Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Materials and their Management
Module 4

Higher Tier

[GSC42]

GSC42

WEDNESDAY 9 NOVEMBER 2011
10.15 am–11.00 am

TIME

45 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 six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 45.
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 your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

1 The properties of some metals are given below.

Metal	Melting temperature/ºC	Electrical conductivity	Relative cost	Relative weight	Relative strength
Aluminium	660	Very good	7.3	1	1
Copper	1083	Excellent	9.2	3	2
Iron	1535	Good	1	2.3	3
Silver	962	Excellent	1923	2.6	1
Zinc	420	Good	5.8	2.3	1.5

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

Examiner Only	
Marks	Remark

(a) Suggest which **one** of the properties is most important when using aluminium for aircraft construction.

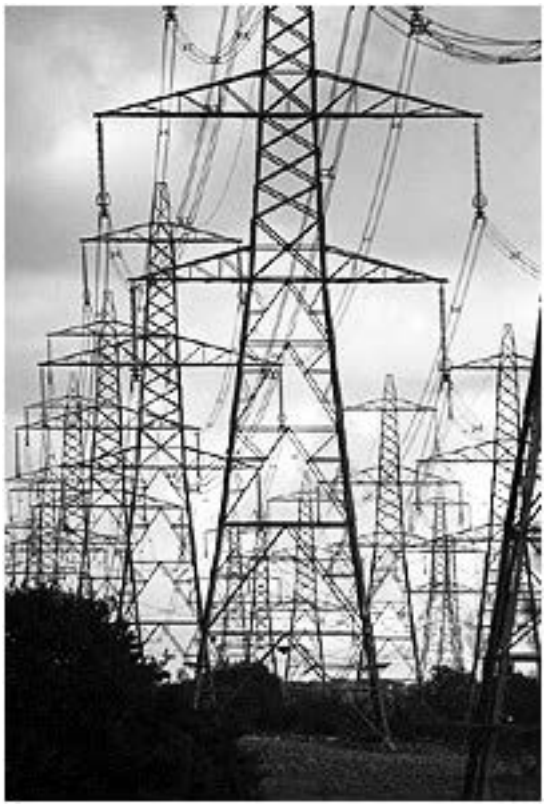
_____ [1]

(b) Give two reasons why iron is used in the construction of buildings rather than zinc.

1. _____

2. _____ [2]

(c) Below is a picture showing part of the national grid.



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Explain fully why overhead electrical cables in the national grid are made of aluminium rather than copper.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** The following hydrocarbons are obtained from crude oil.

paraffin : naphtha : petrol : bitumen : lubricating oil

© *iStockphoto / Thinkstock*

(i) Name the process that is used to obtain these hydrocarbons from crude oil.

_____ [2]

(ii) Which of the hydrocarbons in the list above has the highest boiling point?

_____ [1]

(iii) Give **one** important use of bitumen.

_____ [1]

(iv) Complete the word equation to show what products are produced when petrol burns.

petrol + oxygen ⟶ _____ + _____

[2]

(b) Explain fully why scientists are always trying to find more effective ways of extracting crude oil.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 Most plastics are non-biodegradable and this leads to many problems in our environment.

© Courtesy Algalita.org

(a) Explain fully the meaning of the term non-biodegradable.

_____

_____ [2]

(b) Explain fully why it can be difficult to recycle plastic.

_____

_____ [2]

(c) Name a natural organic compound that can be used to make a biodegradable plastic.

_____ [1]

Examiner Only	
Marks	Remark

4 In forensic science flame tests are used to show the presence of certain metal ions in paint from the scene of a crime.

© Andrew Lambert Photography / Science Photo Library

(a) Describe in detail how a flame test could be carried out in the laboratory. Include a safety procedure you would use.

_____

_____

_____

_____

_____ [4]

(b) Complete the table about the flame colours of different metal ions.

Metal ion	Flame test colour
Sodium	
	Lilac
	Brick red

[3]

(c) Give the type of spectroscopy used in flame tests.

Circle the correct answer.

infra-red : ultraviolet : emission : visible

[1]

Examiner Only	
Marks	Remark

5 A student conducted the following investigation into the cause of hardness in water. He dissolved the same amount of each of six different chemicals in separate flasks each containing 20 cm^3 of distilled (pure) water. He added soap solution to each flask and shook until a lather was formed. The results are shown below.

Solution used	Positive ion	Negative ion	Height of lather/mm
Sodium sulphate	Na^+	SO_4^{2-}	20
Calcium nitrate	Ca^{2+}	NO_3^-	2
Potassium chloride	K^+	Cl^-	19
Magnesium chloride	Mg^{2+}	Cl^-	1
Sodium nitrate	Na^+	NO_3^-	19
Magnesium sulphate	Mg^{2+}	SO_4^{2-}	1

(a) (i) Suggest why it was important to use distilled (pure) water.

_____ [1]

(ii) The student was careful to conduct a 'fair' investigation. Apart from the same amount of chemicals and distilled water used, give **two** other ways the student made the test fair.

1. _____

2. _____ [2]

(iii) What information in the table is used as a measure of the hardness of water?

_____ [1]

(iv) From the results state which two ions cause hardness in water.

_____ and _____ [2]

(b) Fermanagh is a limestone region in Northern Ireland famous for its Marble Arch Caves.

(i) Describe how stalactites and stalagmites are formed in limestone caves.

_____

_____

_____

_____ [3]

(ii) Give **one** method of removing permanent hardness from water.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 Ethene and propane are two important organic chemicals.

(a) Complete the table below to show the molecular and structural formulae of ethene and propane.

Hydrocarbon	Molecular formula	Structural formula
Ethene		
Propane		

[4]

(b) Polythene is a useful plastic made from ethene molecules.

(i) Name the type of reaction that is used to produce polythene from ethene.

_____ [1]

(ii) What is the physical state of polythene at room temperature?

_____ [1]

(c) Propane is used as a fuel.

Balance the symbol equation to show the complete combustion of propane.

$$C_3H_8 \quad + \quad O_2 \quad \longrightarrow \quad CO_2 \quad + \quad H_2O \qquad [2]$$

THIS IS THE END OF THE QUESTION PAPER

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