



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/22

Paper 2 Multiple Choice (Extended)

May/June 2018

45 minutes

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

* 2 6 0 9 9 7 6 6 6 4 *

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.

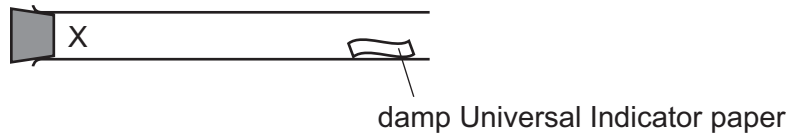
A copy of the Periodic Table is printed on page 16.

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.

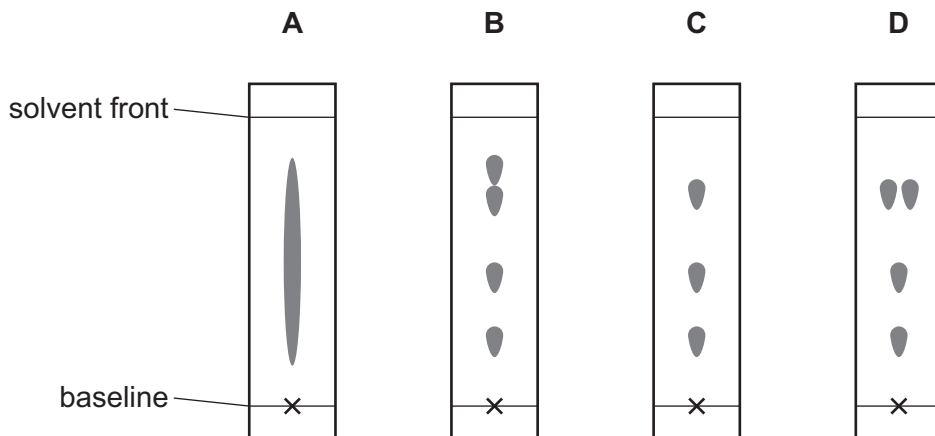


Which gas turns the damp Universal Indicator paper red most quickly?

- A ammonia, NH_3
 - B chlorine, Cl_2
 - C hydrogen chloride, HCl
 - D sulfur dioxide, SO_2
- 2 A chromatography experiment was done to separate a mixture of four substances.

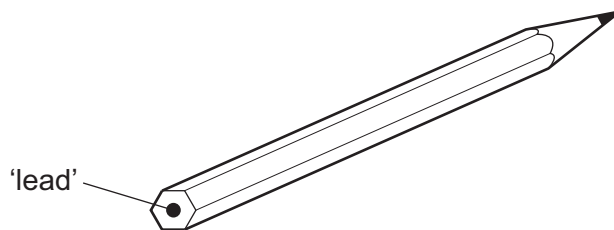
The R_f values measured for these substances were 0.3, 0.5, 0.8 and 0.8.

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.

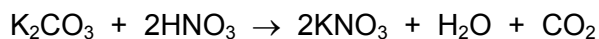


When the percentage of graphite is increased, the pencil slides across the paper more easily.

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.



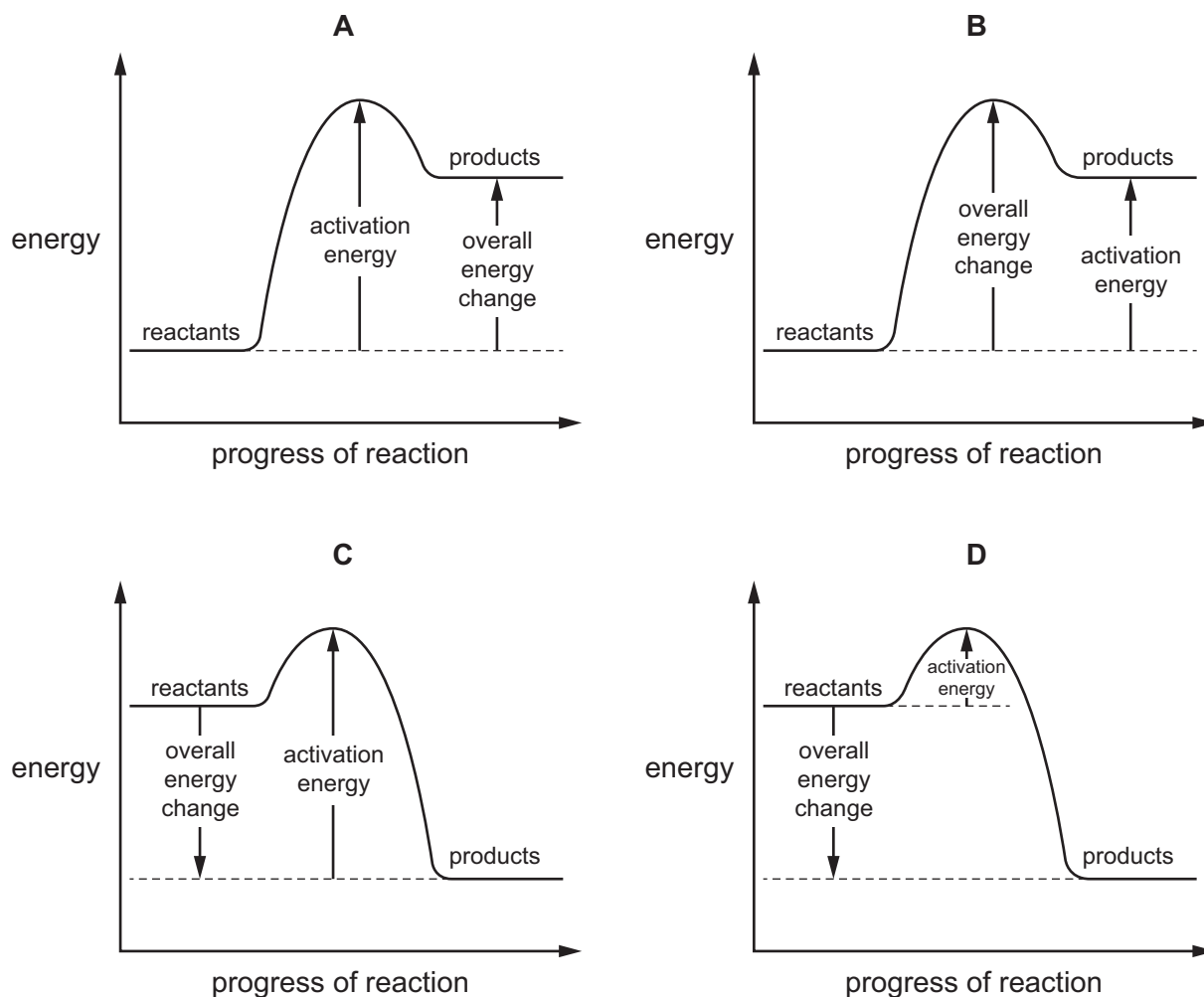
Which volume of carbon dioxide is produced from 69 g of potassium carbonate?

- A 6 dm³ B 12 dm³ C 24 dm³ D 48 dm³
- 9 A solution of sodium carbonate, Na₂CO₃, has a concentration of 0.03 mol/dm³.
Which mass of sodium carbonate is dissolved in 1 dm³ 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.

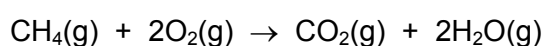
What are the ionic half-equations for the reactions that take place at each electrode?

| | 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?

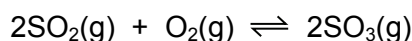
- A** -818 kJ/mol **B** -359 kJ/mol **C** -323 kJ/mol **D** +102 kJ/mol

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

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



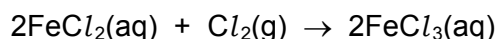
The reaction reaches equilibrium. The pressure is then doubled.

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

| | amount of sulfur trioxide | reason |
|----------|---------------------------|--|
| A | decreases | the forward reaction is exothermic |
| B | decreases | there are fewer molecules on the right |
| C | increases | the forward reaction is exothermic |
| D | 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 Fe^{2+} ions are reduced to Fe^{3+} ions.
- 2 Chlorine acts as a reducing agent.
- 3 Fe^{2+} ions each lose an electron.
- 4 Cl_2 molecules are reduced to 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.

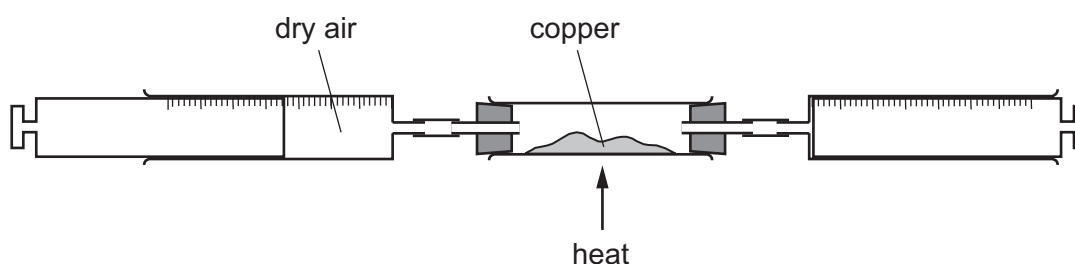
26 Which statement about the industrial extraction of zinc is correct?

- 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 |
|---|-----------------|-----------|-------------------------------|
| A | mild steel | cutlery | resistant to corrosion |
| B | mild steel | machinery | strong |
| C | stainless steel | cutlery | low density |
| D | 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 cm^3 .

What is the starting volume of dry air?

- A 132 cm^3
- B 152 cm^3
- C 180 cm^3
- D 570 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 |
|----------|--------------------|--------------------|----------------------------|--------------------------|
| A | air | natural gas | 250 | 2 |
| B | air | natural gas | 250 | 200 |
| C | natural gas | air | 450 | 2 |
| D | 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 |
|----------|------------------------------|-------------------|
| A | extraction of aluminium | food preservative |
| B | extraction of aluminium | water treatment |
| C | manufacture of sulfuric acid | food preservative |
| D | 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 |
|----------|------------------|------------------------|
| A | fuel oil | making waxes |
| B | gas oil | fuel in diesel engines |
| C | kerosene | jet fuel |
| D | 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.

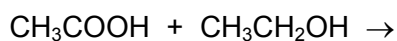
process 1 A compound containing carbon, hydrogen and oxygen is used to produce ethanol.

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 CH_3COOH
- B $\text{HOCH}_2\text{CH}_2\text{OH}$ and CH_3NH_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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| I | II | III | IV | V | VI | VII | VIII | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | 11 Na sodium 23 | 12 Mg magnesium 24 | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 | 18 Ar argon 40 | 19 K potassium 39 | 20 Ca calcium 40 | 21 Sc scandium 45 | 22 Ti titanium 48 | 23 V vanadium 51 | 24 Cr chromium 52 | 25 Mn manganese 55 | 26 Fe iron 56 | 27 Co cobalt 59 | 28 Ni nickel 59 | 29 Cu copper 64 | 30 Zn zinc 65 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 | 37 Rb rubidium 85 | 38 Sr strontium 88 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium — | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 | 55 Cs caesium 133 | 56 Ba barium 137 | 57–71 lanthanoids | 72 Hf hafnium 178 | 73 Ta tantalum 181 | 74 W tungsten 184 | 75 Re rhenium 186 | 76 Os osmium 190 | 77 Ir iridium 192 | 78 Pt platinum 195 | 79 Au gold 197 | 80 Hg mercury 201 | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium — | 85 At astatine — | 86 Rn radon — | 87 Fr francium — | 88 Ra radium — | 89 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 — | 104 Rf rutherfordium — | 105 Db dubnium — | 106 Sg seaborgium — | 107 Bh bohrium — | 108 Hs hassium — | 109 Mt meitnerium — | 110 Ds darmstadtium — | 111 Rg roentgenium — | 112 Cn copernicium — | 113 Nh nihonium — | 114 Fl flerovium — | 115 Lv livermorium — | 116 Ts tennessine — | 117 Og oganesson — | 118 Uue unbinilium — | 119 Uuh ununilium — | 120 Uuq ununquadium — |

Key

atomic number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

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

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