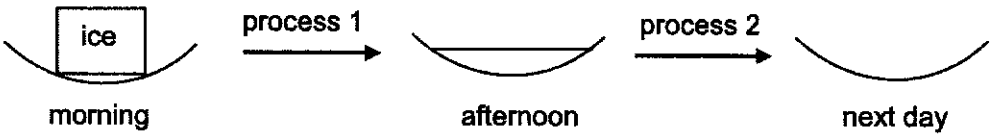
Section A [15 marks]

Answer **all** the questions on the separate Answer Sheet provided.

1 An ice cube was placed on an evaporating dish. The evaporating dish was placed under direct sunlight. The diagrams show the evaporating dish at different times of the day.



What are the names of the processes?

	process 1	process 2
A	melting	boiling
B	melting	evaporation
C	sublimation	boiling
D	sublimation	evaporation

2 What happen to the particles when water evaporates?

A They lose energy to the surroundings.

B They gain energy from the surroundings.

C They move about in fixed positions.

D They move closer together.

3 Which statement describes a compound?

A It contains only two elements chemically combined together.

B It has a fixed composition by mass.

C Its constituents can be separated by physical methods.

D Its properties are similar to those of its constituents.

4 Which list contains mixtures only?

A brass, crude oil and steel

B bronze, iron and nickel

C carbon dioxide, magnesium oxide and seawater

D copper, potassium and zinc

5 Which of the following properties shows that a liquid is pure?

A It boils at an exact temperature.

B It does not react with other chemicals.

C It evaporates completely leaving no residue behind.

D It is colourless and odourless.

6 Which of the following pairs of substances can be separated by heating?

A ammonium chloride and iodine

B chalk and sand

C chalk and sodium chloride

D iodine and sodium chloride

7 The table shows some information about the solubilities of three solids **X**, **Y** and **Z**.

solid	solubility in water	solubility in ethanol
X	insoluble	soluble
Y	soluble	insoluble
Z	insoluble	insoluble

Which of these steps should a student follow to obtain pure **Y** from a mixture of **X**, **Y** and **Z**?

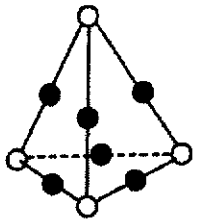
1 Add ethanol
2 Add water
3 Evaporate filtrate
4 Filter

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

8 Tetramethyl lead (T.E.L.) is added to petrol to make the car engine run smoothly. The formula of T.E.L. is $(C_2H_5)_4Pb$.
What is the total number of atoms in one molecule of T.E.L.?

A 11
B 12
C 29
D 30

9 The diagram represents one molecule of a compound.



key
○ = an atom of X
● = an atom of Y

What is the formula of the compound?

A X_2Y_3

B X_3Y_2

C X_4Y_6

D X_6Y_4

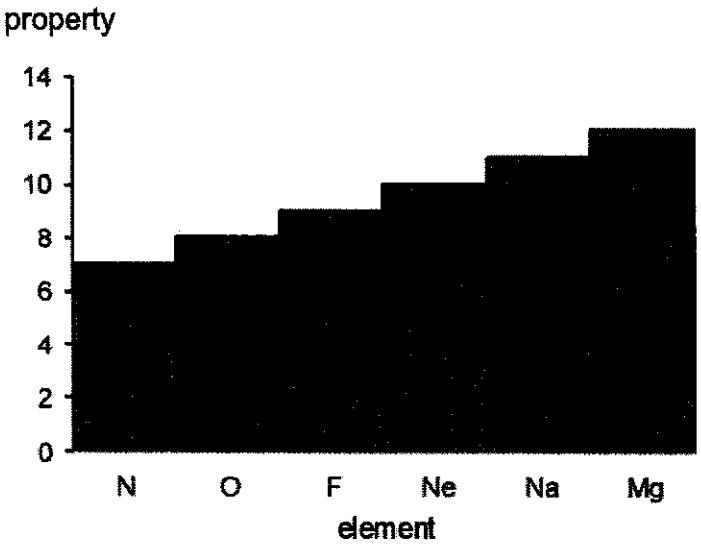
10 What are the relative charges on the proton, neutron and electron?

	proton	neutron	electron
A	-1	0	+1
B	-1	+1	+1
C	+1	0	-1
D	+1	-1	-1

11 Which ion has the correct number of protons, neutrons and electrons?

	ion	number of		
		protons	neutrons	electrons
A	$^{19}_{9}F^-$	10	9	10
B	$^{1}_{1}H^+$	1	0	0
C	$^{24}_{12}Mg^{2+}$	12	12	14
D	$^{32}_{16}S^{2-}$	16	16	16

12 The bar chart shows the change in a property of elements from nitrogen to magnesium.



Which property of these elements is shown on the chart?

A The number of electron shells in an atom of the element.

B The number of electrons used in bonding.

C The number of outer shell electrons in an atom of the element.

D The number of protons in an atom of the element.

13 Element **X** has an electronic structure of 2.8.3.

Element **Y** has an electronic structure of 2.8.6.

What is the formula of the compound formed between **X** and **Y**?

A XY_2

B X_2Y

C X_2Y_3

D X_3Y_2

14 How many electrons are shared in the covalent bonds of an oxygen molecule?

A 2

B 4

C 6

D 8

15 Under which conditions does calcium chloride conduct electricity?

	solid state	molten state	aqueous state
A	√	√	X
B	√	X	X
C	X	√	√
D	X	X	√

Section B [25 marks]
Answer **all** questions in the spaces provided.

1 Name a suitable method to separate the following mixtures.

(a) oxygen from liquid air _____

(b) cooking oil from water _____

(c) pure water from seawater _____ [3]

2 Write down the chemical formulae of the following substances.

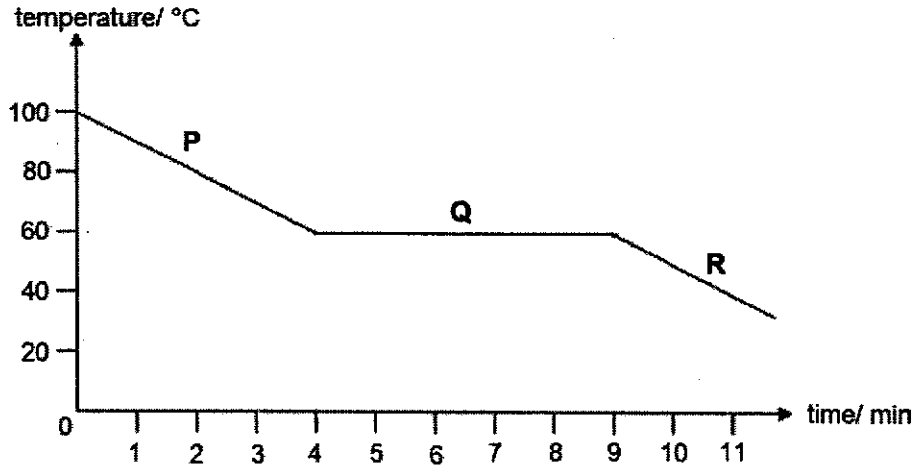
(a) aluminium fluoride _____

(b) zinc oxide _____

(c) copper(II) nitrate _____

(d) silver carbonate _____ [4]

3 The graph below shows the temperature changes when liquid **Y** was cooled.



(a) State the melting point of substance **Y**. _____ [1]

(b) What is/are the physical state(s) of **Y** at 7th minute?

_____ [1]

(c) At which part of the graph (**P**, **Q** or **R**) would there be strongest forces of attraction between the particles of substance **Y**?

_____ [1]

4 The melting and boiling points of five substances **P**, **Q**, **R**, **S** and **T** are shown in the table below.

substance	melting point (°C)	boiling point (°C)
P	-102	-35
Q	-30	70
R	13	48
S	35	346
T	850	1492

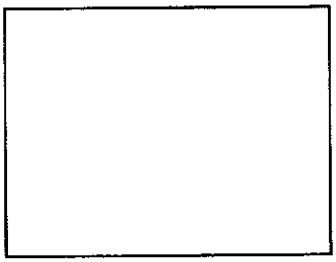
(a) Which substances are liquids at room temperature?

_____ [1]

(b) Which substances are gases at 100 °C?

_____ [1]

(c) Draw the arrangement of particles in substance **T** at 500 °C.



[1]

(d) Describe the **change** in the movement and arrangement of the particles in substance **S** when it is heated from 25 °C to 40 °C.

_____

_____ [2]

5 The drawings in Fig 5.1 represent the particles in six different substances at room temperature and pressure.

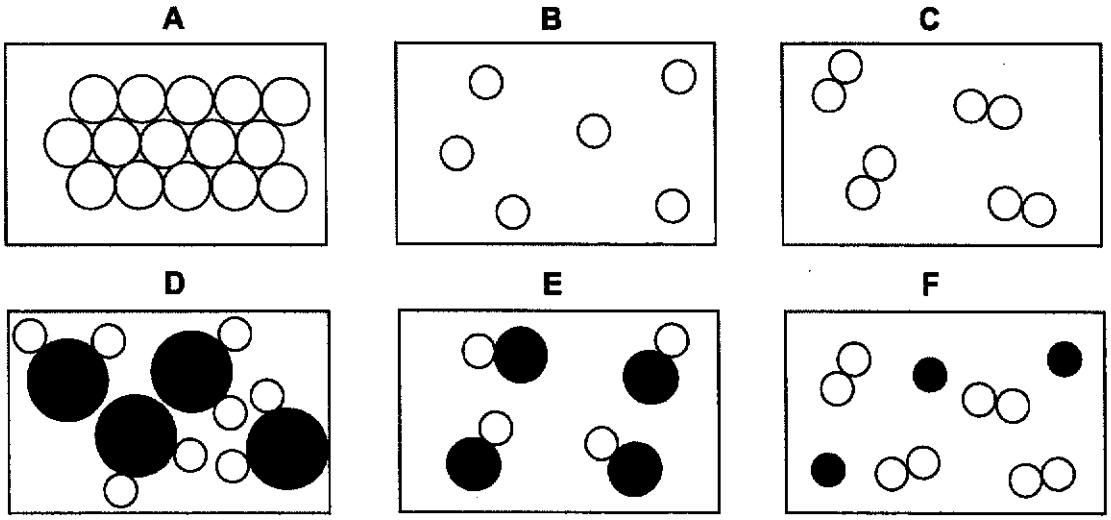


Fig 5.1

Complete the table to show which one of the drawings, **A** to **F**, best represents each of the following substances.

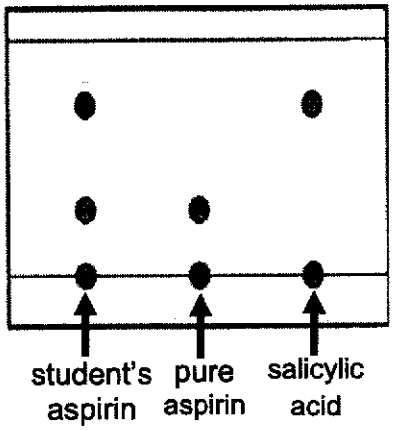
You may use each letter once, more than once or not at all.

substance	a noble gas	iron metal	mixture of two elements	water
diagrams **A** to **F**				

[4]

6 John has a sample of aspirin. He wants to find out if it contains impurities. He uses chromatography to compare his own aspirin with pure samples of aspirin and salicylic acid.

The diagram shows his chromatogram.



(a) Describe, with the help of a labelled diagram, how to set up and carry out the chromatography.

[4]

(b) Based on the chromatogram, is the student's aspirin pure or impure? Explain your answer.

_____

_____ [2]

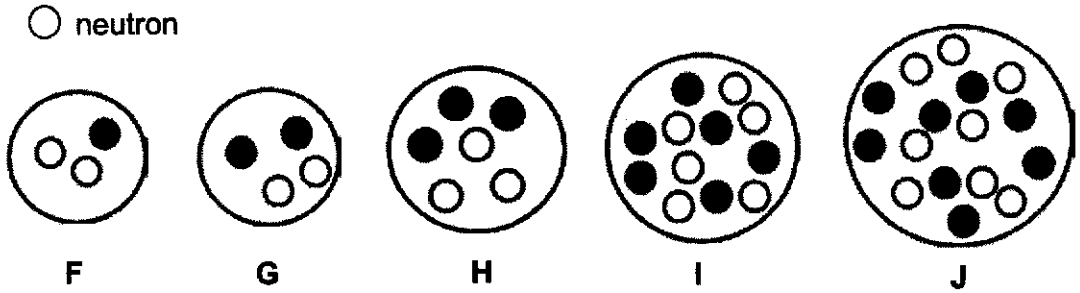
Section C [20 marks]
Answer **all** the questions in the spaces provided.

7 (a) The diagram shows the nuclei of five different atoms, **F**, **G**, **H**, **I** and **J**.

key

● proton

○ neutron



Which of the atoms **F**, **G**, **H**, **I** or **J**

(i) has a stable electronic structure, _____

(ii) has an proton number of six, _____

(iii) has one electron in the outermost shell? _____

(iv) will form an ion with a double negative charge? _____ [4]

(b) Hydrogen, H, deuterium, D and tritium, T are isotopes of one another. The symbol of deuterium, is represented by $^{2}_{1}D$.

(i) State **one** similarity and **one** difference between the atomic structures of hydrogen and deuterium.

_____

_____ [2]

(ii) Tritium has two neutrons. Write in a similar manner as deuterium, the symbol for an atom of tritium.

_____ [1]

(iii) Draw a 'dot and cross' diagram to show the bonding between tritium and chlorine. Show only the outer shell electrons.

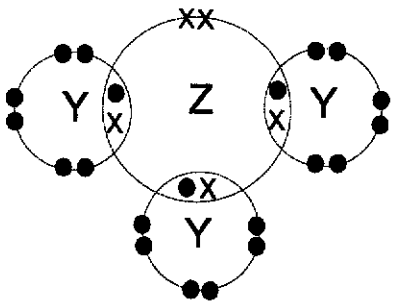
[2]

(c) The relative atomic mass of chlorine is 35.5.
Explain why this is not a whole number.

_____

_____ [1]

8 The diagram shows how the outer shell electrons are arranged in a compound.



(a) Write the formula of this compound. _____ [1]

(b) State two physical properties of this compound.

_____

_____ [2]

(c) Draw a similar diagram to show the arrangement of electrons in a molecule of Y_2. You only need to show the outer shell electrons.

[2]

(d) Element **Y** reacts with sodium to form compound **W**.

(i) Name the type of chemical bonding present in compound **W**.

_____ [1]

(ii) Draw a 'dot and cross' diagram to show the arrangement of electrons in compound **W**. Show only the outer shell electrons.

[2]

(iii) Explain why compound **W** has a high melting point.

_____

_____

_____ [2]

End of Paper

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							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											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 –		

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.).

Marsiling Secondary School
Marking Scheme

Mid-Year Examination 2019

Setter	Mrs Tay-Pang Xiu Hui		
Subject	Science (Chemistry)	Paper No.	5076
Level	Secondary 3	Stream	Express

Section A [15 marks]

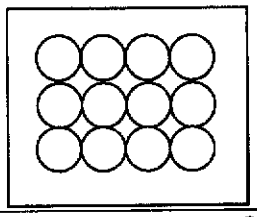
1	**B**	2	**B**	3	**B**	4	**A**	5	**A**
6	**D**	7	**B**	8	**C**	9	**C**	10	**C**
11	**B**	12	**D**	13	**C**	14	**B**	15	**C**

Section B [25 marks]

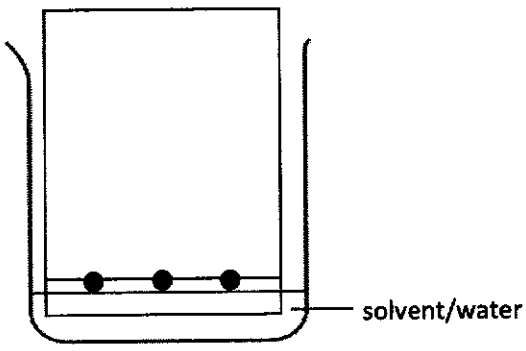
1	a	Fractional distillation	[1]
	b	Separating funnel	[1]
	c	Simple distillation	[1]
			Total: [3]

2	a	AlF_3	[1]
	b	ZnO	[1]
	c	$Cu(NO_3)_2$	[1]
	d	Ag_2CO_3	[1]
			Total: [4]

3	a	60 °C *deduct 1m for no or wrong units*	[1]
	b	solid and liquid	[1]
	c	**R**	[1]
			Total: [3]

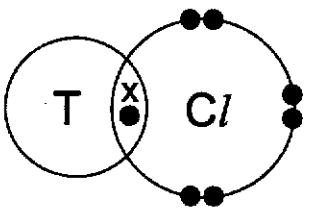
4	a	**Q** and **R**	[1]
	b	**P, Q** and **R**	[1]
	c		[1]
	d	The particles move **faster** or **from vibrates in its fixed position to sliding over one another** and; become **less orderly/ breaks free from fixed position.** [Must use comparative terms] Not: The arrangement of the particles change from closely packed in a disorderly arrangement to far apart in a random arrangement.	[1] [1]
			Total: [5]

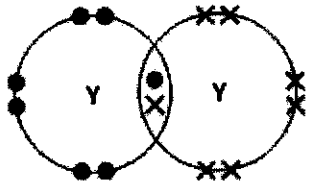
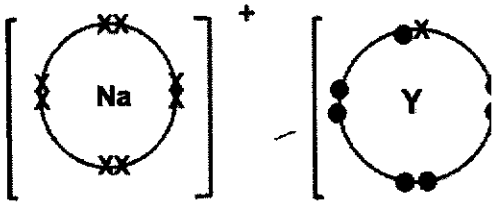
5	substance	a noble gas	iron metal	mixture of two elements	water	[4]
	diagram **A** to **F**	**B**	**A**	**F**	**D**	
	Each correct answer [1]					
						Total: [4]

6	a	<u>Diagram</u>  [1] for correct labelled diagram (Draw solvent level below start line)	[4]

		Steps for chromatography • Draw starting line with a pencil [1] • Solvent level to be below pencil line [1] • A small spot of each of the substances to be placed on the starting line. [1] • Chromatography paper is dipped into a suitable solvent • Stop chromatography when solvent stops travelling up the paper	
	b	Impure [1]. It consists of aspirin and **salicylic acid**. [1]	[2]
			Total: [6]

Section C [20 marks]

7	a	i	**G**	[1]
		ii	**I**	[1]
		iii	**H**	[1]
		iv	**J**	[1]
	b	i	Both have **1 proton / 1 electron**. *(Not accepted: same number of protons)* Deuterium has **1 more neutron** than hydrogen. *(Not accepted: different number of neutrons)*	[1] [1]
		ii	$^{3}_{1}T$	[1]
		iii	 [1]: correct number of shared electrons [1]: correct number of valence electrons	[2]
	c		The mass number of chlorine is the **average mass** of the two **isotopes** of chlorine, chlorine-35 and chlorine-37, which exists in the ratio 3:1.	[1]
				Total: [10]

8	a		ZY_3	[1]
	b		Low melting and boiling points; Cannot conduct electricity in any states; Insoluble in water, soluble in organic solvents; *(Any two)*	[1] [1]
	c		 [1]: correct number of shared electrons [1]: correct number of valence electrons	[2]
	d	i	Ionic bonds	[1]
	d	ii	 [1]: correct sodium ion [1]: correct ion of **Y**	[2]
	d	iii	It has **strong ionic bonds/ electrostatic forces of attraction** between the ions; **Large amount of energy** is required to break the bond/ overcome the electrostatic forces of attraction.	[1] [1]
				Total: [10]