

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



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 ₃ H ₈	liquefied petroleum gases	-188	-42	0.002
hexane	C ₆ H 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

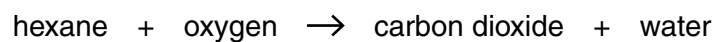
.....

..... [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.



- (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.

.....

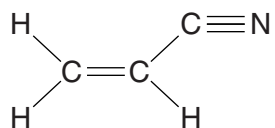
.....

.....

..... [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]

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.

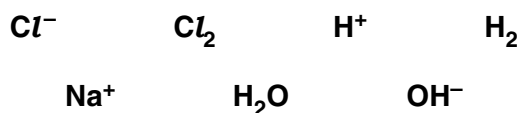


Describe one way that the salt can be extracted from the salt mine.

.....
 [1]

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

Electrolysis of sodium chloride solution involves these particles:



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, O₂.

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, $(\text{NH}_4)_3\text{PO}_4$, is a fertiliser.



(i) Complete the table to show the number of each **type of atom** in the formula $(\text{NH}_4)_3\text{PO}_4$.

Atom	Number
N
H
P
O

[2]

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

.....
 [2]

SECTION C – Module C3

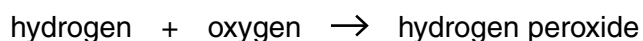
8 Hydrogen peroxide, H_2O_2 , is used in some spacecraft to provide oxygen.

(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 .



(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 100g 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 \rightarrow hydrogen peroxide + barium sulfate



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 ₂ SO ₄	
H ₂ O ₂	34
BaSO ₄	233

(i) Calculate the relative formula mass, M_r , of sulfuric acid, H₂SO₄.

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 cm³ of dilute hydrochloric acid.

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

This is called the **reaction time**.

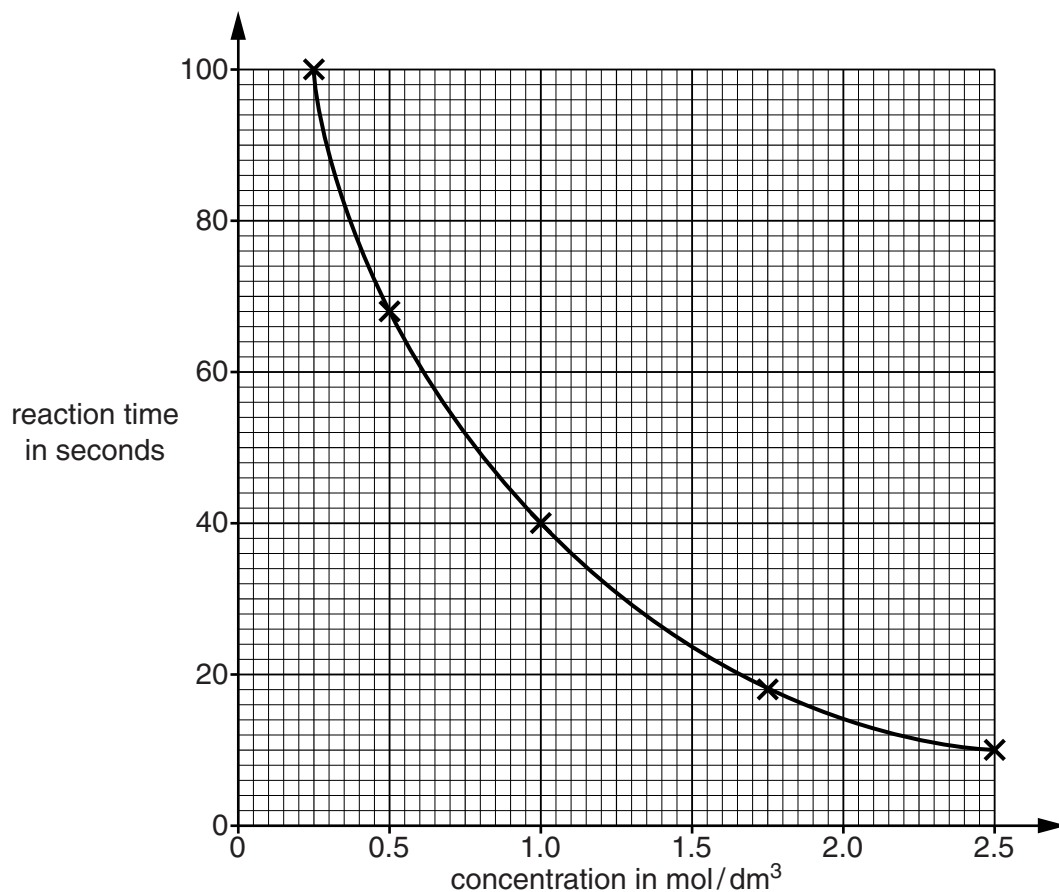
Investigation One

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.



(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

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0		
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminium 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Ar argon 18
	19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Y yttrium 39	25 Zr zirconium 40	26 Nb niobium 41	27 Hf hafnium 72	28 Ta tantalum 73	29 Pb lead 82	30 Ba barium 56
	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Hf hafnium 72	43 Ta tantalum 73	44 Pb lead 82	45 Hg mercury 80	46 Rn radon 86
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	58 Y yttrium 39	59 Zr zirconium 40	60 Nb niobium 41	61 Hf hafnium 72	62 Ta tantalum 73	63 Pb lead 82	64 Rn radon 86
	87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	90 Th thorium 90	91 Pa protactinium 91	92 U uranium 92	93 Np neptunium 93	94 Pu plutonium 94	95 Am americium 95	96 Cm curium 96
	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109	110 Ds darmstadtium 110	111 Rg roentgenium 111	112 Cd cadmium 48	113 In indium 49	114 Sn tin 50	115 Pb lead 82	116 Rn radon 86
	137 Ba barium 56	138 La* lanthanum 57	139 Y yttrium 39	140 Zr zirconium 40	141 Nb niobium 41	142 Hf hafnium 72	143 Ta tantalum 73	144 Pb lead 82	145 Hg mercury 80	146 Rn radon 86
	187 Uu ununoctium 117	188 Uub unubium 118	189 Uut ununtrium 119	190 Uuq ununquadium 120	191 Uup ununpentium 121	192 Uuq ununquadium 120	193 Uuh ununhexium 122	194 Uuq ununquadium 120	195 Uuh ununhexium 122	196 Uuo ununoctium 118
	209 Bi bismuth 83	210 Po polonium 84	211 At astatine 85	212 Rn radon 86	213 Fr francium 87	214 Ra radium 88	215 Ac actinium 89	216 Th thorium 90	217 Pa protactinium 91	218 U uranium 92
	285 Fl flerovium 114	286 Mc moscovium 115	287 Lv livermorium 116	288 Ts tennessine 117	289 Og oganeson 118	290 Uu unununium 123	291 Uub ununbium 124	292 Uuc ununtrium 125	293 Uud ununquadium 126	294 Uue ununpentium 127
	315 Uhp ununheptium 135	316 Uhu ununhexium 134	317 Uuo ununoctium 132	318 Uuh ununhexium 134	319 Uuq ununquadium 133	320 Uuh ununhexium 134	321 Uuo ununoctium 132	322 Uuh ununhexium 134	323 Uuo ununoctium 132	324 Uuh ununhexium 134
	349 Ubu ununbium 124	350 Ubc ununtrium 125	351 Ubd ununquadium 126	352 Ube ununpentium 127	353 Ubf ununhexium 128	354 Ubg ununheptium 129	355 Ubh ununhectium 130	356 Ubi ununnonium 131	357 Ubj unundecium 132	358 Ubk ununduodecium 133
	429 Ufl ununflerovium 154	430 Ufu ununfermium 152	431 Ufs ununseaborgium 150	432 Uft ununtennessine 148	433 Ufu ununfermium 152	434 Ufl ununflerovium 154	435 Ufu ununfermium 152	436 Ufl ununflerovium 154	437 Ufu ununfermium 152	438 Ufl ununflerovium 154
	509 Uol ununolivermorium 178	510 Uou ununoganeson 176	511 Uol ununolivermorium 178	512 Uou ununoganeson 176	513 Uol ununolivermorium 178	514 Uou ununoganeson 176	515 Uol ununolivermorium 178	516 Uou ununoganeson 176	517 Uol ununolivermorium 178	518 Uou ununoganeson 176
	589 Upl ununpentium 127	590 Upu ununpentium 127	591 Upl ununpentium 127	592 Upu ununpentium 127	593 Upl ununpentium 127	594 Upu ununpentium 127	595 Upl ununpentium 127	596 Upu ununpentium 127	597 Upl ununpentium 127	598 Upu ununpentium 127
	689 Uql ununquadium 120	690 Uqu ununquadium 120	691 Uql ununquadium 120	692 Uqu ununquadium 120	693 Uql ununquadium 120	694 Uqu ununquadium 120	695 Uql ununquadium 120	696 Uqu ununquadium 120	697 Uql ununquadium 120	698 Uqu ununquadium 120
	779 Urs ununseptium 121	780 Uru ununseptium 121	781 Urs ununseptium 121	782 Uru ununseptium 121	783 Urs ununseptium 121	784 Uru ununseptium 121	785 Urs ununseptium 121	786 Uru ununseptium 121	787 Urs ununseptium 121	788 Uru ununseptium 121
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	1039 Uvl ununvivium 173	1040 Uvu ununvivium 173	1041 Uvl ununvivium 173	1042 Uvu ununvivium 173	1043 Uvl ununvivium 173	1044 Uvu ununvivium 173	1045 Uvl ununvivium 173	1046 Uvu ununvivium 173	1047 Uvl ununvivium 173	1048 Uvu ununvivium 173
	1219 Uyl ununyttrium 39	1220 Uyu ununyttrium 39	1221 Uyl ununyttrium 39	1222 Uyu ununyttrium 39	1223 Uyl ununyttrium 39	1224 Uyu ununyttrium 39	1225 Uyl ununyttrium 39	1226 Uyu ununyttrium 39	1227 Uyl ununyttrium 39	1228 Uyu ununyttrium 39
	1329 Uzl ununzeptium 129	1330 Uzu ununzeptium 129	1331 Uzl ununzeptium 129	1332 Uzu ununzeptium 129	1333 Uzl ununzeptium 129	1334 Uzu ununzeptium 129	1335 Uzl ununzeptium 129	1336 Uzu ununzeptium 129	1337 Uzl ununzeptium 129	1338 Uzu ununzeptium 129
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	2619 Ull ununlithium 3	2620 Ulu ununlithium 3	2621 Ull ununlithium 3	2622 Ulu ununlithium 3	2623 Ull ununlithium 3	2624 Ulu ununlithium 3	2625 Ull ununlithium 3	2626 Ulu ununlithium 3	2627 Ull ununlithium 3	2628 Ulu ununlithium 3
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	2919 Uol ununolivermorium 178	2920 Uou ununoganeson 176	2921 Uol ununolivermorium 178	2922 Uou ununoganeson 176	2923 Uol ununolivermorium 178	2924 Uou ununoganeson 176	2925 Uol ununolivermorium 178	2926 Uou ununoganeson 176	2927 Uol ununolivermorium 178	2928 Uou ununoganeson 176
	3019 Upl ununpentium 127	3020 Upu ununpentium 127	3021 Upl ununpentium 127	3022 Upu ununpentium 127	3023 Upl ununpentium 127	3024 Upu ununpentium 127	3025 Upl ununpentium 127	3026 Upu ununpentium 127	3027 Upl ununpentium 127	3028 Upu ununpentium 127
	3119 Uql ununquadium 120	3120 Uqu ununquadium 120	3121 Uql ununquadium 120	3122 Uqu ununquadium 120	3123 Uql ununquadium 120	3124 Uqu ununquadium 120	3125 Uql ununquadium 120	3126 Uqu ununquadium 120	3127 Uql ununquadium 120	3128 Uqu ununquadium 120
	3219 Usl ununseptium 121	3220 Usu ununseptium 121	3221 Usl ununseptium 121	3222 Usu ununseptium 121	3223 Usl ununseptium 121	3224 Usu ununseptium 121	3225 Usl ununseptium 121	3226 Usu ununseptium 121	3227 Usl ununseptium 121	3228 Usu ununseptium 121
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	3419 Uvl ununvivium 173	3420 Uvu ununvivium 173	3421 Uvl ununvivium 173	3422 Uvu ununvivium 173	3423 Uvl ununvivium 173	3424 Uvu ununvivium 173				