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Name: _____ ()

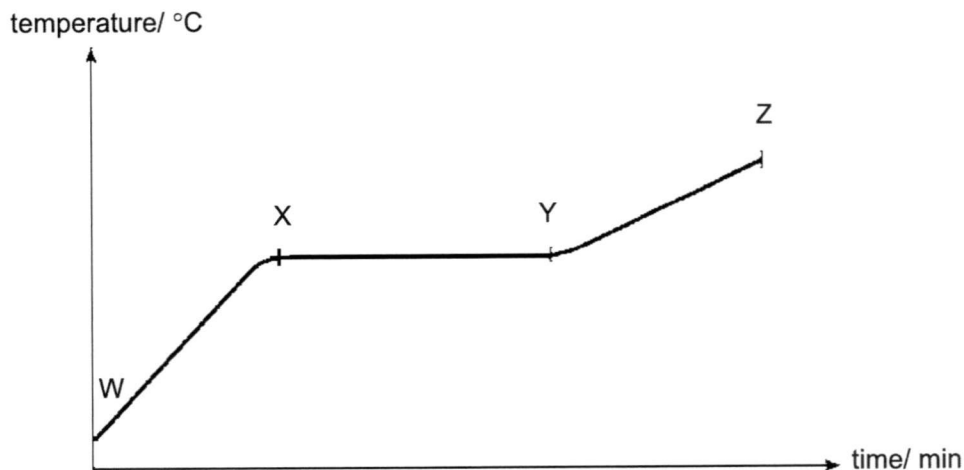
Class: _____

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.

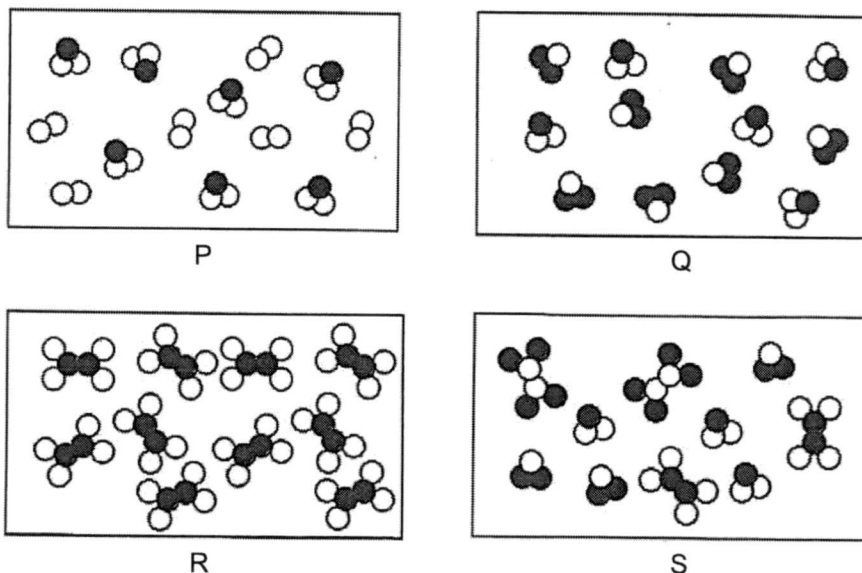
What is the temperature in S.I. unit?

- 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 $^{31}_{15}\text{P}$ and $^{32}_{16}\text{S}$?
- 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 XY₂
- C X₂Y
- D X₂Y₂

-
- 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** $\text{Kc}(\text{SO}_4)_2$
 - C** Kc_2SO_4
 - D** $\text{Kc}_2(\text{SO}_4)_2$
- 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 cm³ of ammonium chloride is added to exactly 25.0 cm³ of sodium hydroxide to obtain a neutral solution.

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

(i) 31.05 cm³ ammonium chloride
..... [1]

(ii) 25.0 cm³ 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.

<p style="text-align: center;">Substance F</p> <p>Substance F is a blue liquid.</p> <p>A green solid dissolves in water to form a blue liquid F with no temperature change.</p>	<p style="text-align: center;">Substance G</p> <p>Substance G is a white solid.</p> <p>When substance G is heated, a white solid is obtained and the gas produced forms a white precipitate in limewater.</p>
--	--

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
$^{18}_8\text{O}$			
$^{18}_8\text{O}^{2-}$			

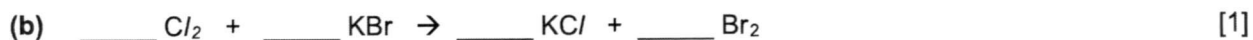
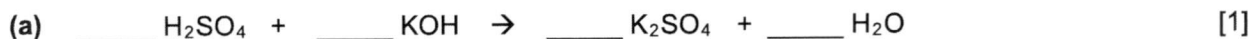
[2]

(b) Predict the type of bonding present when $^{18}_8\text{O}$ atoms combine together to form molecules.

..... [1]

[Total: 3]

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



[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																		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 $-219\text{ }^{\circ}\text{C}$ and $-183\text{ }^{\circ}\text{C}$ respectively.

(i) State the physical state of oxygen at $-240\text{ }^{\circ}\text{C}$.

..... [1]

(ii) Describe the changes to the movement of oxygen particles when cooled from $-225\text{ }^{\circ}\text{C}$ to $-240\text{ }^{\circ}\text{C}$.

.....
..... [1]

(iii) Describe the changes to the arrangement and movement of oxygen particles when it is heated from $-200\text{ }^{\circ}\text{C}$ to $-150\text{ }^{\circ}\text{C}$.

.....
.....
.....
.....
.....
..... [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

I		Group										VII		U																																																																																																																								
II		III										IV		V		VI		VII		U																																																																																																																		
3 L lithium 7	4 Be beryllium 9	11 B boron	12 C carbon	13 Al aluminium	14 Si silicon	15 P phosphorus	16 S sulfur	17 Cl chlorine	18 Ar argon	19 K potassium	20 Ca calcium	21 Sc scandium	22 Ti titanium	23 V vanadium	24 Cr chromium	25 Mn manganese	26 Fe iron	27 Co cobalt	28 Ni nickel	29 Cu copper	30 Zn zinc	31 Ga gallium	32 Ge germanium	33 As arsenic	34 Se selenium	35 Br bromine	36 Kr krypton	37 Rb rubidium	38 Sr strontium	39 Y yttrium	40 Zr zirconium	41 Nb niobium	42 Mo molybdenum	43 Tc technetium	44 Ru ruthenium	45 Rh rhodium	46 Pd palladium	47 Ag silver	48 Cd cadmium	49 In indium	50 Sn tin	51 Sb antimony	52 Te tellurium	53 I iodine	54 Xe xenon	55 Cs cesium	56 Ba barium	57-71 lanthanoids	72 Hf hafnium	73 Ta tantalum	74 W tungsten	75 Re rhenium	76 Os osmium	77 Ir iridium	78 Pt platinum	79 Au gold	80 Hg mercury	81 Tl thallium	82 Pb lead	83 Bi bismuth	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 Lv livermorium	116 Ts tennessine	117 Og oganesson	118 Uu unbinilium	119 Uue ununennium	120 Uuo unbinilium	121 Uuq ununseptium	122 Uuq ununseptium	123 Uuq ununseptium	124 Uuq ununseptium	125 Uuq ununseptium	126 Uuq ununseptium	127 Uuq ununseptium	128 Uuq ununseptium	129 Uuq ununseptium	130 Uuq ununseptium	131 Uuq ununseptium	132 Uuq ununseptium	133 Uuq ununseptium	134 Uuq ununseptium	135 Uuq ununseptium	136 Uuq ununseptium	137 Uuq ununseptium	138 Uuq ununseptium	139 Uuq ununseptium	140 Uuq ununseptium	141 Uuq ununseptium	142 Uuq ununseptium	143 Uuq ununseptium	144 Uuq ununseptium	145 Uuq ununseptium	146 Uuq ununseptium	147 Uuq ununseptium	148 Uuq ununseptium	149 Uuq ununseptium	150 Uuq ununseptium	151 Uuq ununseptium	152 Uuq ununseptium	153 Uuq ununseptium	154 Uuq ununseptium	155 Uuq ununseptium	156 Uuq ununseptium	157 Uuq ununseptium	158 Uuq ununseptium	159 Uuq ununseptium	160 Uuq ununseptium	161 Uuq ununseptium	162 Uuq ununseptium	163 Uuq ununseptium	164 Uuq ununseptium	165 Uuq ununseptium	166 Uuq ununseptium	167 Uuq ununseptium	168 Uuq ununseptium	169 Uuq ununseptium	170 Uuq ununseptium	171 Uuq ununseptium

Key
 proton (atomic) number
 atomic symbol
 name
 relative atomic mass

1 H hydrogen 1

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 158	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
88 Ac actinium	89 Th thorium 232	90 Pa protactinium 231	91 U uranium 238	92 Np neptunium	93 Pu plutonium	94 Am americium	95 Cm curium	96 Bk berkelium	97 Cf californium	98 Es einsteinium	99 Fm fermium	100 Md mendelevium	101 No nobelium	102 Lr lawrencium

lanthanoids

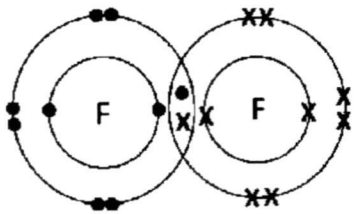
actinoids

The volume of one mole of any gas is 24 dm³ 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

Qn	Answer	Marks/remarks																														
11	(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.	[1] [1] [1] [1]																														
12	<table border="1" style="width: 100%; text-align: center;"> <thead> <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> </thead> <tbody> <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> </tbody> </table> (a) Elements B and E (b) Element D (c) Elements A and C	element	melting point/ °C	boiling point/ °C	electrical conductivity at room temperature	identity	A	-35	-101	low	chlorine	B	-39	357	high	mercury	C	113	445	low	sulfur	D	1414	3265	moderate	silicon	E	1536	2861	high	iron	[1] – both to get 1 m, no 0.5 [1] [1] – both to get 1 m, no 0.5
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13	(a) <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>element</th> <th>compound</th> <th>mixture</th> </tr> </thead> <tbody> <tr> <td>substance F</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>substance G</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </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.		element	compound	mixture	substance F			✓	substance G		✓		[1] [1] [1] any one																		
	element	compound	mixture																													
substance F			✓																													
substance G		✓																														

<p>(b)</p>  <p>Key: • – electron from one fluorine atom x – electron from the other fluorine atom</p> <p>(c) (i) A lot of energy is required to overcome the <u>strong electrostatic forces of attraction between the oppositely charged ions</u> in calcium fluoride. <u>Less energy</u> is required to overcome the <u>weak intermolecular forces of attraction between the fluorine molecules</u>. Thus, calcium fluoride has a higher melting point than fluorine.</p> <p>(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.</p> <p>(d) (i) Isotopes</p> <p>(ii) Fluorine-18 has 9 neutrons while fluorine-19 has 10 neutrons.</p>	<p>[1] one pair of shared electrons [1] other electrons drawn correctly</p> <p>Minus 1 mark for key if incorrectly drawn</p> <p>[1]</p> <p>[1] comparison [1]</p> <p>[1]</p> <p>[1]</p>
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