



# Cambridge O Level

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## CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2025

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)

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### 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.

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This document has **16** pages.

- 1 At temperature X, the volume of samples of hexane and pentane are **not** affected by changing the pressure from 1 atm to 2 atm.

At temperature X, the pentane molecules are free to move.

At temperature X, the hexane molecules are in fixed positions.

What are the states of hexane and pentane at temperature X?

	hexane	pentane
A	liquid	solid
B	liquid	gas
C	solid	liquid
D	solid	gas

- 2 A gas is produced by a chemical reaction at one side of a laboratory.

After a few minutes, the gas is detected at the other side of the laboratory.

Which process explains why the gas is detected at the other side of the laboratory?

- A condensation
- B diffusion
- C dissolving
- D evaporation

- 3 Which statement is correct?

- A All compounds are ionic.
- B All compounds conduct electricity when molten.
- C Each atom of an element contains the same number of protons.
- D In a mixture of substances, the proportions of the substances are always the same.

- 4 Atoms of element Q form positive ions.

An ion of Q has 10 electrons and 14 neutrons.

Which statement is correct?

- A An atom of Q has only two occupied electron shells.
- B Q is a non-metal.
- C The atomic number of Q is 10.
- D The mass number of Q is greater than 24.

5 Which particle contains the greatest number of electrons?

- A** Mg<sup>2+</sup>      **B** N<sup>3-</sup>      **C** Ne      **D** S<sup>2-</sup>

6 The table shows data about the two isotopes in a sample of the element europium.

relative mass of isotope	percentage abundance of isotope
150.92	47.81
152.92	52.19

What is the relative atomic mass of this sample of europium?

- A** 151.88      **B** 151.96      **C** 152.00      **D** 152.04

7 Which statement about magnesium oxide is correct?

- A** It has a high melting point and good electrical conductivity at r.t.p.
- B** It is made up of magnesium anions and oxygen cations.
- C** It is an ionic compound and has good electrical conductivity when molten.
- D** It is strongly bonded because of electrons shared between magnesium atoms and oxygen atoms.

8 Which statement about silicon(IV) oxide is correct?

- A** It conducts electricity.
- B** It has a giant covalent structure.
- C** It is an alloy.
- D** It is ionically bonded.

9 Which compound has the highest relative formula mass,  $M_r$ ?

[Ar: K, 39; N, 14; O, 16; Ca, 40; C, 12; Li, 7; S, 32; Mg, 24; Cl, 35.5]

- A** calcium carbonate
- B** lithium sulfate
- C** magnesium chloride
- D** potassium nitrate

- 10 100 cm<sup>3</sup> of ethene is completely combusted in 400 cm<sup>3</sup> of oxygen. The volumes of both gases are measured at r.t.p.

What is the final volume of gas in the mixture measured at r.t.p.?

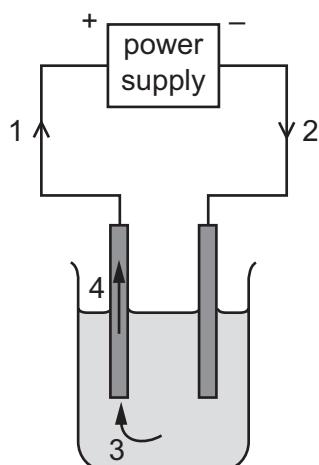
- A 200 cm<sup>3</sup>      B 250 cm<sup>3</sup>      C 300 cm<sup>3</sup>      D 500 cm<sup>3</sup>

- 11 The formula of hydrated sodium carbonate is Na<sub>2</sub>CO<sub>3</sub>•10H<sub>2</sub>O.

What is the percentage composition by mass of oxygen in hydrated sodium carbonate?

- A 16.8      B 22.4      C 55.9      D 72.7

- 12 The diagram shows the electrolysis of molten lead bromide with inert electrodes.



Which row identifies the particles that carry charge along each arrow?

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

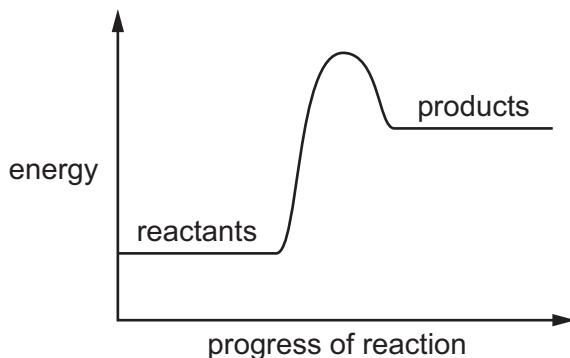
- 13 What are the products formed at the two electrodes when aqueous copper(II) sulfate is electrolysed using copper electrodes?

	anode product	cathode product
<b>A</b>	aqueous copper(II) ions	copper metal
<b>B</b>	aqueous copper(II) ions	hydrogen gas
<b>C</b>	oxygen gas	copper metal
<b>D</b>	oxygen gas	hydrogen gas

14 Which statement about a hydrogen–oxygen fuel cell is correct?

- A It uses a chemical reaction that has only one product.
- B It works by burning hydrogen in air.
- C It requires a continuous input of electrical energy.
- D It is less efficient than a petrol engine.

15 A reaction pathway diagram is shown.



Which equation does the reaction pathway diagram show?

- A  $2\text{H(g)} + \text{O(g)} \rightarrow \text{H}_2\text{O(g)}$
- B  $\text{H}_2\text{(g)} \rightarrow 2\text{H(g)}$
- C  $\text{H}_2\text{O(g)} \rightarrow \text{H}_2\text{O(l)}$
- D  $2\text{O(g)} \rightarrow \text{O}_2\text{(g)}$

16 Which process is a chemical change?

- A the distillation of aqueous ethanol
- B the evaporation of water from aqueous sodium chloride
- C the melting of wax
- D the rusting of iron

- 17 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?

	increasing the concentration of aqueous sodium thiosulfate and hydrochloric acid	increasing the pressure in the reaction vessel containing nitrogen and hydrogen
<b>A</b>	higher frequency of collisions between particles	higher frequency of collisions between particles
<b>B</b>	higher frequency of collisions between particles	the activation energy is decreased
<b>C</b>	the activation energy is decreased	higher frequency of collisions between particles
<b>D</b>	the activation energy is decreased	the activation energy is decreased

- 18 Magnesium reacts with dilute sulfuric acid.



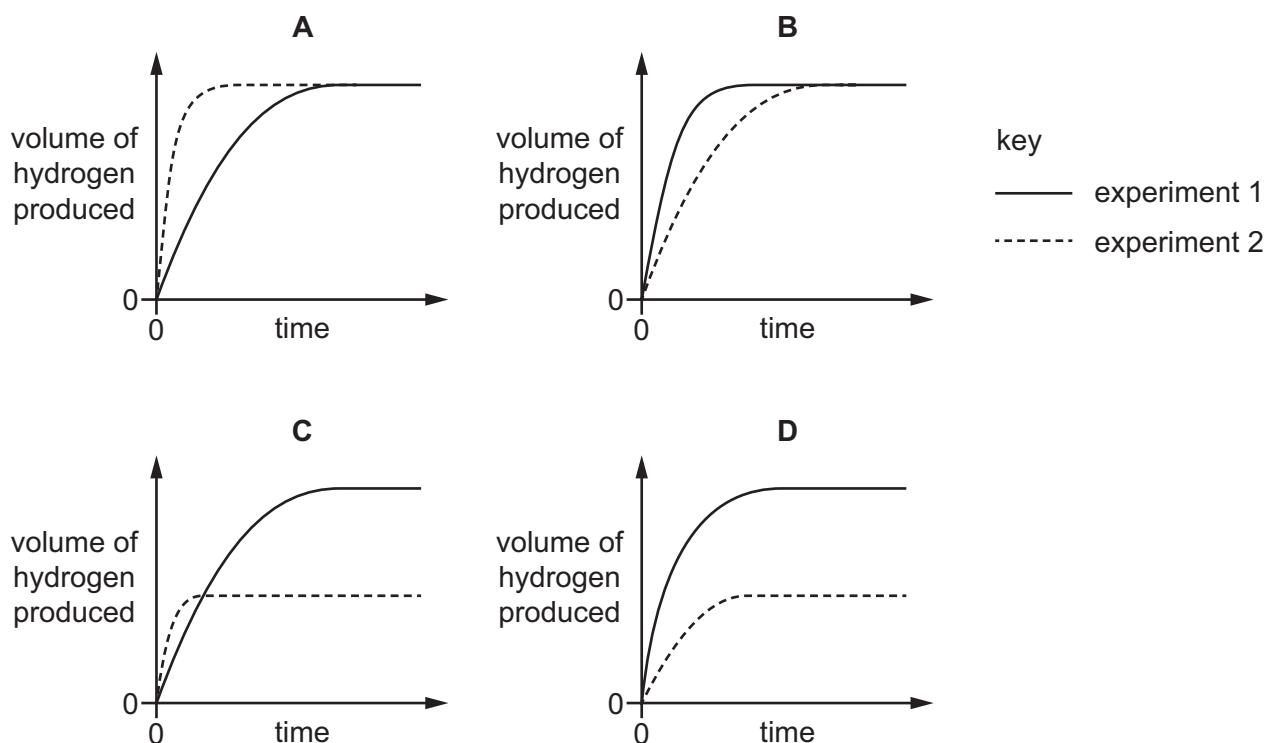
Two experiments are carried out at 25 °C.

experiment 1 24.0 g of powdered magnesium is reacted with 100 cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> sulfuric acid.

experiment 2 24.0 g of powdered magnesium is reacted with 50 cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> sulfuric acid.

During each experiment, the volume of hydrogen produced is measured at regular time intervals. The results are plotted on a graph.

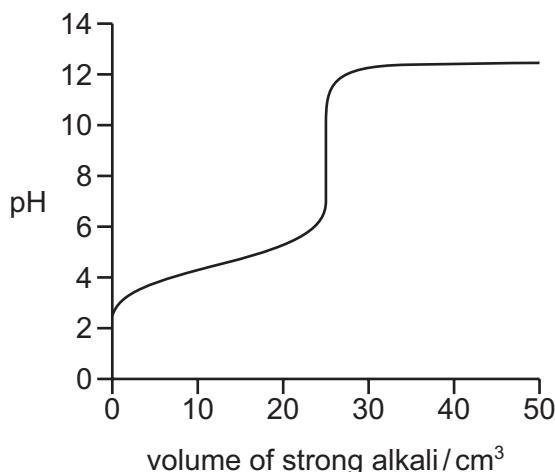
Which graph is correct?



- 19 Which row gives the catalyst for each of the two processes?

	Contact process	Haber process
A	iron	iron
B	iron	nickel
C	vanadium(V) oxide	iron
D	vanadium(V) oxide	nickel

- 20 The diagram shows the change in pH as a strong alkali is added to a weak acid.



40 cm<sup>3</sup> of a strong alkali is added to a weak acid and a sample of the solution is tested separately with methyl orange and thymolphthalein.

Which row is correct?

	methyl orange test	thymolphthalein test
A	red	colourless
B	yellow	colourless
C	red	blue
D	yellow	blue

- 21 Which row shows the equations for the dissociation of methanoic acid and of nitric acid?

	methanoic acid	nitric acid
A	$\text{HCOOH(aq)} \rightarrow \text{H}^+(\text{aq}) + \text{HCOO}^-(\text{aq})$	$\text{HNO}_3(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$
B	$\text{HCOOH(aq)} \rightarrow \text{H}^+(\text{aq}) + \text{HCOO}^-(\text{aq})$	$\text{HNO}_3(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$
C	$\text{HCOOH(aq)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{HCOO}^-(\text{aq})$	$\text{HNO}_3(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$
D	$\text{HCOOH(aq)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{HCOO}^-(\text{aq})$	$\text{HNO}_3(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$

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

- A Across a period, elements at the left-hand side of the Periodic Table are more metallic than those at the right-hand side.
- B Down a group, elements at the top of the group lose electrons more readily than those at the bottom of the group.
- C Elements in the same group of the Periodic Table have the same number of completed shells of electrons.
- D Elements in the same period of the Periodic Table have the same number of electrons in the outer shell.

23 Rubidium and caesium are both elements in Group I of the Periodic Table.

Which prediction comparing rubidium and caesium is correct?

- A Caesium has the higher density and the greater reactivity.
- B Caesium has the higher density; rubidium has the greater reactivity.
- C Rubidium has the higher density and the greater reactivity.
- D Rubidium has the higher density; caesium has the greater reactivity.

24 Three statements about the halogens are listed.

- 1 All halogens are non-metallic diatomic molecules.
- 2 Chlorine displaces both bromine and iodine from aqueous solutions of their salts.
- 3 The halogens become more reactive on descending Group VII of the Periodic Table.

Which statements are correct?

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

25 Which statements about neon are correct?

- 1 It is unreactive.
- 2 It has strong intermolecular forces.
- 3 It has a full outer shell of electrons.

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

26 Substance X has the following properties.

- melting point 1237 °C
- boiling point 2595 °C
- malleable
- good electrical and thermal conductivity at r.t.p.

What is the structure of substance X?

- A giant covalent
- B giant ionic lattice
- C giant metallic lattice
- D simple molecular
- 27 Which statement explains why objects manufactured from aluminium corrode very slowly?
- A Aluminium is above hydrogen in the reactivity series.
- B Aluminium is below hydrogen in the reactivity series.
- C The objects become coated with a protective layer of aluminium nitride.
- D The objects become coated with a protective layer of aluminium oxide.
- 28 The iron(III) oxide used in a blast furnace contains the impurity silicon(IV) oxide, SiO<sub>2</sub>.

Which reaction removes the silicon(IV) oxide?

- A 3SiO<sub>2</sub> + Fe<sub>2</sub>O<sub>3</sub> → 2Fe + 3SiO<sub>3</sub>
- B SiO<sub>2</sub> + C → Si + CO<sub>2</sub>
- C SiO<sub>2</sub> + CaO → CaSiO<sub>3</sub>
- D 2SiO<sub>2</sub> + N<sub>2</sub> → 2Si + 2NO<sub>2</sub>

**29** The domestic water supply is treated before it is supplied to houses. Three treatments are listed.

- sedimentation and filtration
- treatment with chlorine
- treatment with carbon

Which row shows the purpose of the treatments?

	sedimentation and filtration	treatment with chlorine	treatment with carbon
<b>A</b>	kills microbes	removes solids	removes unpleasant tastes and odours
<b>B</b>	removes solids	kills microbes	removes unpleasant tastes and odours
<b>C</b>	removes solids	removes unpleasant tastes and odours	kills microbes
<b>D</b>	removes unpleasant tastes and odours	kills microbes	removes solids

**30** Nitrates and ammonium salts are used as fertilisers.

Which fertiliser contains the greatest mass of nitrogen in 50 kg of the compound?

[ $A_r$ : H, 1; N, 14; O, 16; S, 32; Cl, 35.5; K, 39]

- A**  $\text{NH}_4\text{Cl}$       **B**  $\text{NH}_4\text{NO}_3$       **C**  $(\text{NH}_4)_2\text{SO}_4$       **D**  $\text{KNO}_3$

**31** Which strategy reduces methane emissions?

- A** flue gas desulfurisation  
**B** planting more trees  
**C** reduction in livestock farming  
**D** use of catalytic converters

**32** Compound P is an alcohol with the molecular formula  $\text{C}_4\text{H}_{10}\text{O}$ .

How many structural isomers are there of compound P?

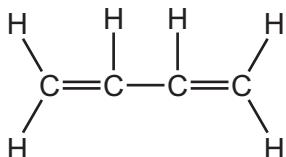
- A** 2      **B** 3      **C** 4      **D** 5

- 33 Alkanes undergo a substitution reaction with chlorine.

Which row shows two correct statements about the reaction between alkanes and chlorine?

	statement 1	statement 2
A	a carbon atom is replaced by a chlorine atom	the reaction requires thermal energy
B	a hydrogen atom is replaced by a chlorine atom	the reaction requires thermal energy
C	a carbon atom is replaced by a chlorine atom	the reaction requires ultraviolet light
D	a hydrogen atom is replaced by a chlorine atom	the reaction requires ultraviolet light

- 34 A molecule of the compound C<sub>4</sub>H<sub>6</sub> is shown.



This molecule undergoes two separate addition reactions. It undergoes an addition reaction with excess bromine and an addition reaction with steam.

One molecule of C<sub>4</sub>H<sub>6</sub> reacts with .....1..... of bromine.

When C<sub>4</sub>H<sub>6</sub> reacts with steam, .....2..... is formed.

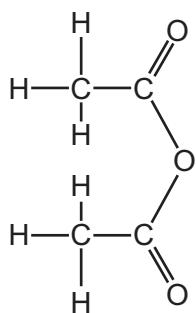
Which words complete gaps 1 and 2?

	1	2
A	one molecule	an alcohol
B	one molecule	a carboxylic acid
C	two molecules	an alcohol
D	two molecules	a carboxylic acid

- 35 Which statement about members of the homologous series of alcohols is correct?

- A An alcohol with two carbon atoms in each molecule is called methanol.
- B Butanol can be combusted to give carbon dioxide and water only.
- C Ethanol is the only alcohol that can be oxidised to a carboxylic acid.
- D Propanol can be made by the catalysed addition of steam to ethene.

- 36 The diagram shows the structure of a compound called ethanoic anhydride.



1 mol of ethanoic anhydride reacts with water to form 2 mol of a carboxylic acid only. This carboxylic acid reacts with ethanol to form an ester.

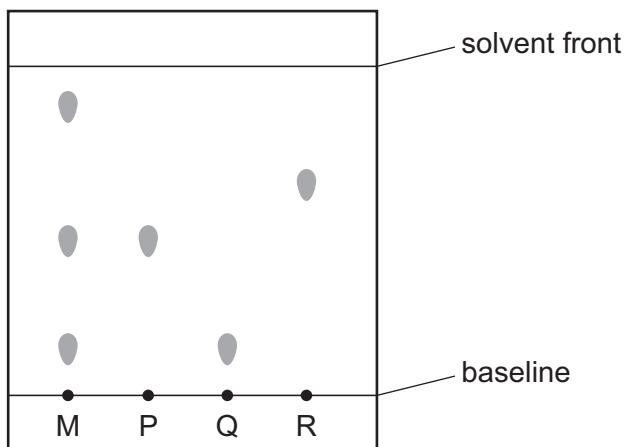
How many moles of water react with 1 mol of the ethanoic anhydride and what is the structure of the ester?

	number of moles of water	structure of the ester
A	1	$\begin{array}{c} \text{H} & & \text{O} \\   & & // \\ \text{H}-\text{C} & -\text{C} & =\text{O} \\   & & \backslash \\ \text{H} & & \text{O} \\ & &   \\ & & \text{H}-\text{C} \\ & &   \\ & & \text{H} \end{array}$
B	1	$\begin{array}{c} \text{H} & \text{H} & \text{O} \\   &   & // \\ \text{H}-\text{C} & -\text{C} & =\text{O} \\   & & \backslash \\ \text{H} & & \text{O} \\ & &   \\ & & \text{H}-\text{C} \\ & &   \\ & & \text{H} \end{array}$
C	2	$\begin{array}{c} \text{H} & & \text{O} \\   & & // \\ \text{H}-\text{C} & -\text{C} & =\text{O} \\   & & \backslash \\ \text{H} & & \text{O} \\ & &   \\ & & \text{H}-\text{C} \\ & &   \\ & & \text{H} \end{array}$
D	2	$\begin{array}{c} \text{H} & \text{H} & \text{O} \\   &   & // \\ \text{H}-\text{C} & -\text{C} & =\text{O} \\   & & \backslash \\ \text{H} & & \text{O} \\ & &   \\ & & \text{H}-\text{C} \\ & &   \\ & & \text{H} \end{array}$

37 Four samples are analysed using paper chromatography.

P, Q and R are pure substances.

M is a mixture of different substances.



Which substances does mixture M contain?

- A P, Q and R
  - B P, Q and another substance
  - C P and Q only
  - D P and R only
- 38 A student is making a sample of aqueous copper(II) sulfate. The student adds an excess of copper(II) oxide powder to warm sulfuric acid and stirs the mixture.

Which apparatus is used to separate aqueous copper(II) sulfate from the excess copper(II) oxide?

- A burette
  - B distillation apparatus
  - C filter funnel and paper
  - D measuring cylinder
- 39 How can a pure sample of barium sulfate be obtained from barium carbonate?
- A Dissolve it in dilute hydrochloric acid, add dilute sulfuric acid, filter and crystallise.
  - B Dissolve it in dilute hydrochloric acid, add dilute sulfuric acid, filter and wash.
  - C Dissolve it in water, add dilute sulfuric acid, filter and crystallise.
  - D Dissolve it in water, add dilute sulfuric acid, filter and wash.

- 40** A sample of a white powder, X, is dissolved in water.

Tests are done on separate portions of this solution and the observations are shown in the table.

test	observation
add aqueous sodium hydroxide a drop at a time until in excess	white precipitate forms, soluble in excess, giving a colourless solution
acidify with dilute nitric acid then add aqueous silver nitrate	white precipitate forms
acidify with dilute nitric acid then add aqueous barium nitrate	the solution remains colourless

What is X?

- A** aluminium chloride
- B** aluminium sulfate
- C** calcium chloride
- D** calcium sulfate

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**The Periodic Table of Elements**

I		II		Group																							
				I						II			III		IV		V		VI		VII		VIII				
3	Li	4	Be	5	C	6	N	7	O	8	F	9	H	10	Ne	11	He	12	He	13	He	14	He	15	He		
lithium		beryllium		carbon		nitrogen		oxygen		fluorine		neon	hydrogen	neon	oxygen	nitrogen	helium	oxygen	helium	oxygen	nitrogen	oxygen	helium	oxygen	helium		
7		9		12		14		16		19		20	1	10	18	19	20	21	22	23	24	25	26	27	28	29	
													1														
11	Na	12	Mg	13		14		15		16		17		18		19		20	21	22	23	24	25	26	27	28	
sodium		magnesium											1					20	21	22	23	24	25	26	27	28	
23													1														
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Zn	30	Ga	31	Ge		
potassium		calcium		scandium		titanium		vanadium		chromium		manganese		55		iron		56		nickel		zinc		gallium		germanium	
39		40		45		48		51		52		55				56		59		59		65		70		73	
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In		
rubidium		strontium		yttrium		zirconium		niobium		molybdenum		93		96		ruthenium		101		106		108		112		115	
85				89																							
55	Cs	56	Ba	57-71	Hf	72	Ta	73	W	74	Re	75	Ir	76	Os	77	Tl	78	Pt	79	Hg	80	Tl	81	Bi		
caesium		barium		lanthanoids		hafnium		tantalum		tungsten		178		181		184		186		195		197		201		204	
133																											
87	Fr	88	Ra	89-103	Rf	104	Db	105	Sg	106	Bh	107	Hs	108	Mt	109	Ds	110	Rg	111	Cn	112	Ff	113	Lv		
francium		radium		actinoids		rutherfordium		dubnium		seaborgium		—		—		meitnerium		darmstadtium		roentgenium		—		fermium		moscovium	
—																											

16

57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Er	68	Tm	69	Yb		
lanthanum		cerium		praseodymium		neodymium		141		144		150		152		gadolinium		terbium		dysprosium		erbium		thulium		ytterbium	
139		140																									
89	Ac	90	Th	91	Pa	92	U	93	Np	94	Am	95	Cm	96	Bk	97	Cf	98	Es	99	Fm	100	Md	101	No	102	Lu
actinium																											
—																											

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