DUNMAN SECONDARY SCHOOL

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

PRELIMINARY EXAMINATION 2026
SECONDARY 4 EXPRESS

CHEMISTRY 6092/01

Paper 1

28 August 2026
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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 17.
The use of an approved scientific calculator is expected, where appropriate.

1 Which statement about chromatography is correct?

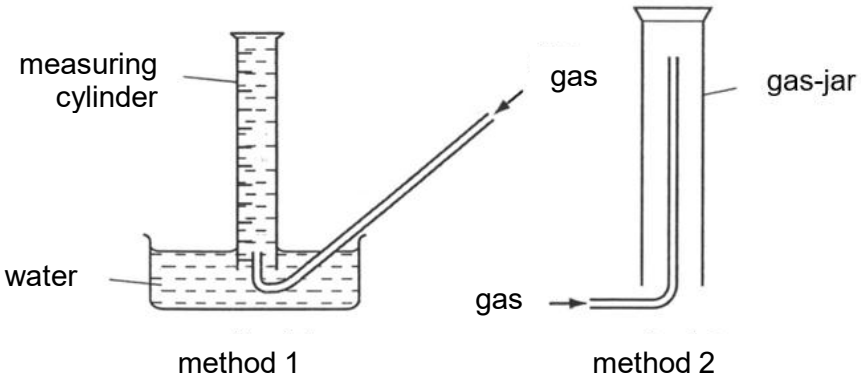
A Each substance has its own unique R_f value in chromatography.

B Locating agents are needed to identify the colours present in ink.

C The start line has to be below the solvent level.

D The R_f value is a ratio of the distance travelled by a component to the solvent front.

2 The diagrams show two methods of gas collection.



method 1 method 2

Which pair of gases can be collected by both methods?

A ammonia and hydrogen

B carbon dioxide and sulfur dioxide

C hydrogen and methane

D nitrogen and hydrogen chloride

3 In a change of state at constant temperature and pressure:

- energy is released as stronger forces of attraction form between the particles
- the average distance between the particles changes very little.

Which change of state is being described?

A boiling **B** condensation **C** freezing **D** melting

4 Four gases are listed.

1 CH_4

2 NH_3

3 N_2O

4 HCl

What is the order of their rate of diffusion at room temperature and pressure?

	fastest → slowest			
A	1	2	4	3
B	2	1	3	4
C	3	4	2	1
D	4	1	3	2

5 The boiling points of some of the substances found in air are given in the table.

substance	boiling point/°C
argon	-186
neon	-246
nitrogen	-196
oxygen	-183

Air is cooled to -200°C.

Which substance will turn into a gas first as the temperature is raised?

A argon **B** neon **C** nitrogen **D** oxygen

6 Two ions, strontium and bromide have the symbols $^{88}_{38}Sr^{2+}$ and $^{81}_{35}Br^{-}$ respectively.

Which statement about these ions is correct?

A The strontium ion has seven more neutrons than the bromide ion.

B The strontium ion has two more protons than the bromide ion.

C They contain the same number of electrons.

D They form a compound with formula Sr_2Br.

7 A pure sample of element X has a relative atomic mass of 51.8.

The sample consists of three isotopes.

The table shows the relative masses and percentage abundances of two of the isotopes.

isotope	relative mass of isotope	percentage abundance of isotope
1	50	40
2	52	40

Which statement is true about the isotopes?

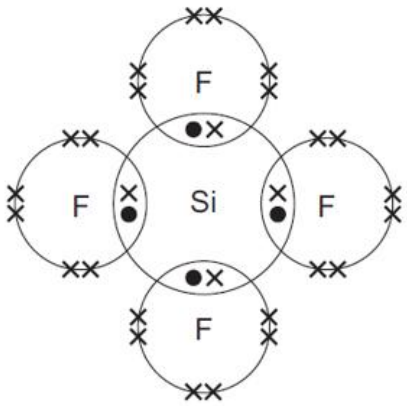
1 The isotopes have different densities.

2 The relative mass of the third isotope is 55.

3 The isotope with the smallest relative mass reacts most readily.

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

8 The diagram shows a 'dot-and-cross' diagram, showing outer shell electrons only, of a molecule of tetrafluorosilane, SiF_4.



Which statement is correct?

A Each molecule of SiF_4 has 12 unbonded pairs of electrons.

B In SiF_4, both silicon and fluorine atoms achieve the same electronic configuration as neon.

C Molten SiF_4 is a poor conductor of electricity.

D Weak bonds between silicon and fluorine result in a low melting point for SiF_4.

9 Atoms of element Q form positive ions.

An ion of Q has 10 electrons and 10 neutrons.

Which statement about Q is correct?

A An atom of Q has only two occupied electron shells.

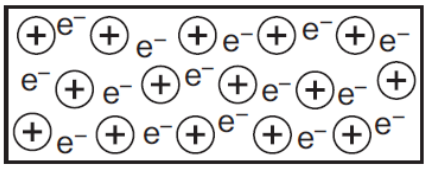
B Q forms ionic compounds with elements in Groups 17 and 18.

C The atomic number of Q less than 10.

D The mass number of Q is greater than 20.

10 Element Z has a lattice of positive ions and a 'sea of electrons'.

Z forms ions with formula, Z^{3+}.



What can be deduced about Z?

A Atoms of Z has three times the number of electrons as protons.

B It conducts electricity through mobile positive ions and electrons.

C It forms strong ionic bonds when it combines other elements to form an alloy.

D It remains chemically unchanged when an electric current passes through it.

11 Which row contains the same amount of substance under room temperature and pressure?

	substance 1	substance 2
A	12 dm^3 argon	12 dm^3 water
B	16 g oxygen	6.02 x 10^{23} molecules of oxygen
C	24 dm^3 nitrogen	6.02 x 10^{23} atoms of nitrogen
D	24 dm^3 neon	24 g magnesium

12 20 cm^3 of nitrogen monoxide gas is mixed with x cm^3 of oxygen gas.

The equation for this reaction is shown.

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

All the nitrogen monoxide is reacted. The total volume of gas at the end of the reaction is 40 cm^3.

All measurements are at room temperature and pressure.

What is the value of x?

A 10 cm^3 **B** 20 cm^3 **C** 30 cm^3 **D** 40 cm^3

13 The molar mass of an organic compound W is 60 g/mol. W contains 40.0% carbon, 6.70% hydrogen and 53.3% oxygen.

Which statement about W is correct?

1 The empirical formula of W is $C_2H_4O_2$.

2 There are 12 g of carbon in 0.5 mole of W.

3 W could be ethanoic acid.

4 W could be methyl methanoate.

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

14 A mixture of sodium hydrogencarbonate and sodium chloride is heated.

The equation for the reaction that takes place when sodium hydrogencarbonate is heated is shown.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

Impurities of sodium chloride is stable to heat.

When 9.0 g of the mixture is heated, the loss in mass is 2.25 g.

What is the percentage by mass of sodium hydrogencarbonate in the mixture?

[M_r: $NaHCO_3$, 84; Na_2CO_3, 106; CO_2, 44; H_2O, 18; NaC*l*, 58.5]

A 34% **B** 48% **C** 68% **D** 95%

15 Which statement about hydrochloric acid and ethanoic acid is correct?

A Hydrochloric acid reacts with sodium hydroxide but ethanoic acid does not.

B Hydrochloric acid undergoes complete ionisation in water but ethanoic acid does not ionise at all.

C The pH of 1 mol/dm^3 ethanoic acid is higher than the pH of 1 mol/dm^3 hydrochloric acid.

D 1 mol/dm^3 hydrochloric acid gives a greater total volume of gas than 1 mol/dm^3 ethanoic acid when reacted with the same mass of calcium carbonate.

16 Which method would **not** produce ammonia?

A compressing hydrogen and nitrogen under high heat in the presence of an iron catalyst

B heating ammonium sulfate with hydrochloric acid

C heating an alkaline solution containing calcium nitrate and aluminium powder

D warming concentrated aqueous ammonia

17 Hydrazine has the formula H_2NNH_2. It has similar properties to ammonia.
Which property will hydrazine have?

A It dissolves in water to produce hydrogen ions.

B It has weak intermolecular forces between nitrogen and hydrogen atoms.

C It reacts with hydrogen chloride to form a compound with formula $Cl H_3NNH_3Cl$.

D It reacts with sodium hydroxide to form a soluble salt.

18 The table gives some statements about acids and bases and explanations for these statements.

Which row shows either an **incorrect** statement or an **incorrect** explanation for the statement?

	statement	explanation
A	ammonia is produced when ammonium carbonate is warmed with sodium hydroxide	the hydroxide ion acts as a base and removes H^+ from the ammonium ion
B	calcium hydroxide is added to soil to control pH	metal hydroxides are basic and react with acids to form insoluble salts
C	phosphorus(V) oxide is an acidic oxide	it reacts with bases to form salts
D	the pH of a weak acid is higher than the pH of a strong acid of the same concentration	pH shows the extent of ionisation – the more ionised the acid is, the lower the pH

19 Which row about the properties of oxides Li_2O, Fe_2O_3, SiO_2 and ZnO is correct?

	property	Li_2O	Fe_2O_3	SiO_2	ZnO
A	can be separated into elements by electrolysis	√	x	x	√
B	soluble in water	√	x	√	x
C	white compounds	√	x	√	√
D	form salts with acids only	√	√	x	√

20 The table shows the results of adding iron nails to separate solutions of P and Q.

solution	initial mass of iron nail/g	mass of iron nail after 30 min/g
P	4	1
Q	4	3

What could solutions P and Q be?

	P	Q
A	calcium chloride	copper(II) nitrate
B	copper(II) sulfate	zinc chloride
C	hydrochloric acid	silver nitrate
D	sulfuric acid	magnesium sulfate

21 An aqueous solution of aluminium chloride is added to different reagents.

Which observation is **not** correct?

	reagent added to aqueous aluminium chloride	observations
A	acidified aqueous barium nitrate	no white precipitate forms
B	aqueous ammonia	white precipitate forms, soluble in excess to form colourless solution
C	aqueous sodium hydroxide	white precipitate forms, soluble in excess to form colourless solution
D	magnesium ribbon	grey precipitate forms

22 The equation for the reaction between sodium sulfite and potassium manganate(VII) is shown.

$$2MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 3H_2O + 5SO_4^{2-}$$

Which option correctly describes the ion that is oxidised and the oxidising agent of the reaction?

	ion that is oxidised	oxidising agent
A	MnO_4^-	H^+
B	MnO_4^-	SO_3^{2-}
C	SO_3^{2-}	H^+
D	SO_3^{2-}	MnO_4^-

23 Oxygen and fluorine are elements in Group 16 and Group 17 of the Periodic Table respectively.

Which statement about oxygen and fluorine is correct?

A Both are colourless gases at room temperature and pressure.

B In their reaction with non-metals, oxygen forms double covalent bonds but fluorine forms single bonds.

C The oxygen atom has three less neutrons than the fluorine atom.

D The oxygen atom has a larger atomic size than the fluorine atom.

24 Which statement about the elements in Group 18 of the Periodic Table is correct?

A Atoms of the elements are held together by weak covalent bonds.

B Going down the group, the number of electrons in the atom increases by eight for each element.

C The outer shell of each noble gas is fully filled with electrons.

D They are coloured gases at room temperature.

25 Which row about properties of Group 1 and Group 17 elements as each group is descended is correct?

	group 1	group 17
1	density decreases	density increases
2	melting and boiling point decreases	melting and boiling point increases
3	reactivity increases	reactivity decreases
4	reducing power decreases	oxidising power decreases

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

26 An iron strip is placed in a beaker of aqueous silver nitrate. Crystals of silver are observed on the iron strip.

Which statement is correct?

A The iron strip is reduced.

B The mass of silver formed is equal to the mass of iron that enters the solution.

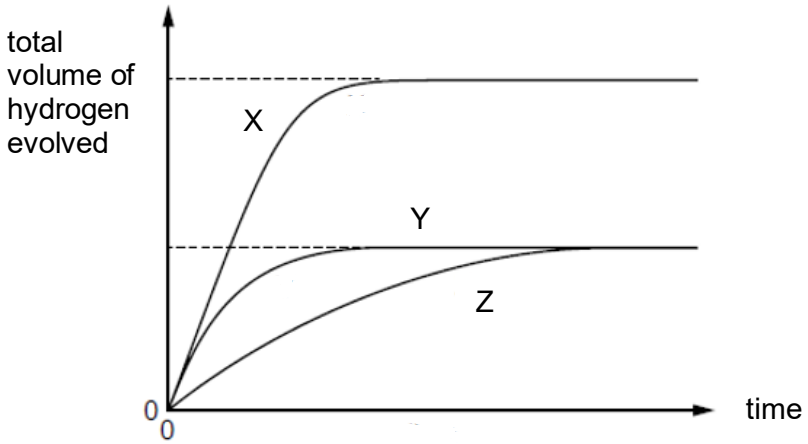
C The colourless solution turns blue.

D The total number of metal ions in the solution decreases.

27 A sample of excess magnesium is reacted with 1 mol/dm^3 acid under the same conditions in three separate experiments.

The total volume of hydrogen evolved is recorded against time. The results are plotted to give three graphs X, Y and Z.

experiment	reactant 1	reactant 2
1	0.5 g magnesium powder	1 mol/dm^3 hydrochloric acid
2	0.5 g magnesium powder	1 mol/dm^3 sulfuric acid
3	1.0 g magnesium ribbon	1 mol/dm^3 hydrochloric acid



Which of the curves X, Y and Z relate to experiments 1, 2 and 3?

	experiment 1	experiment 2	experiment 3
A	Y	X	Z
B	Z	X	Y
C	Y	Z	X
D	Z	Y	X

28 Experiment 1: Aqueous sodium thiosulfate reacts with hydrochloric acid. The temperature of the reaction mixture is increased.

Experiment 2: In the Haber process where nitrogen reacts with hydrogen, the size of the reaction vessel is decreased.

Which row correctly states and explains the effect of each change on the rate of reaction?

	increasing temperature of aqueous sodium thiosulfate and hydrochloric acid		decreasing size of reaction vessel for reaction of nitrogen with hydrogen	
	effect on rate	reason	effect on rate	reason
A	increase	activation energy decreased	decrease	lower frequency of collisions between particles
B	increase	activation energy decreased	increase	higher frequency of collisions between particles
C	increase	higher frequency of collisions between particles	decrease	lower frequency of collisions between particles
D	increase	higher frequency of collisions between particles	increase	higher frequency of collisions between particles

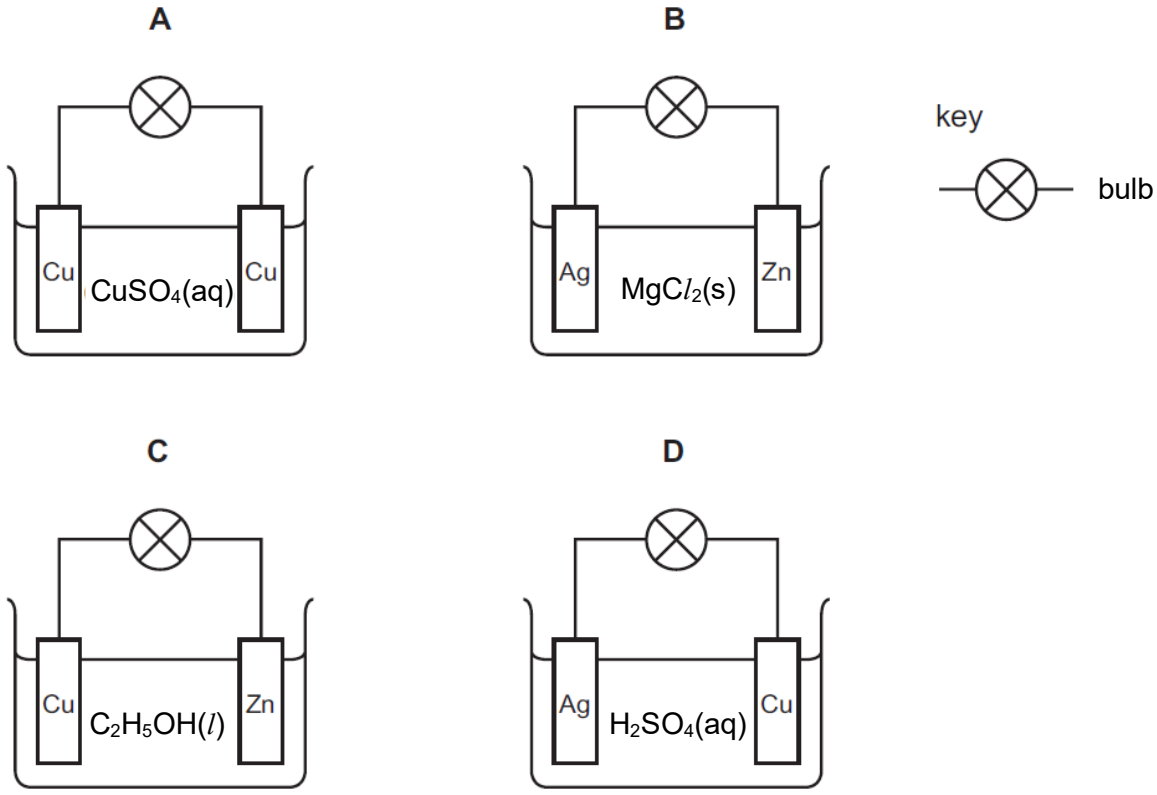
29 The statements refer to the electrolysis of concentrated copper(II) chloride solution.

1 Chloride ions and hydroxide ions are attracted to the anode.
2 Electrons move around the external circuit from the cathode to the anode.
3 Electrons are transferred from the cathode to the copper(II) ions.
4 The pH of the electrolyte remains unchanged.

Which statements about the electrolysis of concentrated copper(II) chloride are correct?

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

30 In which circuit would the bulb light up?



31 Which statement about metals and their compounds is **not** correct?

A Electrolysis is used to extract reactive metals from their aqueous salt solutions.

B For reduction of ores using hydrogen, a lower temperature is needed in the extraction of copper from copper(II) oxide than in the extraction of iron from iron(III) oxide.

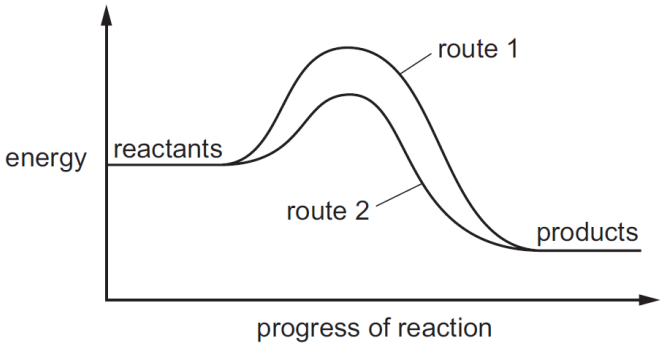
C Heating magnesium powder with zinc oxide produces zinc and a white smoke containing magnesium oxide.

D Metals low in the reactivity series are obtained from their oxides by heating with carbon.

32 Which row about the hydrogen-oxygen fuel cell is correct?

	chemical product	purpose	reaction involved
A	hydrogen	produce electrical energy	redox
B	hydrogen	reduce waste	combustion
C	water	produce electrical energy	redox
D	water	reduce waste	combustion

33 The diagram shows the energy profile for a reaction.



Which statements about the reaction are correct?

1 A temperature rise is observed.
2 The enthalpy change of route 2 is less than that of route 1.
3 The reaction is exothermic and the reactants lose energy.
4 Route 2 is a catalysed reaction involving the same reactants.

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

34 Which row correctly matches the source and effect of the air pollutant?

	air pollutant	source	effect
A	carbon monoxide	incomplete combustion of carbon fuels	global warming
B	methane	anaerobic bacterial decay of vegetation	depletion of ozone layer
C	nitrogen dioxide	combustion of petrol in internal combustion engines	erodes buildings
D	sulfur dioxide	volcanic activity	increases pH of soil

35 Which compound does **not** produce carbon on combustion?

A carbon monoxide
B ethanol
C methane
D polyethene

36 What is the product of the reaction between butene, CH_2=CH-CH_2-CH_3 and bromine, Br_2?

A CH_2Br-CH_2-CHBr-CH_3

B CH_3-CH_2-CHBr-CH_2Br

C CH_2Br-CH_2-CH_2-CH_2Br

D CH_3-CHBr-CH_2-CH_2Br

37 A compound has the structural formula $CH_3COOCH_2CH_2CH_3$.
Which statement about the compound is correct?

A It has a high melting point.

B It is formed when propanoic acid reacts ethanol.

C Its empirical formula is $C_5H_{10}O_2$.

D Its name is methyl butanoate.

38 Ethanol can be manufactured from ethene or from glucose. The table gives statements about the processes involved.

In which row is either one of the statements **incorrect**?

	process using ethene	process using glucose
A	fast, continuous process	slow, batch process
B	high yield of ethanol	low yield of ethanol
C	involves addition reaction with steam	involves aerobic reaction with yeast
D	uses non-renewable raw materials	uses renewable raw materials

39 An unsaturated alcohol has a formula $C_7H_{12}O$.

How many moles of alcohol will completely decolourise 0.5 mol of aqueous bromine?
[M_r: $C_7H_{12}O$, 112]

A 28 g **B** 56 g **C** 84 g **D** 112 g

40 Which statement about the polymer, poly(propene), is correct?

1 The simplest ratio of carbon atoms to hydrogen atoms is 3:6.
2 The mass of its monomers equals the mass of the polymer.
3 It has the same chemical properties as its monomer.

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

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (atomic) number / atomic symbol / name / relative atomic mass									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	3	4	5	6	7	8	9	10	11	12	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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).

The Avogadro constant, $L = 6.02 \times 10^{23}$ mol^{-1}

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