



Rewarding Learning

General Certificate of Secondary Education  
2011–2012

### Science: Double Award (Modular)

Using Materials and Understanding Reactions

End of Module Test

Higher Tier

# B

[GDB02]

TUESDAY 28 FEBRUARY 2012

11.00 am–11.45 am



Centre Number

71	
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Candidate Number

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#### 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 twelve** questions.

#### INFORMATION FOR CANDIDATES

The total mark for this paper is 50.

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	
7	
8	
9	
10	
11	
12	

Total Marks

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1 You may find your Data Leaflet helpful when answering this question.

A list of chemical formulae is given below.



From the list choose the correct formula for:

(a) (i) Sodium hydrogen carbonate \_\_\_\_\_ [1]

(ii) Iron(II) sulphate \_\_\_\_\_ [1]

(b) How many atoms are there in the formula  $\text{CuSO}_4$ ?

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

(c) What is the name of the substance with the formula  $\text{ZnCO}_3$ ?

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

Examiner Only

Marks

Remark

2 Phosphorus is a chemical element with an atomic number of 15 and a mass number of 31.

(a) What is meant by the term **mass number**?

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[2]

(b) Complete the table below to show the atomic structure of phosphorus.

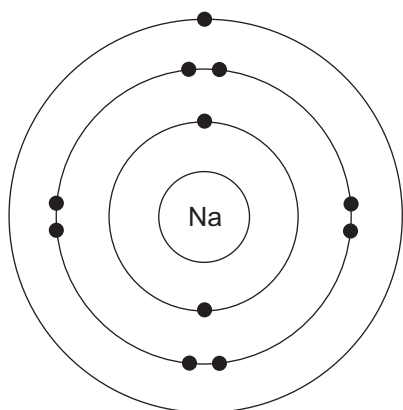
Element	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
phosphorus	15	31			

[3]

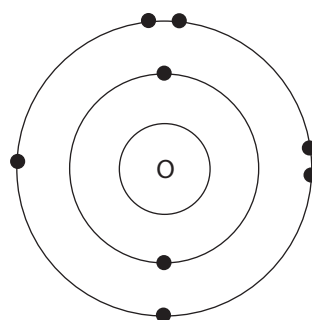
Examiner Only

Marks Remark

- 3 The elements sodium and oxygen react to form a compound, sodium oxide. The electronic structures of a sodium atom and an oxygen atom are shown below.



sodium atom



oxygen atom

- (a) In the spaces below, draw the electronic structures for the ions produced from each of these atoms.

sodium ion

oxide ion

[2]

- (b) Give the chemical formula for sodium oxide.

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

Examiner Only	
Marks	Remark

- 4 (a) The table below gives some information about oxides **A**, **B** and **C**. Complete the table to show which oxides are metal and which are non-metal.

Oxide	Colour with Universal Indicator	Metal or non-metal oxide
<b>A</b>	purple	
<b>B</b>	green	non-metal oxide
<b>C</b>	red	

[2]

- (b) Name a non-metal oxide which is neither acidic nor basic.

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

- (c) Some oxides are basic and can dissolve in water.

What term is used to describe a soluble base?

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

Examiner Only

Marks Remark

- 5 The table below shows the solubility of different gases in water at different temperatures.

Gas	Solubility g/100 g water		
	0 °C	20 °C	40 °C
nitrogen	0.03	0.02	0.01
oxygen	0.07	0.04	0.03
carbon dioxide	0.34	0.17	0.10

- (a) Which of these gases is the least soluble in water at 20 °C?

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

- (b) Use the information in the table to describe the trend in solubility.

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

- (c) Salmon depend on the amount of oxygen dissolved in the water for survival. They cannot swim well when the water temperature rises above 15 °C.

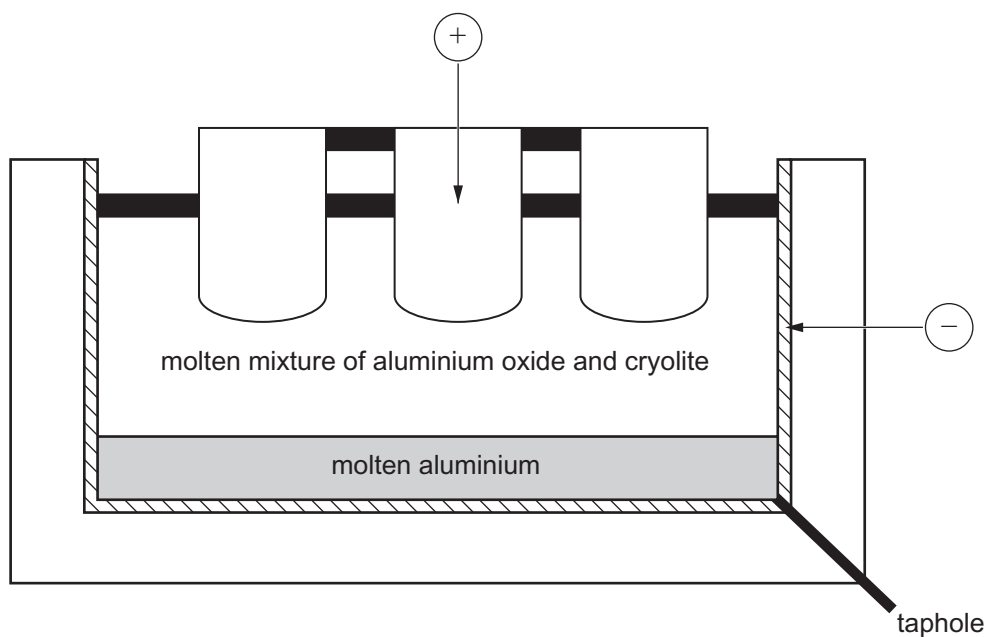
Use the information in the table to explain why the salmon would have difficulty in swimming on hot summer days.

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

Examiner Only

Marks Remark

- 6 The diagram below shows the method used to extract aluminium from its ore.



- (a) What name is given to the process of extraction of aluminium from its ore?

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

- (b) Name the electrode at which the aluminium is produced.

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

- (c) Complete the following sentence:

The positive electrode is made of blocks of carbon (graphite) which have to be replaced at regular intervals because the carbon reacts

with \_\_\_\_\_ to produce \_\_\_\_\_ [2]

Examiner Only

Marks	Remark

7 Water has the chemical formula  $H_2O$ .

(a) Draw a diagram to show how **all** the electrons are arranged in a molecule of water.

[2]

(b) Name the type of bonding in water.

[1]

(c) Which of the following substances have the same kind of bonding as water?

Tick (✓) the **two** correct boxes.

sodium chloride

chlorine gas

magnesium chloride

oxygen gas

calcium oxide

[2]

Examiner Only

Marks

Remark



- 8 Badminton racket frames were originally made from wood, then steel was used. Now racket frames are made from carbon fibre reinforced plastic, a composite material.

The table below gives some properties of widely used materials.

Material	Density g/cm <sup>3</sup>	Relative strength	Relative stiffness
steel	7.8	10	105
polythene	0.96	0.2	0.3
glass fibre reinforced plastic	1.9	15	10
Kevlar	1.45	30	95
carbon fibre reinforced plastic	1.6	18	100

- (a) Why is glass fibre reinforced plastic described as a composite material?

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[2]

- (b) Use the information from the table to explain fully why carbon fibre reinforced plastic is a better material than steel for making badminton racket frames.

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[3]

Examiner Only

Marks Remark

- 9 Two chemical reactions of the same type are represented by the equations below.



- (a) What name is given to this **type** of chemical reaction?

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

- (b) Both of these reactions can be represented by the same **ionic equation**.

In the space below write this **ionic equation** and include state symbols.

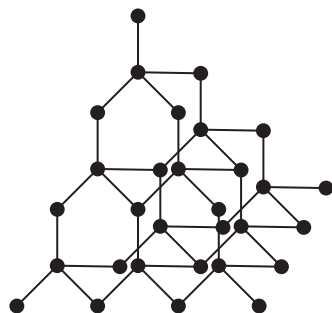
\_\_\_\_\_ [3]

Examiner Only

Marks

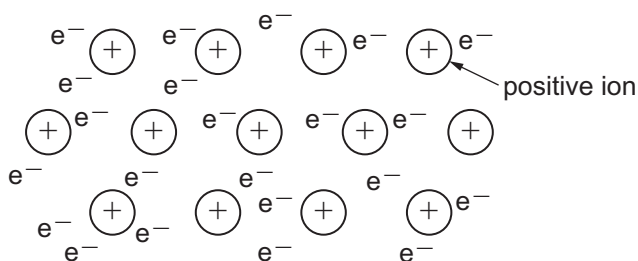
Remark

10 The giant structures of four substances **A**, **B**, **C** and **D** are shown below.



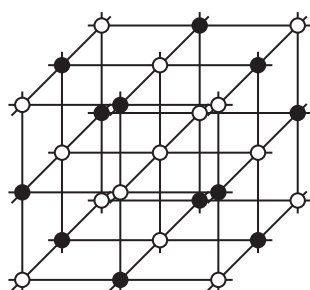
**A**

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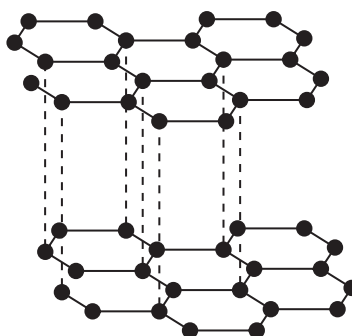
**B**

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**C**

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**D**

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- (a) Which substance **A**, **B**, **C** or **D** only conducts electricity when it is molten or dissolved in water?

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

- (b) Which **two** substances **A**, **B**, **C** or **D** can conduct electricity in the solid state?

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

- (c) Which substance **A**, **B**, **C** or **D** is used to make pencil leads?

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

- (d) Give the name of a substance which has a structure like **A**.

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

Examiner Only	
Marks	Remark

11 When rain water containing dissolved carbon dioxide falls on limestone rock, hard water is formed. This hard water contains calcium hydrogen carbonate.

(a) Complete the symbol equation for this reaction.



Below is a list of some ions that may be present in a water sample.

Carbonate $\text{CO}_3^{2-}$	Calcium $\text{Ca}^{2+}$	Sodium $\text{Na}^+$
Hydroxide $\text{OH}^-$	Hydrogen $\text{H}^+$	Hydrogen Carbonate $\text{HCO}_3^-$

(b) Explain, in terms of ions, how hard water can be softened by ion exchange.

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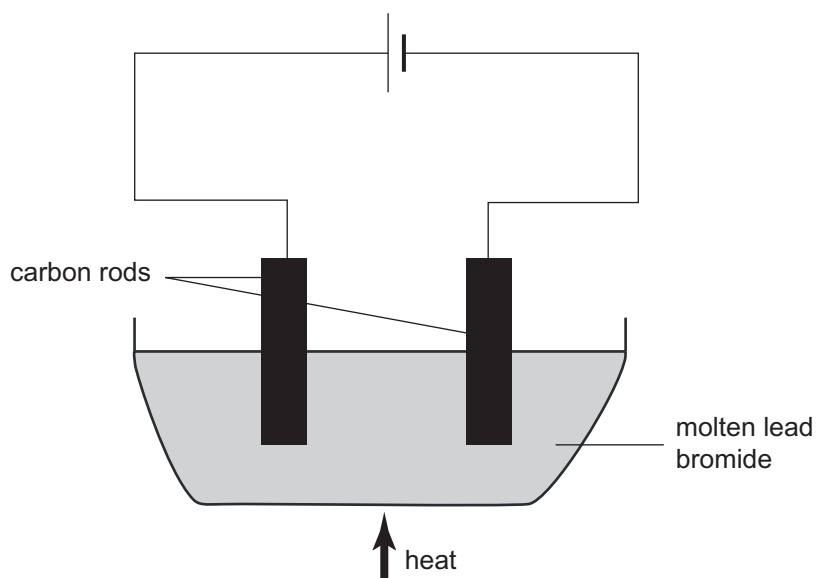
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[2]

Examiner Only	
Marks	Remark

- 12 Electrolysis of lead bromide can be carried out in the laboratory using the apparatus shown below.



- (a) Why is it necessary to heat the lead bromide until it becomes molten?

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

- (b) What is the name of the gas which forms at the anode?

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

- (c) Write an **ionic equation** to show what happens at the cathode.

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

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

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Marks Remark





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