Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | Candidate Number

Thursday 14 May 2020

Morning (Time: 1 hour 45 minutes) | Paper Reference **1CH0/1F**

Chemistry

Paper 1

Foundation Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for each question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 2 0 8 3 R A 0 1 3 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution?

(1)

☒ **A** crystallising

☒ **B** diluting

☒ **C** dissolving

☒ **D** melting

(b) Sodium reacts with hydrochloric acid to form sodium chloride and hydrogen.

(i) Write the word equation for this reaction.

(2)

..... → .....

(ii) The hazard symbol shown in Figure 1 is used on containers of sodium.

Figure 1

What is the meaning of this hazard symbol?

(1)

☒ **A** corrosive

☒ **B** flammable

☒ **C** oxidising

☒ **D** toxic

(iii) Hydrogen has one electron in its electron shell.
Figure 2 shows the incomplete dot and cross diagram of a hydrogen molecule.

Complete Figure 2 to show the electrons in the covalent bond between the two atoms of hydrogen.

(1)

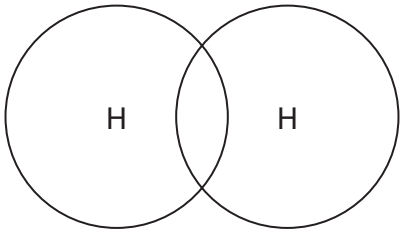

Figure 2

(c) The pH of a sodium chloride solution was measured.

(i) State what could be used to measure the pH of a solution.

(1)

.....

(ii) Sodium chloride solution is neutral.

Give the pH of this solution.

(1)

.....

(Total for Question 1 = 7 marks)

2 Chlorine has an atomic number of 17.

(a) Figure 3 shows the arrangement of electrons in an atom of chlorine.

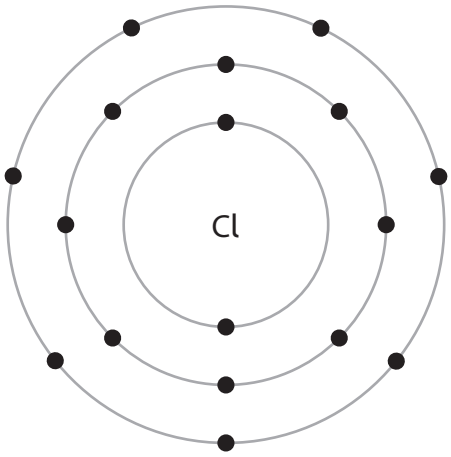

Figure 3

(i) What is the electronic configuration of this atom?

(1)

☒ **A** 10.7

☒ **B** 17

☒ **C** 2.8.7

☒ **D** 7.8.2

(ii) Explain, using Figure 3, why chlorine belongs to group 7 of the periodic table.

(2)

.....

.....

.....

.....

(b) The nucleus of an atom is made up of protons and neutrons.
Atoms of chlorine contain 17 protons.

Figure 4 shows some information about a proton, a neutron and an electron.

	relative mass	relative charge
proton	1	+1
neutron	1	0
electron	very small	−1

Figure 4

(i) Explain, using the information in Figure 3 and Figure 4, why atoms of chlorine have no overall charge.

(2)

.....

.....

.....

.....

(ii) Atoms of chlorine-37 have a mass number of 37.

Calculate the number of neutrons in atoms of chlorine-37.

(1)

.....

number of neutrons = ...

(iii) There are two isotopes of chlorine, chlorine-35 and chlorine-37.

Explain the meaning of the term **isotopes**.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

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3 In industry, ammonia is manufactured by reacting nitrogen with hydrogen.

(a) (i) Give the name of the industrial process used to manufacture ammonia.

(1)

.....

(ii) Write the word equation for this reaction, including the correct symbol to show that the reaction is reversible.

(3)

.....

.....

(b) The formula of ammonia is NH_3.

State what the formula of ammonia shows about the number of nitrogen atoms and the number of hydrogen atoms combined in a molecule of ammonia.

(1)

.....

.....

(c) Most of the ammonia manufactured in industry is used to produce fertilisers.

(i) A fertiliser is made by reacting ammonia with nitric acid.

What is the name of this fertiliser?

(1)

☒ **A** ammonia nitrate

☒ **B** ammonia nitric

☒ **C** ammonium nitrate

☒ **D** ammonium nitric

(ii) Explain the importance of fertilisers in farming.

(2)

.....

.....

.....

.....

(Total for Question 3 = 8 marks)

4 (a) In the 19th century, Mendeleev arranged the elements known at the time to form his periodic table.
Mendeleev's periodic table is different from the modern periodic table.

State **one** difference between Mendeleev's periodic table and the modern periodic table.

(1)

.....

.....

(b) Aluminium oxide reacts with hydrochloric acid to form a salt and water.

(i) State the name of the salt formed.

(1)

.....

(ii) In this reaction aluminium oxide is a base.

State the type of reaction that takes place when an acid reacts with a base.

(1)

.....

(c) Gallium, Ga, is in the same group of the modern periodic table as aluminium.

The formula of aluminium oxide is Al_2O_3.

(i) Predict the formula of gallium oxide.

(1)

.....

(ii) Gallium oxide has a very high melting point.
Gallium oxide does not conduct electricity when solid but does conduct electricity when molten.

What type of substance is gallium oxide?

(1)

☒ **A** giant covalent

☒ **B** ionic

☒ **C** metallic

☒ **D** simple molecular

(d) Figure 5 shows the changes of state for gallium and the arrangement of particles in liquid gallium.

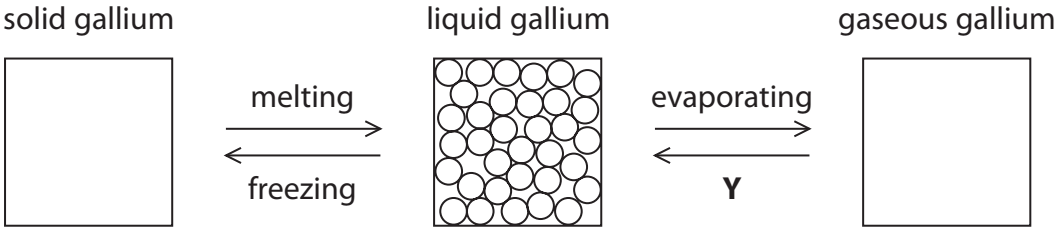

Figure 5

(i) Complete the boxes for solid gallium and gaseous gallium by drawing the arrangement of the particles in each of these physical states.

(2)

(ii) Give the name of the change of state labelled **Y** in Figure 5.

(1)

.....

(e) Gallium metal is a conductor of electricity.

Explain how metals conduct electricity.

(2)

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(Total for Question 4 = 10 marks)

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5 Transition metals have many uses.

(a) The pie chart in Figure 6 shows the uses of one transition metal.

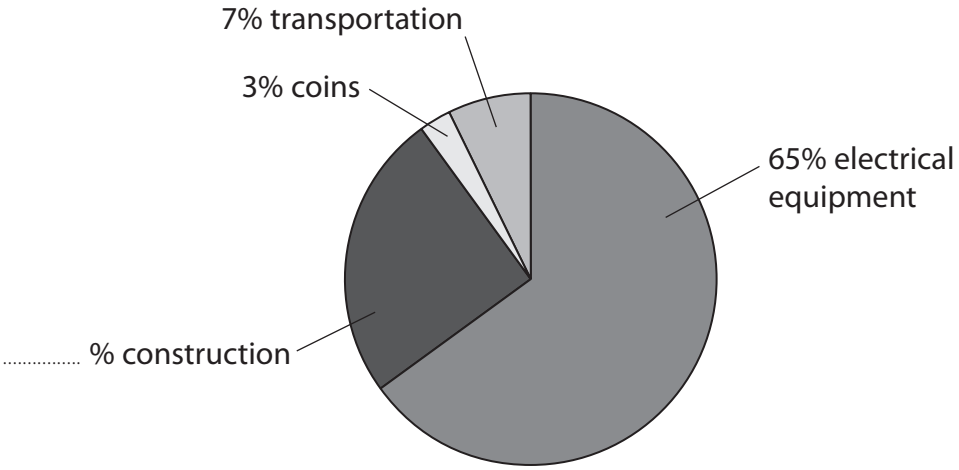

Figure 6

Calculate the percentage of this transition metal used in construction.

(1)

.....

percentage of this transition metal used in construction = ...

(b) Figure 7 shows five statements about iron.

Put ticks (✓) in the boxes in Figure 7 to show which statements are true and which statements are false.
The first one has been done for you.

(3)

	true	**false**
iron is a poor conductor of heat		✓
iron can act as a catalyst		
iron forms compounds that are coloured		
iron has a low density		
iron has a very high melting point		

Figure 7

(c) Most iron produced is converted into alloys of iron.

(i) State why alloys have more uses than pure metals.

(1)

.....

.....

(ii) An alloy of iron contains 0.40 % of molybdenum.

Calculate the mass of molybdenum contained in a 30 g sample of this alloy of iron.

(2)

.....

.....

.....

.....

mass of molybdenum = ... g

(d) Many transition metals are used to make the reactants in chemical cells.

Figure 8 shows a graph of the voltage produced by a chemical cell as it is used in a torch for many hours.

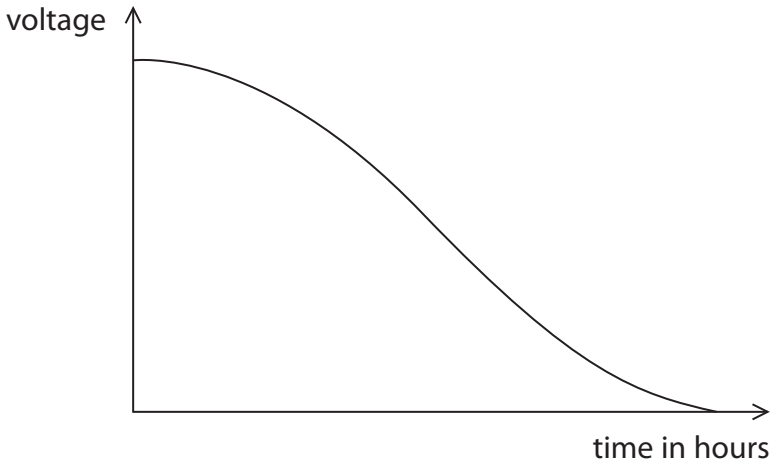

Figure 8

Suggest an explanation for the shape of the graph.

(2)

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.....

.....

.....

(Total for Question 5 = 9 marks)

6 Some metals are found in the Earth's crust as uncombined elements.
Reactive metals are found in ores.

In ores, metals are combined with other elements.

(a) Which of these metals is found as the uncombined element in the Earth's crust?

(1)

☒ **A** aluminium

☒ **B** gold

☒ **C** potassium

☒ **D** zinc

(b) Give **two** advantages of recycling metals rather than extracting metals from their ores.

(2)

1 .....

.....

2 .....

.....

(c) An ore of iron is mostly iron oxide, Fe_2O_3.
Iron can be extracted from this iron oxide by heating it with carbon.

Balance this equation for the reaction that takes place.

(1)

$2Fe_2O_3$ + ...C → .....Fe + ...CO_2

(d) Most copper ores are described as low grade.
This means that the percentage of copper in the ore is very small.

5000 kg of one copper ore was found to contain 42.5 kg of copper.

Calculate the percentage of copper in this ore.

(2)

.....

.....

.....

percentage of copper in ore = ...

(e) In one stage of the extraction of lead from its ore, lead oxide is heated strongly with carbon.

The equation for the reaction is

$$2PbO + C \rightarrow 2Pb + CO_2$$

Explain, using this equation, which substance has been oxidised in this reaction.

(2)

(f) A titanium ore was analysed and found to contain 12 g of titanium atoms combined with 8.0 g of oxygen atoms.

Calculate the empirical formula of this titanium compound.
(relative atomic masses: Ti = 48, O = 16)

You must show your working.

(3)

empirical formula = ...

(Total for Question 6 = 11 marks)

7 (a) Iron rusts when it is left in certain conditions.

(i) Figure 9 shows the apparatus used to investigate the rusting of some iron nails.

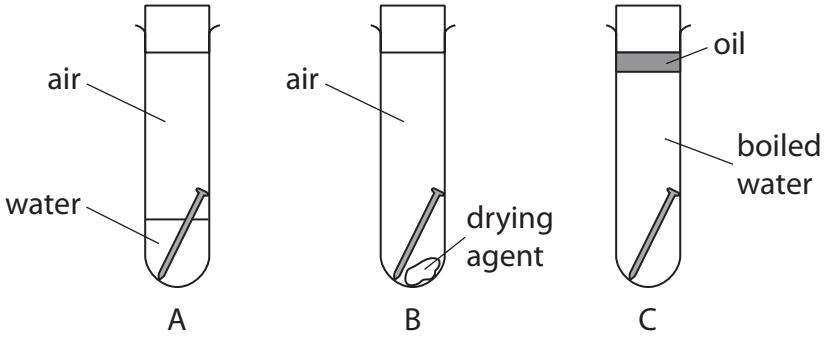

Figure 9

Explain why the iron nail in tube A would rust but the iron nails in tubes B and C would not rust.

(3)

(ii) Magnesium is more reactive than iron.
Figure 10 shows an iron nail with a strip of magnesium wrapped around it, placed in some water.
The tube was left for a few days.

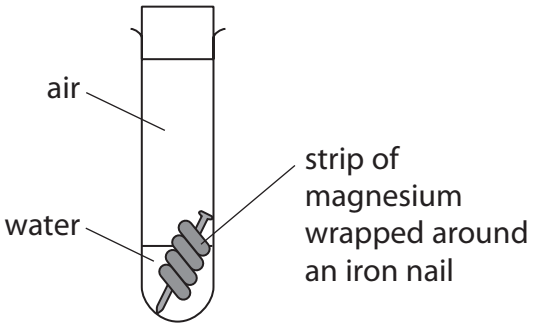

Figure 10

State what would happen to this iron nail.

(1)

.....

.....

(iii) When iron rusts, a brown solid forms on the surface of the iron.

What happens to the iron as the rust forms?

(1)

☒ **A** the iron is hydrated

☒ **B** the iron is neutralised

☒ **C** the iron is oxidised

☒ **D** the iron is reduced

(b) Give **one** reason why metals are electroplated.

(1)

.....

.....

*(c) The pure metals aluminium, copper and gold and the alloys brass and magnalium are used to make many useful articles.

The way in which these metals and alloys are used is related to their properties, such as their density, electrical conductivity, resistance to corrosion and strength.

State some uses of aluminium, copper, gold, brass and magnalium and explain how each use is related to their properties.

(6)

(Total for Question 7 = 12 marks)

8 Figure 11 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

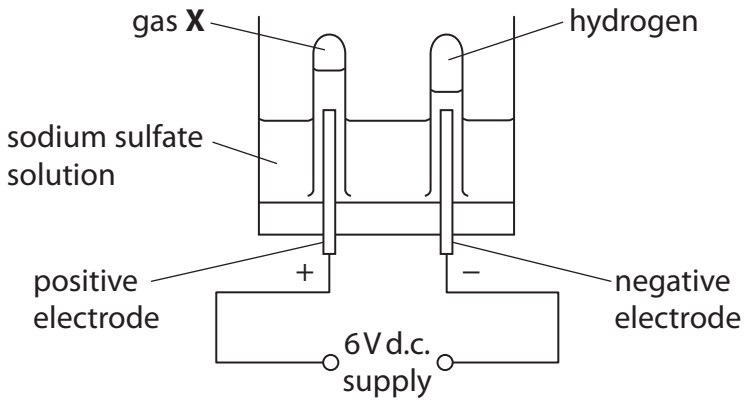

Figure 11

(a) Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

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.....

.....

.....

(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

☒ **A** ammonia

☒ **B** oxygen

☒ **C** nitrogen

☒ **D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

.....

.....

.....

.....

(b) The sodium sulfate solution was made by dissolving 28.4 g of sodium sulfate in water to make 250 cm^3 of solution.

Calculate the concentration of this solution in g dm^{-3}.

Give your answer to three significant figures.

(3)

concentration = ... g dm^{-3}

(c) The ions present in sodium sulfate are

sodium	Na^+
sulfate	SO_4^{2-}

Write the formula of sodium sulfate using this information.

(1)

.....

(d) (i) In Figure 11, the gases given off at the electrodes are collected in test-tubes. However, the actual volume of gases cannot be measured using these test-tubes.

Suggest what apparatus could be used in place of the test-tubes in Figure 11 to measure the volume of gases given off.

(1)

.....

(ii) State what could be added into the circuit to show a current is flowing during electrolysis.

(1)

.....

(Total for Question 8 = 11 marks)

9 The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

(a) (i) Complete the balanced equation for this reaction.

(2)

$$CuCO_3 + \ldots\ldots\ldots\ldots \rightarrow \ldots\ldots\ldots\ldots + CO_2 + H_2O$$

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

.....

.....

.....

relative formula mass of $CuCO_3$ = ...

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

☒ **A** bubble the gas through limewater, limewater turns cloudy

☒ **B** put damp blue litmus paper in the gas, litmus paper turns red

☒ **C** put a lighted splint into the gas, splint is extinguished

☒ **D** measure the pH of the gas, pH = 4

(b) Figure 12 shows a conical flask containing dilute sulfuric acid.
Copper carbonate is added to the acid in the flask.
The copper carbonate is added one spatula measure at a time until the reaction has finished.

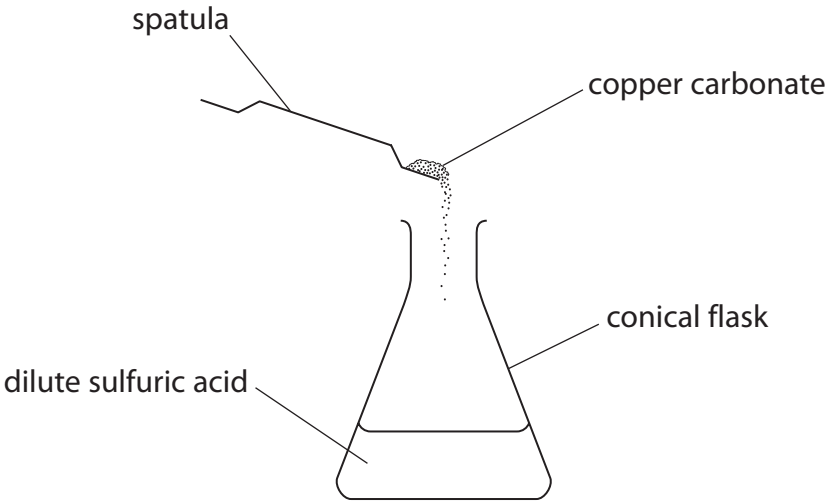

Figure 12

(i) State **two** observations that would show the reaction has finished.

(2)

1 .....

.....

2 .....

.....

*(ii) Describe how you would obtain a solution of copper sulfate from the mixture and how you would obtain pure, dry copper sulfate crystals from this solution.

Your description should include the apparatus you would use.

You may wish to use diagrams in your answer.

(6)

(Total for Question 9 = 13 marks)

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10 Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

(a) A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

(i) Write the steps in the correct order.

Some of the steps have been completed for you.

(1)

first step				**last step**
K				**M**

(ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm^3 of potassium hydroxide solution.

(1)

(b) A student was then asked to produce a pure sample of solid potassium chloride.

After finding the volume of acid reacted in step M, the student added this volume of acid to a fresh 25.0 cm^3 sample of the potassium hydroxide solution.
This mixture was then evaporated.

(i) Explain why this new mixture was evaporated rather than the original mixture from the titration, to produce a pure sample of solid potassium chloride.

(2)

.....

.....

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.....

.....

(ii) After evaporation, the mass of the potassium chloride was determined.

The theoretical yield of the experiment was 0.70 g.
The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.

(2)

.....

.....

.....

percentage yield = ...

(iii) Suggest a reason why the actual yield was greater than the theoretical yield.

(1)

.....

.....

.....

(iv) The equation for the reaction between potassium hydroxide solution and dilute hydrochloric acid is

$$KOH + HCl \rightarrow KCl + H_2O$$

Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.
(relative formula masses: KOH = 56.0, HCl = 36.5, KCl = 74.5, H_2O = 18.0)

Give your answer to one decimal place.

(4)

atom economy = ... %

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

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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

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

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