



Centre Number

71

Candidate Number

General Certificate of Secondary Education  
2011–2012

## Science: Double Award (Modular)

Using Materials and Understanding Reactions  
End of Module Test

Higher Tier

# B

[GDB02]

WEDNESDAY 9 NOVEMBER 2011

9.15 am–10.00 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 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



1 Calcium hypochlorite,  $\text{Ca}(\text{ClO})_2$ , is used to kill bacteria in swimming pools.

(a) How many different elements are present in calcium hypochlorite?

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

(b) How many oxygen atoms are present in the formula for calcium hypochlorite?

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

(c) What is the total number of atoms present in  $\text{Ca}(\text{ClO})_2$ ?

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

The calcium ion has a charge of 2+ ( $\text{Ca}^{2+}$ ).

(d) Use this information to suggest the charge of the hypochlorite ion in the compound calcium hypochlorite.

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

(e) Calcium hypochlorite dissolves in water to form an acid.

Name the ion which is present in the solution formed when an acid is dissolved in water.

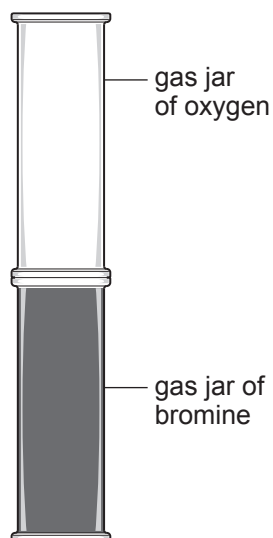
\_\_\_\_\_ [1]

Examiner Only

Marks

Remark

- 2 Brown bromine vapour is more dense than oxygen. A gas jar of oxygen was placed on top of a gas jar of bromine and left for 15 minutes, as shown in the diagram below.



- (a) What would you expect to see after 15 minutes?

\_\_\_\_\_

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

- (b) Which of the following statements best describes what happens during the 15 minutes?

Tick (✓) the box next to the correct answer.

bromine remains in the lower gas jar and oxygen stays in the top gas jar

oxygen moves into the lower jar and the bromine remained in the lower jar

some of the oxygen moves into the lower jar and some of the bromine moves into the top gas jar

the oxygen reacts with the bromine

[1]

- (c) What is the name given to the process that happens in the gas jars?

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

Examiner Only

Marks Remark

- 3 Complete the table below which gives information about the particles in an atom.

Particle	Relative charge	Relative mass	Position in atom: shells/ nucleus
proton	+1		
electron		$\frac{1}{1840}$	shells
neutron	0		nucleus

[4]

Examiner Only	
Marks	Remark

- 4 Three samples of hard water, A, B and C, were tested to find out which was the hardest sample.

The volume of solution X needed to produce a lather which lasted 30 seconds was recorded in the table below.

Sample of hard water	Volume of solution X needed to produce a lather lasting 30 seconds	
	Untreated sample	Boiled sample
A	14 cm <sup>3</sup>	14 cm <sup>3</sup>
B	27 cm <sup>3</sup>	14 cm <sup>3</sup>
C	18 cm <sup>3</sup>	2 cm <sup>3</sup>

- (a) Name solution X. \_\_\_\_\_ [1]

The results of the test show that sample B is the hardest sample.

- (b) Explain why sample B is the hardest.

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

Use the information in the table to answer the following questions.

- (c) Which sample of water, A, B or C, is permanent hard water only?

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

- (d) Which sample of water, A, B or C, would give the most problems with scale or fur in kettles?

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

Examiner Only

Marks Remark

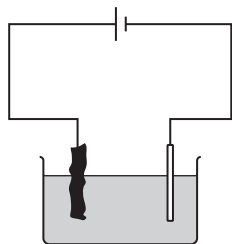
- 5 Lead is a mixture of three isotopes:  $^{206}_{82}\text{Pb}$ ,  $^{207}_{82}\text{Pb}$  and  $^{208}_{82}\text{Pb}$ . Complete the table below to show the similarities and differences between these isotopes.

Isotope	Mass number	Number of protons	Number of neutrons	Number of electrons
$^{206}_{82}\text{Pb}$	206			
$^{207}_{82}\text{Pb}$		82		
$^{208}_{82}\text{Pb}$			126	

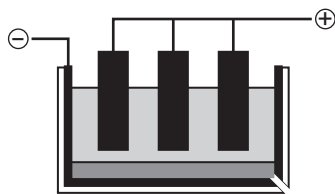
[4]

Examiner Only	
Marks	Remark

6 The diagrams below show two different electrolysis processes.



the purification of copper



production of aluminium from aluminium oxide

The sentences which follow are about the electrolysis processes shown in the diagrams above.

Read the sentences carefully. State if the sentence is true or false. The first one is done for you.

	Sentence	True or False
	The electrolytes in both processes are dissolved in water	False
a.	The electrodes in both of the processes are made from carbon	
b.	The anodes in both processes gradually disappear	
c.	The purification of copper happens at room temperature while the production of aluminium requires heat to begin the reaction	
d.	Pure copper and aluminium are both formed at the cathode	

[4]

Examiner Only	
Marks	Remark

7 Many homes in Northern Ireland use natural gas for their central heating. Natural gas contains methane which has the chemical formula  $\text{CH}_4$ .

(a) In the space below draw a diagram to show the electronic arrangement of **all** the electrons in a methane molecule.

[2]

(b) One of the following statements about the bonding in methane is correct.

Tick (✓) the correct box.

Methane has a simple ionic structure

The hydrogen atoms give their electrons to the carbon atom

The electrons are shared between the carbon and hydrogen atoms

[1]

Examiner Only	
Marks	Remark



- 8 Problems involving a fixed mass of gas can be solved using the relationship:

$$PV/T = \text{a constant.}$$

A gas syringe holds  $80 \text{ cm}^3$  of hydrogen at a pressure of  $10\,000 \text{ Pa}$  and a temperature of  $300 \text{ K}$ .

What would the volume of gas be if the pressure was doubled to  $20\,000 \text{ Pa}$  and the temperature increased from  $300 \text{ K}$  to  $400 \text{ K}$ ?

Show all your working. State the units clearly.

Examiner Only	
Marks	Remark

Answer \_\_\_\_\_ [4]



10 The substances below may be classified as ionic, metallic, covalent, molecular or giant covalent in terms of their properties.

Substance	Melting point °C	Boiling point °C	Electrical conductivity when solid	Electrical conductivity when molten
A	119	445	poor	poor
B	975	1465	poor	good
C	-182	-161	poor	poor
D	3730	4830	poor	poor
E	1083	2600	good	good

(a) Which substance, A, B, C, D or E, has a simple molecular structure and is a solid at room temperature?

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

(b) Which substance, A, B, C, D or E, is made up of positive and negative ions joined in a crystal lattice?

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

(c) (i) Give the name of a substance which could be D.

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

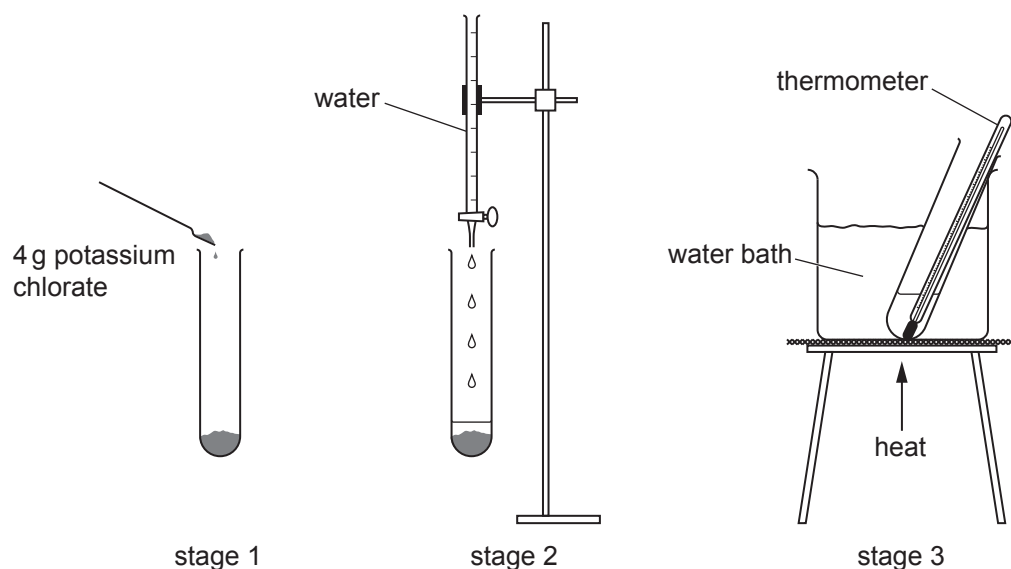
(ii) Explain why this substance is unable to conduct electricity.

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

Examiner Only

Marks Remark

- 11 A student wanted to obtain results to plot a solubility graph for potassium chlorate. She used the method shown below.



Stage 1: 4 g of potassium chlorate are placed in a boiling tube.

Stage 2: 10 cm<sup>3</sup> of water are added.

Stage 3: The boiling tube is placed in a beaker of hot water and heated until all the potassium chlorate has dissolved. Then the boiling tube is taken out of the water bath.

(a) What should the student be looking for after stage 3?

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

(b) What measurement needs to be recorded?

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

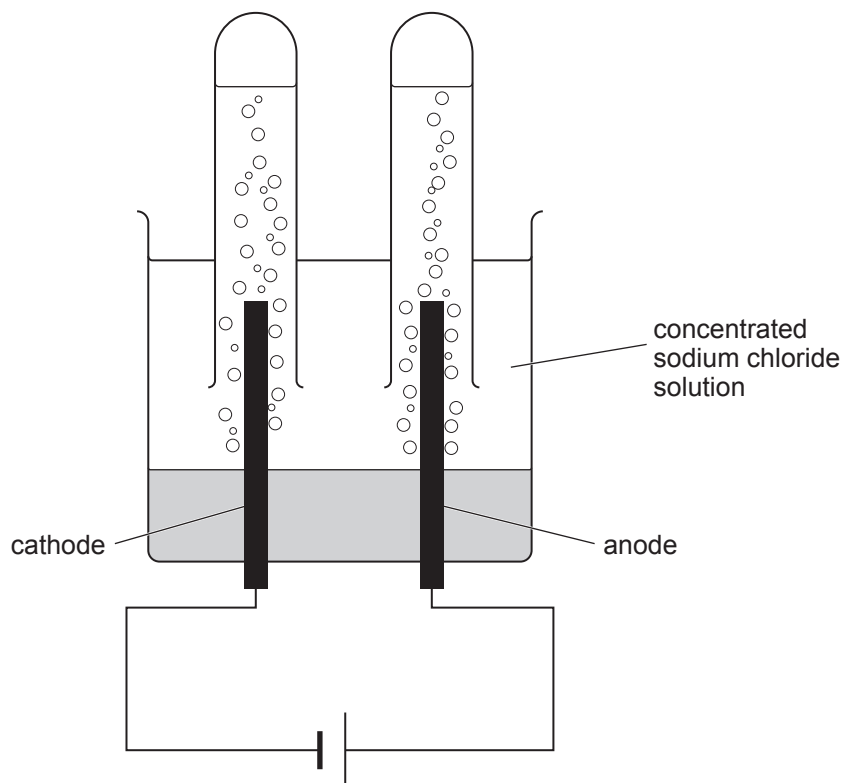
(c) More water, 2.5 cm<sup>3</sup>, is added to the boiling tube. Describe the steps the student should then take to complete the experiment.

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

Examiner Only

Marks Remark

- 12 The electrolysis of concentrated sodium chloride solution is used widely in industry to manufacture two gases and other useful substances. The electrolysis can be carried out in the laboratory as shown in the diagram below.



- (a) Name the gas produced at the cathode.

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

- (b) Write an **ionic** equation for the reaction which happens at the anode.

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

- (c) Two ions remain in solution and form an important chemical substance which is widely used in industry. Give the formulae of both of these ions.

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

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

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