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)

THURSDAY 4 JUNE 2009: 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

DC (LEO/SW) OV90659 10394/2

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 total number of marks for this paper is 60.**
- **The Periodic Table is printed on the back page.**

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Answer ALL the questions.

SECTION A – MODULE C1

1 The rose is a flower which has a very pleasant smell.

A perfume can be made from the oil in the rose.

The same perfume can be made in a laboratory. The perfume contains an ester.

(a) Colin makes this ester in a laboratory.

He adds an acid to an alcohol. Water is also made in this reaction.

Write down the WORD equation for the making of this ester.

_____ **[1]**

(b) We can smell perfumes easily.

Perfumes have a property that makes them easy to smell.

Which property?

_____ **[1]**

(c) Esters can be used to dissolve coloured nail varnish.

Water does not dissolve coloured nail varnish.

(i) Explain why water does NOT dissolve coloured nail varnish.

Use ideas about attraction between water particles and particles in the nail varnish.

_____

_____ **[1]**

(ii) Suggest why esters do dissolve coloured nail varnish.

_____

_____ **[1]**

[Total: 4]

2 This question is about the burning of fuels.

James and Anita move into a flat.

A gas fire heats a room.

(a) They are advised to increase the flow of air to the fire.

This helps complete combustion of the fuel in the gas fire.

Describe <u>TWO ADVANTAGES OF COMPLETE COMBUSTION</u>.

1 _____

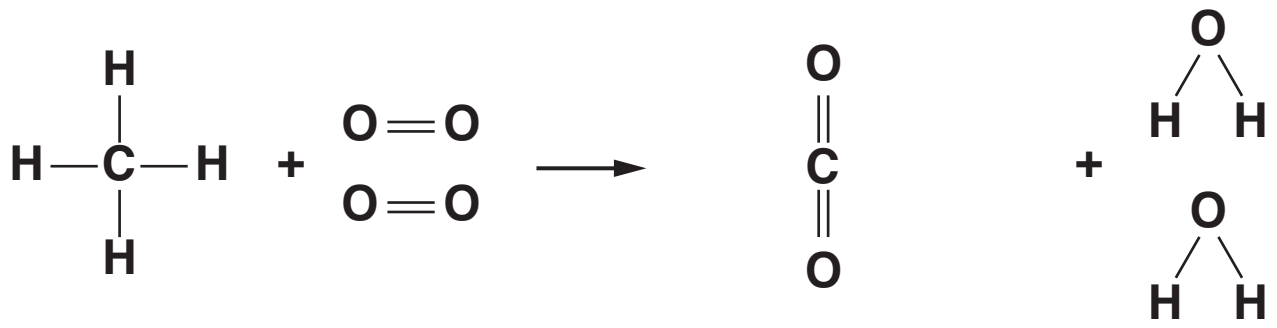
_____

2 _____

_____ **[2]**

(b) The gas fire in James and Anita's flat burns methane gas.

Look at the equations. They show what happens when methane burns.



METHANE + OXYGEN ⟶ CARBON DIOXIDE + WATER

During the reaction, bonds are broken and new bonds are made.

Complete the sentences.

The burning of methane is an exothermic reaction.

Energy is _____ the surroundings.

Breaking bonds is an _____

process. **[2]**

[Total: 4]

3 A special material called Gore-Tex® is used to make many outdoor clothes.

Jill buys a coat made of Gore-Tex®.

Gore-Tex® has a number of useful properties.

Two of these properties are:

- **it is waterproof**
- **it is breathable.**

(a) Describe <u>ONE OTHER</u> useful property of Gore-Tex®.

_____ **[1]**

(b) Jill wears her Gore-Tex® coat when she goes climbing.

Gore-Tex® is breathable.

A breathable coat is very useful for active people like Jill to wear.

Explain why.

_____

_____ **[1]**

(c) Gore-Tex® is made of nylon which has been laminated with a polymer membrane.

The polymer membrane allows the Gore-Tex® to be both waterproof and breathable.

Explain how.

_____

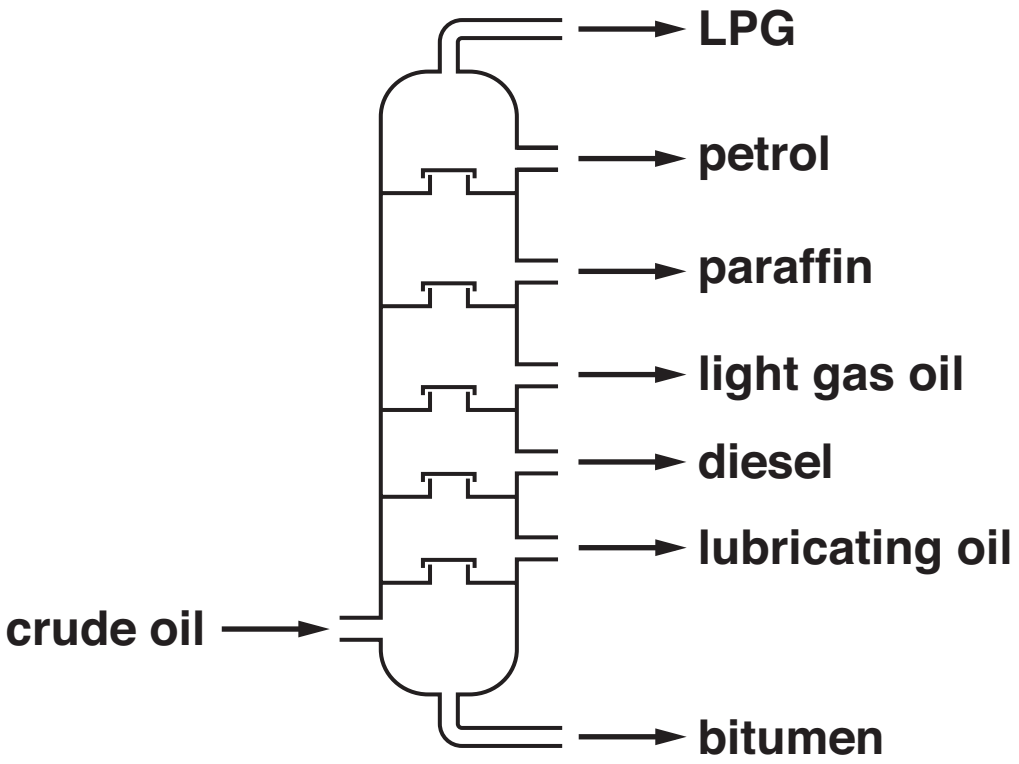
_____

_____ **[2]**

[Total: 4]

4 Crude oil is separated into useful substances by fractional distillation.

Look at the diagram. It shows a fractionating column.



(a) The LPG exits from the top of the fractionating column.

Explain why.

Use ideas about boiling points.

_____

_____ **[1]**

(b) The fractions have different boiling points.

Explain why.

Use ideas about

- **the size of the molecule**
- **the forces between molecules.**

_____

_____

_____ **[2]**

(c) The petrol fraction contains octane, C_8H_{18}.

Octane is a HYDROCARBON.

Explain why.

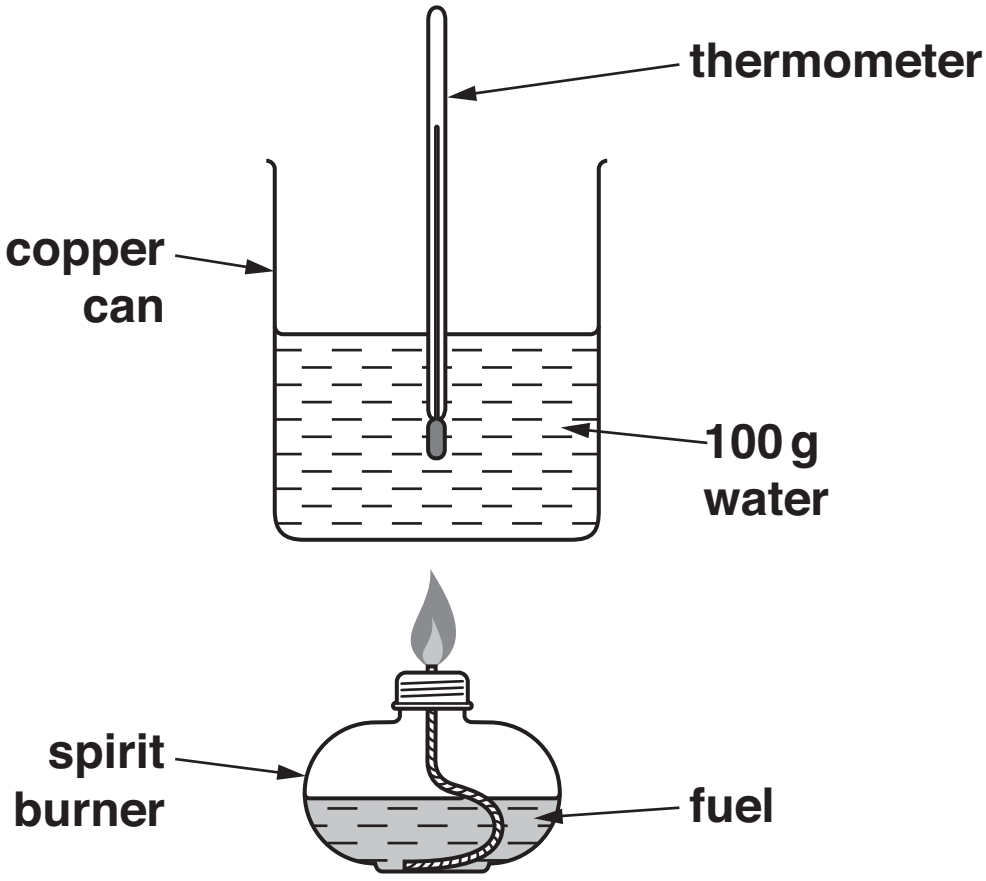
_____

_____ **[2]**

[Total: 5]

5 Michael and Alison investigate fuels.

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



They burn 2.0 grams of each fuel.

The energy is used to heat 100 grams of water.

The temperature of the water is measured before and after heating.

They put their results in a table.

Look at the table.

FUEL	MASS OF FUEL BURNT IN GRAMS	TEMPERATURE BEFORE IN °C	TEMPERATURE AFTER IN °C
A	2.0	20.0	50.0
B	2.0	20.0	72.6
C	2.0	20.0	60.0
D	2.0	20.0	44.5

(a) Which fuel gives out the most energy?

Choose from A, B, C or D.

answer _____ [1]

(b) Calculate the energy released by fuel A.

Use the formula:

energy = mass × specific heat capacity × temperature change

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

_____

_____

answer _____ J [2]

[Total: 3]

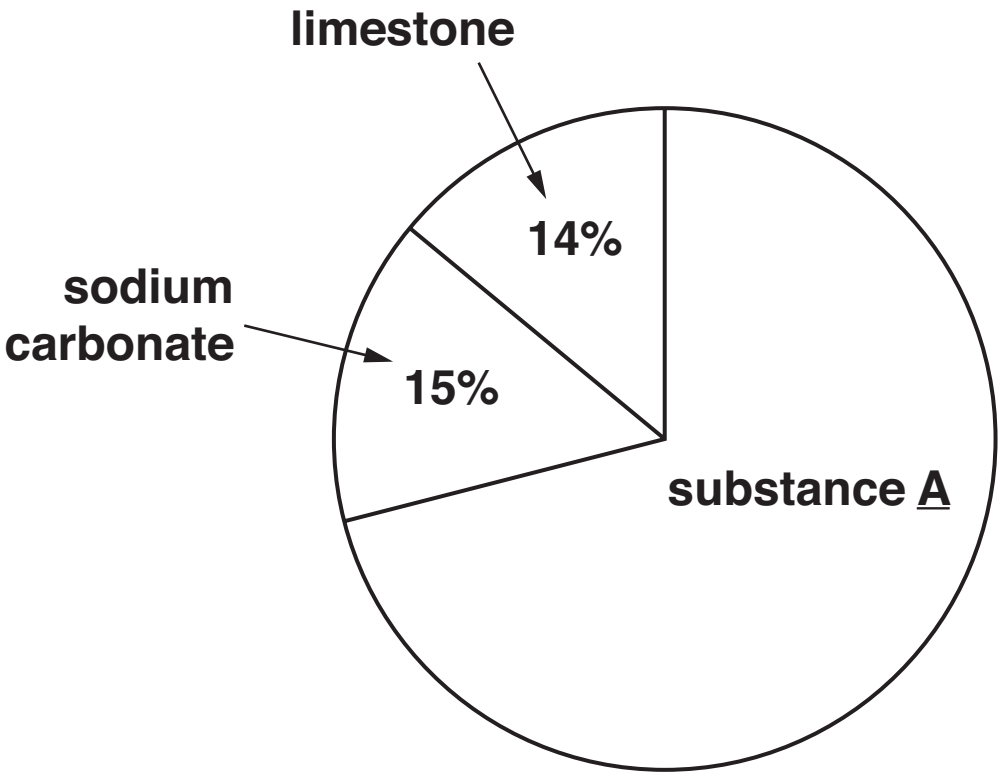
SECTION B – MODULE C2

6 Glass is made by mixing and heating three materials.

(a) Two of them are sodium carbonate and limestone.

Look at the pie chart.

It shows the percentages of different materials used to make one type of glass.



(i) Write down the name of substance A.

_____ **[1]**

(ii) Calculate the percentage of substance A.

_____ **[1]**

(b) The chemical name for limestone is calcium carbonate.

Calcium carbonate is heated strongly.

Calcium oxide and carbon dioxide are made.

Write the WORD equation for this reaction.

_____ **[1]**

(c) Limestone is heated with clay.

A building material is made.

What is the building material called?

Choose your answer from the list.

BRICK

CEMENT

CONCRETE

GRANITE

answer _____ **[1]**

(d) Granite is harder than limestone.

(i) What TYPE of rock is granite?

_____ **[1]**

(ii) What TYPE of rock is limestone?

_____ **[1]**

[Total: 6]

7 Nigel has an old Landrover.

Some of the Landrover is made from aluminium.

(a) Aluminium does not corrode.

Explain why.

_____

_____

_____ **[2]**

(b) Look at the table.

It shows some information about iron and aluminium.

	ALUMINIUM	IRON
density in g/cm^3	2.7	7.9
relative strength	1	2.7
effect of moist air	no corrosion	rusts quickly

(i) Write down one ADVANTAGE of using aluminium to make car bodies.

_____ **[1]**

(ii) Write down one DISADVANTAGE of using aluminium to make car bodies.

_____ **[1]**

(c) European law says that 85% of a car must be able to be recycled.

Give a reason, other than cost, why it is good to recycle parts of a car.

_____

_____

_____ **[1]**

[Total: 5]

8 Look at the table.

It shows the concentration of some gases found in the atmosphere over the last 100 years.

YEAR	CONCENTRATION OF OXIDES OF NITROGEN IN PARTS PER MILLION	CONCENTRATION OF CARBON DIOXIDE IN PARTS PER MILLION
1900	18	300
1920	18	305
1940	20	310
1960	25	320
1980	30	340
2000	35	370

(a) Suggest what the concentration of CARBON DIOXIDE might be in the atmosphere in the year 2020.

concentration _____ parts per million

Explain your answer.

_____

_____ **[1]**

(b) Oxides of nitrogen are pollutants in the air.

Where do the oxides of nitrogen come from?

_____

_____ **[1]**

(c) Sulfur dioxide, SO_2, is another atmospheric pollutant.

It reacts with water and oxygen, O_2, to give dilute sulfuric acid, H_2SO_4.

Write a balanced <u>SYMBOL</u> equation for this reaction.

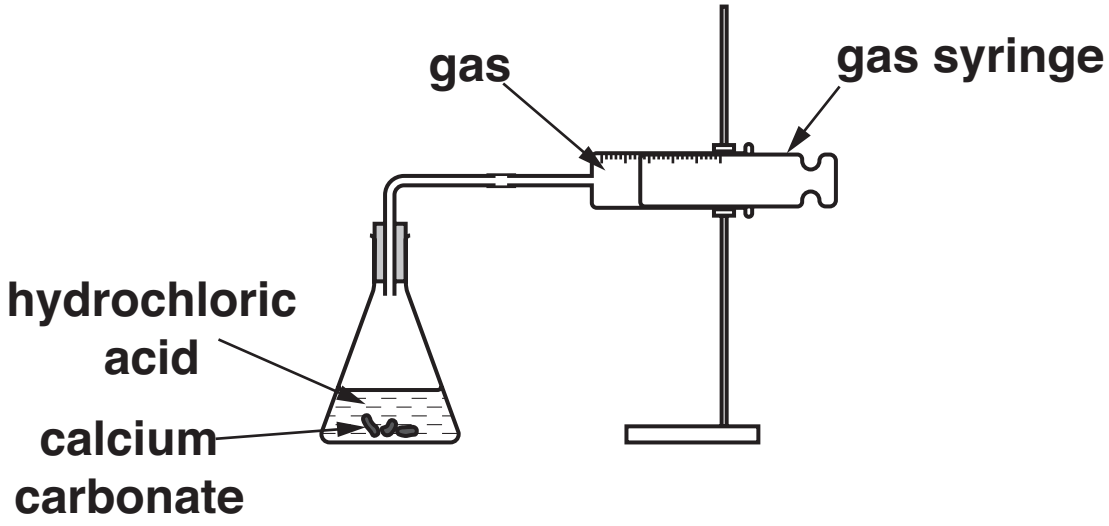
_____ **[2]**

[Total: 4]

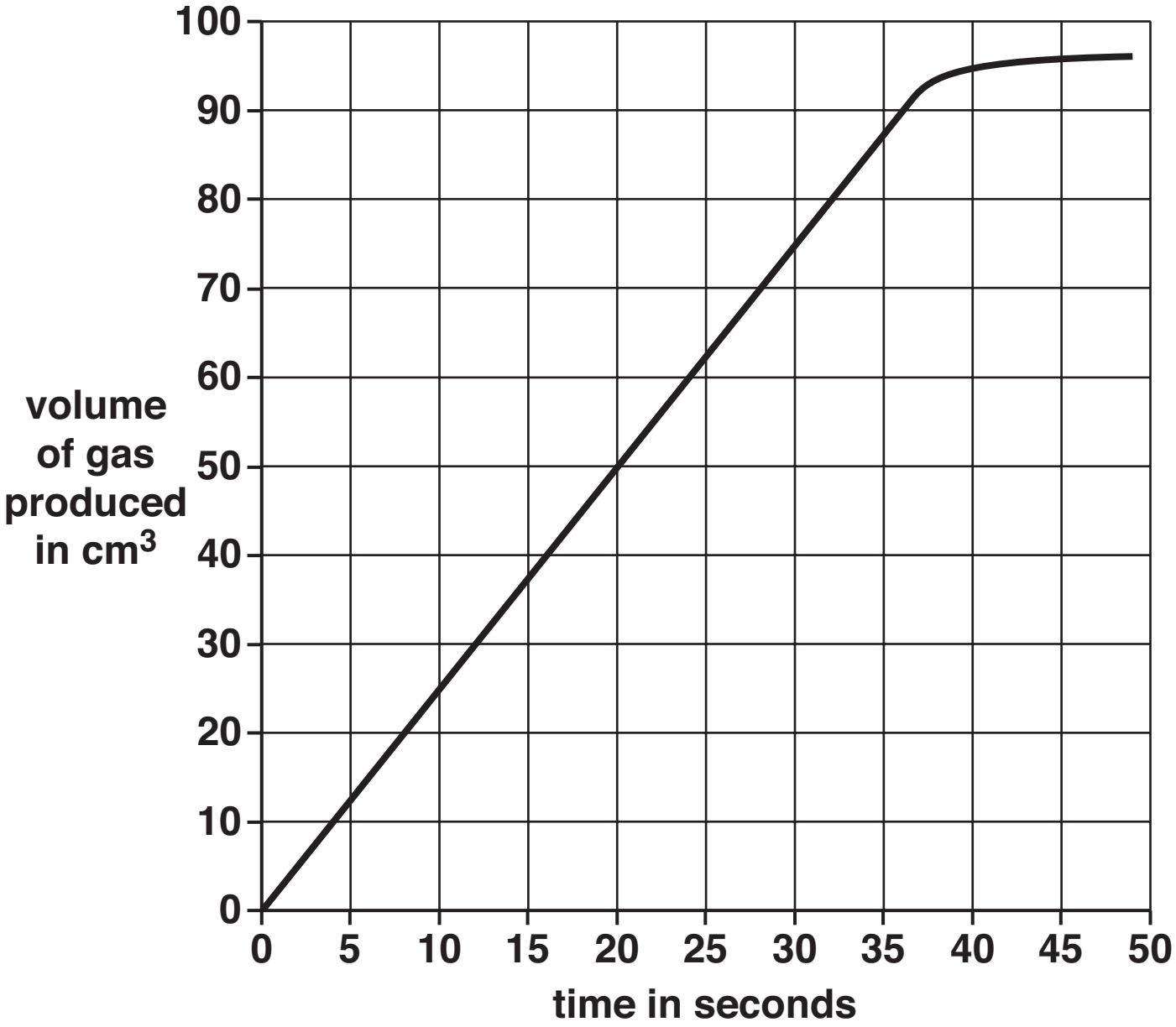
9 John reacts calcium carbonate with hydrochloric acid.

Carbon dioxide gas is made and collected.

The diagram shows the apparatus he uses.



(a) Look at the graph. It shows his results.



Calculate the rate of reaction during the first 30 seconds.

_____

_____

_____

answer _____ cm^3/s [2]

(b) The reaction goes faster at higher temperatures.

Explain why.

Use ideas about collisions between particles.

_____

_____

_____

_____ **[3]**

[Total: 5]

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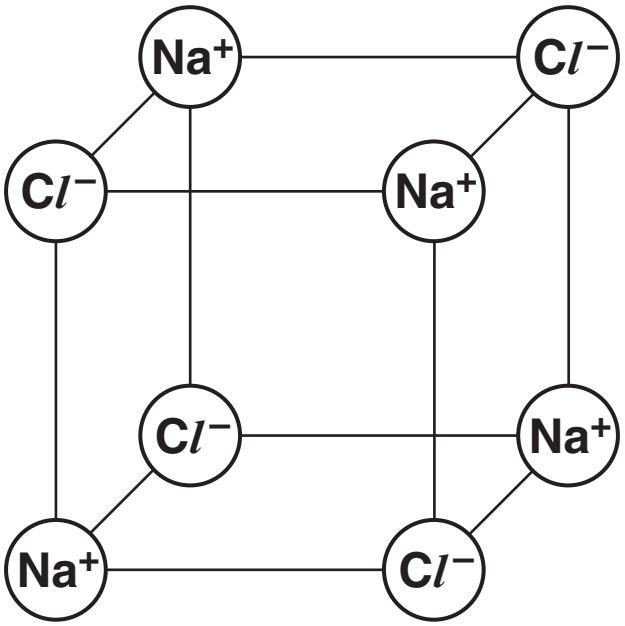
SECTION C – MODULE C3

10 Sodium chloride, NaC*l*, and magnesium oxide, MgO, are both ionic compounds.

(a) Look at the diagram. It shows the giant ionic structure of sodium chloride.



Sodium chloride contains sodium ions, Na^+, and chloride ions, Cl^-.

(i) Sodium ions are made from sodium atoms.

Describe how.

_____ **[1]**

(ii) <u>SOLID</u> sodium chloride does <u>NOT</u> conduct electricity.

Explain why.

_____ **[1]**

(iii) Sodium chloride SOLUTION does conduct electricity.

Explain why.

_____ **[1]**

(b) Draw a 'dot and cross' diagram for magnesium oxide.

The electronic structure for magnesium is 2.8.2 and for oxygen is 2.6.

Include in your answer

- **the electronic structure of the ions formed**
- **the charges on the ions.**

[2]

[Total: 5]

11 Becky investigates some solutions.

She adds sodium hydroxide solution to four different solutions.

Look at her table of results.

SOLUTION	COLOUR OF SOLUTION	EFFECT OF ADDING SODIUM HYDROXIDE SOLUTION
W	orange	yellow solution made
X	colourless	remains a colourless solution
Y	light green	green solid (precipitate) made
Z	blue	blue solid (precipitate) made

(a) Look at the colour of the solutions.

One solution did not contain a compound of a transition element.

Which solution?

Choose from W, X, Y or Z.

answer _____

Explain your answer.

_____

_____ **[1]**

(b) Write down the name or formula of the metal ion found in solution Z.

_____ **[1]**

(c) Becky tests another solution with sodium hydroxide.

This time she gets a red-brown solid.

She knows that the solution must contain Fe^{3+}.

Look at the ionic equation for the reaction that takes place.

It is not balanced.

$$Fe^{3+} + OH^{-} \rightarrow Fe(OH)_3$$

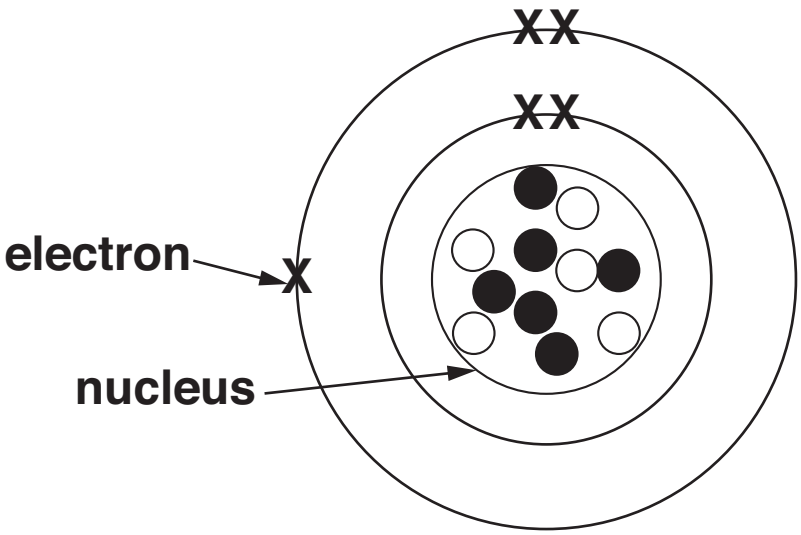
Copy out and balance the equation.

_____ **[1]**

[Total: 3]

12 This question is about atomic structure.

Look at the diagram. It shows the structure of an atom.



○ = a proton

● = a neutron

(a) What is the <u>ATOMIC</u> number of this atom?

_____ **[1]**

(b) What is the <u>MASS</u> number of this atom?

_____ **[1]**

(c) An element is made up of these atoms.

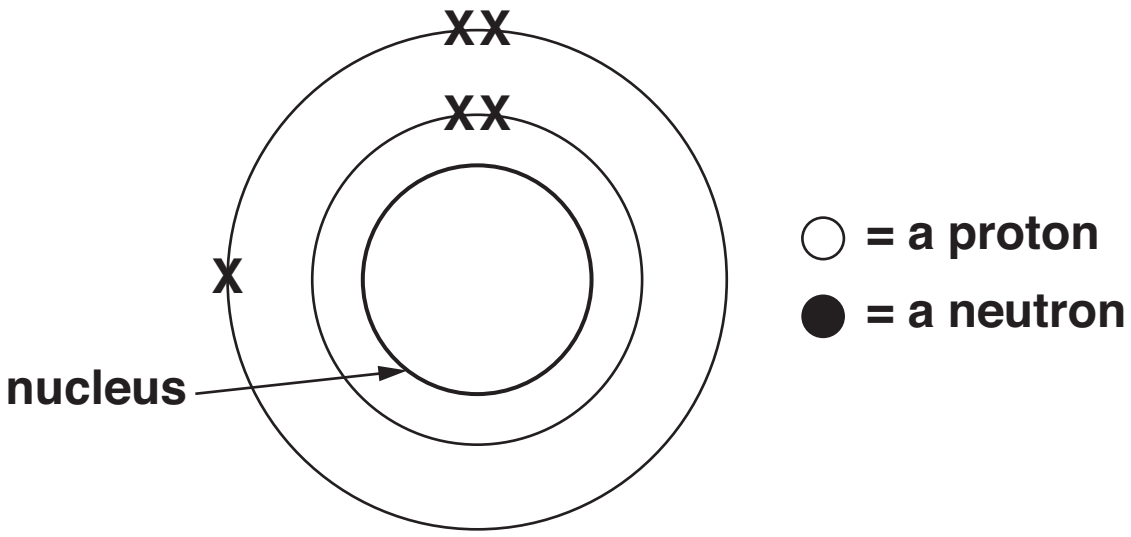
(i) Which <u>GROUP</u> of the Periodic Table is this element in?

_____ **[1]**

(ii) Which <u>PERIOD</u> of the Periodic Table is this element in?

_____ **[1]**

(d) **Finish the diagram to show an isotope of the element opposite.**



[1]

[Total: 5]

13 Sodium is an alkali metal.

It is in Group 1 of the Periodic Table.

Sodium is stored under oil because it reacts with water.

(a) Sodium reacts with cold water.

A colourless gas and an alkaline solution are made.

Look at the balanced symbol equation for this reaction.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

(i) What is the <u>NAME</u> of the colourless gas made?

_____ **[1]**

(ii) What is the <u>NAME</u> of the alkaline solution made?

_____ **[1]**

(b) Francium, Fr, is another alkali metal.

It is at the bottom of Group 1 in the Periodic Table.

It is highly radioactive and so is difficult to investigate in a laboratory.

Predict how francium will react with cold water.

Include in your answer

- **experimental observations**
- **names of products**
- **a balanced SYMBOL equation.**

_____

_____

_____

_____

_____ **[3]**

[Total: 5]

14 This question is about electrolysis.

Look at the table.

It shows the products of some electrolysis reactions.

Finish the table by filling in the gaps.

ELECTROLYTE	PRODUCT MADE AT CATHODE	PRODUCT MADE AT ANODE
molten aluminium oxide	_____	oxygen
dilute sulfuric acid	hydrogen	_____

[2]

[Total: 2]

END OF QUESTION PAPER

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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.