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ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (CHEMISTRY)
5105 / 03
5107 / 03

ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL
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LEVEL:	Sec 4 Normal (Academic)	**DATE :**	1 August 2018
CLASSES:	Sec 4/3, 4/4	**DURATION:**	1 hour 15 minutes *(Papers 3 & 4)*

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, INDEX NUMBER and CLASS at the top of this page and on the OAS paper. **Shade your index number on the OAS paper.**

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.**

At the end of the examination, hand in your OAS paper and Question Papers separately.

INFORMATION FOR CANDIDATES
You are advised to spend no longer than 30 minutes on Paper 3.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.

A copy of the Periodic Table is printed on the last page of Paper 4.

This question paper consists of 9 printed pages including this page.

[Turn over

1. Substance **X** can be condensed using a water-cooled condenser.

What is the melting point and boiling point of this substance?

	melting point / ˚C	boiling point / ˚C
A	–78	–33
B	–94	105
C	–119	–1
D	–130	36

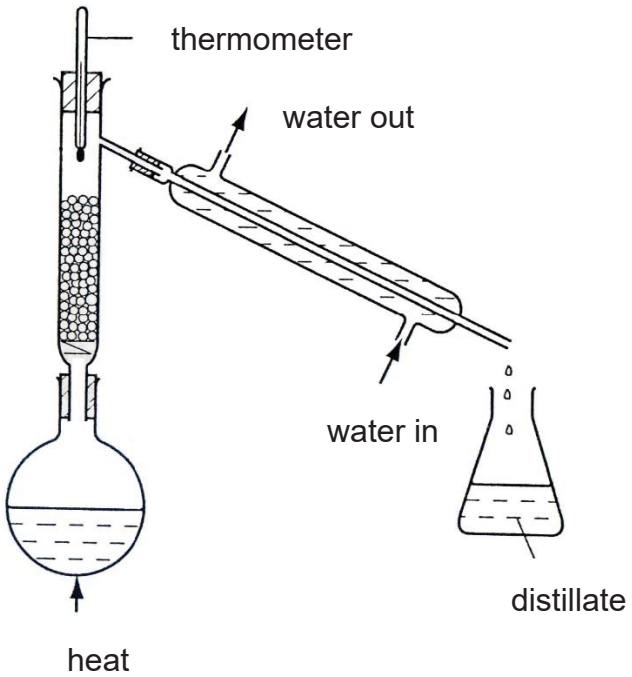
2. Which apparatus is the most suitable to measure exactly 21.50 cm^3 of a solution?

A beaker
B gas syringe
C burette
D measuring cylinder

3. Which statement is likely to be a pure compound?

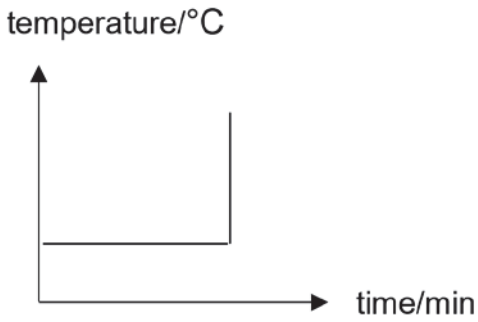
A a colourless liquid which boils over a range of temperatures from 27°C to 40°C
B a grey substance which can be separated using a magnet
C green crystals which melt at 80°C
D a suspension which leaves a residue during filtration

4. The following apparatus was used to separate a mixture of three miscible liquids, **P**, **Q** and **R**. The boiling points of the three liquids are 80°C, 53°C and 108°C respectively.

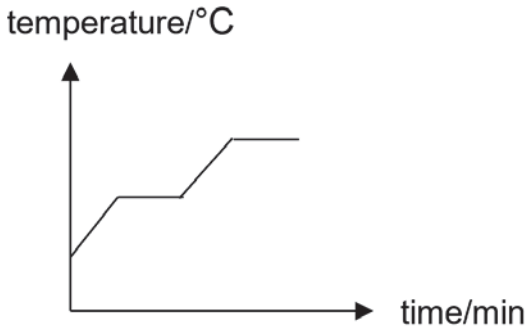


Which graph correctly indicates the thermometer reading when the mixture is heated from room temperature to 80°C?

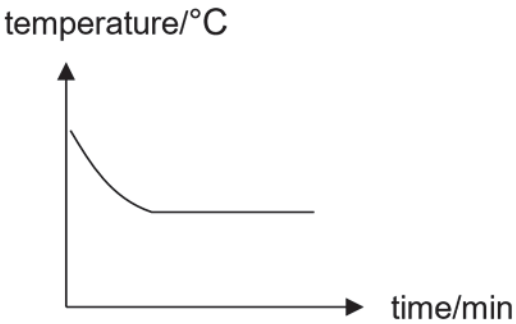
A



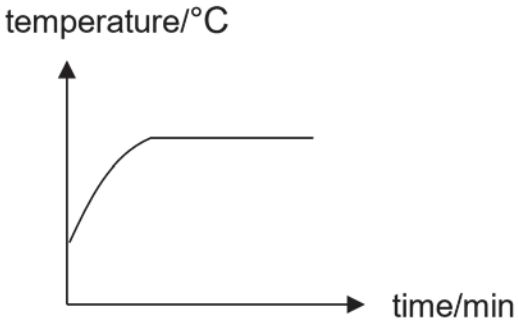
B



C



D



5. An isotope of element **X** has a nucleon number of 40 and 19 protons. What is element **X**?

A argon
B cobalt
C calcium
D potassium

6. A particle consists of two electrons, three protons and four neutrons. Which statements are true?

(i) It has a charge of +1.
(ii) It has a nucleon number of four.
(iii) It has a proton number of three.

A **(i)** and **(ii)** only
B **(i)** and **(iii)** only
C **(ii)** and **(iii)** only
D **(i)**, **(ii)** and **(iii)** only

The diagram below represents one molecule of a compound.

Key:
= an atom of P
= an atom of Q
= an atom of R

Use the above diagram to answer questions 7 and 8.

7. What is the formula of the compound?

A $PQ_3PQ_2RPQ_3$
B Q_3P_9R
C $QP_3QP_2RQP_3$
D $Q_3P_6R_3$

8. What is the relative molecular mass of the compound given the new key as shown below?

Key:

= an atom of hydrogen

= an atom of carbon

= an atom of oxygen

A 60 **B** 61

C 90 **D** 126

9. What is the ionic equation of the chemical reaction between sodium hydroxide and hydrochloric acid?

A H^+ (aq) + OH^- (aq) → H_2O (*l*)

B NaOH (aq) + HC*l* (aq) → NaC*l* (aq) + H_2O (*l*)

C Na^+ (aq) + OH^- (aq) → NaOH (aq)

D H^+ (aq) + Cl^- (aq) → H_2O (*l*)

10. Magnesium reacts with dilute nitric acid to form a salt and hydrogen gas. The chemical equation is shown below.

$$Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$$

What is the mass of magnesium nitrate formed with 96 g of magnesium metal?

A 24 g **B** 148 g

C 444 g **D** 592 g

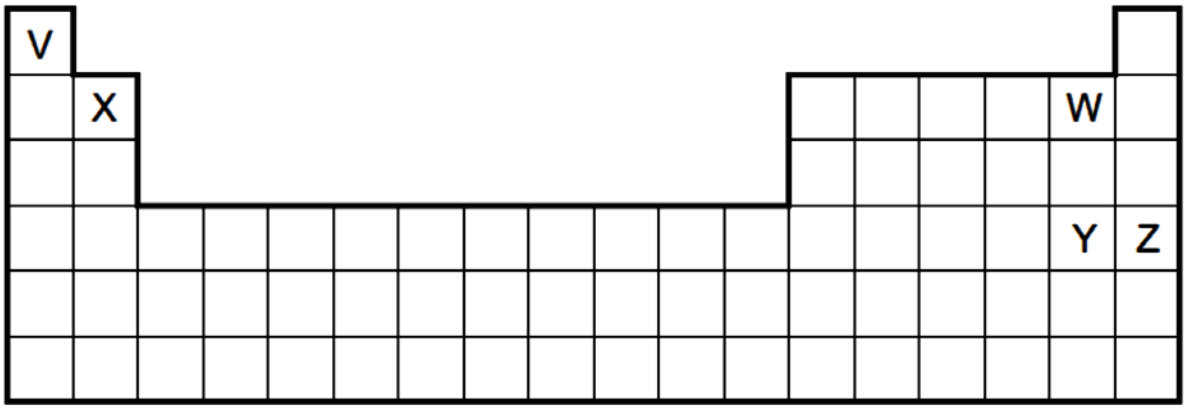
11. Which oxide reacts with both an acid and a base to form a salt?

A aluminium oxide
B calcium oxide
C sulfur dioxide
D nitrogen monoxide

12. An excess of sodium hydroxide solution is added to an aqueous solution of salt **X** and the mixture is boiled. Ammonia gas is given off. What is salt **X**?

A ammonium chloride
B sodium sulfate
C calcium nitrate
D magnesium carbonate

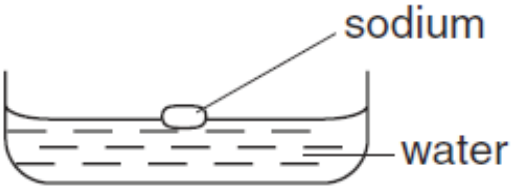
13. The diagram below shows an outline of the Periodic Table.



Which two elements have similar chemical properties?

A **X** and **W**
B **V** and **X**
C **Y** and **Z**
D **W** and **Y**

14. When sodium reacts with water, a solution and a gas are produced.



The solution is tested with litmus papers and the gas is tested with a splint. What are the expected observations?

	litmus paper	splint
A	blue to red	glowing splint relights
B	blue to red	lighted splint “pops”
C	red to blue	glowing splint relights
D	red to blue	lighted splint “pops”

15. Which is the correct statement for both chlorine and iodine?

A They are diatomic molecules.

B They are gases at room temperature and pressure.

C They are colourless liquids.

D There are very soluble in water.

16. Which is the main constituent of natural gas?

A oxygen

B ethane

C methane

D nitrogen

17. Carbon monoxide is a pollutant emitted from car exhausts. Which property makes it harmful to humans?

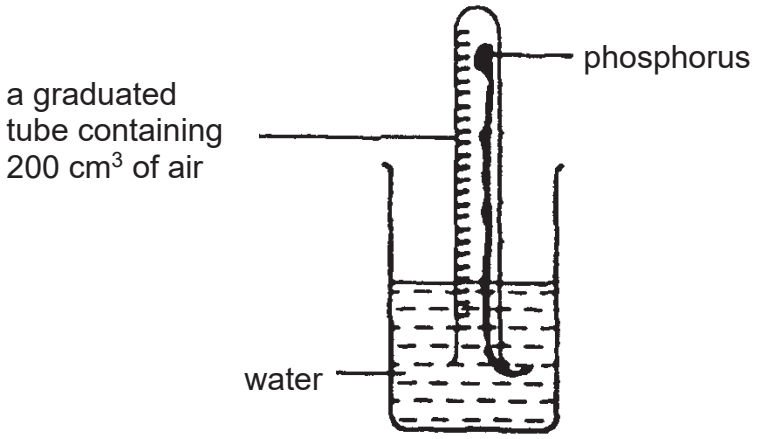
A It has no colour, taste or smell.

B It irritates the eyes.

C It forms a stable compound with blood.

D It combines with haemoglobin in the blood.

18. An apparatus is used to measure the percentage of oxygen in air. Phosphorus reacts with oxygen in the air to form phosphorus(V) oxide.



The initial volume of air in the tube is 200 cm^3. What is the volume of gas remaining in the apparatus after the reaction?

A 42 cm^3

B 100 cm^3

C 158 cm^3

D 200 cm^3

19. Which list shows a homologous series?

A	
name	*formula*
ethane	C_2H_6
propane	C_3H_8
butane	C_4H_{10}

B	
name	*formula*
ethane	C_2H_6
propene	C_3H_6
butene	C_4H_8

C	
name	*formula*
lithium	Li
sodium	Na
potassium	K

D	
name	*formula*
water	H_2O
ice	H_2O
steam	H_2O

20. A student investigated the reaction of vegetable oils with hydrogen.
100 cm^3 of hydrogen was bubbled through 1 g samples of four different vegetable oils.
The volume of hydrogen remaining after each experiment was recorded.

vegetable oil	volume of hydrogen remaining/ cm^3
P	100
Q	87
R	63
S	0

Which vegetable oil(s) is / are unsaturated?

A **P**, **Q** and **R** only

B **Q** and **R** only

C **Q**, **R** and **S** only

D **S** only

- End of Paper 3 -

Name: …….. ( ) Class: ……...

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (CHEMISTRY)
5105 / 04
5107 / 04

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LEVEL: Sec 4 Normal (Academic) **DATE :** 1 August 2018

CLASSES: Sec 4/3, 4/4 **DURATION:** 1 hour 15 minutes *(Papers 3 & 4)*

Additional Materials provided: NIL

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

Write your NAME, INDEX NUMBER and CLASS 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 or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in Section A and any **two** questions in Section B.
Enter the numbers of the Section B questions you have answered on the dotted lines in the grid below.
In calculations, you should show all the steps in your working, giving your answer at each stage.

You are advised to spend no longer than 30 minutes on Paper 3.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
A copy of the Periodic Table is printed on the last page of Paper 4.

For Examiner's Use	
Paper 3	/ 20
Section A	/ 14
Section B	/ 16
Total	/ 50

At the end of the examination, hand in your OAS paper and Question Papers separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 13 printed pages including this page.

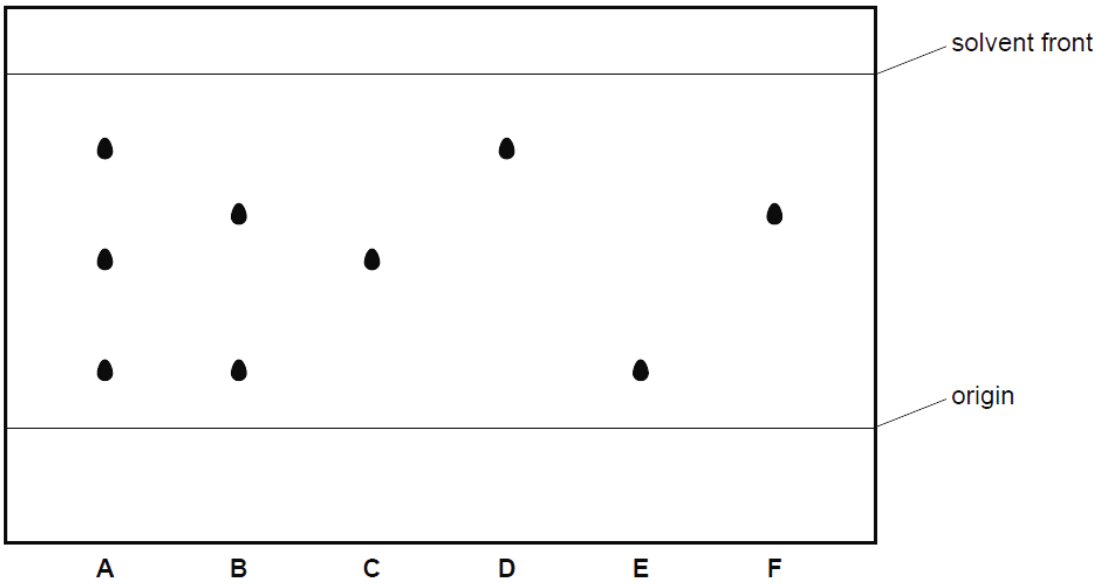
[Turn over

Section A [14 marks]

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

1 The diagram shows the results of an experiment to separate and identify the colours present in two paints, **A** and **B**.

Substances **C**, **D**, **E** and **F** are single colours.



(a) State one difference and one similarity between paints **A** and **B**.

Difference: ……..

……..

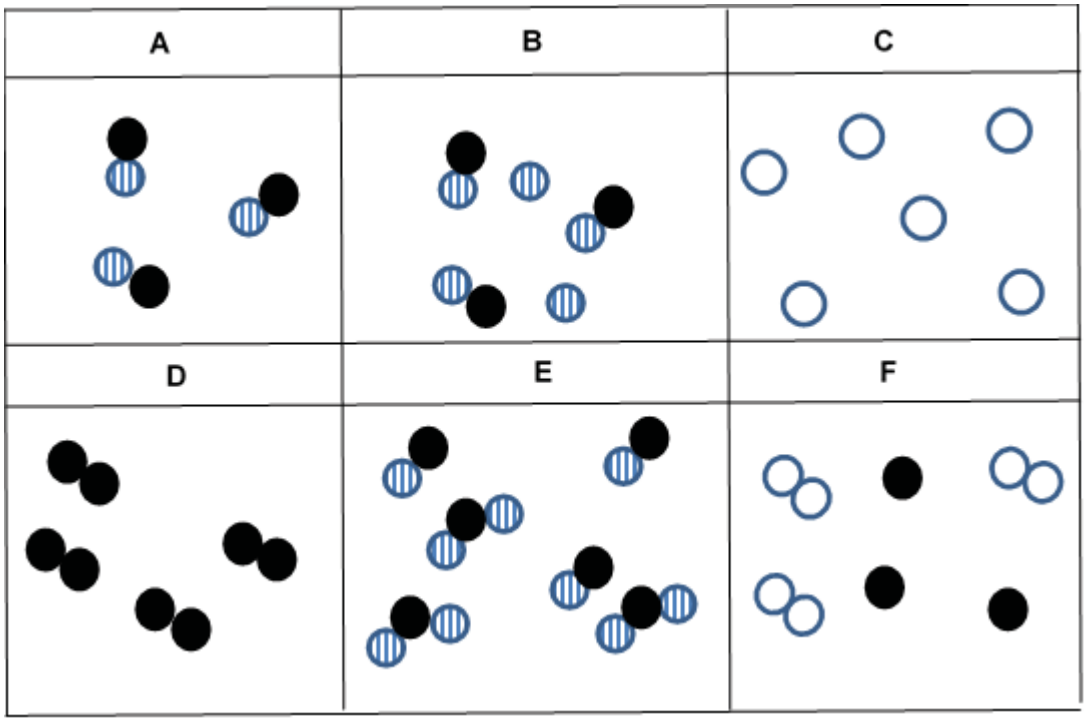
Similarity: ……

…….. [2]

(b) Which coloured substances are present in paint **A**?

…….. [1]

2 The diagrams below show elements, compounds and mixtures.



State the letter(s) for the diagram(s) which matches the descriptions below.

(a) an element ..... [1]

(b) a mixture of an element and a compound ..... [1]

3 In industries, magnesium oxide is used to line the interior of machines as it is heat resistant.

(a) In the space below, draw a dot-and-cross diagram to represent magnesium oxide, showing all electrons.

[2]

(b) With reference to its structure and bonding, explain why magnesium oxide is used to line the interior of machines.

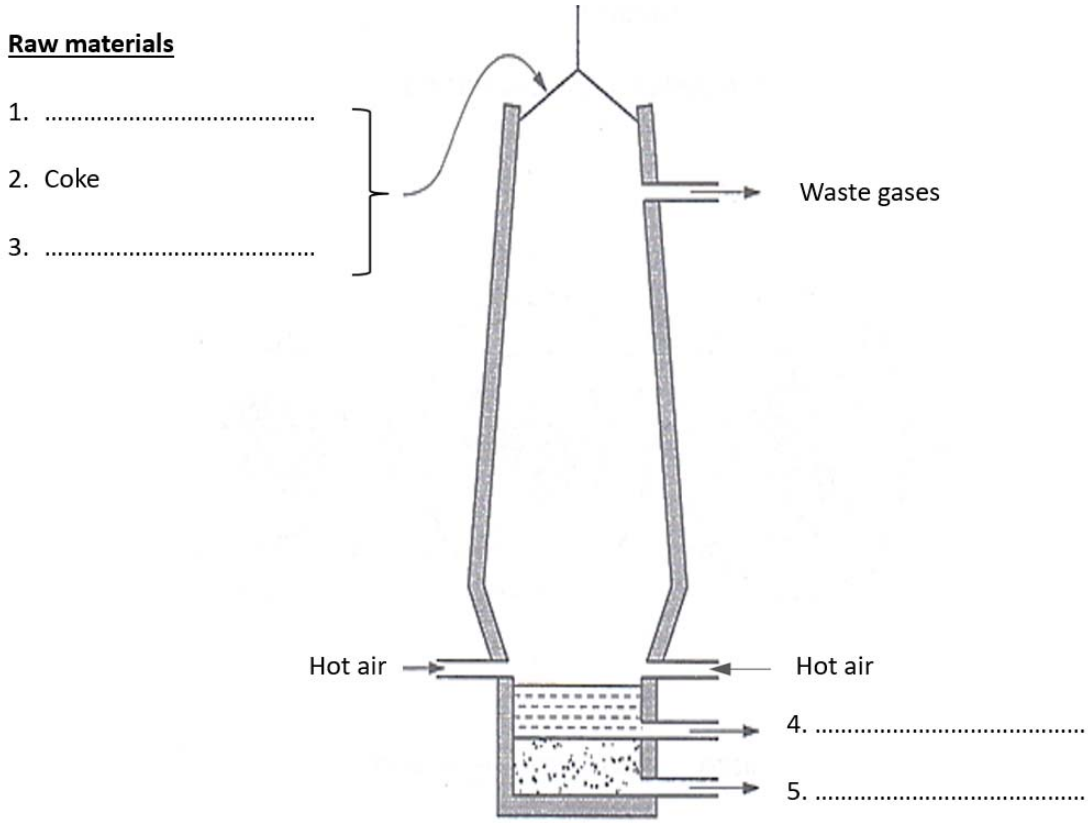
……..

……..

…….. [2]

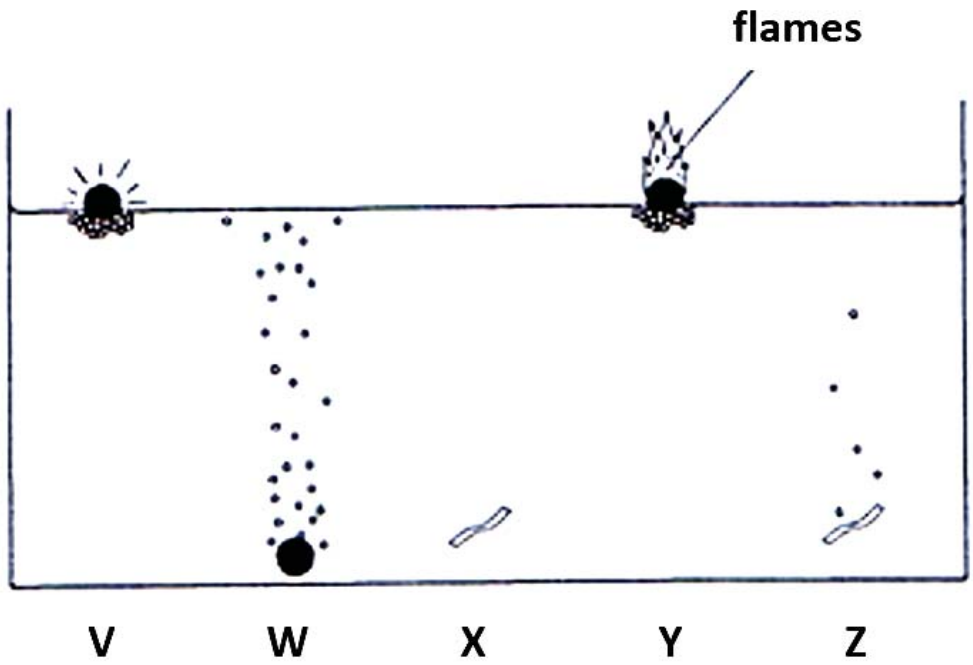
4 Iron is extracted from its ore in a Blast Furnace.

(a) Complete the labels in the figure below.



[2]

(b) Five metals – **V**, **W**, **X**, **Y** and **Z**, are placed in a trough of cold water. The results observed are shown in the diagram below.



(i) Complete the table to identify metals **V**, **W**, **X**, **Y** and **Z**.

metal	letter **V**, **W**, **X**, **Y** or **Z**
calcium	
copper	
magnesium	
potassium	
sodium	

[2]

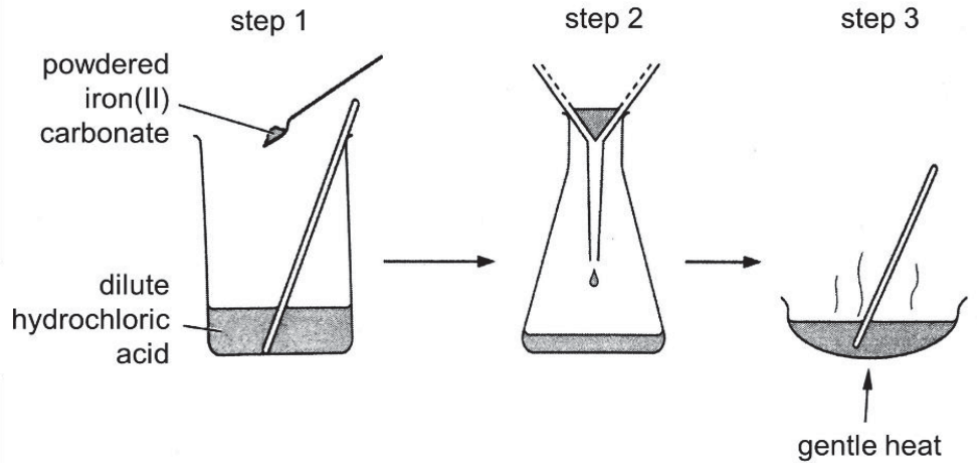
(ii) Write a balanced chemical equation for the reaction between sodium and cold water.

…… [1]

Section B [16 marks]

Answer any **two** questions from this section in the spaces provided.

5 Iron(II) chloride can be made by reacting with dilute hydrochloric acid with an excess of powdered iron(II) carbonate.



(a) Explain why an excess of iron(II) carbonate has to be used.

……..

…….. [1]

(b) In the reaction between iron(II) carbonate and dilute hydrochloric acid, a gas is produced.

Name the gas and describe a positive test to identify the gas.

Name of gas: …….

Test for gas: ……...

Observation: ……..... [2]

(c) The liquid from step 3 is allowed to stand for some time to allow crystals to grow.

Describe the subsequent steps that are needed in order to obtain a dry sample of the iron(II) chloride crystals.

……..

……..

…….. [2]

(d) Explain why crystallisation is not a necessary step for obtaining the dry salt of silver chloride.

……..

…….. [1]

(e) An article describes the method of making iced-coffee (cold-brew).

"Cold-brew involves soaking coffee beans in room-temperature water over a long time to extract the coffee. It is then distilled and served over ice. It removes the need to use hot water to extract coffee, which tends to "bring out" the acids in coffee beans. Some people prefer the absence of the sour taste in such coffees."

Describe a simple method that can be used to verify the claim that cold-brew method produces coffee that is less acidic.

……..

……..

…….. [2]

6 **(a)** Bronze is made up of two different metals. It consists of 88% copper and 12% tin.

(i) What is the name given to a mixture of metals?

…….. [1]

(ii) Using the arrangement and structure of the atoms, explain why bronze is used to make statues and medals rather than using pure copper or pure tin.

……..

……..

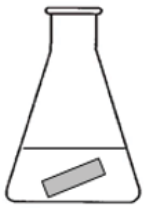
…….. [2]

(iii) In the box below, draw the arrangement of the atoms in bronze.

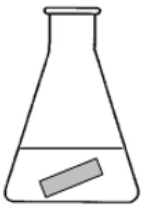
[1]

(b) Three conical flasks labelled **A**, **B** and **C** were each filled with 50 cm^3 of dilute hydrochloric acid.

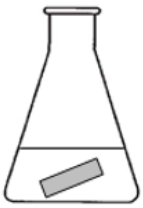
10 g of metals **X**, **Y** and **Z** were placed in the respective conical flasks as shown below.



Flask **A**
Metal **X** in 50 cm^3 of dilute hydrochloric acid



Flask **B**
Metal **Y** in 50 cm^3 of dilute hydrochloric acid



Flask **C**
Metal **Z** in 50 cm^3 of dilute hydrochloric acid

After 5 minutes, the metals **X**, **Y** and **Z** were removed from the conical flasks. The metals were dried and weighed. The masses of the metals before and after placing in the conical flasks were recorded in the table below.

	Mass of **X** / g	Mass of **Y** / g	Mass of **Z** / g
before	5.0	5.0	5.0
after	2.4	5.0	3.6

(i) Arrange the metals **X**, **Y** and **Z** in decreasing order of reactivity.

…….. [1]

(ii) Suggest a possible identity for metal **Y**. Explain your answer.

……..

…….. [2]

(iii) If **Z** is zinc, construct a balanced chemical equation between **Z** and dilute hydrochloric acid.

…….. [1]

7 Crude oil can be separated into various fractions through fractional distillation.

(a) Which fraction has the lowest boiling point?

…….. [1]

(b) The molecular formula of one of the hydrocarbons present in the various fractions is propene, C_3H_6.

(i) Draw the structural formula of propene.

[1]

(ii) Propene undergoes a reaction with hydrogen. State the name of this type of reaction and describe the conditions required for the reaction to take place.

Name of reaction: ……..

Conditions required: …….. [2]

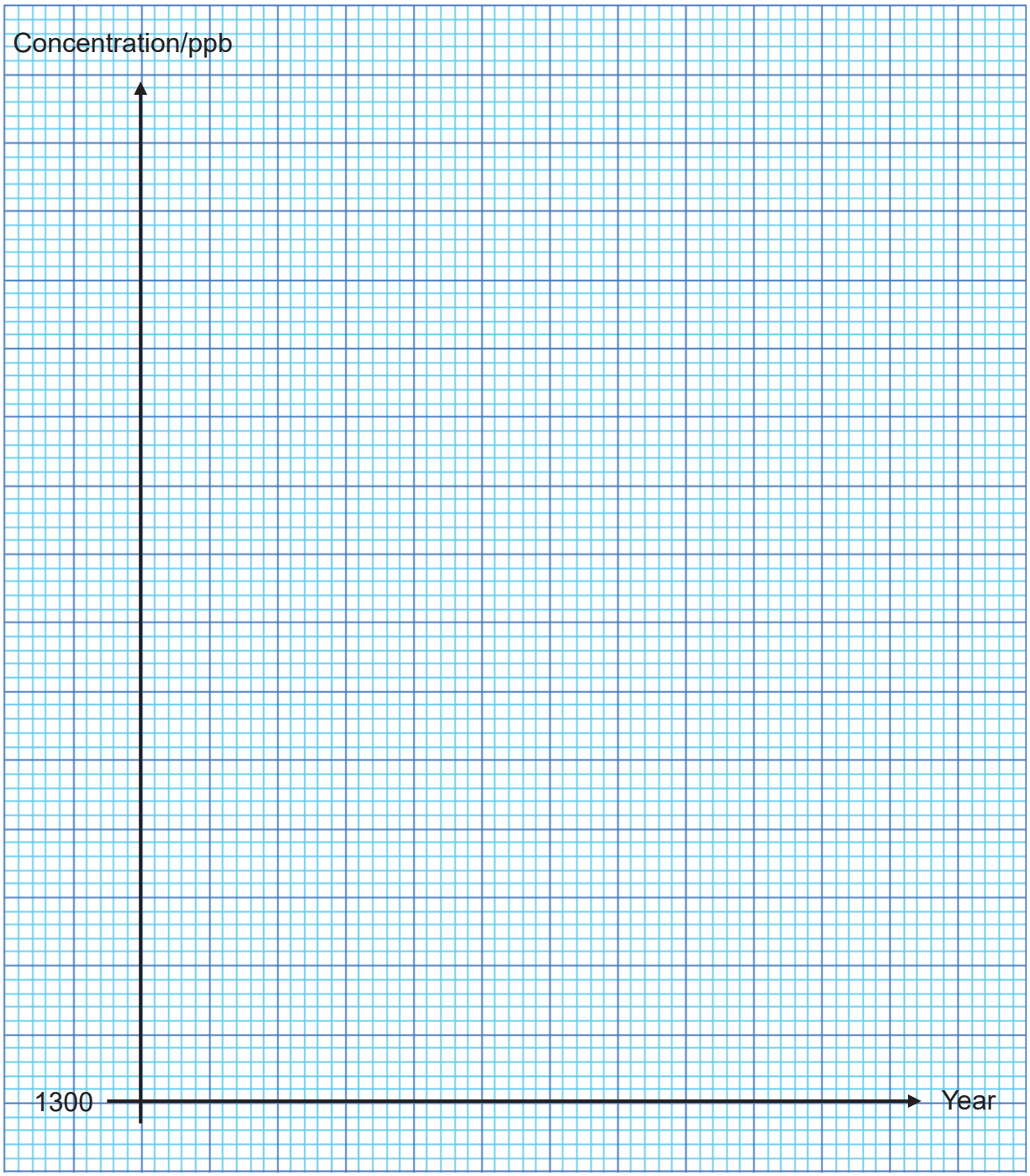
(c) Unburnt hydrocarbons can get into the air from the incomplete combustion of fossil fuels.

The table below shows the concentration of hydrocarbons in the air in a city from 2007 to 2011. The concentration is measured in parts per billion (ppb).

year	**concentration / ppb**
2007	1930
2008	1650
2009	1670
2010	1550
2011	1410

(i) Plot a graph of concentration of hydrocarbons in the air against the year based on the data provided in the table.

Draw a line of best fit for your plotted points.



[2]

(ii) Describe, using the information from the graph, the general trend of the concentrations of hydrocarbons in the air over the years.

……..

…….. [2]

- End of Paper 4 -

1300

The Periodic Table of Elements

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

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											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 –

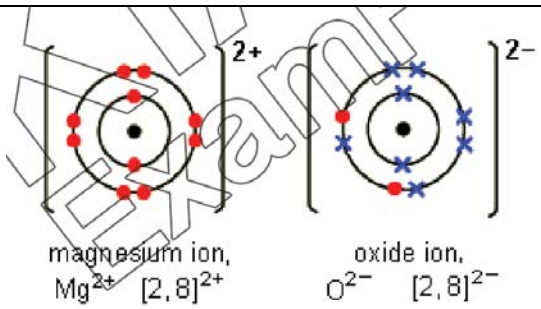
The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018
SCIENCE (CHEMISTRY)

Paper 3

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

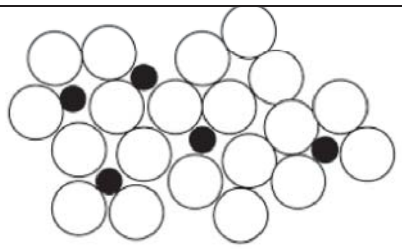
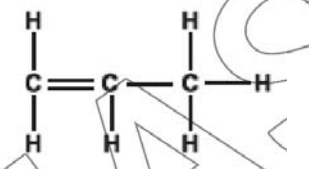
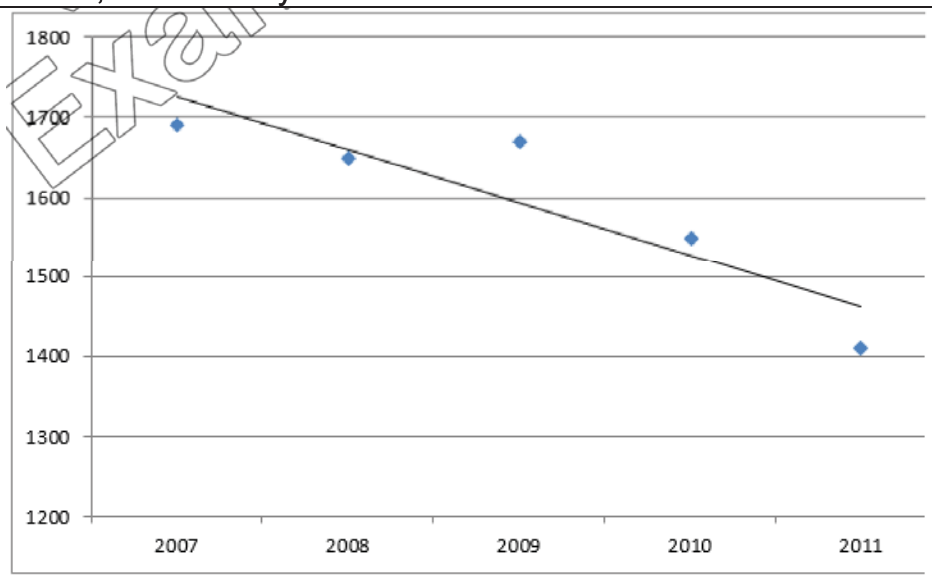
Paper 4 – Section A

1	**(a)**	Difference: •Paint A is made up of 3 colours whereas Paint B is made up of 2 colours. •Paint A is made up of colours C and D which are not found in Paint B. •Paint B contains colour F which is not found in Paint A. Similarity: •Both Paints A and B both contain colour E. **1 difference: [1]** **1 similarity: [1]**	
	(b)	Coloured substances C, D and E.	**[1]**
2	**(a)**	C, D	**[1]**
	(b)	B	**[1]**
3	**(a)**	 **Correct electron diagram of Magnesium cation: [1]** **Correct electron diagram of Oxide anion: [1]**	
	(b)	Magnesium oxide has strong electrostatic forces of attraction between oppositely-charged ions which require large amount of heat energy to overcome it. Therefore, it has a high melting point and can withstand high temperatures.	**[1]** **[1]**

4	**(a)**	1. Limestone / Calcium carbonate 3. Haematite / Iron(III) oxide 4. Molten slag 5. Molten iron **Every 2 correct labels: [1]** **Total: [2]**		
	(b)	**(i)**	<table><tr><th>metal</th><th>letter **V**, **W**, **X**, **Y** or **Z**</th></tr><tr><td>calcium</td><td>W</td></tr><tr><td>copper</td><td>X</td></tr><tr><td>magnesium</td><td>Z</td></tr><tr><td>potassium</td><td>Y</td></tr><tr><td>sodium</td><td>V</td></tr></table> **5 correct: [2]** **3 – 4 correct: [1]** **0 – 2 correct: [0]**	
		(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$	**[1]**

<u>Paper 4 – Section B</u>

4	**(a)**	To ensure that all the acid has been reacted.	**[1]**
	(b)	Name of gas: carbon dioxide gas Test for gas: Bubble the gas through limewater. A white precipitate is formed.	**[1]** **[1]**
	(c)	1. Filter the mixture to remove crystals. 2. Wash the crystals with a little distilled water. 3. Dry the crystals between sheets of filter paper. **3 correct steps: [2]** **2 correct steps: [1]** **0-1 correct step: [0]**	
	(d)	Silver chloride is already an insoluble salt and can be obtained by filtration.	**[1]**
	(e)	<u>Method 1: Use of universal indicator solution / paper</u> The cold-brew coffee will show a yellow colour while the hot brew coffee will show an orange colour. <u>Method 2: Use of a pH meter</u> The pH of the cold-brew coffee will be higher than that of a hot brew coffee. **Method used: [1]** **Expected results: [1]**	

5	(a)	(i)	Alloy	[1]
		(ii)	In an alloy, the atoms of different metals have different sizes, leading to a disorderly arrangement. When a force is applied, the atoms of different sizes cannot slide over each other easily. This makes bronze stronger and harder than pure copper or pure tin.	[1] [1]
		(iii)		[1]
	(b)	(i)	X, Z, Y	[1]
		(ii)	Y is copper / silver / gold / platinum. Y is an unreactive metal as it did not react with dilute hydrochloric acid.	[1] [1]
		(iii)	$Zn + 2HCl \rightarrow ZnCl_2 + H_2$	[1]
6	(a)		Petroleum gas	[1]
	(b)	(i)		[1]
		(ii)	Name of reaction: Hydrogenation / Addition reaction with hydrogen Conditions required: 200°C, Nickel catalyst	[1] [1]
	(c)	(i)	 **Correct plotted points and axis: [1]** **Best-fit line: [1]**	

		(ii)	There is an overall decrease in the concentration of hydrocarbons from 1930 ppb to 1410 ppb. There is a slight increase in the concentration of hydrocarbons from 2008 to 2009.	**[1]** **[1]**