

Please write clearly in block capitals.

H

Centre number

Candidate
number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

CHEMISTRY

Higher Tier Paper 2

Practice Paper Series – Set 1

Time allowed: 1 hour 45 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 100.
- 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 questions 05.4 and 07.4 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	
9	
10	
TOTAL	

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

- 0 1** Scientists have suggested different theories about the Earth's early atmosphere. One theory suggests that the early atmosphere was like the atmosphere of Mars today.

Table 1 shows the composition of the early atmosphere suggested by this theory and the composition of the atmosphere today.

Table 1

Gas	Percentage in the early atmosphere	Percentage in the atmosphere today
Carbon dioxide	95	0.04
Nitrogen	3	78
Oxygen	0	21
Other gases	2	1

- 0 1 . 1** Describe how the composition of the atmosphere has changed. [2 marks]
Use **Table 1**.

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- 0 1 . 2** The oceans formed when water vapour from volcanoes condensed. [2 marks]
Explain how the formation of the oceans reduced the percentage of carbon dioxide in the atmosphere.

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- 0 1 . 3** Explain how the formation of coal reduced the amount of carbon dioxide in the atmosphere. [2 marks]

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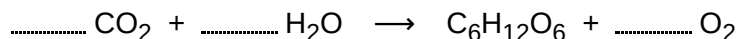
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- 01.4** Algae and plants produced the oxygen in the atmosphere by photosynthesis. [1 mark]

Balance the equation for photosynthesis.



- 01.5** Calculate the mass of oxygen produced when 66 g of carbon dioxide is used in photosynthesis. [3 marks]

Relative atomic masses (A_r): C = 12 O = 16

Mass of oxygen = ... g

- 02** 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**.

- 02.1** The start line was drawn in pencil. [1 mark]
Give the reason why.

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- 02.2** Explain how paper chromatography separates the dyes in **G**. [2 marks]

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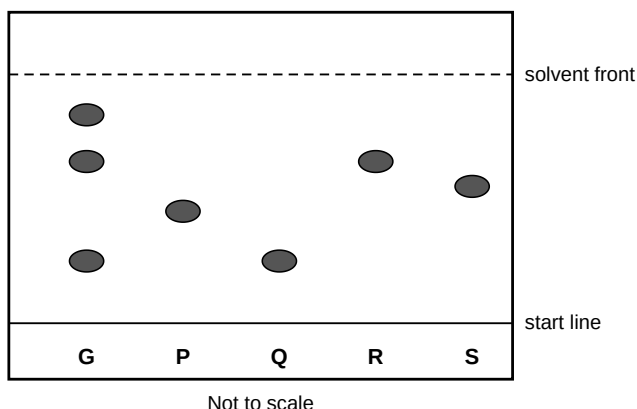
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Question 2 continues on the next page

Figure 1 shows the chromatogram.

Figure 1



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0 2 . 3 Which **two** of the dyes **P**, **Q**, **R** and **S** are in **G**? [1 mark]

..... and

0 2 . 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 2 . 5 What does the top spot in **G** show about the food colouring? [1 mark]

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.....

0 2 . 6 The student repeated the chromatography of dye **P** with two other [1 mark]

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

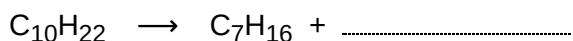
What does this show about dye **P**?

.....

0 3 Propene, C_3H_6 , is an alkene.

0 3 . 1 Propene can be produced by cracking decane. [1 mark]

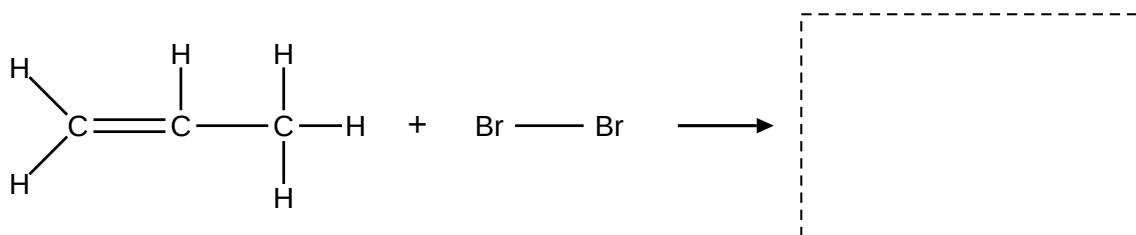
Complete the equation for this reaction.



Propene reacts with bromine.

Figure 2 shows the displayed formulae of the reactants.

Figure 2



0 3 . 2 Complete **Figure 2** to show the displayed formula of the product. [2 marks]

0 3 . 3 Propene reacts with hydrogen in the presence of a catalyst. [1 mark]
Give the formula of the product.

Formula = ...

Propanoic acid, $\text{C}_2\text{H}_5\text{COOH}$, is a carboxylic acid.

0 3 . 4 A 0.1 mol/dm^3 solution of propanoic acid has a pH of 2.9 [3 marks]
A 0.1 mol/dm^3 solution of hydrochloric acid has a pH of 1.0
Explain why the pH values are different.

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0 3 . 5 Propanoic acid reacts with sodium carbonate. [1 mark]
Name the salt produced.

.....

0 3 . 6 Ethyl ethanoate is an ester. [2 marks]
Name the **two** substances that react to produce ethyl ethanoate **and**
give the type of catalyst used.

Substances and

Catalyst

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04

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.

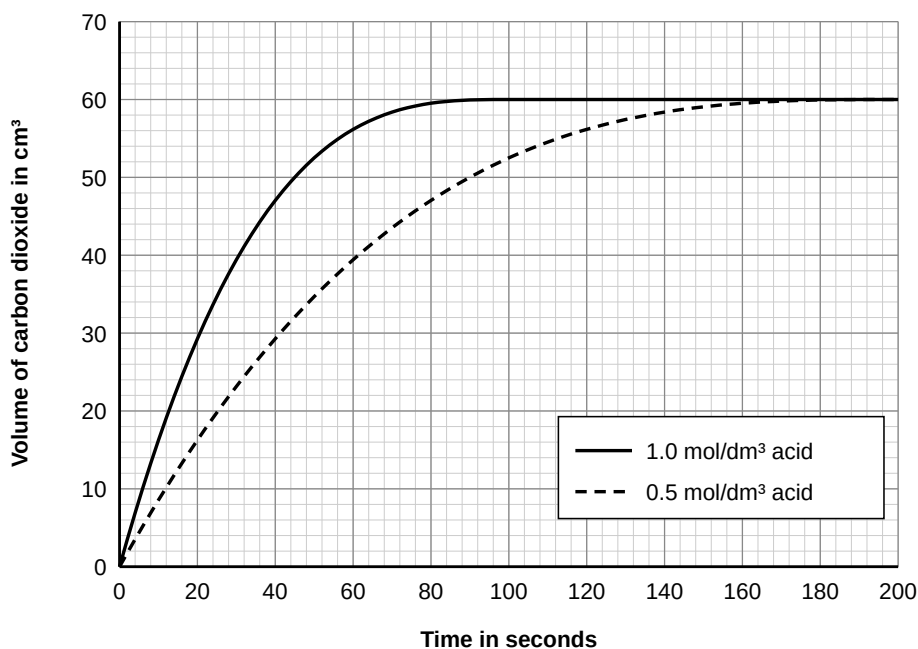
The hydrochloric acid was in excess in both experiments.

04.1

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

Figure 3 shows the results.

Figure 3



04.2

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

Show your working on **Figure 3**.

Rate of reaction = ... cm³/s

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0 4 . 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.

0 4 . 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

0 4 . 5

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

Answer in terms of particles.

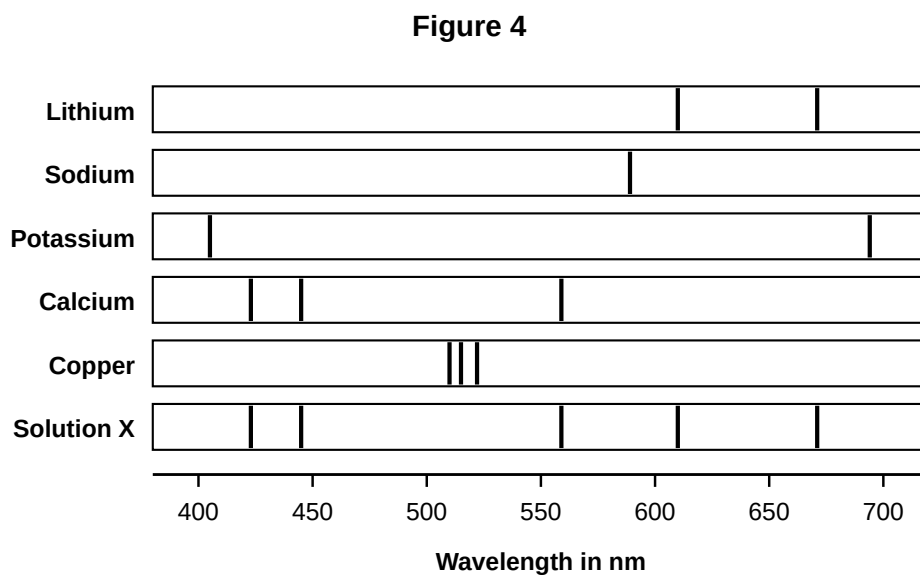
0 4 . 6

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

Turn over for the next question

0 5 Flame emission spectroscopy can be used to identify metal ions.

Figure 4 shows the flame emission spectra of five metal ions and of a solution **X**.



0 5 . 1 Which **two** metal ions are in solution **X**? [2 marks]

..... and

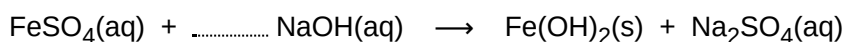
0 5 . 2 Give **one** advantage of using flame emission spectroscopy instead of a flame test to identify the metal ions in solution **X**. [1 mark]

.....
.....

0 5 . 3 A student added sodium hydroxide solution to iron(II) sulfate solution. A precipitate formed. [2 marks]

Give the colour of the precipitate **and** balance the equation for the reaction.

Colour



Question 5 continues on the next page

[6 marks]

- aluminium sulfate
- calcium chloride
- magnesium bromide.

You should describe the tests and give the result of each test for each solid.

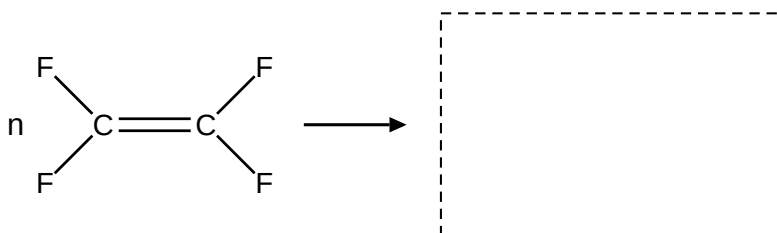
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Turn over ►

- 0 6** Poly(tetrafluoroethene), PTFE, is used to coat non-stick pans. PTFE is made from tetrafluoroethene by addition polymerisation.

Figure 5 shows the displayed formula of tetrafluoroethene.

Figure 5

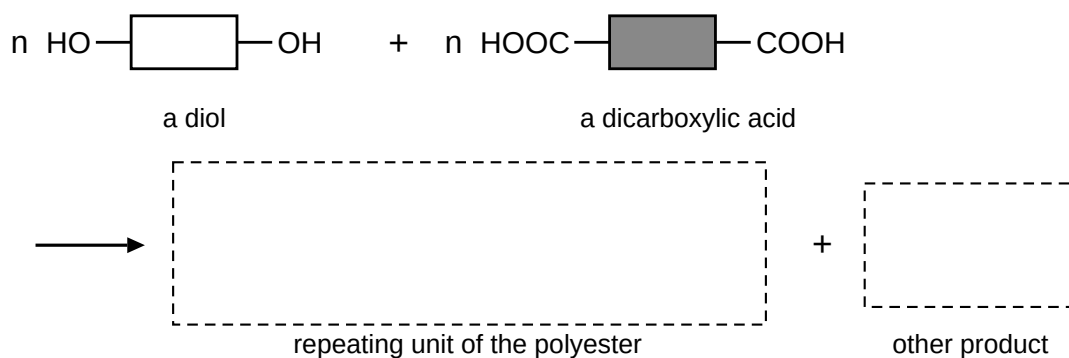


- 0 6 . 1** Complete **Figure 5** to show the displayed formula of the repeating unit of PTFE. [2 marks]

Polyesters are made by condensation polymerisation.

Figure 6 shows the two monomers used to make a polyester.

Figure 6



- 0 6 . 2** Complete **Figure 6** to show the repeating unit of the polyester **and** the other product of the reaction. [3 marks]

- 0 6 . 3** Give **two** differences between addition polymerisation and condensation polymerisation. [2 marks]

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0 6 . 4 Amino acids react by condensation polymerisation. [1 mark]

Name the **two** functional groups in an amino acid molecule.

..... and

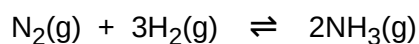
0 6 . 5 Name the type of polymer produced when amino acids join together. [1 mark]

0 6 . 6 DNA is a naturally occurring polymer. [1 mark]

Name the monomers that make up DNA.

.....

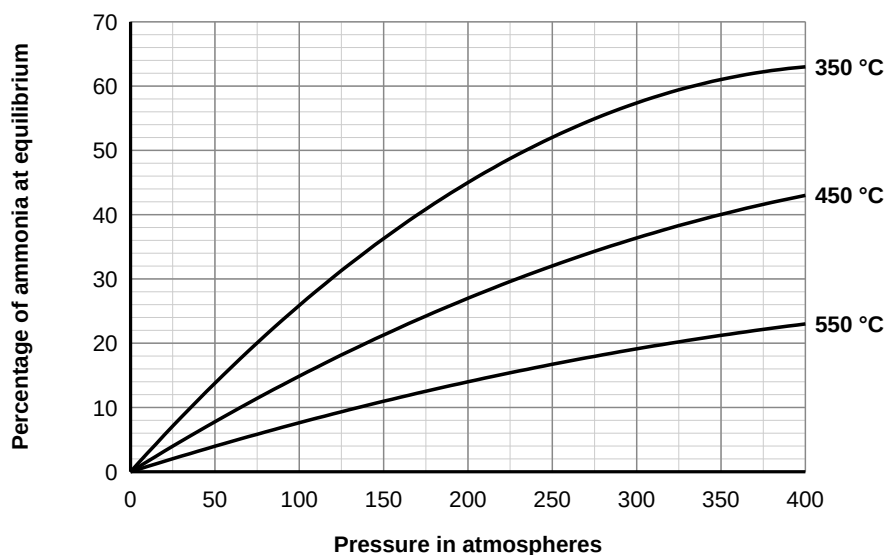
0 7 Ammonia is produced by the Haber process.



The forward reaction is exothermic.

Figure 7 shows how the percentage of ammonia in the equilibrium mixture changes with pressure at three different temperatures.

Figure 7



0 7 . 1 Give the percentage of ammonia at equilibrium at 300 atmospheres and 350 °C. [1 mark]

Percentage of ammonia = ... %

Question 7 continues on the next page

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[2 marks]

[2 marks]

[6 marks]

- Explain why these conditions are used.

[illegible]

0 8 Ammonia from the Haber process is used to make fertilisers.

NPK fertilisers contain compounds of nitrogen, phosphorus and potassium.

0 8 . 1 Give **one** reason why farmers use fertilisers.

[1 mark]

0 8 . 2 Ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$, is used as a fertiliser.

[3 marks]

Calculate the percentage by mass of nitrogen in ammonium sulfate.

Relative atomic masses (A_r): H = 1 N = 14 O = 16 S = 32

Percentage of nitrogen = _____ %

Question 8 continues on the next page

0 8 . 3 Phosphate rock is mined. It is treated with acid before it is used in fertilisers. [2 marks]

Explain why.

0 8 . 4 Name the salt produced when phosphate rock is treated with phosphoric acid. [1 mark]

0 8 . 5 Give **one** source of the potassium compounds used in NPK fertilisers. [1 mark]

Table 2 compares the laboratory preparation of ammonium sulfate with its industrial production.

Table 2

	Laboratory	Industry
Starting materials	ammonia solution and dilute sulfuric acid, bought from a supplier	ammonia and sulfuric acid made on site from raw materials (air, natural gas, sulfur and water)
Scale	a few grams	thousands of tonnes each year
Method	batch process: titration, then crystallisation	continuous process in large reactors
Energy	a Bunsen burner is used to evaporate the water	energy released by the reactions is used to evaporate the water

0 8 . 6 Suggest **two** reasons why the industrial production of ammonium sulfate is different from the laboratory preparation. [2 marks]

Use **Table 2**.

1

2

0 9 Copper ores are becoming scarce. Low-grade ores contain only small amounts of copper compounds.

0 9 . 1 A low-grade ore contains 0.4% copper by mass. [1 mark]
Calculate the mass of copper in 500 tonnes of this ore.

Mass of copper = _____ tonnes

0 9 . 2 Describe how phytomining is used to obtain copper compounds from a low-grade ore. [3 marks]

0 9 . 3 Phytomining and bioleaching produce compounds of copper. Copper metal can be obtained by adding scrap iron to a solution of a copper compound. [2 marks]

Explain why iron can be used to obtain copper in this way.

Question 9 continues on the next page

Copper is used to make alloys.

Table 3 shows information about three copper alloys.

Table 3

Alloy	Metals in the alloy	Relative hardness	Resistance to corrosion in sea water	Relative cost
Brass	copper 65%, zinc 35%	2	poor	low
Bronze	copper 88%, tin 12%	3	good	medium
Cupronickel	copper 70%, nickel 30%	3	very good	high

0 9 . 4 The propeller of a ship must be hard and must not corrode in sea water. [2 marks]

Which alloy in **Table 3** should be used to make the propeller of a ship?

Give reasons for your answer.

Alloy

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0 9 . 5 Steel buckets are galvanised by coating them with zinc. [2 marks]

Explain why the steel does not rust even when the zinc coating is scratched.

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Turn over for the next question

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1 0 Carbon dioxide and methane are greenhouse gases.

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

Use ideas about radiation in your answer.

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

1 0 . 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

1 0 . 4 Give **two** reasons why actions to reduce carbon dioxide emissions may be limited. [2 marks]

1

2

END OF QUESTIONS

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

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Write the question numbers in the left-hand margin.

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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.