Cambridge Assessment International Education

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)

1397826625

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.

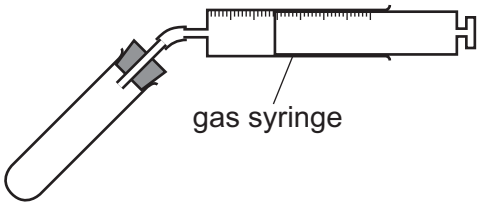
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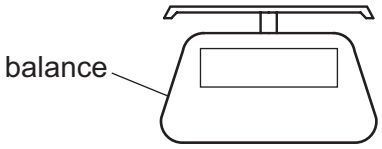
1 The formula of magnesium oxide can be investigated by using the fact that when magnesium is heated it reacts with oxygen to form magnesium oxide.

Which apparatus is used for this investigation?

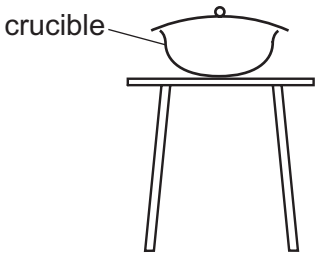
1



2



3



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.

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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+}

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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.

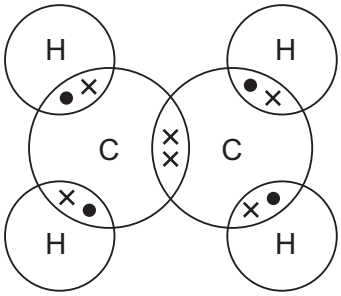
2 Y is in Group V of the Periodic Table.

3 Z is a cation.

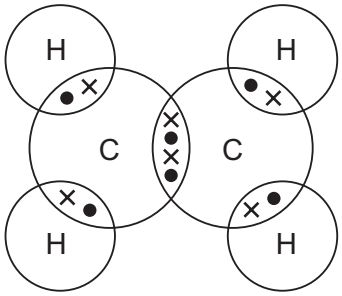
A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

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

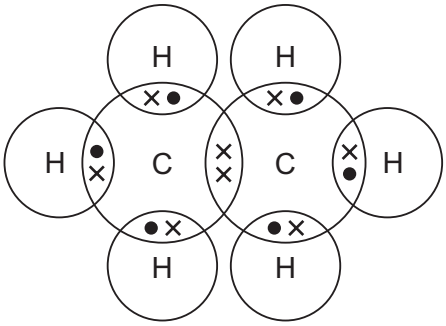
A



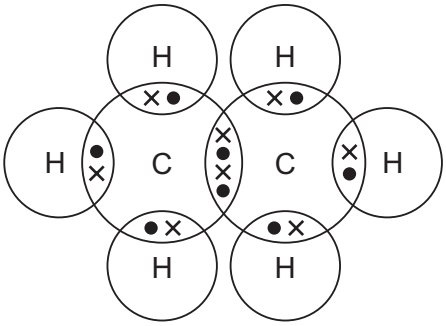
B



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.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

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.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

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

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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.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

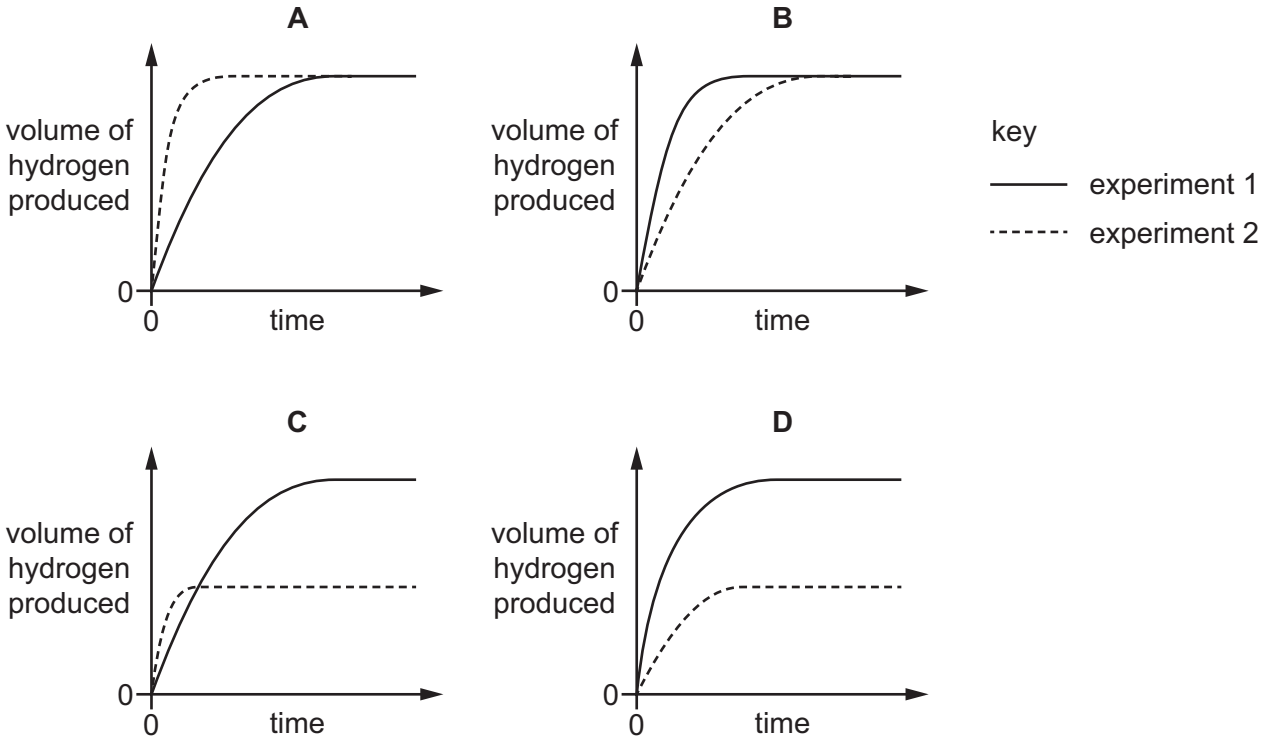
Two experiments are carried out at 25 °C.

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

experiment 2 24.0 g of powdered magnesium is reacted with 50 cm^3 of 2.0 mol/dm^3 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.

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

$$\underset{\text{brown}}{2NO_2(g)} \rightleftharpoons \underset{\text{colourless}}{N_2O_4(g)}$$

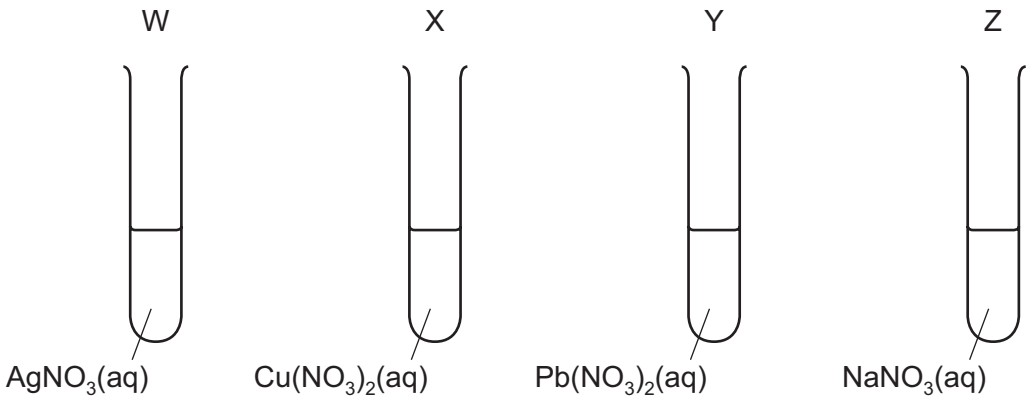
Which changes would make the equilibrium mixture darker in colour?

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

22 Which row shows the pH values for $0.1\,\text{mol}/\text{dm}^3$ 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	✗	✓	✗	✓
B	✓	✗	✓	✗
C	✓	✗	✓	✓
D	✓	✗	✗	✗

key

✗ = clear solution

✓ = precipitate formed

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

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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 is .....1..... and the reaction of caesium with water is .....2..... vigorous. The number of valence electrons in caesium is .....3..... 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 $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

B $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

C $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

D $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

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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

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37 Which statements about alcohols are correct?

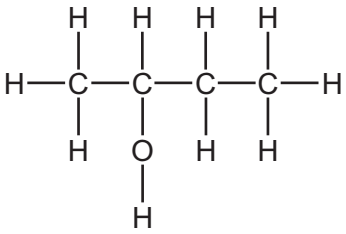
1 All alcohols contain the hydroxide ion, OH^-.

2 Ethanol can be formed from ethene using a reaction catalysed by yeast.

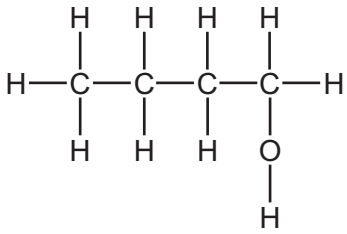
3 Methanol can be oxidised to methanoic acid.

4 The alcohols X and Y shown are isomers.

X



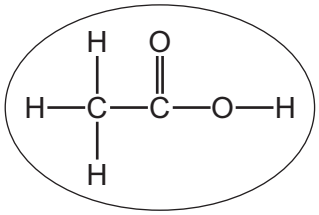
Y



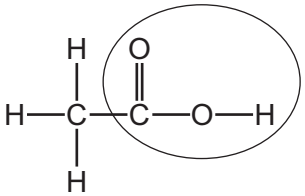
A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

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

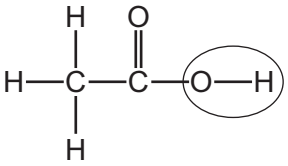
A



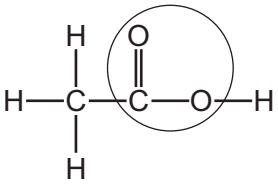
B



C



D



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.

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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
							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.).