Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/11**

Paper 1 Multiple Choice **May/June 2022**

1 hour

You must answer on the multiple choice answer sheet.

5983816930

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.

IB22 06_5070_11/3RP
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[Turn over

1 A scientist needs to add approximately 100 cm^3 of water to each of 50 large beakers. The scientist needs to fill the beakers as quickly as possible.

Which method should be used?

A A 50 cm^3 burette should be used twice for each beaker.

B A 100 cm^3 gas syringe should be used once for each beaker.

C A 25 cm^3 graduated pipette should be used four times for each beaker.

D A 100 cm^3 measuring cylinder should be used once for each beaker.

2 Four mixtures, each containing two substances, are shown in the table.

The two substances need to be separated and collected.

Which row is correct?

	mixture	separation method
A	copper(II) sulfate and water	chromatography
B	methanol and ethanol	evaporation
C	oxygen and nitrogen	fractional distillation
D	sand and barium sulfate	filtration

3 Two samples of a colourless solution are tested separately with aqueous sodium hydroxide, NaOH(aq), and aqueous ammonia, NH_3(aq), and the results are recorded.

- A white precipitate is formed with two drops of NaOH(aq). This precipitate dissolves in an excess of NaOH(aq).
- A white precipitate is formed with two drops of NH_3(aq). This precipitate dissolves in an excess of NH_3(aq).

What can be deduced from these results?

A The anion present is Cl^-.

B The anion present is not Cl^-.

C The cation present is Al^{3+}.

D The cation present is Zn^{2+}.

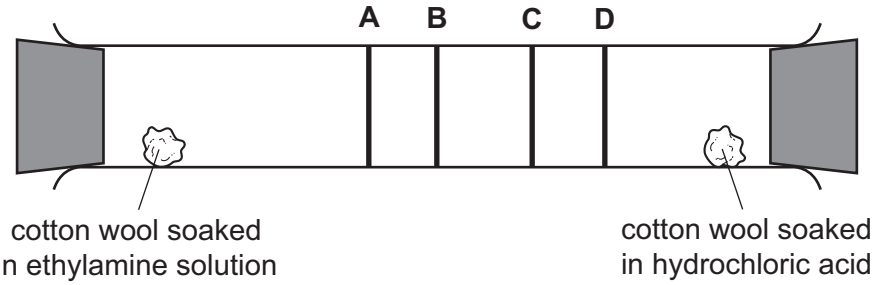
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4 Which row correctly describes changes in the particles when a substance freezes?

	arrangement of the particles	energy change in the particles
A	particles become more ordered	particles gain energy
B	particles become more ordered	particles lose energy
C	particles become less ordered	particles gain energy
D	particles become less ordered	particles lose energy

5 Ethylamine gas, $C_2H_5NH_2$, and hydrogen chloride gas, HCl, react together to form a white solid, ethylamine hydrochloride.

At which position in the tube would a ring of solid white ethylamine hydrochloride form?



6 Two particles have the symbols $^{54}_{26}Fe^{2+}$ and $^{59}_{27}Co^{3+}$.

Which statement about these particles is correct?

A They contain the same number of electrons.

B They contain the same number of neutrons.

C They contain the same number of protons.

D They do not contain the same number of protons, neutrons or electrons.

7 Two isotopes of chlorine are ^{35}Cl and ^{37}Cl.

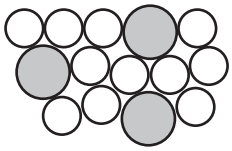
Using these isotopes and ^{12}C and ^{1}H, how many different relative molecular masses are possible for the compound with molecular formula $C_2H_3Cl_3$?

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

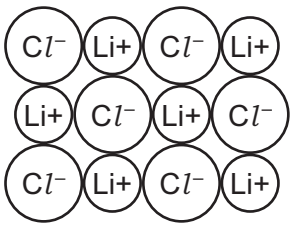
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8 Which statement about the substances, at room temperature and pressure, is correct?

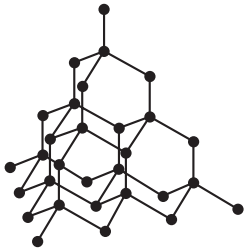
W



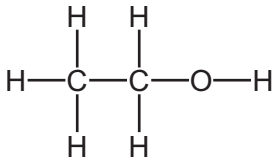
X



Y



Z



A W and X conduct electricity.

B W and Y are elements.

C X and Z dissolve in water.

D Y and Z have low melting points.

9 A piece of magnesium reacts with dilute hydrochloric acid.

The resulting solution is then evaporated leaving a solid residue of magnesium chloride.

Which statement is correct?

A A covalent solid is formed in this process.

B Each chlorine atom gains one electron in this process.

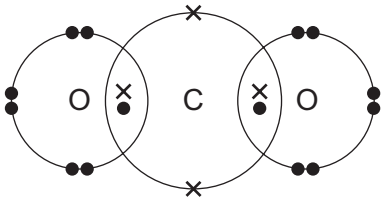
C Each magnesium atom loses only one electron in this process.

D Molecules of an element are formed during the reaction.

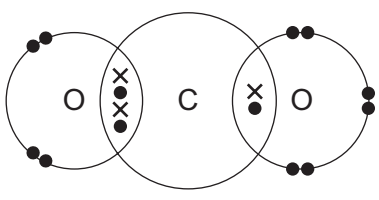
10 Which dot-and-cross diagram represents carbon dioxide?

Only outer shell electrons are shown.

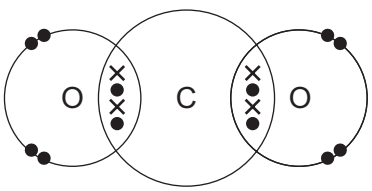
A



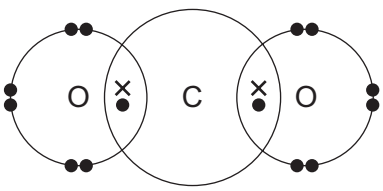
B



C



D



11 Two statements about the structure and properties of metals are given.

statement 1 Metals are malleable and have high melting points.

statement 2 Metals have mobile electrons in their structure.

What is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

12 How many different elements are present in ammonium nitrate?

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

13 Aqueous calcium hydroxide is an alkali. It is neutralised by dilute nitric acid to produce calcium nitrate and water.

What is the **ionic** equation for this reaction?

A $Ca^{+} + OH^{-} + H^{+} + NO_3^{-} \rightarrow CaNO_3 + H_2O$

B $Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O$

C $Ca^{2+}(OH^{-})_2 + 2H^{+}NO_3^{-} \rightarrow Ca^{2+}(NO_3^{-})_2 + H_2O$

D $OH^{-} + H^{+} \rightarrow H_2O$

14 The relative molecular mass, M_r, of liquid Z is 60. Z contains 40.0% carbon, 6.70% hydrogen and 53.3% oxygen.

Which row shows the correct empirical and molecular formulae of Z?

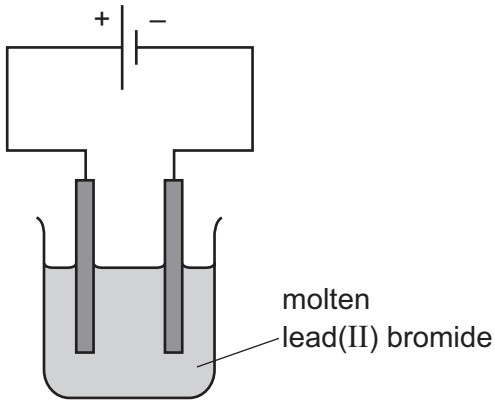
	empirical formula	molecular formula
A	CH_2O	CH_2O
B	CH_2O	$C_2H_4O_2$
C	$C_2H_4O_2$	$C_2H_4O_2$
D	CH_3O	$C_2H_6O_2$

15 How many tonnes of aluminium oxide, Al_2O_3, are required to produce 27 tonnes of aluminium?

A 27 **B** 51 **C** 54 **D** 102

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16 Lead(II) bromide is electrolysed using inert electrodes.



Which statement is correct?

A A brown gas is seen at the positive electrode.

B Electrons pass through the solution from one electrode to the other.

C Ions pass through the circuit from one electrode to the other.

D The lead(II) ions are oxidised.

17 Compound X is sodium iodide, NaI.

Compound Y is methyl methanoate, HCO_2CH_3.

At room temperature and pressure, ...1..... solid. In aqueous solution, ...2..... electricity.

Which words correctly complete gaps 1 and 2?

	1	2
A	both X and Y are	both X and Y conduct
B	both X and Y are	only X conducts
C	only X is	both X and Y conduct
D	only X is	only X conducts

18 For the forward reaction of a reversible reaction, the enthalpy change of reaction, ΔH, is –50 kJ / mol and the activation energy, E_a, is +60 kJ / mol.

What is the activation energy of the reverse reaction?

A –110 kJ / mol

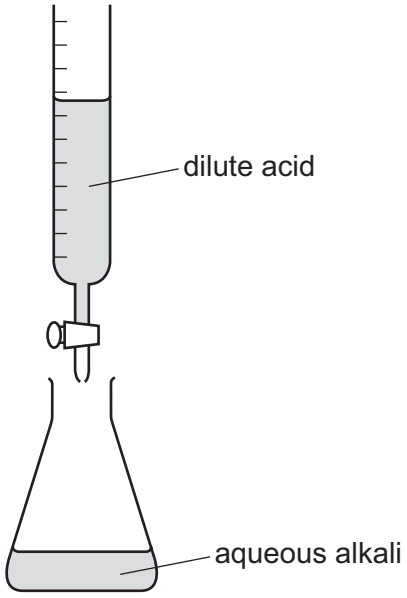
B –10 kJ / mol

C +10 kJ / mol

D +110 kJ / mol

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19 The diagram shows a titration experiment.



Which row about the reaction in the conical flask is correct?

	the reaction is	the value of ΔH is
A	endothermic	negative
B	endothermic	positive
C	exothermic	negative
D	exothermic	positive

20 Sulfur dioxide reacts with oxygen in the air.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H = -196\,kJ/mol$$

The reaction is very slow if no catalyst is present.

Which statement explains this?

A Air contains only 21% oxygen so there is not enough oxygen for all the sulfur dioxide to react.

B Only a small proportion of the sulfur dioxide and oxygen molecules have enough energy to react, even at high temperatures.

C The reaction is exothermic and so at high temperatures the equilibrium shifts to the left.

D The reaction is reversible and so products turn back to reactants; this happens more quickly at high temperatures.

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21 Which statement is correct?

A An enzyme is a biological catalyst that decreases the activation energy of a reaction.

B An enzyme is a biological catalyst that increases the activation energy of a reaction.

C An enzyme is a compound of a transition element that decreases the activation energy of a reaction.

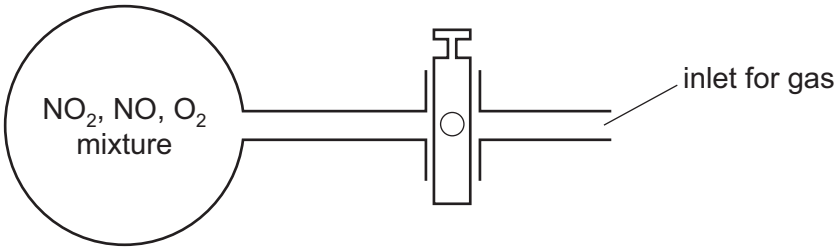
D An enzyme is a compound of a transition element that increases the activation energy of a reaction.

22 Nitrogen dioxide, NO_2, is a dark brown gas that decomposes as shown in the equation.

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

dark brown colourless

The diagram shows a glass flask containing a mixture of the three gases. The mixture is pale brown.



More oxygen is forced into the flask.

Which colour change is seen in the mixture?

A It becomes a darker brown.

B It becomes a paler brown.

C It turns colourless.

D There is no change.

23 Concentrated hydrochloric acid is oxidised by manganese(IV) oxide, MnO_2.

What are two products of this reaction?

A Mn^{2+} and Cl^-

B Mn^{2+} and Cl_2

C Mn^{6+} and Cl^-

D Mn^{6+} and Cl_2

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24 The table gives some information about four redox reactions.

Which row gives correct information about what is oxidised and the evidence that this is oxidation?

	equation	what is oxidised in the reaction	evidence for this oxidation
A	$CuO(s) + C(s) \rightleftharpoons CO(g) + Cu(s)$	copper	copper oxide has given oxygen to carbon
B	$Na(s) + \frac{1}{2}Cl_2(g) \rightleftharpoons NaCl(s)$	sodium	sodium has lost an electron
C	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	nitrogen	nitrogen has gained hydrogen
D	$Zn(NO_3)_2(aq) + Mg(s) \rightleftharpoons Mg(NO_3)_2(aq) + Zn(s)$	zinc	zinc has gained two electrons

25 Which statement about acids and bases is correct?

A All strong acids react with carbonates but all weak acids do not.

B The oxides of Group I metals are amphoteric.

C The pH of $1.0\,mol/dm^3$ ethanoic acid, CH_3COOH, is higher than the pH of $1.0\,mol/dm^3$ sulfuric acid, H_2SO_4.

D The pH of $1.0\,mol/dm^3$ nitric acid, HNO_3, is lower than the pH of $1.0\,mol/dm^3$ hydrochloric acid, HCl.

26 Some types of chemical reaction are listed.

1 acid-base

2 combustion

3 redox

Which types of reaction occur in a blast furnace during the extraction of iron?

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

27 Which method should be used to make a pure sample of potassium chloride?

A adding $AgCl(s)$ to $KNO_3(aq)$

B adding excess $K_2CO_3(s)$ to $HCl(aq)$

C mixing $KNO_3(aq)$ with $NaCl(aq)$

D titrating $KOH(aq)$ with $HCl(aq)$

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28 A pure sample of lead sulfate is made by reacting aqueous solutions of two salts. The lead sulfate formed is then separated from the mixture.

Which solutions and method of separation are used?

	salt solution 1	salt solution 2	method of separation
A	lead chloride	sodium sulfate	crystallisation
B	lead chloride	sodium sulfate	filtration
C	lead nitrate	potassium sulfate	crystallisation
D	lead nitrate	potassium sulfate	filtration

29 Which statement is correct?

A Food can be preserved by using sulfur dioxide.

B In the Contact process oxygen reacts with sulfur to make sulfur trioxide.

C Sulfur dioxide is used to kill bacteria present in wood pulp.

D Sulfuric acid is used as a bleach.

30 Element Y is in Period 3 of the Periodic Table. It forms a chloride that is a liquid at room temperature.

Which row shows correct information about the group number and the nature of the oxide of element Y?

	group number	nature of oxide
A	I	basic
B	II	acidic
C	IV	amphoteric
D	VI	acidic

31 Which gases are used in light bulbs?

1 argon

2 oxygen

3 neon

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

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32 The carbonates of metals W, X and Y are heated and the results are shown.

	colour of metal carbonate	gas given off which turns limewater cloudy	colour after heating
W	white	yes	yellow when hot, white when cold
X	green	yes	black
Y	white	no	no change

These experimental results can be used to write statements about W, X and Y.

1 The carbonates of W and X gave off carbon dioxide on heating.

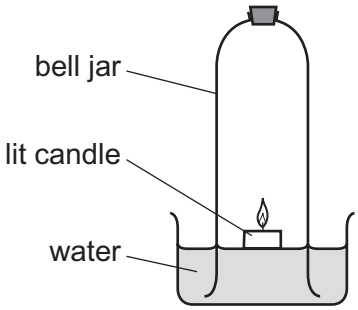
2 Metals X and Y are less reactive than metal W.

3 X could be copper.

Which statements are correct?

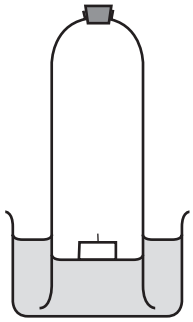
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

33 The diagram shows an experiment to determine the percentage of oxygen in air.

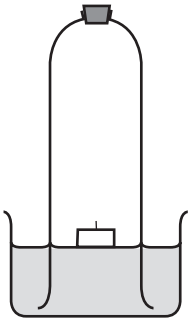


Which diagram shows the correct level of water after the candle stops burning?

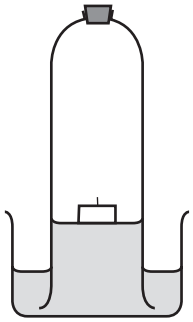
A



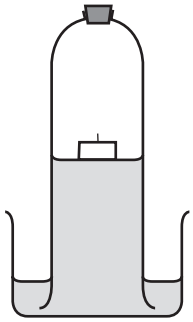
B



C



D



34 Two statements are given.

statement 1 The percentage of carbon by mass is greater in methane than in butane.

statement 2 Butane is one of two isomers with the molecular formula C_4H_{10}.

Which statements are correct?

A both statement 1 and statement 2

B statement 1 only

C statement 2 only

D neither statement 1 nor statement 2

35 One mole of each of the compounds shown is completely combusted.

$C_5H_{12}O$ C_6H_{12} C_6H_{14} $C_6H_{14}O$

How many of the compounds need exactly nine moles of oxygen for complete combustion?

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

36 The reactants and products of two reactions are shown.

reaction 1 $C_3H_6 + H_2O \rightarrow X$

reaction 2 $X + O_2 \rightarrow CO_2 + H_2O$

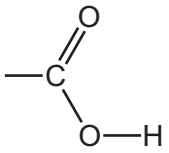
Which row correctly describes these two reactions?

	identity of compound X	conditions for reaction 1	reaction 2
A	butanol	high pressure and a catalyst	combustion
B	butanol	heat and a catalyst	decomposition
C	propanol	heat and a catalyst	decomposition
D	propanol	heat and a catalyst	combustion

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37 Which statement about carboxylic acids is correct?

A All carboxylic acids include the group:

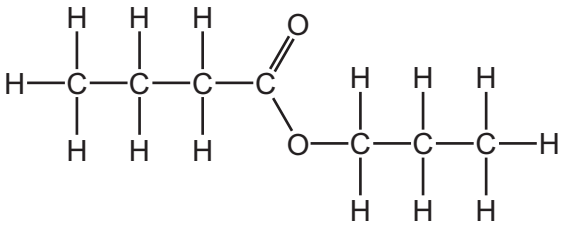


B Ethanoic acid reacts with both copper(II) oxide and copper.

C Methanoic acid, formed by bacterial oxidation, is present in vinegar.

D Propanoic acid decolourises acidified potassium manganate(VII).

38 The structure of an ester is shown.



What is the name of this ester?

A butyl butanoate

B butyl propanoate

C propyl butanoate

D propyl propanoate

39 Poly(ethene) is formed by .....1..... polymerisation of ethene.

The formation of nylon and *Terylene* are examples of .....2..... polymerisation.

Proteins contain the same .....3..... linkage as nylon.

Fats contain the same .....4..... linkage as *Terylene*.

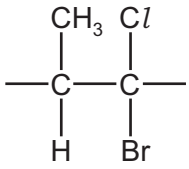
On hydrolysis, proteins form .....5..... .

Which words correctly complete gaps 1–5?

	1	2	3	4	5
A	addition	condensation	amide	ester	amino acids
B	addition	condensation	amide	ester	simple sugars
C	addition	condensation	ester	amide	amino acids
D	condensation	addition	ester	amide	simple sugars

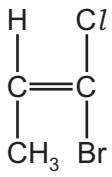
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40 The repeat unit of a polymer is shown.

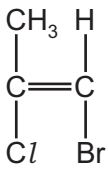


Which monomer would produce this polymer?

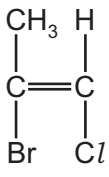
A



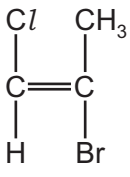
B



C



D



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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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).