



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**CHEMISTRY**

Paper 2 Multiple Choice (Extended)

**0620/22**

**May/June 2018**

**45 minutes**

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



**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.

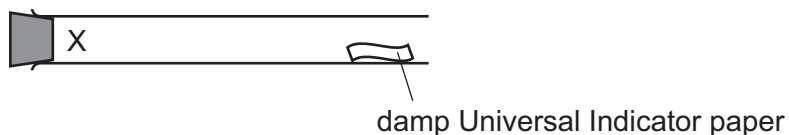
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **13** printed pages and **3** blank pages.



- 1 A gas is released at point X in the apparatus shown.

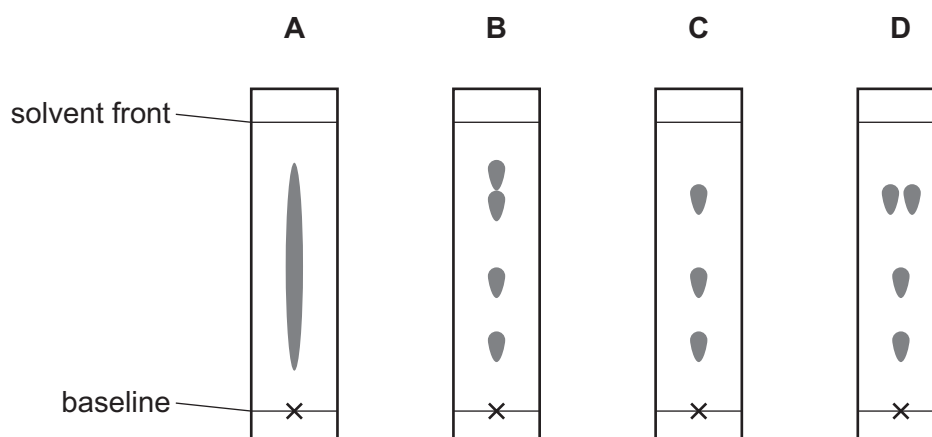


Which gas turns the damp Universal Indicator paper red most quickly?

- A ammonia,  $\text{NH}_3$
  - B chlorine,  $\text{Cl}_2$
  - C hydrogen chloride,  $\text{HCl}$
  - D sulfur dioxide,  $\text{SO}_2$
- 2 A chromatography experiment was done to separate a mixture of four substances.

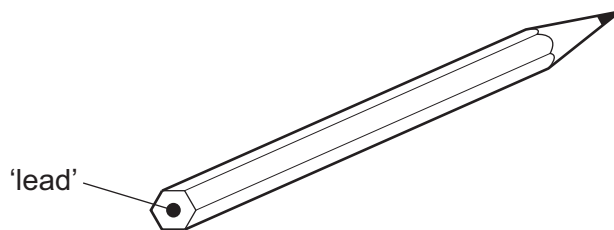
The  $R_f$  values measured for these substances were 0.3, 0.5, 0.8 and 0.8.

Which diagram shows the chromatogram obtained?



- 3 Which piece of apparatus **cannot** be used to collect and measure the volume of gas produced in an experiment?
- A burette
  - B gas syringe
  - C measuring cylinder
  - D pipette

- 4 The 'lead' in a pencil is made of a mixture of graphite and clay.

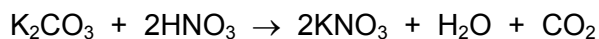


When the percentage of graphite is increased, the pencil slides across the paper more easily.

Which statement explains this observation?

- A Graphite has a high melting point.
  - B Graphite is a form of carbon.
  - C Graphite is a lubricant.
  - D Graphite is a non-metal.
- 5 Which pair shows particles with the same chemical properties?
- A  ${}_{11}^{23}\text{M}$  and  ${}_{11}^{23}\text{M}^{+}$
  - B  ${}_{11}^{23}\text{M}$  and  ${}_{11}^{24}\text{M}$
  - C  ${}_{11}^{23}\text{M}$  and  ${}_{12}^{23}\text{M}$
  - D  ${}_{11}^{24}\text{M}^{+}$  and  ${}_{12}^{24}\text{M}^{+}$
- 6 Which substances have similar structures?
- A diamond and graphite
  - B diamond and silicon(IV) oxide
  - C graphite and poly(ethene)
  - D graphite and silicon(IV) oxide
- 7 Which substance is **not** a macromolecule?
- A diamond
  - B graphite
  - C silicon(IV) oxide
  - D sulfur

- 8 The equation for the reaction between potassium carbonate and nitric acid is shown.



Which volume of carbon dioxide is produced from 69 g of potassium carbonate?

- A 6 dm<sup>3</sup>      B 12 dm<sup>3</sup>      C 24 dm<sup>3</sup>      D 48 dm<sup>3</sup>

- 9 A solution of sodium carbonate, Na<sub>2</sub>CO<sub>3</sub>, has a concentration of 0.03 mol/dm<sup>3</sup>.

Which mass of sodium carbonate is dissolved in 1 dm<sup>3</sup> of this solution?

- A 1.06 g      B 3.18 g      C 10.60 g      D 31.80 g

- 10 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement about the electrolysis is **not** correct?

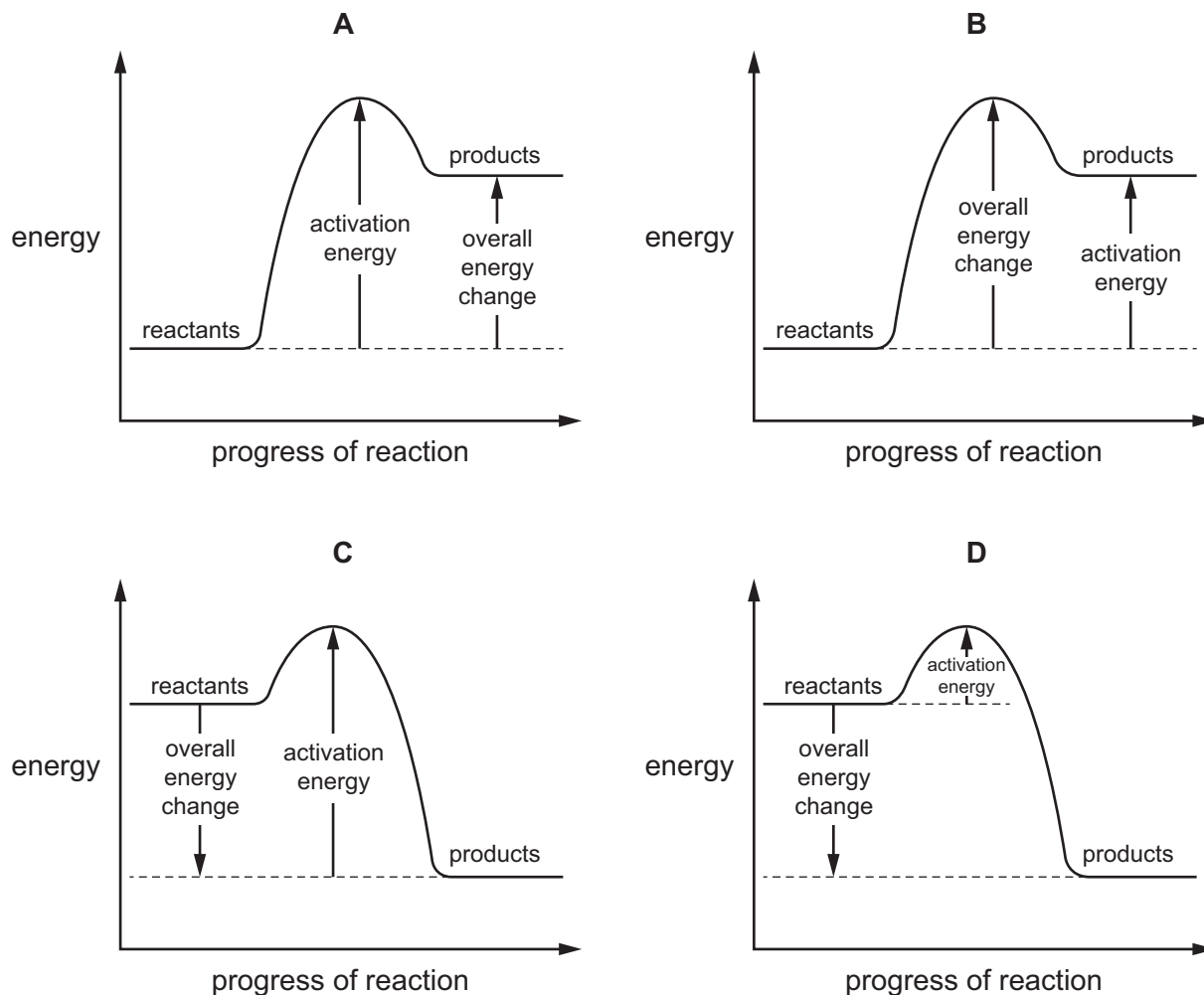
- A An oxidation reaction occurs at the positive electrode.  
 B The current is carried through the electrolyte by ions.  
 C The negative electrode gains mass.  
 D The number of copper(II) ions in the electrolyte decreases.

- 11 Dilute sulfuric acid is electrolysed using inert electrodes.

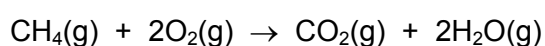
What are the ionic half-equations for the reactions that take place at each electrode?

|   | positive electrode                                                        | negative electrode                                                        |
|---|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| A | $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$                        | $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$ |
| B | $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$                        | $4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$              |
| C | $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$ | $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$                        |
| D | $4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$              | $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$                        |

12 Which diagram is a correctly labelled energy level diagram for an endothermic reaction?



13 The equation for the complete combustion of methane is shown.



The bond energies are shown in the table.

| bond | bond energy in kJ/mol |
|------|-----------------------|
| C–H  | +410                  |
| C=O  | +805                  |
| O–H  | +460                  |
| O=O  | +496                  |

What is the energy change for the reaction?

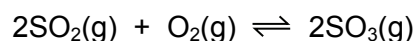
- A** –818 kJ/mol   **B** –359 kJ/mol   **C** –323 kJ/mol   **D** +102 kJ/mol

- 14 Which row describes the effects of increasing both concentration and temperature on the collisions between reacting particles?

|          | increasing concentration                                                       | increasing temperature                                                         |
|----------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>A</b> | more collisions per second only                                                | more collisions per second only                                                |
| <b>B</b> | more collisions per second and more collisions with sufficient energy to react | more collisions per second only                                                |
| <b>C</b> | more collisions per second only                                                | more collisions per second and more collisions with sufficient energy to react |
| <b>D</b> | more collisions per second and more collisions with sufficient energy to react | more collisions per second and more collisions with sufficient energy to react |

- 15 Sulfur dioxide reacts with oxygen at 2 atmospheres pressure. The forward reaction is exothermic.

The equation for the reaction is shown.



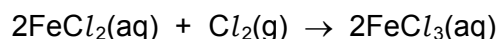
The reaction reaches equilibrium. The pressure is then doubled.

How and why does the amount of sulfur trioxide formed change?

|          | amount of sulfur trioxide | reason                                 |
|----------|---------------------------|----------------------------------------|
| <b>A</b> | decreases                 | the forward reaction is exothermic     |
| <b>B</b> | decreases                 | there are fewer molecules on the right |
| <b>C</b> | increases                 | the forward reaction is exothermic     |
| <b>D</b> | increases                 | there are fewer molecules on the right |

- 16 Iron(II) chloride solution reacts with chlorine gas.

The equation is shown.



Which statements about this reaction are correct?

- 1  $\text{Fe}^{2+}$  ions are reduced to  $\text{Fe}^{3+}$  ions.
- 2 Chlorine acts as a reducing agent.
- 3  $\text{Fe}^{2+}$  ions each lose an electron.
- 4  $\text{Cl}_2$  molecules are reduced to  $\text{Cl}^-$  ions.

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

17 Which statement about oxides is correct?

- A A solution of magnesium oxide has a pH less than pH 7.
- B A solution of sulfur dioxide has a pH greater than pH 7.
- C Magnesium oxide reacts with nitric acid to make a salt.
- D Sulfur dioxide reacts with hydrochloric acid to make a salt.

18 Which statement about acids and bases is correct?

- A A base is a donor of hydrogen ions.
- B An acid is an acceptor of protons.
- C A strong acid is fully ionised in aqueous solution.
- D A weak acid cannot be used to neutralise a strong base.

19 The solubility of some salts is shown.

|           | chloride  | nitrate | sulfate   | carbonate |
|-----------|-----------|---------|-----------|-----------|
| barium    | soluble   | soluble | insoluble | insoluble |
| lead(II)  | insoluble | soluble | insoluble | insoluble |
| potassium | soluble   | soluble | soluble   | soluble   |
| zinc      | soluble   | soluble | soluble   | insoluble |

Which two aqueous solutions produce an insoluble salt when mixed together?

- A barium chloride and zinc nitrate
- B barium nitrate and lead(II) nitrate
- C lead(II) nitrate and potassium carbonate
- D potassium nitrate and zinc sulfate

20 Which methods are suitable for preparing **both** zinc sulfate and copper(II) sulfate?

- 1 reacting the metal oxide with warm dilute aqueous sulfuric acid
- 2 reacting the metal with dilute aqueous sulfuric acid
- 3 reacting the metal carbonate with dilute aqueous sulfuric acid

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

21 Which statement about the Periodic Table is correct?

- A Elements in the same group have the same number of electron shells.
- B It contains elements arranged in order of increasing proton number.
- C Metals are on the right and non-metals are on the left.
- D The most reactive elements are at the bottom of every group.

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

Which statement about these elements is **not** correct?

- A The colour gets darker down the group.
- B The density increases down the group.
- C They are all gases at room temperature and pressure.
- D They are all non-metals.

23 Which row describes the properties of a transition element?

|   | property 1                 | property 2                  |
|---|----------------------------|-----------------------------|
| A | forms colourless compounds | acts as a catalyst          |
| B | forms colourless compounds | low electrical conductivity |
| C | high density               | acts as a catalyst          |
| D | high density               | low electrical conductivity |

24 Stainless steel is an alloy of iron, carbon and other metals.

Which row is correct?

|   | stainless steel is harder than pure iron | stainless steel resists corrosion better than pure iron |
|---|------------------------------------------|---------------------------------------------------------|
| A | ✓                                        | ✓                                                       |
| B | ✓                                        | x                                                       |
| C | x                                        | ✓                                                       |
| D | x                                        | x                                                       |



**25** Metal X is more reactive than metal Y. Metal Y is more reactive than metal Z.

Which statement is correct?

- A** When metal X is placed in a solution of Y sulfate, there is no reaction.
- B** When metal X is placed in a solution of Z sulfate, a reaction occurs.
- C** When metal Y is placed in a solution of Z sulfate, there is no reaction.
- D** When metal Z is placed in a solution of X sulfate, a reaction occurs.

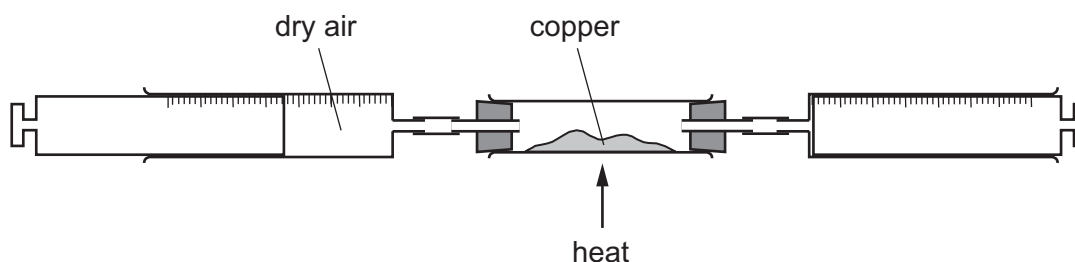
**26** Which statement about the industrial extraction of zinc is correct?

- A** Cryolite is added to lower the melting point.
- B** Molten zinc oxide is electrolysed.
- C** Zinc oxide is heated with coke.
- D** Zinc sulfide is heated with coke.

**27** Which row describes the use of an alloy and the property upon which the use depends?

|          | alloy           | use       | property                      |
|----------|-----------------|-----------|-------------------------------|
| <b>A</b> | mild steel      | cutlery   | resistant to corrosion        |
| <b>B</b> | mild steel      | machinery | strong                        |
| <b>C</b> | stainless steel | cutlery   | low density                   |
| <b>D</b> | stainless steel | machinery | good conductor of electricity |

**28** Dry air is passed over hot copper until all the oxygen has reacted.



The volume of gas at the end of the reaction is  $120\text{ cm}^3$ .

What is the starting volume of dry air?

- A**  $132\text{ cm}^3$
- B**  $152\text{ cm}^3$
- C**  $180\text{ cm}^3$
- D**  $570\text{ cm}^3$

- 29** A steel bicycle which had been left outdoors for several months was starting to rust.

What would **not** reduce the rate of corrosion?

- A** Remove the rust and paint the bicycle.
- B** Remove the rust and store the bicycle in a dry shed.
- C** Remove the rust and wipe the bicycle with a clean, damp cloth.
- D** Remove the rust and wipe the bicycle with an oily cloth.

- 30** Which statements about water are correct?

- 1 Household water contains dissolved salts.
- 2 Water for household use is filtered to remove soluble impurities.
- 3 Water is treated with chlorine to kill bacteria.
- 4 Water is used in industry for cooling.

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

- 31** Ammonia is manufactured by reacting hydrogen with nitrogen in the Haber process.

Which row describes the sources of hydrogen and nitrogen and the conditions used in the manufacture of ammonia in the Haber process?

|          | source of hydrogen | source of nitrogen | temperature of reaction / °C | pressure of reaction / atm |
|----------|--------------------|--------------------|------------------------------|----------------------------|
| <b>A</b> | air                | natural gas        | 250                          | 2                          |
| <b>B</b> | air                | natural gas        | 250                          | 200                        |
| <b>C</b> | natural gas        | air                | 450                          | 2                          |
| <b>D</b> | natural gas        | air                | 450                          | 200                        |

- 32** Which statements about the carbon cycle are correct?

- 1 Carbon dioxide is added to the atmosphere by respiration.
- 2 Carbon dioxide is added to the atmosphere by combustion of coal.
- 3 Carbon dioxide is removed from the atmosphere by photosynthesis.

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

33 Which row describes the uses of sulfur and sulfur dioxide?

|          | sulfur                       | sulfur dioxide    |
|----------|------------------------------|-------------------|
| <b>A</b> | extraction of aluminium      | food preservative |
| <b>B</b> | extraction of aluminium      | water treatment   |
| <b>C</b> | manufacture of sulfuric acid | food preservative |
| <b>D</b> | manufacture of sulfuric acid | water treatment   |

34 Limestone is used in many industrial processes.

In which process is it **not** used?

- A** manufacture of alkenes
- B** manufacture of cement
- C** manufacture of iron
- D** manufacture of lime

35 What is **not** the correct use of the fraction named?

|          | name of fraction | use                    |
|----------|------------------|------------------------|
| <b>A</b> | fuel oil         | making waxes           |
| <b>B</b> | gas oil          | fuel in diesel engines |
| <b>C</b> | kerosene         | jet fuel               |
| <b>D</b> | naphtha          | making chemicals       |

36 Which statement about alkenes is **not** correct?

- A** They decolourise aqueous bromine.
- B** They only contain the elements carbon and hydrogen.
- C** They react with hydrogen to form alkanes.
- D** They react with steam to produce carboxylic acids.

37 Which substances can be obtained by cracking hydrocarbons?

- A** ethanol and ethene
- B** ethanol and hydrogen
- C** ethene and hydrogen
- D** ethene and poly(ethene)

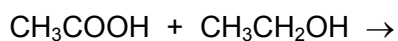
38 Two processes used for the large-scale production of ethanol are shown.

- process 1    A compound containing carbon, hydrogen and oxygen is used to produce ethanol.
- process 2    A compound containing carbon and hydrogen only is used to produce ethanol.

Which statement is correct?

- A    Process 1 uses a renewable starting material.
- B    Process 1 is done at a very high temperature.
- C    Process 2 involves fermentation.
- D    Process 2 is done at room temperature.

39 What is the name of the organic product of the reaction shown?



- A    ethyl ethanoate
- B    ethyl methanoate
- C    methyl ethanoate
- D    methyl propanoate

40 Which two compounds react together to form a condensation polymer?

- A     $\text{HOCH}_2\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{COOH}$
- B     $\text{HOCH}_2\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{NH}_2$
- C     $\text{HOCH}_2\text{CH}_2\text{OH}$  and  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$
- D     $\text{HOCH}_2\text{CH}_2\text{OH}$  and  $\text{HOOCCH}_2\text{CH}_2\text{COOH}$

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## The Periodic Table of Elements

| Group                      |                             |                                                                |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                               |                              |                              |                              |                                |  |                        |
|----------------------------|-----------------------------|----------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|--|------------------------|
| I                          | II                          | Key                                                            |                                 |                             |                              |                             |                              |                              |                                |                               |                               | III                         | IV                            | V                            | VI                           | VII                          | VIII                           |  |                        |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | atomic number<br>atomic symbol<br>name<br>relative atomic mass |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 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>— | 117<br>Ts<br>tennessine<br>— | 118<br>Og<br>oganesson<br>—  | 119<br>Nh<br>nihonium<br>—   | 120<br>Ds<br>darmstadtium<br>— |  |                        |

|             |           |    |           |          |    |    |        |         |     |    |              |              |     |    |           |         |     |    |            |           |    |    |          |           |    |    |          |           |    |    |            |        |    |    |         |           |    |    |            |             |    |    |         |             |    |     |        |         |    |     |         |             |    |     |           |          |    |     |          |            |   |
|-------------|-----------|----|-----------|----------|----|----|--------|---------|-----|----|--------------|--------------|-----|----|-----------|---------|-----|----|------------|-----------|----|----|----------|-----------|----|----|----------|-----------|----|----|------------|--------|----|----|---------|-----------|----|----|------------|-------------|----|----|---------|-------------|----|-----|--------|---------|----|-----|---------|-------------|----|-----|-----------|----------|----|-----|----------|------------|---|
| 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 | euporium | 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  $24\text{ dm}^3$  at room temperature and pressure (r.t.p.).