

Write your name here

Surname

Other names

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

Centre Number

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Candidate Number

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Chemistry

Paper 1

Higher Tier

Sample Assessment Materials for first teaching September 2016

Time: 1 hour 45 minutes

Paper Reference

1CH0/1H

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.

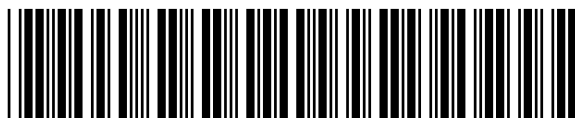
Advice

- 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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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 Mixtures of coloured substances can be separated by paper chromatography.
- (a) Paper chromatography was used to separate a mixture of blue and red inks. A spot of the mixture was placed on chromatography paper as shown in Figure 1.

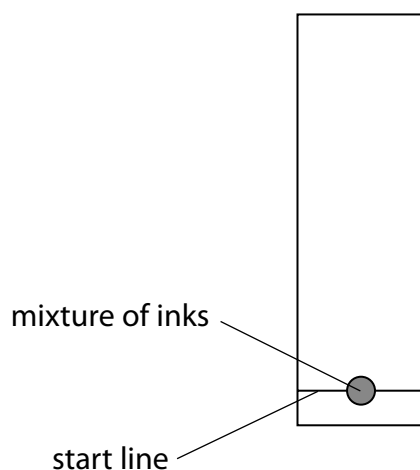


Figure 1

- (i) Give a reason why the start line is drawn in pencil rather than in ink.

(1)

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- (ii) The chromatography paper, with the spot of mixture on it, was placed in a beaker with the bottom of the paper in water.

On Figure 2, complete the diagram showing the position of the chromatography paper with the spot of mixture at the start of the experiment.

(1)

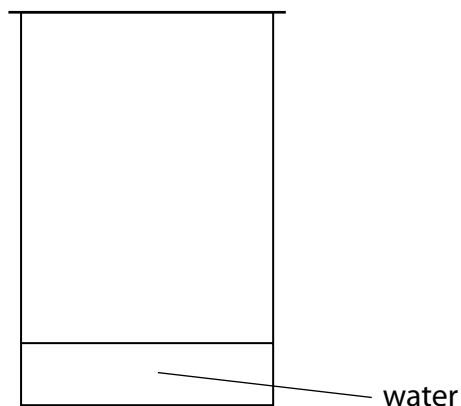


Figure 2

- (iii) The chromatography was carried out and the result is shown in Figure 3.

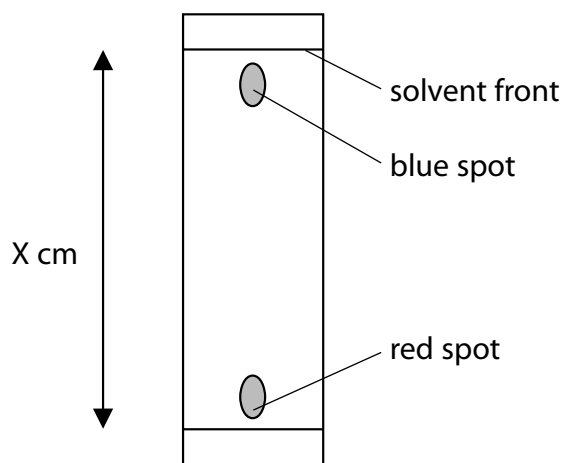


Figure 3

The blue spot had moved 14.5 cm and the solvent front had moved 15.3 cm.

Calculate the R_f value of the substance in the blue spot, giving your answer to 2 significant figures.

$$R_f \text{ value} = \frac{\text{distance travelled by a dye}}{\text{distance travelled by solvent front}}$$

(2)

R_f value =

2 Ionic compounds contain ions.

- (a) The numbers of electrons, neutrons and protons in four particles, **W**, **X**, **Y** and **Z**, are shown in Figure 5.

| particle | electrons | neutrons | protons |
|----------|-----------|----------|---------|
| W | 9 | 10 | 9 |
| X | 10 | 14 | 12 |
| Y | 16 | 16 | 16 |
| Z | 18 | 18 | 16 |

Figure 5

Explain which particle, **W**, **X**, **Y** or **Z**, is a negative ion.

(2)

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- (b) Calcium nitrate contains calcium ions and nitrate ions.

Calculate the relative formula mass of calcium nitrate, $\text{Ca}(\text{NO}_3)_2$.
(relative atomic masses: Ca = 40, N = 14, O = 16)

(2)

relative formula mass =

(c) Lithium fluoride, LiF, is an ionic compound.

It contains lithium cations and fluoride anions.

The electronic configurations of a lithium atom and of a fluorine atom are shown in Figure 6.

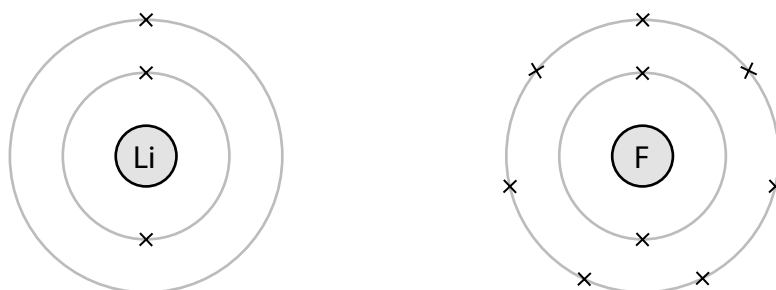


Figure 6

Complete Figure 7 to show the electronic configurations and charges of the ions in lithium fluoride.

(4)



charge on ion

charge on ion

Figure 7

(Total for Question 2 = 8 marks)

3 A student carried out an experiment to see how reactive different metals are when they are placed in dilute hydrochloric acid.

A sample of each metal was placed in a separate test tube of acid.

(a) When zinc reacts with dilute hydrochloric acid, a gas is given off and zinc chloride is formed.

(i) Which gas is given off?

- A carbon dioxide
- B chlorine
- C hydrogen
- D oxygen

(1)

(ii) What is the formula of zinc chloride?

- A ZnCl
- B Zn₂Cl
- C ZnCl₂
- D Zn₂Cl₂

(1)

(b) In the experiment, the student used the same amount of each metal in a finely powdered form.

State **two** factors, concerning the hydrochloric acid, which should also be controlled to produce valid results.

(2)

1

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2

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(c) Part of the reactivity series is shown in Figure 8.

| | |
|-----------------------|-----------|
| most reactive | magnesium |
| | aluminium |
| | iron |
| least reactive | silver |

Figure 8

Iron is extracted from its ore by heating with carbon.
Aluminium is extracted from its ore using a different method.

(i) Give the name of the method used to extract aluminium. (1)

(ii) Explain why aluminium is extracted by a different method rather than heating the ore with carbon. (2)

(d) The extraction of iron involves the reduction of iron oxide, Fe_2O_3 , by carbon monoxide, CO. During this reaction, the iron oxide is reduced to iron, Fe, and the carbon monoxide is oxidised to carbon dioxide.

Write the balanced equation for the reaction. (2)

(Total for Question 3 = 9 marks)

4 The method used to prepare a salt depends on its solubility in water.

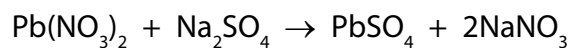
(a) Complete Figure 9 by placing one tick in each row to show whether the salt is soluble or insoluble.

(2)

| salt | soluble | insoluble |
|---------------------|---------|-----------|
| ammonium chloride | | |
| lithium sulfate | | |
| magnesium carbonate | | |

Figure 9

(b) Lead nitrate solution mixed with sodium sulfate solution forms lead sulfate as a precipitate.



The theoretical yield of lead sulfate for this reaction was 2.85 g.

The actual yield of lead sulfate obtained was 2.53 g.

Calculate the percentage yield of lead sulfate in this experiment.

Give your answer to two significant figures.

(3)

percentage yield =%

(c) The method used to make the lead sulfate is:

- pour 100 cm³ lead nitrate solution into a beaker
- add drops of sodium sulfate solution until a precipitate is seen
- allow the precipitate to settle to the bottom of the beaker
- pour off the liquid
- use a spatula to transfer the solid lead sulfate onto a filter paper

Explain **two** ways of improving this experimental method to increase the amount and quality of lead sulfate obtained from the same volume of lead nitrate solution.

(4)

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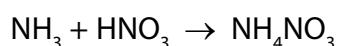
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(d) Ammonium nitrate is produced from ammonia and nitric acid on a large scale in industry.

Ammonium nitrate can also be made in the laboratory by titrating ammonia solution with dilute nitric acid.



Ammonium nitrate crystals can then be obtained by evaporating off some of the water from the solution.

Give **two** reasons why this laboratory method is not suitable for use on a large scale in industry.

(2)

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(Total for Question 4 = 11 marks)

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5 Objects made from transition metals are sometimes coated with a thin layer of another transition metal to improve their appearance and to protect against corrosion.

(a) Figure 10 shows equipment that can be used to electroplate an iron spoon with silver.

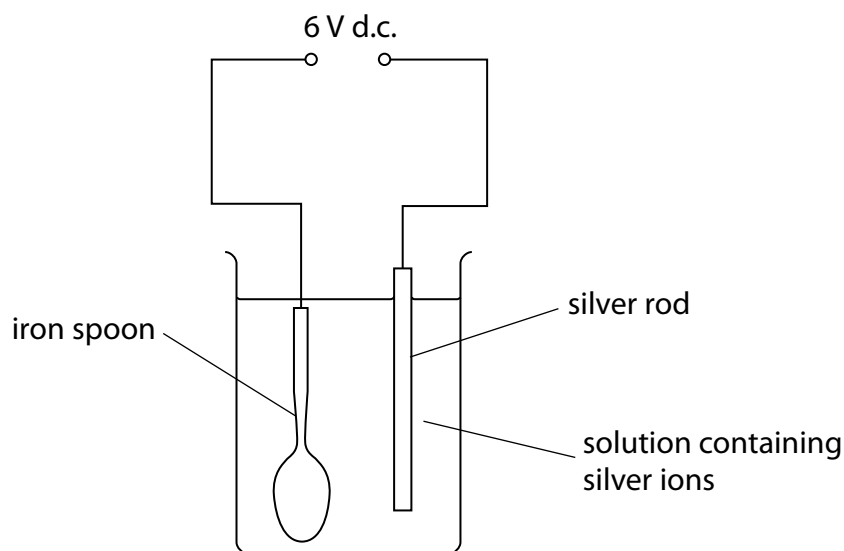


Figure 10

(i) Which row of the table correctly shows the charge on the silver rod electrode and the type of reaction occurring at this electrode?

(1)

| | charge | type of reaction |
|----------------------------|----------|------------------|
| <input type="checkbox"/> A | negative | oxidation |
| <input type="checkbox"/> B | negative | reduction |
| <input type="checkbox"/> C | positive | oxidation |
| <input type="checkbox"/> D | positive | reduction |

(ii) Silver metal is deposited on the spoon.

Which half-equation represents this reaction?

(1)

- A** $\text{Ag} + \text{e} \rightarrow \text{Ag}^+$
- B** $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$
- C** $\text{Ag}^+ + \text{e} \rightarrow \text{Ag}$
- D** $\text{Ag}^+ \rightarrow \text{Ag} + \text{e}^-$

(b) The voltage of a cell is 1.5V.

Give a reason why this voltage of the cell decreases when the cell is left connected in a circuit.

(1)

(c) Duralumin is an alloy of aluminium and copper.

The radii of the aluminium and copper atoms are shown in Figure 11.

| | radius of atom / m |
|-----------|------------------------|
| aluminium | 1.43×10^{-12} |
| copper | 1.27×10^{-12} |

Figure 11

Explain why copper added to aluminium to form the alloy makes the alloy stronger than pure aluminium.

(2)

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(d) Gold is often alloyed with other metals when it is used to make jewellery.

The proportion of gold in a piece of gold jewellery is measured in carats.

Pure gold is 24 carats.

A 9 carat gold ring has a mass of 12 g.

Calculate the mass of gold in this ring.

(2)

mass of gold ring = g

(Total for Question 5 = 7 marks)

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6 Electrodes are placed in three different solutions, **J**, **K** and **L**.

A 6V direct current source is connected to the electrodes.

Any products formed at the electrodes are identified.

The results are given in Figure 12.

| solution | solution conducts electricity | product at cathode | product at anode |
|-----------------|--------------------------------------|---------------------------|-------------------------|
| J | yes | copper | chlorine |
| K | yes | hydrogen | oxygen |
| L | no | none | none |

Figure 12

(a) Explain which solutions are electrolytes.

(2)

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(b) Which material is most suitable to make the electrodes for the electrolysis of a dilute acid?

(1)

- A** zinc
- B** sulfur
- C** iron
- D** graphite

- (c) When a solution of sodium sulfate, Na_2SO_4 , is electrolysed, the products formed at the electrodes are hydrogen and oxygen.

Explain the formation of the products at the electrodes.

(4)

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- (d) Copper is purified by the electrolysis of copper sulfate solution using an impure copper anode and a pure copper cathode.

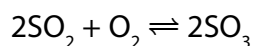
Write the half-equation for the formation of a copper atom from a copper ion.

(2)

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(Total for Question 6 = 9 marks)

7 Sulfur trioxide is produced by reacting sulfur dioxide with oxygen.



- (a) (i) This reaction takes place in industry at 1–2 atm pressure and can reach a dynamic equilibrium.

Explain the effect on the rate of attainment of equilibrium, if the process is carried out at a pressure higher than 1–2 atm.

(3)

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- (ii) What volume of oxygen, in cm^3 , would react completely with 500 cm^3 sulfur dioxide? (1)

- A $500 \div 2$
- B 500
- C 500×2
- D 500×32

- (b) When there are alternative methods of producing a product, the final pathway is chosen by considering atom economy, cost of energy, yield of product and rates of reactions.

State another factor that should also be considered.

(1)

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8 Figure 13 shows a model of how particles are arranged in a solid.

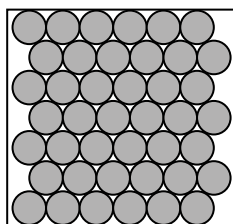


Figure 13

(a) (i) State **two** ways in which this model fails to accurately represent a crystal of sodium chloride.

(2)

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(ii) Magnesium oxide has a melting point of 2852°C .

Explain why magnesium oxide has such a high melting point.

(3)

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- (b) (i) Carbon dioxide can be formed by the reaction of calcium carbonate, CaCO_3 , with dilute hydrochloric acid.

Write the balanced equation for this reaction.

(3)

- (ii) The thermal decomposition of copper carbonate forms copper oxide and carbon dioxide.



15.0 g of pure copper carbonate is decomposed completely.

Calculate the mass of solid produced.

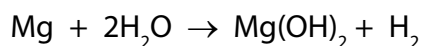
(relative atomic masses: C = 12.0; O = 16.0; Cu = 63.5)

Give your answer to two significant figures.

(2)

mass of solid = g

(c) Magnesium reacts with water in the form of steam as shown in the equation.



2.4 g of magnesium reacts with sufficient steam for a complete reaction to form 5.8 g of magnesium hydroxide and 0.2 g of hydrogen.

Show, by calculation, that the law of conservation of mass applies to this reaction.

(relative atomic masses: H = 1.0, O = 16, Mg = 24)

(3)

(Total for Question 8 = 13 marks)

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9 Some acids such as hydrochloric acid are described as strong acids. Some acids such as ethanoic acid are described as weak acids.

(a) (i) Explain the difference between a strong acid and a weak acid.

(2)

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(ii) Give a reason why adding hydroxide ions to an acid solution leads to an increase in pH.

(1)

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(b) The salt zinc nitrate can be made by reacting zinc oxide, ZnO, with dilute nitric acid, HNO₃.

Write the balanced equation for this reaction.

(2)

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(c) 50 cm³ of potassium hydroxide solution of concentration 40 g dm⁻³ is needed for an experiment.

Calculate the mass of potassium hydroxide that must be dissolved in water to make 50 cm³ of solution of this concentration.

(2)

mass of potassium hydroxide = g

* (d) Salts of metals can be made by reacting one of the metal's compounds with the appropriate acid.

Plan an experiment to prepare pure, dry crystals of magnesium sulfate, MgSO_4 , by reacting a suitable magnesium compound with a suitable acid.

You may use equations if you wish.

(6)

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(Total for Question 9 = 13 marks)

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- 10 (a) In an experiment, ammonia gas is made by heating a mixture of ammonium chloride and calcium hydroxide.



10.0g of ammonium chloride is added to an excess of calcium hydroxide.

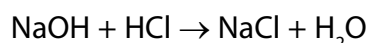
Calculate the maximum volume of ammonia gas that could be formed.

(relative atomic mass H = 1.00, N = 14.0, O = 16.0 and Ca = 40.0; one mole of any gas occupies 24 dm³ at room temperature and pressure)

(2)

volume = dm³

- (b) Sodium hydroxide solution reacts with hydrochloric acid.



- (i) 25.0 cm³ of 0.100 mol dm⁻³ sodium hydroxide, NaOH, solution is added to 35.0 cm³ of 0.0750 mol dm⁻³ dilute hydrochloric acid, HCl.

Use the information to determine which reagent is in excess.

(3)

- (ii) To find the exact amount of dilute hydrochloric acid that reacts with 25.0 cm^3 of the sodium hydroxide solution, a titration is carried out. Figure 14 shows the results for the titrations.

| | 1st titration | 2nd titration | 3rd titration | 4th titration |
|---|---------------|---------------|---------------|---------------|
| final burette reading / cm^3 | 37.60 | 36.20 | 39.15 | 38.40 |
| initial burette reading / cm^3 | 1.80 | 0.00 | 3.95 | 2.10 |
| volume of acid used / cm^3 | 35.80 | 36.20 | 35.20 | 36.30 |

Figure 14

In this titration, the accurate volumes of acid used that are within 0.20 cm^3 of each other are considered concordant volumes.

Use the concordant results to calculate the mean volume of hydrochloric acid required.

(1)

mean volume = cm^3

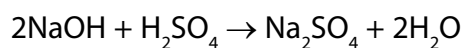
- (iii) During the titration, the indicator used changed colour at the end point.

Which of the following shows an indicator with the colour change that would be seen in this titration?

(1)

| | indicator | colour in alkali | colour at end point |
|--------------------------|-------------------|------------------|---------------------|
| <input type="checkbox"/> | A phenolphthalein | colourless | pink |
| <input type="checkbox"/> | B phenolphthalein | pink | yellow |
| <input type="checkbox"/> | C methyl orange | red | yellow |
| <input type="checkbox"/> | D methyl orange | yellow | orange |

- (c) In another titration, 25.0 cm³ of a different sodium hydroxide solution is titrated with 0.200 mol dm⁻³ sulfuric acid, H₂SO₄.



24.80 cm³ of acid are required to neutralise 25.0 cm³ of the sodium hydroxide solution.

Calculate the concentration of the sodium hydroxide solution, NaOH, in mol dm⁻³.

(4)

concentration = mol dm⁻³

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

The Periodic Table of the Elements

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | | |
|--|--------------------------------------|------------------------------------|---------------------------------------|--|--------------------------------------|---|---|--------------------------------------|---|--|---|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|-------------------------------------|------------------------------------|----------------------------------|--|
| | 7 Li lithium 3 | 9 Be beryllium 4 | 11 Na sodium 11 | 12 C carbon 6 | 13 Al aluminium 13 | 14 N nitrogen 7 | 15 P phosphorus 15 | 16 O oxygen 8 | 17 F fluorine 9 | 18 Ar argon 18 | | | | | | | | | |
| | 19 K potassium 19 | 20 Ca calcium 20 | 23 Sc scandium 21 | 24 Ti titanium 22 | 25 V vanadium 23 | 26 Cr chromium 24 | 27 Mn manganese 25 | 28 Fe iron 26 | 29 Co cobalt 27 | 30 Ni nickel 28 | 31 Cu copper 29 | 32 Zn zinc 30 | 33 Ga gallium 31 | 34 Ge germanium 32 | 35 As arsenic 33 | 36 Se selenium 34 | 37 Br bromine 35 | 38 Kr krypton 36 | |
| | 39 Rb rubidium 37 | 40 Sr strontium 38 | 89 Y yttrium 39 | 90 Zr zirconium 40 | 91 Nb niobium 41 | 92 Mo molybdenum 42 | 93 Tc technetium 43 | 101 Ru ruthenium 44 | 102 Rh rhodium 45 | 103 Pd palladium 46 | 104 Ag silver 47 | 105 Cd cadmium 48 | 106 In indium 49 | 107 Sn tin 50 | 108 Sb antimony 51 | 109 Te tellurium 52 | 110 I iodine 53 | 111 Xe xenon 54 | |
| | 133 Cs caesium 55 | 137 Ba barium 56 | 139 La* lanthanum 57 | 178 Hf hafnium 72 | 179 Ta tantalum 73 | 180 W tungsten 74 | 181 Re rhenium 75 | 186 Os osmium 76 | 190 Ir iridium 77 | 192 Pt platinum 78 | 195 Au gold 79 | 201 Hg mercury 80 | 204 Tl thallium 81 | 207 Pb lead 82 | 209 Bi bismuth 83 | 210 Po polonium 84 | 211 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 | [268] Mt meitnerium 109 | [277] Hs hassium 108 | [271] Ds darmstadtium 110 | [272] Rg roentgenium 111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | | | | | | | |

| | |
|----------|----------|
| 1 | H |
| hydrogen | 1 |

| |
|------------------------|
| 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.

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