Collins

AQA

GCSE

Chemistry

F

SET A – Paper 2 Foundation Tier

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Materials

Time allowed: 1 hour 45 minutes

For this paper you must have:

- a ruler
- a calculator
- the Periodic Table (found at the end of the paper).

Instructions

- Answer all questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- There are 100 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering question 07.5 you need to make sure that your answer:
  – is clear, logical, sensibly structured
  – fully meets the requirements of the question
  – shows that each separate point or step supports the overall answer.

Advice

- In all calculations, show clearly how you work out your answer.

Name: .....

01.1 Which **one** of the following substances is pure?

Tick **one** box.

Air in a city ☐

Sea water near a factory ☐

Oxygen from a cylinder ☐

Chocolate milkshake ☐

[1 mark]

01.2 Which statement about pure substances is **false**?

Tick **one** box.

A pure substance can be an element or a compound. ☐

Formulations must be pure substances in order to be safe. ☐

Pure substances have specific melting points and boiling points. ☐

A mixture can be pure. ☐

[1 mark]

01.3 Identify the following substances as mixtures or formulations.

Write either M (for mixture) or F (for formulation) in **each** row in **Table 1.1**

Table 1.1

Name of substance	Formulation or mixture
baby food	
rock salt and sand	
cough medicine	
sea water	

[4 marks]

01.4 Which **one** of the following gases is **not** considered to be an atmospheric pollutant produced by the combustion of fuels?

Tick **one** box.

Sulfur dioxide ☐

Carbon monoxide ☐

Oxides of nitrogen ☐

Oxygen ☐

[1 mark]

01.5 Name the two main greenhouse gases.

Greenhouse gas 1. .....

Greenhouse gas 2. ..... **[2 marks]**

Turn over >

02.1 Which list shows the first four members of the **alkanes** in the correct order?

Tick **one** box.

Ethene, propene, butane, pentene ☐

Methane, ethane, propane, butane ☐

Butane, ethane, methane, propane ☐

Butene, ethene, pentene, propene ☐

[1 mark]

02.2 Which statement about alkanes **and** alkenes is **true**?

Tick **one** box.

Alkanes and alkenes are both part of a homologous series. ☐

The general formula for alkanes is C_nH_{2n} and for alkenes is C_nH_{2n+2} ☐

Alkenes are saturated hydrocarbons and alkanes are unsaturated. ☐

Alkanes contain a double bond between C atoms and alkenes don't. ☐

[1 mark]

02.3 Tick **two** boxes that correctly complete the sentence below.

As the size of alkane and alkene molecules **increases**…

…they burn more readily and more completely. ☐

…they can flow less easily and are harder to pour. ☐

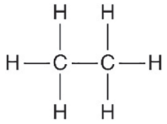
…the boiling point increases. ☐

…the flammability increases. ☐

[2 marks]

02.4 Which of the following is an **alkene**?

Tick **one** box.



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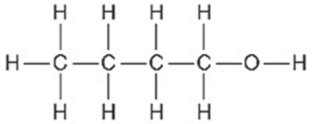

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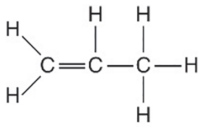

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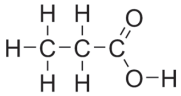


☐

[1 mark]

02.5 Complete the following sentences about **fractional distillation**.

Use the correct words from the grid.

compound	**melting**	**cool**	**mixture**	**boiling**
melt	**evaporate**	**freeze**	**condense**	**solidify**

Crude oil is a ..... of hydrocarbons.

This means it can be separated into fractions.

The fractions have different ..... points.

Heating the crude oil causes the fractions to .....

As they move up the fractionating column, they .....
and .....

[5 marks]

Turn over >

03.1 Which statement about the reactions of organic molecules is **false**?

Tick **one** box.

Alkanes and alkenes are both very reactive. ☐

Ethanol and ethane burn to make carbon dioxide and water. ☐

Hydrogen and halogens can be added to alkenes. ☐

Ethanoic acid reacts with carbonates to make carbon dioxide. ☐

[1 mark]

03.2 What is the product when hydrogen reacts with propene?

Tick **one** box.

Propanol ☐

Propanoic acid ☐

Propyl propanoate ☐

Propane ☐

[1 mark]

03.3 Which **two** statements about cracking are true?

Tick **two** boxes.

Steam cracking takes place at a higher temperature than catalytic cracking. ☐

More alkenes are produced in steam cracking than catalytic cracking. ☐

More alkenes are produced in catalytic cracking than steam cracking. ☐

Steam cracking and catalytic cracking require high operating pressures. ☐

[2 marks]

03.4 Describe the test that can show whether a substance is propane or propene.

Include the expected results for each substance.

Test .....

Expected results .....

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

03.5 Complete the symbol equation for the cracking of dodecane ($C_{12}H_{26}$).

$$C_{12}H_{26} \rightarrow C_3H_6 + C_4H_8 + C\ldots H\ldots$$

[2 marks]

03.6 Ethanol can be manufactured by reacting steam (H_2O) with a hydrocarbon.

What is the name of the hydrocarbon?

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

03.7 Ethanol can also be produced by fermentation of sugar solution.

Draw **two** lines from **each** process to the **two** conditions required to carry it out.

Process	Condition
	high temperature and pressure
fermentation	low temperature and pressure
adding water to a hydrocarbon	anaerobic
	addition of a metal catalyst

[2 marks]

Turn over >

04.1 Which **one** of the following statements about the factors affecting the rate of reaction is **true**?

Tick **one** box.

The rate of reaction is faster with a lower temperature. ☐

The rate of reaction is faster with a higher concentration. ☐

The rate of reaction is slower with a catalyst. ☐

The rate of reaction is faster with a lower pressure. ☐

[1 mark]

04.2 Which one of the following is **not** a unit for rate of reaction?

Tick **one** box.

g/s ☐

cm^3/s ☐

kg/hr ☐

m/s ☐

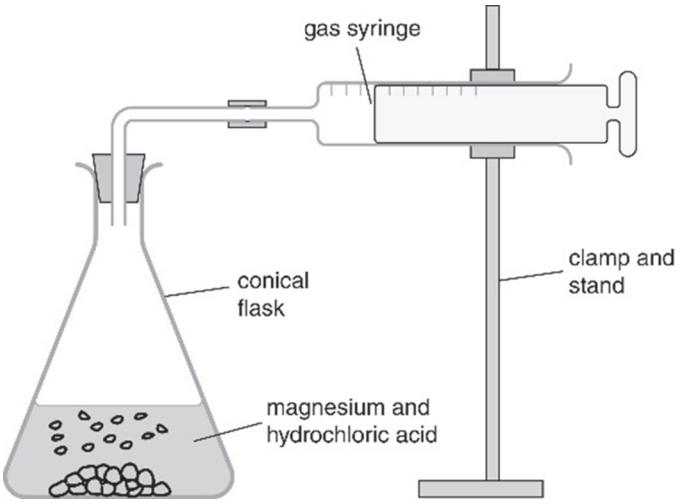
[1 mark]

04.3 A student investigated the rate of the following reaction:

magnesium + hydrochloric acid → magnesium chloride + hydrogen

The student used apparatus as shown in **Figure 4.1**

Figure 4.1



How could the mean rate of reaction of the complete reaction be measured most accurately?

Tick **one** box.

Measure the total volume of hydrogen in the gas syringe and divide by the time taken to make it. ☐

Measure the time taken for the bubbles of hydrogen to stop being made. ☐

Measure the time taken for the magnesium to completely react and dissolve. ☐

Measure the time taken for 10 cm^3 of hydrogen to be made, and divide by the time taken to make the 10 cm^3 of hydrogen. ☐

[1 mark]

Question 4 continues on the next page

04.4 The rate of reaction was measured for different concentrations of acid.

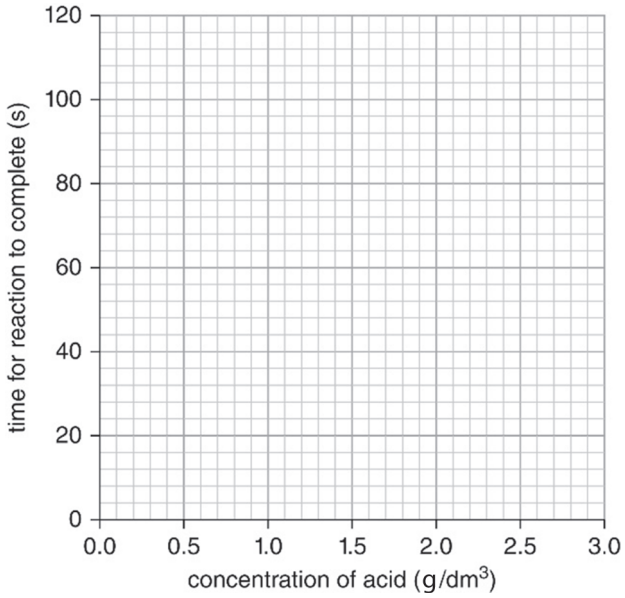
Table 4.1 shows the results.

Table 4.1

Time for the reaction to complete (s)	Concentration of acid (g / dm^3)
120	0.5
100	1.0
50	1.5
25	2.0
18	2.5
15	3.0

On the grid below:

- Plot these results
- Draw a line of best fit
- Highlight any anomalous points



[3 marks]

04.5 The total volume of hydrogen produced in each reaction was 900 cm^3

Calculate the rate of reaction at the **highest** concentration in **Table 4.1**

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{total volume of hydrogen made } (cm^3)}{\text{time taken (s)}}$$

Mean rate of reaction = ... cm^3/s **[2 marks]**

04.6 Describe how the rate of reaction changes with concentration.

Use the data in **Table 4.1** and/or your graph.

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

04.7 Explain why the rate changes with increasing concentration.

Use your knowledge of particles and collisions.

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

Turn over >

05.1 Draw **one** line from each gas to the test used to identify it.

Gas	Test and result
	bubble gas through limewater; limewater will turn cloudy
hydrogen	its volume at 100 °C is less than its volume at 20 °C
chlorine	insert glowing splint; splint will relight
oxygen	conducts electricity
carbon dioxide	place damp litmus into the gas; litmus will turn white
	insert burning splint; a pop sound is heard

[4 marks]

05.2 An unknown metal salt was added to sodium hydroxide solution.

A blue precipitate was observed.

The unknown metal salt produced a green flame.

Name the metal ion in the unknown metal salt.

Include its charge.

.....

[1 mark]

05.3 The unknown metal salt is a sulfate.

Describe a suitable test to show whether sulfate ions are present.

Include the expected result if sulfate ions are present.

Test .....

.....

Expected result ..... **[2 marks]**

05.4 **Table 5.1** shows the results of tests on two salts.

Table 5.1

	Test and result			
Salt	**Flame test**	**Add acidified barium chloride**	**Add acidified silver nitrate**	**Add sodium hydroxide solution**
A	crimson flame	no change	cream precipitate	no result
B	unclear	white precipitate	no result	brown precipitate

Analyse and interpret the results to identify the cations (metal ions) and anions (non-metal ions) in each salt.

Cation in salt A .....

Anion in salt A .....

Cation in salt B .....

Anion in salt B ..... **[4 marks]**

05.5 Give three reasons why **instrumental** methods of chemical detection are preferred to **chemical** methods.

.....

.....

.....

.....

.....

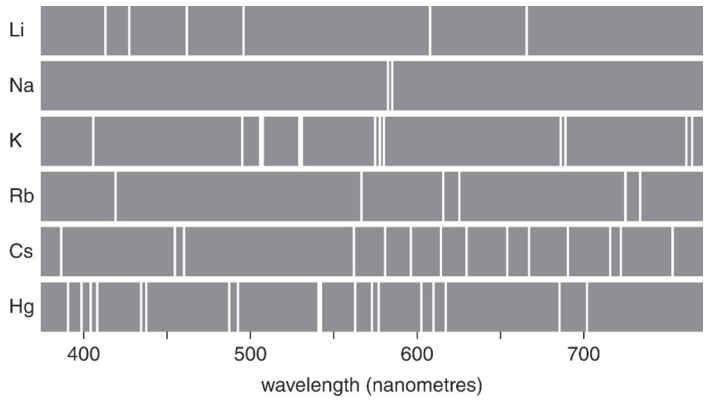
..... **[3 marks]**

Question 5 continues on the next page

05.6 Flame emission spectroscopy can be used to analyse metal ions in solution.

Figure 5.1 shows the results from a flame emission analysis of different elements.

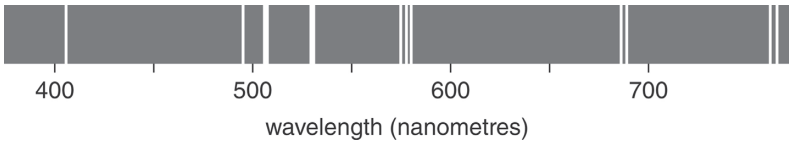
Figure 5.1



An unknown salt was analysed using flame emission spectroscopy.

The result for the salt is shown in **Figure 5.2**

Figure 5.2



Compare **Figure 5.1** and **Figure 5.2**

What conclusion can you draw?

Explain your answer.

.....

.....

[2 marks]

06 **Table 6.1** shows the composition of gases in the early atmosphere and the composition of gases in the atmosphere today.

Table 6.1

Name of gas	Composition in early atmosphere (%)	Composition in atmosphere today (%)
carbon dioxide	98	0.04
oxygen	0	20
nitrogen	0	80
ammonia	small amounts	none
methane	small amounts	small amounts
water	variable	variable

06.1 Describe **three** differences between the gases in the early atmosphere and the gases in the atmosphere today.

.....

.....

.....

.....

.....

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

Question 6 continues on the next page

06.2 Carbon dioxide levels have changed between the early atmosphere and the present atmosphere.

Describe **two** different processes that account for these changes.

Explain why each of them has caused the change.

[4 marks]

06.3 Oxygen in the atmosphere is produced by only one process.

Write a balanced symbol equation for this process.

[2 marks]

06.4 Describe **two** of the effects of the recent increase in average global temperature.

[2 marks]

06.5 Describe **four** possible actions that could be taken to reduce the emissions of greenhouse gases.

Explain why each of these actions would lead to a reduction.

[4 marks]

07.1 What is the difference between **potable** water and **pure** water?

.....

.....

[1 mark]

07.2 Two rivers, A and B, were considered as possible sources of drinking water.

Water samples from both rivers were analysed to test if they were potable.

The data from both rivers are given in **Table 7.1**, alongside data for recommended safe drinking water quality.

Table 7.1

		Maximum recommended level	River A	River B
	hardness	1500 mg/l	1000 mg/l	3000 mg/l
Ion concentration (mg/l)	**chloride**	500	12 800	500
	sulfate	1000	1	1
	iron	50	20	30
	magnesium	200	150	150
	sodium	500	3000	500
	nitrate	50	20	20
	pH value	6.0–8.5	5.5	7.0

Which of the two rivers would be most appropriate to use as a source for potential potable water?

Give **three** reasons for your answer.

Use the data in **Table 7.1**

River .....

Reasons .....

.....

.....

.....

.....

.....

.....

.....

[4 marks]

07.3 What are the **two** water treatment processes used to treat water from **all** potential water sources?

[2 marks]

07.4 Explain why ozone may be added to produce potable water.

[2 marks]

Question 7 continues on the next page

07.5 Potable water can be produced either from seawater or from groundwater.

Compare the similarities and differences in the processes involved to obtain potable water from each of these sources.

[6 marks]

08 Ammonia is produced using this reaction:

nitrogen + hydrogen $\rightleftharpoons$ ammonia

08.1 What does the $\rightleftharpoons$ sign mean?

.....

[1 mark]

08.2 If the reaction is exothermic in the forward direction, what can you say about the reverse direction?

.....

[1 mark]

08.3 Describe the conditions used industrially for the reaction above.

.....

.....

.....

.....

[3 marks]

08.4 NPK fertilisers are produced from different raw materials.

Name the **two** substances that are needed to make **ammonium phosphate** using a neutralisation reaction.

.....

.....

.....

[2 marks]

Question 8 continues on the next page

08.5 NPK fertilisers are formulations of various salts containing appropriate percentages of the elements.

The salts contain three important elements.

State the names of these elements.

.....

[2 marks]

08.6 Phosphate rock contains calcium phosphate.

When treated with nitric acid the products are a weak acid and a salt of a strong acid.

The weak acid is reacted with ammonium hydroxide to produce ammonium phosphate, a soluble salt that is used as a fertiliser.

Write two word equations to show these two reactions which lead to the production of ammonium phosphate.

.....

.....

.....

.....

.....

.....

[4 marks]

END OF QUESTIONS

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Key

Metals

Non-metals

Relative atomic mass — 1
Atomic symbol — H
Name — hydrogen
Atomic/proton number — 1

1	2											3	4	5	6	7	0 or 8
																	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	[285] **Cn** copernicium 112	[286] **Uut** ununtrium 113	[289] **Fl** flerovium 114	[289] **Uup** ununpentium 115	[293] **Lv** livermorium 116	[294] **Uus** ununseptium 117	[294] **Uuo** ununoctium 118

*The lanthanides (atomic numbers 58–71) and the actinides (atomic numbers 90–103) have been omitted.

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