



Cambridge O Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2021

1 hour

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

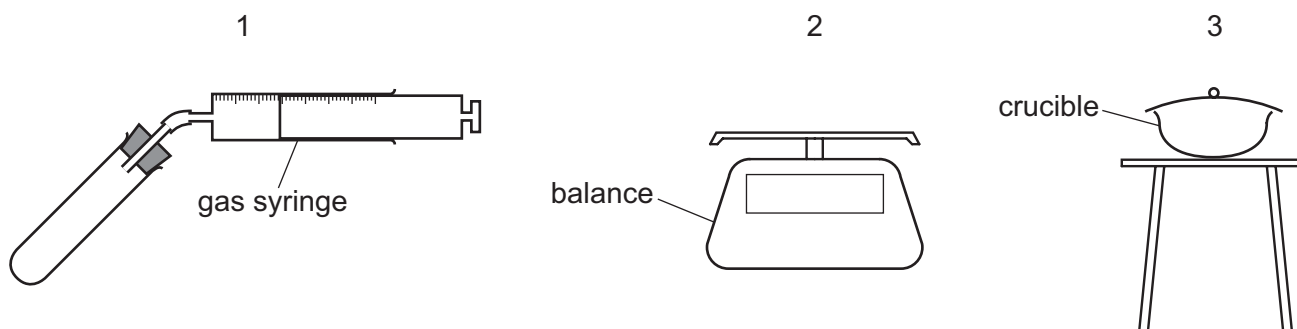
- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages.



- 1 The formula of magnesium oxide can be investigated by using the fact that when magnesium is heated it reacts with oxygen to form magnesium oxide.

Which apparatus is used for this investigation?



- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only
- 2 Which property of a liquid ester can be used to check its purity before use as a food flavouring?
- A** boiling point
B colour
C smell
D solubility in water
- 3 Which separation method would give pure samples of **both** substances from the mixture?

	mixture	separation method
A	copper sulfate crystals and water	crystallisation
B	ethanol and water	evaporation
C	salt and sand	filtration
D	nitrogen and oxygen	fractional distillation

- 4 An aqueous solution of J is a colourless solution that contains cations and chloride ions.

Separate samples of the solution give a white precipitate with a few drops of aqueous sodium hydroxide and with a few drops of aqueous ammonia.

Which statement about J is correct?

- A** The cation in J must be Al^{3+} .
B The cation in J must be Fe^{2+} .
C When dilute nitric acid and aqueous barium nitrate are added to an aqueous solution of J, a white precipitate is formed.
D When dilute nitric acid and aqueous silver nitrate are added to an aqueous solution of J, a white precipitate is formed.

5 Gas X has the following properties.

- 1 colourless
- 2 no effect on either damp red or blue litmus papers
- 3 no effect on limewater
- 4 flammable

What is gas X?

- A ammonia
- B chlorine
- C hydrogen
- D oxygen

6 Which statement about states of matter is correct?

- A When a liquid freezes it becomes a solid and energy is released to the surroundings.
- B When a liquid reaches its boiling point it becomes a gas. This process is called evaporation.
- C When a solid changes directly to a gas the process is called condensation.
- D When a solid melts the particles get further apart and have less energy.

7 Use the Periodic Table to answer this question.

Which two particles have the same number of electrons?

- A Ar and Ca
- B Na^+ and K^+
- C Fe^{2+} and Fe^{3+}
- D Ca^{2+} and Sc^{3+}

8 The table shows data for particles W, X, Y and Z.

particle	proton number	nucleon number	number of electrons
W	6	12	6
X	6	14	6
Y	7	14	7
Z	8	16	10

Which statements are correct?

- 1 W and X are isotopes of the same element.
- 2 Y is in Group V of the Periodic Table.
- 3 Z is a cation.

A 1 and 2

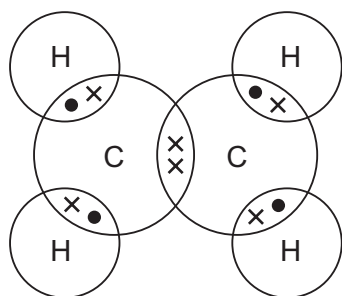
B 1 and 3

C 1 only

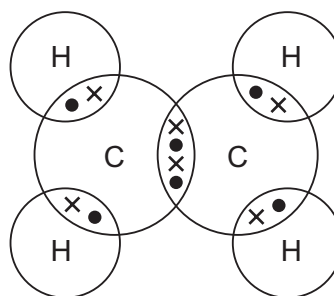
D 2 and 3

9 Which dot-and-cross diagram correctly shows a molecule of ethene?

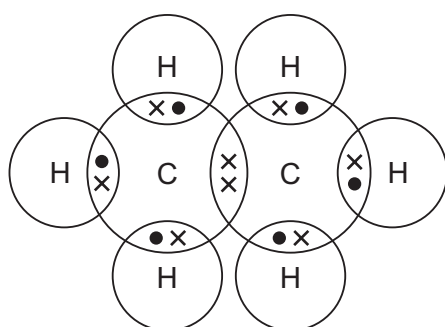
A



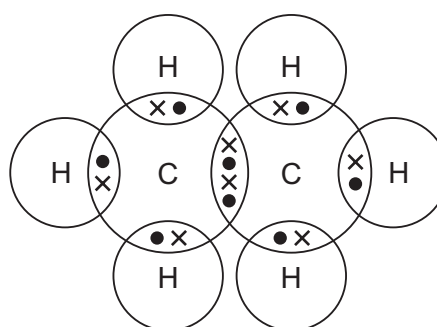
B



C



D



- 10 The names and formulae of three nitrogen compounds are shown.

ammonia	hydrazine	hydroxylamine
NH_3	N_2H_4	NH_2OH

Which compound has the highest relative molecular mass, M_r , and in which compound is the percentage by mass of hydrogen the greatest?

	highest M_r	greatest percentage by mass of hydrogen
A	N_2H_4	NH_3
B	N_2H_4	N_2H_4
C	NH_2OH	NH_3
D	NH_2OH	N_2H_4

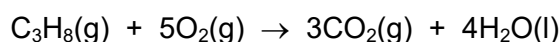
- 11 The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

- 12 10 cm^3 of propane is burned in 70 cm^3 of oxygen in a closed container.

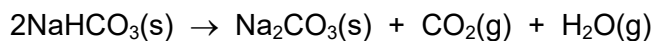


What is the total volume of gas present after the reaction?

(Assume all volumes of gases are measured at room temperature and pressure.)

- A** 30 cm^3 **B** 50 cm^3 **C** 70 cm^3 **D** 90 cm^3

- 13** When a mixture of sodium chloride and sodium hydrogencarbonate is heated, the reaction shown takes place.



Sodium chloride is unchanged on heating.

When 6.0 g of the mixture is heated, the loss in mass is 1.5 g.

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

[relative molecular mass, M_r : NaHCO_3 , 84; Na_2CO_3 , 106; CO_2 , 44; H_2O , 18]

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

- 14** Molten sodium chloride is electrolysed.

Which change occurs at the cathode?

- A** Sodium ions are oxidised.
B Sodium ions are reduced.
C Chloride ions are oxidised.
D Chloride ions are reduced.

- 15** Which positive ions are present in aqueous copper(II) sulfate?

- A** copper(II) ions only
B copper(II) ions and hydrogen ions
C sulfate ions only
D sulfate ions and hydroxide ions

- 16** Natural gas is used as a source of energy.

What is the main compound in natural gas?

- A** ethane
B ethene
C methane
D methanol

- 17** Ethanol is produced by the fermentation of glucose from sugar cane. In some countries ethanol is used as a fuel.

Which statements are correct?

- 1 Sugar cane is a non-renewable (finite) resource.
- 2 When sugar cane is growing it removes carbon dioxide from the atmosphere.

- A** 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

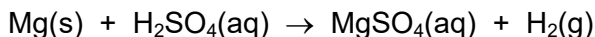
- 18** Aqueous sodium thiosulfate reacts with hydrochloric acid. The rate of the reaction increases if the concentration of both reactants is increased.

Nitrogen gas reacts with hydrogen gas. The rate of the reaction increases if the pressure in the reaction vessel is increased.

Which row correctly explains why the given change increases the rate of the reaction?

	aqueous sodium thiosulfate + hydrochloric acid	nitrogen + hydrogen
A	higher frequency of collisions between particles	higher frequency of collisions between particles
B	higher frequency of collisions between particles	the activation energy is decreased
C	the activation energy is decreased	higher frequency of collisions between particles
D	the activation energy is decreased	the activation energy is decreased

19 Magnesium reacts with dilute sulfuric acid.



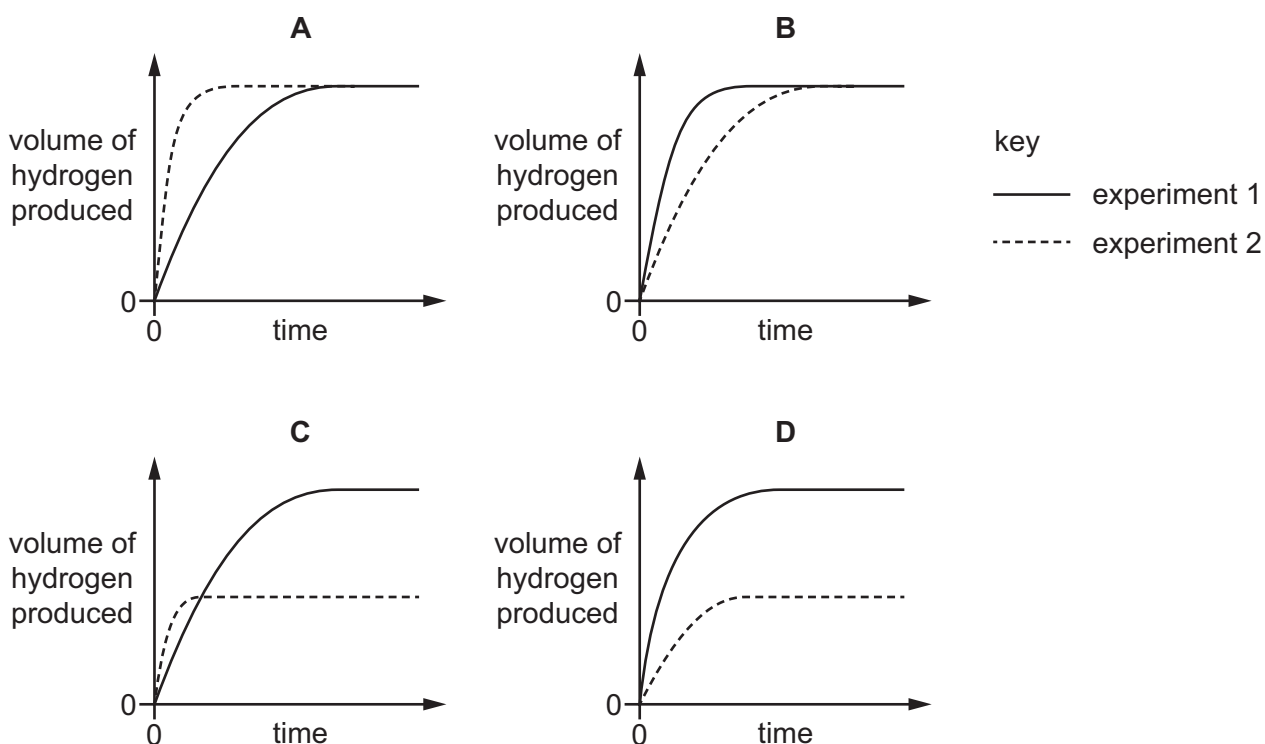
Two experiments are carried out at 25 °C.

experiment 1 24.0 g of powdered magnesium is reacted with 100 cm³ of 1.0 mol/dm³ sulfuric acid.

experiment 2 24.0 g of powdered magnesium is reacted with 50 cm³ of 2.0 mol/dm³ sulfuric acid.

During each experiment the volume of hydrogen produced is measured. The results are plotted on a graph.

Which graph is correct?



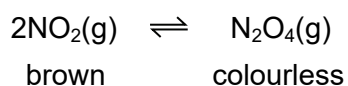
20 Solution X is colourless. A few drops of aqueous potassium iodide solution are added to a sample of X. No change is seen.

Solution Y is colourless. A few drops of aqueous acidified potassium manganate(VII) solution are added to a sample of Y. The colour of the potassium manganate(VII) disappears.

What can be deduced about X and Y from these two observations?

- A X and Y are both reducing agents.
- B X is an oxidising agent and Y is **not** a reducing agent.
- C X is **not** a reducing agent and Y is an oxidising agent.
- D X is **not** an oxidising agent and Y is a reducing agent.

- 21** Brown nitrogen dioxide reacts to form colourless dinitrogen tetroxide in a reversible reaction. The forward reaction is exothermic.



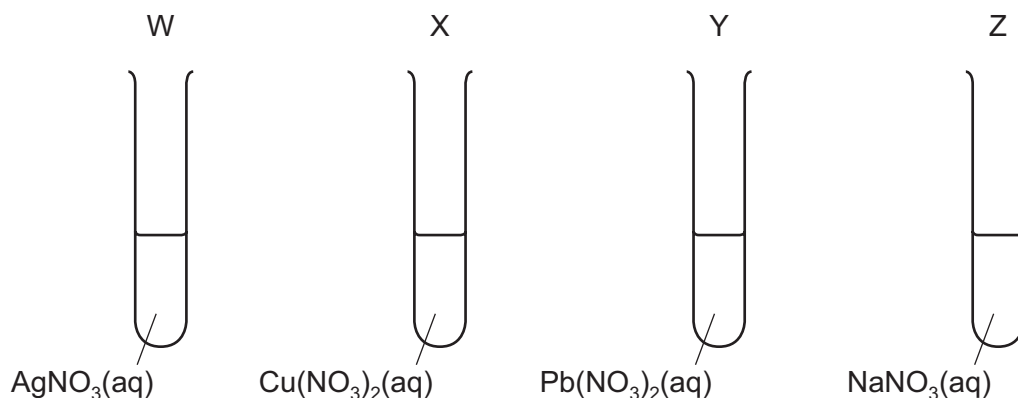
Which changes would make the equilibrium mixture darker in colour?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 22** Which row shows the pH values for 0.1 mol/dm³ solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	NH ₃	HCl	NaCl	NaOH
A	1	7	13	11
B	7	1	11	13
C	11	1	7	13
D	13	11	7	1

23 Four test-tubes are set up as shown.



What is the effect of adding dilute hydrochloric acid to each test-tube?

	W	X	Y	Z	
A	x	✓	x	✓	key x = clear solution ✓ = precipitate formed
B	✓	x	✓	x	
C	✓	x	✓	✓	
D	✓	x	x	x	

24 Aqueous ammonia reacts with a compound to form a salt, ammonium phosphate.

What type of reaction will ammonia undergo to form ammonium phosphate?

- A** combustion
- B** neutralisation
- C** oxidation
- D** precipitation

25 Sulfuric acid is manufactured in the contact process. Several substances are involved in this process, including vanadium(V) oxide and water.

Which roles are played by vanadium(V) oxide and water in the contact process?

	vanadium(V) oxide	water
A	catalyst	reactant
B	catalyst	solvent
C	reactant	reactant
D	reactant	solvent

26 Some properties which indicate the differences in elements are listed.

- 1 metallic character
- 2 number of electron shells in an atom
- 3 number of protons in an atom
- 4 total number of electrons in an atom

Which two properties increase across a period of the Periodic Table?

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

27 Germanium is in Group IV of the Periodic Table. It has a proton number of 32.

Selenium is in Group VI of the Periodic Table. It has a proton number of 34.

Which prediction can be made, based on the positions of germanium and selenium in the Periodic Table?

- A** A germanium atom has two more valence electrons than a selenium atom.
B Germanium forms a Ge^{3+} ion and selenium forms an Se^{3-} ion.
C Germanium has more metallic character than selenium.
D Germanium has similar properties to tellurium, and selenium has similar properties to tin.

28 The proton number of caesium is 55.

Compared with lithium, the melting point of caesium is1..... and the reaction of caesium with water is2..... vigorous. The number of valence electrons in caesium is3..... compared to lithium.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	higher	more	the same
B	higher	less	the same
C	lower	more	greater
D	lower	more	the same

29 Nickel is a transition element.

Which properties does it have?

- 1 It can act as a catalyst.
- 2 It conducts electricity when molten.
- 3 It forms coloured compounds.
- 4 It has only one oxidation state in its compounds.

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

30 Which metal reacts with steam and can be extracted from its ore by reduction with carbon?

- A** magnesium
B calcium
C copper
D zinc

31 Three correct statements about aluminium are listed.

- 1 Aluminium is the most common metal in the Earth's crust.
- 2 It is costly to extract aluminium from its ore, bauxite.
- 3 The world's supply of bauxite is limited.

Which statements explain why aluminium should be recycled?

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

32 Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion.

Which reaction protects the iron from corrosion?

- A** $\text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$
B $\text{Fe}(\text{s}) \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-}$
C $\text{Mg}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Mg}(\text{s})$
D $\text{Mg}(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^{-}$

33 Iron is extracted from its ore, haematite, in a blast furnace.

Which statement about this extraction process is correct?

- A** Air is blown into the blast furnace to react with carbon.
- B** At the bottom of a blast furnace a layer of molten iron floats on top of a layer of molten slag.
- C** Limestone is decomposed in the blast furnace to produce carbon monoxide.
- D** Silicon dioxide, an impurity in the ore, is a basic oxide.

34 Which statement about the preparation and properties of aluminium is correct?

- A** Aluminium is obtained by heating aluminium oxide with carbon.
- B** Aluminium is produced at the anode by electrolysis of aluminium oxide dissolved in molten cryolite.
- C** Aluminium is unreactive as it forms an oxide coating.
- D** Aluminium is used in overhead electricity cables as it is a good conductor of electricity and has a high density.

35 How many moles of hydrogen chloride are formed when one mole of methane reacts with a large excess of chlorine in sunlight?

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

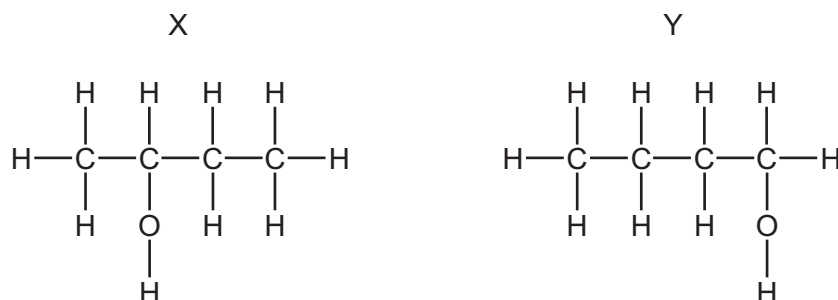
36 Vegetable oils can be made into margarine.

Which row describes the changes which take place?

	hydrogen	viscosity
A	is added	increases
B	is removed	decreases
C	is added	decreases
D	is removed	increases

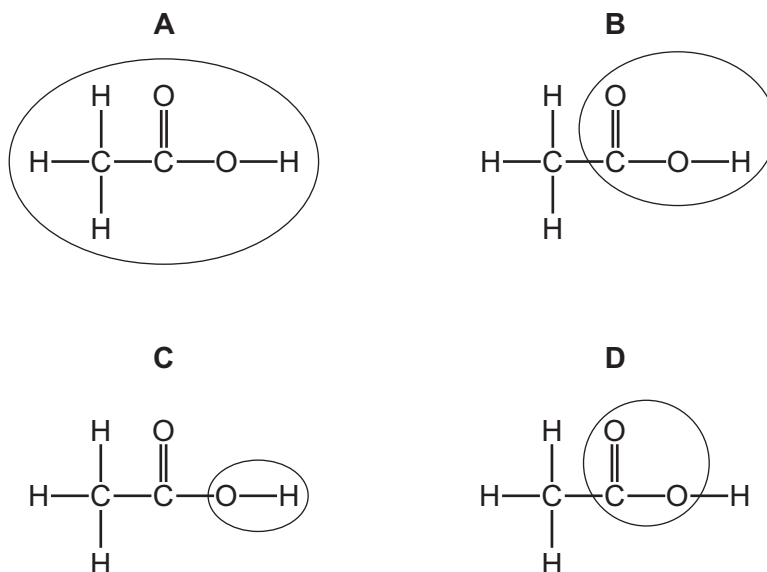
37 Which statements about alcohols are correct?

- 1 All alcohols contain the hydroxide ion, OH^- .
- 2 Ethanol can be formed from ethene using a reaction catalysed by yeast.
- 3 Methanol can be oxidised to methanoic acid.
- 4 The alcohols X and Y shown are isomers.



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

38 Which circled structure shows only the functional group of a carboxylic acid?



39 Which statement about polymers is correct?

- A** Nylon and *Terylene* are both polyesters.
- B** Proteins and nylon have the same monomer units.
- C** Proteins have the same amide linkages as nylon.
- D** *Terylene* and fats are esters but with different linkages.

40 Some information about compound X is given.

X contains the elements carbon, hydrogen and oxygen only.

The product of the hydrolysis of X is the simple sugar, glucose.

What is X?

- A** a polyester
- B** a protein
- C** nylon
- D** starch

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The Periodic Table of Elements

Group																	
I	II	III										IV	V	VI	VII	VIII	
		1Hhydrogen1															
		Key atomic number atomic symbol name relative atomic mass															
3Li lithium 7	4Be beryllium 9											5B boron 11	6C carbon 12	7N nitrogen 14	8O oxygen 16	9F fluorine 19	10Ne neon 20
11Na sodium 23	12Mg magnesium 24											13Al aluminium 27	14Si silicon 28	15P phosphorus 31	16S sulfur 32	17Cl chlorine 35.5	18Ar argon 40
19K potassium 39	20Ca calcium 40	21Sc scandium 45	22Ti titanium 48	23V vanadium 51	24Cr chromium 52	25Mn manganese 55	26Fe iron 56	27Co cobalt 59	28Ni nickel 59	29Cu copper 64	30Zn zinc 65	31Ga gallium 70	32Ge germanium 73	33As arsenic 75	34Se selenium 79	35Br bromine 80	36Kr krypton 84
37Rb rubidium 85	38Sr strontium 88	39Y yttrium 89	40Zr zirconium 91	41Nb niobium 93	42Mo molybdenum 96	43Tc technetium —	44Ru ruthenium 101	45Rh rhodium 103	46Pd palladium 106	47Ag silver 108	48Cd cadmium 112	49In indium 115	50Sn tin 119	51Sb antimony 122	52Te tellurium 128	53I iodine 127	54Xe xenon 131
55Cs caesium 133	56Ba barium 137	57–71lanthanoids	72Hf hafnium 178	73Ta tantalum 181	74W tungsten 184	75Re rhenium 186	76Os osmium 190	77Ir iridium 192	78Pt platinum 195	79Au gold 197	80Hg mercury 201	81Tl thallium 204	82Pb lead 207	83Bi bismuth 209	84Po polonium —	85At astatine —	86Rn radon —
87Fr francium —	88Ra radium —	89–103actinoids	104Rf rutherfordium —	105Db dubnium —	106Sg seaborgium —	107Bh bohrium —	108Hs hassium —	109Mt meitnerium —	110Ds darmstadtium —	111Rg roentgenium —	112Cn copernicium —	113Nh nihonium —	114Fl flerovium —	115Lv livermorium —	116Ts tennessine —	117Uue unbinilium —	118Og oganeson —

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.).