



# Cambridge IGCSE™

## CHEMISTRY

0620/12

Paper 1 Multiple Choice (Core)

October/November 2023

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.



**2**

- 1** The melting points and boiling points of four elements are shown.

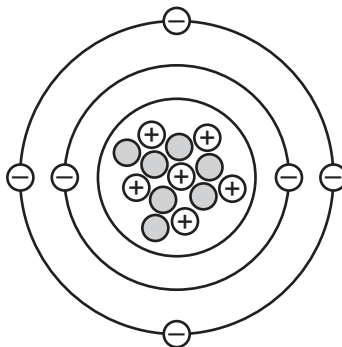
| element | melting point/°C | boiling point/°C |
|---------|------------------|------------------|
| W       | −7               | 60               |
| X       | −101             | −34              |
| Y       | 114              | 184              |
| Z       | 39               | 688              |

In which elements do the particles vibrate about fixed positions at 0 °C?

- A** W and X      **B** W and Z      **C** X and Y      **D** Y and Z
- 2** Which statements about clean, dry air are correct?

- 1 It is a mixture of elements only.
- 2 It is a mixture of elements and compounds.
- 3 It contains only non-metals.

- A** 1 and 3      **B** 1 only      **C** 2 and 3      **D** 2 only
- 3** A representation of an atom is shown.



What is the nucleon number of this atom?

- A** 6      **B** 7      **C** 12      **D** 13
- 4** Which statement describes isotopes of the same element?
- A** They have different electron arrangements.
- B** They have different nuclear charges.
- C** They have nuclei with masses that are the same.
- D** They have the same number of protons.

## 3

- 5 Potassium reacts with iodine to form potassium iodide.

Which statement about potassium iodide is correct?

- A Each potassium atom shares a pair of electrons with an iodine atom.
- B In potassium iodide, the particles of potassium have more protons than electrons.
- C Potassium iodide has a high melting point because it is a covalent compound.
- D Potassium iodide has a low melting point because it is an ionic compound.

- 6 Which row describes the properties of a simple molecular substance?

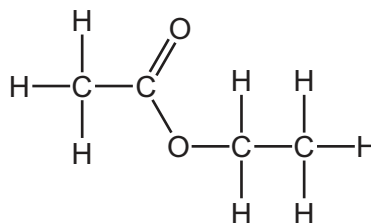
|   | boiling point | electrical conductivity when solid |
|---|---------------|------------------------------------|
| A | low           | poor                               |
| B | high          | poor                               |
| C | low           | good                               |
| D | high          | good                               |

- 7 Different forms of an element G are used as lubricants and in cutting tools.

What is the structure of G?

- A giant covalent
- B ionic
- C metallic
- D simple covalent

- 8 The diagram shows the structure of a molecule of ethyl ethanoate.



What is the molecular formula of a molecule of ethyl ethanoate?

- A CHO
- B C<sub>4</sub>H<sub>8</sub>O<sub>2</sub>
- C C<sub>4</sub>(H<sub>2</sub>)<sub>2</sub>(O<sub>2</sub>)
- D C<sub>2</sub>H<sub>4</sub>O

4

- 9 The formula of a compound containing element X is  $\text{Na}_2\text{X}_2\text{O}_3$ .

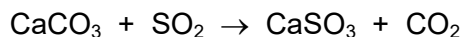
The relative formula mass of the compound is 158.

What is the relative atomic mass of X?

- A** 32                      **B** 59.5                      **C** 64                      **D** 119

- 10 Limestone is used to reduce sulfur dioxide emissions from coal-fired power stations.

The equation for the reaction is shown.



What is the smallest mass of  $\text{CaCO}_3$  required to remove 1 tonne of  $\text{SO}_2$ ?

- A** 1 tonne  
**B** 2 tonnes  
**C** 64 tonnes  
**D** 100 tonnes

- 11 Which statement about electrolysis is correct?

- A** Bromine and hydrogen are formed during the electrolysis of molten lead(II) bromide.  
**B** Metals are formed at the positive electrode.  
**C** Molten covalent compounds are broken down by electricity.  
**D** Platinum is used as an inert electrode.

- 12 Which statements about hydrogen-oxygen fuel cells are correct?

- 1 The reaction between hydrogen and oxygen is endothermic.
- 2 The waste product in a hydrogen-oxygen fuel cell is water.
- 3 A chemical reaction in the cell produces hydrogen which is used as the fuel.
- 4 A hydrogen-oxygen fuel cell is used to generate electricity.

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

**13** The initial and final temperatures of four different reactions are measured.

Which reaction is the **least** exothermic?

|          | initial<br>temperature<br>/°C | final<br>temperature<br>/°C |
|----------|-------------------------------|-----------------------------|
| <b>A</b> | 19                            | 25                          |
| <b>B</b> | 21                            | 18                          |
| <b>C</b> | 22                            | 17                          |
| <b>D</b> | 22                            | 26                          |

**14** Solid calcium carbonate reacts with dilute hydrochloric acid.

Which changes to the reaction conditions increase the rate of reaction?

|          | concentration of<br>hydrochloric acid | surface area of<br>calcium carbonate |
|----------|---------------------------------------|--------------------------------------|
| <b>A</b> | decrease                              | decrease                             |
| <b>B</b> | decrease                              | increase                             |
| <b>C</b> | increase                              | decrease                             |
| <b>D</b> | increase                              | increase                             |

**15** Zinc reacts slowly with dilute sulfuric acid at room temperature.

Bubbles of a gas, L, form on the surface of the zinc.

When a small amount of copper is added, the reaction is faster.

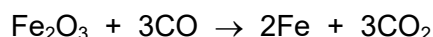
Which row identifies L and explains why the reaction is faster?

|          | gas formed<br>in reaction | reason the reaction is faster     |
|----------|---------------------------|-----------------------------------|
| <b>A</b> | hydrogen                  | copper acts as a catalyst         |
| <b>B</b> | hydrogen                  | copper is more reactive than zinc |
| <b>C</b> | oxygen                    | copper acts as a catalyst         |
| <b>D</b> | oxygen                    | copper is more reactive than zinc |

**16** Which reaction shows a colour change from white to blue?

- A** adding water to anhydrous copper(II) sulfate
- B** adding water to hydrated copper(II) sulfate
- C** heating anhydrous copper(II) sulfate
- D** heating hydrated copper(II) sulfate

**17** In a blast furnace, iron(III) oxide is converted to iron and carbon monoxide is converted to carbon dioxide.



What happens to each of these reactants?

- A** Both iron(III) oxide and carbon monoxide are oxidised.
- B** Both iron(III) oxide and carbon monoxide are reduced.
- C** Iron(III) oxide is oxidised and carbon monoxide is reduced.
- D** Iron(III) oxide is reduced and carbon monoxide is oxidised.

**18** Which products are formed when magnesium carbonate reacts with dilute hydrochloric acid?

- A** carbon dioxide, hydrogen and magnesium chloride
- B** carbon dioxide and magnesium chloride only
- C** carbon dioxide, water and magnesium chloride
- D** water and magnesium chloride only

**19** Which element forms an oxide that reacts with an aqueous solution of a base?

- A** argon
- B** sulfur
- C** magnesium
- D** copper

**20** Which salt is insoluble?

- A** barium sulfate
- B** lead(II) nitrate
- C** magnesium chloride
- D** sodium carbonate

**21** Some properties of element R are shown.

|                                  |                              |
|----------------------------------|------------------------------|
| melting point in °C              | 98                           |
| boiling point in °C              | 883                          |
| reaction with cold water         | gives off H <sub>2</sub> gas |
| reaction when heated with oxygen | burns to give a white solid  |

In which part of the Periodic Table is R found?

- A** Group I
- B** Group VII
- C** Group VIII
- D** transition elements

**22** Lithium, sodium and potassium are elements in Group I.

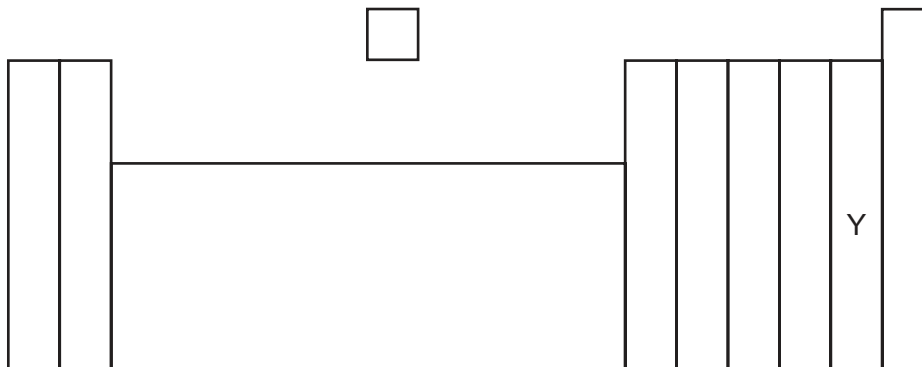
Statements about these elements are listed.

- 1 Lithium is more dense than sodium.
- 2 Sodium is more reactive than potassium.
- 3 They all conduct electricity at room temperature.
- 4 They all react with oxygen at room temperature.

Which statements are correct?

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

**23** An outline of the Periodic Table is shown.



Which name is given to the elements in column Y?

- A** alkali metals
- B** halogens
- C** noble gases
- D** transition elements

**24** Which row describes the properties of a metal that can be used in the manufacture of aircraft?

|          | strength | density | ease of corrosion |
|----------|----------|---------|-------------------|
| <b>A</b> | high     | high    | corrodes easily   |
| <b>B</b> | high     | low     | resists corrosion |
| <b>C</b> | low      | high    | corrodes easily   |
| <b>D</b> | low      | low     | resists corrosion |

**25** Which metallic element is added to iron in the manufacture of stainless steel?

- A** carbon
- B** copper
- C** lead
- D** nickel

**26** Which statement about the uses of metals is correct?

- A** Aluminium is used in the manufacture of overhead electrical cables as it has a high density.
- B** Aluminium is used to make food containers as it conducts electricity.
- C** Stainless steel is used in cutlery because it is resistant to rusting.
- D** Stainless steel is used to make chemical reactors because it is a soft alloy.



**27** The list gives the order of some metals and hydrogen in the reactivity series.

Metal X is also included.

|                |    |
|----------------|----|
| most reactive  | K  |
|                | Mg |
|                | Zn |
|                | H  |
|                | X  |
| least reactive | Cu |

Which row shows the properties of metal X?

|          | reacts with dilute acids | oxide reduced by carbon |
|----------|--------------------------|-------------------------|
| <b>A</b> | no                       | no                      |
| <b>B</b> | no                       | yes                     |
| <b>C</b> | yes                      | no                      |
| <b>D</b> | yes                      | yes                     |

**28** Which gas in the air is needed for iron to rust?

- A** argon
- B** carbon dioxide
- C** nitrogen
- D** oxygen

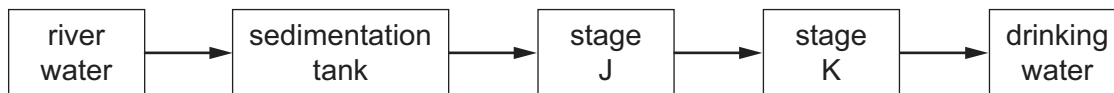
**29** Why is limestone added to the blast furnace?

- A** It neutralises the molten slag produced.
- B** It reacts with impurities to form slag.
- C** It releases carbon dioxide which reduces the iron(III) oxide.
- D** It removes acidic gases such as carbon dioxide.

**30** Which process removes carbon dioxide from the atmosphere?

- A** photosynthesis
- B** thermal decomposition of calcium carbonate
- C** combustion of fossil fuels
- D** reaction of sodium carbonate with an acid

- 31 The flow chart shows stages in the treatment of river water to produce drinking water.



What occurs at stages J and K?

|          | J            | K            |
|----------|--------------|--------------|
| <b>A</b> | distillation | chlorination |
| <b>B</b> | distillation | filtration   |
| <b>C</b> | filtration   | chlorination |
| <b>D</b> | filtration   | distillation |

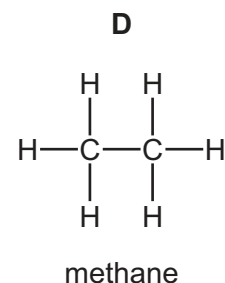
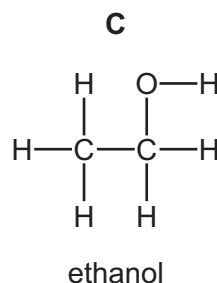
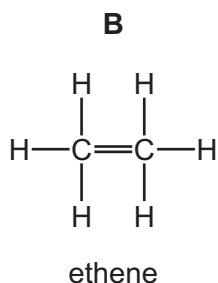
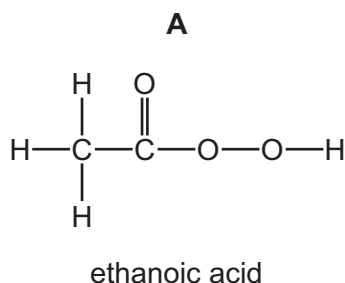
- 32 Which two compounds can be mixed together to form an NPK fertiliser?

- A** ammonium phosphate and calcium hydroxide
- B** calcium phosphate and ammonium nitrate
- C** potassium nitrate and calcium oxide
- D** potassium phosphate and ammonium nitrate

- 33 What are the main substances produced by the fractional distillation of liquid air?

- A** oxygen and carbon dioxide
- B** oxygen and nitrogen
- C** helium and nitrogen
- D** hydrogen and oxygen

- 34 Which diagram shows the displayed formula for the named organic compound?



**35** Poly(ethene) is formed from petroleum using three separate processes.

In which order are the processes used?

- A** cracking → fractional distillation → polymerisation
- B** cracking → polymerisation → fractional distillation
- C** fractional distillation → cracking → polymerisation
- D** fractional distillation → polymerisation → cracking

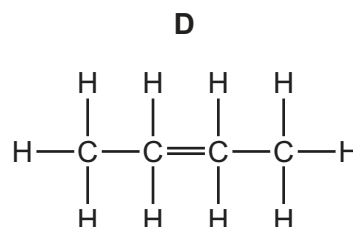
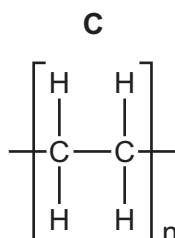
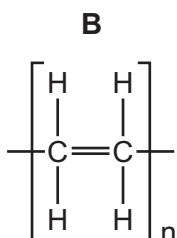
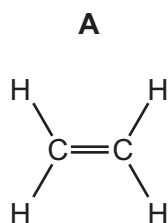
**36** Gas oil and naphtha are two fractions obtained from petroleum.

What are uses of gas oil and naphtha?

|          | gas oil            | naphtha          |
|----------|--------------------|------------------|
| <b>A</b> | jet fuel           | making chemicals |
| <b>B</b> | jet fuel           | making roads     |
| <b>C</b> | diesel engine fuel | making chemicals |
| <b>D</b> | diesel engine fuel | making roads     |

**37** Ethene can be polymerised.

Which diagram represents the structure of the product formed?



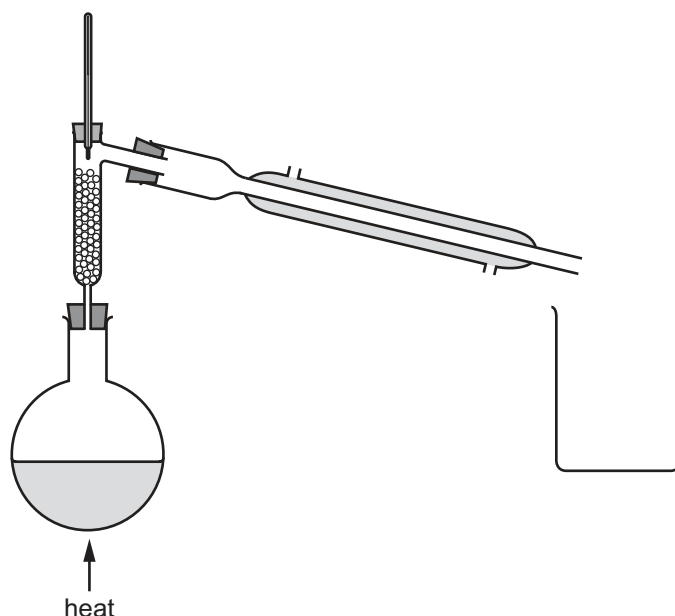
**38** An acid–base titration is described.

- 25.0 cm<sup>3</sup> of dilute aqueous alkali is put into a conical flask.
- Indicator is added to the flask.
- Dilute acid is added to the aqueous alkali until the indicator changes colour.
- The volume of acid used is then recorded.

Which use of apparatus is correct?

- A** The 25.0 cm<sup>3</sup> of aqueous alkali is measured using a volumetric pipette.
- B** The 25.0 cm<sup>3</sup> of aqueous alkali is measured using the lines on the conical flask.
- C** The volume of acid is measured using a measuring cylinder.
- D** The volume of acid is measured using a volumetric pipette.

**39** The apparatus shown is used to separate a mixture.



What is the mixture?

- A** anhydrous copper(II) sulfate and hydrated copper(II) sulfate
- B** sodium chloride and sand
- C** ethanol and methanol
- D** iron and steel

13

40 The results of tests on three gases, X, Y and Z, are shown.

| test                             | X                    | Y          | Z         |
|----------------------------------|----------------------|------------|-----------|
| aqueous potassium manganate(VII) | purple to colourless | no change  | no change |
| damp red litmus paper            | no change            | turns blue | no change |
| lighted splint                   | no change            | no change  | pops      |

What are X, Y and Z?

|          | X              | Y              | Z        |
|----------|----------------|----------------|----------|
| <b>A</b> | chlorine       | sulfur dioxide | hydrogen |
| <b>B</b> | chlorine       | sulfur dioxide | oxygen   |
| <b>C</b> | sulfur dioxide | ammonia        | oxygen   |
| <b>D</b> | sulfur dioxide | ammonia        | hydrogen |

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The Periodic Table of Elements

| Group                                                                                                             |                         |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
|-------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------|-----------------------------|--------------------------|--------------------------|--------------------------|------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-------------------------|-------------------------|--------------------------|---------------------------|--------------------------|------------------------|
| I                                                                                                                 | II                      |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           | III                       | IV                      | V                       | VI                       | VII                       | VIII                     |                        |
| <div>1Hhydrogen1</div> <div>Key<div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div></div> |                         |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 3Li<br>lithium<br>7                                                                                               | 4Be<br>beryllium<br>9   |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 11Na<br>sodium<br>23                                                                                              | 12Mg<br>magnesium<br>24 | 13Al<br>aluminium<br>27 | 14Si<br>silicon<br>28   | 15P<br>phosphorus<br>31     | 16S<br>sulfur<br>32      | 17Cl<br>chlorine<br>35.5 | 18Ar<br>argon<br>40      |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 19K<br>potassium<br>39                                                                                            | 20Ca<br>calcium<br>40   | 21Sc<br>scandium<br>45  | 22Ti<br>titanium<br>48  | 23V<br>vanadium<br>51       | 24Cr<br>chromium<br>52   | 25Mn<br>manganese<br>55  | 26Fe<br>iron<br>56       | 27Co<br>cobalt<br>59   | 28Ni<br>nickel<br>59     | 29Cu<br>copper<br>64       | 30Zn<br>zinc<br>65        | 31Ga<br>gallium<br>70     | 32Ge<br>germanium<br>73 | 33As<br>arsenic<br>75   | 34Se<br>selenium<br>79   | 35Br<br>bromine<br>80     | 36Kr<br>krypton<br>84    |                        |
| 37Rb<br>rubidium<br>85                                                                                            | 38Sr<br>strontium<br>88 | 39Y<br>yttrium<br>89    | 40Zr<br>zirconium<br>91 | 41Nb<br>niobium<br>93       | 42Mo<br>molybdenum<br>96 | 43Tc<br>technetium<br>—  | 44Ru<br>ruthenium<br>101 | 45Rh<br>rhodium<br>103 | 46Pd<br>palladium<br>106 | 47Ag<br>silver<br>108      | 48Cd<br>cadmium<br>112    | 49In<br>indium<br>115     | 50Sn<br>tin<br>119      | 51Sb<br>antimony<br>122 | 52Te<br>tellurium<br>128 | 53I<br>iodine<br>127      | 54Xe<br>xenon<br>131     |                        |
| 55Cs<br>caesium<br>133                                                                                            | 56Ba<br>barium<br>137   | 57–71<br>lanthanoids    |                         | 72Hf<br>hafnium<br>178      | 73Ta<br>tantalum<br>181  | 74W<br>tungsten<br>184   | 75Re<br>rhenium<br>186   | 76Os<br>osmium<br>190  | 77Ir<br>iridium<br>192   | 78Pt<br>platinum<br>195    | 79Au<br>gold<br>197       | 80Hg<br>mercury<br>201    | 81Tl<br>thallium<br>204 | 82Pb<br>lead<br>207     | 83Bi<br>bismuth<br>209   | 84Po<br>polonium<br>—     | 85At<br>astatine<br>—    | 86Rn<br>radon<br>—     |
| 87Fr<br>francium<br>—                                                                                             | 88Ra<br>radium<br>—     | 89–103<br>actinoids     |                         | 104Rf<br>rutherfordium<br>— | 105Db<br>dubnium<br>—    | 106Sg<br>seaborgium<br>— | 107Bh<br>bohrium<br>—    | 108Hs<br>hassium<br>—  | 109Mt<br>meitnerium<br>— | 110Ds<br>darmstadtium<br>— | 111Rg<br>roentgenium<br>— | 112Cn<br>copernicium<br>— | 113Nh<br>nihonium<br>—  | 114Fl<br>flerovium<br>— | 115Mc<br>moscovium<br>—  | 116Lv<br>livermorium<br>— | 117Ts<br>tennessine<br>— | 118Og<br>oganeson<br>— |

|             |                              |                            |                                 |                              |                             |                             |                             |                               |                            |                               |                              |                           |                               |                              |                              |
|-------------|------------------------------|----------------------------|---------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|-------------------------------|------------------------------|---------------------------|-------------------------------|------------------------------|------------------------------|
| lanthanoids | 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 dm<sup>3</sup> at room temperature and pressure (r.t.p.).