Class	Centre/Index Number	Name

南洋女子中學校

Nanyang Girls' High School

Preliminary Examination 2024
Secondary 4

CHEMISTRY **6092/01**

Paper 1 Multiple Choice

1 hour

Friday 23 August **1200 – 1300**

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue, correction fluid or tape.

Write your name, register number and class in the spaces at the top of this page and on the Answer Sheet in the spaces provided.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

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.

A copy of the Periodic Table is printed on page 20.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **17** printed pages and **3** blank pages.

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1 A balloon full of helium gas was found to be smaller in size as the temperature changes from 30 °C to 10 °C.

Which statement best explains why this is so?

A The gas condenses into a liquid and so takes up less space.

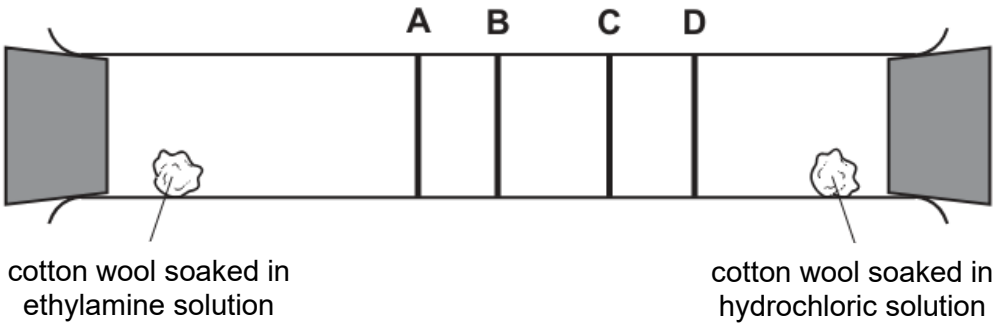
B The gas particles become smaller at lower temperatures.

C The gas particles diffuse through the balloon and escape.

D The gas particles move more slowly hence reducing the pressure.

2 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 white ring of ethylamine hydrochloride be formed?



3 Substances can be elements, compounds or mixtures.

Which row is correct?

	element	compound	mixture
A	calcium	brass	zinc
B	methane	carbon	crude oil
C	nitrogen	carbon dioxide	water vapour
D	oxygen	glucose	air

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

The substances need to be separated and collected.

Which row correctly matches the mixture to the separation method?

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

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

Using these isotopes, how many different relative molecular masses are possible for the compound with the molecular formula $C_2H_3Cl_3$?

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

6 A piece of magnesium reacts with dilute hydrochloric acid.

Which statement is correct?

A A covalent compound is formed during the reaction.

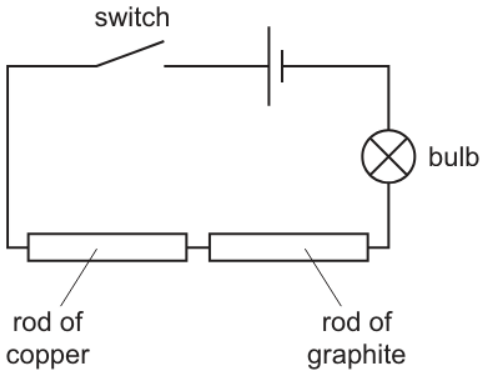
B Each chlorine atom loses one electron in the process.

C Each magnesium atom gains one electron in the process.

D Molecules of an element is formed during the reaction.

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7 The circuit diagram shows an experiment using a rod of copper and a rod of graphite.

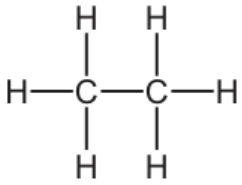


When the switch is closed, the bulb lights because an electric current flows through the copper and the graphite.

Which particle(s) move through these rods?

	copper(II) ions	electrons	carbon ions
A	✓	✗	✓
B	✗	✓	✗
C	✓	✓	✗
D	✗	✓	✓

8 The diagram shows the covalent bonds in an organic compound.



The total number of electrons in one molecule of this compound is ……X…… .

The total number of electrons in the bonds in one molecule of this compound is ……Y…… .

Which numbers correctly complete gaps X and Y?

	X	Y
A	18	14
B	18	12
C	14	14
D	14	12

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9 Two samples of a colourless solution are tested separated 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 ion present is Al^{3+}.
D The cation ion present is Zn^{2+}.

10 A solution of potassium chloride is added to a contaminated sample of water.
A white precipitate forms.
Which ion present in the water causes the precipitate to form?

A carbonate **B** magnesium **C** silver **D** sulfate

11 Compound R has a percentage composition by mass of 63.6 % nitrogen and 36.4 % oxygen.
What is the empirical formula of R?

A N_2O **B** NO **C** NO_2 **D** N_2O_4

12 A chemist makes calcium nitrate by reacting 7.00 g of impure calcium oxide and an excess of dilute nitric acid according to the equation below.

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

It was found that 13.3 g of pure, anhydrous calcium nitrate crystals was produced.
What is the percentage purity of calcium oxide used?
[relative atomic masses, A_r: Ca, 40; N, 14; H, 1; O, 16]

A 50.0 **B** 65.0 **C** 75.0 **D** 80.0

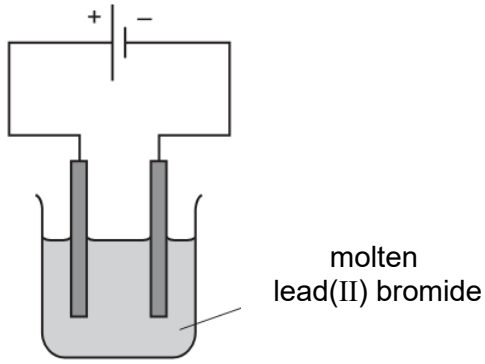
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13 60 cm^3 of propane, C_3H_8, was reacted with 100 cm^3 of oxygen. The resulting mixture was allowed to cool to 25.0 °C.

What is the volume of gases in the resulting mixture?

A 0 cm^3 **B** 60 cm^3 **C** 100 cm^3 **D** 140 cm^3

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



Which statement is correct?

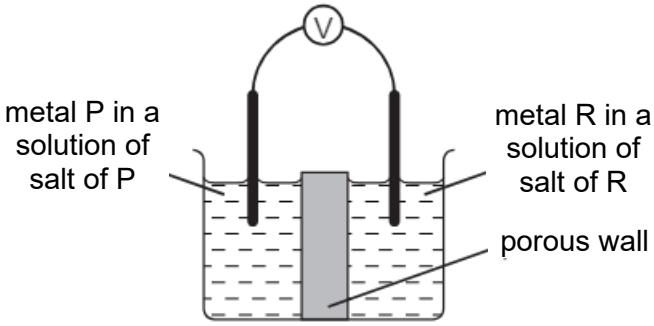
A A reddish-brown gas is seen.

B Electrons pass through the electrolyte 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.

15 Which pair of metals, P and R, will produce the highest voltage when used as electrodes in a simple cell?



	metal P	metal R
A	copper	silver
B	magnesium	silver
C	magnesium	zinc
D	zinc	copper

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16 Concentrated aqueous potassium chloride is electrolysed using inert electrodes.

Which row shows what happens in this electrolysis and why it happens?

	change occurring	explanation
A	oxygen gas is produced at the anode	OH^-(aq) ions loses electrons more easily than Cl^-(aq) ions
B	during electrolysis, the pH of the electrolyte increases	H^+ (aq) ions are discharged in the aqueous solution
C	solid potassium is produced at the cathode	K^+(aq) ions are discharged in the aqueous solution
D	the products stay the same if the aqueous potassium chloride is replaced by dilute aqueous potassium chloride	K^+ and Cl^- are present in both concentrated and dilute aqueous potassium chloride

17 An aqueous mixture of copper(II) nitrate and silver nitrate is electrolysed with pure copper electrodes.

Which half-equation correctly describes the change occurring at the anode?

A $Cu(s) \rightarrow Cu^{2+}(aq) + 2\ e^-$

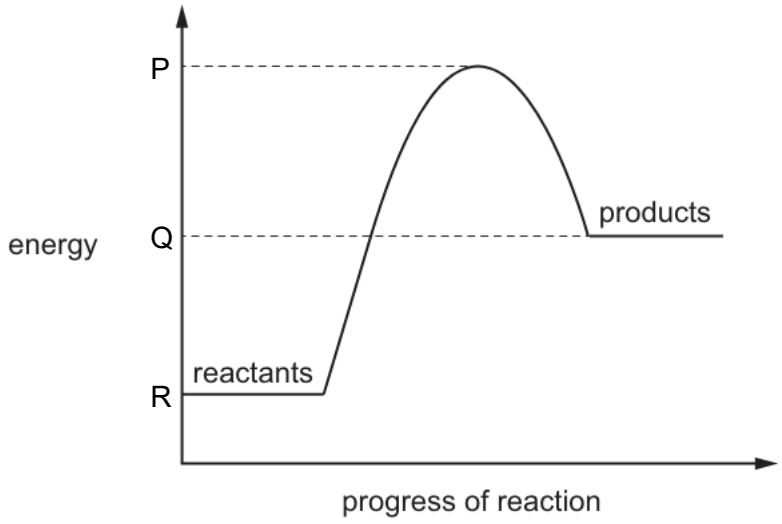
B $Cu^{2+}(aq) + 2\ e^- \rightarrow Cu(s)$

C $Ag(s) \rightarrow Ag^+(aq) + e^-$

D $Ag^+(aq) + e^- \rightarrow Ag(s)$

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18 The energy profile diagram for a reaction is shown below.



Which statement about this reaction is correct?

A It is endothermic and the activation energy is P to Q.
B It is endothermic and the activation energy is P to R.
C It is exothermic and the activation energy is P to Q.
D It is exothermic and the activation energy is P to R.

19 Which statements about the energy changes during a chemical reaction are correct?

1 The activation energy, *Ea*, is the maximum energy the colliding particles must have in order to react.
2 During an endothermic reaction, thermal energy is taken in from the surroundings leading to a decrease in temperature of the surroundings.
3 The making of chemical bonds is an exothermic process.

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

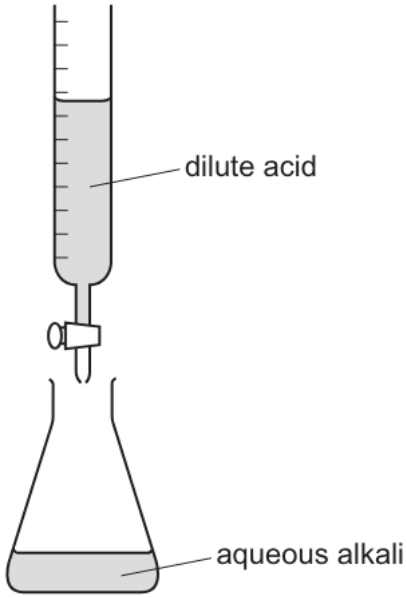
20 Two gases react inside a sealed vessel.
Which change in conditions would increase the rate of reaction?

1 increasing the pressure inside the vessel
2 increasing the temperature inside the vessel
3 increasing the volume of the vessel

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

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21 The diagram shows a titration experiment.



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

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

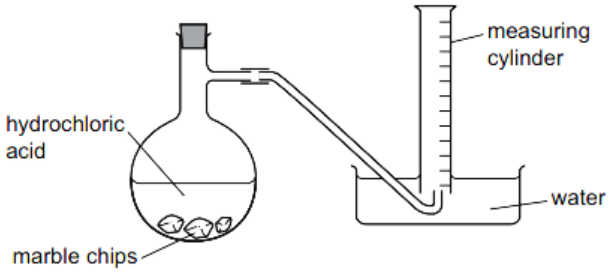
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22 A student plans to investigate how the rate of reaction changes when dilute hydrochloric acid and marble chips, $CaCO_3$, react.

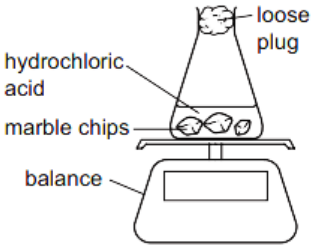
$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Three methods are described below.

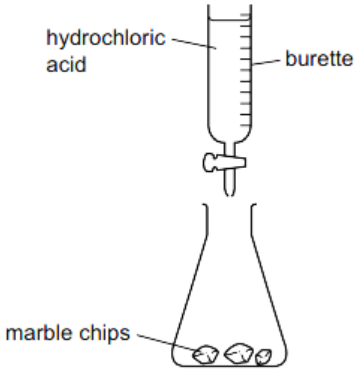
1



2



3



With the use of a stopwatch, which methods could be used to measure how the rate of reaction changes?

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

23 The following statements about dilute sulfuric acid are all correct.

1 A white precipitate is formed when aqueous barium chloride is added.
2 The solution turns anhydrous copper(II) sulfate from white to blue.
3 Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
4 The solution reacts with copper(II) oxide, forming a blue solution.

Which two statements confirm the acidic nature of the solution?

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

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24 Which element will burn in oxygen to form an acidic oxide?

A aluminium
B barium
C carbon
D magnesium

25 The diagram shows colours of indicators, methyl orange and methyl red at different pH values.

pH	2	3	4	5	6
colour of methyl orange	red		yellow		
colour of methyl red	red				yellow

The table shows the pH of four solutions.

solution	W	X	Y	Z
pH	2	3	5	6

In which solutions will both indicators be yellow?

A W and X **B** X and Y **C** Y and Z **D** Z only

26 Which method is not suitable to prepare copper(II) nitrate?

A React copper with nitric acid.
B React copper(II) carbonate with nitric acid.
C React copper(II) hydroxide with nitric acid.
D React copper(II) oxide with nitric acid.

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27 Which method of preparation of iron(II) sulfate is an example of a redox reaction?

A $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

B $FeO + H_2SO_4 \rightarrow FeSO_4 + H_2O$

C $Fe(OH)_2 + H_2SO_4 \rightarrow FeSO_4 + 2H_2O$

D $FeCO_3 + H_2SO_4 \rightarrow FeSO_4 + CO_2 + H_2O$

28 Which change in the properties of the halogens is not correct?

	chlorine → bromine → iodine
A	darker in colour
B	decrease in melting point
C	decrease in oxidising power
D	increase in density

29 The elements are arranged in groups and periods in the Periodic Table.
Which row is correct?

	group determined by	period determined by	elements in the Periodic Table are arranged by
A	the number of valence electrons	the number of occupied shells	increasing mass number
B	the number of occupied shells	the number of valence electrons	increasing proton number
C	the number of valence electrons	the number of occupied shells	increasing proton number
D	the number of occupied shells	the number of valence electrons	increasing mass number

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30 When a strip of magnesium is placed in aqueous silver nitrate, a displacement reaction takes place.

What is the ionic equation for this reaction?

A $Ag^{2+}(aq) + Mg(s) \rightarrow Ag(s) + Mg^{2+}(aq)$

B $2Ag^{+}(aq) + Mg(s) \rightarrow 2Ag(s) + Mg^{2+}(aq)$

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

D $2AgNO_3(aq) + Mg(s) \rightarrow 2Ag(s) + Mg(NO_3)_2(aq)$

31 Zinc is used to galvanise iron, which prevents the iron from rusting.

Which statements are correct?

1 When iron rusts, atoms of iron loses electrons to form ions.

2 Zinc will oxidise before the iron does, even if the layer of zinc is scratched.

3 The layer of zinc forms a barrier between the iron and the oxygen and water in the atmosphere.

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

32 Which statement about global warming is correct?

A Methane produced by decomposition of animals has no effect on the rate of global warming.

B The products of burning of fossil fuels have no effect on the rate of global warming.

C The products of decomposition of vegetative matter have no effect on the rate of global warming.

D The products of photosynthesis have no effect on the rate of global warming.

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33 Different strategies to reduce the effects of environmental issues have been suggested.
Which row is correct?

	strategy to reduce the effects of climate change	strategy to reduce the effects of acid rain
A	reduction in livestock farming	planting trees
B	reduction in livestock farming	using low-sulfur fuel
C	reduction in the use of renewable energy	planting trees
D	reduction in the use of renewable energy	using low-sulfur fuel

34 Hydrogen is used as a reactant both in the Haber process and in its addition to alkenes.
Which row is correct?

	catalyst in Haber process	product of addition of hydrogen to an alkene
A	iron	alkane
B	iron	alcohol
C	nickel	alkane
D	nickel	alcohol

35 Ethanol is produced by the fermentation of glucose from sugar cane. In some countries, ethanol is used as a fuel.

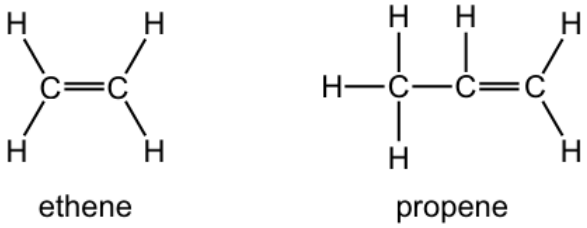
Which statements are correct?

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

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36 The diagram shows the structures of ethene and propene.



ethene propene

Which statement is true about both 1 mole of ethene and 1 mole of propene?

A They contain equal numbers of atoms.

B They give equal volumes of carbon dioxide when burnt completely in oxygen.

C They give equal masses of ethane and propane when reacted with hydrogen.

D They react with equal masses of bromine.

37 Which equation shows the reaction of ethane with chlorine in the presence of ultraviolet light?

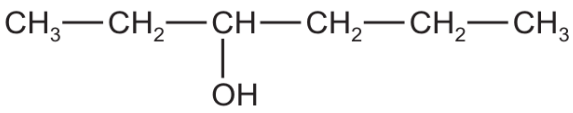
A $C_2H_6 + Cl_2 \rightarrow C_2H_6Cl_2$

B $C_2H_6 + Cl_2 \rightarrow C_2H_4Cl_2 + H_2$

C $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

D $C_2H_6 + Cl_2 \rightarrow 2CH_3Cl$

38 Hexan-3-ol is an alcohol.



hexan-3-ol

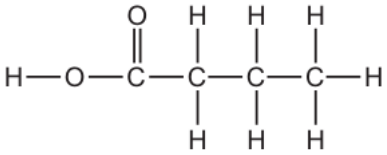
How many molecules of oxygen are needed for the complete combustion of one molecule of hexan-3-ol?

A 9 **B** 10 **C** 18 **D** 19

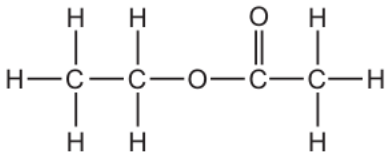
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39 What is the displayed formula of methyl propanoate?

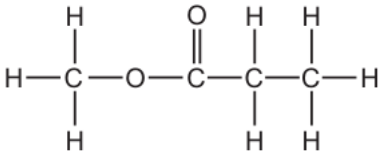
A



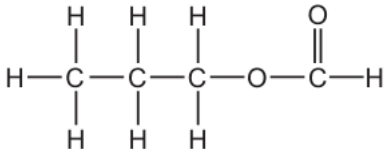
B



C



D



40 Polymer X is an addition polymer. The monomer used to make X is but-2-ene.

Polymer Y is a condensation polymer. The monomers used to make Y are $HOCH_2CH_2OH$ and $HOOCCH_2COOH$.

Which statement about X and Y is correct?

A The repeat unit of X is $–[CH(CH_3)CH(CH_3)]–$ and Y is a polyamide.

B The repeat unit of X is $–[CH(CH_3)CH(CH_3)]–$ and Y is a polyester.

C The repeat unit of X is $–[CH_2CH(C_2H_5)]–$ and Y is a polyamide.

D The repeat unit of X is $–[CH_2CH(C_2H_5)]–$ and Y is a polyester.

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The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							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	3	4	5	6	7	8	9	10	11	12	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

proton (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.).
The Avogadro constant, L = 6.02 x 10^{23} mol^{-1}

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