF THE QUESTION PAPER**

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