

CHEMISTRY

5070/11

Paper 1 Multiple Choice

May/June 2018

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

* 9 8 5 1 2 7 7 8 8 3 *



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

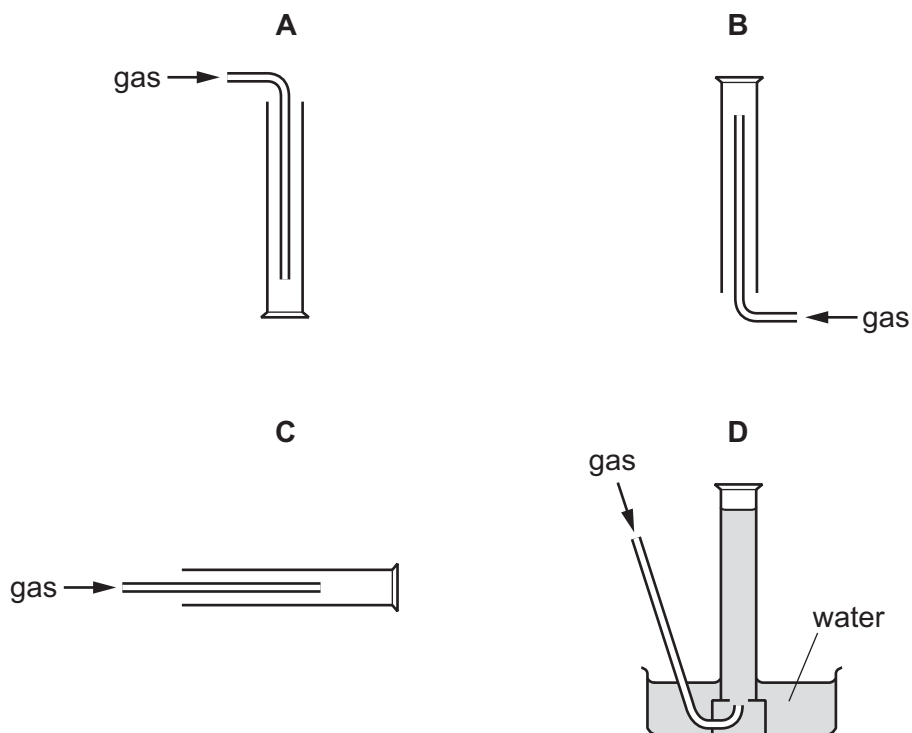
A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **16** printed pages.

- 1 A gas is less dense than air and dissolves in water.

Which diagram shows the correct method of collecting this gas?



- 2 Which mixture can be separated into its components by adding water, stirring and filtering?

- A calcium carbonate and sodium chloride
- B magnesium and iron
- C sodium chloride and copper(II) sulfate
- D sulfuric acid and hydrochloric acid

- 3 Tests were carried out on an aqueous solution of an unknown compound, **P**. The observations are recorded in the table.

| test | observation |
|--|--|
| aqueous sodium hydroxide added | green precipitate, soluble in excess giving a green solution |
| dilute nitric acid added then aqueous barium nitrate | white precipitate |
| dilute nitric acid added then aqueous silver nitrate | no precipitate |

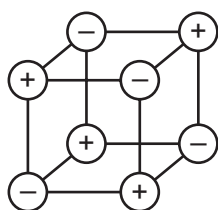
Which ions are present in **P**?

- A** Cr^{3+} and Cl^-
B Cr^{3+} and SO_4^{2-}
C Fe^{2+} and Cl^-
D Fe^{2+} and SO_4^{2-}
- 4 Which substance would diffuse most quickly?
- A** carbon dioxide at 0°C
B carbon dioxide at 25°C
C neon at 0°C
D neon at 25°C
- 5 The ion Q^{2+} has three complete shells of electrons.

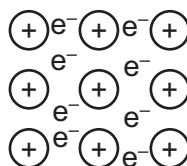
What is Q?

- A** calcium
B magnesium
C oxygen
D sulfur

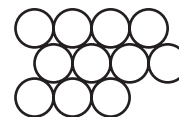
- 6 The diagrams show the arrangement of particles in three **solids**: X, Y and Z. The three solids are krypton, potassium and sodium chloride.



X



Y



Z

Which row correctly identifies X, Y and Z?

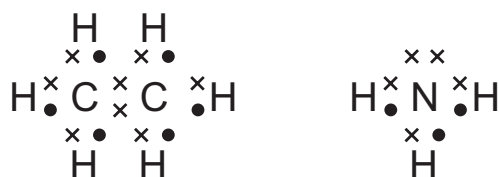
| | X | Y | Z |
|----------|-----------------|-----------------|-----------------|
| A | krypton | potassium | sodium chloride |
| B | krypton | sodium chloride | potassium |
| C | sodium chloride | krypton | potassium |
| D | sodium chloride | potassium | krypton |

- 7 In the electrolysis of $\text{CuSO}_4(\text{aq})$, what is the ionic equation for the reaction at the cathode?

- A** $\text{Cu} + 2\text{e}^- \rightarrow \text{Cu}^{2+}$
B $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
C $2\text{H}_2\text{O} + \text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}(\text{OH})_2 + \text{O}_2$
D $\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{SO}_4 + \text{H}_2$

- 8 Ethane, C_2H_6 , and ammonia, NH_3 , are covalent compounds.

The dot-and-cross diagrams of these compounds are shown.



Which statements are correct?

- A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- An unreacted nitrogen atom has five outer electrons.
- In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

9 Which statement is correct?

- A All compounds are ionic.
- B All compounds conduct electricity when molten.
- C Each element only contains one type of atom.
- D In a mixture of substances, the proportions of the substances are always the same.

10 When 1 volume of gas **R** reacts with exactly 5 volumes of oxygen, it forms carbon dioxide and water only.

What is **R**?

- A butane, C_4H_{10}
- B ethane, C_2H_6
- C methane, CH_4
- D propane, C_3H_8

11 Two characteristics of a gas, **G**, are given.

- **G** reduces copper(II) oxide to a pink-brown solid.
- 1.4 g of **G** has a volume of 1.2 dm^3 at room temperature and pressure.

What is **G**?

- A carbon monoxide, CO
- B hydrogen, H_2
- C nitrogen, N_2
- D nitrogen monoxide, NO

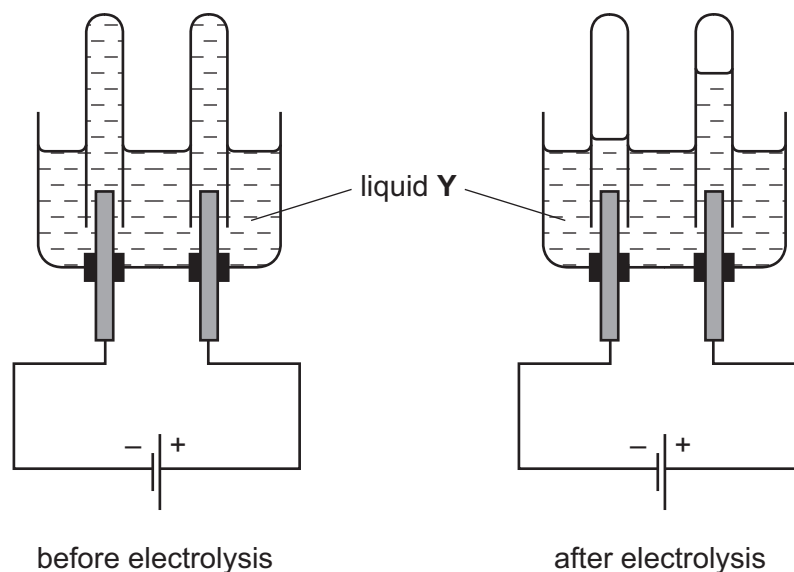
12 The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

| | compound | relative formula mass |
|----------|-----------|-----------------------|
| A | Al_2O_3 | 102 |
| B | CuO | 80 |
| C | H_2SO_4 | 98 |
| D | HNO_3 | 63 |

13 The diagrams show an electrolysis experiment using inert electrodes.



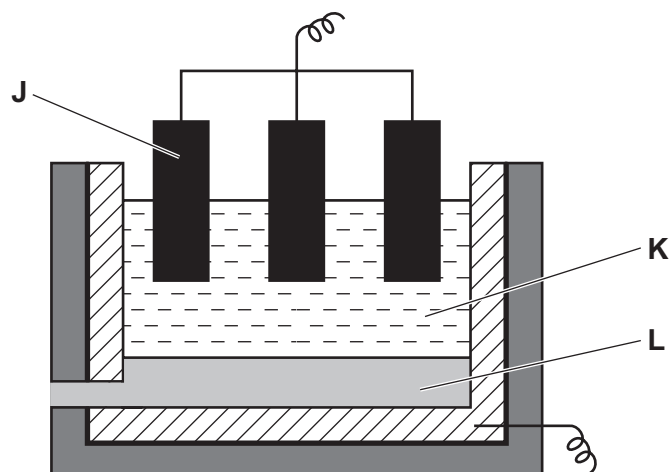
What could liquid **Y** be?

- A aqueous copper(II) sulfate
- B concentrated aqueous sodium chloride
- C dilute sulfuric acid
- D ethanol

14 Which statement about ionic compounds is correct?

- A Ionic compounds conduct electricity when solid because they contain charged particles that can move.
- B Ionic compounds consist of a lattice of positive ions and negative ions.
- C Most ionic compounds are solids at room temperature because of the strong attraction between electrons and positive ions.
- D When molten or in aqueous solution, ionic compounds conduct electricity because they contain electrons that can move.

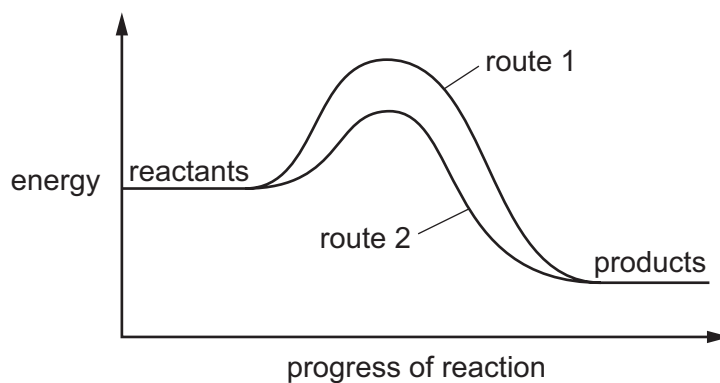
15 The diagram shows apparatus that can be used to extract aluminium from its ore.



What are J, K and L?

| | J | K | L |
|---|--------------------|----------------------------|-----------------|
| A | negative electrode | aluminium oxide + cryolite | aluminium |
| B | negative electrode | cryolite | aluminium oxide |
| C | positive electrode | aluminium oxide | cryolite |
| D | positive electrode | aluminium oxide + cryolite | aluminium |

16 The diagram shows the energy profile for a reaction.

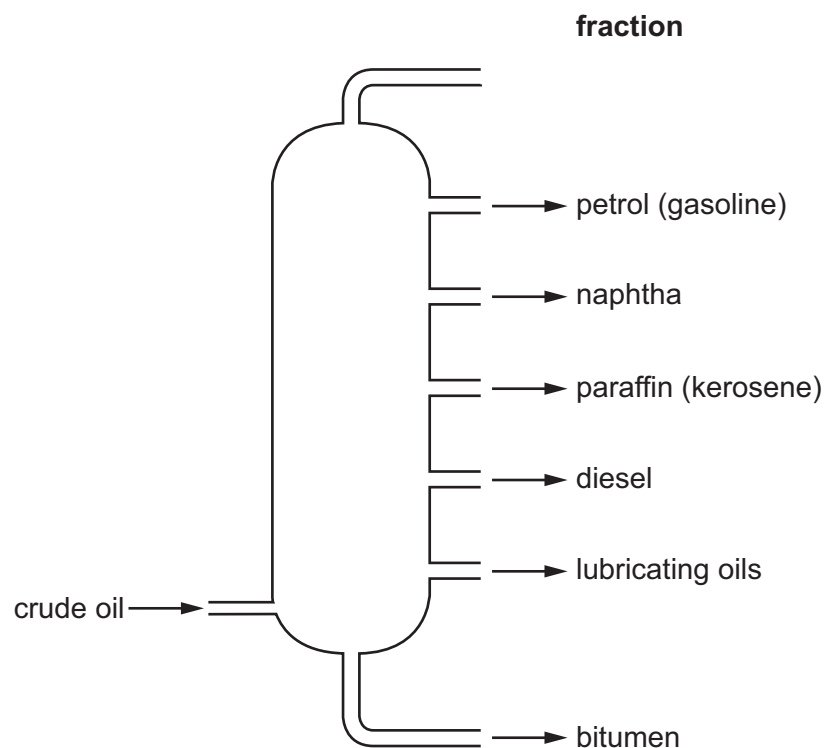


Which statements about this reaction are correct?

- 1 More energy is needed to break the bonds than is released when new bonds are formed.
- 2 Route 1 and route 2 give the same overall equation for the reaction.
- 3 Route 2 involves the use of a catalyst.
- 4 The reaction is exothermic.

A 1, 2 and 3 B 1 and 2 only C 2, 3 and 4 D 3 and 4 only

17 The diagram shows the fractionation of petroleum (crude oil).



Which row shows the correct use for the fraction?

| | fraction | use |
|----------|---------------------|------------------------------|
| A | bitumen | as a lubricant |
| B | diesel | for aircraft engines |
| C | naphtha | making road surfaces |
| D | paraffin (kerosene) | fuel for heating and cooking |

18 Which compound is a constituent of petroleum (crude oil)?

- A** C_2H_5OH **B** CH_3CO_2H **C** C_8H_{18} **D** $C_6H_{12}O_6$

19 A student wrote two conclusions about calcium carbonate.

conclusion 1 The reaction with dilute hydrochloric acid is faster with powdered calcium carbonate than with large pieces of calcium carbonate.

conclusion 2 Grinding large pieces of calcium carbonate to form powder increases the surface area.

Which statement is correct?

- A Both conclusions are correct and conclusion 2 explains conclusion 1.
- B Both conclusions are correct but conclusion 2 does not explain conclusion 1.
- C Conclusion 1 is correct but conclusion 2 is not correct.
- D Conclusion 2 is correct but conclusion 1 is not correct.

20 A compound decolourises acidified potassium manganate(VII).

What could this compound be?

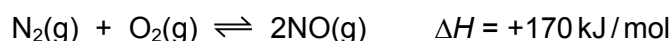
1 magnesium chloride, $MgCl_2$

2 iron(II) chloride, $FeCl_2$

3 ethanol, C_2H_5OH

- A 1, 2 and 3 B 1 and 2 only C 2 and 3 only D 3 only

21 Nitrogen reacts with oxygen in an equilibrium reaction.



When the reaction is at equilibrium, which statement is correct?

- A The concentration of nitrogen present will change with time.
- B The forward and backward reactions are taking place at the same rate.
- C The forward reaction releases heat energy.
- D There are more molecules on the left hand side of the equation than on the right.

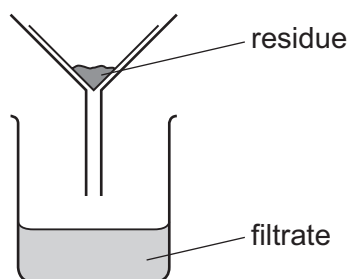
22 A solution of **W** has the following properties.

- When added in excess to solid ammonium chloride, a gas is given off that turns damp red litmus paper blue.
- When added in excess to a solution of pH 3, the resulting solution has a pH of 13.

What is **W**?

- A** a strong acid
B a strong base
C a weak acid
D a weak base

23 Pure lead(II) sulfate is prepared by mixing two substances, X and Y. When the reaction is complete the mixture is filtered. Pure lead(II) sulfate is obtained.



Which row shows the best way to prepare pure lead(II) sulfate?

| | substance X | substance Y | method after filtration |
|----------|--------------------------|------------------------|--------------------------|
| A | aqueous lead(II) nitrate | aqueous sodium sulfate | crystallise the filtrate |
| B | aqueous lead(II) nitrate | aqueous sodium sulfate | wash and dry the residue |
| C | solid lead(II) carbonate | dilute sulfuric acid | crystallise the filtrate |
| D | solid lead(II) carbonate | dilute sulfuric acid | wash and dry the residue |

24 What are the percentages by mass of nitrogen in ammonium nitrate, NH_4NO_3 , and in calcium nitrate, $\text{Ca}(\text{NO}_3)_2$?

| | % nitrogen in NH_4NO_3 | % nitrogen in $\text{Ca}(\text{NO}_3)_2$ |
|----------|--|--|
| A | 18 | 14 |
| B | 18 | 17 |
| C | 35 | 9 |
| D | 35 | 17 |

30 Which statement about the reactions of some metals and metal compounds is correct?

- A Copper reacts with dilute hydrochloric acid to form hydrogen.
- B Sodium oxide is reduced to sodium metal by heating with carbon.
- C Zinc carbonate is more thermally stable than sodium carbonate.
- D Zinc displaces copper from aqueous copper(II) sulfate.

31 Which metal is used in the galvanising of iron?

- A calcium
- B copper
- C lead
- D zinc

32 Iron is obtained in the blast furnace from the ore haematite.

Which process takes place in the blast furnace?

- A Calcium carbonate is used to remove acidic impurities.
- B Coke is reduced to carbon dioxide.
- C Haematite is oxidised by carbon monoxide.
- D Haematite undergoes thermal decomposition.

33 Aluminium is a Group III element. It is extracted from its ore by electrolysis.

The position of aluminium in the Periodic Table indicates that its aqueous ion is likely to be1..... .

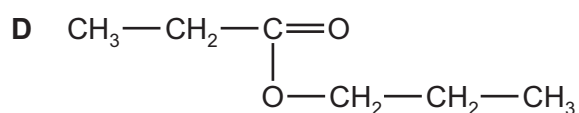
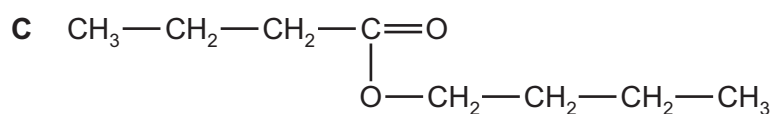
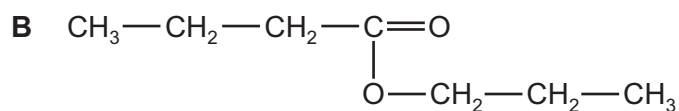
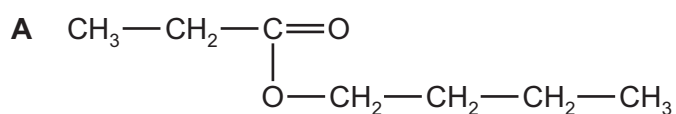
Its method of extraction indicates that aluminium is2..... in the reactivity series.

Which words complete gaps 1 and 2?

| | 1 | 2 |
|----------|------------|------|
| A | coloured | high |
| B | coloured | low |
| C | colourless | high |
| D | colourless | low |

- 38 A carboxylic acid of molecular formula $C_4H_8O_2$ reacts with an alcohol of molecular formula C_3H_8O to form an ester.

What could be the formula of the ester formed?



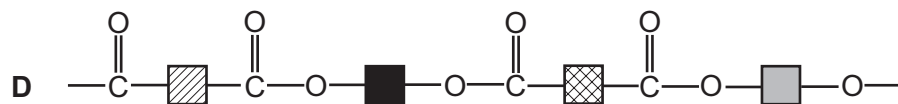
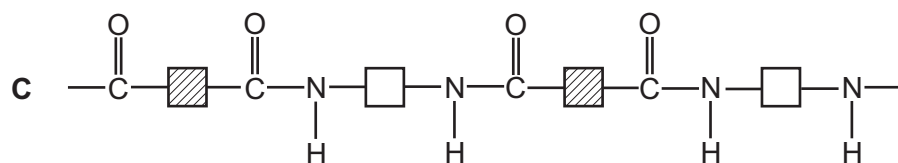
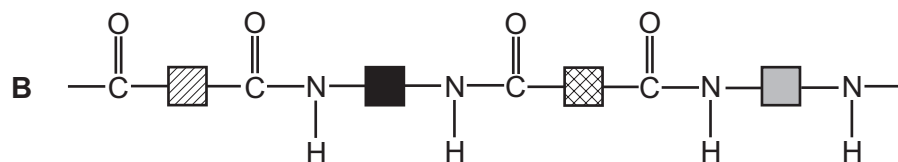
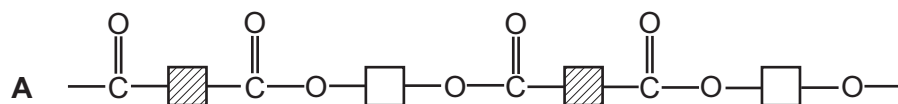
- 39 Some properties of compound **J** are listed.

- It reacts with potassium carbonate to produce carbon dioxide.
- It reacts with ethanol to produce a sweet-smelling liquid.
- It reacts with sodium hydroxide to produce a salt.

What is a possible identity of **J**?

- A ethanoic acid
 B ethanol
 C ethyl ethanoate
 D ethyl methanoate

40 Which partial structure represents nylon?



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The Periodic Table of Elements

| | | Group | | | | | | | | | | | | | | | |
|----------------------------|-----------------------------|----------------------------|---------------------------------|---|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|-------------------------------|------------------------------|
| I | II | III | IV | V | VI | VII | VIII | | | | | | | | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | 11 Na sodium 23 | 12 Mg magnesium 24 | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Key atomic number atomic symbol name relative atomic mass </div> | | | | | | | | | | | | | |
| 19 K potassium 39 | 20 Ca calcium 40 | 21 Sc scandium 45 | 22 Ti titanium 48 | 23 V vanadium 51 | 24 Cr chromium 52 | 25 Mn manganese 55 | 26 Fe iron 56 | 27 Co cobalt 59 | 28 Ni nickel 59 | 29 Cu copper 64 | 30 Zn zinc 65 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 |
| 37 Rb rubidium 85 | 38 Sr strontium 88 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium — | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 |
| 55 Cs caesium 133 | 56 Ba barium 137 | 57–71 lanthanoids | 72 Hf hafnium 178 | 73 Ta tantalum 181 | 74 W tungsten 184 | 75 Re rhenium 186 | 76 Os osmium 190 | 77 Ir iridium 192 | 78 Pt platinum 195 | 79 Au gold 197 | 80 Hg mercury 201 | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium — | 85 At astatine — | 86 Rn radon — |
| 87 Fr francium — | 88 Ra radium — | 89–103 actinoids | 104 Rf rutherfordium — | 105 Db dubnium — | 106 Sg seaborgium — | 107 Bh bohrium — | 108 Hs hassium — | 109 Mt meitnerium — | 110 Ds darmstadtium — | 111 Rg roentgenium — | 112 Cn copernicium — | 114 Fl flerovium — | 116 Lv livermorium — | 118 Og oganesson — | 119 Uue unbinilium — | 120 Uub unbinilium — | 121 Uut ununilium — |

| | | | | | | | | | | | | | | | |
|-------------|------------------------------|----------------------------|---------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|-------------------------------|------------------------------|---------------------------|-------------------------------|------------------------------|------------------------------|
| lanthanoids | 57 La lanthanum 139 | 58 Ce cerium 140 | 59 Pr praseodymium 141 | 60 Nd neodymium 144 | 61 Pm promethium — | 62 Sm samarium 150 | 63 Eu europium 152 | 64 Gd gadolinium 157 | 65 Tb terbium 159 | 66 Dy dysprosium 163 | 67 Ho holmium 165 | 68 Er erbium 167 | 69 Tm thulium 169 | 70 Yb ytterbium 173 | 71 Lu lutetium 175 |
| actinoids | 89 Ac actinium — | 90 Th thorium 232 | 91 Pa protactinium 231 | 92 U uranium 238 | 93 Np neptunium — | 94 Pu plutonium — | 95 Am americium — | 96 Cm curium — | 97 Bk berkelium — | 98 Cf californium — | 99 Es einsteinium — | 100 Fm fermium — | 101 Md mendelevium — | 102 No nobelium — | 103 Lr lawrencium — |

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).