

Thursday 24 May 2012 – Morning**GCSE GATEWAY SCIENCE
CHEMISTRY B****B641/02** Unit 1 Modules C1 C2 C3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename						Candidate surname					
Centre number						Candidate number					

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

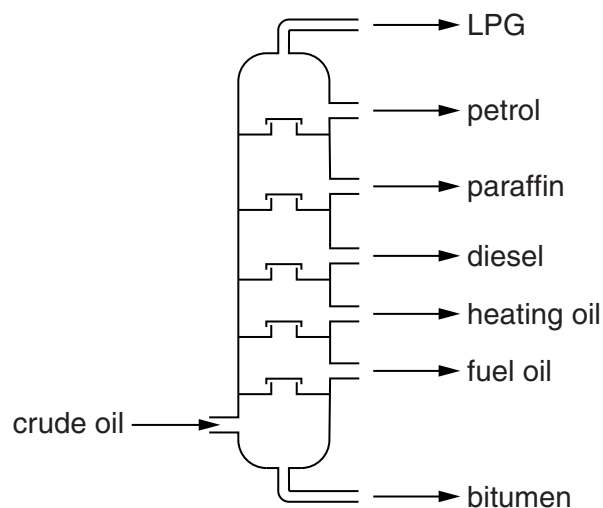
2

Answer **all** the questions.**Section A – Module C1**

- 1** This question is about crude oil.

Crude oil is separated into useful substances, called fractions, by fractional distillation.

Look at the diagram. It shows a fractionating column.



- (a)** **LPG** comes out of the top of the column.

Explain why.

Use ideas about boiling points.

.....
..... [1]

3

(b) Explain why crude oil can be separated by fractional distillation.

Use ideas about

- size of molecules
- forces between molecules

and how these affect boiling point.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 4]

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5

2 This question is about polymers.

(a) Nick buys a hot drink in a cup.

The cup is made from polystyrene.

Polystyrene is an insulator and is insoluble in water.

Explain how these properties make polystyrene useful for a cup for hot drinks.

.....

.....

..... [2]

(b) Polymers are made in a process called **polymerisation**.

Put a tick (✓) in the box next to the correct description of polymerisation.

A reaction which requires low pressure and a low temperature.

☐

A reaction in which many monomer molecules react together.

☐

A reaction which converts large alkane molecules into smaller alkane and alkene molecules.

☐

A reaction in which many small alkane molecules join together.

☐

[1]

(c) One way of disposing of waste polymers is to burn them.

Explain the environmental problems caused by burning waste polymers.

.....

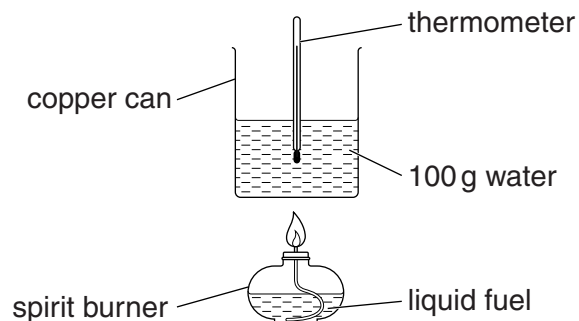
..... [1]

[Total: 4]

3 Molly and Jess investigate three fuels.

They want to find out which fuel gives off the most energy.

Look at the diagram. It shows the equipment they use.



(a) They burn 2.0 g of fuel and use 100 g of water each time.

Write down **one other** way Molly and Jess could make sure that each experiment is a **fair test**.

.....

..... [1]

(b) Look at their table of results.

fuel	starting temperature of water in °C	final temperature of water in °C	temperature change in °C
A	18	42	24
B	20	38	18
C	19	45	26

(i) Calculate the energy given out by 2.0 g of fuel **C** used to heat 100 g of water.

Use the formula

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

(Specific heat capacity of water is 4.2 J/g °C).

.....

.....

.....

.....

answer J [2]

(ii) Calculate the energy given out **per gram** of fuel **C**.

.....

..... [1]

answer J/g

(c) The burning of fuels is an exothermic reaction.

Energy is taken in when bonds are broken.

Explain why the reaction is exothermic.

Use ideas about bond making and bond breaking.

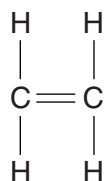
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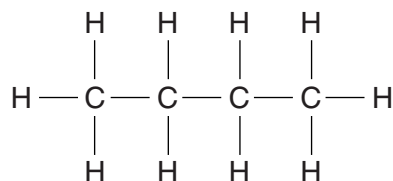
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[Total: 6]

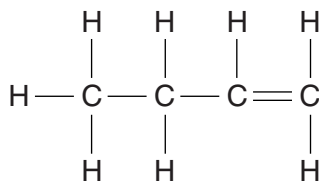
4 Look at the displayed formulas of some hydrocarbons.



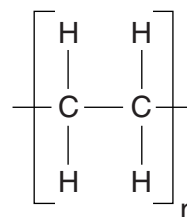
compound **A**



compound **B**



compound **C**



compound **D**

(a) Compounds **A**, **B**, **C** and **D** are **hydrocarbons**.

Explain why.

.....
 [1]

(b) Compounds **A** and **C** are **alkenes**.

Explain why.

.....
 [1]

(c) Look at the displayed formula for compound **B**.

Write down the **molecular formula** of compound **B**.

answer [1]

(d) One of the compounds is a **polymer**.

Which one?

Choose from **A**, **B**, **C** or **D**.

answer [1]

[Total: 4]

9

- 5 (a) Look at the picture of a packet of biscuits.

Inside the packet is some silica gel.

Silica gel absorbs water.

This is an example of active packaging.



sachet of silica gel

One reason why it is important to remove water from the packet of biscuits is to stop them going soft.

Suggest **one other** reason why it is important to remove water.

.....
 [1]

- (b) Look at the picture of a can of drink.

There is a square on the can which changes colour when the drink is at the best temperature to drink.



What is the name of this type of packaging?

Choose from this list.

active

breathable

intelligent

insulating

answer packaging

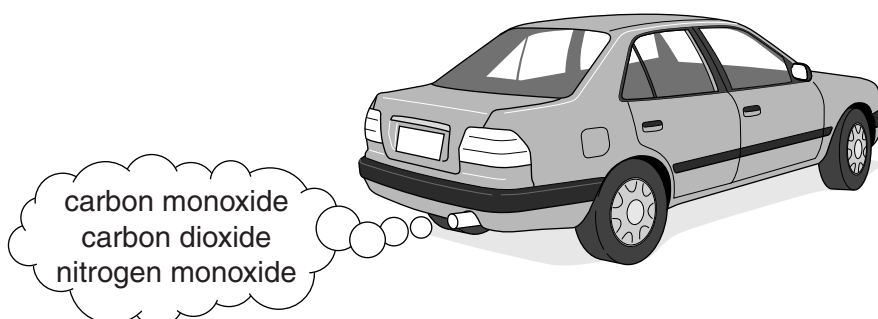
[1]

[Total: 2]

Section B – Module C2

6 Car engines make pollutants.

The picture shows some of the pollutants found in the exhaust gas of a car.



(a) Explain why carbon monoxide is made inside a car engine.

.....
 [1]

(b) Nitrogen, N_2 , reacts with oxygen, O_2 , inside a hot car engine.

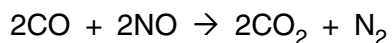
Nitrogen monoxide, NO, is made.

Write down the **balanced symbol** equation for this reaction.

..... [2]

(c) A catalytic converter lowers the levels of carbon monoxide and nitrogen monoxide in the exhaust gas.

Carbon monoxide reacts with nitrogen monoxide.



(i) The reaction between carbon monoxide and nitrogen monoxide is very slow at 25°C .

Suggest why.

Use ideas about particles.

.....

 [2]

11

- (ii) A catalyst makes the reaction between carbon monoxide and nitrogen monoxide go faster.

The larger the surface area of the catalyst the faster the reaction.

Explain why a large surface area makes the reaction faster.

Use ideas about collisions between particles.

.....
..... [1]

[Total: 6]

7 Hazel investigates the rusting of iron.

She finds out from the internet that rusting involves the oxidation of iron.

(a) Complete the **word equation** for the rusting of iron.

Include the **chemical** name for rust.

iron + oxygen + water $\rightarrow$ [1]

(b) She also finds out that acid rain makes iron rust faster.

Write down the name of **another** substance that makes iron rust faster.

..... [1]

(c) Hazel decides to investigate the rusting of iron by acid rain.

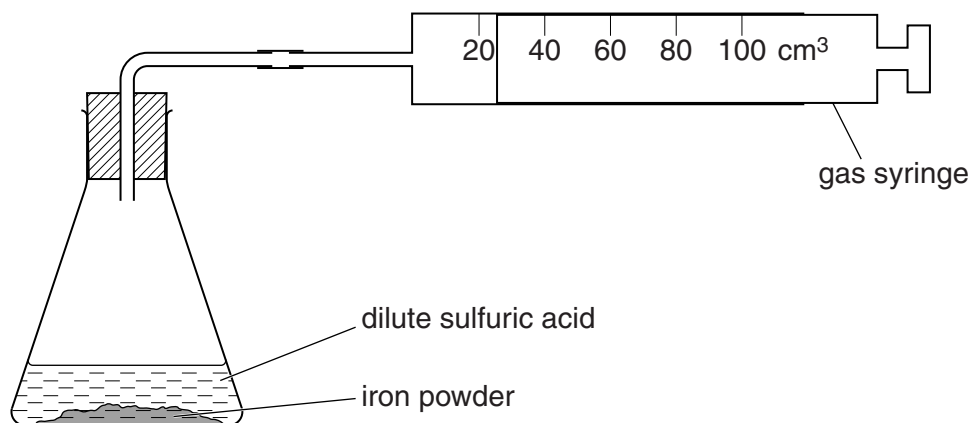
She adds 50 cm³ of dilute sulfuric acid to 1.0 g of iron powder.

The mixture slowly produces hydrogen gas.

iron + sulfuric acid $\rightarrow$ iron(II) sulfate + hydrogen

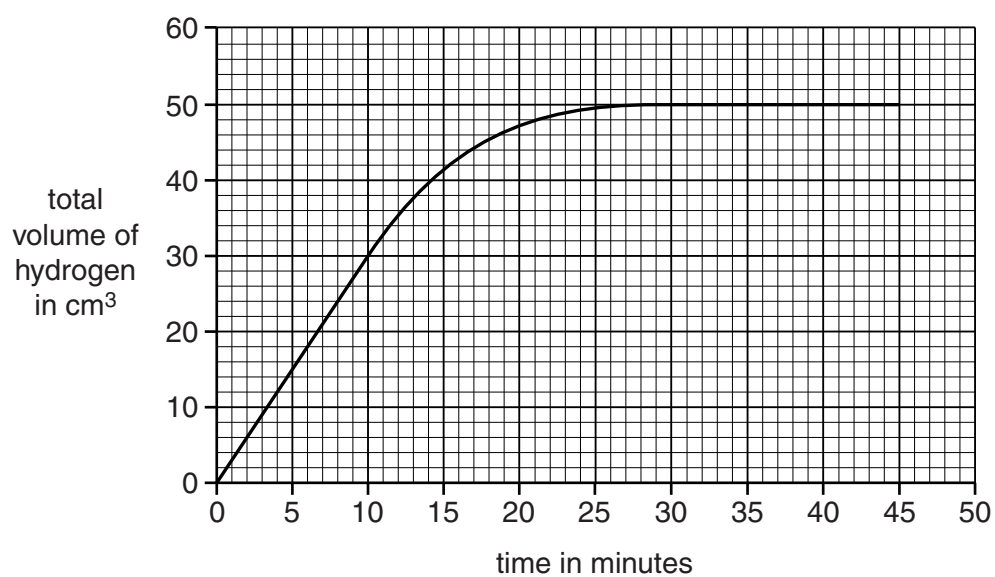
She measures the total volume of hydrogen made every five minutes.

Look at the apparatus she uses.



13

Look at the graph of her results.



(i) At what time did the reaction stop?

answer minutes

[1]

(ii) What is the rate of reaction during the first 10 minutes?

.....
.....
.....

rate = cm³/min

[2]

14

(d) Aluminium and steel are both used to make car bodies.

Look at the table of information about aluminium and steel.

property	aluminium	steel
magnetism	not magnetic	magnetic
corrosion	corrodes extremely slowly	rusts quite rapidly
density in g/cm ³	2.7	7.9
relative electrical conductivity	4.0	1.1
relative strength	7.0	21.0

Explain **two** advantages of using aluminium, rather than steel, to make a car body.

Use information from the table.

.....

.....

.....

..... [2]

[Total: 7]

- 8 The picture shows a can of oil paint.

The oil paint in the can is a mixture.

The mixture contains oil, pigment, binding agent and a solvent.

The mixture is not a solution.



- (a) The different parts of the oil paint will not separate.

Explain why.

Use ideas about particles.

.....

.....

.....

..... [2]

- (b) When the oil paint dries two processes happen.

In the first process the solvent evaporates.

This leaves a thin surface of oil, binding agent and pigment.

Explain what happens to the oil in the second process.

.....

..... [1]

- (c) Phosphorescent pigments are used to make objects 'glow in the dark'.

Explain how phosphorescent pigments can 'glow in the dark'.

.....

..... [1]

[Total: 4]

- 9 This question is about building materials.

Look at this list of building materials.

aluminium

concrete

copper

glass

granite

limestone

marble

steel

Choose **only** building materials from the list to answer the questions.

Each building material can be used **once**, **more than once** or **not at all**.

- (a) Which building material is made from sand?

..... [1]

- (b) Which building material is the **hardest rock**?

..... [1]

- (c) Two of the building materials can be thermally decomposed to make calcium oxide.

Write down the name of **one** of these building materials.

..... [1]

[Total: 3]

Section C – Module C3

10 This question is about chlorine, Cl , and bromine, Br .

The Periodic Table on the back page may help you.

(a) How many electrons are there in the outer shell of a bromine atom?

..... [1]

(b) How many occupied electron shells are there in a bromine atom?

..... [1]

(c) Bromine is an orange liquid at room temperature.

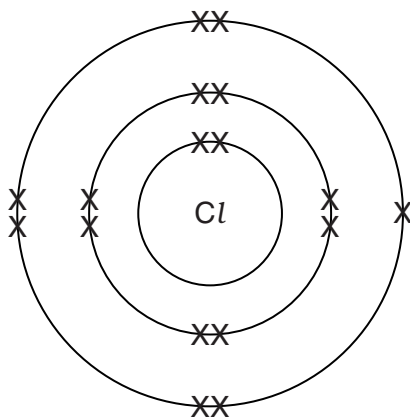
What does **chlorine** look like at room temperature?

..... [1]

(d) The electronic structure of chlorine is 2.8.7.

A chlorine molecule has the formula Cl_2 .

Finish the 'dot and cross' diagram for a chlorine molecule.



[2]

[Total: 5]

- 11 Kate heats some magnesium in air.

Magnesium reacts with oxygen.

Magnesium oxide is made.

- (a) Write down the **word equation** for this reaction.

..... [1]

- (b) When a magnesium atom reacts with oxygen a magnesium ion is made.

Look at the table.

It shows the particles in a magnesium atom and a magnesium ion.

particle	magnesium atom	magnesium ion
number of electrons	12	10
number of protons	12	12
number of neutrons	12	12

- (i) How many particles are there in the **nucleus** of a magnesium ion?

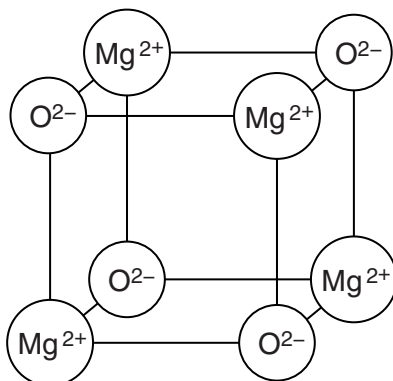
..... [1]

- (ii) Explain how a magnesium **ion** is formed from a magnesium atom.

.....
 [1]

(c) Look at the diagram.

It shows part of the giant ionic lattice of magnesium oxide.



(i) Magnesium oxide has a very high melting point.

Explain why.

.....

.....

.....

..... [2]

(ii) Solid magnesium oxide does not conduct electricity.

Explain why.

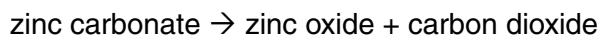
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..... [1]

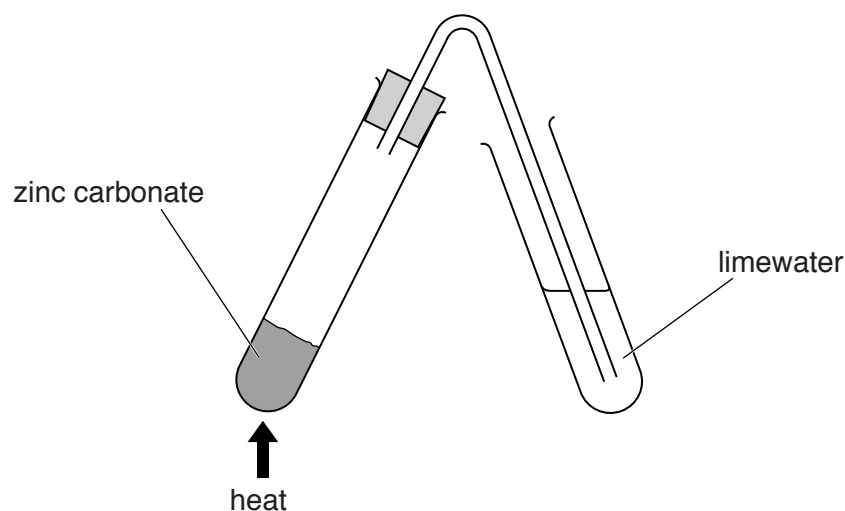
[Total: 6]

12 Ali heats zinc carbonate.

Zinc carbonate decomposes as shown in the word equation.



Look at the diagram. It shows the apparatus he uses.



Ali records the mass of the zinc carbonate before he starts heating.

He also records the mass after he has finished heating.

Ali then repeats the experiment with three more substances.

substance	mass before heating in g	mass after heating in g	effect on limewater
zinc carbonate	2.00	1.30	goes milky
sodium carbonate	2.00	2.00	stays colourless
copper carbonate	2.00	1.29	goes milky
iron (II) sulfate	2.00	1.16	stays colourless

(a) What is the mass of carbon dioxide made when zinc carbonate is heated?

.....

mass of carbon dioxide = g [1]

(b) Zinc carbonate has the formula ZnCO_3 .

Write down the **balanced symbol** equation for the decomposition of zinc carbonate.

..... [1]

21

(c) Iron(II) sulfate has the formula FeSO_4 .

A solution of iron(II) sulfate contains Fe^{2+} ions.

(i) Ali adds some sodium hydroxide solution to iron(II) sulfate solution.

Write down what Ali will see.

..... [1]

(ii) In this reaction iron(II) ions, Fe^{2+} , react with hydroxide ions, OH^- .

Iron(II) hydroxide is made.

What is the formula for iron(II) hydroxide?

..... [1]

[Total: 4]

13 Potassium is an alkali metal.

It is in Group 1 of the Periodic Table.

(a) Potassium reacts vigorously with cold water.

Write about the reaction of potassium with cold water.

Include in your answer

- what you would see
- the names of the products of the reaction.

.....

.....

.....

.....

..... [3]

(b) Look at the table. It shows information about the alkali metals.

alkali metal	atomic symbol	atomic number	melting point in °C	density in g/cm ³	atomic radius in pm
lithium	Li	3	181	0.53	152
sodium	Na	11	98	0.97	182
potassium	K	19	64	0.86	227
rubidium	Rb	37	39	1.53	247
caesium	Cs	55	29	1.87	265
francium	Fr	87			

(i) Predict the melting point of francium.

..... °C [1]

(ii) It is easier to predict the atomic radius of francium rather than its density.

Explain why.

.....

..... [1]

[Total: 5]

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The Periodic Table of the Elements

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.