GradeMax

Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **October/November 2025**

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.

© UCLES 2025

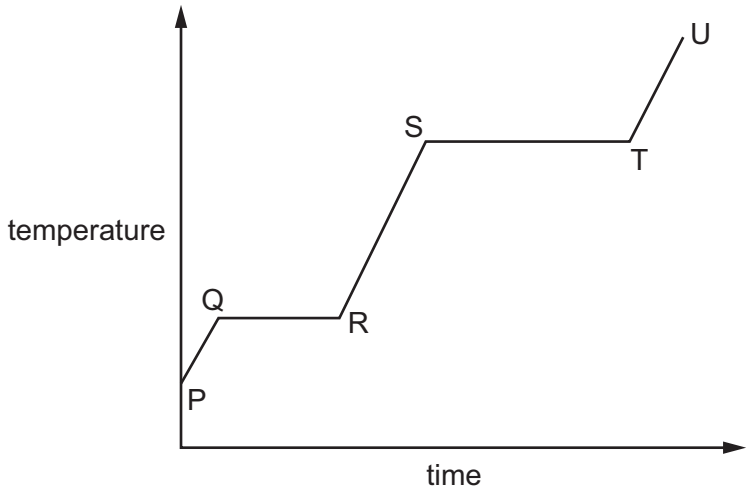
[Turn over

GradeMax

1 What happens to the volume of a fixed mass of gas when the temperature is increased or the pressure is decreased?

	increased temperature	decreased pressure
A	volume decreased	volume decreased
B	volume decreased	volume increased
C	volume increased	volume decreased
D	volume increased	volume increased

2 The diagram shows the heating curve for a substance.



Between which two points do the particles of the substance change from being in fixed positions to being mobile?

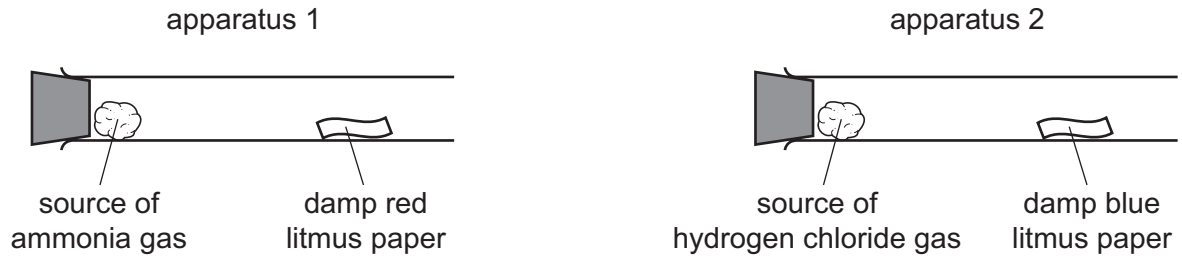
A P and Q **B** Q and R **C** S and T **D** T and U

© UCLES 2025

GradeMax

3 A student investigates the diffusion of ammonia gas, NH_3, and hydrogen chloride gas, HCl.

Two sets of apparatus are set up as shown at room temperature and pressure.



The damp red litmus paper in apparatus 1 changes colour after 30 seconds.

How long does it take for the damp blue litmus paper in apparatus 2 to change colour?

A 21 seconds

B 30 seconds

C 64 seconds

D The damp blue litmus paper does **not** change colour.

4 Which row describes elements, compounds and mixtures?

	elements	compounds	mixtures
A	all the atoms are the same type	contain different atoms chemically joined together	can be separated using physical processes
B	all the atoms are the same type	can be separated into new substances using chemical processes	contain different atoms chemically joined together
C	can be separated into new substances using chemical processes	all the atoms are the same type	contain different atoms chemically joined together
D	contain different atoms chemically joined together	all the atoms are the same type	can be separated using physical processes

5 Which statement about atoms or ions is correct?

A The mass number of an atom is the total number of nucleons and protons.

B The electronic configuration of an aluminium ion, Al^{3+}, is 2,8,3.

C Hydrogen is the only atom that has an incomplete first electron shell.

D Most of the volume of an atom is taken up by its nucleus.

© UCLES 2025

[Turn over

GradeMax

6 Which two values are used to calculate the relative atomic mass of a sample of boron?

	value 1	value 2
A	the total number of boron isotopes	the total number of boron atoms
B	the relative abundance of each boron isotope in the sample	the relative mass of each boron isotope
C	the relative abundance of each boron isotope in the sample	the total number of boron atoms
D	the total number of boron isotopes	the relative mass of each boron isotope

7 Which statement describes the structure of sodium chloride?

A a lattice of alternating positive and negative ions

B a lattice of positive ions surrounded by a ‘sea’ of delocalised electrons

C a mixture of sodium and chlorine atoms

D a regular lattice of sodium and chlorine atoms

8 Graphite and diamond are both forms of the element carbon.

Which row shows the number of other carbon atoms that each carbon atom is covalently bonded to in graphite and in diamond?

	graphite	diamond
A	3	3
B	3	4
C	4	3
D	4	4

9 Which row describes the structure and bonding in cobalt?

	structure	bonding
A	giant	ionic
B	simple	ionic
C	giant	metallic
D	simple	metallic

© UCLES 2025

GradeMax

10 The equation for the combustion of ethanol is shown.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$

The relative molecular mass, M_r, of ethanol is 46.

Which statement about the reaction is correct?

A 4.6 g of ethanol produces 4.4 g of carbon dioxide.

B 92 g of ethanol produces 88 g of carbon dioxide and 108 g of water.

C 138 g of ethanol reacts with 32 g of oxygen.

D 184 g of ethanol produces 216 g of water.

11 A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen only.

The relative molecular mass, M_r, of the compound is 60.

Which row shows the empirical formula and the molecular formula of the compound?

	empirical formula	molecular formula
A	CH_2O	CH_2O
B	CH_2O	$C_2H_4O_2$
C	$C_3H_7O_3$	$C_3H_7O_3$
D	C_3H_8O	C_3H_8O

12 Hydrogen–oxygen fuel cells are used in electric cars.

Three statements about these fuel cells are listed.

1 The process in the cell is called electrolysis.

2 Water is broken down in the cell to produce hydrogen, oxygen and electricity.

3 Water is the only chemical product formed in the reaction.

Which statements are correct?

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

© UCLES 2025

[Turn over

GradeMax

13 A solution of copper(II) sulfate can be electrolysed using copper electrodes or carbon electrodes.

Which statements are correct?

1 Using copper electrodes, oxygen gas forms at the anode.

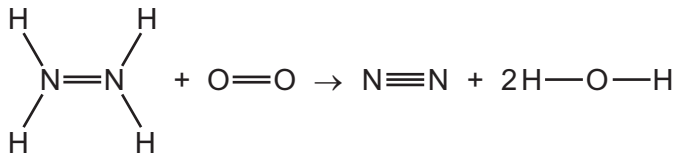
2 Using copper electrodes, copper atoms lose electrons at the anode.

3 Using carbon electrodes, copper metal forms at the cathode.

4 Using carbon electrodes, copper ions gain electrons at the cathode.

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

14 The equation for the combustion of hydrazine, N_2H_4, is shown.



bond	bond energy in kJ / mol
N–H	391
N=N	409
N≡N	944
O–H	463
O=O	496

What is the overall enthalpy change for the combustion of one mole of hydrazine?

A –327 kJ / mol

B –111 kJ / mol

C +111 kJ / mol

D +327 kJ / mol

© UCLES 2025

GradeMax

15 Dissolving ammonium chloride in water is an endothermic change.

Which row shows the energy change and temperature change of the mixture during the dissolving of ammonium chloride?

	energy change	temperature change
A	energy is absorbed	decrease
B	energy is absorbed	increase
C	energy is released	decrease
D	energy is released	increase

16 Aqueous sodium thiosulfate, $Na_2S_2O_3$, reacts with dilute hydrochloric acid to form a yellow precipitate of sulfur.

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + S(s) + SO_2(g)$$

The precipitate forms more quickly when the reactants are heated.

Which statements explain this observation?

1 The reacting particles collide more frequently.

2 The collisions between reacting particles have more energy.

3 The activation energy of the reaction is lower.

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

17 Which statement about the conditions used in the Haber process and in the Contact process is correct?

A The typical pressure used in the Haber process is similar to that used in the Contact process.

B The typical temperature used in the Haber process is similar to that used in the Contact process.

C The Haber process uses a vanadium(V) oxide catalyst, and the Contact process uses an iron catalyst.

D Both processes produce an acidic gas.

© UCLES 2025

[Turn over

GradeMax

18 The equation shows the equilibrium between dinitrogen tetroxide, N_2O_4, and nitrogen dioxide, NO_2.

The colours of the reactant and product are shown.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

colourless brown

The forward reaction is endothermic.

Which statement is **not** correct?

A At equilibrium, the concentrations of the reactant and the product stay constant.

B At equilibrium, the rate of the forward reaction is equal to the rate of the reverse reaction.

C When the pressure is increased, a darker brown colour is seen.

D When the temperature is increased, a darker brown colour is seen.

19 What is the oxidation number of chromium in the $Cr_2O_7^{2-}$ ion?

A –2 **B** –1 **C** +6 **D** +12

20 Which method is used to prepare a pure, dry sample of lead(II) chloride?

A mix aqueous lead(II) nitrate and dilute hydrochloric acid → filter → crystallise and dry the filtrate

B mix aqueous lead(II) nitrate and dilute hydrochloric acid → filter → wash and dry the residue

C mix solid lead(II) hydroxide and aqueous sodium chloride → filter → crystallise and dry the filtrate

D mix solid lead(II) hydroxide and aqueous sodium chloride → filter → wash and dry the residue

21 Phosphorus is an element in Group V of the Periodic Table.

It burns in air to form an oxide that dissolves in water to form a solution with a pH of 1.

Which row describes this oxide of phosphorus?

	metal oxide	non-metal oxide	acidic oxide	basic oxide
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = yes

✗ = no

© UCLES 2025

22 The equation shows the reaction between aqueous hydrogen bromide and aqueous ammonia.

$$HBr(aq) + NH_3(aq) \rightarrow NH_4^+(aq) + Br^-(aq)$$

Which statement describes the role of aqueous hydrogen bromide?

A It is a catalyst.

B It is a reducing agent.

C It is a proton acceptor.

D It is a proton donor.

23 Which statement about the elements in Group I is correct?

A Hydrogen is produced when Group I elements react with water.

B Ions of Group I elements have a 1– charge.

C Sodium is more reactive than potassium.

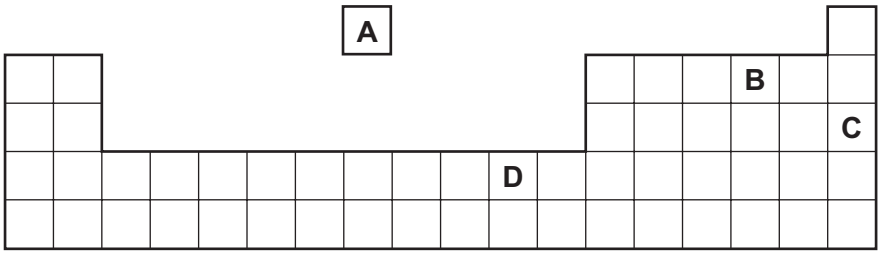
D Solid sodium is a poor electrical conductor.

24 Which row describes the colour and state of iodine at room temperature and pressure?

	colour	state
A	green	liquid
B	grey-black	solid
C	purple	solid
D	red-brown	liquid

25 Part of the Periodic Table is shown.

Which element is an inert gas?



GradeMax

26 Four different metals are separately added to water.

The oxide of each metal is separately heated with carbon.

The results are shown.

metal	metal with water	metal oxide with carbon
Q	no reaction	brown solid forms
R	rapid fizzing	no reaction
S	a few bubbles	no reaction
T	a few bubbles	grey solid forms

What is the order of reactivity of the four metals, least reactive first?

A Q → T → S → R

B Q → S → T → R

C R → S → T → Q

D R → T → S → Q

27 An iron nail is fully covered with zinc to prevent it from rusting.

Which row describes this method of protection and explains why zinc is used to protect the iron nail?

	method of protection	reason zinc is used
A	barrier method and sacrificial protection	zinc is more reactive than iron
B	barrier method and sacrificial protection	iron is more reactive than zinc
C	sacrificial protection only	zinc is more reactive than iron
D	barrier method only	iron is more reactive than zinc

28 Iron is extracted from hematite in the blast furnace.

Which reaction increases the temperature in the blast furnace to over 1500 °C?

A calcium carbonate → calcium oxide + carbon dioxide

B calcium oxide + silicon(IV) oxide → calcium silicate

C carbon + oxygen → carbon dioxide

D carbon dioxide + carbon → carbon monoxide

© UCLES 2025

GradeMax

29 Aluminium is extracted by the electrolysis of purified bauxite.

Which row shows the half-equations at the electrodes and explains why one of the electrodes has to be replaced regularly?

	half-equation at anode	half-equation at cathode	electrode replacement
A	$2O^{2-} \rightarrow O_2 + 4e^-$	$Al^{3+} + 3e^- \rightarrow Al$	cathode replaced as it gets coated with aluminium
B	$2O^{2-} \rightarrow O_2 + 4e^-$	$Al^{3+} + 3e^- \rightarrow Al$	anode replaced as it burns away in oxygen
C	$Al^{3+} + 3e^- \rightarrow Al$	$2O^{2-} \rightarrow O_2 + 4e^-$	cathode replaced as it burns away in oxygen
D	$Al^{3+} + 3e^- \rightarrow Al$	$2O^{2-} \rightarrow O_2 + 4e^-$	anode replaced as it gets coated with aluminium

30 Which flow chart describes the correct treatment sequence of the domestic water supply?

A filtration → chlorination → sedimentation

B sedimentation → chlorination → filtration

C chlorination → filtration → sedimentation

D sedimentation → filtration → chlorination

31 Which statement about oxides of nitrogen is correct?

A They are made in car engines by the incomplete combustion of gasoline at a high temperature.

B They are made in car engines when nitrogen in gasoline reacts with oxygen in air at a high temperature.

C They are removed from car exhausts by catalytic converters and form nitrogen and sulfur dioxide.

D They are removed from car exhausts when they react with carbon monoxide in catalytic converters.

32 The alkenes are a homologous series.

Which statement about the members of the homologous series of the alkenes is correct?

A They have the same functional group.

B They have the same relative molecular mass.

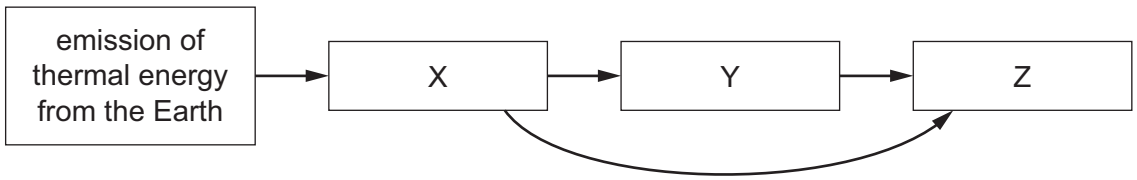
C They have different chemical properties.

D They have different general formulae.

© UCLES 2025

[Turn over

33 The diagram represents two processes, X and Y, and their effect, Z, in increasing global warming.



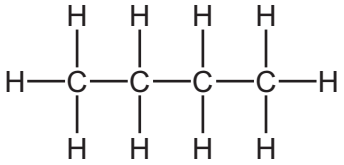
Which row identifies X, Y and Z?

	X	Y	Z
A	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	reduced thermal energy loss to space
B	emission of thermal energy by greenhouse gases	emission of thermal energy to space	reduced thermal energy loss to space
C	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	increased thermal energy loss to space
D	emission of thermal energy by greenhouse gases	emission of thermal energy to space	increased thermal energy loss to space

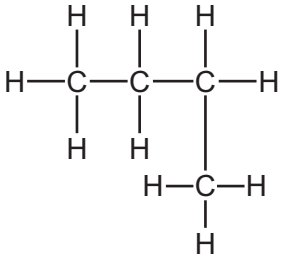
© UCLES 2025

GradeMax

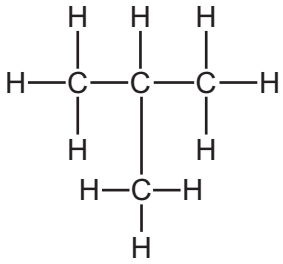
34 Which structures are structural isomers of each other?



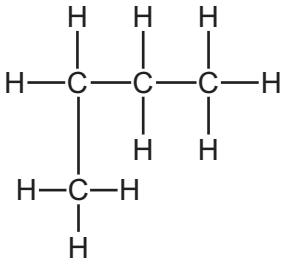
1



2



3



4

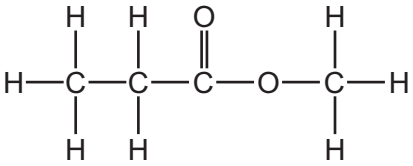
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

35 The structure of an ester is shown.



What is the name of this ester?

A ethyl methanoate

B methyl ethanoate

C propyl methanoate

D methyl propanoate

© UCLES 2025

[Turn over

36 Which row shows the products obtained by the cracking of a large alkane?

	alkene	hydrogen	water
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = yes

✗ = no

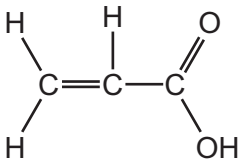
37 Ethanol is produced by the fermentation of aqueous glucose or by the catalytic addition of steam to ethene.

Which row shows some advantages and disadvantages of these processes?

	fermentation of aqueous glucose		catalytic addition of steam to ethene	
	advantage	disadvantage	advantage	disadvantage
A	fast reaction	ethanol produced continuously	almost pure ethanol formed	renewable raw material
B	ethanol produced in batches	slow reaction	fast reaction	ethanol produced continuously
C	renewable raw material	ethanol produced in batches	almost pure ethanol formed	slow reaction
D	renewable raw material	dilute aqueous ethanol formed	fast reaction	non-renewable raw material

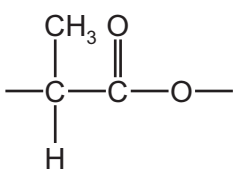
38 Propenoic acid is an organic compound that is both an alkene and a carboxylic acid.

The structure of propenoic acid is shown.

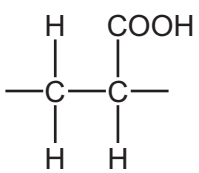


Which structure represents one repeat unit of the addition polymer formed from propenoic acid?

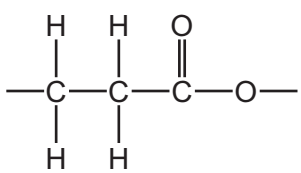
A



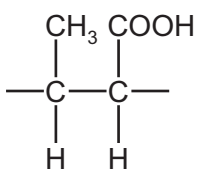
B



C



D



GradeMax

39 Which item of apparatus is used to measure 13.7 cm^3 of dilute hydrochloric acid?

A a balance

B a burette

C a conical flask

D a volumetric pipette

40 Chromatography is used to separate and analyse mixtures of soluble substances.

The first steps of the process are listed.

- apply sample to baseline
- develop chromatogram in solvent

What is the next step in the process to detect soluble **colourless** substances?

A calculate the R_f values

B compare the results with known substances

C count the number of spots

D use a suitable locating agent

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2025

© UCLES 2025

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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).

GradeMax