Name: …….. ( ) Class: Sec 4 SG 5 / 6

Queenstown Secondary School

Preliminary Examination 2024
Secondary Four Normal (Academic)
Science (Chemistry)
5105/03

30 July 2024
Tuesday

Time: 1015 – 1130h
Papers 3 and 4: 1 hour 15 minutes

Setter:

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

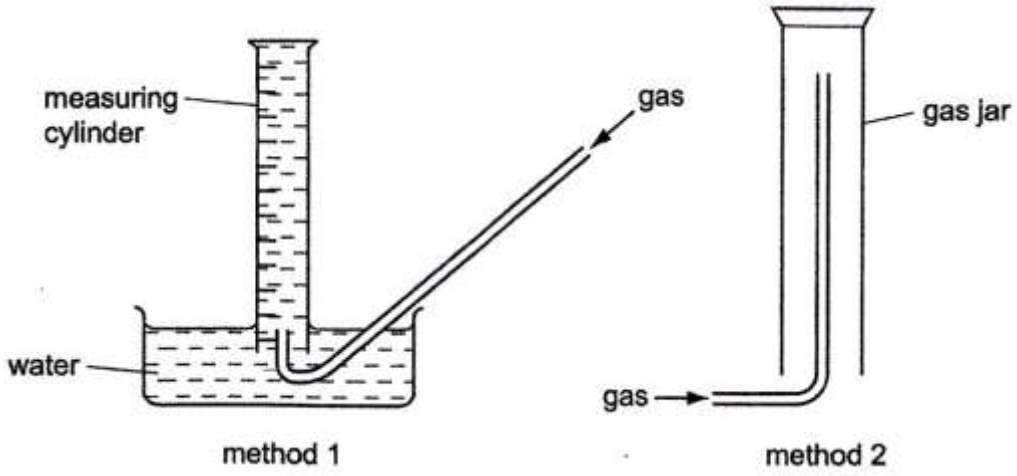
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **twenty** 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.

Answers to Paper 3 and Paper 4 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **30 minutes** on **Paper 3**.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 11.
The use of an approved scientific calculator is expected, where appropriate.

1 The diagrams show two methods of collecting gases.



Which row gives the properties of a gas that can be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	**insoluble in water**	**less dense than air**
C	soluble in water	denser than air
D	soluble in water	less dense than air

2 Three separations are listed.

1 obtaining water from sodium chloride solution

2 obtaining solid copper(II) sulfate from copper(II) sulfate solution

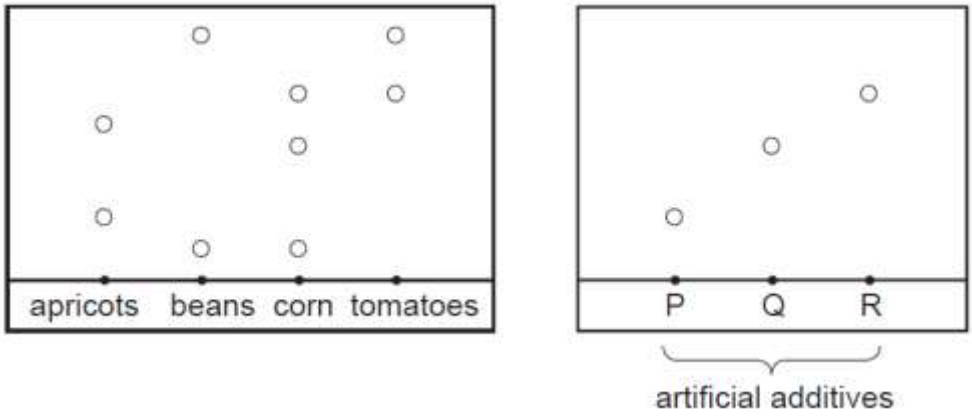
3 obtaining sand from a mixture of sand and sodium chloride solution

	1	2	3
A	**distillation**	**crystallisation**	**filtration**
B	distillation	evaporation	sublimation
C	filtration	crystallisation	sublimation
D	filtration	evaporation	filtration

3 Samples of tinned apricots, beans, corn and tomatoes are tested for additives by using chromatography.

The chromatograms are compared with those of three artificial additives, P, Q and R.

The results are as follows.



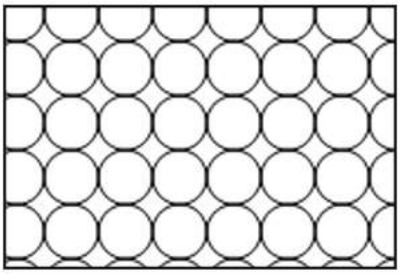
Which tinned food does **not** contain any artificial additives?

A apricots **B** beans **C** corn **D** tomatoes

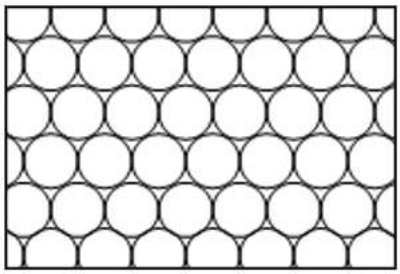
4 Substance X has a melting point of –7°C and a boiling point of 79°C.

Which diagram shows the correct arrangement of particles of substance X under room conditions? **[liquid at room conditions]**

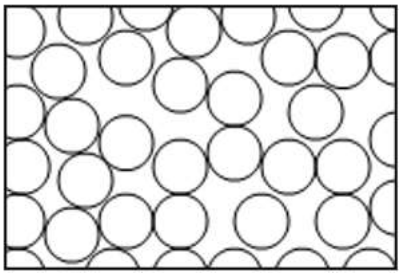
A



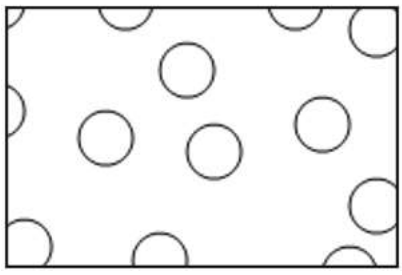
C



B



D



5 An atom of fluorine is represented by $^{19}_{9}F$.

What is the electron arrangement of the fluorine atom?

A 2,7 **B** 2,8 **C** 2,8,8 **D** 2,8,8,1

6 The atomic structures of four different particles are shown.

particle	number of protons	number of neutrons	number of electrons
Al	**W**	14	13
Al^{3+}	13	14	**X**
S	16	**Y**	16
S^{2-}	16	16	**Z**

What are the values for **W**, **X**, **Y** and **Z**?

	W	**X**	**Y**	**Z**
A	10	16	14	16
B	**13**	**10**	**16**	**18**
C	13	16	18	10
D	14	13	18	14

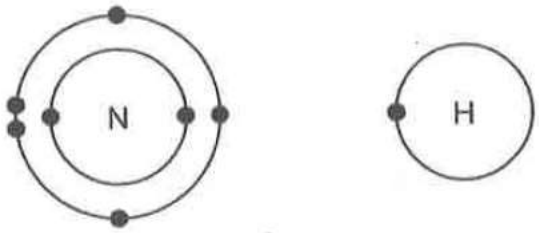
7 Gallium combines with sulfur to make an ionic compound gallium sulfide.

The formula of gallium sulfide is Ga_2S_3.

Which row describes the melting point of gallium sulfide and the formulae of the ions in the compound?

	melting point	ions present
A	high	Ga^{2+} S^{3-}
B	**high**	**Ga^{3+} S^{2-}**
C	low	Ga^{2+} S^{3-}
D	low	Ga^{3+} S^{2-}

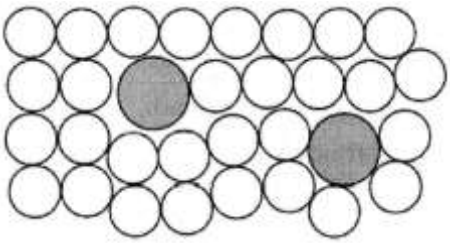
8 The electronic structures of an atom of nitrogen **[non-metal]** and an atom of hydrogen **[non-metal]** are shown.



Which row describes what happens to the electrons in the valence shells and the type of bonding when atoms of N and H form a compound?

	electrons	type of bond
A	transferred	covalent
B	**shared**	**covalent**
C	transferred	ionic
D	shared	ionic

9 The diagram shows the arrangement of particles in substance Z. **[alloy]**



Which statement is correct?

A **Z is hard and strong.**

B Z is soluble in water.

C Z has a fixed melting point.

D Z conducts electricity in the aqueous state.

10 The chemical equation below represents the reaction between barium nitrate, $Ba(NO_3)_2$, and copper(II) sulfate, $CuSO_4$.

$$Ba(NO_3)_2\,(aq) + CuSO_4\,(aq) \rightarrow BaSO_4\,(s) + Cu(NO_3)_2\,(aq)$$

What is the ionic equation that represents the above reaction?

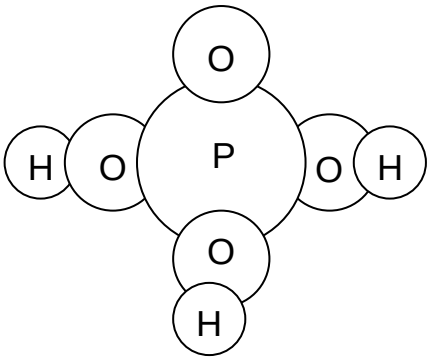
A $Ba^{2+}\,(aq) + 2NO_3^-\,(aq) \rightarrow Ba(NO_3)_2\,(aq)$

B **$Ba^{2+}\,(aq) + SO_4^{2-}\,(aq) \rightarrow BaSO_4\,(s)$**

C $Cu^{2+}\,(aq) + 2NO_3^-\,(aq) \rightarrow Cu(NO_3)_2\,(aq)$

D $Cu^{2+}\,(aq) + SO_4^{2-}\,(aq) \rightarrow CuSO_4\,(aq)$

11 The diagram shows a model of a molecule.



What is the relative molecular mass, M_r, of this molecule?

[H_3PO_4 = 3(1) + 31 + 4(16) = 98]

A 50 **B** 82 **C** **98** **D** 106

12 Why is calcium hydroxide **[alkaline]** added to soil **[acidic due to SO_2 and NO_2]**?

A to decrease pH and neutralise acidity

B to decrease pH and neutralise alkalinity

C **to increase pH and neutralise acidity**

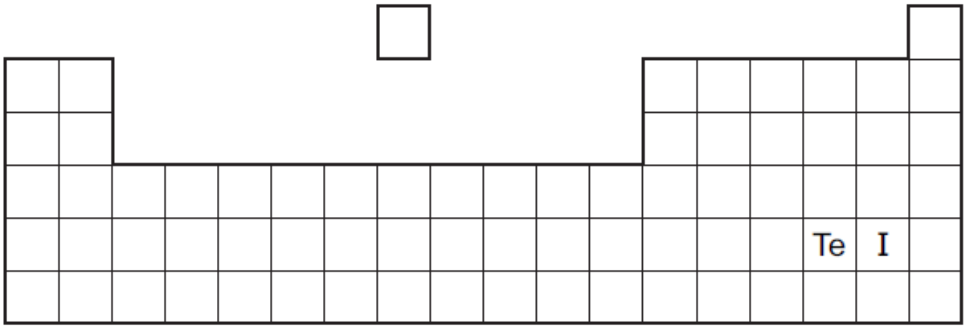
D to increase pH and neutralise alkalinity

13 An amphoteric oxide was added separately to dilute hydrochloric acid and aqueous sodium hydroxide.

Which of the following is correct?

	hydrochloric acid	sodium hydroxide
A	salt formed	no reaction
B	**salt formed**	**salt formed**
C	no reaction	salt formed
D	no reaction	no reaction

14 Iodine, I, has a lower nucleon (mass) number than tellurium, Te, but is placed after it in the Periodic Table.



Which statement explains why iodine is placed after tellurium in the Periodic Table?

A Iodine has fewer neutrons than tellurium.

B Iodine has fewer protons than tellurium.

C Iodine has more neutrons than tellurium.

D **Iodine has more protons than tellurium.**

15 Which statement about bromine and iodine is correct?

A Bromine is a red-brown gas that reacts with sodium chloride solution. **✖ liquid**

B **Bromine is a red-brown liquid that reacts with potassium iodide solution.**

Br_2 (l) + 2KI (aq) → 2KBr (aq) + I_2 (s)

C Iodine is a grey solid that reacts with potassium bromide solution. **✖ black**

D Iodine is a purple vapour that reacts with sodium chloride solution.

✖ no displacement

16 W, X, Y and Z are four different metals.

W does **not** react with acids. **[least reactive = easiest to extract]**

X reacts with steam and acids but **not** with cold water. **[more reactive than Z]**

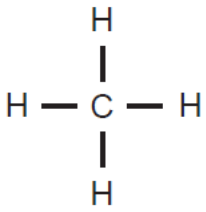
Y reacts with cold water. **[most reactive = most difficult to extract]**

Z reacts slowly with acids but **not** with steam.

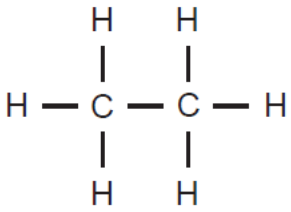
Which row shows the ease with which the metals can be extracted from their ores?

	easiest to extract →			most difficult to extract
A	W	X	Z	Y
B	**W**	**Z**	**X**	**Y**
C	Y	X	Z	W
D	Y	Z	X	W

17 The names and molecular structure of two alkanes are shown.



methane

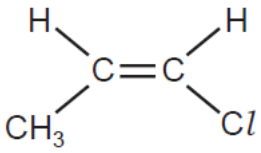


ethane

What is the next alkane in the homologous series?

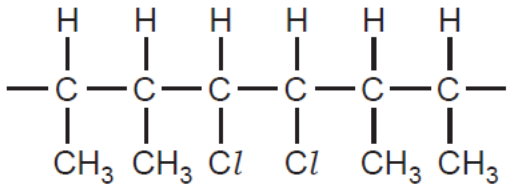
	name	formula
A	butane	C_3H_6
B	butane	C_3H_8
C	propane	C_3H_6
D	**propane**	**C_3H_8**

18 The following formula represents a monomer.

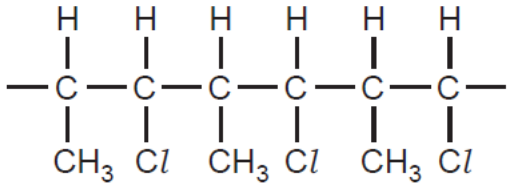


Which formula shows a part of the polymer chain formed from 3 molecules of the monomer? **[B]**

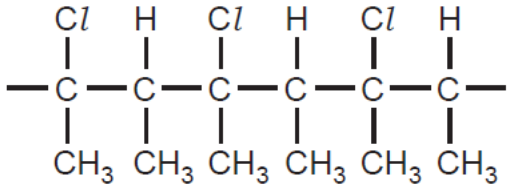
A



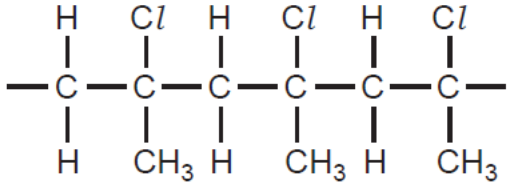
B



C



D

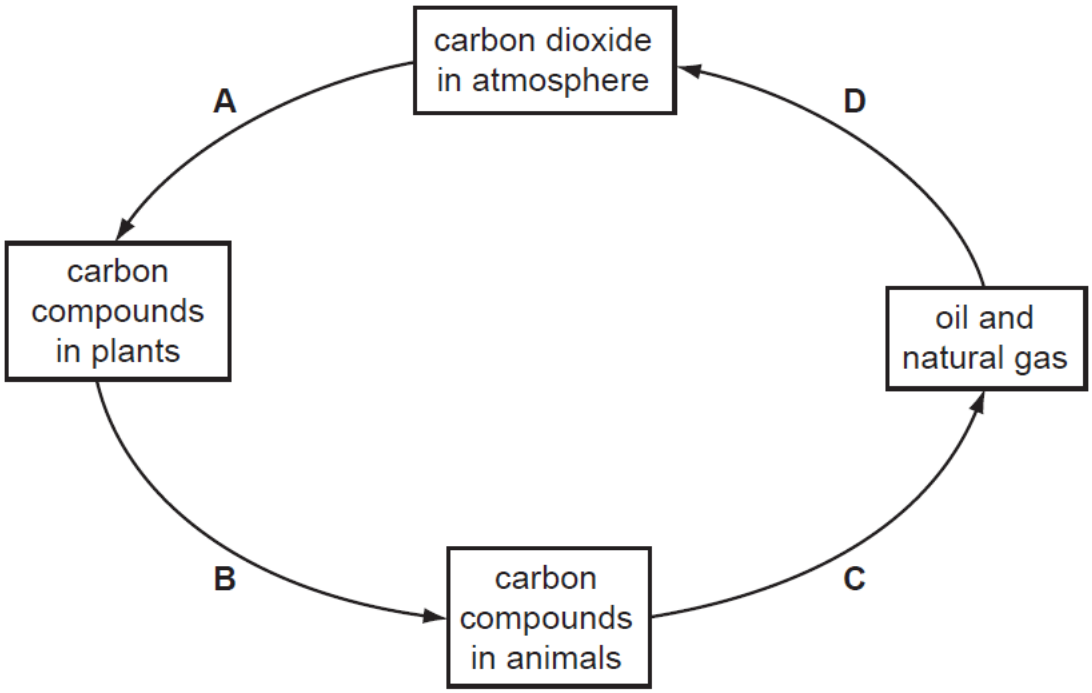


19 Which atmospheric pollutants are responsible for damage to buildings? **[acid rain]**

1 nitrogen dioxide
2 sulfur dioxide
3 carbon monoxide
4 methane

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

20 Which step in the diagram shows the process of combustion? **[D]**



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.).

[Turn over