

Please write clearly in block capitals.

H

Centre number

Candidate
number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier Chemistry Paper 2

Practice Paper Series – Set 1

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (printed at the back of this booklet).

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- 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 01.2 you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully developed
 - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

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sciencegcse.co.uk | Practice Paper Series – Set 1 | SGC/S1/C/2H

0 1 Shopping bags can be made from plastic (poly(ethene)) or from paper.
Scientists carried out a life cycle assessment (LCA) of the two types of bag.

0 1 . 1 What is a life cycle assessment? [1 mark]

.....

.....

Table 1 shows some of the information the scientists collected. The values are for 1000 bags of each type.

Table 1

	Plastic bags	Paper bags
Raw material	crude oil	trees (wood)
Energy used to make the bags in MJ	500	2600
Water used to make the bags in dm ³	60	1100
Mass of 1000 bags in kg	7	55
Number of times each bag is used before disposal	2 to 4	1 to 2
Time taken to break down in landfill	hundreds of years	a few months

0 1 . 2 Evaluate the environmental impact of plastic bags compared with paper bags. [6 marks]

Use **Table 1** and your own knowledge.

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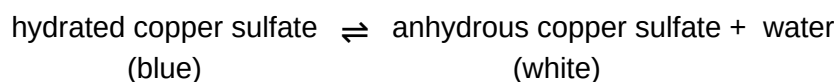
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- 02 When blue copper sulfate crystals are heated, they turn white and water is given off.
The reaction is reversible.



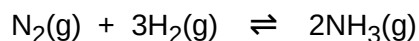
- 02.1 What is meant by a **reversible** reaction? [1 mark]

- 02.2 The reaction that takes place when the crystals are heated is endothermic. [2 marks]

Water is then added to the white anhydrous copper sulfate.

Compare the energy change for this reverse reaction with the energy change when the crystals are heated.

Ammonia is made from nitrogen and hydrogen in a reversible reaction.



The reaction is carried out in a closed container and reaches equilibrium.

0 2 . 3 What is meant by **equilibrium**? [2 marks]

0 2 . 4 A catalyst is used in the reaction. [2 marks]
Explain how a catalyst increases the rate of a reaction.

0 3 A student used paper chromatography to find out which dyes are in a green food colouring, **G**.

The student compared **G** with four dyes, **P**, **Q**, **R** and **S**.

0 3 . 1 The start line was drawn in pencil. [1 mark]
Give the reason why.

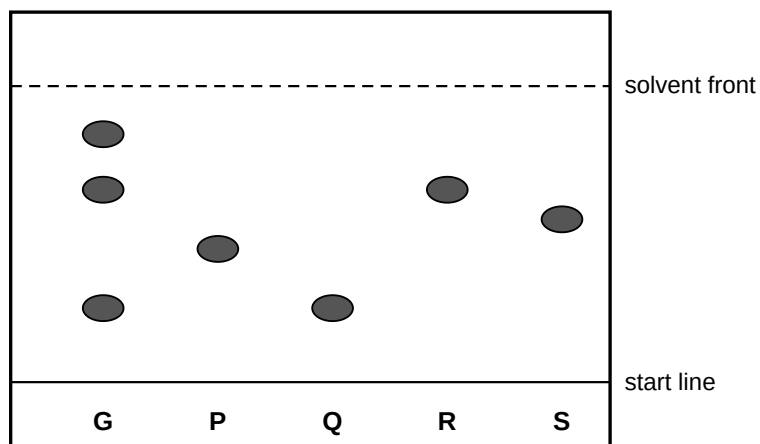
0 3 . 2 Explain how paper chromatography separates the dyes in **G**. [2 marks]

Question 3 continues on the next page

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Figure 1 shows the chromatogram.

Figure 1



Not to scale

0 3 . 3 Which **two** of the dyes **P**, **Q**, **R** and **S** are in **G**? [1 mark]

..... and

0 3 . 4 The solvent front moved 8.0 cm from the start line. [2 marks]

The top spot in **G** moved 6.7 cm from the start line.

Calculate the R_f value of this spot.

Give your answer to 2 significant figures.

R_f = ...

0 3 . 5 What does the top spot in **G** show about the food colouring? [1 mark]

.....
.....

0 3 . 6 The student repeated the chromatography of dye **P** with two other [1 mark]

solvents. Dye **P** produced a single spot each time.

What does this show about dye **P**?

.....

Turn over for the next question

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0 4 Carbon dioxide and methane are greenhouse gases.

0 4 . 1 Explain how greenhouse gases in the atmosphere keep the Earth warm. [3 marks]

Use ideas about radiation in your answer.

0 4 . 2 Give **one** human activity that increases the amount of methane in the atmosphere. [1 mark]

0 4 . 3 A car emits 120 g of carbon dioxide for each kilometre it travels. [2 marks]

The car travels 12 000 km in one year.

Calculate the mass of carbon dioxide emitted by the car in one year.

Give your answer in tonnes.

1 tonne = 1 000 000 g

Mass of carbon dioxide = _____ tonnes

0 4 . 4 Give **two** reasons why actions to reduce carbon dioxide emissions may be limited. [2 marks]

1

2

Turn over for the next question

Do not write outside the box

- 0 5** Nitrogen dioxide, NO_2 , is a brown gas. Dinitrogen tetroxide, N_2O_4 , is a colourless gas. In a sealed container the two gases reach equilibrium.

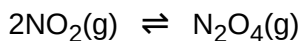


Table 2 shows the percentage of N_2O_4 in the equilibrium mixture at different temperatures. The pressure was the same each time.

Table 2

Temperature in $^{\circ}\text{C}$	25	50	75	100
Percentage of N_2O_4 in the mixture	68	40	17	6

- 0 5 . 1** Is the forward reaction exothermic or endothermic? [3 marks]
 Explain your answer.
 Use **Table 2**.

- 0 5 . 2** A sealed tube containing the equilibrium mixture at 25°C is put into iced water. [2 marks]
 Predict how the colour of the mixture changes.
 Explain your prediction.

- 0 5 . 3** The mixture is put into a gas syringe and compressed, so that the pressure increases. The temperature does not change. [2 marks]
 Explain what happens to the amount of NO_2 in the equilibrium mixture.

06

A student investigated how the concentration of hydrochloric acid affects the rate of its reaction with calcium carbonate.



This is the method used.

1. Put 0.25 g of calcium carbonate into a conical flask.
2. Add 50 cm³ of 1.0 mol/dm³ hydrochloric acid and immediately connect a gas syringe.
3. Record the volume of gas in the gas syringe every 10 seconds.
4. Repeat steps 1 to 3 using 50 cm³ of 0.5 mol/dm³ hydrochloric acid.

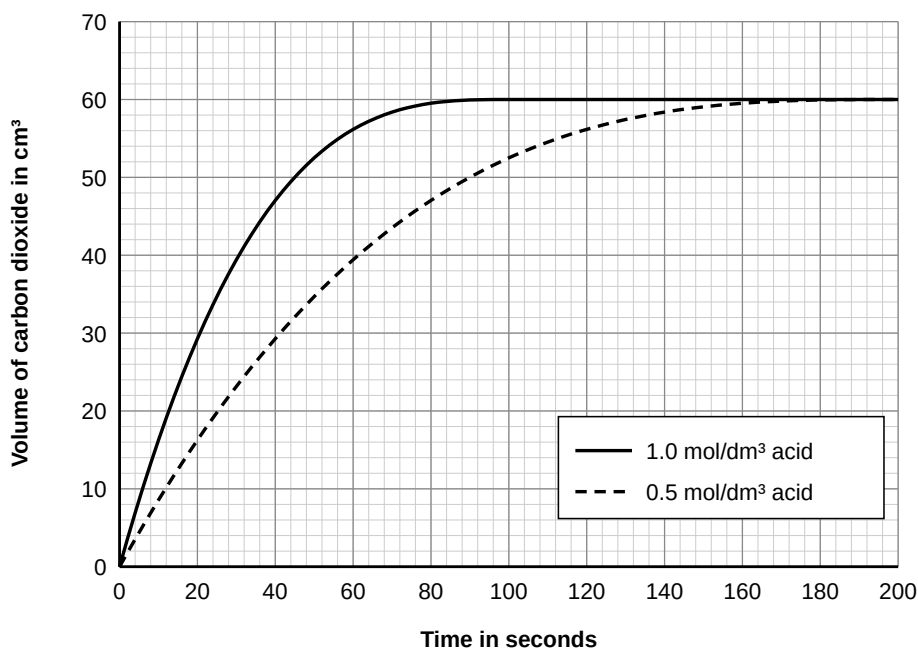
The hydrochloric acid was in excess in both experiments.

06.1

Give **one** variable, other than the mass of calcium carbonate and the volume of acid, that the student should control. [1 mark]

Figure 2 shows the results.

Figure 2



06.2

Determine the rate of reaction at 20 seconds with the 1.0 mol/dm³ acid. [3 marks]

Show your working on **Figure 2**.

Rate of reaction = ... cm³/s

Do not write outside the box

06.3

The student concluded:

[2 marks]

'Doubling the concentration of the acid doubles the rate of reaction.'

Use the time taken to produce 30 cm^3 of gas in each experiment to evaluate this conclusion.

06.4

The 0.25 g of calcium carbonate reacted completely with the 1.0 mol/dm^3 acid in 100 seconds.

[3 marks]

Calculate the mean rate of this reaction in mol/s .

Relative formula mass (M_r): $\text{CaCO}_3 = 100$

Give your answer in standard form.

Mean rate of reaction = _____ mol/s

06.5

Explain why the rate of reaction was greater with the 1.0 mol/dm^3 acid. [2 marks]

Answer in terms of particles.

06.6

Explain why the final volume of gas was the same in both experiments. [1 mark]

Turn over for the next question

07 This question is about obtaining water and metals.

Waste water from homes is treated before it is returned to rivers. The first stage is screening and grit removal.

07.1 Describe the other stages in the treatment of waste water. [3 marks]

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07.2 Drinking water is sterilised with chlorine. [2 marks]

Describe the test for chlorine gas.

Give the result of the test.

Test

Result

The Earth's resources of copper ores are limited. Copper compounds can be obtained from low-grade ores by phytomining or by bioleaching.

07.3 Describe how phytomining is used to obtain copper compounds. [2 marks]

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.....

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.....

07.4 Describe how bioleaching is used to obtain copper compounds. [1 mark]

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.....

07.5 Copper can be obtained from a solution of a copper compound by adding scrap iron. [1 mark]

Explain why.

.....

.....

07.6

A low-grade ore contains 0.25% copper by mass.

[2 marks]

Calculate the mass of ore that contains 1.0 tonne of copper.

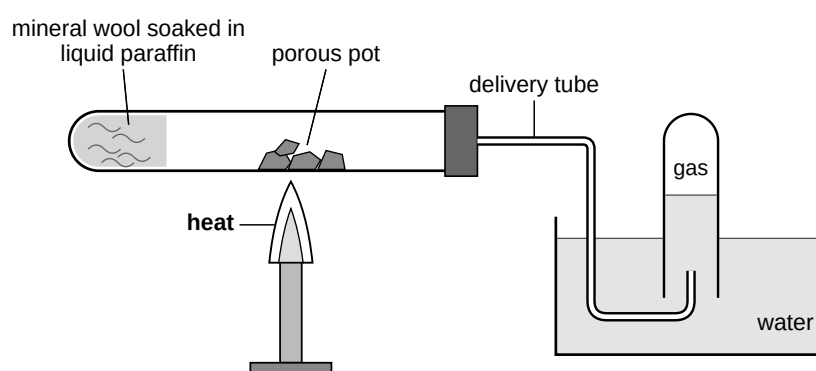
Mass of ore = ... tonnes

08

Liquid paraffin is a mixture of alkanes.

A teacher cracked liquid paraffin in the laboratory. **Figure 3** shows the apparatus.

Figure 3



08.1

What is the purpose of the porous pot?

[1 mark]

08.2

At the end of the experiment, the teacher removed the delivery tube from the water before stopping heating.

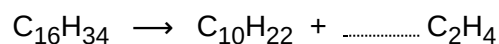
[2 marks]

Explain why.

08.3

One reaction that happens is:

[1 mark]



Complete the equation.

Question 8 continues on the next page

Oil companies crack some of the fractions from crude oil.

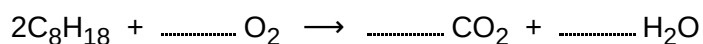
Table 3 shows the supply of some fractions from crude oil and the demand for them.

Table 3

Fraction	Supply from crude oil in %	Demand in %
Refinery gases	5	8
Petrol	20	34
Diesel oil	21	24
Fuel oil and bitumen	54	34

- 0 8 . 4** Explain why oil companies crack the fuel oil and bitumen fraction. [2 marks]
Use data from **Table 3**.

- 0 8 . 5** Octane, C_8H_{18} , is one of the alkanes in petrol. [2 marks]
Complete the balanced equation for the complete combustion of octane.



- 0 8 . 6** When petrol burns in a car engine, some carbon monoxide is produced. [2 marks]
Explain why carbon monoxide is dangerous.

END OF QUESTIONS

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Additional page, if required.

Write the question numbers in the left-hand margin.

Handwriting practice area with 25 horizontal dotted lines.

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Additional page, if required.

Write the question numbers in the left-hand margin.

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There are no questions printed on this page

There are no more questions in this paper. Original practice paper © sciencegcse.co.uk – free to use for non-commercial education. Not an AQA paper.

The Periodic Table of Elements

1	2											3	4	5	6	7	0
relative atomic mass atomic symbol name atomic (proton) number Key												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	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

* The lanthanides (atomic numbers 58–71) and the actinides (atomic numbers 90–103) have been omitted. Relative atomic masses for Cu and Cl have not been rounded to the nearest whole number.