



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

**CHEMISTRY**

**0620/22**

Paper 2 Multiple Choice (Extended)

**October/November 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 **16** printed pages.

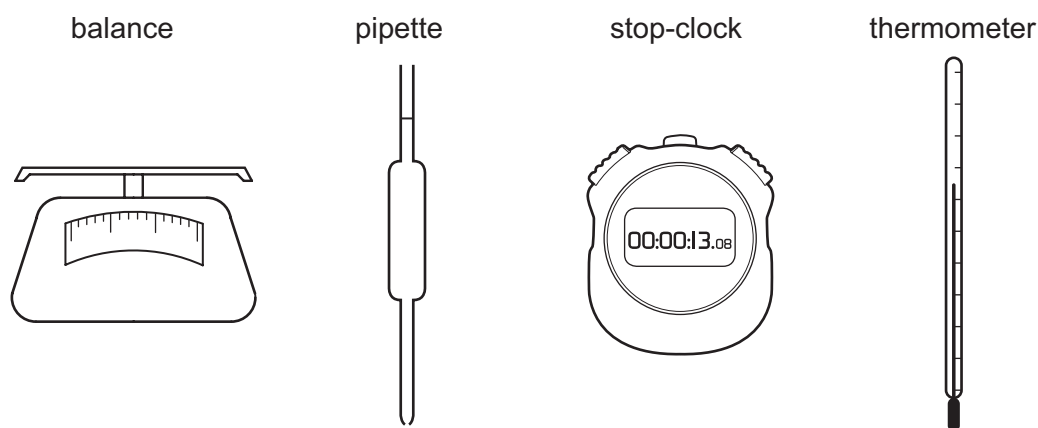
- 1 Oxygen and fluorine are gaseous elements next to each other in the Periodic Table.

Under the same conditions of temperature and pressure, oxygen diffuses .....1..... than fluorine because its .....2..... is less than that of fluorine.

Which words correctly complete gaps 1 and 2?

	1	2
<b>A</b>	faster	molecular mass
<b>B</b>	faster	reactivity
<b>C</b>	slower	molecular mass
<b>D</b>	slower	reactivity

- 2 The diagrams show four pieces of laboratory equipment.



Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

	balance	pipette	stop-clock	thermometer
<b>A</b>	x	x	x	✓
<b>B</b>	✓	x	x	✓
<b>C</b>	x	✓	x	✓
<b>D</b>	✓	x	✓	x

- 3 How many neutrons are present in the atom  ${}_{21}^{45}\text{X}$  ?

**A** 21                      **B** 24                      **C** 45                      **D** 66

- 4 Two naturally occurring isotopes of oxygen are  $^{16}\text{O}$  and  $^{17}\text{O}$ .

Which statement is correct?

- A** Both isotopes react with iron to form rust.  
**B** Neither isotope reacts with iron to form rust.  
**C** Only  $^{16}\text{O}$  reacts with iron to form rust.  
**D** Only  $^{17}\text{O}$  reacts with iron to form rust.

- 5 How many electrons are used to form covalent bonds in a molecule of methanol,  $\text{CH}_3\text{OH}$ ?

- A** 5                      **B** 6                      **C** 8                      **D** 10

- 6 Potassium bromide and methanol are both compounds.

Their melting points are different.

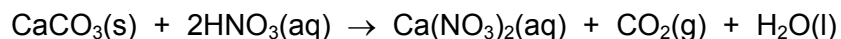
Which row is correct?

	substance with the higher melting point	reason why the melting points are different
<b>A</b>	methanol	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules
<b>B</b>	methanol	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions
<b>C</b>	potassium bromide	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules
<b>D</b>	potassium bromide	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions

- 7 Which gas sample contains the smallest number of molecules?

- A** 4 g of helium  
**B** 16 g of oxygen  
**C** 28 g of carbon monoxide  
**D** 28 g of nitrogen

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



25 g of calcium carbonate is reacted with an excess of dilute nitric acid.

Which mass of calcium nitrate and which volume of carbon dioxide is produced at room temperature and pressure?

	mass of calcium nitrate / g	volume of carbon dioxide / dm <sup>3</sup>
<b>A</b>	29	6
<b>B</b>	29	12
<b>C</b>	41	6
<b>D</b>	41	12

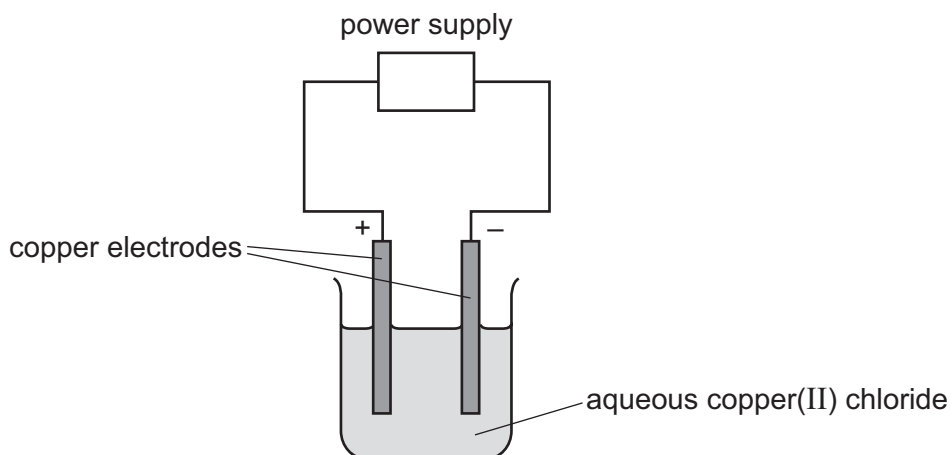
- 9 The formulae of some ions are shown.

positive ion	negative ion
Ti <sup>4+</sup>	PO <sub>4</sub> <sup>3-</sup>
Al <sup>3+</sup>	SO <sub>4</sub> <sup>2-</sup>
Mg <sup>2+</sup>	NO <sub>3</sub> <sup>-</sup>
K <sup>+</sup>	Cl <sup>-</sup>

Which formula is **not** correct?

- A** Al<sub>3</sub>(SO<sub>4</sub>)<sub>2</sub>      **B** K<sub>3</sub>PO<sub>4</sub>      **C** Mg(NO<sub>3</sub>)<sub>2</sub>      **D** TiCl<sub>4</sub>

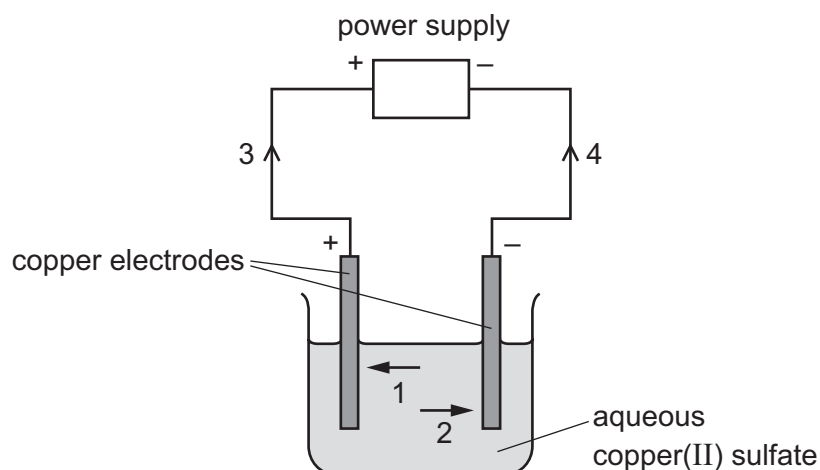
10 Concentrated aqueous copper(II) chloride is electrolysed using copper electrodes as shown.



What happens to the mass of each electrode during this process?

	positive electrode	negative electrode
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

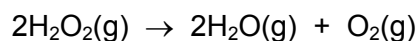
11 The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
<b>A</b>	1	3
<b>B</b>	1	4
<b>C</b>	2	3
<b>D</b>	2	4

12 Hydrogen peroxide, H–O–O–H, decomposes to form water and oxygen.



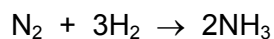
The bond energies are shown in the table. The reaction is exothermic.

bond	bond energy in kJ/mol
O–H	+460
O–O	+150
O=O	+496

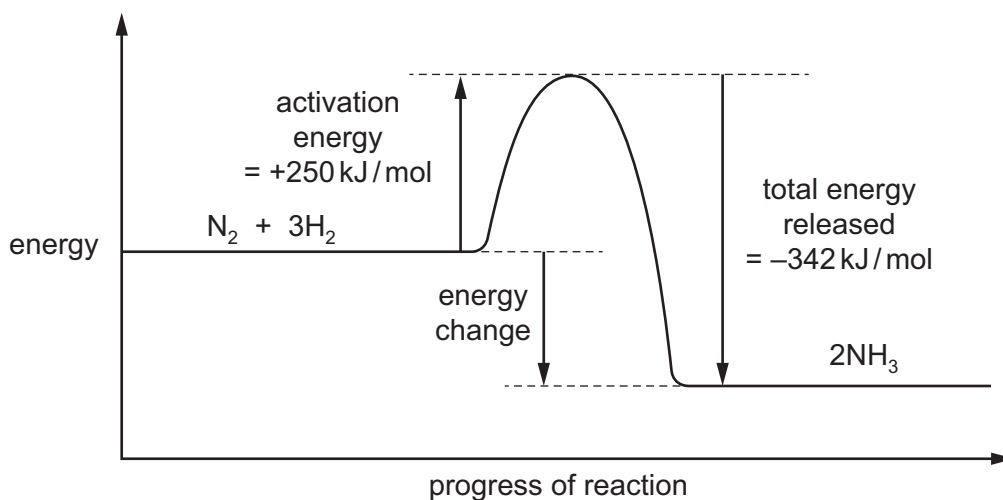
What is the energy change for the reaction?

- A** –346 kJ/mol    **B** –196 kJ/mol    **C** +196 kJ/mol    **D** +346 kJ/mol

- 13 The equation for the formation of ammonia is shown.



The energy level diagram for the reaction is shown.



What is the energy change for the reaction?

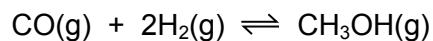
- A  $-592 \text{ kJ/mol}$   
 B  $-92 \text{ kJ/mol}$   
 C  $+92 \text{ kJ/mol}$   
 D  $+592 \text{ kJ/mol}$
- 14 The rate of reaction between magnesium ribbon and  $2 \text{ mol/dm}^3$  hydrochloric acid at  $25^\circ\text{C}$  to produce hydrogen gas is measured.

In another experiment, either the concentration of the hydrochloric acid or the temperature is changed. All other conditions are kept the same.

Which conditions increase the rate of reaction?

- A  $1 \text{ mol/dm}^3$  hydrochloric acid at  $25^\circ\text{C}$   
 B  $2 \text{ mol/dm}^3$  hydrochloric acid at  $10^\circ\text{C}$   
 C  $2 \text{ mol/dm}^3$  hydrochloric acid at  $20^\circ\text{C}$   
 D  $3 \text{ mol/dm}^3$  hydrochloric acid at  $25^\circ\text{C}$

15 Methanol is prepared by the reversible reaction shown.



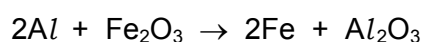
The forward reaction is exothermic.

Which conditions produce the highest equilibrium yield of methanol?

	temperature	pressure
<b>A</b>	high	high
<b>B</b>	high	low
<b>C</b>	low	high
<b>D</b>	low	low

16 The thermite reaction can be used to produce iron from iron(III) oxide.

The equation for the reaction is shown.



Which statements about this reaction are correct?

- 1 Aluminium is the oxidising agent.
- 2 Aluminium is less reactive than iron.
- 3 Electrons are transferred from aluminium to iron.
- 4 The iron in the iron(III) oxide is reduced.

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

17 In which row are the oxides correctly identified?

	acidic	basic
<b>A</b>	magnesium oxide, calcium oxide	sulfur dioxide, carbon dioxide
<b>B</b>	magnesium oxide, sulfur dioxide	carbon dioxide, calcium oxide
<b>C</b>	sulfur dioxide, carbon dioxide	calcium oxide, magnesium oxide
<b>D</b>	sulfur dioxide, magnesium oxide	calcium oxide, carbon dioxide



- 18 When dilute sulfuric acid is added to solid X, a colourless solution is formed and a gas is produced.

What is X?

- A copper(II) oxide
- B sodium oxide
- C copper(II) carbonate
- D sodium carbonate

- 19 A few drops of methyl orange are added to a reaction mixture.

During the reaction, a gas is produced and the methyl orange turns from red to orange.

What are the reactants?

- A aqueous sodium hydroxide and ammonium chloride
- B aqueous sodium hydroxide and calcium carbonate
- C dilute hydrochloric acid and magnesium
- D dilute hydrochloric acid and aqueous sodium hydroxide

- 20 Some general rules for the solubility of salts in water are listed.

- Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).
- Chlorides are soluble (except lead(II) chloride and silver chloride).
- Nitrates are soluble.
- Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate).

Which substances produce an insoluble salt when aqueous solutions of them are mixed?

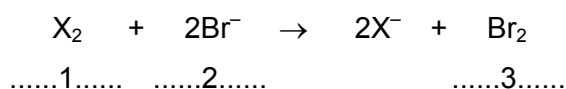
- A barium chloride and magnesium nitrate
- B calcium chloride and ammonium nitrate
- C silver nitrate and zinc chloride
- D sodium carbonate and potassium sulfate

21 Elements in Group I of the Periodic Table react with water.

Which row describes the products made in the reaction and the trend in reactivity of the elements?

	products	trend in reactivity
<b>A</b>	metal hydroxide and hydrogen	less reactive down the group
<b>B</b>	metal hydroxide and hydrogen	more reactive down the group
<b>C</b>	metal oxide and hydrogen	less reactive down the group
<b>D</b>	metal oxide and hydrogen	more reactive down the group

22 The equation shows the reaction between a halogen and aqueous bromide ions.



Which words complete gaps 1, 2 and 3?

	1	2	3
<b>A</b>	chlorine	brown	colourless
<b>B</b>	chlorine	colourless	brown
<b>C</b>	iodine	brown	colourless
<b>D</b>	iodine	colourless	brown

23 An inert gas R is used to fill weather balloons.

Which descriptions of R are correct?

	number of outer shell electrons in atoms of R	structure of gas R
<b>A</b>	2	diatomic molecules
<b>B</b>	2	single atoms
<b>C</b>	8	diatomic molecules
<b>D</b>	8	single atoms

24 Heating copper(II) carbonate produces copper(II) oxide and carbon dioxide.

Heating the copper(II) oxide formed with carbon produces copper.

Which processes are involved in this conversion of copper(II) carbonate to copper?

- A sublimation followed by oxidation
- B sublimation followed by reduction
- C thermal decomposition followed by oxidation
- D thermal decomposition followed by reduction

25 Four metals, W, X, Y and Z, are separately reacted with water and dilute hydrochloric acid.

The results are shown.

	metal			
	W	X	Y	Z
reaction with water	fizzes	no reaction	fizzes vigorously	no reaction
reaction with dilute hydrochloric acid	fizzes	no reaction	fizzes violently	fizzes

What is the order of reactivity of the four metals starting with the least reactive?

	least reactive		→	most reactive	
<b>A</b>	X	W		Z	Y
<b>B</b>	X	Z		W	Y
<b>C</b>	Y	W		Z	X
<b>D</b>	Y	Z		W	X

26 Which statement about the uses of metals is **not** correct?

- A Aluminium is used in aircraft because of its strength and good electrical conductivity.
- B Copper is used in electrical wiring because of its good electrical conductivity.
- C Stainless steel resists corrosion and is used to make cutlery.
- D Transition elements are often used as catalysts.

27 Bauxite contains aluminium oxide.

Aluminium is extracted from aluminium oxide by electrolysis.

Why is cryolite added to the electrolytic cell used to extract aluminium?

- A Cryolite prevents the carbon anodes being burned away.
- B Cryolite removes impurities from the bauxite.
- C Cryolite increases the rate at which aluminium ions are discharged.
- D Molten cryolite dissolves the aluminium oxide.

28 Which statement about the Haber process is correct?

- A The hydrogen used is obtained from the air.
- B The nitrogen used is obtained from nitrates in the soil.
- C Nitrogen reacts with hydrogen to make ammonia.
- D The reaction takes place at room temperature and pressure.

29 Which statements about sulfur dioxide pollution are correct?

- 1 It increases the pH of rivers.
- 2 It damages limestone buildings.
- 3 It causes respiratory problems.

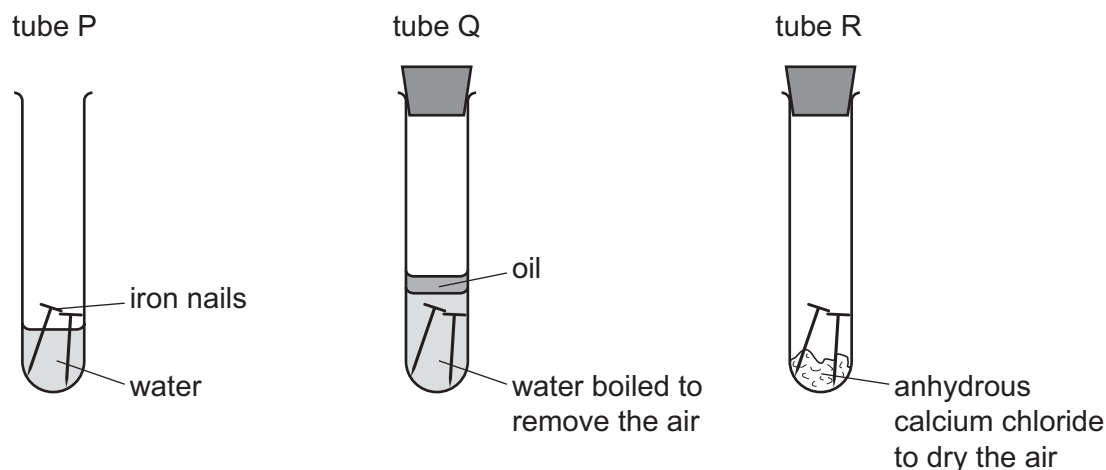
- A 1 only      B 2 only      C 1 and 3      D 2 and 3

30 Argon is a noble gas used to fill light bulbs.

What is the approximate percentage of argon in air?

- A 1%      B 20%      C 79%      D 99%

31 The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

- 1 In tube P, the iron nails rust.
- 2 In tube Q, the iron nails do not rust.
- 3 In tube R, the iron nails do not rust.

Which predictions are correct?

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

32 In the carbon cycle, which two processes add carbon dioxide to the atmosphere?

- A** combustion and carbonate formation  
**B** combustion and photosynthesis  
**C** combustion and respiration  
**D** respiration and photosynthesis

33 Which statement about sulfur or one of its compounds is correct?

- A** Sulfur occurs naturally as the element sulfur.  
**B** Sulfur dioxide is used to kill bacteria in drinking water.  
**C** Sulfuric acid is a weak acid.  
**D** Dilute sulfuric acid is a dehydrating agent.

34 What is **not** a use of lime?

- A It is used as a bleach in the manufacture of wood pulp.
- B It is used to desulfurise flue gases.
- C It is used to neutralise acidic industrial waste.
- D It is used to treat acidic soil.

35 Which equation representing a reaction of methane is correct?

- A  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$
- B  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_4\text{Cl}_2$
- C  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_2\text{Cl}_2 + \text{H}_2$
- D  $2\text{CH}_4 + 2\text{Cl}_2 \rightarrow 2\text{CH}_3\text{Cl} + \text{Cl}_2 + \text{H}_2$

36 Which two compounds are molecules which both contain a double bond?

- A ethane and ethanoic acid
- B ethane and ethanol
- C ethene and ethanoic acid
- D ethene and ethanol

37 Ethanol can be formed by:

- 1 fermentation
- 2 reaction between steam and ethene.

Which of these processes use a catalyst?

	1	2
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

38 Ethanol is manufactured from ethene.

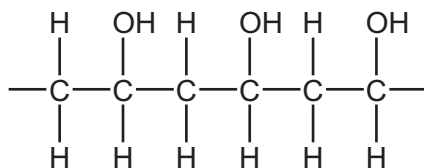
What is an advantage of this process?

- A It is a continuous process.
- B It has high labour costs.
- C It needs high temperature and pressure.
- D It uses non-renewable materials.

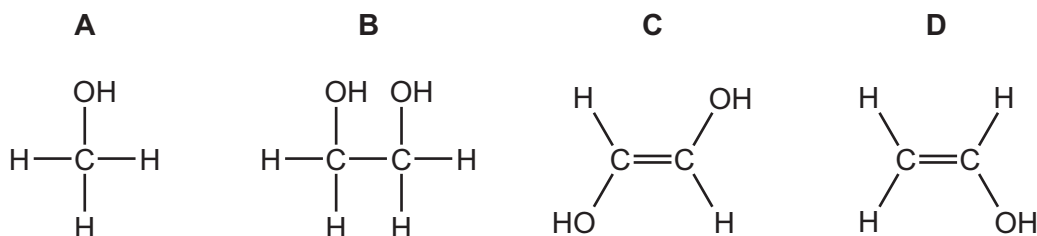
39 Which reaction can be used to make ethanoic acid?

- A oxidation of ethanol
- B oxidation of ethene
- C reduction of ethanol
- D reduction of ethene

40 The structure of an addition polymer is shown.



Which monomer is used to make this polymer?



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The Periodic Table of Elements

Group															
I	II	III						IV	V	VI	VII	VIII			
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>Key</b>                      atomic number                      atomic symbol                      name                      relative atomic mass                 </div>										2 <b>He</b> helium 4			
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24											5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84				
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	116 <b>Lv</b> livermorium —	—	—	—

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).