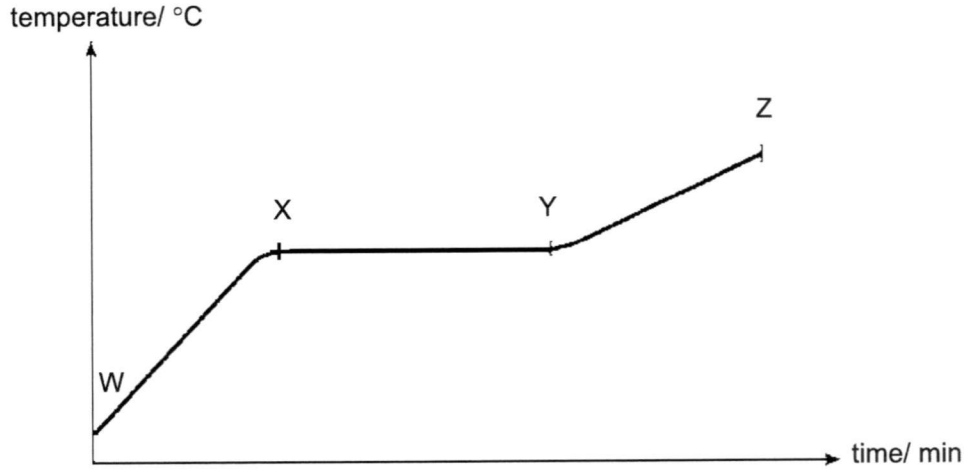
Name: _____ ( ) Class: _____

Section A [10 marks]

Answer **all** questions in this section.
Write your answers in the boxes provided on page 5.

1 The diagram shows the heating curve of ethanol.



What are the states of ethanol at each region?

	WX	XY	YZ
A	liquid	liquid and gas	gas
B	solid	liquid	gas
C	solid	solid and liquid	liquid
D	solid and liquid	liquid	liquid and gas

2 The measured value on a mercury thermometer is 26.0.

What is the temperature in S.I. unit?

A –247.0 K
B 26.0 °C
C 26.0 K
D 299.0 K

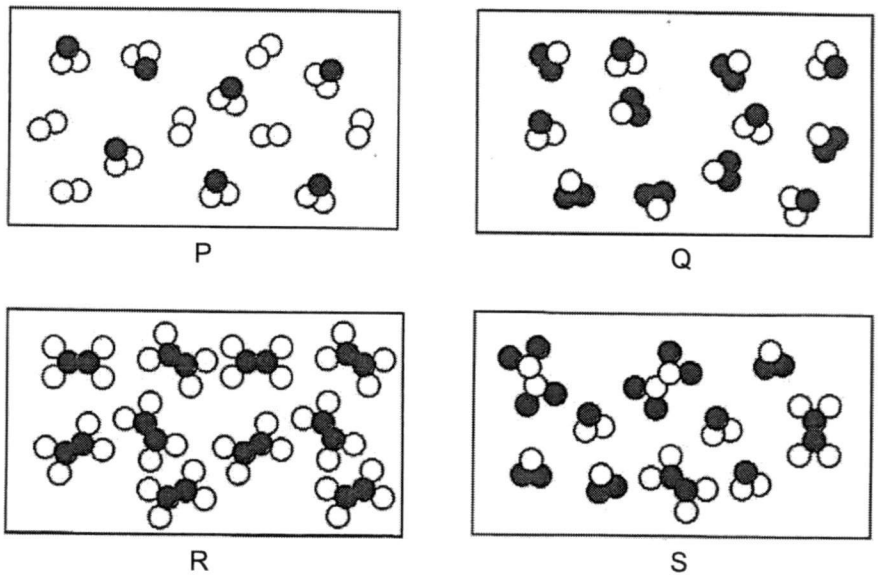
3 Which is **not** part of a simple distillation set-up?

A condenser
B fractionating column
C receiver
D thermometer

4 Which technique should be used to determine if a particular food colouring is pure?

A crystallisation
B evaporation to dryness
C magnetic attraction
D paper chromatography

5 The diagram shows the molecules in four different substances P, Q, R and S.



Which substances are a mixture of compounds?

A P and Q
B Q and S
C R and S
D P, Q and S

6 What can be deduced from the symbols of these two atoms $^{31}_{15}P$ and $^{32}_{16}S$?

A They have the same nucleon number.
B They have the same number of electrons.
C They have the same number of neutrons.
D They have the same number of protons.

7 Element X has an electronic structure of 2,8,8,2. Element Y has an electronic structure of 2,7.

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

A XY
B XY_2
C X_2Y
D X_2Y_2

8 Which electronic configuration is that of a gas normally used to fill light bulbs?

A 2
B 2.6
C 2.8.2
D 2.8.8

9 A newly discovered element, Katonium (Kc), is placed in Group II of the Periodic Table.

Which is the chemical formula of its sulfate?

A $KcSO_4$
B $Kc(SO_4)_2$
C Kc_2SO_4
D $Kc_2(SO_4)_2$

10 Why are sodium and chlorine in the same period of the Periodic Table?

A Sodium and chlorine combine together to form a compound of formula NaCl.
B Sodium is a reactive metal and chlorine is a reactive non-metal.
C The atoms of both elements have eight electrons in their second electron shell.
D The atoms of both elements have only three electron shells containing electrons.

Section B [20 marks]
Answer **all** questions in this section.
Write your answers in the spaces provided.

11 Ammonium chloride reacts with sodium hydroxide, an alkali, to form sodium chloride, water and ammonia gas.

(a) 31.05 cm^3 of ammonium chloride is added to exactly 25.0 cm^3 of sodium hydroxide to obtain a neutral solution.

Name a suitable apparatus to measure the volume of the following reagents.

(i) 31.05 cm^3 ammonium chloride

..... [1]

(ii) 25.0 cm^3 sodium hydroxide

..... [1]

(b) Ammonia gas produced from the reaction can be collected using the upward delivery method.

(i) Explain why ammonia gas can be collected using this method.

.....

..... [1]

(ii) Suggest an alternative method for the collection of ammonia gas.

..... [1]

[Total: 4]

12 Table 12.1 shows the properties of five elements A to E.

Table 12.1

element	melting point/ °C	boiling point/ °C	electrical conductivity at room temperature
A	-35	-101	low
B	-39	357	high
C	113	445	low
D	1414	3265	moderate
E	1536	2861	high

(a) State the element(s) which is/ are metal.

..... [1]

(b) State the element(s) which is/ are metalloid.

..... [1]

(c) State the element(s) which is/ are non-metal.

..... [1]

[Total: 3]

13 Fig. 13.1 gives some information on substances F and G.

Substance F	**Substance G**
Substance F is a blue liquid. A green solid dissolves in water to form a blue liquid F with no temperature change.	Substance G is a white solid. When substance G is heated, a white solid is obtained and the gas produced forms a white precipitate in limewater.

Fig. 13.1

(a) Put a tick (✓) to indicate if substances F and G are an element, a compound or a mixture.

	element	compound	mixture
substance F			
substance G			

[2]

(b) State one difference between a compound and a mixture.

.....

..... [1]

[Total: 3]

14 **(a)** Complete the table.

	number of protons	number of electrons	number of neutrons
$^{18}_{8}O$			
$^{18}_{8}O^{2-}$			

[2]

(b) Predict the type of bonding present when $^{18}_{8}O$ atoms combine together to form molecules.

..... [1]

[Total: 3]

15 Balance the following equations by writing the appropriate coefficient in the blanks provided.

(a) _____ H_2SO_4 + _____ KOH → _____ K_2SO_4 + _____ H_2O [1]

(b) _____ Cl_2 + _____ KBr → _____ KCl + _____ Br_2 [1]

[Total: 2]

16 Part of a Periodic Table is shown in Fig. 16.1 with some of the elements represented by letters. The letters are **NOT** symbols of the elements.

	I	II										III	IV	V	VI	VII	0
1							J										H
2													F	G		K	
3	P	R										E			I	L	N
4	Q					D										M	

Fig. 16.1

(a) Write the letter representing the element that is chemically inert.

..... [1]

(b) The element Q belongs to a group called alkali metals.

State two physical properties of element Q.

1.....

2..... [2]

(c) State one similarity and one difference between the electronic configuration of elements K and L.

similarity .....

.....

difference.....

..... [2]

[Total: 5]

Name: _____ ( ) Class: _____

Section C [20 marks]
Answer **all** questions in this section.
Write your answers in the spaces provided.

17 Copper(II) oxide is formed from the reaction between copper and oxygen.

(a) The melting and boiling points of oxygen are –219 °C and –183 °C respectively.

(i) State the physical state of oxygen at –240 °C.

..... [1]

(ii) Describe the changes to the movement of oxygen particles when cooled from –225 °C to –240 °C.

.....

..... [1]

(iii) Describe the changes to the arrangement and movement of oxygen particles when it is heated from –200 °C to –150 °C.

.....

.....

.....

.....

.....

..... [3]

17 (b) An excess of copper(II) oxide solid is reacted with dilute sulfuric acid at room temperature to form copper(II) sulfate and hydrogen gas.

A student wants to obtain a sample of pure copper(II) sulfate solid from the reaction between copper(II) oxide and dilute sulfuric acid.

She is only able to come up with three out of six steps in the following experimental procedure.

step	experimental procedure
1	Separate copper(II) sulfate solution from a mixture of copper(II) oxide solid and copper(II) sulfate solution.
2	?
3	?
4	?
5	Wash pure copper(II) sulfate solid with cold distilled water.
6	Dry pure copper(II) sulfate solid between pieces of filter paper.

(i) Describe the appearance of pure copper(II) sulfate solid.

..... [1]

(ii) Name the separation technique used in step 1.

..... [1]

(iii) Describe how pure copper(II) sulfate solid can be obtained from copper(II) sulfate solution in steps 2, 3 and 4.

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

18 Calcium fluoride is used to manufacture windows and lenses, while fluorine is used in making toothpaste.

(a) Draw a 'dot and cross' diagram to show the arrangement of electrons in calcium fluoride in the space below.

[2]

(b) Draw a 'dot and cross' diagram to show the arrangement of electrons in fluorine in the space below.

[2]

18 **(c)** Explain why

(i) calcium fluoride has a higher melting point than fluorine.

.....

.....

.....

.....

.....

..... [3]

(ii) fluorine does not conduct electricity in any state.

.....

..... [1]

(d) Fluorine exists as fluorine-18 and fluorine-19.

(i) What is the name given to atoms such as fluorine-18 and fluorine-19?

.....

..... [1]

(ii) With reference to the atomic structure, state the difference between fluorine-18 and fluorine-19.

.....

..... [1]

[Total: 10]

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.).

3E Sci(Chemistry) MYE Answer Scheme 2017

1	2	3	4	5	6	7	8	9	10
A	D	B	D	B	C	B	D	A	D

<table>
<tr><th>Qn</th><th>Answer</th><th>Marks/remarks</th></tr>
<tr><td>11</td><td>(a) (i) Burette

(ii) Pipette (A: burette)

(b) (i) Ammonia is less dense than air.

(ii) Ammonia gas can be collected using a gas syringe.</td><td>[1]

[1]

[1]

[1]</td></tr>
<tr><td>12</td><td>
<table>
<tr><th>element</th><th>melting point/ °C</th><th>boiling point/ °C</th><th>electrical conductivity at room temperature</th><th>identity</th></tr>
<tr><td>A</td><td>-35</td><td>-101</td><td>low</td><td>chlorine</td></tr>
<tr><td>B</td><td>-39</td><td>357</td><td>high</td><td>mercury</td></tr>
<tr><td>C</td><td>113</td><td>445</td><td>low</td><td>sulfur</td></tr>
<tr><td>D</td><td>1414</td><td>3265</td><td>moderate</td><td>silicon</td></tr>
<tr><td>E</td><td>1536</td><td>2861</td><td>high</td><td>iron</td></tr>
</table>
(a) Elements B and E

(b) Element D

(c) Elements A and C</td><td>

[1] – both to get 1 m, no 0.5
[1]

[1] – both to get 1 m, no 0.5</td></tr>
<tr><td>13</td><td>(a)
<table>
<tr><th></th><th>element</th><th>compound</th><th>mixture</th></tr>
<tr><td>substance F</td><td></td><td></td><td>✓</td></tr>
<tr><td>substance G</td><td></td><td>✓</td><td></td></tr>
</table>
(b) A compound is broken down by chemical processes but a mixture is separated by physical processes./
The chemical properties of a compound are different from its constituent elements but the chemical properties of a mixture are the same as its components./
A chemical reaction takes place when a compound is formed but does not take place when a mixture is formed./
There is an energy change when a compound is formed but there is no energy change when a mixture is formed./
The elements in a compound are always bonded in a fixed proportion but the components in a mixture can be mixed in any proportion./
A compound has a fixed boiling/melting point but a mixture has a range of boiling/melting points.</td><td>

[1]
[1]

[1]
any one</td></tr>
</table>

<table>
<tr><td>14</td><td>(a)
<table>
<tr><th></th><th>number of protons</th><th>number of electrons</th><th>number of neutrons</th></tr>
<tr><td>$^{18}_{8}O$</td><td>8</td><td>8</td><td>10</td></tr>
<tr><td>$^{18}_{8}O^{2-}$</td><td>8</td><td>10</td><td>10</td></tr>
</table>
(b) Covalent bonding</td><td>Each correct line [1]

Max [2]

[1]</td></tr>
<tr><td>15</td><td>(a) $H_2SO_4 + 2\,KOH \rightarrow K_2SO_4 + 2\,H_2O$
(b) $Cl_2 + 2\,KBr \rightarrow 2\,KCl + Br_2$
(A: if students put '1' instead of leaving blank)</td><td>[1]
[1]</td></tr>
<tr><td>16</td><td>(a) H or N
(b) Floats on water, low density, low melting and boiling points
(c) Similarity: K and L have 7 valence electrons
Difference: K has 2 electron shells, L has 3 electron shells</td><td>[1]
Any 2 [2]
[1]
[1]</td></tr>
<tr><td>17</td><td>(a) (i) Solid state

(ii) The particles lose kinetic energy and <u>vibrate less vigorously</u>.

(iii) At -200 °C, the particles are <u>closely packed in a disorderly manner</u> and they <u>move freely by sliding over one another</u>.
When <u>heated</u>, the particles <u>gain kinetic energy</u> and move faster.
<u>At -183 °C</u>, the particles <u>overcome the forces of attraction</u> and move further apart to become a gas.
At -150 °C, the particles are <u>very far apart in a disorderly manner</u> and they <u>move randomly at high speeds in all directions</u>.

(b) (i) They appear as blue crystals.

(ii) Filtration

(iii) <u>Heat</u> the salt solution to obtain a <u>saturated solution</u>.
Leave the saturated solution to <u>cool</u> and crystals will form.
<u>Filter</u> to collect the crystals. The <u>crystals will be in the residue</u> and the <u>salt solution will be the filtrate</u>.</td><td>[1]

[1]

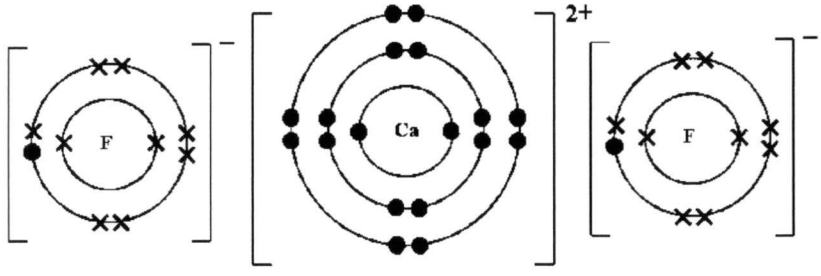
[1]

[1]

[1]

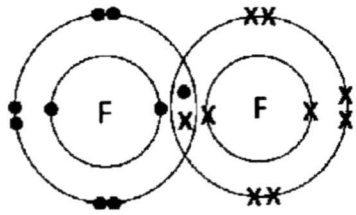
[1]

[1]

[1]
[1]
[1]</td></tr>
<tr><td>18</td><td>(a)
 

Key: • – electron from calcium
x– electron from fluorine</td><td>[1] correctly drawn Ca^{2+}
[1] correctly drawn F^-

Minus 1 mark for key if incorrectly drawn</td></tr>
</table>

	(b)  Key: • – electron from one fluorine atom x– electron from the other fluorine atom	[1] one pair of shared electrons [1] other electrons drawn correctly Minus 1 mark for key if incorrectly drawn
	(c) (i) A lot of energy is required to overcome the strong electrostatic forces of attraction between the oppositely charged ions in calcium fluoride. Less energy is required to overcome the weak intermolecular forces of attraction between the fluorine molecules. Thus, calcium fluoride has a higher melting point than fluorine.	[1] [1] comparison [1]
	(ii) All the electrons are used up for bonding in fluorine and there are no free moving electrons, so fluorine does not conduct electricity in any state.	[1]
	(d) (i) Isotopes	[1]
	(ii) Fluorine-18 has 9 neutrons while fluorine-19 has 10 neutrons.	[1]