Name: .... (   )

ASSUMPTION ENGLISH SCHOOL
MID-YEAR EXAMINATION 2017

SCIENCE (CHEMISTRY)
5076

LEVEL:	Sec 3 Express	**DATE :**	4 May 2017
CLASS:	Sec 3/1	**DURATION :**	1 hour 15 minutes

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page and on the OAS paper. **Shade your index number on the OAS paper.** This paper consists of 3 sections.

SECTION A (20 marks)
MULTIPLE CHOICE QUESTIONS
There are 20 questions in this paper. Answer all questions. For each question, there are four possible answers A, B, C and D. Choose the correct answer and record your choice in soft or 2B pencil on the OAS paper provided. **DO NOT fold or bend the OAS paper.**

SECTION B (30 marks)
SHORT-STRUCTURED QUESTIONS
Answer **all** questions. Write your answers in the spaces provided on the question paper.

SECTION C (20 marks)
LONG-STRUCTURED QUESTIONS
Answer any **two** out of the three questions in the spaces provided on the question paper.

For Examiner's use:	
Section A	/ 20
Section B	/ 30
Section C	/ 20
Total	**/ 70**

A copy of the periodic table is printed on the last page.
At the end of the examination, hand in your OAS paper and Question Papers separately.

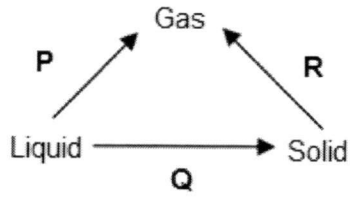
This question paper consists of 21 printed pages including this page.

[Turn over

SECTION A: MULTIPLE CHOICE QUESTIONS [20 MARKS]

There are 20 questions in this section. Answer **ALL** questions. Choose the correct answer and record your choice on the OAS paper provided.

1 The diagram below shows the different processes that a substance undergoes.



Which statement about processes **P**, **Q**, and **R** are correct?

A During process **P**, the particles move slower and closer together.

B During processes **P** and **Q**, the energy of the particles increases.

C During process **Q**, the separation between the particles decreases.

D During process **R**, the attractive forces between the particles increases.

2 The table shows the melting and boiling points of four pure substances.

At room temperature, which substance is a liquid and rapidly evaporates if left exposed to air?

substance	melting point / °C	boiling point / °C
A	−100	−35
B	−7	58
C	−6	225
D	44	280

3 In an experiment involving the addition of hydrochloric acid to aqueous sodium hydroxide, heat is given off. Which piece of apparatus could be used to determine if the reaction is complete?

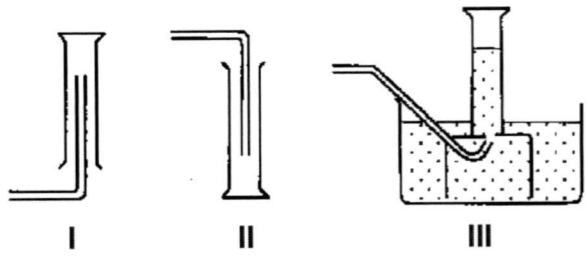
A balance

B gas syringe

C stop watch

D thermometer

4 The diagrams show three methods that are used to collect gases.



The solubility of the gases are given below.

gas	solubility in water
O_2	insoluble
H_2	insoluble
Cl_2	soluble

What is the best method for collecting each gas?

	O_2	H_2	Cl_2
A	**I**	**I**	**III**
B	**II**	**III**	**III**
C	**III**	**I**	**II**
D	**III**	**III**	**I**

5 A liquid boils at a temperature of 100°C.

Which other property of the liquid proves that it is pure water?

A It does not leave a residue when boiled.

B It freezes at 0°C.

C It is colourless and odourless.

D It is neutral.

6 Potassium nitrate crystals, a soluble salt, can be separated from sand using the four processes shown below. Which order of processes is correct?

A filter → dissolve → evaporate → crystallise

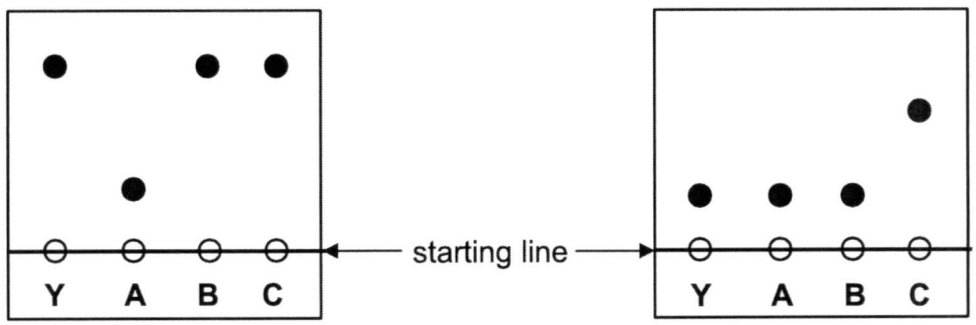
B dissolve → evaporate → crystallise → filter

C dissolve → evaporate → filter → crystallise

D dissolve → filter → evaporate → crystallise

7 It was suspected that an illegal drug **Y** contained one or more of three poisonous compounds, **A**, **B**, or **C**.

Spots of each poisonous compound were put on the starting line of two separate chromatograms. The chromatograms were developed with two solvents, methylated spirit and water respectively. The results are shown below.



methylated spirit water

From these chromatograms, we can deduce that drug **Y** contains .....

A compound **A** only

B compound **B** only

C compound **C** only

D compounds **B** and **C** only

8 Which set contains an element, a compound and a mixture?

A air, seawater, chlorine

B carbon dioxide, nitrogen, sodium

C nitrogen, silver chloride, seawater

D sodium chloride, sugar, zinc sulfate

9 The table below contains descriptions of 4 different substances **W**, **X**, **Y** and **Z**.

substance	description
W	a solid which melts on heating to a yellow liquid that cannot be made into simpler substance.
X	blue solid turns white upon heating, with water vapour collected at the mouth of the test tube
Y	a white solid that can be separated into two different substances by adding water and filtering
Z	a colourless substance with a fixed melting point and a fixed boiling point

What is the correct classification of the four substances?

	element	compound	mixture	either an element or compound
A	**W**	**X**	**Y**	**Z**
B	**W**	**Y**	**X**	**Z**
C	**Z**	**X**	**Y**	**W**
D	**Z**	**Y**	**W**	**X**

10 How many types of elements are there in $(NH_4)_3PO_4$?

A 3

B 4

C 12

D 20

11 Which option shows the correct relative masses of a proton, neutron and electron?

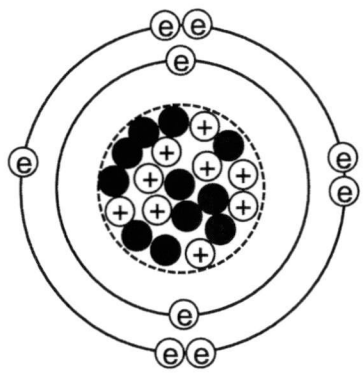
	proton	neutron	electron
A	1	1	1
B	1	$\frac{1}{1840}$	1
C	1	1	$\frac{1}{1840}$
D	$\frac{1}{1840}$	1	1

12 Which two molecules have the same number of protons?

I CH_4 II N_2
III NH_3 IV O_2

A I and III **B** I and IV
C II and III **D** II and IV

13 The diagram represents an atom of element, **Y**.



Which atom is represented by the diagram above?

A $^{20}_{9}F$

B $^{20}_{9}Ne$

C $^{19}_{9}F$

D $^{20}_{10}Ne$

14 In which set does each of the three particles have the same total number of electrons?

A Li^+, Na^+, K^+

B K^+, Ca^{2+}, Br^-

C F^-, Ne, Na^+

D Cl^-, Br^-, I^-

15 Element **X** has n protons and forms ions with a charge of 2−. Element **Y** has (n+3) protons.

What is the correct structure and formula of a compound formed between elements **X** and **Y**?

A a covalent compound $\mathbf{YX_2}$

B a covalent compound $\mathbf{Y_2X}$

C an ionic compound $\mathbf{YX_2}$

D an ionic compound $\mathbf{Y_2X}$

16 Element **P** has an electronic configuration (2, 8, 6). It is able to form compounds with a number of different elements.

The following compounds can be formed **except** .....

A $\mathbf{CP_2}$

B $\mathbf{Li_2P}$

C $\mathbf{MgP_2}$

D $\mathbf{PF_2}$

17 Which statement correctly describes sodium chloride?

A A sodium ion is only bonded to one chloride ion which it donated its outermost electron to.

B A sodium atom with one outermost electron forms a single covalent bond with one chlorine atom, producing a sodium chloride molecule.

C The attraction between oppositely charged sodium and chloride ions results in the charges being neutralised, forming neutral molecules.

D The sodium chloride lattice consists of sodium ions and chloride ions, in which the total number of sodium ions is equal to the total number of chloride ions.

18 Some magnesium metal is burnt in a 150 cm^3 sample of air to form magnesium oxide. What is the final volume of air left in the sample?

A 30 cm^3

B 31.5 cm^3

C 118.5 cm^3

D 120 cm^3

19 Which statements about the pollutant carbon monoxide are correct?

1 It is a colourless, odourless gas.
2 It is formed by incomplete combustion of fuel.
3 It reacts with haemoglobin in the blood.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

20 The following gases are present in car exhaust fumes.

- carbon dioxide
- carbon monoxide
- nitrogen
- nitrogen dioxide
- water vapour

Which of these gas(es) is / are also present in unpolluted air?

A Nitrogen only

B Nitrogen and water vapour only

C Nitrogen, carbon dioxide and water vapour only

D Nitrogen, carbon monoxide, carbon dioxide and water vapour only

SECTION B: SHORT-STRUCTURED QUESTIONS [30 MARKS]

Answer **all** the questions in the spaces provided.

1 The diagram shows the outline of part of the Periodic Table.

Use the symbols from the table to answer the following questions.

(a) Which element has a stable electronic configuration?

..... [1]

(b) Which two elements can combine to form an ionic compound? Give the formula of the compound formed.

..... [2]

(c) Suggest one element that can form covalent bonds.

..... [1]

(d) Suggest any **two** elements that have the same number of electron shells.

..... [1]

(e) State one element that can conduct electricity.

..... [1]

2 The following information was found on a bottle of milk.

	mass per serving / g
Proteins	10.0
Fats	4.5
Carbohydrates	3.0
Calcium	0.5

(a) Based on the information given, would you expect the milk to boil at a fixed temperature? Explain your answer.

.....

..... [1]

(b) **(i)** Identify an element on the milk label.

..... [1]

(ii) Draw the electronic structure of the atom of the element identified in **(i)**. Show all the electrons clearly.

[1]

(iii) State the formula of the compound formed between the **ion** of the element in **(i)** and chlorine.

..... [1]

(c) State the apparatus needed for the following:

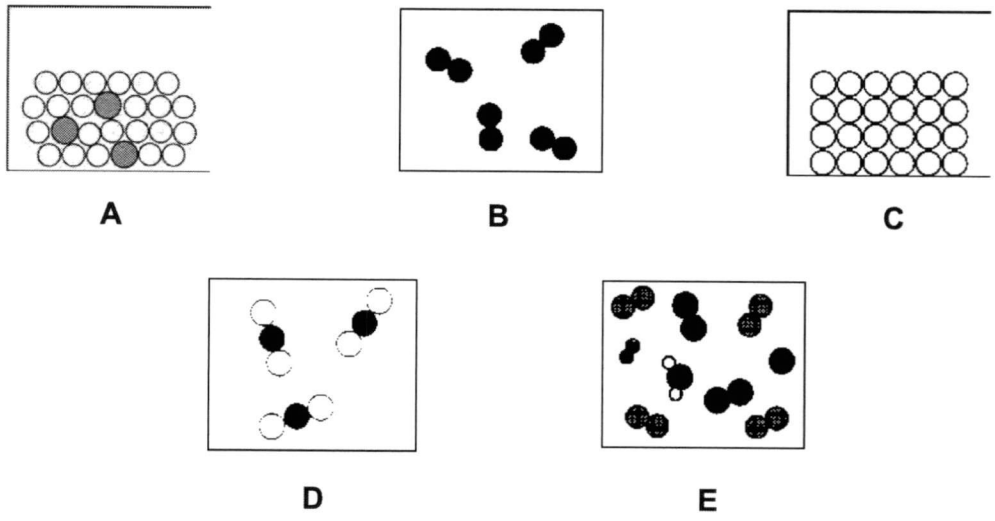
(i) Delivering 34.6 cm^3 of milk into a carton.

..... [1]

(ii) Measuring out **exactly** 25.0 cm^3 of milk into a glass.

..... [1]

3 The diagrams below represent five different substances.



(a) State which diagram represents the following substances.

(i) Sodium .....

(ii) Carbon dioxide .....

(iii) Chlorine .....

(iv) Air ..... [4]

(b) State two differences between compounds and mixtures.

Difference 1: .....

.....

Difference 2: .....

..... [2]

4 The table below shows some information about particles **A** to **E**.

particle	proton number	mass number	number of		
			protons	neutrons	electrons
A	3	7	3		
B		12	6		6
C		14	6	8	
D	8			8	8
E	17	35			18

(a) Fill in the missing information in the table. [2]

(b) **(i)** Define *isotopes*.

.....

..... [1]

(ii) Identify a pair of isotopes in the table above.

..... [1]

(c) **(i)** Which particle is an ion? Explain your answer.

.....

..... [1]

(ii) State the charge of the ion identified in **(c)(i).**

..... [1]

(d) Draw the 'dot-and-cross' diagram of the compound formed between particles **B** and **D**, showing **all** the electrons.

[2]

5 Sulfur dioxide is an air pollutant that causes serious health problems when inhaled.

(a) State one natural and one man-made source of sulfur dioxide.

Natural: .....

Man-made: ..... [2]

(b) State one environmental impact of sulfur dioxide.

.....

..... [1]

(c) State another air pollutant that has the same environmental impact as mentioned in **(b)**.

..... [1]

SECTION C: LONG-STRUCTURED QUESTIONS [20 MARKS]

Answer **two** out of the three questions in the spaces provided.

1 **(a)** Iodine is an element found in Group VII of the Periodic Table. Solid iodine undergoes sublimation upon heating.

(i) Explain what is meant by the term *sublimation*.

.....

..... [1]

(ii) Describe, in terms of energy change, the changes in **arrangement** and **movement** of iodine particles as it sublimes.

.....

.....

.....

..... [3]

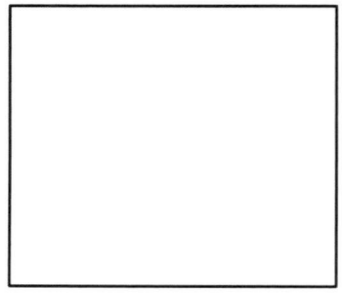
(b) Bromine is another element in Group VII, above iodine. Bromine has a melting point of −7.2°C and a boiling point of 58.8°C.

(i) What is the physical state of bromine at room temperature (i.e. 25°C)?

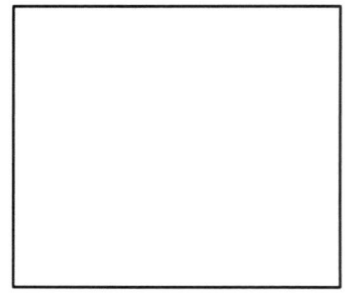
..... [1]

(ii) Draw the arrangement of bromine particles at temperatures −4°C and 60°C.

At −4°C

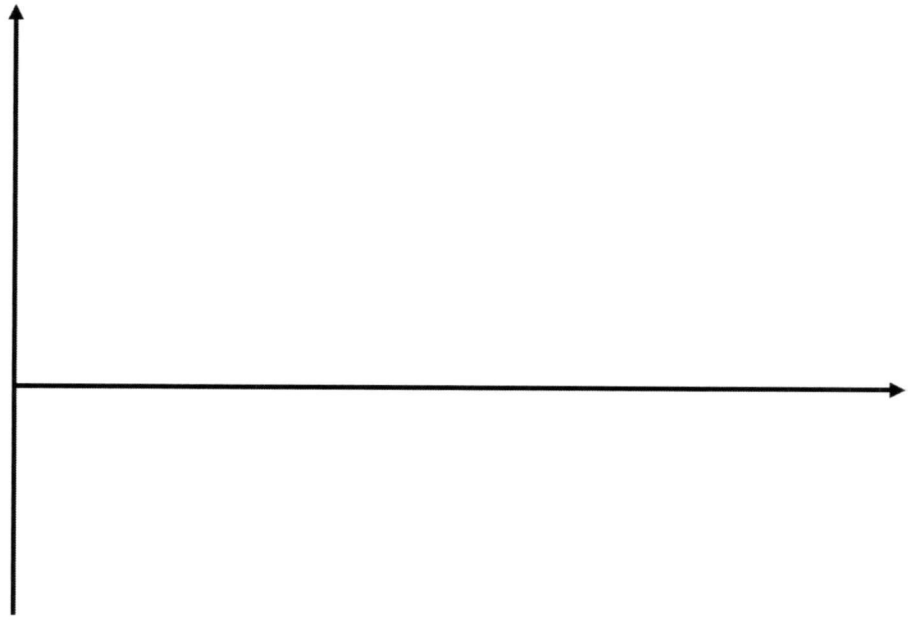


At 60°C



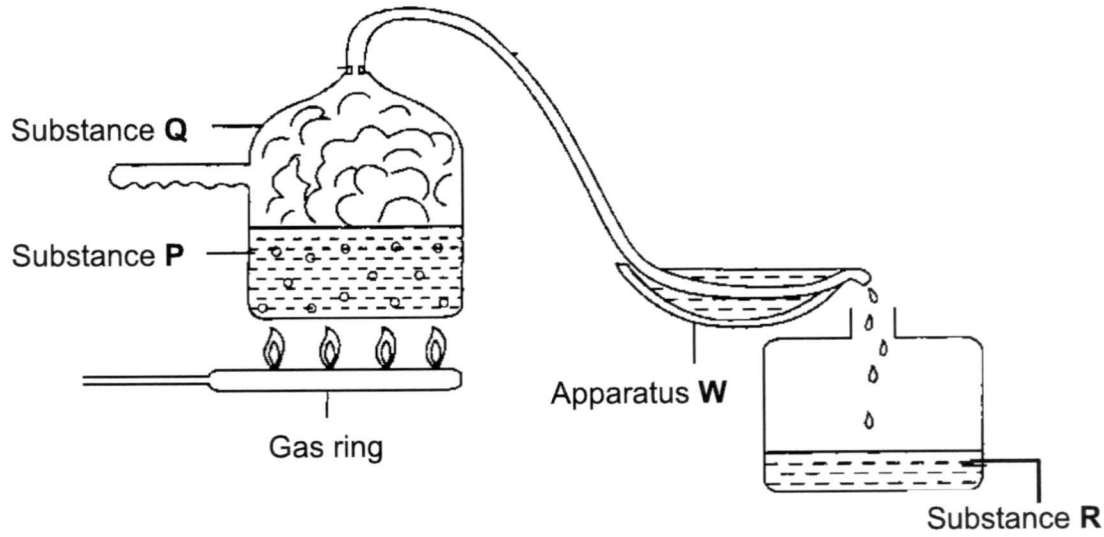
[2]

(iii) Draw the graph of bromine in the axes below when it is heated from −20°C to 70°C. Label the graph accordingly.



[3]

2 The diagram below shows a home-made setup used to obtain clean drinking water from seawater.



(a) What is the name of this separation technique?

..... [1]

(b) **(i)** A common apparatus used in this technique is missing from this setup. Identify the apparatus.

..... [1]

(ii) Put a cross (**X**) on the diagram where the missing apparatus should be placed. [1]

(c) State the purpose of apparatus **W**.

..... [1]

(d) Substances **P** and **R** are both colourless liquids. Describe a test to differentiate them and state how the results obtained lead to that conclusion.

.....

.....

.....

..... [3]

(e) If a new liquid substance **S**, of a lower boiling point and flammable nature, was added into substance **P**, describe the **two** changes made to the setup in order to separate substance **P** and **S** and state which substance will be collected first.

.....

.....

.....

..... [3]

3 Calcium phosphide, Ca_3P_2, is a chemical used in fireworks. It can react with water to form phosphine, PH_3, which is a poisonous and flammable gas.

(a) Draw the 'dot-and-cross' diagram of calcium phosphide, Ca_3P_2, showing **all** the electrons.

[3]

(b) Suggest the physical state of calcium phosphide at room temperature. Explain your answer.

Physical state at room temperature: .....

Reason: .....

.....

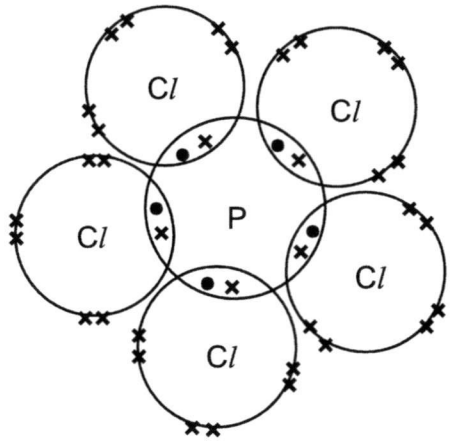
.....

..... [3]

(c) **(i)** Draw the electronic structure of phosphine, PH_3, showing **only** the valence electrons.

[2]

(c) (ii) The diagram below shows the electronic structure of another compound of phosphorus, phosphorus pentachloride, PCl_5.



Using the electronic structure of phosphine drawn in **(c)(i)**, comment on the unusual difference in electronic structure of the phosphorus in PCl_5 and PH_3.

.....

..... [1]

(d) Suggest whether PCl_5 can conduct electricity in any state. Explain your answer.

.....

..... [1]

– 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.).

Name: .... (   )

ASSUMPTION ENGLISH SCHOOL
MID-YEAR EXAMINATION 2017

SCIENCE (CHEMISTRY)
5076 / 05

LEVEL: Sec 3 Express

DATE : 27 April 2017

CLASS: Sec 3/1

DURATION : 1 hour 30 minutes (for both Physics and Chemistry)

Additional Materials Provided: Nil

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions.

A copy of the periodic table is printed on page 6.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's use:	
Total	15

This question paper consists of 6 printed pages including this page.

[Turn over

There are **2** parts to this practical test. Please read all instructions carefully before attempting the experiment.

Part 1

Aim: To obtain pure liquid **X** from its impure mixture **X**.

Apparatus and Materials:

250 cm^3 Beaker
Boiling tube
Test tube
Delivery tube and stopper
Retort stand and clamp
Bunsen burner
Wooden block

Mixture **X**
Ice cube (6)
Boiling chip

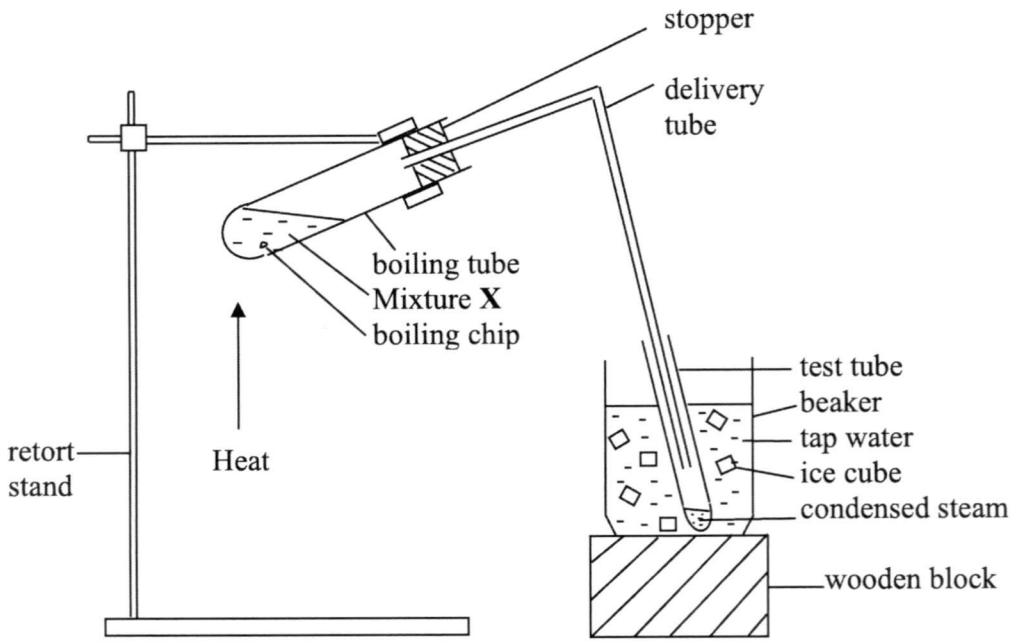


Diagram A

Safety Precautions:

1 Wear safety goggles at all times.

2 Adjust to a medium flame to prevent vigorous boiling of solution.

Procedure:

1 Measure out about ¼ of a boiling tube of mixture **X** and add two boiling chips into the boiling tube.

2 Fill the 250 cm^3 beaker with ice water till it is half full.

3 Set up the distillation apparatus as shown in **diagram A** above.

4 Heat mixture **X** carefully. Control the flame whenever the boiling gets too vigorous.

5 Collect the condensed liquid in the test tube.

6 Let the boiling tube cool down before washing.

7 Leave the test tube containing the distillate in the beaker of ice water for checking.

Results:

	Checked
Distillate	

[1]

1 What is the colour of the distillate obtained?

..... [1]

2 What is observed in the boiling tube after the experiment?

..... [1]

Discussion:

3 Why do we add ice water to the beaker containing the test tube of distillate?

..... [1]

4 How will you test the purity of the distillate obtained?

..... [1]

5 Describe one experimental error and explain how it affects the results.

.....

.....

..... [2]

Part 2

Aim: To investigate the components of three coloured markers.

Apparatus and Materials:

Filter paper
250 cm^3 beaker
White tile
3 markers of different colours (blue, red, brown)
Deionised water

Procedure:

1 Measure out 2 cm from the bottom of the filter paper and draw the starting line in pencil.

2 Place the samples at the starting line.

3 Fill up a 250 cm^3 beaker with water. Ensure that the water level is below the starting line.

4 Place the filter paper with the samples into the beaker of water and place a white tile on the beaker.

5 When the solvent level has reached approximately 1 cm from the top, remove the chromatogram from the beaker.

6 Leave the chromatogram to dry.

Results:

Paste the chromatogram in the box below.

[1]

Discussion:

1 Name the coloured marker(s) that is / are pure. Explain your answer.

.....

..... [2]

2 Name one component colour that is similar between any two coloured markers.

..... [1]

3 Why must the water level be below the starting line?

.....

..... [1]

4 If two components of a sample are very close together, suggest an extension to the chromatography method to separate and differentiate them.

.....

..... [1]

5 Identify one experimental error and explain how it affects the chromatogram results.

.....

.....

..... [2]

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 –

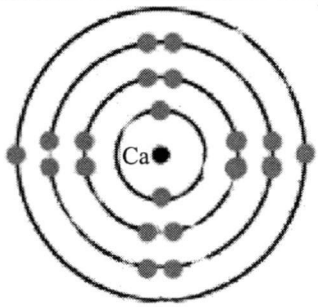
The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

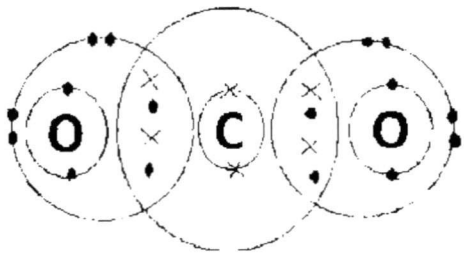
3 Express Science Chemistry 5076 Mid Year Exam 2017 Marking Scheme

Section A Multiple-Choice Questions [20m]

1	2	3	4	5	6	7	8	9	10
C	**B**	**D**	**C**	**B**	**D**	**B**	**C**	**A**	**B**
11	12	13	14	15	16	17	18	19	20
C	**A**	**A**	**C**	**D**	**C**	**D**	**C**	**D**	**C**

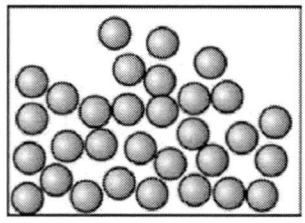
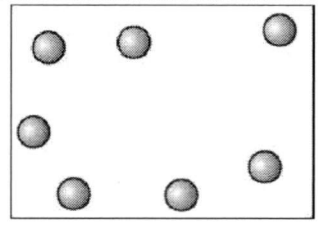
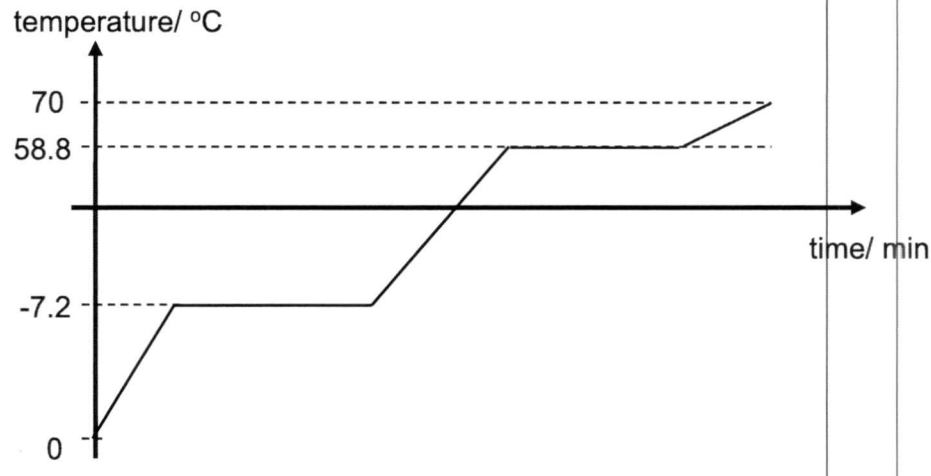
Section B Short-Structured Questions [30m]

1	a) **I** b) **A/B/D** and **F/G/H** and corresponding formula c) **E / F / G / H** d) **B, F, I / A, D, E, G / C, H** *any 2 from each group* e) **A / B / C / D**	1 1+1 1 1 1
2(a)	No, milk is a mixture of different components.	1
(b)(i)	Calcium	1
(b)(ii)		1
(b)(iii)	$CaCl_2$	1
(c)(i)	Burette	1
(c)(ii)	Pipette	1
3(a)	(i) C (ii) D (iii) B (iv) E	1 1 1 1
(b)	1. Fixed/not fixed compositions 2. Properties same/different from constituents 3. Separated physically/chemically 4. Energy change *Any 2*	2

<table>
<tr><td>4(a)</td><td>
<table>
<tr><th rowspan="2">Particle</th><th rowspan="2">Proton number</th><th rowspan="2">Mass number</th><th colspan="3">Number of</th></tr>
<tr><th>protons</th><th>neutrons</th><th>electrons</th></tr>
<tr><td>A</td><td>3</td><td>7</td><td>3</td><td>4</td><td>3</td></tr>
<tr><td>B</td><td>6</td><td>12</td><td>6</td><td>6</td><td>6</td></tr>
<tr><td>C</td><td>6</td><td>14</td><td>6</td><td>8</td><td>6</td></tr>
<tr><td>D</td><td>8</td><td>16</td><td>8</td><td>8</td><td>8</td></tr>
<tr><td>E</td><td>1</td><td>5</td><td>17</td><td>18</td><td>18</td></tr>
</table>
1 mark for every 5 correct.
</td><td>2</td></tr>
<tr><td>(b)(i)</td><td>Atoms of the same element with the same number of protons but different number of neutrons.</td><td>1</td></tr>
<tr><td>(b)(ii)</td><td>B and C.</td><td>1</td></tr>
<tr><td>(c)(i)</td><td>Particle E. It has one more electron than proton.</td><td>1</td></tr>
<tr><td>(c)(ii)</td><td>Charge: −1.</td><td>1</td></tr>
<tr><td>(d)</td><td> 

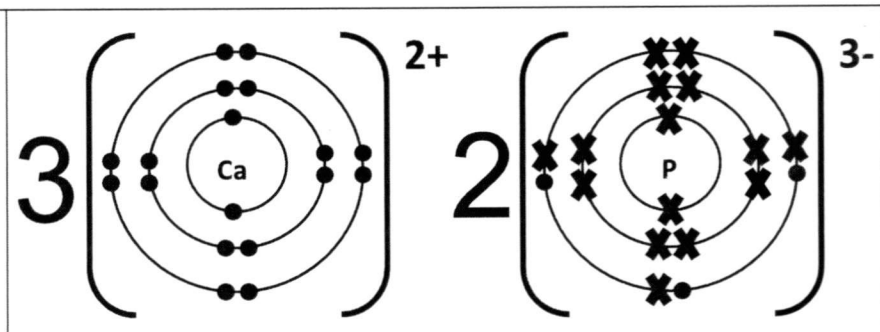
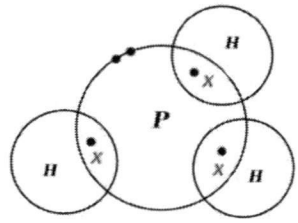
1 mark: correct bonding and number of each element
1 mark: correct number of bonding electrons</td><td>2</td></tr>
<tr><td>5(a)</td><td>Natural: volcano eruptions
Man-made: burning of fossil fuels</td><td>1
1</td></tr>
<tr><td>(b)</td><td>Dissolves in rain water to form acid rain which causes marine animals/plants to die. OR corrode metal bridges/buildings.</td><td>1</td></tr>
<tr><td>(c)</td><td>Nitrogen dioxide</td><td>1</td></tr>
</table>

Section C Long-Structured Questions [20m]

1(a)(i)	Change of state from solid to gas <u>without going through the liquid state</u> and vice versa	1
(a)(ii)	When iodine sublimes, the particles <u>gain kinetic energy</u> and change from <u>being closely packed in an orderly arrangement and vibrating about their fixed positions</u> to <u>widely spaced and moving freely in all directions.</u>	1 1 1
(b)(i)	Liquid	1
(b)(ii)	  At −4°C At 60°C 1 mark each	2
(b)(iii)	 Labelled axes with units Shape of graph Correct temperature points	 1 1 1

2(a)	Simple distillation	1
(b)(i)	Thermometer.	1
(b)(ii)	*At the mouth of the inlet tube / top of the distillating flask	1

(c)	To condense the vapour back to liquid.	1
(d)	Boil both liquids and test their boiling point. **P** will boil over a range of temperatures while **R** will boil at a fixed temperature. OR Evaporate off the water. **P** will leave behind a white solid while **R** will not leave behind any residue.	1 1 1 1 1 1
(e)	Add a fractionating column and a water bath. **S** will distill out first, followed by **P**.	2 1

3(a)	 1 mark for correct Ca^{2+} structure 1 mark for correct P^{3-} structure 1 mark for correct coefficients	3
(b)	Solid. Ca_3P_2 is an ionic compound with a giant lattice structure. A lot of energy is required to overcome the strong electrostatic forces of attraction between the ions in Ca_3P_2. Hence, it has a high melting and boiling point and therefore a solid at room temperature.	1 1 1
(c)(i)	 1 mark for overall covalent structure (P in the centre, H around) 1 mark for correct number of shared valence electrons.	2
(c)(ii)	P in PCl_3 has 8 electrons in its valence shell whereas whereas P in PCl_5 has 10 electrons in its valence shell.	1
(d)	No. It is a simple covalent structure, all electrons are used in bonding, hence it does not have any mobile charge carriers.	1

2017 3E Sci(Chem) P5 Mark Scheme

Part 1

1	Colourless	[1]
2	Blue solution/blue solid (depends on how much the students heat)	[1]
3	To provide a cold environment for the vapour to condense back to liquid.	[1]
4	Test the boiling point of the distillate obtained.	[1]
5	1. Overheating – Causes some of the mixture to over-boil into the test tube and contaminate the distillate. OR 2. Some vapour escaping when the system is not entire closed – loss of distillate *any other reasonable answers*	[2]
	[6] + [1] from product = [7]	

Part 2

1	Blue and red. Only one spot / Streak is of one colour only.	[1] [1]
2	Red / Pink	[1]
3	So that the samples will not dissolve in the water.	[1]
4	Use another different solvent.	[1]
5	1. Sample spots are too close together – Merge as they ascend the paper. OR 2. Sample spots are too big – Will merge as they ascend the paper. *Any other reasonable answers*	[2]
	[7] + [1] from chromatogram = [8]	