

Candidate Forename						Candidate Surname					
Centre Number							Candidate Number				

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

B641/02

**GATEWAY SCIENCE
CHEMISTRY B**

Unit 1 Modules C1 C2 C3 (Higher Tier)

MONDAY 18 JANUARY 2010: Morning

DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

INFORMATION FOR CANDIDATES

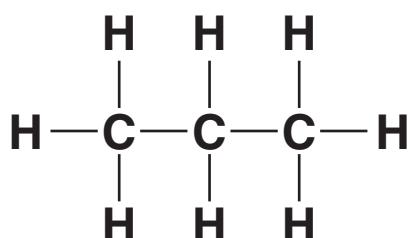
- **The number of marks is given in brackets [] at the end of each question or part question.**
- **The Periodic Table is printed on the back page.**
- **The total number of marks for this paper is 60.**

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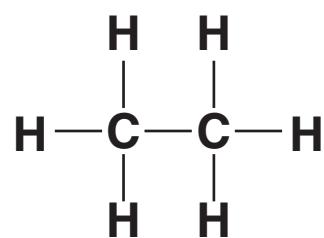
Answer ALL the questions.

SECTION A – MODULE C1

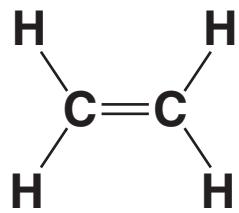
1 Look at the displayed formulas of some compounds of carbon.



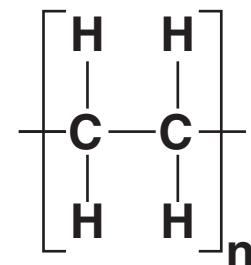
compound A



compound B



compound C



compound D

(a) Which one of the compounds is a POLYMER?

Choose from A, B, C or D.

answer _____ [1]

(b) Which one of the compounds is an ALKENE?

Choose from A, B, C or D.

answer _____ [1]

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

The atoms of carbon and hydrogen are joined together by covalent bonds.

Describe how a covalent bond is formed between an atom of carbon and an atom of hydrogen.

[2]

[Total: 4]

2 This question is about cooking and foods.

Look at the list of some foods provided.

BREAD

CABBAGE

CARROTS

LEMON

MEAT

APPLE

(a) Write down the name of one food that contains a lot of PROTEIN.

Choose from the foods in the list.

[1]

(b) Some of the foods in the list need to be cooked before eating them.

(i) Write down ONE reason why some foods need to be cooked.

[1]

(ii) Cooking food is an example of a chemical change.

Explain why.

[1]

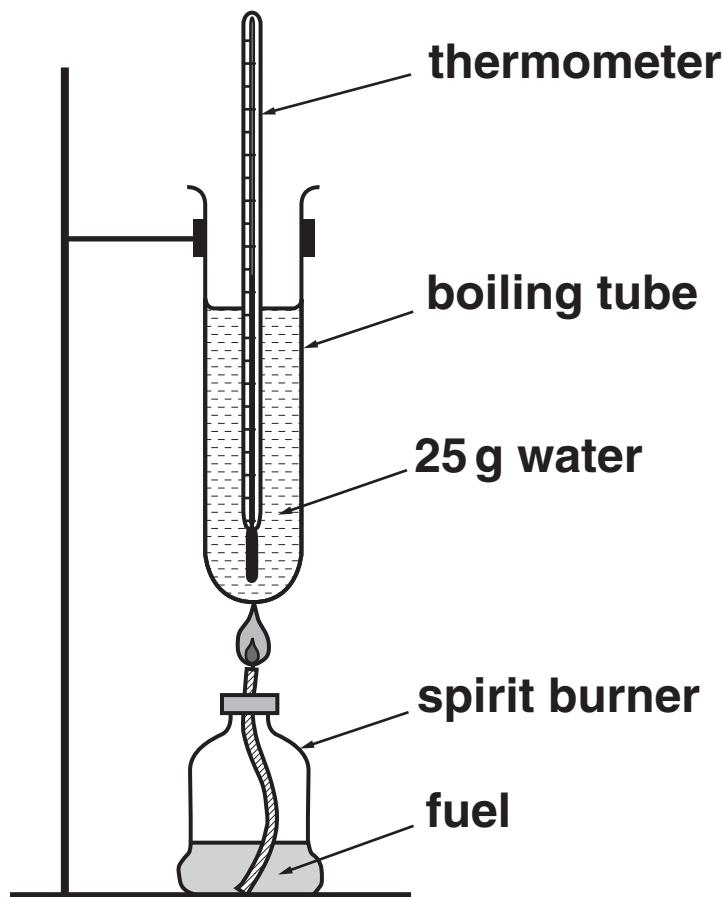
[Total: 3]

3 Luke and Sophie investigate the energy content of two fuels.

(a) (i) Look at the diagram.

It shows the apparatus they use.

They burn 1.0 g of fuel each time.



Look at their table of results.

fuel	starting temperature of water in °C	final temperature of water in °C
ethanol	20	35
paraffin	20	50

Calculate the amount of energy transferred when they burn 1.0g of ethanol.

ENERGY = MASS × SPECIFIC HEAT CAPACITY

× TEMPERATURE CHANGE

The specific heat capacity of water is 4.2 J/g °C.

answer _____ J

[3]

(ii) When 1.0 g of paraffin is burnt 3150 J is released.

Calculate the energy transferred in joules when burning 0.5 g of paraffin.

[1]

(b) Burning fuels is an EXOTHERMIC reaction.

What is meant by an exothermic reaction?

[1]

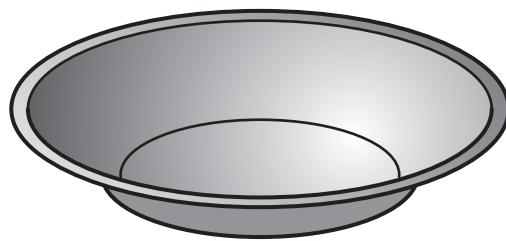
[Total: 5]

4 This question is about polymers and plastics.**(a) Local councils find it difficult to dispose of plastics.****Explain why. Complete the table.**

METHOD OF DISPOSAL	DIFFICULTIES AND PROBLEMS
recycling	difficult to sort different types of plastics
burning	_____
landfill site	_____

[2]

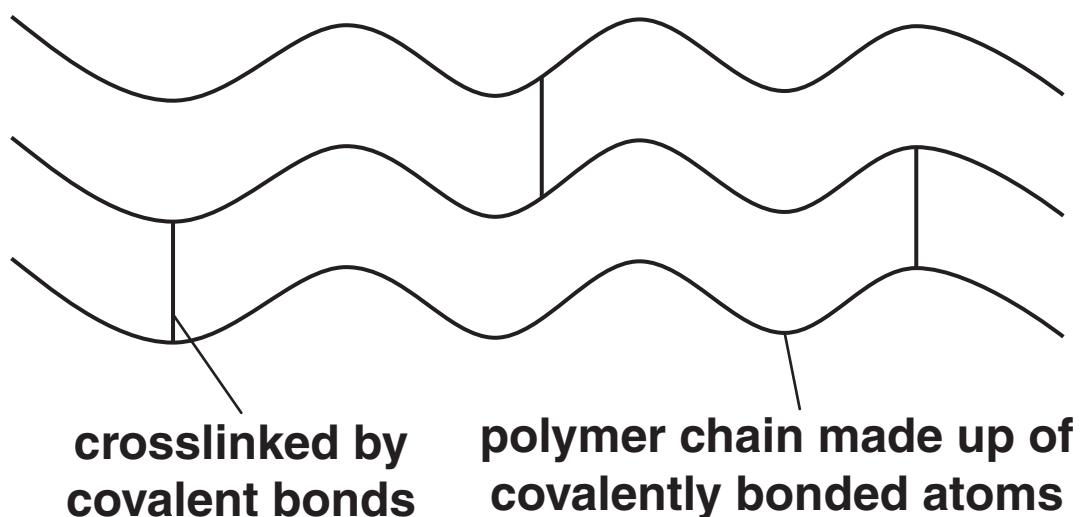
(b) Look at the picture.



The plastic container shown in the picture cannot be stretched.

This property is due to the way the polymer molecules are arranged.

The diagram shows how the polymer chains are arranged in the plastic.



Explain why the plastic cannot be stretched easily.

[3]

[Total: 5]

5 This question is about different types of chemical processes.

(a) Match the PROCESS with its correct DESCRIPTION.

One has been done for you.

PROCESS	DESCRIPTION
combustion	a reaction which converts large alkane molecules into smaller alkane and alkene molecules
cracking	a reaction which makes large molecules from many smaller molecules
fractional distillation	the separation of a mixture of hydrocarbons
polymerisation	a reaction in which carbon dioxide and water are made

[2]

(b) Alcohols react with acids to make an ester and water.

Write a word equation for this reaction.

_____ [1]

[Total: 3]

SECTION B – MODULE C2

6 Limestone is a rock used to make buildings.

The chemical name for limestone is calcium carbonate, CaCO_3 .

When heated strongly calcium carbonate changes into calcium oxide.

calcium carbonate \rightarrow calcium oxide + carbon dioxide

This change is called THERMAL DECOMPOSITION.

(a) What is thermal decomposition?

[1]

(b) Write the balanced SYMBOL equation for the thermal decomposition of calcium carbonate.

[1]

(c) Buildings can be made from limestone.

Limestone is calcium carbonate.

Limestone is a soft and crumbly rock.

Statues can be made from marble.

Marble is calcium carbonate.

Marble is a hard rock.

Marble is harder than limestone.

Explain why. Use ideas about types of rock and how they are made.

[2]

[Total: 4]

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7 Iron reacts very slowly with dilute sulfuric acid.

The reaction makes iron sulfate and hydrogen.

(a) Write down the WORD equation for this reaction.

[1]

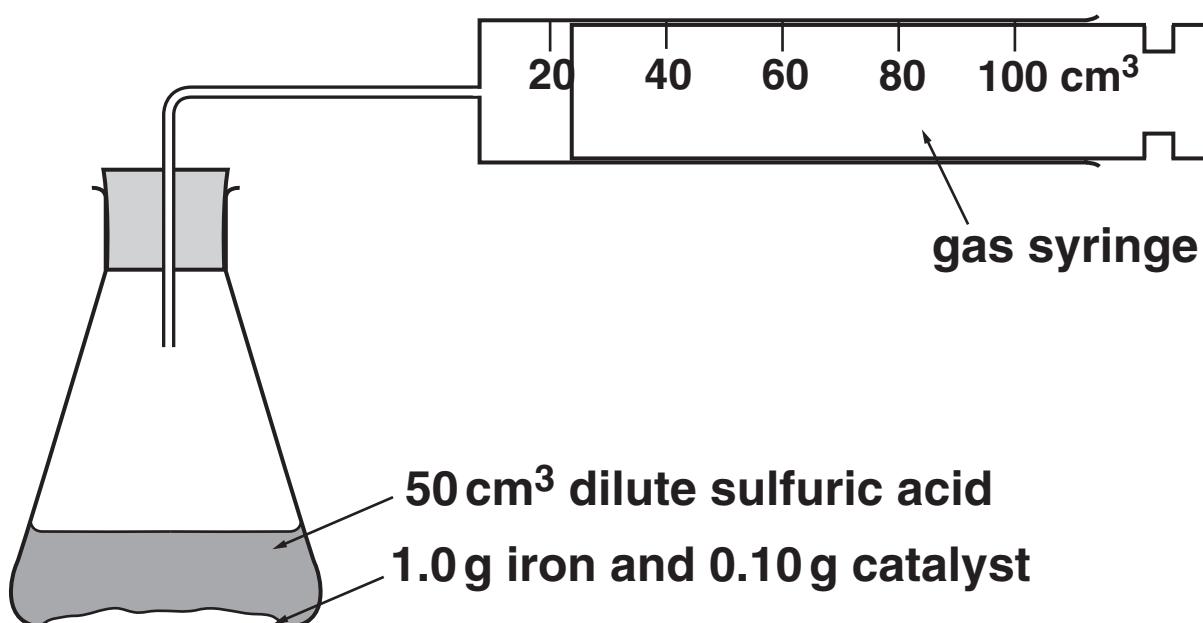
(b) Milly wants to make the reaction faster.

She knows that catalysts make reactions faster.

She tries to find a catalyst for this reaction.

Look at the diagram.

It shows the apparatus she uses.



She measures the time it takes to collect 100 cm^3 of hydrogen in the gas syringe.

In experiments 2 to 5 she uses 0.10 g of catalyst each time.

In experiment 1 no catalyst is used.

Look at the results table on the next page.

Milly thinks that copper powder is a catalyst for this reaction.

Explain how Milly made this conclusion from her results.

[2]

(c) Milly uses iron powder rather than a lump of iron.

This is because the reaction is faster with iron powder.

Explain why the reaction is faster.

Use ideas about collisions between particles.

[2]

EXPERIMENT NUMBER	NAME OF CATALYST	COLOUR OF CATALYST AT START OF REACTION	COLOUR CATALYST AT END OF REACTION	MASS OF CATALYST AT THE START OF REACTION IN GRAMS	MASS OF CATALYST LEFT AT THE END OF REACTION IN GRAMS	TIME TO COLLECT 100 cm ³ OF HYDROGEN IN SECONDS
1	no catalyst added					130
2	copper powder	pink	pink	0.10	0.10	20
3	copper sulfate powder	blue	pink	0.10	0.04	15
4	calcium sulfate powder	white	white	0.10	0.10	130
5	zinc powder	silver	silver	0.10	0.05	10

8 Steel is an alloy that contains iron and carbon.

Iron rusts much more easily than steel.

(a) Write one OTHER way in which steel is more useful than iron.

[1]

(b) Look at the word equation for rusting.

It is not finished.

Fill in the names of the missing substances in the WORD equation.

iron + water + _____ → _____ [2]

(c) Solder is an alloy.

Which TWO metals are found in solder?

Choose from:

IRON

LEAD

MERCURY

TIN

ZINC

answer _____ and _____ [1]

(d) Fizzy drinks cans are made from metal.

The metal used to make the can must be malleable.

This is a property of the metal.

Write down two OTHER properties that the metal used to make fizzy drink cans must have.

1 _____

2 _____ **[2]**

[Total: 6]

9 This question is about paints.

Look at the table. It shows the ingredients of two different paints.

INGREDIENT	PERCENTAGE	
	IN GLOSS PAINT	IN EMULSION PAINT
additives	4	1
binder	52	21
extender	11	21
pigment	23	19
solvent	10	38

(a) Describe TWO differences between this gloss paint and this emulsion paint.

1 _____

2 _____ [2]

(b) Paints are not solutions. They are examples of a colloid.

The solid particles in these colloids are mixed with particles of a liquid.

The particles do not settle at the bottom. Explain why.

_____ [1]

(c) Two processes are involved when an oil paint dries.

The first process is solvent evaporation.

What is the second process?

[1]

(d) Years ago 'glow in the dark' watches used a radioactive substance.

Now a phosphorescent pigment is used.

Suggest why.

[1]

[Total: 5]

SECTION C – MODULE C3

10 This question is about the elements in the Periodic Table.

Look at the diagram. It shows part of the Periodic Table.

		H					
Li	Be						He
Na	Mg						Ne
K	Ca		B	C	N	O	F
			Al	Si	P	S	Cl
							Ar

Answer the questions.

Choose your answers from the symbols shown on this Periodic Table.

Each element can be used ONCE, MORE THAN ONCE or NOT AT ALL.

(a) Write the symbol of the most reactive Group 1 metal SHOWN ABOVE.

[1]

(b) Write the symbol for an element with an atom with SEVEN electrons in its outer shell.

[1]

(c) An atom GAINS TWO electrons to get an outer shell with eight electrons.

Write the symbol for an element with this atom.

[1]

[Total: 3]

11 Iron and copper are transition elements.

(a) Brahim adds a small volume of sodium hydroxide solution to five different solutions.

An insoluble solid called a precipitate is made each time.

Look at the results table. It is not finished.

SOLUTION	FORMULA	COLOUR OF PRECIPITATE MADE
copper chloride	CuCl_2	blue
copper nitrate	$\text{Cu}(\text{NO}_3)_2$	_____
iron(II) chloride	FeCl_2	green
iron(II) sulfate	FeSO_4	green
iron(III) nitrate	$\text{Fe}(\text{NO}_3)_3$	_____

(i) Finish the table.

[2]

(ii) Look at the formulas in the table.

Which formula contains SIX oxygen atoms?

Choose from the table.

[1]

(iii) Solutions of copper chloride and sodium hydroxide react.

Copper hydroxide, Cu(OH)_2 , is made.

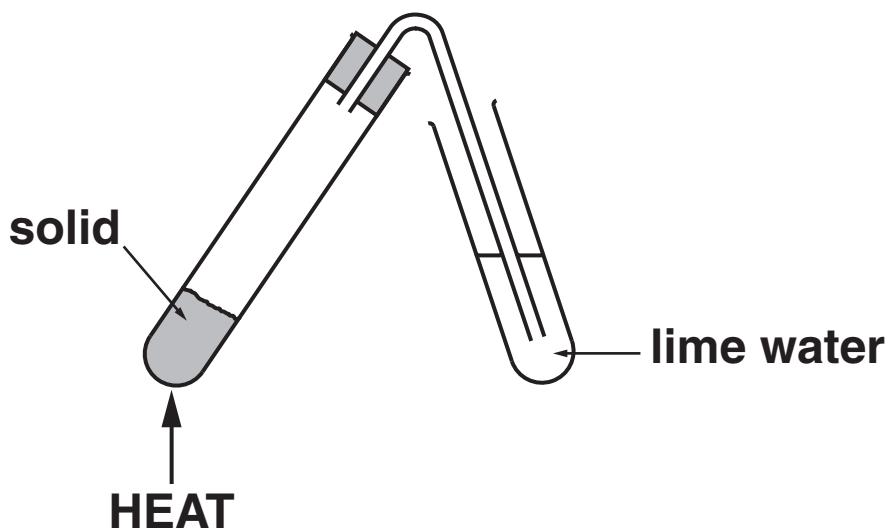
In this reaction copper ions, Cu^{2+} , react with hydroxide ions, OH^- .

Write the BALANCED IONIC equation for this reaction.

[2]

(b) Brahim investigates what happens when he heats some solids.

Look at the apparatus he uses.



Look at the results table.

SOLID	COLOUR CHANGE OF SOLID	EFFECT ON LIME WATER
COPPER CARBONATE	green to black	goes milky
IRON(II) SULFATE	green to brown	stays colourless
POTASSIUM CARBONATE	stays white	stays colourless
ZINC CARBONATE	white to yellow and back to white	goes milky

When heated, copper carbonate, CuCO_3 , makes two products.

What are the names of these two products?

_____ and _____ [1]

[Total: 6]

12 This question is about the elements in Group 7.

These elements are called the halogens.

(a) Look at the table. It shows information about some of the halogens.

ELEMENT	ATOMIC NUMBER	DENSITY IN g/dm ³	MELTING POINT IN °C	ATOMIC RADIUS IN pm
chlorine	17	1.56	-101	99
bromine	35	2.93	-7	114
iodine	53	4.93	114	133

(i) Fluorine is a halogen with an atomic number of 9.

Predict the melting point of fluorine.

answer _____ °C [1]

(ii) Astatine is a halogen with an atomic number of 85.

Predict the atomic radius for astatine.

answer _____ pm [1]

(b) The reactivity of the halogens changes as the atomic number increases.

Describe how.

[1]

(c) Fluorine is bubbled through a solution of potassium iodide.

Predict the NAMES of the TWO products of this reaction.

_____ and _____ [1]

(d) Look at the table. It shows information about two isotopes of chlorine.

	ISOTOPE 1	ISOTOPE 2
atomic number	17	17
mass number	35	37
number of protons	17	17
number of neutrons	18	20

What is an isotope? Use information from the table to help you.

[1]

[Total: 5]

13 This question is about alkali metals and their compounds.

(a) Hannah tests some metal compounds.

She uses the flame test.

Look at Hannah's results.

METAL COMPOUND	COLOUR OF FLAME
potassium chloride	lilac
sodium chloride	yellow
lithium chloride	red

Describe how to do a flame test.

Include a labelled diagram of the apparatus she uses.

[3]

[3]

(b) Sodium chloride is an ionic compound.

Solid sodium chloride does not conduct electricity.

Explain why.

[1]

[1]

(c) Sodium has an electronic structure of 2.8.1.

Oxygen has an electronic structure of 2.6.

Sodium reacts with oxygen to make sodium oxide, Na_2O .

Sodium oxide is an ionic compound.

Draw 'dot and cross' diagrams to show the ions in sodium oxide.

Include the charges on the ions.

[2]

[Total: 6]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	Key																	
7	9	relative atomic mass atomic symbol name atomic (proton) number																	
Li	Be	hydrogen 1																	
Na	Mg	beryllium 4																	
potassium	calcium	40	45	48	51	52	55	56	59	59	63.5	65	70	73	75	79	80	84	84
19	20	Li	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	Kr
Rb	Sr	88	89	91	93	96	[98]	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	Br	Xe	Xe
37	38	potassium	strontium	yttrium	zirconium	niobium	technetium	rhodium	rhodium	palladium	silver	cadmium	indium	tin	antimony	tellurium	iodine	xenon	xenon
Cs	Ba	137	139	178	181	184	190	192	195	197	Hg	Tl	Bi	Po	At	[210]	[222]	Rn	Rn
55	56	caesium	barium	Hf	Ta	W	Os	Ir	Pt	Au	mercury	thallium	lead	bismuth	polonium	astatine	radon	radon	radon
[223]	[226]	[227]	[261]	[262]	[266]	[268]	[277]	[264]	[271]	[268]	[271]	[272]	[271]	[272]	[271]	[271]	[271]	[271]	[271]
Fr	Ra	Ac*	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Roentgenium	darmstadtium	meitnerium	109	110	111	111	111	111
		actinium	rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	darmstadtium	roentgenium									
		89	104	105	106	107	108	109	110	111									
		88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
		87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
		133	137	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
		55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
		113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Li	Be	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* 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.