OCR
Oxford Cambridge and RSA

F

Friday 5 June 2015 – Afternoon

GCSE GATEWAY SCIENCE
CHEMISTRY B

B741/01 Chemistry modules C1, C2, C3 (Foundation 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 15 minutes

* B 7 4 1 0 1 *

* 5 0 6 7 9 4 6 9 6 5 *

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 quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

SECTION A – Module C1

1 This question is about some of the hydrocarbons found in crude oil.

The table shows some information about five of these hydrocarbons.

Hydrocarbon	Molecular formula	Fraction of crude oil that contains the hydrocarbon	Melting point in °C	Boiling point in °C	Density in g/cm^3
propane	C_3H_8	liquefied petroleum gases	–188	–42	0.002
hexane	C_6H_{14}	petrol	–95	68	0.66
decane	$C_{10}H_{22}$	paraffin	–30	174	0.73
hexadecane	$C_{16}H_{34}$	diesel	18	287	0.77
icosane	$C_{20}H_{42}$	heating oil	37	343	

(a) Which compound has a molecule with **20 atoms**?

Choose from the table.

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

(b) Propane is a **hydrocarbon**.

What is meant by a hydrocarbon?

.....

.....

..... **[2]**

(c) The density changes as the number of carbon atoms in a hydrocarbon molecule increases.

Describe this trend in density and predict the density of icosane.

.....

.....

..... **[2]**

(d) A mixture contains hexane, decane, hexadecane and icosane.

Which method can be used to separate this mixture?

Choose from

cracking

emulsification

evaporation

fractional distillation

polymerisation

Explain your answer.

Method .....

Explanation .....

.....

..... **[2]**

(e) Hexane is one of the hydrocarbons found in petrol.

Hexane completely burns in a plentiful supply of air.

Look at the word equation for this reaction.

hexane + oxygen → carbon dioxide + water

(i) Which gas in the air is needed for combustion?

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

(ii) **Incomplete combustion** happens when there is a limited supply of air.

Write down the **word** equation for the incomplete combustion of hexane.

Use your equation to suggest **one** disadvantage of incomplete combustion.

.....

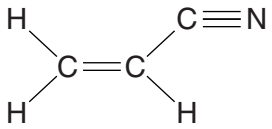
.....

.....

..... **[2]**

2 Stowmarket Synthetics is a chemical company that makes polymers.

They make a polymer from a monomer called propenenitrile.



(a) What is the name of the polymer made from propenenitrile?

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

(b) How many covalent bonds are shown in the displayed formula of propenenitrile?

Tick (✓) the correct box.

three	☐
four	☐
five	☐
eight	☐
nine	☐

[1]

(c) Stowmarket Synthetics also make a polymer that is used to make bottles for fizzy drinks.

The polymer used to make the bottles is **non-biodegradable**.

Some scientists want the polymer to be **biodegradable**.

What is a **biodegradable** polymer?

Write about the advantages and disadvantages of using a **biodegradable** polymer to make these bottles.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

3 Some foods contain additives.

Flavour enhancers improve the flavour of a food.

An emulsifier stops oil and water in a food from separating.

(a) Write down the name of **another** food additive.

Describe the job of this food additive.

name of food additive .....

job of the additive .....

..... **[2]**

(b) Phil finds some information about four emulsifiers.

Look at this information.

Emulsifier	Is it poisonous?	Does it have a smell?	Cost of making 1g of emulsifier in pence
A	yes	no	3
B	yes	no	6
C	no	no	1
D	no	yes	5

Which emulsifier is the most suitable to be used in a food?

Explain your answer.

.....

.....

.....

..... **[3]**

(c) Baking powder is used in cake mixes.

Baking powder makes carbon dioxide when heated.

Write about the chemical test for carbon dioxide.

.....

.....

..... **[2]**

SECTION B – Module C2

4 This question is about building materials.

(a) Limestone is a rock used for buildings.

(i) Write down the name of **another** rock used for buildings.

Choose from the list.

amalgam

brass

granite

solder

answer ..... **[1]**

(ii) Limestone is dug out of the ground in a quarry.

Removing limestone rock from a quarry causes environmental problems.

Write about **two** environmental problems caused by quarrying limestone.

.....

.....

..... **[2]**

(b) Concrete is a building material.

Concrete is made stronger using a steel support.

This is called **reinforced concrete**.

Look at the table.

It gives some information about three types of steel.

Type of steel	Iron alloyed with	Relative strength	Other properties
A	about 0.25% carbon	386	easily shaped
B	up to 2.5% carbon	414	hard, more difficult to shape
C	chromium and nickel	515	easily shaped, resistant to corrosion

(i) Steel **C** is the best choice for reinforcing concrete.

Use information from the table to give **two** reasons why.

.....

.....

..... **[2]**

(ii) The three types of steel in the table are **alloys**.

What is meant by an alloy?

.....

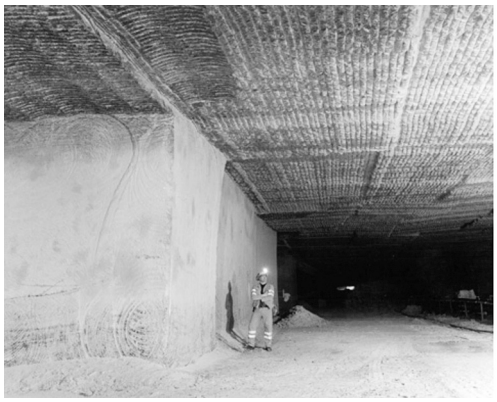
..... **[1]**

5 This question is about sodium chloride (salt).

(a) Write down one **use** of sodium chloride.

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

(b) Most of the UK's salt comes from the Winsford Salt Mine in Cheshire.



Describe one way that the salt can be extracted from the salt mine.

.....

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

(c) Useful products are made from sodium chloride solution by electrolysis.

Electrolysis of sodium chloride solution involves these particles:

Cl^- Cl_2 H^+ H_2

Na^+ H_2O OH^-

Some of the particles are **ions**.

Some of the particles are **molecules**.

Finish the table.

Two particles have been done for you.

Ions	Molecules
OH^-	H_2

[2]

6 Martin investigates the corrosion of different metals.

He places strips of metals in some damp gases.

Look at his results.

Metal	Appearance at start	Appearance after two weeks in damp …		
		… oxygen	… acidic air	… nitrogen
copper	shiny pink	small patches of green on surface	thick green layer on surface	shiny pink
iron	shiny silver	small patches of brown on surface	lots of brown flakes on surface	shiny silver
lead	shiny silver	dull silver	black layer on surface	shiny silver

(a) Martin concludes that:

- oxygen is needed for corrosion
- more corrosion happens in acidic air than in any of the other conditions.

Is he correct? .....

How can you tell? Write down evidence from the table in your answer.

.....

.....

.....

..... **[2]**

(b) Copper reacts with oxygen, O_2.

Copper oxide, CuO, is made.

Write a **balanced symbol** equation for this reaction.

..... **[2]**

7 This question is about fertilisers.

(a) Farmers add fertilisers to the soil.

What part of a plant absorbs the minerals from the fertilisers?

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

(b) Ammonium phosphate, $(NH_4)_3PO_4$, is a fertiliser.

(i) Complete the table to show the number of each **type of atom** in the formula $(NH_4)_3PO_4$.

Atom	Number
N	.....
H	.....
P	.....
O	.....

[2]

(ii) Write down the **names** of the **two** essential elements in ammonium phosphate.

.....

..... **[2]**

(c) Ammonium phosphate solution is made by reacting an acid with an alkali in a neutralisation reaction.

Write down the name of the **acid** and the **alkali** needed to make ammonium phosphate.

Describe how an indicator can be used to check the **pH** of the solution made.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

SECTION C – Module C3

8 Hydrogen peroxide, H_2O_2, is used in some spacecraft to provide oxygen.

(a) Hydrogen peroxide is a compound.

How can you tell from its molecular formula?

.....

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

(b) Hydrogen peroxide, H_2O_2, can be made from hydrogen, H_2, and oxygen, O_2.

hydrogen + oxygen $\rightarrow$ hydrogen peroxide

(i) Write the **balanced symbol** equation for this reaction.

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

(ii) This reaction has a 100% atom economy.

What does this mean?

.....

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

(iii) Oskar finds out that 5 g of hydrogen should make 85 g of hydrogen peroxide.

Show that 100 g of hydrogen should make 1700 g of hydrogen peroxide.

.....

.....

.....

.....

..... **[2]**

(iv) Oskar uses 100 g of hydrogen to make hydrogen peroxide.

He predicts he should make 1700 g of hydrogen peroxide.

He actually makes 1530 g of hydrogen peroxide.

Calculate Oskar's percentage yield of hydrogen peroxide.

percentage yield = ...% **[2]**

(c) Hydrogen peroxide can also be made from barium peroxide.

barium peroxide + sulfuric acid → hydrogen peroxide + barium sulfate

BaO_2 + H_2SO_4 → H_2O_2 + $BaSO_4$

The table shows the relative formula masses, M_r, of the substances in the symbol equation.

Substance	Relative formula mass, M_r
BaO_2	169
H_2SO_4	
H_2O_2	34
$BaSO_4$	233

(i) Calculate the relative formula mass, M_r, of sulfuric acid, H_2SO_4.

Put your answer in the table.

The relative atomic mass, A_r, of H = 1, O = 16 and S = 32.

[1]

(ii) Barium sulfate is a waste product in this reaction.

Calculate the atom economy for this reaction.

atom economy = ...% **[2]**

9 Fatimah investigates the reaction between sodium hydrogencarbonate and dilute hydrochloric acid.

Fatimah does two investigations.

She always adds 0.5 g of sodium hydrogencarbonate to 20 cm^3 of dilute hydrochloric acid.

She measures the time it takes for the reaction mixture to stop bubbling.

This is called the **reaction time**.

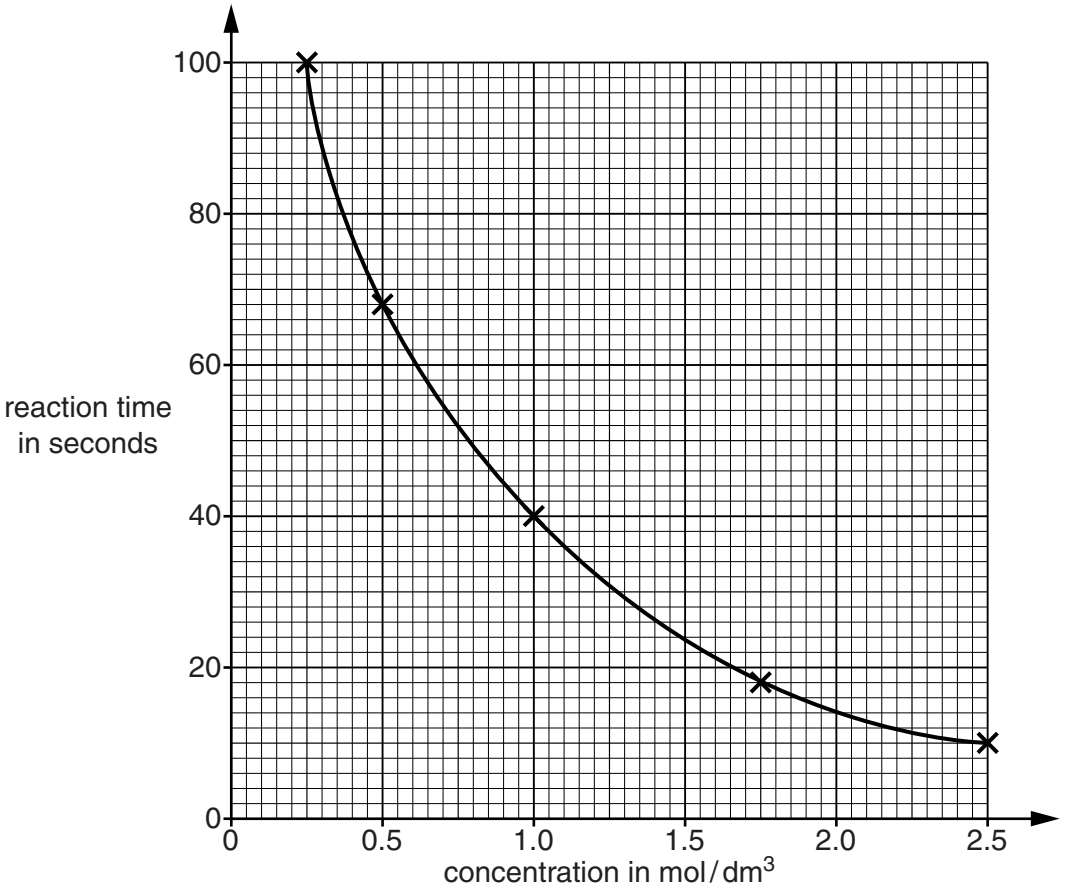
Investigation One

She does five different experiments.

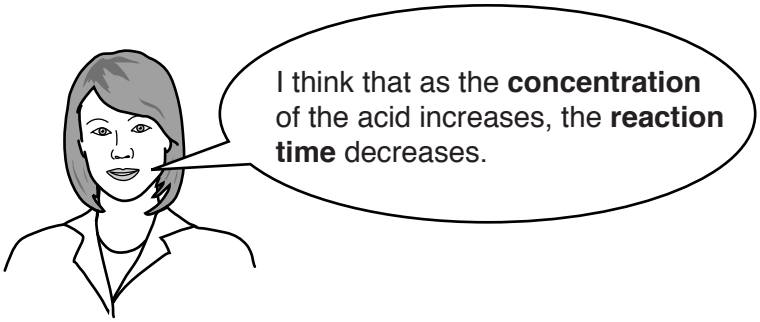
She keeps the temperature the same.

Each experiment uses a **different concentration** of acid.

Look at a graph of her results.



(a) Fatimah makes a conclusion.



Do the results in **Investigation one** support Fatimah's conclusion?

Explain your answer.

Use the reacting particle model to explain Fatimah's results.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(b) Investigation Two

Fatimah does five experiments.

She keeps the concentration of the acid the same.

She uses acid at **different temperatures**.

Look at her results.

Temperature of acid in °C	Reaction time in seconds
20	68
30	34
40	17
50	9
60	5

(i) What conclusion can you make about the effect of **temperature** on the **reaction time**?

.....

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

(ii) Fatimah does an experiment with acid at a temperature of 10 °C.

Predict the reaction time, in seconds.

..... seconds **[1]**

10 A pharmaceutical drug is made by a batch process.

(a) Write about **three** factors that affect the **cost** of making a pharmaceutical drug.

.....

.....

.....

.....

.....

..... **[3]**

(b) When a pharmaceutical drug is manufactured it must be as pure as possible.

(i) Explain why it is important that the pharmaceutical drug is as pure as possible.

.....

.....

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

(ii) Write down **one** method a chemist can use to show that a pharmaceutical drug is pure.

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

11 Diamond is a form of carbon.

Diamonds are used in jewellery because they are lustrous (shiny).

Write about two **other** properties of diamond.

.....

..... **[2]**

END OF QUESTION PAPER

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.