Anglo-Chinese School (Independent)

Year 4 Express
Preliminary Examination 2022

CHEMISTRY **6092/1**

PAPER 1 Multiple Choice

Wednesday 24th August 2022 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.

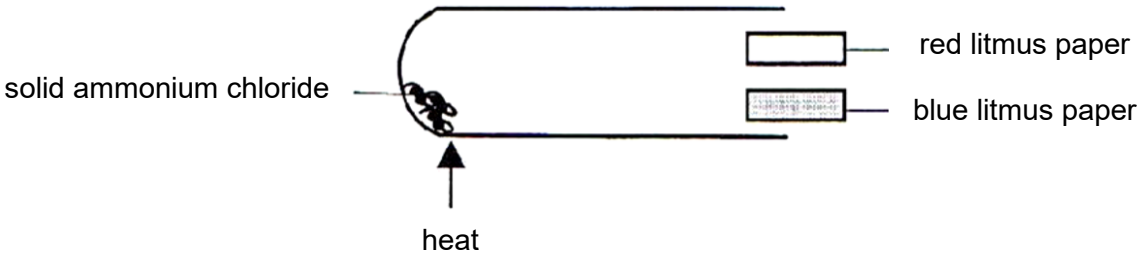
There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

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 17.

This question paper consists of 17 printed pages.

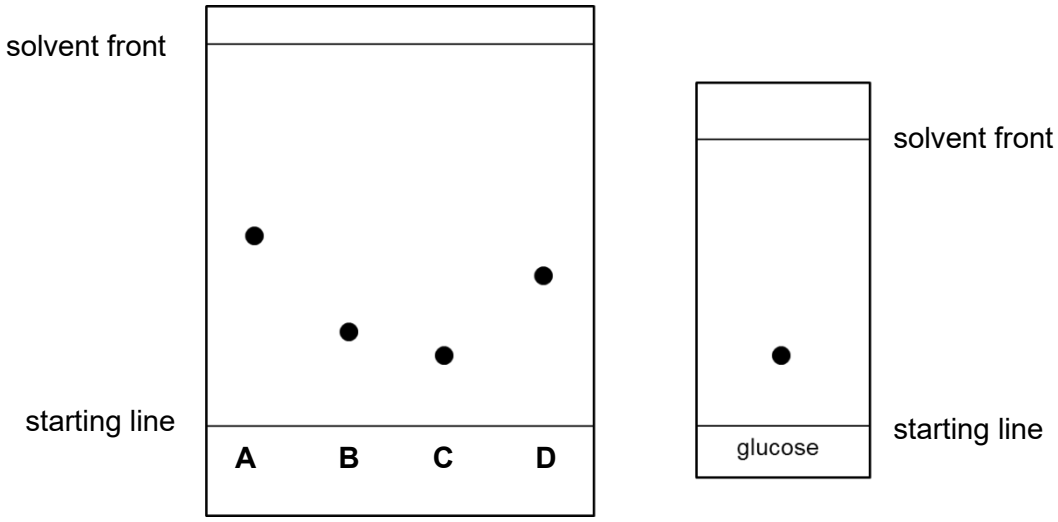
1 A student conducted an experiment by heating some ammonium chloride, NH_4Cl, in a test tube. He tested the gases coming out of the tube with moist litmus papers.



Which statement describes the observation made by the student regarding the experiment?

A Both litmus papers changed colour at the same time.
B The blue litmus paper turned red first.
C The red litmus paper turned blue first.
D There is no change in the colour of both litmus papers.

2 The diagram below shows two separate chromatograms. Both chromatograms were conducted using the same solvent. The chromatogram on the left shows four unknown sugars, **A**, **B**, **C** and **D**. The chromatogram on the right shows glucose and was stopped earlier than the one on the left which caused the solvent front to be lower.



Which sugar, **A**, **B**, **C** and **D**, is glucose?

3 At which temperatures does seawater freezes and boils at sea level?

	freezes at	boils at
A	2°C	102°C
B	2°C	98°C
C	- 2°C	102°C
D	- 2°C	98°C

4 Which of the following contains an element, a mixture and a compound?

A water, seawater, table salt
B air, petrol, carbon dioxide
C silver, tungsten, magnesium oxide
D titanium, steel, rust

5 Titanium has five stable isotopes and shows three oxidation states, +2, +3 and +4. Below is an ion formed from the most abundant isotope.

$$^{48}_{22}Ti^{4+}$$

Which of the following shows the number of protons, neutrons and electrons of an ion formed by a **different** isotope of titanium?

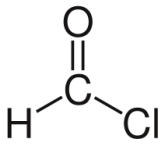
	protons	**neutrons**	**electrons**
A	22	26	19
B	18	22	22
C	22	28	20
D	22	24	17

6 Which of the following substances contain delocalized electrons?

1 graphite
2 molten sodium oxide
3 aqueous copper(II) sulfate
4 water
5 aluminium

A 1 only
B 1 and 5 only
C 2 and 3 only
D 3 and 4 only

7 The structural formula of formyl chloride, CHC*l*O, is as shown:



How many electrons are **not** involved in bonding in a molecule of CHC*l*O?

A 10
B 12
C 16
D 24

8 Substance **X** has a melting point of 1710°C and does not conduct electricity in any states. It is also insoluble in any solvent. What could be the identity of substance **X** be?

A aluminium oxide
B silicon dioxide
C mercury
D carbon dioxide

9 In a pathology laboratory, a sample of urine containing 0.120 g of urea, NH_2CONH_2, was treated with 25.0 cm^3 of 0.750 mol/dm^3 of nitrous acid. The urea reacted according to the equation below:

$$NH_2CONH_2 + 2HNO_2 \rightarrow CO_2 + 2N_2 + 3H_2O$$

The gas produced was passed through aqueous sodium hydroxide and the final volume measured. What was the final volume of gas left behind, measured at room temperature and pressure?

A 9.60 cm^3
B 14.4 cm^3
C 48.0 cm^3
D 96.0 cm^3

10 Which of the following has the same number of oxygen atoms/ions as 21.93 g of aluminium oxide?

A 4.95 g of lithium oxide
B 15.6 g of iron(III) oxide
C 7.74 dm^3 of nitrogen dioxide gas
D 12.2 dm^3 of carbon monoxide gas

11 A chloride of an unknown transition metal **Z** has the formula **Z**Cl_3.

32.5 g of **Z**Cl_3 was added to water to form an aqueous solution of **Z**Cl_3. It was found that 300 cm^3 of 2.0 mol/dm^3 aqueous silver nitrate was required to precipitate all the chloride ions. What is the relative atomic mass of metal **Z**?

A 11
B 27
C 56
D 114

12 Which of the following reactions does not show hydrochloric acid behaving as an acid?

A $2HCl + Mg \rightarrow MgCl_2 + H_2$

B $2HCl + CaCO_3 \rightarrow CaCl_2 + CO_2 + H_2O$

C $HCl + AgNO_3 \rightarrow AgCl + HNO_3$

D $2HCl + Na_2O \rightarrow 2NaCl + H_2O$

13 How many moles of hydrogen ions are present in 50 cm^3 of 1 mol/dm^3 sulfuric acid?

A 0.01 mol

B 0.05 mol

C 0.10 mol

D 1.00 mol

14 Three substances were added, separately, to sodium chloride and sodium sulfate solutions. The three substances were

1 aqueous barium nitrate

2 aqueous ammonia

3 dilute nitric acid

Which substance(s), when added separately, can be used to distinguish between sodium chloride and sodium sulfate?

A 1 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

15 Aqueous sodium hydroxide was added to a sample of aqueous iron(II) chloride and left to stand. The reaction was observed over a period of time.

1 A green precipitate was formed.
2 A reddish-brown precipitate was formed.
3 The precipitate increased in mass over time.

Which of the observation(s) above would be true over a period of time?

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

16 In an experiment, 8.0 cm^3 of 1 mol/dm^3 of sodium hydroxide solution is added to 6.0 cm^3 of 1 mol/dm^3 of copper(II) sulfate solution. What will be observed by the student after the reaction?

A a colourless solution only
B a blue precipitate and a blue solution
C a blue precipitate and a colourless solution
D a white precipitate and a colourless solution

17 A pale green solution **G** forms a green precipitate with excess aqueous sodium hydroxide. An alkaline gas is given off when the mixture is warmed with powdered aluminium. What is the identity of **G**?

A iron(II) nitrate
B ammonium nitrate
C copper(II) chloride
D ammonium chloride

18 What is the oxidation state of vanadium in vanadyl sulfate, $VOSO_4$?

A + 2
B - 2
C + 4
D - 4

19 Disproportionation is a reaction in which the same element is both oxidized and reduced. Which reaction is an example of disproportionation?

A $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
B $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$
C $Fe_2(SO_4)_3 + 2KI \rightarrow 2FeSO_4 + K_2SO_4 + I_2$
D $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

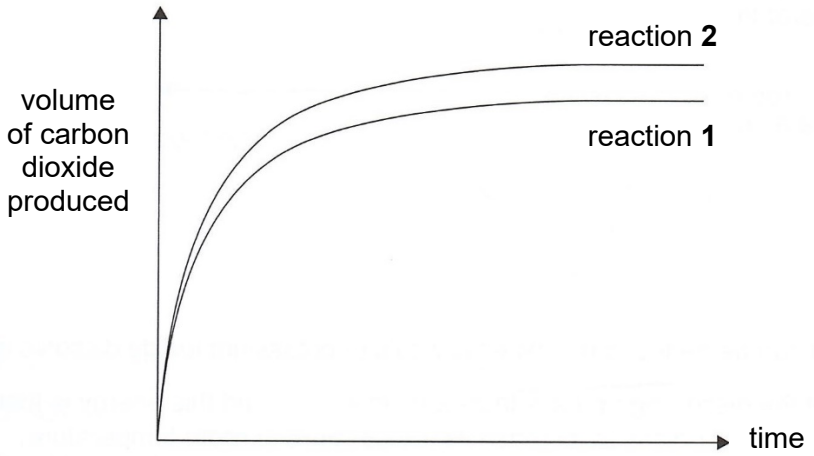
20 Which of the following correctly states the product(s) formed and the type of energy generated by a hydrogen fuel cell?

	product(s) formed	**type of energy generated**
A	water	chemical
B	water, carbon dioxide	electrical
C	hydrogen, carbon	chemical
D	water	electrical

21 Which of the following changes gives out heat energy and involves the largest change in volume?

A boiling
B condensation
C freezing
D sublimation

22 In two separate experiments (reaction **1** and **2**), excess dilute hydrochloric acid was reacted with calcium carbonate. The following graphs were obtained.



In both reactions, the same concentration and volume of hydrochloric acid were used. Why are the graphs different?

A A catalyst was used in reaction **2**.

B A finer version of the calcium carbonate powder was used in reaction **2**.

C The temperature of the acid was higher in reaction **2**.

D A greater mass of calcium carbonate was used in reaction **2**.

23 Which of the following reactions would have a greater reaction rate by increasing the pressure?

A $2HCl\ (aq) + Na_2O\ (s) \rightarrow 2NaCl\ (aq) + H_2O\ (l)$

B $CaCO_3\ (s) \rightarrow CaO\ (s) + CO_2\ (g)$

C $N_2\ (g) + 3H_2\ (g) \rightarrow 2NH_3\ (g)$

D $Ba(NO_3)_2\ (aq) + Na_2SO_4\ (aq) \rightarrow BaSO_4\ (s) + 2NaNO_3\ (aq)$

24 Many properties of an element and its compounds can be predicted from the position of the element in the Periodic Table. Which of the following properties **cannot** be predicted by this method?

A solubility

B formula of its chloride

C acidic or basic nature of its oxide

D metallic or non-metallic properties

25 Thallium is in Group III but resembles Group I elements in several properties. Which property of thallium does **not** resemble that of Group I elements?

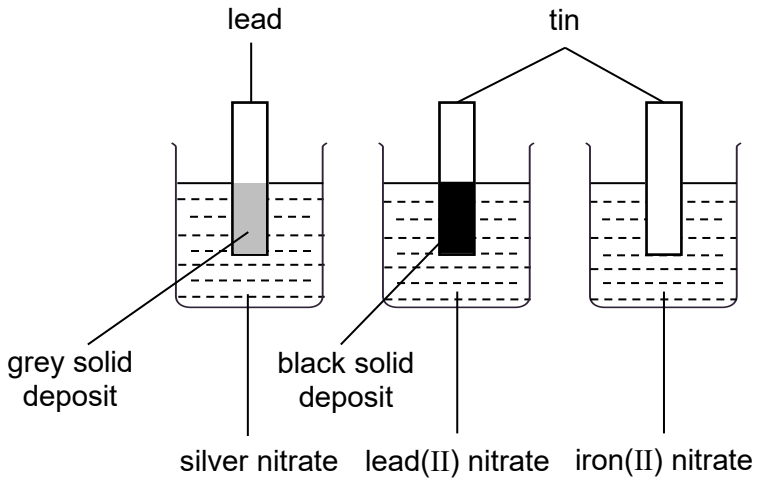
A Thallium oxide is mildly basic.

B Thallium forms the oxide Tl_2O.

C Thallium has a low melting point.

D Thallium is relatively insoluble in water.

26 The reactivity of four metals were investigated via three experiments as shown below:



Which of the following shows the correct order of reactivity of the four metals?

	most reactive	→		**least reactive**
A	tin	lead	iron	silver
B	tin	iron	lead	silver
C	iron	tin	lead	silver
D	silver	lead	tin	iron

27 Which of the following metal oxides can be reduced by carbon but not by hydrogen gas to its elemental form?

A zinc oxide

B calcium oxide

C copper(II) oxide

D lead(II) oxide

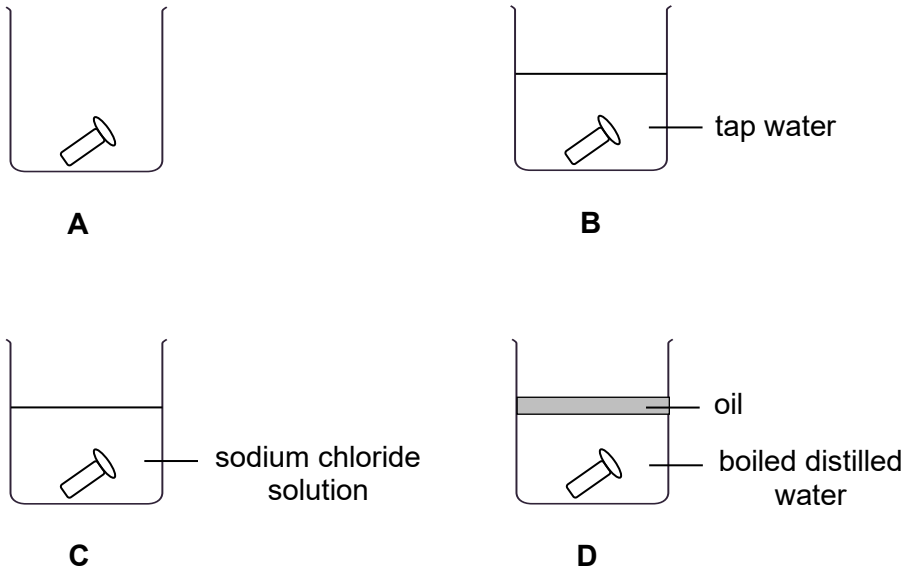
28 The following table shows some observations in the reactions involving metal **R**.

reaction	observation
metal **R** with cold water	no reaction
metal **R** with steam	effervescence observed
metal **R** with hydrochloric acid	effervescence observed

Which of the following could be metal **R**?

A calcium
B copper
C iron
D lead

29 In which of the following experimental set-ups will the iron **not** rust after one week?

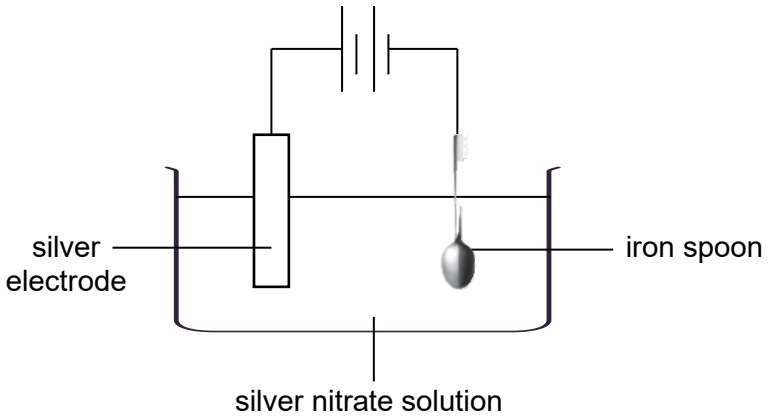


A **B** **C** **D**

30 Electrolysis is carried out on a concentrated solution of sodium chloride using carbon electrodes. Which of the following correctly describes the observations made at the cathode and anode?

	cathode	**anode**
A	colourless effervescence observed	greenish-yellow effervescence observed
B	greenish-yellow effervescence observed	colourless effervescence observed
C	silvery solid formed	colourless effervescence observed
D	silvery solid formed	greenish-yellow effervescence observed

31 A student attempts to electroplate an iron spoon with silver and has set up his experiment as shown below:



Which of the following statements is correct?

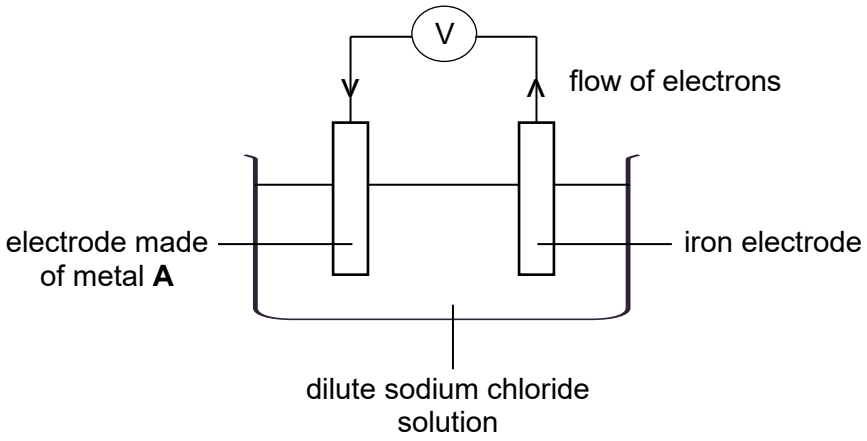
A The positions of the iron spoon and silver electrode should be swapped.

B The anode becomes smaller over time.

C Silver nitrate is not a suitable electrolyte.

D The half equation for the reaction occurring at the cathode is $Ag \rightarrow Ag^{+} + e^{-}$.

32 The diagram below shows the set-up of a simple cell. One of the electrodes is made of iron and the other is made of metal **A**.



Which of the following statements is correct about the above cell?

A Iron is less reactive than metal **A**.
B The mass of the iron electrode will increase.
C The iron electrode is the negative electrode.
D Oxidation takes place at the electrode made of metal **A**.

33 Which method **cannot** be used to produce ammonia gas?

A heating aqueous ammonium carbonate with hydrochloric acid
B heating aqueous ammonium sulfate with aqueous potassium hydroxide
C heating aqueous iron(II) nitrate with aqueous sodium hydroxide and aluminium foil
D heating aqueous concentrated aqueous ammonia

34 How many of the following substances can be used to distinguish ethanol and ethanoic acid?

1 acidified potassium manganate(VII) solution
2 copper metal
3 sodium carbonate solution
4 yeast

A 1
B 2
C 3
D 4

35 Which is the correct use of the different fractions present in crude oil?

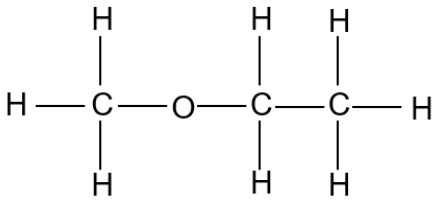
A Diesel is used to lubricate machine parts.
B Naphtha is used for making chemicals.
C Petrol is used as a fuel for aircraft.
D Petroleum gas is used as a fuel for motor vehicles.

36 An organic compound **X** has the formula of $C_3H_7COOC_5H_9$.

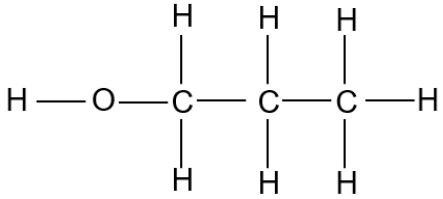
Which statement about compound **X** is correct?

A It can undergo addition polymerization.
B It has only one functional group.
C It is a condensation polymer.
D It is a saturated compound.

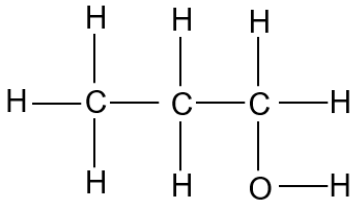
37 The structures of four compounds, **P**, **Q**, **R** and **S,** are shown.



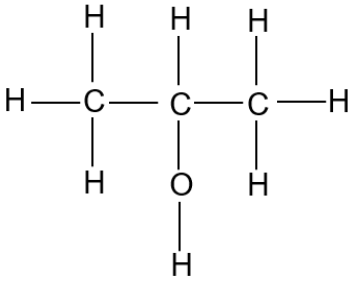
P



Q



R



S

Which statement about the compounds is correct?

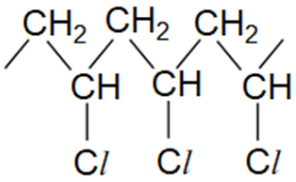
A Compounds **P** and **Q** belong to the same homologous series as they have the same molecular formula.

B Compounds **Q**, **R** and **S** belong to the same homologous series as they contain a hydroxide ion.

C Compounds **Q** and **R** are isomers of each other as they have the same molecular formula.

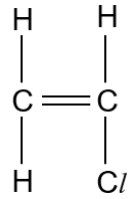
D Compounds **P** and **S** are isomers of each other as they have different structural formula.

38 The diagram shows a section of a polymer.

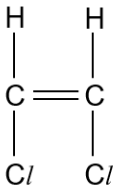


Which monomer could be used to make this polymer?

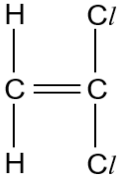
A



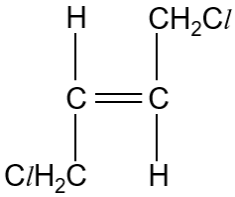
B



C



D



39 Which of the pollutants below are removed by oxidation in the catalytic converter?

1 carbon monoxide
2 nitrogen monoxide
3 unburnt hydrocarbons

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

40 Which of the following gases is not considered toxic?

A carbon monoxide
B carbon dioxide
C nitrogen monoxide
D nitrogen dioxide

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.).