



# Cambridge IGCSE™

**CHEMISTRY**

**0620/12**

Paper 1 Multiple Choice (Core)

**February/March 2021**

**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.

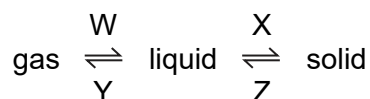
## INFORMATION

- 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 In which changes do the particles move further apart?



- A** W and X      **B** W and Z      **C** X and Y      **D** Y and Z

2 Gases are separated from liquid air by fractional distillation.

The boiling points of four gases are shown.

Which gas is both monoatomic and a liquid at  $-200\text{ }^{\circ}\text{C}$ ?

|          | gas      | boiling point/ $^{\circ}\text{C}$ |
|----------|----------|-----------------------------------|
| <b>A</b> | argon    | $-186$                            |
| <b>B</b> | helium   | $-269$                            |
| <b>C</b> | neon     | $-246$                            |
| <b>D</b> | nitrogen | $-196$                            |

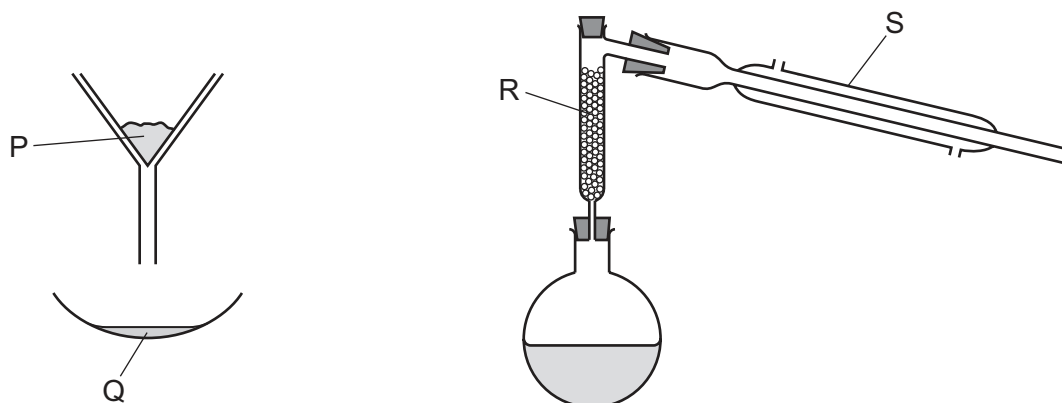
3 Impurities change the melting and boiling points of substances.

Sodium chloride is added to a sample of pure water.

How does the addition of sodium chloride affect the melting point and the boiling point of the water?

|          | melting point | boiling point |
|----------|---------------|---------------|
| <b>A</b> | increases     | increases     |
| <b>B</b> | decreases     | decreases     |
| <b>C</b> | increases     | decreases     |
| <b>D</b> | decreases     | increases     |

- 4 The apparatus used to separate a mixture of sand, methanol and ethanol is shown.



Which row identifies the labels on the diagrams?

|          | P        | Q        | R                    | S                    |
|----------|----------|----------|----------------------|----------------------|
| <b>A</b> | filtrate | residue  | condenser            | fractionating column |
| <b>B</b> | filtrate | residue  | fractionating column | condenser            |
| <b>C</b> | residue  | filtrate | condenser            | fractionating column |
| <b>D</b> | residue  | filtrate | fractionating column | condenser            |

- 5 A neutral atom, J, contains 45 neutrons and 35 electrons.

Which row is correct for atom J?

|          | proton number | nucleon number |
|----------|---------------|----------------|
| <b>A</b> | 35            | 45             |
| <b>B</b> | 35            | 80             |
| <b>C</b> | 45            | 45             |
| <b>D</b> | 45            | 80             |

- 6 Lithium and fluorine react to form lithium fluoride.

A student writes three statements about the reaction.

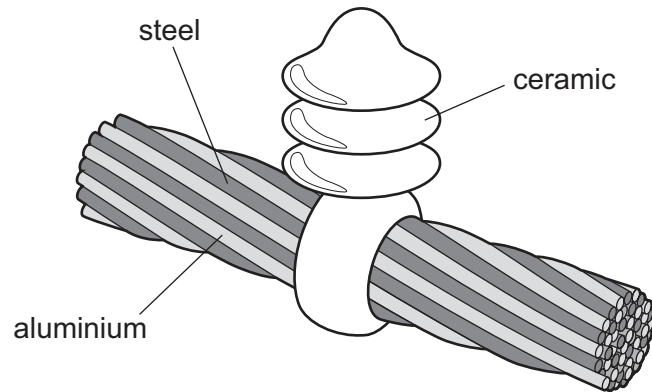
- 1 Lithium atoms lose an electron when they react.
- 2 Each fluoride ion has one more electron than a fluorine atom.
- 3 Lithium fluoride is a mixture of elements.

Which statements are correct?

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

- 7 Which definition of isotopes is correct?
- A atoms of the same element that have the same number of electrons and nucleons
  - B atoms of the same element that have the same number of neutrons and protons
  - C atoms of the same element that have the same number of protons but a different number of electrons
  - D atoms of the same element that have the same number of protons but a different number of nucleons
- 8 In which molecule are all the outer shell electrons from each atom used to form covalent bonds?
- A CH<sub>4</sub>                      B Cl<sub>2</sub>                      C H<sub>2</sub>O                      D NH<sub>3</sub>
- 9 What is the balanced chemical equation for the reaction between calcium and water?
- A  $\text{Ca} + \text{H}_2\text{O} \rightarrow \text{CaOH} + \text{H}_2$
  - B  $\text{Ca} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$
  - C  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{CaOH} + \text{H}_2$
  - D  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$
- 10 A compound has the formula XF<sub>2</sub> and has a relative mass of 70.
- What is element X?
- A gallium
  - B germanium
  - C sulfur
  - D ytterbium

11 The diagram shows a section of an overhead power cable.



Which statement explains why a particular substance is used?

- A Aluminium has a low density and is a good conductor of electricity.
- B Ceramic is a good conductor of electricity.
- C Steel can rust in damp air.
- D Steel is more dense than aluminium.

12 Three substances are electrolysed using inert electrodes.

Which substances produce hydrogen at the negative electrode?

- 1 concentrated hydrochloric acid
- 2 concentrated aqueous sodium chloride
- 3 dilute sulfuric acid

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

13 Which row describes an endothermic reaction?

|          | energy level diagram | energy transfer                                             |
|----------|----------------------|-------------------------------------------------------------|
| <b>A</b> |                      | energy is transferred from the surroundings to the reaction |
| <b>B</b> |                      | energy is transferred from the surroundings to the reaction |
| <b>C</b> |                      | energy is transferred from the reaction to the surroundings |
| <b>D</b> |                      | energy is transferred from the reaction to the surroundings |

14 Fuels release heat energy when they burn.

Which substances are used as fuels?

- 1 argon
- 2 butane
- 3 hydrogen
- 4 methane

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

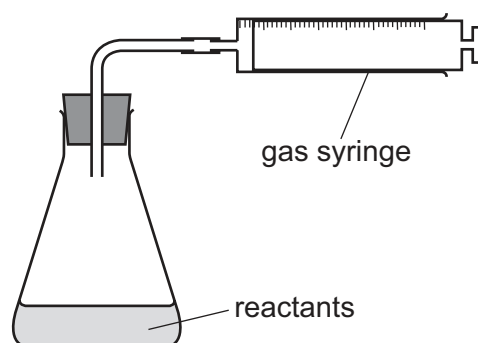
15 When zinc carbonate is mixed with dilute hydrochloric acid a change, M, takes place.

When carbon is heated with copper(II) oxide a change, N, takes place.

Which row describes changes M and N?

|          | M        | N        |
|----------|----------|----------|
| <b>A</b> | chemical | chemical |
| <b>B</b> | chemical | physical |
| <b>C</b> | physical | chemical |
| <b>D</b> | physical | physical |

16 The apparatus shown is used to measure the rate of a reaction.



Which equation represents a reaction where the rate can be measured using this apparatus?

- A**  $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
- B**  $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
- C**  $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$
- D**  $2\text{Na(s)} + \text{Br}_2\text{(l)} \rightarrow 2\text{NaBr(s)}$

**17** P is a hydrated metal salt with a blue colour. When P is heated, water is given off, leaving solid Q.

R is a hydrated metal salt with a pink colour. When R is heated, water is given off, leaving solid S.

Which row gives the name of P and the colour of S?

|          | name of P                    | colour of S |
|----------|------------------------------|-------------|
| <b>A</b> | hydrated cobalt(II) chloride | blue        |
| <b>B</b> | hydrated cobalt(II) chloride | white       |
| <b>C</b> | hydrated copper(II) sulfate  | blue        |
| <b>D</b> | hydrated copper(II) sulfate  | white       |

**18** Which property is shown by the alkali sodium hydroxide?

- A** It has a pH less than pH 7.  
**B** It produces a gas when it is warmed with ammonium chloride.  
**C** It turns blue litmus red.  
**D** It turns universal indicator green.

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

Which element forms an acidic oxide?

|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------|----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>A</b> |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|          | <b>C</b> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**20** When aqueous sodium hydroxide is added to a solution of a metal ion, a grey-green precipitate forms, which dissolves in excess to form a dark green solution.

What is the identity of the metal ion?

- A** chromium(III)  
**B** iron(II)  
**C** iron(III)  
**D** copper(II)



21 Which statements describe the Periodic Table?

- 1 The elements are arranged in order of their nucleon number.
- 2 The elements are arranged in order of their proton number.
- 3 It is used to predict the properties of elements.

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

22 Which row shows how the properties of the Group I elements change on descending the group?

|          | density   | melting point | reactivity |
|----------|-----------|---------------|------------|
| <b>A</b> | decreases | increases     | increases  |
| <b>B</b> | decreases | increases     | decreases  |
| <b>C</b> | increases | decreases     | increases  |
| <b>D</b> | increases | decreases     | decreases  |

23 Copper is a transition element.

Two compounds of copper are copper(II) oxide and copper(II) carbonate.

Which row describes the two compounds?

|          | copper(II) oxide | colour of copper(II) carbonate |
|----------|------------------|--------------------------------|
| <b>A</b> | acidic           | green                          |
| <b>B</b> | acidic           | white                          |
| <b>C</b> | basic            | green                          |
| <b>D</b> | basic            | white                          |

24 The metal beryllium does not react with cold water.

It reacts with hydrochloric acid but cannot be extracted from its ore by using carbon.

Where is beryllium placed in the reactivity series?

magnesium

**A**

zinc

**B**

iron

**C**

copper

**D**

25 Pure iron is a soft metal.

When mixed with small amounts of tungsten it produces a hard alloy called tungsten steel.

Which statements are correct?

- 1 Pure iron is a transition element.
- 2 The particles in pure iron are arranged in ordered layers.
- 3 Tungsten steel is a compound.

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

26 Which row describes magnesium?

|          | electrical conductivity | reacts with dilute acid |
|----------|-------------------------|-------------------------|
| <b>A</b> | low                     | no                      |
| <b>B</b> | low                     | yes                     |
| <b>C</b> | high                    | no                      |
| <b>D</b> | high                    | yes                     |

27 Four equations are shown.

- 1  $C + O_2 \rightarrow CO_2$
- 2  $CaCO_3 \rightarrow CaO + CO_2$
- 3  $SiO_2 + 2CO \rightarrow Si + 2CO_2$
- 4  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Which equations represent reactions that take place during the extraction of iron from hematite?

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

28 Copper is used to make saucepans.

Which properties of copper make it suitable for this use?

- 1 Copper has a relatively high melting point.
- 2 Copper has a low density.
- 3 Copper is a good conductor of electricity.
- 4 Copper is a good conductor of heat.

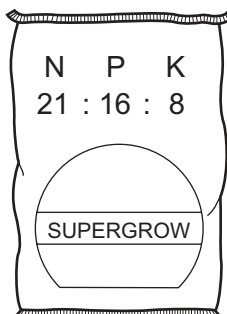
**A** 1 and 2      **B** 1 and 4      **C** 2 and 4      **D** 3 and 4

29 Which pollutants are responsible for the erosion of buildings and statues?

- 1 carbon monoxide
- 2 oxides of nitrogen
- 3 sulfur dioxide

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

30 Which combination of chemical compounds can be used to produce the fertiliser shown?



- A  $(\text{NH}_4)_3\text{PO}_4$ ,  $\text{KCl}$   
B  $\text{NH}_4\text{NO}_3$ ,  $\text{Ca}_3(\text{PO}_4)_2$   
C  $\text{NH}_4\text{NO}_3$ ,  $\text{CO}(\text{NH}_2)_2$   
D  $\text{NH}_4\text{NO}_3$ ,  $\text{K}_2\text{SO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$

31 X is produced when petrol burns completely in air.

What is X?

- A argon  
B carbon dioxide  
C carbon monoxide  
D hydrogen

32 Which substance is used as a bleach in the manufacture of paper?

- A carbon dioxide  
B nitrogen dioxide  
C silicon dioxide  
D sulfur dioxide

33 What is an industrial use of calcium carbonate?

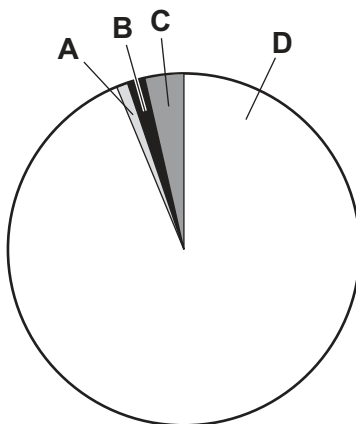
- A cracking of hydrocarbons
- B manufacture of aluminium
- C manufacture of cement
- D purification of water

34 Which product is formed when calcium carbonate undergoes thermal decomposition?

- A calcium
- B calcium hydroxide
- C calcium oxide
- D calcium silicate

35 The pie chart represents the composition of natural gas.

Which sector represents methane?

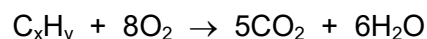


36 Which fraction, obtained from petroleum, is used for jet fuel?

- A bitumen
- B gasoline
- C kerosene
- D naphtha

37 The formula of a hydrocarbon is  $C_xH_y$ .

The equation for its complete combustion is shown.



What are the values of x and y?

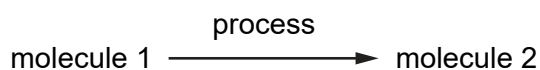
|          | x  | y  |
|----------|----|----|
| <b>A</b> | 5  | 6  |
| <b>B</b> | 5  | 12 |
| <b>C</b> | 6  | 5  |
| <b>D</b> | 12 | 5  |

38 Pentane is an alkane and pentene is an alkene.

What is observed when bromine water is added to a sample of each compound?

|          | pentane            | pentene            |
|----------|--------------------|--------------------|
| <b>A</b> | becomes colourless | becomes colourless |
| <b>B</b> | becomes colourless | remains unchanged  |
| <b>C</b> | remains unchanged  | becomes colourless |
| <b>D</b> | remains unchanged  | remains unchanged  |

39 Molecule 1 undergoes a process to make molecule 2.



Which row describes the molecules and the process?

|          | molecule 1     | process        | molecule 2 |
|----------|----------------|----------------|------------|
| <b>A</b> | monomer        | cracking       | polymer    |
| <b>B</b> | monomer        | polymerisation | polymer    |
| <b>C</b> | small molecule | polymerisation | monomer    |
| <b>D</b> | small molecule | cracking       | monomer    |

40 Which substance has long-chain molecules and is a constituent of food?

- A carbohydrate
- B nylon
- C poly(ethene)
- D *Terylene*

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The Periodic Table of Elements

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

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