Anglo-Chinese School
(Independent)

Year 4 Express
Preliminary Examination 2021

CHEMISTRY

6092/1

PAPER 1 Multiple Choice

Tuesday 17th August 2021 1 hour

Additional materials:
Calculator
Multiple Choice answer sheet
Soft clean eraser
Soft pencil (type 2B recommended)

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write and shade the candidate number on the answer sheet in the spaces provided.

There are **forty** questions in 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 separate answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
You may use a calculator.
A copy of the Periodic Table is printed on page 16.

This question paper consists of 16 printed pages.

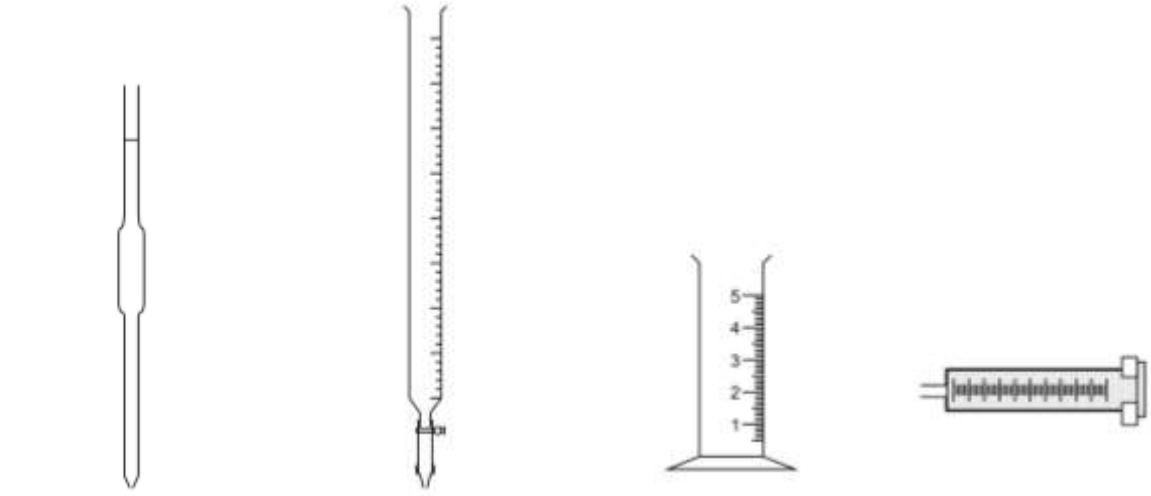
1 The boiling points of various gases found in a gas sample are shown below.

gas	boiling point / ^oC
argon	- 186
oxygen	- 183
nitrogen	- 198

Which gas(es) will remain gas(es) in the gas sample at – 185^{o}C?

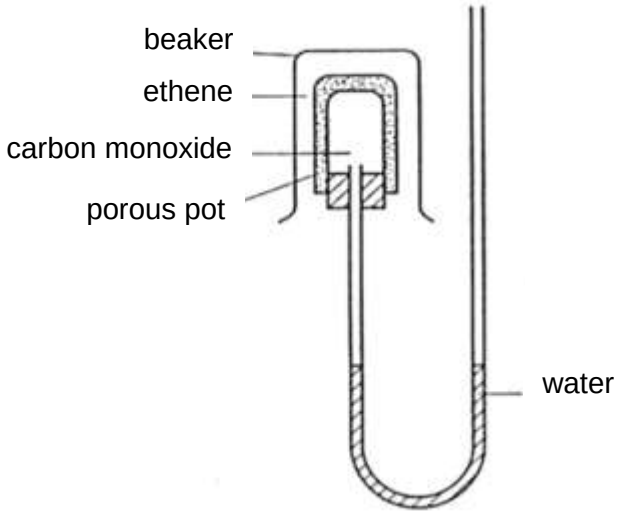
A nitrogen only
B oxygen only
C argon and nitrogen only
D oxygen and nitrogen only

2 Which of the following apparatus will be most suitable to measure accurately 14.8 cm^3 of dilute nitric acid?



A **B** **C** **D**

3 When a beaker full of ethene is inverted over a porous pot containing carbon monoxide as shown in the diagram below, the water level does not move.



This is because both gases _____.

A are carbon compounds
B are miscible
C do not dissolve in water
D have the same relative molecular mass

4 A mobile phone with a stainless steel casing contains the neurotoxin mercury and the carcinogen gallium arsenide.

Which row correctly classifies the materials found in the phone casing?

	element	**mixture**	**compound**
A	mercury	gallium arsenide	stainless steel
B	mercury	stainless steel	gallium arsenide
C	stainless steel	gallium arsenide	mercury
D	stainless steel	mercury	gallium arsenide

5 The nucleon number of an ion X^{3+} is 27 and it has 10 electrons. What does the nucleus of the ion X^{3+} contains?

	number of protons	number of neutrons
A	7	20
B	10	17
C	13	14
D	14	13

6 Particle **X** has 3 protons, 4 neutrons and 3 electrons. Particle **Y** has 3 protons, 4 neutrons and 2 electrons. Which statement best describes particle **Y**?

A Particle **X** and particle **Y** are atoms of the same element.
B Particle **Y** has a larger relative atomic mass than particle **X**.
C Particle **Y** is an ion of particle **X**.
D Particle **Y** is an isotope of particle **X**.

7 Which substance contains the same number of atoms as 1 g of hydrogen gas?
(All volumes are measured at room temperature and pressure.)

A 0.5 mol of neon gas
B 24 dm^3 of chlorine gas
C 48 g of ozone gas
D 3×10^{23} oxygen molecules

8 Silver ions react with chloride ions as shown in the equation below.

$$Ag^+ (aq) + Cl^- (aq) \rightarrow AgCl (s)$$

It is found that 5 cm^3 of 0.1 mol/dm^3 solution of the chloride of metal **X** requires 10 cm^3 of 0.1 mol/dm^3 silver nitrate for complete reaction. What is the formula of the chloride?

A XCl_4
B XCl_2
C XCl
D X_2Cl

9 The compound SO_2Cl_2 reacts with water and is represented by the equation below.

$$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$$

How many moles of sodium hydroxide will be needed to neutralize the solution produced by one mole of SO_2Cl_2 and excess water?

A 1
B 2
C 3
D 4

10 Which of the sets of substances contains an element, a mixture and a compound?

A iron, steel, rust
B diamond, coal, seawater
C sodium, sodium hydroxide, sodium chloride
D hydrogen, air, petroleum

11 How many non-bonding pair(s) of electrons are there in one molecule of methane, CH_4?

A 0
B 1
C 2
D 3

12 Which of the following is characteristic of all bases?

A All bases contain oxide or hydroxide ions.
B All bases react with neutral oxides.
C All bases dissolve in water to produce solutions of pH about 7.
D All bases react with ammonium salts to produce ammonia gas.

13 A black powder is burnt in air.

The gas produced dissolves in water to form solution **R**. The difference between the pH of solution **R** and pure water is very small. The gas is readily absorbed in aqueous sodium hydroxide. What type of substance is present in solution **R**?

A strong acid

B strong base

C weak acid

D weak base

14 Which of the following reactions shows calcium hydroxide undergoing a precipitation reaction?

A $Ca(OH)_2 + Na_2SO_4 \rightarrow CaSO_4 + 2NaOH$

B $Ca(OH)_2 + 2NO_2 + O_2 \rightarrow Ca(NO_3)_2 + H_2O$

C $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + H_2O$

D $Ca(OH)_2 + 2NH_4NO_3 \rightarrow Ca(NO_3)_2 + 2H_2O + 2NH_3$

15 A reddish brown precipitate was produced when an excess of aqueous sodium hydroxide was added dropwise to solution **B**.

In another experiment, a white precipitate was produced when dilute nitric acid and aqueous barium nitrate were added to solution **B**.

What is the identity of solution **B**?

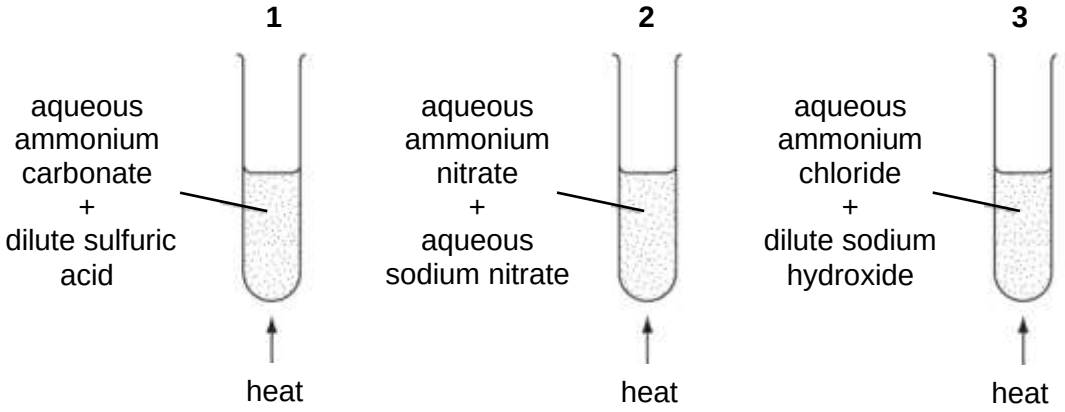
A iron(II) chloride

B iron(II) sulfate

C iron(III) chloride

D iron(III) sulfate

16 The diagrams below show three different experiments involving ammonium compounds.



In which experiment(s) is/are ammonia formed?

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

17 Hydrogen reacts with chlorine in an exothermic reaction.

$$H_2\,(g) + Cl_2\,(g) \rightarrow 2HCl\,(g) \qquad \Delta H = -184\ kJ$$

Why does ΔH for this reaction have a negative sign?

A The total energy released in bond breaking is greater than the total energy absorbed in bond forming.
B The total energy absorbed in bond breaking is greater than the total energy released in bond forming.
C The total energy absorbed in bond breaking is less than the total energy released in bond forming.
D The total energy released in bond breaking is less than the total energy released in bond forming.

18 Methane undergoes combustion in the equation given below.

$$CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (g)$$

bond	bond energy kJ/mol
O - O	142
O = O	494
C - H	435
C - O	358
C = O	799
O - H	464

What is the enthalpy change of the reaction?

A + 507 kJ/mol
B + 1001 kJ/mol
C - 548 kJ/mol
D - 726 kJ/mol

19 How are respiration, combustion and rusting similar?

A They are all enzyme-driven processes.
B They all require oxygen to be present.
C They are highly endothermic processes.
D They all require water to be present.

20 Which of the following shows the effect on the activation energy of a reaction between two gases when there is an increase in the pressure and when a catalyst is added to the reaction mixture?

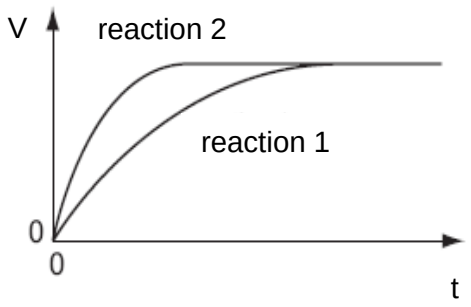
	change in activation energy of the reaction	
	addition of a catalyst	**increase in the pressure**
A	decrease	decrease
B	decrease	no change
C	increase	decrease
D	increase	no change

21 Dilute hydrochloric acid was reacted with magnesium at room temperature in the following two experiments.

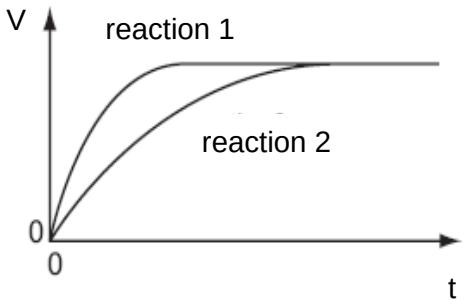
Experiment **1**	10 g of magnesium ribbon was added to excess hydrochloric acid of concentration of 2.0 mol/dm^3
Experiment **2**	5 g of magnesium ribbon was added to excess hydrochloric acid of concentration of 3.0 mol/dm^3

The volume of hydrogen gas produced, **V**, was plotted against time, **t**. Which of the following graphs is correct?

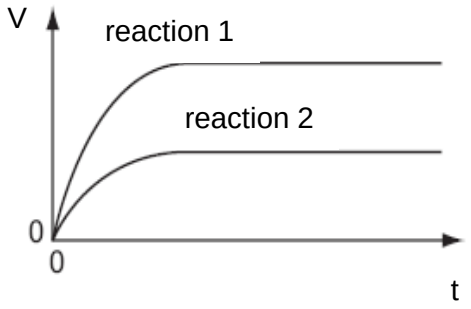
A



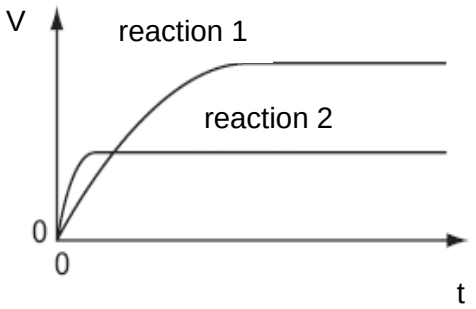
B



C



D



22 The graph below shows the total volume of carbon dioxide evolved over time when calcium carbonate reacts with excess nitric acid.

Which of the following is/are true?

1	The reaction is faster at point **Y** than at point **X**.
2	The reaction first reaches completion at point **Z**.
3	The total volume of carbon dioxide gas evolved increases if a greater mass of calcium carbonate is used.

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

23 Disproportionation is a reaction in which the same element is both oxidized and reduced simultaneously. Which of the following reactions is not a disproportionation reaction?

A $2CuCl \rightarrow Cu + CuCl_2$
B $Cl_2 + H_2O \rightarrow HCl + HClO$
C $CaCO_3 \rightarrow CaO + CO_2$
D $2H_2O_2 \rightarrow 2H_2O + O_2$

24 Which of the following shows the correct observation when a few drops of oxidizing agent were added to a test tube containing the organic compounds below?

	organic compound	oxidizing agent added	observation
A	pentane	aqueous bromine	reddish brown solution turns colourless rapidly
B	pentene	aqueous bromine	reddish brown solution turns colourless rapidly
C	pentanoic acid	acidified potassium manganate(VII)	purple solution turns colourless
D	pentanol	acidified potassium manganate(VII)	purple solution remains unchanged

25 Which of the following group I metals is the best reducing agent?

A lithium
B sodium
C potassium
D rubidium

26 By referring to the halogens and their compounds, which of the following statements is incorrect?

A Bromine can displace iodine from a solution of potassium iodide.
B Silver bromide is insoluble in dilute nitric acid.
C Hydrogen bromide is an ionic compound similar to hydrogen chloride.
D Liquid bromine is reddish brown in colour.

27 Which pollutant from factories burning coal, can cause metal structures to corrode it is not removed properly?

A chlorine
B carbon dioxide
C carbon monoxide
D sulfur dioxide

28 The concentration of carbon dioxide in the atmosphere has slowly increased over the past 200 years. Which of the following could be a contributing factor?

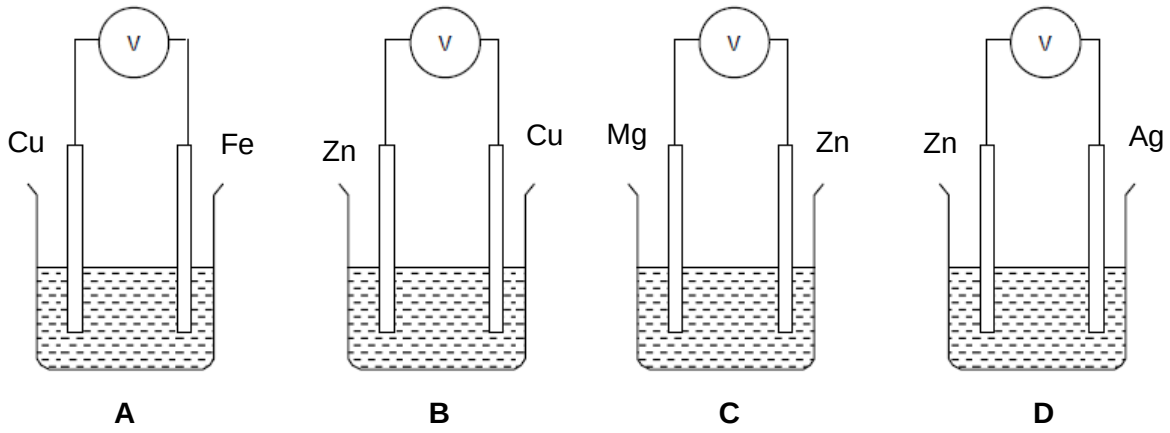
1 motor vehicles emissions
2 power stations using coal and oil
3 increased lightning activities

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

29 A spoon is to be electroplated with silver. Which of the following shows suitable materials needed for the plating bath?

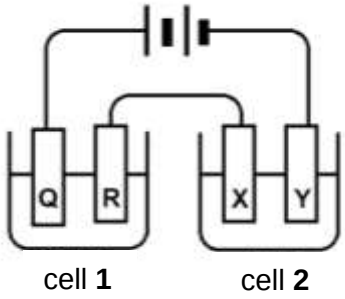
	cathode	**anode**	**electrolyte**
A	pure silver	spoon	silver nitrate
B	pure silver	spoon	silver chloride
C	spoon	pure silver	silver nitrate
D	spoon	pure silver	silver chloride

30 In which of the following cells will the electrons flow in an anti-clockwise direction?



A **B** **C** **D**

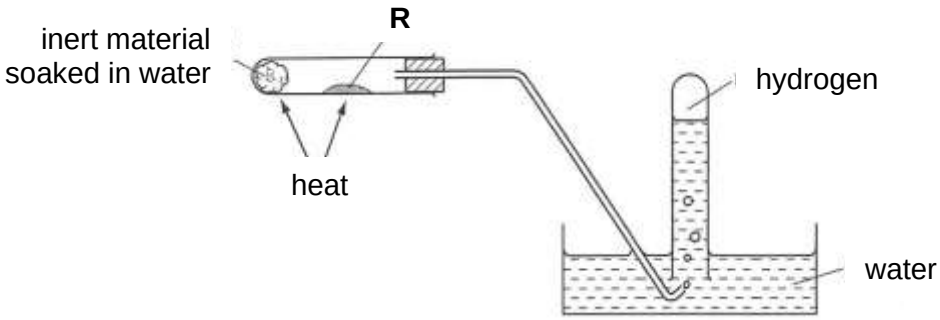
31 In the diagram below, each cell contains an aqueous solution of a single binary salt solution and all four electrodes are graphite. Electrodes **R** and **Y** increase in mass during the electrolysis but no gases are produced at electrodes **R** and **Y**.



The increase in mass of electrode **R** is greater than the increase in the mass of electrode **Y**. Which of the following statements is necessarily true?

A The anions of the solutions in cells **1** and **2** are different.
B The cations of the solutions in cells **1** and **2** are different.
C The current flowing in cell **1** is greater than the current flowing in cell **2**.
D The solution in cell **1** is more concentrated than the solution in cell **2**.

32 The diagram shows an experiment to produce and collect hydrogen gas.



What is **R**?

A copper
B copper(II) oxide
C iron
D iron(II) oxide

33 In the manufacture of iron by the blast furnace, which of the following is ultimately responsible for the reduction process to produce iron metal?

A carbon
B carbon monoxide
C carbon dioxide
D coke

34 Which statement about group II alkaline earth metals is correct?

A They dissolve in water to form metal oxides.
B They form covalent bonds with the halogens.
C They are more reactive than group I metals.
D Their carbonates are less stable to heat than group I metal carbonates.

35 During the Haber Process, ammonia that is produced is separated from the reaction mixture by _____.

A cooling the mixture
B dissolving ammonia gas
C filtering the other two gases by passing through cotton wool
D passing the gaseous mixture through fused calcium chloride

36 Crude oil can be separated into its fractions via fractional distillation. Which of the following shows the fractions in order of increasing boiling point?

	lowest boiling point ⟶			highest boiling point
A	bitumen	paraffin	diesel oil	petrol
B	diesel oil	petrol	paraffin	bitumen
C	petrol	diesel oil	paraffin	bitumen
D	petrol	paraffin	diesel oil	bitumen

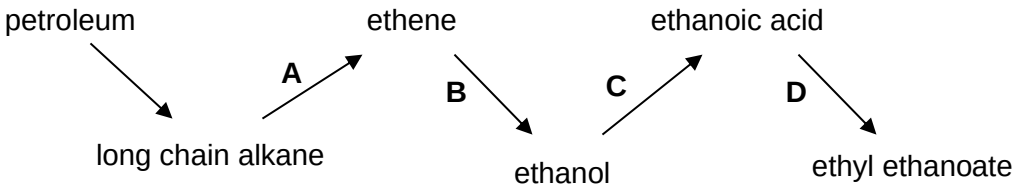
37 Propanol is used as a solvent in deodorants and perfumes. Which pair of properties makes it suitable for these uses?

A It is flammable and a good solvent.
B It is flammable and mixes easily with water.
C It is flammable and volatile.
D It is a good solvent and vaporizes easily.

38 Which of the following mixtures cannot be produced when octane, C_8H_{18}, undergoes cracking?

A propane and pentene (C_5H_{10})
B butane and butene
C pentane (C_5H_{12}) and propene
D butane, propene and hydrogen

39 The following diagram represents a possible method for the manufacture of ethyl ethanoate from petroleum. Which stage does **not** involve the use of a catalyst?



40 In the polymerization of propene to form polypropene, there is no change in _____.

A boiling point
B density
C empirical formula
D molecular formula

END OF PAPER 1

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (atomic) number / atomic symbol / name / relative atomic mass									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 –		

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.).