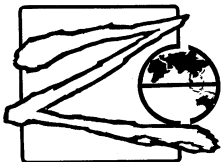


Candidate Name: _____ Index No: _____ Class: _____



**ZHENGHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS
CHEMISTRY**

6092/01

Paper 1 Multiple Choice

27 August 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

*Zhenghua Secondary School Zhenghua Secondary School Zhenghua Secondary School Zhenghua Secondary School
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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, Centre number and index number 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** or **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 18.

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

Name of Setter: Ms Tan Li Er Natalie

The end-point is reached when the methyl orange indicator turns ...3... .

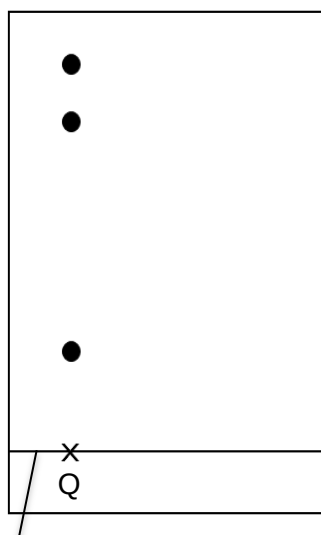
Which words correctly complete blanks 1, 2 and 3?

	1	2	3
A	burette	pipette	red
B	burette	pipette	orange
C	pipette	burette	orange
D	pipette	burette	red

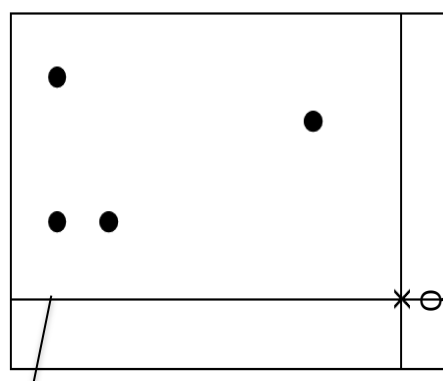
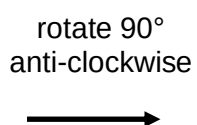
- 2 Chromatogram 1 shows the separation of coloured inks in mixture Q, using solvent A.

Chromatogram 2 shows the separation using the same piece of paper in another solvent B after it has been rotated 90° anti-clockwise.

chromatogram 1



chromatogram 2



first starting line

second starting line

How many different types of ink are present in mixture Q?

- | | | | |
|----------|---|----------|---|
| A | 3 | B | 4 |
| C | 6 | D | 7 |

- 3** An element, Z, has p protons and n neutrons in the nucleus of its atoms.

Z reacts with oxygen to form a basic oxide.

Which list gives the correct information about the ion of an isotope of Z?

	number of protons	number of neutrons	number of electrons
A	p	$n + 1$	$p + 1$
B	p	$n + 1$	$p - 1$
C	$p + 1$	n	$p + 1$
D	$p + 1$	n	$p - 1$

- 4** A solution contains barium ions and sodium ions and one type of anion.

What could the anion be?

- A** chloride only
- B** nitrate only
- C** sulfate only
- D** chloride or nitrate

- 5** Solid P conducts electricity and has a high melting point.

When solid P is warmed with excess dilute hydrochloric acid, it partially dissolves leaving behind a residue.

What is P?

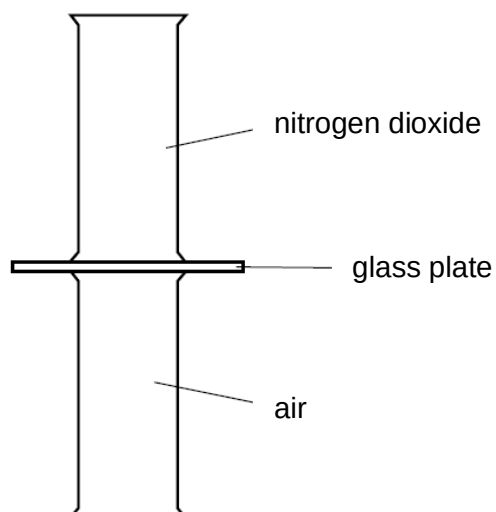
- A** brass
- B** copper(II) oxide
- C** graphite
- D** iron

- 6 In a molecule of hydrogen cyanide, HCN, what is the total number of electrons present and how many of them are involved in bonding?

	total number of electrons	number of electrons involved in bonding
A	14	4
B	14	8
C	26	4
D	26	8

- 7 Nitrogen dioxide is a dark brown gas and is denser than air.

A gas jar containing nitrogen dioxide is sealed with a glass plate and is then inverted on top of a gas jar containing air.



The glass plate is removed.

Which row correctly describes the colours inside the gas jars after a long period of time? The gases are at room temperature and pressure.

	upper gas jar	lower gas jar
A	brown	brown
B	colourless	dark brown
C	dark brown	light brown
D	light brown	dark brown

- 8** Sodium is a grey solid. Chlorine is yellowish-green gas.

When sodium is heated and mixed with chlorine, a reaction takes place and a white crystalline substance called sodium chloride is formed.

Which statement about sodium chloride is correct?

- A** It is a compound of sodium and chlorine.
- B** It is a mixture of sodium and chlorine.
- C** It is a new element.
- D** It is an alloy of sodium and chlorine.

- 9** Which equation represents the ionic equation of the reaction between zinc and dilute hydrochloric acid?

- A** $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$
- B** $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{H}(\text{aq})$
- C** $\text{Zn(s)} + 2\text{HCl}(\text{aq}) \rightarrow \text{ZnCl}_2(\text{s}) + \text{H}_2(\text{g})$
- D** $\text{Zn(s)} + 2\text{HCl}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq}) + \text{H}_2(\text{g})$

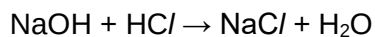
- 10** The formula for hydrated copper(II) nitrate is $\text{Cu}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$.

It contains 36.5% of water of crystallisation by mass.

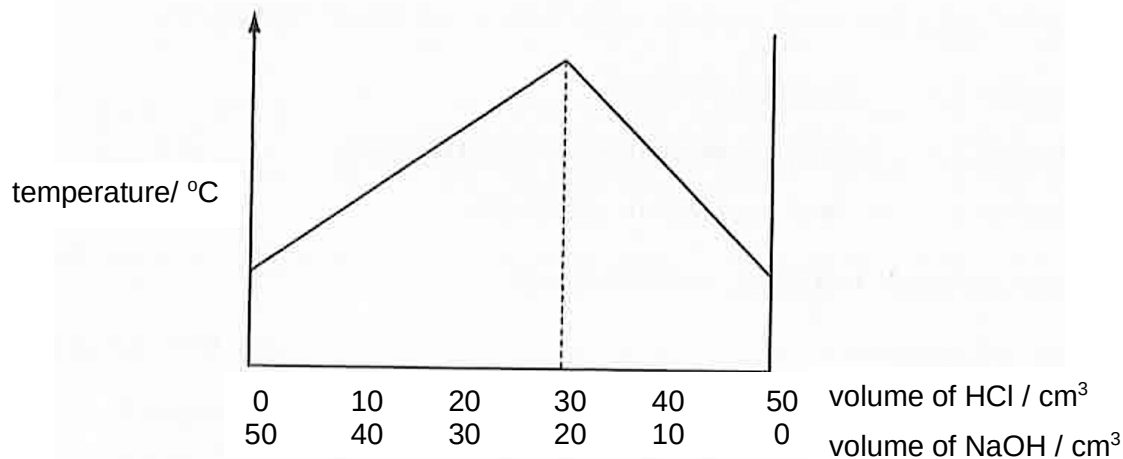
What is the value of x ?

- | | | | |
|----------|---|----------|---|
| A | 4 | B | 5 |
| C | 6 | D | 7 |

- 11** An aqueous solution of hydrochloric acid has a concentration of 2.0 mol / dm^3 . Different volumes of the acid are added to different volumes of aqueous sodium hydroxide.



The maximum temperature of each mixture is measured. The graph shows the results.



What is the concentration of the aqueous sodium hydroxide?

- A** 0.67 mol/dm^3
B 1.3 mol/dm^3
C 1.5 mol/dm^3
D 3.0 mol/dm^3
- 12** 8 g of X_2O_3 , an oxide of element X, contains 5.6 g of X.

How many moles of X does 5.6 g of the element contain?

- A** $\frac{2.4}{16} \times \frac{2}{3}$ **B** $\frac{2.4}{16} \times \frac{3}{2}$
C $\frac{8}{16} \times \frac{2}{3}$ **D** $\frac{8}{16} \times \frac{3}{2}$

- 13** In which reaction does the smallest percentage change in volume occur?

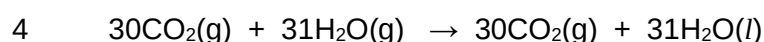
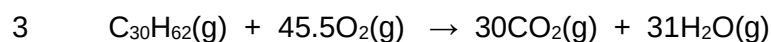
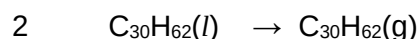
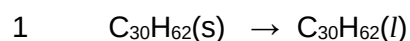
- A** $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$
B $4\text{NH}_3(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{N}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
C $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
D $2\text{H}_2\text{S}(\text{g}) + \text{SO}_2(\text{g}) \rightarrow 3\text{S}(\text{s}) + 2\text{H}_2\text{O}(\text{l})$

- 14** One mole of compound X gives three moles of ions in aqueous solution. X reacts with ammonium carbonate to give an acidic gas.

What is X?

- A** barium hydroxide
- B** ethanoic acid
- C** potassium hydroxide
- D** sulfuric acid

- 15** The scheme shows four stages, 1 to 4, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.



Which stages are exothermic?

- | | |
|-----------------------|-----------------------|
| A 1 and 2 only | B 2 and 3 only |
| C 3 and 4 only | D 1 and 4 only |

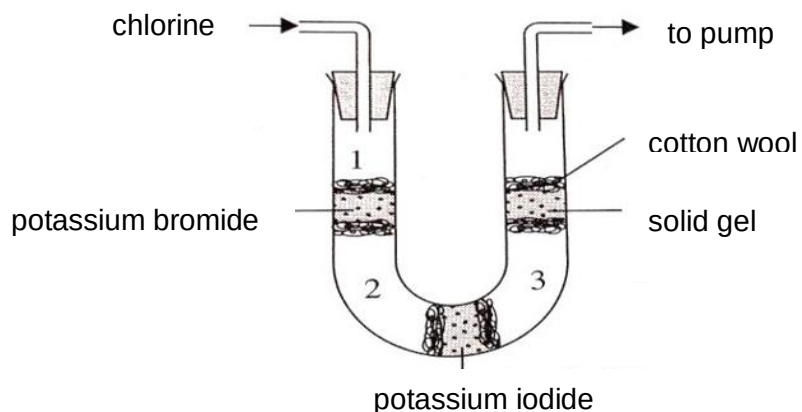
- 16** These statements are about the activation energy of a chemical reaction.

- 1 Chemical reactions in gases and liquids take place when molecules collide with sufficient energy to overcome the activation energy.
- 2 If the activation energy for a reaction is high, many of the collisions have enough energy to be successful and the reaction is fast.
- 3 A catalyst reduces the activation energy for a reaction and therefore the overall enthalpy change of the reaction is lower.

Which statements are correct?

- | | |
|-----------------------|-----------------------|
| A 1 only | B 1 and 2 only |
| C 2 and 3 only | D 3 only |

- 17** Gaseous chlorine was passed through the following apparatus. The apparatus was continuously heated.



What observations would be made at regions 1, 2 and 3?

	region 1	region 2	region 3
A	yellow-green gas	violet gas	black solid
B	yellow-green gas	reddish-brown gas	violet gas
C	red-brown gas	violet gas	violet gas
D	red-brown gas	black solid	black solid

- 18** P is a Group 1 element. What would happen when a small piece of P is put into a bowl that contains water and a few drops of litmus solution?

- 1 Heat is released.
- 2 An electrolyte is formed.
- 3 The solution turns blue.
- 4 A gas is given off.

- | | |
|--------------------------|------------------------|
| A 1 and 3 only | B 3 and 4 only |
| C 1, 3 and 4 only | D 1, 2, 3 and 4 |

- 19** X, Y, and Z are elements in the same period of the Periodic Table.

X forms an amphoteric oxide, Y forms an acidic oxide and Z forms a basic oxide.

If X, Y and Z are placed in order of increasing atomic number, which order is correct?

- A** X, Y, Z
- B** Y, Z, X
- C** Z, X, Y
- D** Z, Y, X

- 20** 216 g of silver is deposited when an electric current is passed through a solution of silver nitrate using graphite electrodes.

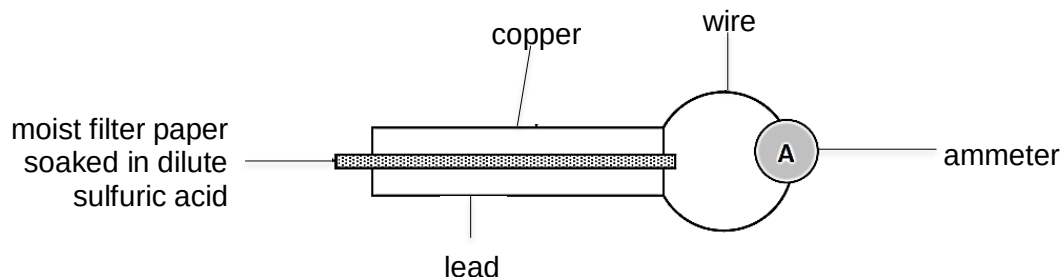
What is the mass of magnesium formed when the same amount of current is passed through molten magnesium chloride using graphite electrodes?

- A** 24 g **B** 48 g
- C** 72 g **D** 96 g

- 21** Which pair of electrolyte and electrodes will not result in a change in the concentration of the solution during electrolysis?

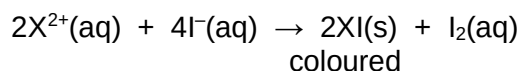
	electrolyte	electrodes
A	copper(II) nitrate	carbon
B	copper(II) nitrate	copper
C	sodium nitrate	carbon
D	sodium nitrate	copper

- 22** In the following set-up, lead and copper strips are pressed against a piece of wet filter paper soaked in dilute sulfuric acid and the amount of electric current flowing through can be detected by an ammeter, a device used to measure current.



Which statement is correct?

- A** Copper strip decreases in size.
 - B** Electrons flow from copper to lead through the wire.
 - C** Lead strip is coated with a pink substance.
 - D** Oxidation occurs on the lead strip.
- 23** The ions of metal X react with aqueous potassium iodide.

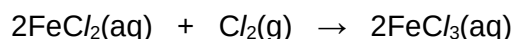


From this information, it can be deduced that X is most likely a1..... metal and the $X^{2+}(aq)$ ions are2.....

Which words correctly complete blanks 1 and 2?

	blank 1	blank 2
A	group 2	oxidised
B	group 2	reduced
C	transition	oxidised
D	transition	reduced

- 24** Iron(II) chloride solution reacts with chlorine gas. The equation is shown.



Which statements about this reaction are correct?

- 1 Fe^{2+} ions are reduced to Fe^{3+} ions.
- 2 Chlorine acts as a reducing agent.
- 3 Fe^{2+} ions each lose an electron.
- 4 Cl_2 molecules are reduced to Cl^- ions.

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

- 25** When chlorine gas dissolves in concentrated sodium hydroxide a reaction occurs.



Which row correctly identify the oxidation state for chlorine in the chlorine-containing species?

	Cl_2	NaCl	NaOCl
A	-1	-1	-1
B	0	-1	+1
C	-1	+1	0
D	0	+1	-1

- 26** Gas X turns acidified potassium manganate(VII) from purple to colourless. Gas Y turns aqueous potassium iodide from colourless to brown.

What do these observations tell us about the role of gas X and gas Y?

	gas X	gas Y
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

- 27** The table shows the method of extraction of metals P, Q and R from their ores.

metal	method
P	reduction by hydrogen
Q	electrolysis
R	reduction by carbon

What is the the order of reactivity of the metals from least reactive to most reactive?

- A** P, Q, R
- B** P, R, Q
- C** Q, P, R
- D** R, P, Q
- 28** Which statement about the Haber process is correct?
- A** Increasing the temperature will increase yield but operating cost is high.
- B** One volume of hydrogen reacts with three volumes of nitrogen to form two volumes of ammonia.
- C** The raw materials are obtained from the air.
- D** The reaction does not go to completion.

29 The solid carbonates of three metals, P, Q and R are heated.

action of heat on carbonates of	results
P	carbon dioxide produced solid changes colour from green to black
Q	carbon dioxide produced solid does not change colour
R	no carbon dioxide produced solid does not change colour

Which statements are correct?

- 1 Metal R is more reactive than metal Q.
- 2 Metal P is a transition metal.
- 3 If dilute nitric acid is added to all three carbonates, carbon dioxide is given off from the carbonates of P and Q but not from the carbonate of R.

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

30 Which metal is mined commercially in its elemental state rather than as a compound?

- A** copper
- B** lead
- C** silver
- D** sodium

31 Which of the following sentences about the fractional distillation of crude oil is true?

- A** Plastic is collected at the bottom of the fractionating column.
- B** Shorter hydrocarbons are collected near the top of the fractional distillation.
- C** The fractions are collected one after the other during the process of fractional distillation.
- D** The hydrocarbon with the lowest boiling point remains in the furnace.

32 Two statements about substances X, Y and Z are given.

- 1 A hydrocarbon X is cracked to make Y and hydrogen gas.
- 2 Compound Z is formed by the addition polymerisation of Y.

Based on the two statements above, which statement is true?

- A** X is an unsaturated compound.
- B** Y is a saturated compound.
- C** Y can react with steam to form an alcohol.
- D** Z has a lower melting point than Y.

33 In which reaction does the product have less carbon atoms than the underlined reactant?

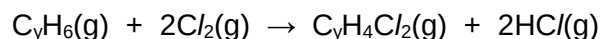
- A** a carboxylic acid produced from an alcohol and an oxidising agent
- B** an alcohol produced from an alkene and steam
- C** carbon dioxide produced from the combustion of ethanol
- D** calcium ethanoate produced from ethanoic acid and calcium carbonate

34 100 cm³ of ethane is burnt in 200 cm³ of oxygen.

When cooled to room temperature, what could be the resulting mixture of gases?

- A** ethane, carbon monoxide, water vapour
- B** ethane, carbon monoxide, carbon dioxide
- C** ethane, carbon dioxide, oxygen
- D** oxygen, carbon monoxide, carbon dioxide

- 35** The reaction between a hydrocarbon C_yH_6 and chlorine is shown.



Which statement is correct?

- A** It is an addition reaction.
 - B** The molecular formula of the hydrocarbon is C_3H_6 .
 - C** The presence of UV light is essential for the reaction to take place.
 - D** High temperature, high pressure and a catalyst are required in the reaction.
- 36** Carbohydrates can be converted to poly(ethene) in different stages as shown.



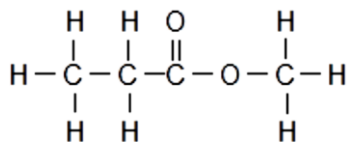
Which row correctly labels the processes X and Y?

	X	Y
A	photosynthesis	oxidation
B	fermentation	addition polymerisation
C	fermentation	condensation polymerisation
D	photosynthesis	addition polymerisation

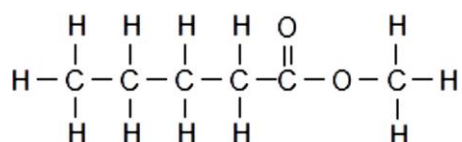
37 An ester was produced by the condensation reaction of methanol and butanoic acid.

Which structure represents the ester compound?

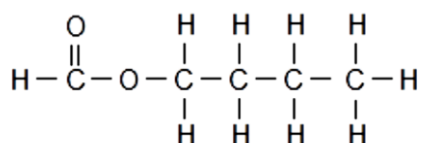
A



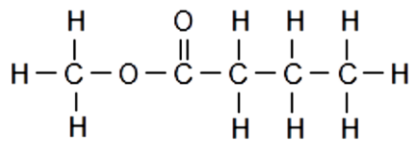
B



C

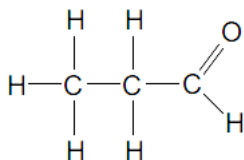


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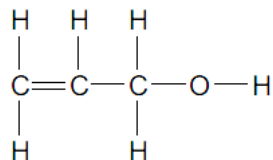


38 Which compound is an isomer of propanol?

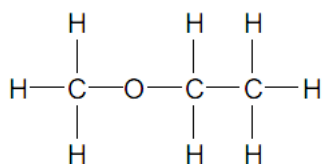
A



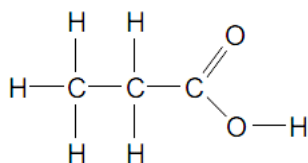
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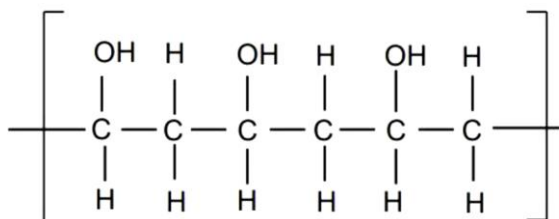
C



D

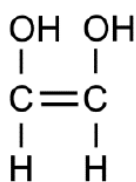


39 The structure of a polymer is shown below.

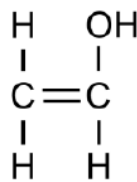


What is the monomer unit for this polymer?

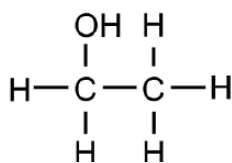
A



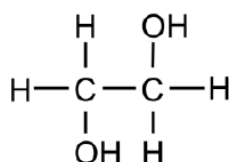
B



C



D



40 X is an organic compound containing four carbon atoms. It gives negative results with the following tests.

- reacting X with aqueous bromine
- reacting X with acidified potassium manganate (VII) solution
- reacting X with sodium carbonate solution

Which of the following could be the structural formula of X?

- A** $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$
- B** $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- C** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$
- D** $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

The Periodic Table of Elements

Periodic Table of Elements																	
Group												13	14	15	16	17	18
1	2											13	14	15	16	17	18
							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	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 oganeson —

18

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 dm³ at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$

