



# Cambridge IGCSE™

**CHEMISTRY**

**0620/23**

Paper 2 Multiple Choice (Extended)

**October/November 2020**

**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)

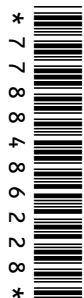
## INSTRUCTIONS

- 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. 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. Blank pages are indicated.



1 Which gas has the slowest rate of diffusion?

- A  $H_2$                       B  $NH_3$                       C  $CH_4$                       D  $CO_2$

2 When a dark grey solid element is heated, it changes directly into a purple gas.

Which word describes this change?

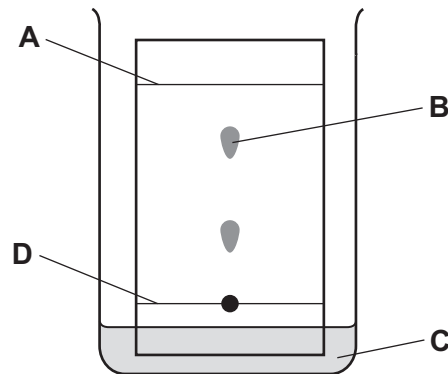
- A boiling  
B evaporation  
C melting  
D sublimation

3 Nickel(II) sulfate is a green solid that is soluble in water.

Which method is used to obtain a pure sample of nickel(II) sulfate crystals from a mixture of nickel(II) sulfate and sand?

- A Heat the mixture with water and distil it to give nickel(II) sulfate.  
B Heat the mixture with water and leave it to crystallise.  
C Heat the mixture with water and filter off the nickel(II) sulfate.  
D Heat the mixture with water, filter and allow the solution to crystallise.

4 In the chromatography experiment shown, which label represents the solvent front?



- 5 Molecules containing only non-metal atoms are covalently bonded.

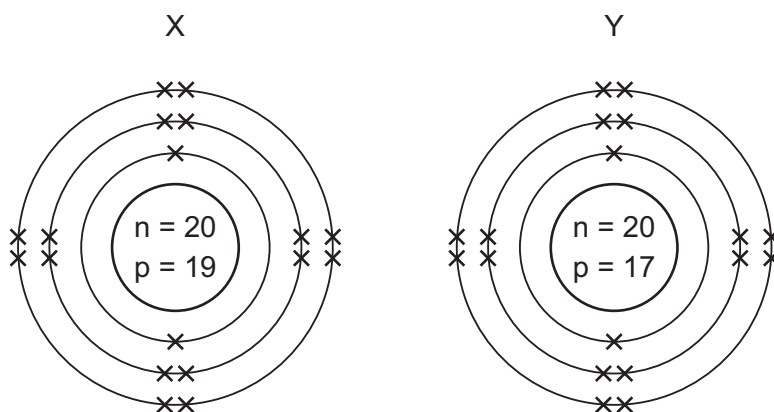
The formulae of four covalently bonded molecules are given below:

- 1 nitrogen,  $N_2$
- 2 carbon dioxide,  $CO_2$
- 3 ethene,  $C_2H_4$
- 4 methanol,  $CH_3OH$

Which of the molecules contain double bonds?

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

- 6 The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

- A**  $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$
- B**  $X_2 + 2Y \rightarrow 2X^- + 2Y^+$
- C**  $2X + Y_2 \rightarrow 2X^+ + 2Y^-$
- D**  $2X + Y_2 \rightarrow 2X^- + 2Y^+$
- 7 Magnesium reacts with sulfuric acid.

What are the formulae of the products formed in this reaction?

- A**  $MgSO_4$  and  $H_2$
- B**  $MgSO_4$  and  $H_2O$
- C**  $Mg(SO_4)_2$  and  $H_2$
- D**  $Mg(SO_4)_2$  and  $H_2O$

- 8 Sodium reacts with chlorine to form sodium chloride.

Which row describes the bonding in the three substances?

	sodium	chlorine	sodium chloride
<b>A</b>	covalent	covalent	covalent
<b>B</b>	covalent	metallic	ionic
<b>C</b>	metallic	covalent	ionic
<b>D</b>	metallic	metallic	covalent

- 9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
<b>A</b>	electron gained	$\text{Rb}^+$
<b>B</b>	electron gained	$\text{Rb}^-$
<b>C</b>	electron lost	$\text{Rb}^+$
<b>D</b>	electron lost	$\text{Rb}^-$

- 10 Which statement explains why graphite is used as a lubricant?

- A** All bonds between the atoms are weak.
- B** It conducts electricity.
- C** It has a low melting point.
- D** Layers in the structure can slide over each other.

- 11 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

- A** a neutron
- B** a proton
- C** an atom of carbon-12
- D** an atom of hydrogen-1

12 What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

- A FeO                      B Fe<sub>2</sub>O                      C Fe<sub>2</sub>O<sub>3</sub>                      D Fe<sub>3</sub>O<sub>4</sub>

13 Electrolysis is carried out on dilute aqueous potassium bromide.

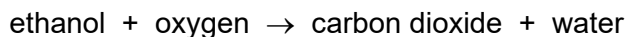
Which products are formed at the anode and the cathode?

	anode	cathode
A	bromine	hydrogen
B	bromine	potassium
C	hydrogen	bromine
D	hydrogen	potassium

14 Which substance does **not** require oxygen in order to produce energy?

- A coal  
B hydrogen  
C natural gas  
D <sup>235</sup>U

15 Ethanol is used as a fuel.

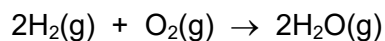


Which statements are correct?

- 1 The reaction is endothermic.
- 2 The products have more energy than the reactants.
- 3 The oxygen for this reaction comes from the air.
- 4 The temperature of the reaction mixture rises during this reaction.

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

- 16 The reaction between hydrogen and oxygen releases 486 kJ/mol of energy.



The bond energy of H–H is 436 kJ/mol and that of H–O is 464 kJ/mol.

What is the bond energy of O=O?

- A 430 kJ/mol
  - B 458 kJ/mol
  - C 498 kJ/mol
  - D 984 kJ/mol
- 17 Which reaction of hydrochloric acid is a redox reaction?
- A  $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2$
  - B  $\text{Na}_2\text{O} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O}$
  - C  $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
  - D  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- 18 Which reaction is an example of a photochemical reaction?
- A glucose forming carbon dioxide and water
  - B magnesium reacting with oxygen
  - C potassium reacting with water
  - D silver chloride forming silver metal

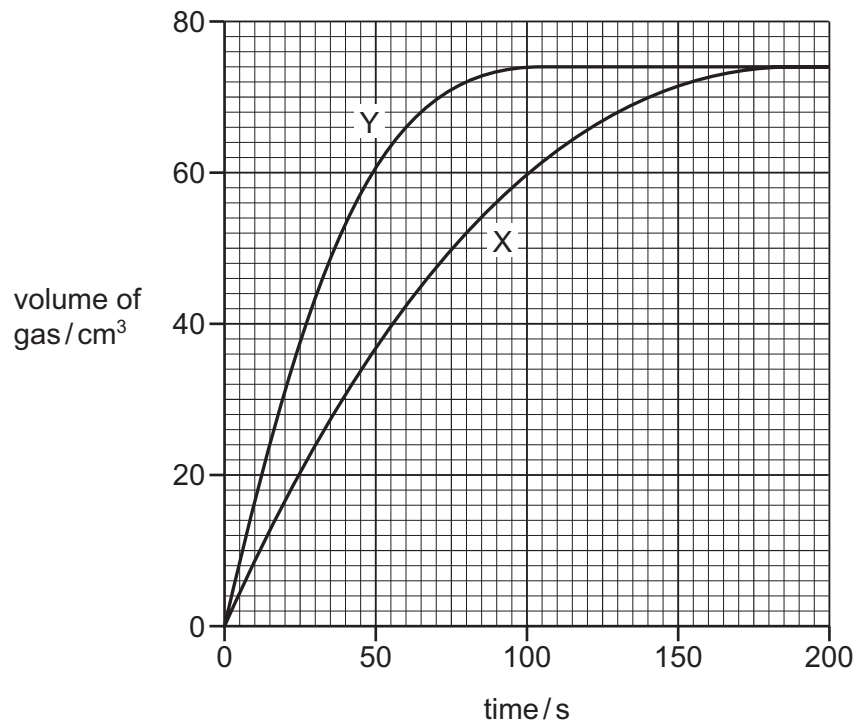
19 An excess of calcium carbonate is added to dilute hydrochloric acid, X.

The carbon dioxide gas given off is collected and its volume recorded at regular time intervals.

Line X on the graph shows the results obtained.

The experiment is repeated using dilute hydrochloric acid, Y.

Line Y on the graph shows the results obtained.



Which statement about the two hydrochloric acid samples, X and Y, is correct?

- A They had the same volume but Y had higher concentration.
- B They had the same concentration but Y had a larger volume.
- C X had a higher concentration but Y had a larger volume.
- D Y had a higher concentration but X had a larger volume.

20 Period 3 of the Periodic Table contains the elements sodium to argon.

Element Q is a non-metal from this period.

Which statement about Q is correct?

- A It conducts electricity.
- B It has a lower proton number than sodium.
- C It has electrons in only three shells.
- D It is malleable.

21 Which metal has variable oxidation states?

- A aluminium
- B calcium
- C copper
- D sodium

22 An aqueous cation reacts with aqueous sodium hydroxide to form a white precipitate.

The precipitate is insoluble in excess sodium hydroxide.

What is the aqueous cation?

- A aluminium ion
- B calcium ion
- C chromium ion
- D zinc ion

23 Zinc oxide is an amphoteric oxide.

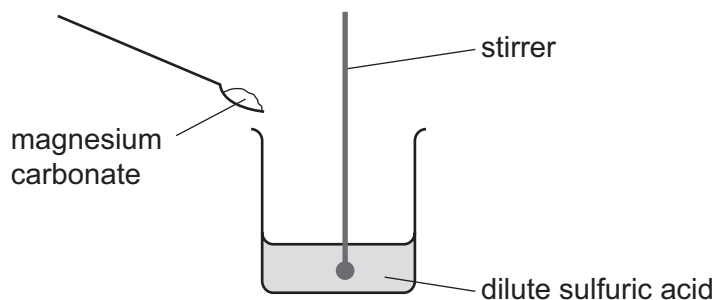
Which row describes the reactions of zinc oxide?

	reaction with alkalis	reaction with acids
A	✓	✓
B	✓	x
C	x	✓
D	x	x



24 A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

- A crystallisation
- B evaporation
- C filtration
- D neutralisation

25 Which statement about the halogens and their compounds is correct?

- A The colour of the element gets lighter going down Group VII.
- B The elements get less dense going down Group VII.
- C When chlorine is added to sodium iodide solution, iodine is formed.
- D When iodine is added to sodium bromide solution, bromine is formed.

26 Elements in Group II of the Periodic Table show the same trends in their reaction with water and their density as Group I.

Which row shows how the properties of barium compare with calcium?

	reaction with water	density
A	faster	higher
B	faster	lower
C	slower	higher
D	slower	lower

27 A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

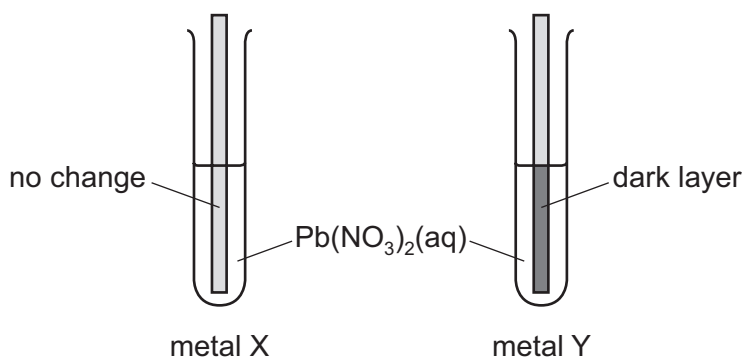
Which gas is suitable?

- A argon
- B hydrogen
- C methane
- D oxygen

28 An experiment is performed to determine the order of reactivity of metals X and Y compared to lead.

Strips of each metal were added to separate test-tubes containing aqueous lead(II) nitrate,  $\text{Pb}(\text{NO}_3)_2$ .

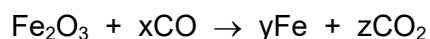
The results are shown.



What is the order of reactivity, least reactive first?

- A  $\text{Pb} \rightarrow \text{X} \rightarrow \text{Y}$
- B  $\text{X} \rightarrow \text{Y} \rightarrow \text{Pb}$
- C  $\text{X} \rightarrow \text{Pb} \rightarrow \text{Y}$
- D  $\text{Y} \rightarrow \text{Pb} \rightarrow \text{X}$

- 29 The equation for the reaction between iron(III) oxide and carbon monoxide is shown.



Which values of x, y and z balance the equation?

	x	y	z
<b>A</b>	2	2	2
<b>B</b>	2	3	3
<b>C</b>	3	1	3
<b>D</b>	3	2	3

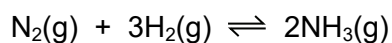
- 30 Which process is used to separate oxygen from liquid air?

- A** chromatography
- B** distillation
- C** filtration
- D** fractional distillation

- 31 What is the catalyst in the Haber process?

- A** Fe
- B** Ni
- C** Pt
- D**  $\text{V}_2\text{O}_5$

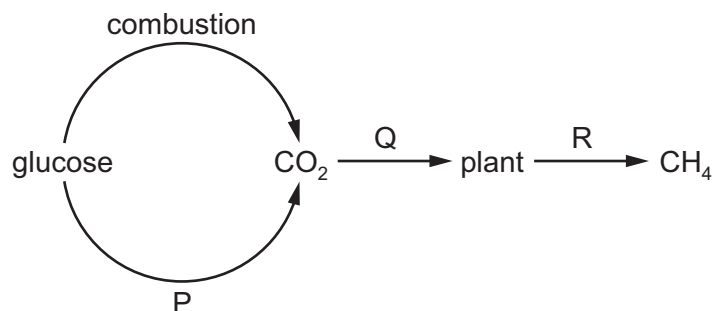
- 32 Ammonia is manufactured in an exothermic reaction.



What is the effect of lowering the pressure on the rate of formation of ammonia and percentage yield of ammonia at equilibrium?

	rate of formation	percentage yield
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

33 Part of the carbon cycle is shown.



What are processes P, Q and R?

	P	Q	R
<b>A</b>	decomposition	respiration	photosynthesis
<b>B</b>	respiration	photosynthesis	decomposition
<b>C</b>	respiration	decomposition	photosynthesis
<b>D</b>	photosynthesis	respiration	decomposition

34 Which row shows the conditions used for the manufacture of sulfuric acid in the Contact process?

	pressure / atm	temperature / °C	catalyst
<b>A</b>	250	200	vanadium(V) oxide
<b>B</b>	2	450	vanadium(V) oxide
<b>C</b>	250	200	iron
<b>D</b>	2	450	iron

35 Which calcium compound does **not** neutralise an acid soil?

- A** calcium oxide
- B** calcium sulfate
- C** calcium hydroxide
- D** calcium carbonate

36 Which product is obtained when bromine reacts with propene, CH<sub>3</sub>CH=CH<sub>2</sub>?

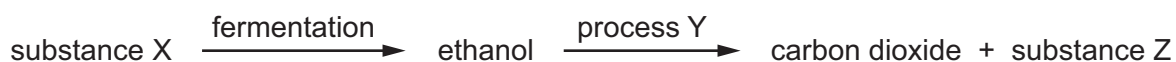
- A** CH<sub>3</sub>CH=CHBr
- B** CH<sub>3</sub>CBr=CHBr
- C** CH<sub>3</sub>CH<sub>2</sub>CHBr<sub>2</sub>
- D** CH<sub>3</sub>CHBrCH<sub>2</sub>Br

37 Propanol is oxidised by acidified potassium manganate(VII) in a similar way to ethanol.

Which compound is produced by the oxidation of propanol with acidified potassium manganate(VII)?

- A  $\text{CH}_3\text{CH}_2\text{OH}$
- B  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- C  $\text{CH}_3\text{COOH}$
- D  $\text{CH}_3\text{CH}_2\text{COOH}$

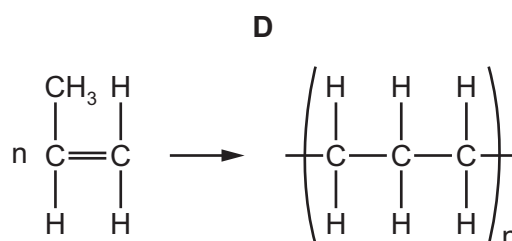
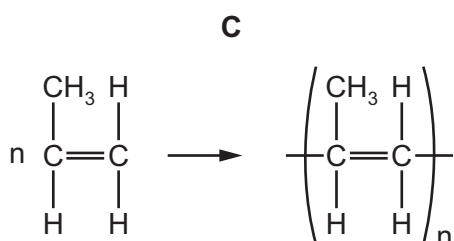
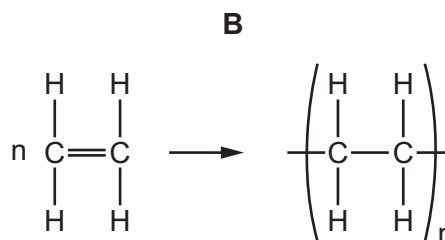
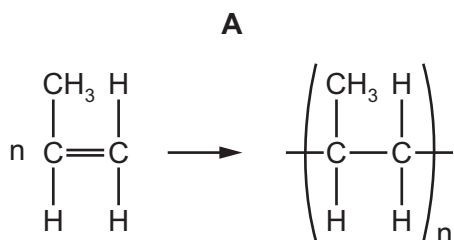
38 The flow chart shows the preparation of ethanol and some important chemistry of ethanol.



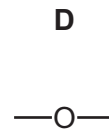
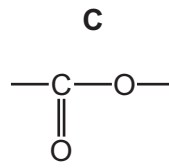
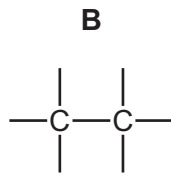
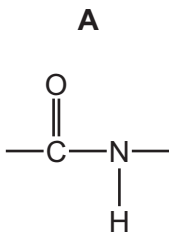
What are X, Y and Z?

	X	Y	Z
<b>A</b>	yeast	combustion	oxygen
<b>B</b>	glucose	combustion	steam
<b>C</b>	glucose	polymerisation	water
<b>D</b>	yeast	fermentation	glucose

39 Which equation represents the formation of poly(propene) from propene?



40 Which type of linkage joins the amino acids in a protein?



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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	1 <b>H</b> hydrogen 1	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20	2						
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	<p><b>Key</b></p> <p>atomic number</p> <p>atomic symbol</p> <p>name</p> <p>relative atomic mass</p>								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
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40									26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	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	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	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	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	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	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 —	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 —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	116 <b>Lv</b> livermorium —	116 <b>Lv</b> livermorium —	116 <b>Lv</b> livermorium —	116 <b>Lv</b> livermorium —			

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
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 —

lanthanoids

actinoids

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