



# Cambridge IGCSE™

## CHEMISTRY

Paper 1 Multiple Choice (Core)

0620/12

May/June 2022

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

## INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

## INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.



- 1 Substances change state when their temperature is changed.

Which changes of state take place when the temperature of a substance is lowered?

- 1 boiling
- 2 condensation
- 3 freezing
- 4 melting

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

- 2 A student measures the time taken for 2.0 g of magnesium to dissolve in 50 cm<sup>3</sup> of dilute sulfuric acid.

Which apparatus is essential to complete the experiment?

- 1 stop-clock
- 2 measuring cylinder
- 3 thermometer
- 4 balance

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

- 3 Which method is used to separate a mixture of the following liquids?

| liquid      | boiling point/°C |
|-------------|------------------|
| methanol    | 64.5             |
| ethanol     | 78.5             |
| propan-1-ol | 97.2             |
| butan-1-ol  | 117.0            |

- A** crystallisation
- B** evaporation
- C** filtration
- D** fractional distillation

- 4 X and Y are two different elements.

X and Y have the same number of nucleons.

Which statement about X and Y is correct?

- A They have the same physical properties.
- B Their atoms have the same number of electrons.
- C They are in different groups of the Periodic Table.
- D They have different relative masses.

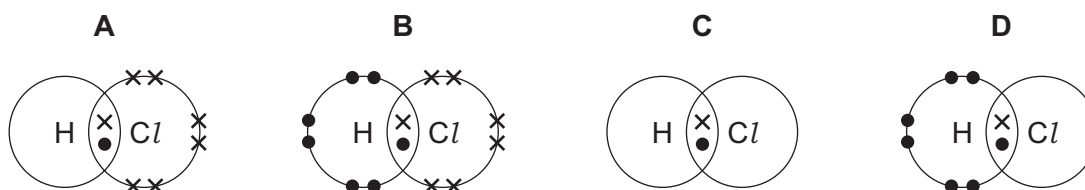
- 5 Which row identifies an alloy, a pure metal and a non-metal?

|          | alloy  | pure metal | non-metal |
|----------|--------|------------|-----------|
| <b>A</b> | brass  | carbon     | copper    |
| <b>B</b> | brass  | copper     | carbon    |
| <b>C</b> | copper | brass      | carbon    |
| <b>D</b> | copper | carbon     | brass     |

- 6 Which statement about ions and ionic bonding is correct?

- A Caesium atoms gain electrons to form negatively charged caesium ions.
- B Ionic bonding involves sharing of pairs of electrons.
- C Potassium ions and chloride ions have the same number of outer-shell electrons.
- D Sodium ions have an equal number of protons and electrons.

- 7 Which dot-and-cross diagram shows the arrangement of outer shell electrons in a molecule of hydrogen chloride?



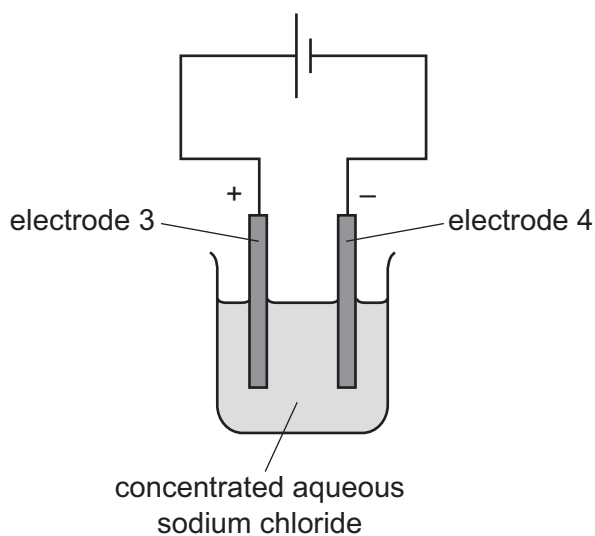
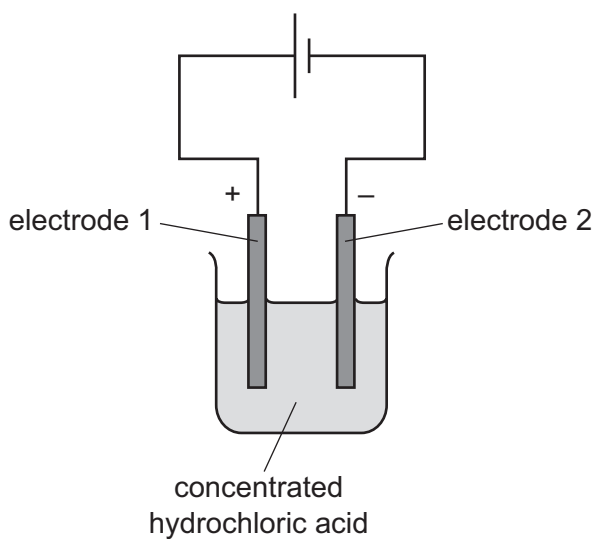
- 8 Which statement explains why graphite can be used as a lubricant?

- A All of the atoms in graphite are carbon.
- B Each carbon atom forms three bonds.
- C Graphite has a macromolecular structure.
- D The layers in graphite can slide over each other.

- 9 A compound of element X has the formula  $X_2O$  and a relative formula mass of 144.

What is element X?

- A copper, Cu
  - B gadolinium, Gd
  - C sulfur, S
  - D tellurium, Te
- 10 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



At which electrodes is hydrogen produced?

- A electrode 1 only
  - B electrodes 1 and 3
  - C electrode 2 only
  - D electrodes 2 and 4
- 11 Which type of reaction occurs when calcium carbonate is heated at a high temperature to produce calcium oxide and carbon dioxide?
- A combustion
  - B endothermic
  - C oxidation
  - D reduction

12 Which row identifies a chemical change and a physical change?

|          | chemical change             | physical change             |
|----------|-----------------------------|-----------------------------|
| <b>A</b> | boiling ethanol             | burning ethanol             |
| <b>B</b> | burning ethanol             | evaporating ethanol         |
| <b>C</b> | dissolving ethanol in water | burning ethanol             |
| <b>D</b> | evaporating ethanol         | dissolving ethanol in water |

13 Which statement about rate of reaction is correct?

- A** Catalysts increase the time for the reaction to be completed.
- B** Decreasing particle size increases the rate of reaction.
- C** Decreasing temperature increases the rate of reaction.
- D** Rate of reaction decreases as the concentration increases.

14 Some common household substances are tested with litmus and methyl orange.

| household substance | colour of litmus | colour of methyl orange |
|---------------------|------------------|-------------------------|
| bicarbonate of soda | blue             | yellow                  |
| lemonade            | red              | red                     |
| milk                | red              | red                     |
| milk of magnesia    | blue             | yellow                  |
| washing powder      | blue             | yellow                  |
| vinegar             | red              | red                     |

Which statement is correct?

- A** Lemonade, milk and bicarbonate of soda are all acidic.
- B** Milk of magnesia can neutralise washing powder.
- C** Milk of magnesia, washing powder and vinegar are all bases.
- D** Vinegar can neutralise bicarbonate of soda.

**15** Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

- A** The copper(II) sulfate turns blue and the solution formed gets colder.
- B** The copper(II) sulfate turns blue and the solution formed gets hotter.
- C** The copper(II) sulfate turns white and the solution formed gets colder.
- D** The copper(II) sulfate turns white and the solution formed gets hotter.

**16** In which equation is carbon both oxidised and reduced?

- A**  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- B**  $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
- C**  $3\text{CO} + \text{Fe}_2\text{O}_3 \rightarrow 3\text{CO}_2 + 2\text{Fe}$
- D**  $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$

**17** Aqueous solutions containing copper(II) ions can be identified using flame tests and by adding aqueous sodium hydroxide.

Which row describes what is observed in these tests?

|          | flame test       | aqueous sodium hydroxide |
|----------|------------------|--------------------------|
| <b>A</b> | blue-green flame | light blue precipitate   |
| <b>B</b> | blue-green flame | green precipitate        |
| <b>C</b> | lilac flame      | light blue precipitate   |
| <b>D</b> | lilac flame      | green precipitate        |

- 18 The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

| oxide tested | pH of solution |
|--------------|----------------|
| X            | 1              |
| Y            | 13             |

Which information about X and Y is correct?

|          | oxide is acidic | oxide is basic | metal | non-metal |
|----------|-----------------|----------------|-------|-----------|
| <b>A</b> | X               | Y              | X     | Y         |
| <b>B</b> | X               | Y              | Y     | X         |
| <b>C</b> | Y               | X              | X     | Y         |
| <b>D</b> | Y               | X              | Y     | X         |

- 19 An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

- A** crystallisation → evaporation → filtration  
**B** evaporation → crystallisation → filtration  
**C** filtration → crystallisation → evaporation  
**D** filtration → evaporation → crystallisation

- 20 Some statements about gas G are listed.

G is monoatomic.

G is found in clean, dry air.

G is used in lamps.

Which element is G?

- A** argon  
**B** helium  
**C** nitrogen  
**D** oxygen

**21** Part of the Periodic Table is shown.

Which element is a metal?

A simplified periodic table grid is shown, consisting of a 6x12 grid of squares. The grid is divided into four main sections by a vertical gap between the 3rd and 4th columns. The sections are: a 2x2 block in the top-left, a 2x2 block in the top-right, a 4x4 block in the middle-left, and a 4x4 block in the middle-right. The elements are marked as follows: 'A' is in the top-middle gap; 'B' is in the top-right 2x2 block, specifically in the 4th row and 10th column; 'C' is in the middle-left 4x4 block, specifically in the 4th row and 8th column; 'D' is in the middle-right 4x4 block, specifically in the 4th row and 11th column.

**22** The elements sodium to argon form Period 3 of the Periodic Table.

Which row describes the trend across Period 3 from left to right?

|          | number of<br>outer-shell electrons | metallic<br>character | group<br>number |
|----------|------------------------------------|-----------------------|-----------------|
| <b>A</b> | decreases                          | decreases             | decreases       |
| <b>B</b> | decreases                          | increases             | decreases       |
| <b>C</b> | increases                          | decreases             | increases       |
| <b>D</b> | increases                          | increases             | increases       |

**23** Some properties of element E are listed.

It has a high density.

It has a high melting point.

## What is E?

- A** aluminium  
**B** bromine  
**C** iron  
**D** lithium

**24** Lithium, sodium and potassium are elements in Group I of the Periodic Table.

Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

Which row identifies the **least** dense of these elements in each group?

|          | Group I   | Group VII |
|----------|-----------|-----------|
| <b>A</b> | lithium   | chlorine  |
| <b>B</b> | lithium   | iodine    |
| <b>C</b> | potassium | chlorine  |
| <b>D</b> | potassium | iodine    |

**25** The reactions of metals P, Q, R and S are shown.

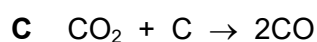
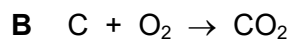
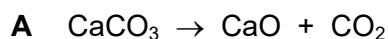
| metal | reaction with water | reaction with hydrochloric acid | reduction of the metal oxide with carbon |
|-------|---------------------|---------------------------------|------------------------------------------|
| P     | no reaction         | no reaction                     | reduced                                  |
| Q     | slow                | vigorous                        | no reaction                              |
| R     | vigorous            | vigorous                        | no reaction                              |
| S     | very slow           | vigorous                        | reduced                                  |

What is the order of reactivity of the metals?

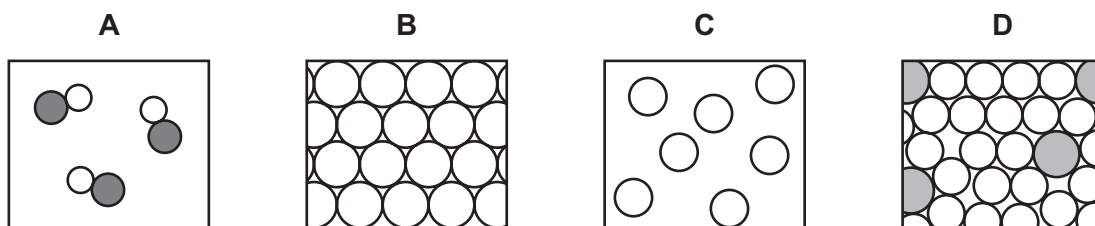
|          | least reactive |  |   |  | most reactive |
|----------|----------------|-------------------------------------------------------------------------------------|---|--|---------------|
| <b>A</b> | P              | S                                                                                   | Q |  | R             |
| <b>B</b> | P              | Q                                                                                   | S |  | R             |
| <b>C</b> | R              | S                                                                                   | Q |  | P             |
| <b>D</b> | R              | Q                                                                                   | S |  | P             |

**26** Iron is extracted from hematite in the blast furnace at a temperature of about 1550 °C.

Which equation shows the main reaction that increases the temperature in the furnace?



27 Which diagram represents the arrangement of atoms in an alloy?



28 Which uses of the metals shown are correct?

|          | aluminium       | stainless steel |
|----------|-----------------|-----------------|
| <b>A</b> | aircraft bodies | car bodies      |
| <b>B</b> | car bodies      | aircraft bodies |
| <b>C</b> | chemical plant  | food containers |
| <b>D</b> | food containers | cutlery         |

29 Which row identifies a substance present in clean air and a substance that is a pollutant in air?

|          | present in clean air | pollutant in air |
|----------|----------------------|------------------|
| <b>A</b> | oxides of nitrogen   | nitrogen         |
| <b>B</b> | carbon dioxide       | sulfur dioxide   |
| <b>C</b> | carbon monoxide      | lead compounds   |
| <b>D</b> | nitrogen             | argon            |

30 Which property of sulfur dioxide explains why it is used as a food preservative?

- A** acidic oxide
- B** bleach
- C** kills bacteria
- D** pungent smell

**31** Fertilisers are used to provide three of the elements needed for plant growth.

Which two compounds would give a fertiliser containing all three of these elements?

- A**  $\text{Ca}(\text{NO}_3)_2$  and  $(\text{NH}_4)_2\text{SO}_4$
- B**  $\text{Ca}(\text{NO}_3)_2$  and  $(\text{NH}_4)_3\text{PO}_4$
- C**  $\text{KNO}_3$  and  $(\text{NH}_4)_2\text{SO}_4$
- D**  $\text{KNO}_3$  and  $(\text{NH}_4)_3\text{PO}_4$

**32** Compound J is an unsaturated carboxylic acid.

Which bonds are present in a molecule of J?

|          | C=C | C=O | O-H |                          |
|----------|-----|-----|-----|--------------------------|
| <b>A</b> | ✓   | ✓   | ✓   | key<br>✓ = yes<br>x = no |
| <b>B</b> | x   | ✓   | ✓   |                          |
| <b>C</b> | ✓   | x   | x   |                          |
| <b>D</b> | x   | ✓   | x   |                          |

**33** Petroleum is separated into useful fractions by fractional distillation.

Which fraction is used as a fuel for jet aeroplanes?

- A** fuel oil
- B** gasoline
- C** naphtha
- D** kerosene / paraffin

**34** What are the products when limestone (calcium carbonate) is heated strongly?

- A** calcium hydroxide and carbon dioxide
- B** calcium hydroxide and carbon monoxide
- C** calcium oxide and carbon dioxide
- D** calcium oxide and carbon monoxide

35 Ethene reacts with substance X to form ethanol.

What is X?

- A ethanoic acid
- B glucose
- C hydrogen
- D steam

36 What is the equation for the complete combustion of methane?

- A  $\text{CH}_4 + 4\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- B  $2\text{CH}_4 + 3\text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2\text{O}$
- C  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- D  $\text{C}_2\text{H}_6 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

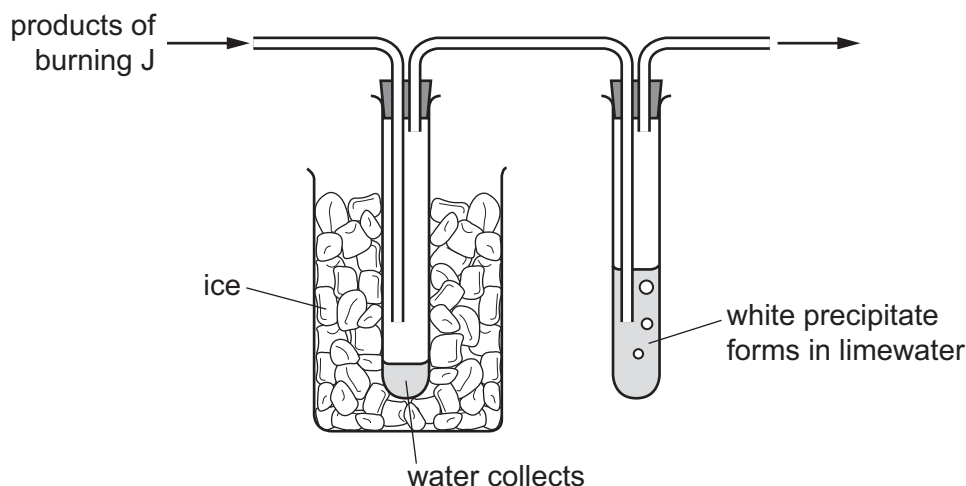
37 Alkenes can be produced by cracking large hydrocarbon molecules to form smaller hydrocarbon molecules.

Which equations represent possible reactions when tetradecane,  $\text{C}_{14}\text{H}_{30}$ , is cracked?

- 1  $\text{C}_{14}\text{H}_{30} \rightarrow \text{C}_2\text{H}_6 + \text{C}_3\text{H}_6 + \text{C}_4\text{H}_8 + \text{C}_5\text{H}_{10}$
- 2  $\text{C}_{14}\text{H}_{30} \rightarrow \text{H}_2 + \text{C}_2\text{H}_4 + \text{C}_3\text{H}_6 + \text{C}_4\text{H}_8 + \text{C}_5\text{H}_{10}$
- 3  $\text{C}_{14}\text{H}_{30} \rightarrow \text{C}_2\text{H}_6 + 4\text{C}_3\text{H}_6$
- 4  $\text{C}_{14}\text{H}_{30} \rightarrow \text{C}_2\text{H}_6 + \text{C}_3\text{H}_8 + \text{C}_9\text{H}_{18}$

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

38 The products formed by burning substance J are passed through the apparatus shown.



What is substance J?

- A carbon monoxide
- B ethanol
- C hydrogen
- D sulfur

39 Which statements about ethanoic acid are correct?

- 1 Aqueous ethanoic acid reacts with magnesium to form magnesium ethanoate.
- 2 Carbon dioxide is formed when aqueous ethanoic acid reacts with sodium carbonate.
- 3 Hydrogen is formed when aqueous ethanoic acid reacts with sodium hydroxide.
- 4 Ethanoic acid turns red litmus paper blue.

- A 1 and 2      B 1 and 3      C 2 and 3      D 2 and 4

40 Which statement about polymerisation is correct?

- A Large monomer molecules join to form small polymer molecules.
- B Large polymer molecules join to form small monomer molecules.
- C Small monomer molecules join to form large polymer molecules.
- D Small polymer molecules join to form large monomer molecules.

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The Periodic Table of Elements

| Group                      |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                           |  |                        |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|---------------------------|--|------------------------|
| I                          | II                          |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | III                         | IV                          | V                           | VI                            | VII                          | VIII                      |  |                        |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 1<br>H<br>hydrogen<br>1     |                             |                             |                               |                              |                           |  | 2<br>He<br>helium<br>4 |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                           |  |                        |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                           |  |                        |
| 11<br>Na<br>sodium<br>23   | 12<br>Mg<br>magnesium<br>24 |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 5<br>B<br>boron<br>11       | 6<br>C<br>carbon<br>12      | 7<br>N<br>nitrogen<br>14    | 8<br>O<br>oxygen<br>16        | 9<br>F<br>fluorine<br>19     | 10<br>Ne<br>neon<br>20    |  |                        |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 13<br>Al<br>aluminium<br>27 | 14<br>Si<br>silicon<br>28   | 15<br>P<br>phosphorus<br>31 | 16<br>S<br>sulfur<br>32       | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40   |  |                        |
| 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40   | 21<br>Sc<br>scandium<br>45                                                                  | 22<br>Ti<br>titanium<br>48      | 23<br>V<br>vanadium<br>51   | 24<br>Cr<br>chromium<br>52   | 25<br>Mn<br>manganese<br>55 | 26<br>Fe<br>iron<br>56       | 27<br>Co<br>cobalt<br>59     | 28<br>Ni<br>nickel<br>59       | 29<br>Cu<br>copper<br>64      | 30<br>Zn<br>zinc<br>65        | 31<br>Ga<br>gallium<br>70   | 32<br>Ge<br>germanium<br>73 | 33<br>As<br>arsenic<br>75   | 34<br>Se<br>selenium<br>79    | 35<br>Br<br>bromine<br>80    | 36<br>Kr<br>krypton<br>84 |  |                        |
| 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89                                                                    | 40<br>Zr<br>zirconium<br>91     | 41<br>Nb<br>niobium<br>93   | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>— | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103   | 46<br>Pd<br>palladium<br>106   | 47<br>Ag<br>silver<br>108     | 48<br>Cd<br>cadmium<br>112    | 49<br>In<br>indium<br>115   | 50<br>Sn<br>tin<br>119      | 51<br>Sb<br>antimony<br>122 | 52<br>Te<br>tellurium<br>128  | 53<br>I<br>iodine<br>127     | 54<br>Xe<br>xenon<br>131  |  |                        |
| 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137   | 57–71<br>lanthanoids                                                                        | 72<br>Hf<br>hafnium<br>178      | 73<br>Ta<br>tantalum<br>181 | 74<br>W<br>tungsten<br>184   | 75<br>Re<br>rhenium<br>186  | 76<br>Os<br>osmium<br>190    | 77<br>Ir<br>iridium<br>192   | 78<br>Pt<br>platinum<br>195    | 79<br>Au<br>gold<br>197       | 80<br>Hg<br>mercury<br>201    | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207     | 83<br>Bi<br>bismuth<br>209  | 84<br>Po<br>polonium<br>—     | 85<br>At<br>astatine<br>—    | 86<br>Rn<br>radon<br>—    |  |                        |
| 87<br>Fr<br>francium<br>—  | 88<br>Ra<br>radium<br>—     | 89–103<br>actinoids                                                                         | 104<br>Rf<br>rutherfordium<br>— | 105<br>Db<br>dubnium<br>—   | 106<br>Sg<br>seaborgium<br>— | 107<br>Bh<br>bohrium<br>—   | 108<br>Hs<br>hassium<br>—    | 109<br>Mt<br>meitnerium<br>— | 110<br>Ds<br>darmstadtium<br>— | 111<br>Rg<br>roentgenium<br>— | 112<br>Cn<br>copernicium<br>— |                             | 114<br>Fl<br>flerovium<br>— |                             | 116<br>Lv<br>livermorium<br>— |                              |                           |  |                        |

lanthanoids

actinoids

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

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