Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **1523/22**

Paper 2 Multiple Choice (Extended) **May/June 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.

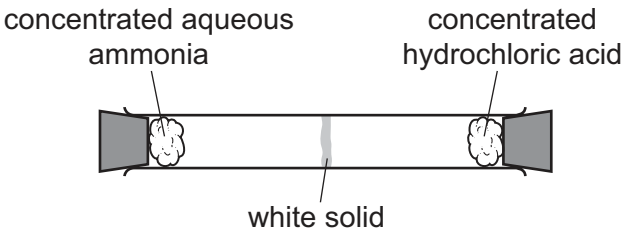
[Turn over

1 Gaseous ammonia and gaseous hydrogen chloride react to form ammonium chloride, a white solid.

Cotton wool soaked in concentrated aqueous ammonia is placed in one end of a glass tube and at the same time cotton wool soaked in concentrated hydrochloric acid is placed at the other end of the tube. The tube is sealed.

Where in the tube does the white solid initially appear?

A



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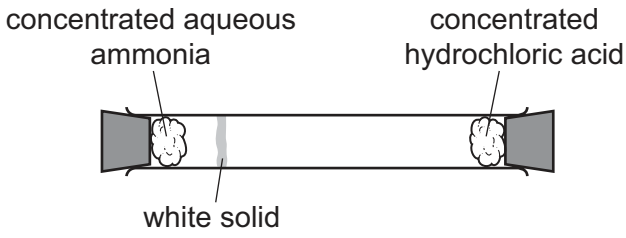

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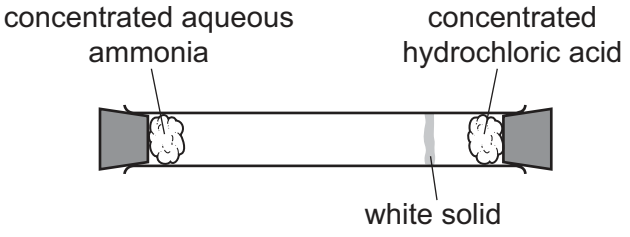

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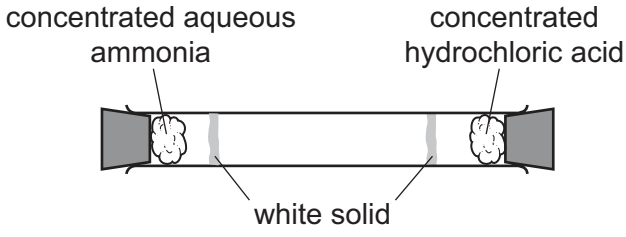
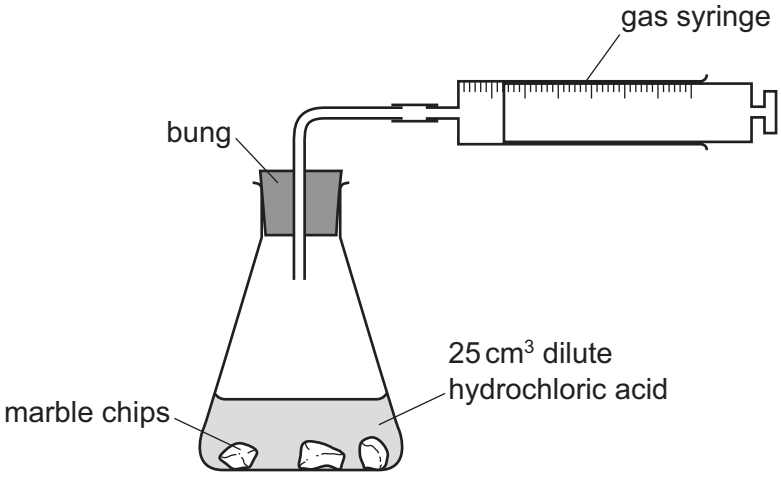


2 A student uses the apparatus shown to measure the volume of carbon dioxide gas made when different masses of marble chips are added to 25 cm^3 of dilute hydrochloric acid.



Which other items of apparatus are needed?

A funnel and balance

B funnel and stop-watch

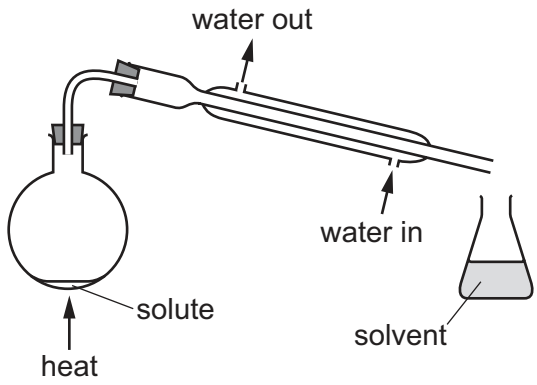
C measuring cylinder and balance

D measuring cylinder and stop-watch

3 A solute and a solvent are separated by distillation.

Which diagram is correctly labelled?

A



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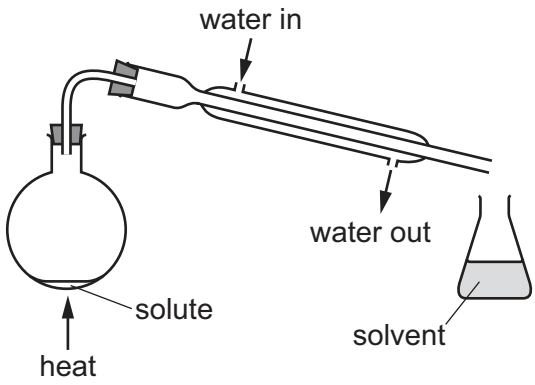

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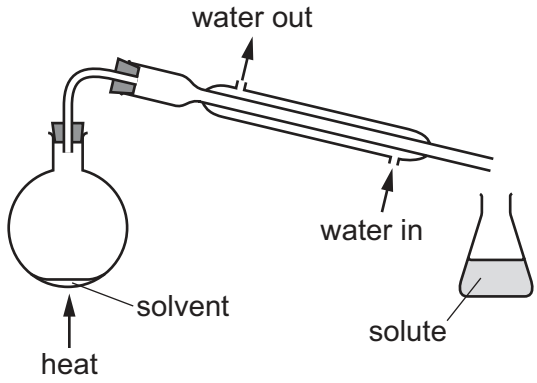

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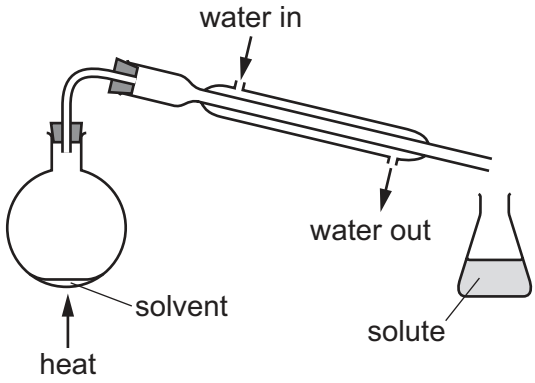


4 A magnesium atom has the symbol $^{24}_{12}Mg$. It reacts to form a magnesium ion, Mg^{2+}.

Which row identifies the number of protons, neutrons and electrons in the ion?

	protons	neutrons	electrons
A	10	10	10
B	10	12	12
C	12	12	10
D	12	12	12

[Turn over

5 Which dot-and-cross diagram shows the outer-shell electron arrangement in a molecule of carbon dioxide?

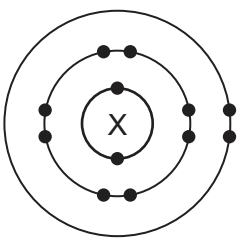
A

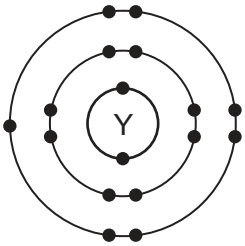
B

C

D

6 The electronic structures of atoms X and Y are shown.





key
● electron

What is the formula of the molecule formed by X and Y?

A XY_2 **B** X_3Y_2 **C** X_2Y_3 **D** X_2Y

7 Which row about a property of silicon(IV) oxide and the explanation of the property is correct?

	property of silicon(IV) oxide	explanation
A	it conducts electricity	electrons can move freely through the structure
B	it is used as a lubricant	there are weak forces between the layers of silicon and oxygen atoms
C	it has a high melting point	there is a strong attraction between silicon and oxide ions
D	it is a hard solid	it is a macromolecule with strong bonds

8 These two statements are about metals, their properties and bonding.

statement 1 Metals conduct electricity when solid.

statement 2 In metals, a lattice of positive ions exists in a 'sea of electrons' which can move throughout the metal.

Which answer is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

9 The equation for the complete combustion of ethanethiol, C_2H_6S, is shown.

$$2C_2H_6S + 9O_2 \rightarrow ..... + 2SO_2 + 6H_2O$$

Which formula balances the equation?

A $2CO_2$ **B** $4CO_2$ **C** $2CO$ **D** $4CO$

10 The equation for the formation of ethanol from glucose is shown.

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

In an experiment, 36 g of glucose produces 9.2 g of ethanol.

[M_r: $C_6H_{12}O_6$, 180; C_2H_5OH, 46]

What is the percentage yield of ethanol in this experiment?

A 20 **B** 26 **C** 50 **D** 100

11 Four electrolysis experiments are described.

electrolyte	electrodes
aqueous copper(II) sulfate	copper
aqueous copper(II) sulfate	graphite
concentrated aqueous sodium chloride	graphite
dilute sulfuric acid	graphite

Which statement is correct for **all** four electrolysis experiments?

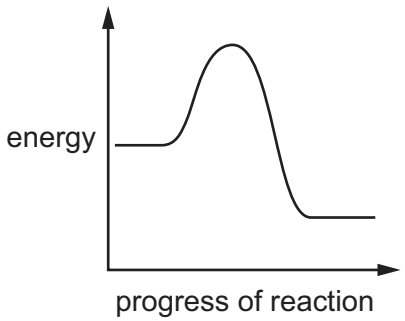
A Hydrogen gas is formed at the cathode.

B Ions gain electrons at the cathode.

C The electrodes are inert.

D Two or more products are formed.

12 An energy level diagram for a reaction is shown.



Which statement and explanation about this reaction are correct?

	statement	explanation
A	the reaction is endothermic	the products have more energy than the reactants
B	the reaction is endothermic	the products have less energy than the reactants
C	the reaction is exothermic	the products have more energy than the reactants
D	the reaction is exothermic	the products have less energy than the reactants

13 Which product is made in a fuel cell?

A carbon dioxide

B ethanol

C hydrogen

D water

14 Which processes are physical changes?

1 melting ice

2 reduction of copper(II) oxide

3 burning sulfur

4 boiling ethanol

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

15 A chemical reaction is carried out at a fixed temperature.

It is repeated at a higher concentration. All other conditions remain the same.

Which row describes how the collision rate and the proportion of molecules with the activation energy changes in the second reaction?

	collision rate	proportion of molecules with the activation energy
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

16 The equation for the reaction between aqueous potassium iodide and aqueous bromine is shown.

$$2KI(aq) + Br_2(aq) \rightarrow 2KBr(aq) + I_2(s)$$

Which statement about the reaction is correct?

A Bromine is reduced.

B The potassium ions act as an oxidising agent.

C The potassium ions are oxidised.

D The iodide ions gain electrons.

17 Hydrogen and iodine gases react together to produce gaseous hydrogen iodide in a reversible reaction.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

The forward reaction is exothermic.

Hydrogen and hydrogen iodide are colourless gases. Iodine gas is purple.

Which statement is correct?

A The forward and reverse reactions both stop when equilibrium is reached.

B The position of equilibrium is not affected by pressure changes.

C The position of equilibrium is not affected by temperature changes.

D The reaction mixture continues to change colour after equilibrium is reached.

18 Ethanoic acid is a weak acid.

Hydrochloric acid is a strong acid.

Which statements are correct?

1 Ethanoic acid molecules are partially dissociated in aqueous solution.

2 1.0 mol / dm^3 ethanoic acid has a higher pH than 1.0 mol / dm^3 hydrochloric acid.

3 Ethanoic acid is always more dilute than hydrochloric acid.

4 Ethanoic acid is a proton acceptor.

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

19 Which oxide neutralises aqueous sodium hydroxide?

A calcium oxide

B carbon monoxide

C sulfur dioxide

D water

20 An excess of aqueous sodium sulfate was added to aqueous barium chloride and the mixture was filtered.

Which row shows the identity of the residue and the substances present in the filtrate?

	residue	substances in filtrate
A	barium sulfate	barium chloride and sodium chloride
B	barium sulfate	sodium chloride and sodium sulfate
C	sodium chloride	barium chloride and sodium sulfate
D	sodium chloride	barium sulfate and sodium sulfate

21 Compound X is tested and the results are shown.

test	result
aqueous sodium hydroxide is added, then heated gently	gas given off which turns damp red litmus paper blue
dilute hydrochloric acid is added	effervescence, gas given off which turns limewater milky

Which ions are present in compound X?

A ammonium ions and carbonate ions

B ammonium ions and chloride ions

C calcium ions and carbonate ions

D calcium ions and chloride ions

22 Which statement about elements in the Periodic Table is correct?

A Elements are arranged in order of increasing nucleon number.

B Elements in Group VII are diatomic non-metals.

C Elements with similar properties are in the same period.

D Transition elements are a collection of metals and non-metals.

23 Which statement explains why the noble gas helium is unreactive?

A It has a complete outer shell of electrons.

B It has two protons in the nucleus.

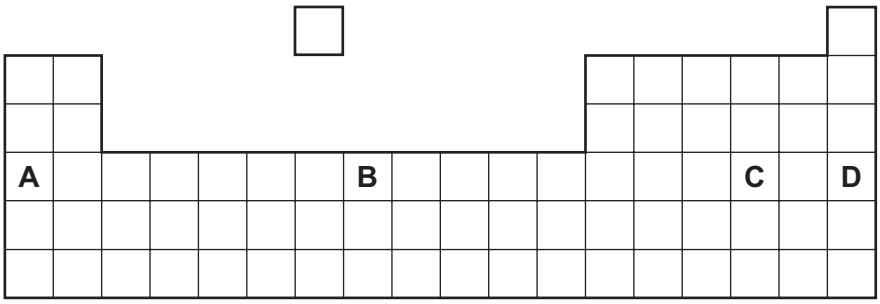
C It has the same number of protons and neutrons.

D It has the same number of protons, electrons and neutrons.

[Turn over

24 The positions of four elements in the Periodic Table are shown.

Which element forms ionic compounds in which the element has different oxidation numbers (states)?



25 The element rutherfordium, Rf, was first detected in 1964.

Rutherfordium is a metal.

What are the predicted properties of rutherfordium?

1 Rutherfordium conducts electricity when molten.

2 Rutherfordium does not conduct electricity when solid.

3 Rutherfordium has a low melting point.

4 Rutherfordium is malleable.

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

26 The results of three reactions of metal M and its nitrate are given.

reaction 1 M reacts with dilute hydrochloric acid.

reaction 2 M displaces zinc metal from aqueous zinc salts.

reaction 3 Heat decomposes the nitrate of M into a mixture of two gases and a solid.

What is M?

A copper

B iron

C magnesium

D potassium

27 Which statement about the extraction of aluminium from aluminium oxide is correct?

A Aluminium is formed at the positive electrode during electrolysis.

B Pure aluminium oxide is dissolved in molten cryolite.

C Pure aluminium oxide is electrolysed using aluminium as the positive electrode.

D Pure aluminium oxide is heated with carbon to form carbon dioxide and aluminium.

28 Iron is extracted from its ore in a blast furnace.

The equations for four different reactions are shown.

1 $4Fe + 3CO_2 \rightarrow 2Fe_2O_3 + 3C$

2 $CO_2 \rightarrow C + O_2$

3 $CO_2 + C \rightarrow 2CO$

4 $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Which equations represent reactions that occur in the blast furnace?

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

29 Some uses of water are listed.

1 as a solvent

2 as a coolant in the chemical industry

3 to irrigate crops

4 to provide safe drinking water

During a drought, which uses are important to sustain the population of a country?

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

30 Which substances are needed for iron to rust?

A carbon dioxide and oxygen

B oxygen only

C water and carbon dioxide

D water and oxygen

31 Which process removes carbon dioxide from the atmosphere?

A cement manufacture

B combustion

C photosynthesis

D respiration

32 Which statements about sulfur dioxide are correct?

1 It is produced when sulfuric acid is electrolysed.

2 It is produced when sodium sulfite reacts with dilute hydrochloric acid.

3 It is a neutral oxide.

4 It reacts with oxygen in the presence of a catalyst to form sulfur trioxide.

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

33 What are uses of sulfur dioxide?

1 as a bleach in the manufacture of wood pulp

2 as a food preservative

3 in the conversion of iron to steel

4 to kill bacteria in water treatment

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

34 Which type of reaction occurs when calcium oxide is formed from calcium carbonate?

A addition

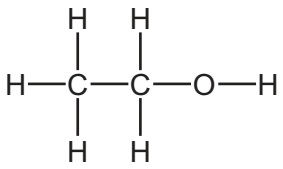
B combustion

C neutralisation

D thermal decomposition

35 The structures of some organic compounds are shown.

1



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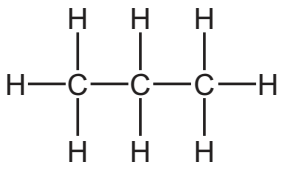

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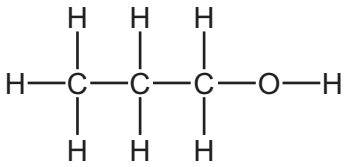

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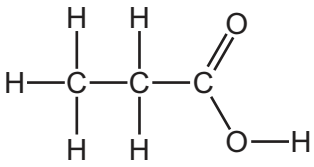
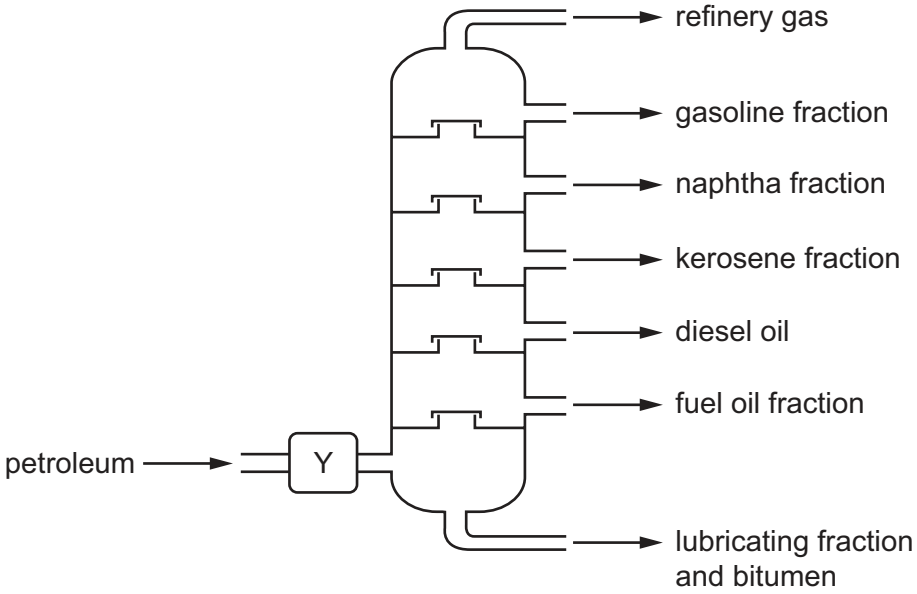


Which compounds belong to the same homologous series?

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

36 The industrial fractional distillation of petroleum is shown.



Which process happens at Y?

A burning

B condensation

C cracking

D evaporation

37 Which pair of compounds is used to prepare $CH_3CH_2COOCH_2CH_3$?

A ethanoic acid and ethanol

B ethanoic acid and propanol

C propanoic acid and ethanol

D propanoic acid and propanol

38 Ethanol is oxidised to ethanoic acid by acidified potassium manganate(VII).

Which colour change is observed in the reaction?

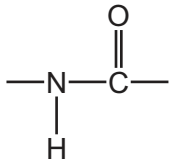
A colourless to purple

B purple to colourless

C colourless to orange

D orange to colourless

39 The linkage between monomer units in a condensation polymer is shown.



Which types of polymer contain this linkage?

1 a complex carbohydrate

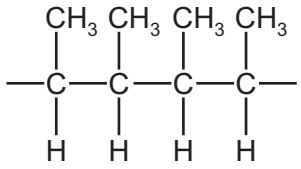
2 a polyamide

3 a polyester

4 a protein

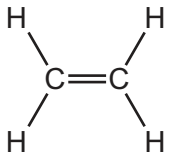
A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

40 The structure of part of a polymer is shown.



Which monomer is used to make this polymer?

A



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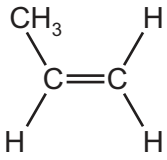

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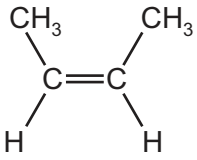

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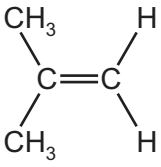

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
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 –	89–103 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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).