



Cambridge IGCSE™

CHEMISTRY

0620/22

Paper 2 Multiple Choice (Extended)

February/March 2020

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. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.



- 1 The formula of methane is CH_4 and the formula of ethane is C_2H_6 .

Which row describes diffusion and the relative rates of diffusion of methane and ethane?

| | description of diffusion | relative rate of diffusion |
|----------|---|---|
| A | particles move from a high concentration to a low concentration | ethane diffuses more quickly than methane |
| B | particles move from a high concentration to a low concentration | methane diffuses more quickly than ethane |
| C | particles move from a low concentration to a high concentration | ethane diffuses more quickly than methane |
| D | particles move from a low concentration to a high concentration | methane diffuses more quickly than ethane |

- 2 Which test is used to show that a sample of water is pure?

- A** Evaporate the water to see if any solids remain.
- B** Heat the water to check its boiling point.
- C** Test with anhydrous cobalt(II) chloride.
- D** Use universal indicator paper to check its pH.

- 3 Chromatography is used to separate and identify the components in both coloured and colourless mixtures.

For colourless mixtures the chromatogram has to be treated with another chemical.

What is the name of this type of chemical?

- A** colouring agent
- B** display agent
- C** finding agent
- D** locating agent

- 4 Lithium reacts with fluorine to form the compound lithium fluoride.

Which statement about this reaction is correct?

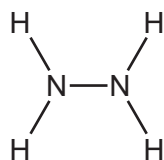
- A Each fluorine atom gains one electron.
- B Each fluorine atom gains two or more electrons.
- C Each fluorine atom loses one electron.
- D Each fluorine atom loses two or more electrons.

- 5 $^{14}_6\text{C}$ and $^{12}_6\text{C}$ are isotopes of carbon.

Which statement about these isotopes is correct?

- A $^{12}_6\text{C}$ is more reactive than $^{14}_6\text{C}$ because the atoms have less mass.
- B $^{12}_6\text{C}$ is more reactive than $^{14}_6\text{C}$ because the atoms have different numbers of neutrons.
- C The reactions of $^{12}_6\text{C}$ are similar to $^{14}_6\text{C}$ because they have the same number of outer shell electrons.
- D The reactions of $^{12}_6\text{C}$ are similar to $^{14}_6\text{C}$ because they have the same number of protons in the nucleus.

- 6 The molecular structure of hydrazine, N_2H_4 , is shown.



Which description of the bonding in hydrazine is **not** correct?

- A Each nitrogen atom has a non-bonding pair of electrons.
- B Each nitrogen atom has four bonding pairs of electrons.
- C Each nitrogen atom shares one of its electrons with a nitrogen atom.
- D Each nitrogen atom shares two of its electrons with hydrogen atoms.

- 7 Solid X has a high boiling point.

Its structure has positive ions surrounded by a sea of electrons.

Which other properties does solid X have?

- A** brittle and an electrical conductor
B brittle and an insulator
C malleable and an electrical conductor
D malleable and an insulator
- 8 The formulae of some ions are shown.

| positive ions | negative ions |
|---------------|---------------|
| Al^{3+} | Cl^{-} |
| Fe^{2+} | N^{3-} |
| Mg^{2+} | NO_3^{-} |
| Na^{+} | O^{2-} |
| Zn^{2+} | SO_4^{2-} |

In which row is the formula **not** correct?

| | compound | formula |
|----------|------------------|--------------|
| A | aluminium oxide | Al_2O_3 |
| B | iron(II) nitride | Fe_2N_3 |
| C | sodium sulfate | Na_2SO_4 |
| D | zinc nitrate | $Zn(NO_3)_2$ |

- 9 The equation for the decomposition of magnesium nitrate is shown.



Which volume of gas is produced when 0.1 moles of magnesium nitrate is decomposed completely?

- A** 1.2 dm³ **B** 4.8 dm³ **C** 6.0 dm³ **D** 8.4 dm³

10 Which statements about the electrolysis of molten lead(II) bromide are correct?

- 1 Lead ions move to the anode and are oxidised.
- 2 Lead ions move to the cathode and are reduced.
- 3 Bromide ions move to the anode and are oxidised.
- 4 Bromide ions move to the cathode and are reduced.

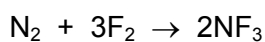
A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

11 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

Which statement is correct?

- A** Bubbles of hydrogen are formed at the anode.
- B** Bubbles of oxygen gas are formed at the cathode.
- C** Copper is deposited at the anode.
- D** The blue colour of the solution fades.

12 Nitrogen trifluoride, NF_3 , is used in the manufacture of certain types of solar panels. The equation for the formation of nitrogen trifluoride is shown.



| type of bond | bond energy (kJ mol^{-1}) |
|---------------------|--------------------------------------|
| $\text{N}=\text{N}$ | +950 |
| $\text{F}-\text{F}$ | +150 |
| $\text{N}-\text{F}$ | +280 |

Using the table of bond energies, what is the energy change for this reaction?

- A** -560 kJ mol^{-1}
- B** -280 kJ mol^{-1}
- C** $+280 \text{ kJ mol}^{-1}$
- D** $+3080 \text{ kJ mol}^{-1}$

13 Which statements about hydrogen fuel cells are correct?

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

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

14 Which change is a physical change?

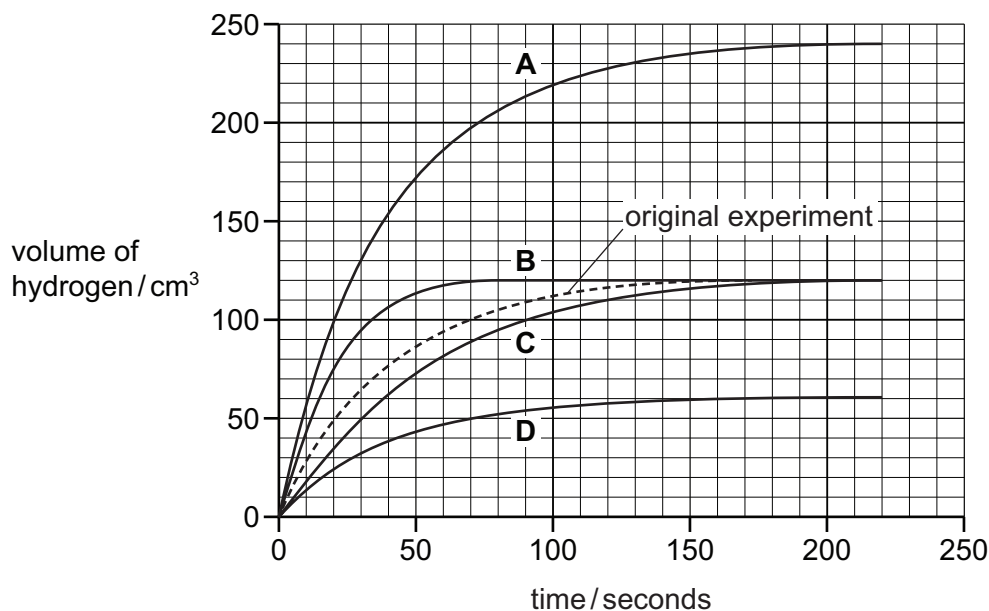
- A** Copper(II) carbonate changes colour from green to black when it is heated, and stays black when it cools.
- B** Ethanol reacts with oxygen to form carbon dioxide and water.
- C** Hydrogen peroxide decomposes into water and oxygen when it is boiled.
- D** Ice forms liquid water when it is heated.

15 A student adds excess magnesium ribbon to 10 cm^3 of 0.5 mol/dm^3 sulfuric acid.

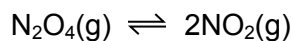
The hydrogen gas is collected and its volume measured every 10 seconds.

The experiment is repeated using the same mass of magnesium ribbon with 5 cm^3 of 0.5 mol/dm^3 sulfuric acid added to 5 cm^3 of water.

Which graph shows the results of the second experiment?



16 An equilibrium reaction is shown.

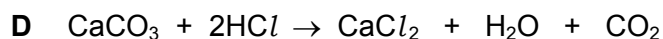
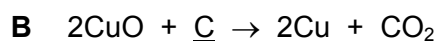
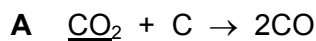


The forward reaction is endothermic.

What is the effect of changing the temperature and pressure on the equilibrium position?

| | increasing temperature | increasing pressure |
|----------|------------------------|---------------------|
| A | moves to the left | moves to the left |
| B | moves to the left | moves to the right |
| C | moves to the right | moves to the left |
| D | moves to the right | moves to the right |

17 In which reaction is the underlined compound acting as a reducing agent?



18 X, Y and Z are oxides of elements in the same row of the Periodic Table.

Some information about each oxide is shown.

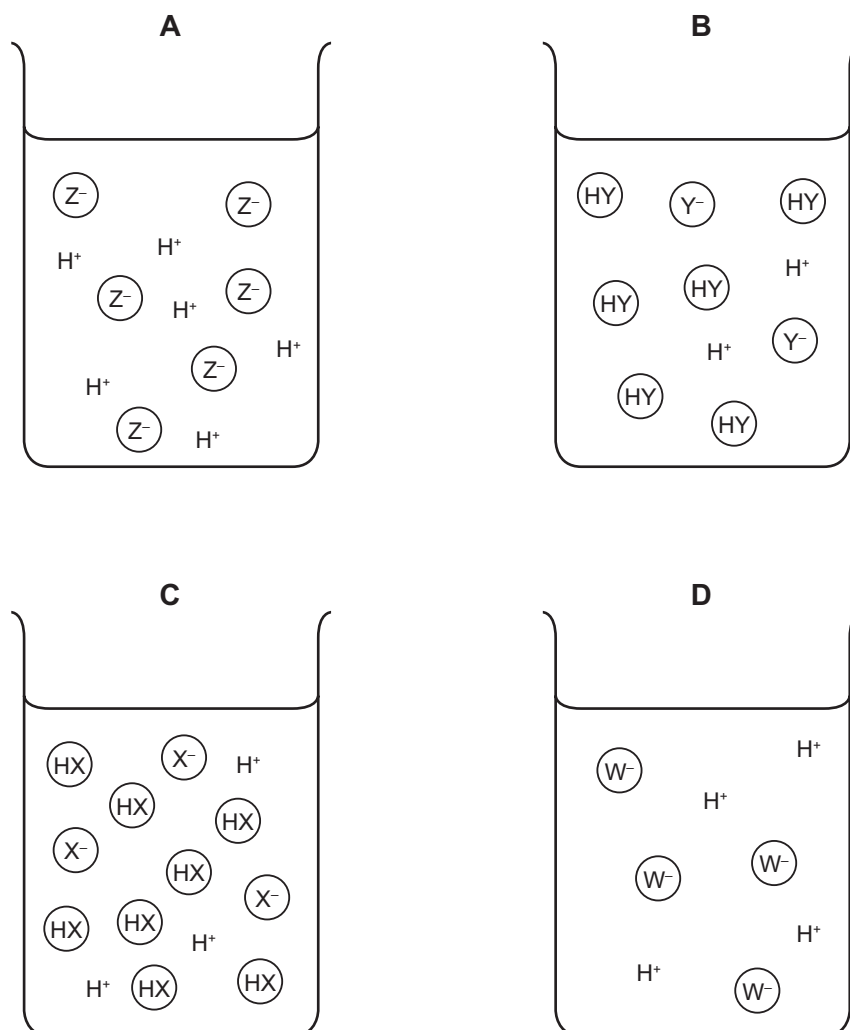
| oxide | solubility in water | ability to neutralise an acid | ability to neutralise an alkali | |
|-------|---------------------|-------------------------------|---------------------------------|--------------|
| X | soluble | x | ✓ | key |
| Y | insoluble | ✓ | ✓ | ✓ = able |
| Z | slightly soluble | ✓ | x | x = not able |

Which types of oxides are X, Y and Z?

| | X | Y | Z |
|----------|------------|------------|------------|
| A | acidic | amphoteric | basic |
| B | amphoteric | basic | basic |
| C | basic | amphoteric | acidic |
| D | basic | acidic | amphoteric |

19 Four different acids are dissolved in water.

Which beaker contains the most concentrated strong acid solution?



20 The following substances can be reacted together to prepare salts.

- 1 copper(II) oxide and excess hydrochloric acid
- 2 hydrochloric acid and excess sodium hydroxide
- 3 hydrochloric acid and excess zinc carbonate

In which reactions can the excess reactant be separated from the solution by filtration?

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

24 Some properties of substances are listed.

- 1 They conduct electricity.
- 2 They have low densities.
- 3 They have high melting points.
- 4 They are malleable.

Which properties are shown by transition metals?

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

25 Sodium is a Group I metal.

Which property, that is typical of most metals, is **not** shown by sodium?

- A** conductor of heat
B high melting point
C malleable
D shiny

26 Four metals, iron, copper, magnesium and Y, are heated separately with their oxides.

The results are shown.

| metal | magnesium oxide | Y oxide | copper oxide | iron oxide |
|-----------|-----------------|---------|--------------|------------|
| Y | x | x | ✓ | ✓ |
| magnesium | x | ✓ | ✓ | ✓ |
| copper | x | x | x | x |
| iron | x | x | x | x |

key

✓ = reacts

x = no reaction

What is the order of reactivity of the metals, least reactive first?

| | least reactive \longrightarrow most reactive | | | |
|----------|--|------|------|-----------|
| A | copper | iron | Y | magnesium |
| B | copper | Y | iron | magnesium |
| C | magnesium | iron | Y | copper |
| D | magnesium | Y | iron | copper |

27 Aluminium is extracted from bauxite by electrolysis.

Which statement is correct?

- A Aluminium ions are oxidised to form aluminium.
- B The cathode has to be replaced regularly because it reacts with the oxygen which is formed.
- C Cryolite is added to remove impurities.
- D Carbon dioxide is produced at the anode.

28 Some properties of aluminium are listed.

- 1 It conducts heat.
- 2 It has a low density.
- 3 It is strong.
- 4 It is resistant to corrosion.

Which of these properties make aluminium suitable for making food containers for chilled food products?

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

29 Water is treated at a waterworks to make it fit to drink.

What is present in the water when it leaves the waterworks?

- A bacteria only
- B bacteria and insoluble substances
- C chlorine compounds only
- D chlorine compounds and soluble substances

30 Sulfur dioxide, carbon monoxide and oxides of nitrogen are common gaseous pollutants found in the air.

Which pollutants contribute to acid rain?

- A carbon monoxide and sulfur dioxide
- B oxides of nitrogen and sulfur dioxide
- C oxides of nitrogen only
- D sulfur dioxide only

31 Oxides of nitrogen, such as NO and NO₂, are formed in the petrol engines of cars.

They are removed from the exhaust gases by reactions in the car's catalytic converter.

Which row describes how oxides of nitrogen are formed in a petrol engine, and a reaction that happens in the catalytic converter?

| | how oxides of nitrogen are formed | a reaction that happens in the catalytic converter |
|----------|--|---|
| A | by the reaction between nitrogen and oxygen from the air | $2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$ |
| B | by the reaction between nitrogen and oxygen from the air | $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$ |
| C | by the reaction between nitrogen compounds in petrol and oxygen from the air | $2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$ |
| D | by the reaction between nitrogen compounds in petrol and oxygen from the air | $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$ |

32 Zinc is used to cover iron to prevent it from rusting.

Why is zinc a suitable metal to use?

- A** Iron is more reactive than zinc.
- B** Iron atoms are bigger than zinc atoms.
- C** Zinc is more reactive than iron.
- D** Zinc atoms are bigger than iron atoms.

33 Fertilisers are mixtures of different compounds used to increase the growth of crops.

Which pair of substances contain the three essential elements for plant growth?

- A** ammonium nitrate and calcium phosphate
- B** ammonium nitrate and potassium chloride
- C** ammonium phosphate and potassium chloride
- D** potassium nitrate and calcium carbonate

34 Which row describes the conditions used in the manufacture of sulfuric acid by the Contact process?

| | catalyst | pressure | temperature |
|----------|-------------------|----------|-------------|
| A | iron | high | high |
| B | iron | low | low |
| C | vanadium(V) oxide | high | low |
| D | vanadium(V) oxide | low | high |

35 Petroleum is an important raw material that is separated into useful products.

Which terms describe petroleum and the method used to separate it?

| | description | separation method |
|----------|-------------|-------------------------|
| A | compound | cracking |
| B | compound | fractional distillation |
| C | mixture | cracking |
| D | mixture | fractional distillation |

36 Which statements about propene are correct?

- 1 Propene contains only single bonds.
- 2 Propene decolourises bromine water.
- 3 Propene is obtained by cracking.
- 4 Propene is a hydrocarbon.

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

37 Which row describes the production of ethanol and its properties?

| | can be made from glucose | can be made from ethene | is used as a fuel | is used as a solvent |
|----------|--------------------------|-------------------------|-------------------|----------------------|
| A | ✓ | ✓ | ✓ | ✓ |
| B | ✓ | x | ✓ | ✓ |
| C | x | ✓ | ✓ | x |
| D | x | ✓ | x | ✓ |

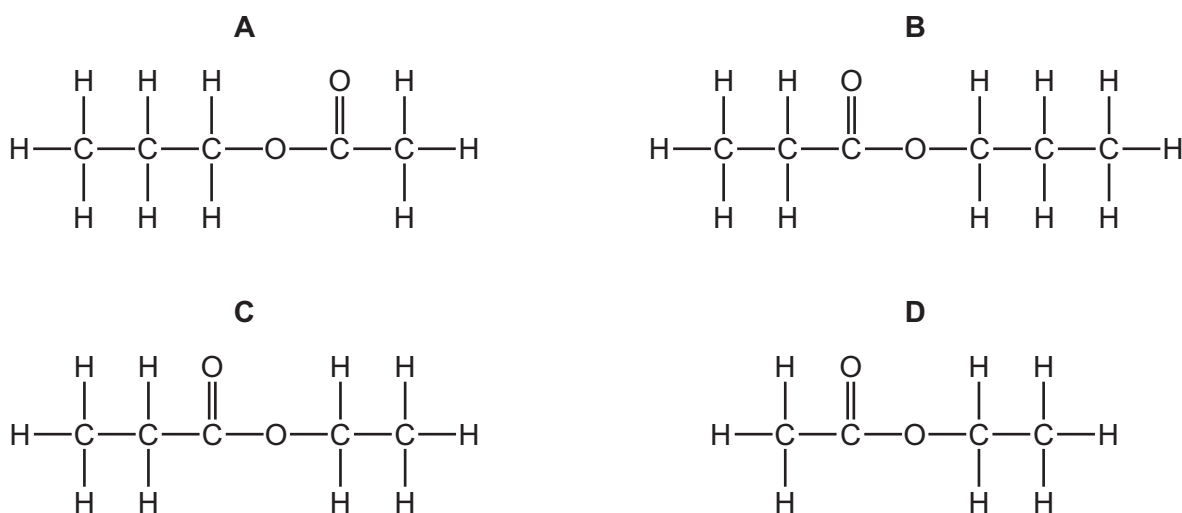
key
 ✓ = yes
 x = no

38 Ethanoic acid is a typical carboxylic acid.

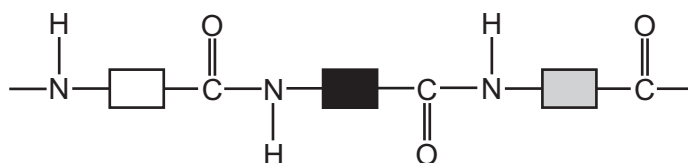
Which statement about ethanoic acid is correct?

- A It can be oxidised to produce ethanol.
- B It is a proton acceptor.
- C It is fully dissociated in water.
- D It reacts with ethanol to produce ethyl ethanoate and water.

39 Which structure represents the ester made from ethanoic acid and propanol?



40 The structure of a polymer is shown.



Which statements about the polymer are correct?

- 1 The polymer is nylon.
- 2 The polymer is formed by condensation polymerisation.
- 3 There are ester linkages between the monomers.

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

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The Periodic Table of Elements

| | | Group | | | | | | | | | | | | | | | |
|-----------------------------------|------------------------------------|--|--|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|------------------------------------|-------------------------------------|----------------------------------|----------------------------------|
| I | II | III | IV | V | VI | VII | VIII | | | | | | | | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Key atomic number atomic symbol name relative atomic mass </div> | | | | | | | | | | 2 He helium 4 | | | | | |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 |
| 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 — | 89–103 actinoids | 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 — | 114 Fl flerovium — | 116 Lv livermorium — | — | — | — | — |

| | | | | | | | | | | | | | | | |
|-------------|-------------------------------------|-----------------------------------|--|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| 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.).