KENT RIDGE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2019

SCIENCE (CHEMISTRY) **5076**

SEC 3 EXPRESS

Monday 7 October 2019 **1 hour 15 minutes**

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Name: _____( ) **Class: Sec** _____

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number clearly in the spaces at the top of this page provided.

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

Section A
There are **ten** questions. Answer **all** questions.
For each question, there are four possible answers, **A**, **B**, **C**, and **D**.
Choose the **one** you consider correct and record your choice in the table on page 5.

Section B
Answer **all** questions.
Write your answers in the spaces provided in the question paper.

Section C
Answer any **two** questions.
Write your answers in the spaces provided in the question paper.

FOR EXAMINER'S USE	
Section A	10
Section B	20
Section C	20
Q:.....	
Q:.....	
Total	50

Enter the numbers of the **Section C** questions you have answered in the grid above.

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

A copy of the Periodic Table is printed on page 17.

This Question Paper consists of 17 printed pages, including this page.

Setter: Mrs Elaine Su

[Turn over

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Section A

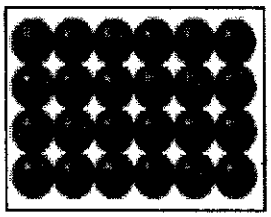
The total mark for this section is 10.

1 A student wishes to add 15.7 cm^3 of acid to exactly 25.0 cm^3 of alkali as part of an experiment.

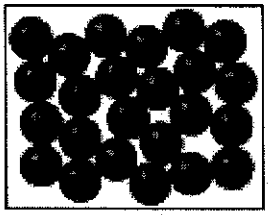
Which apparatus should the student use to measure these volumes?

	acid	alkali
A	burette	measuring cylinder
B	burette	pipette
C	pipette	burette
D	measuring cylinder	pipette

2 The diagrams below show the arrangement of particles in substance Z at two different temperatures.



-100°C



-50°C

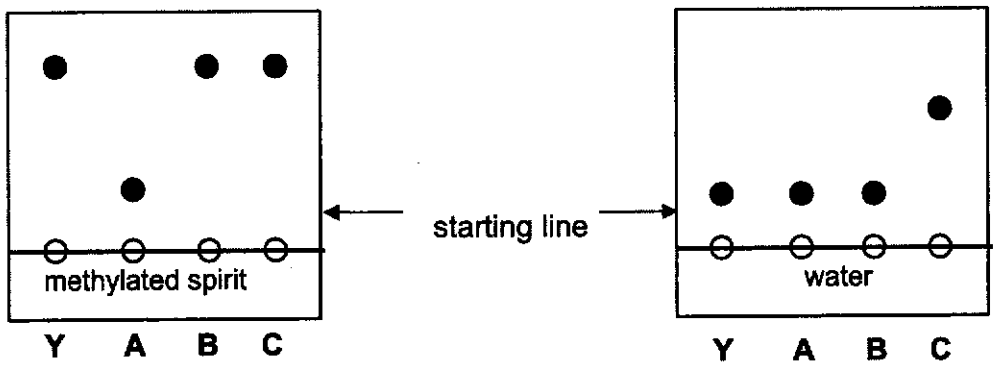
Which of the following could be the melting and boiling point of substance Z?

	melting point /°C	boiling point /°C
A	-84	-53
B	-96	-48
C	-110	-45
D	-112	-88

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3 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.



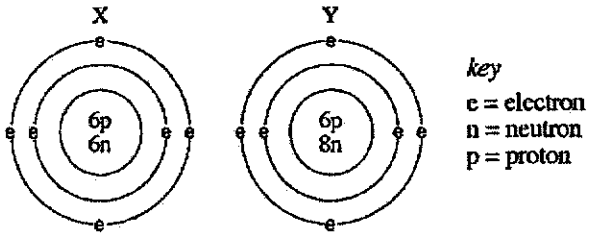
From these chromatograms, we can deduce that drug **Y** contains ..... .

A compound **A** only
B compound **B** only
C compound **C** only
D compounds **B** and **C** only

4 The atoms $^{31}_{15}P$ and $^{32}_{16}S$ have the same ..... .

A nucleon number
B number of protons
C number of electrons
D number of neutrons

5 Two atoms, **X** and **Y** have the structures shown below.



Which term describes **X** and **Y**?

A atoms
B ions
C isotopes
D molecule

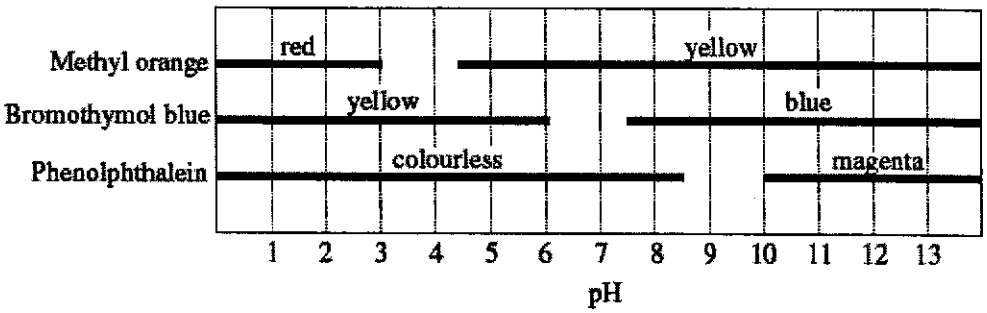
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6 Astatine is below iodine in Group VII of the Periodic Table. Which of the following statements about astatine is/are correct?

1 It is a solid at room temperature and pressure.
2 It reacts with sodium to form an ionic compound.
3 It is able to displace bromine out of its halide solution.

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

7 The graph shows the colour ranges of the acid–base indicators methyl orange, bromothymol blue and phenolphthalein.



A solution is yellow in methyl orange, blue in bromothymol blue and colourless in phenolphthalein. What is the pH range of the solution?

A 4.5 to 6.0
B 6.0 to 7.5
C 7.5 to 8.5
D 8.5 to 10.0

8 Which is the best reagent, when added to excess, can neutralise acid spilled in the laboratory, without leaving an alkaline solution?

A calcium carbonate
B potassium oxide
C sodium hydroxide
D water

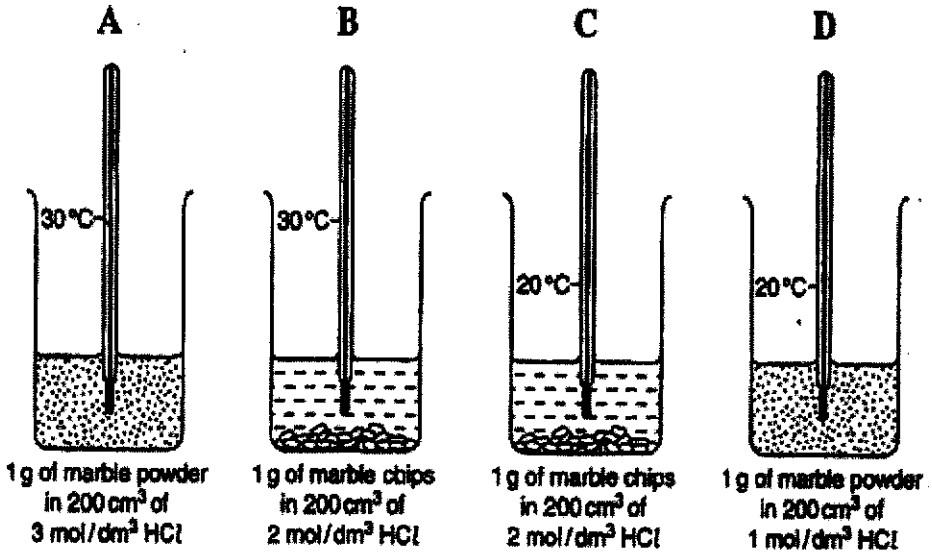
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9 Which trend(s) will be observed for the oxides of the elements across Period 3 of the Periodic Table?

1 It changes from liquid to solid at room temperature.
2 It becomes less basic and more acidic.
3 It changes from ionic compound to covalent compound.

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

10 The thermometer shows the temperature at the start of the reaction in each beaker. In which beaker will the reaction be the fastest?



Answers for Section A MCQ:

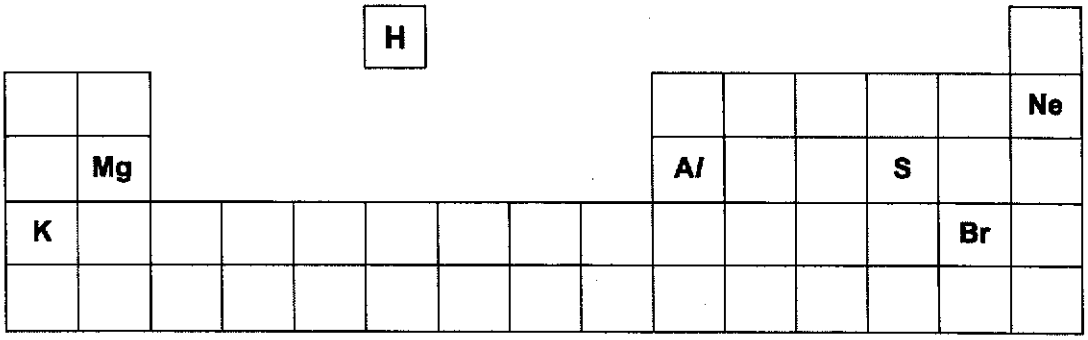
Qn	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Ans										

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Section B

The total mark for this section is 20.

11 The table shows part of the Periodic Table of elements.



Use the elements listed in the Periodic Table above to answer the following questions. You may use each element once, more than once, or not at all.

Identify an element that

(a) forms a neutral oxide, _____

(b) forms diatomic molecules, _____

(c) forms ions with a charge of +2, _____

(d) has the highest proton number, _____

(e) has only one electron shell. _____

[5]

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12 Fig. 12.1 shows a mixture of water and alcohol being separated by distillation. The boiling point of alcohol is 78 °C.

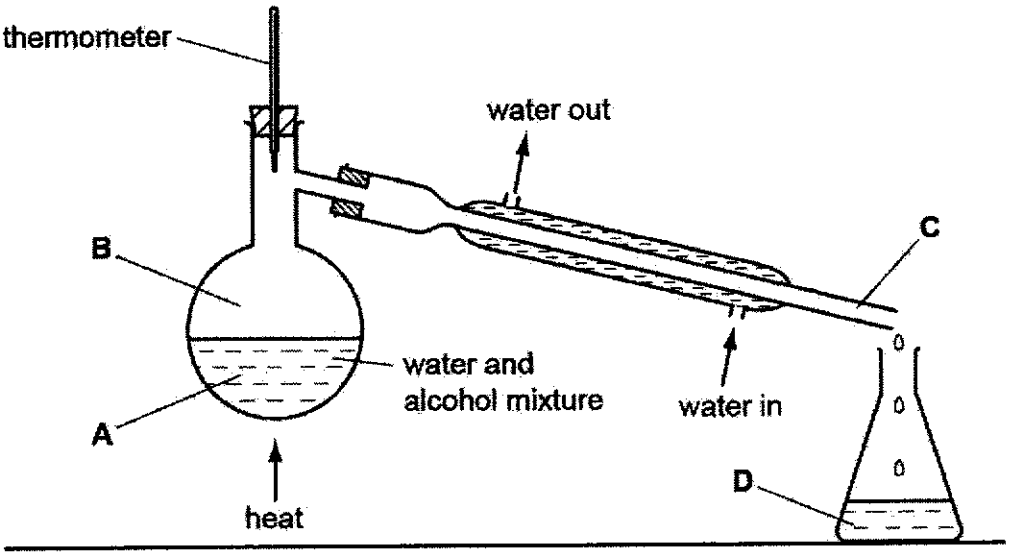


Fig. 12.1

(a) Draw in the box below to show the arrangement of particles at **C**. [1]

(b) Explain using the kinetic particle theory, what happens to the particles in **A** when it is heated from room temperature to 100 °C. [2]

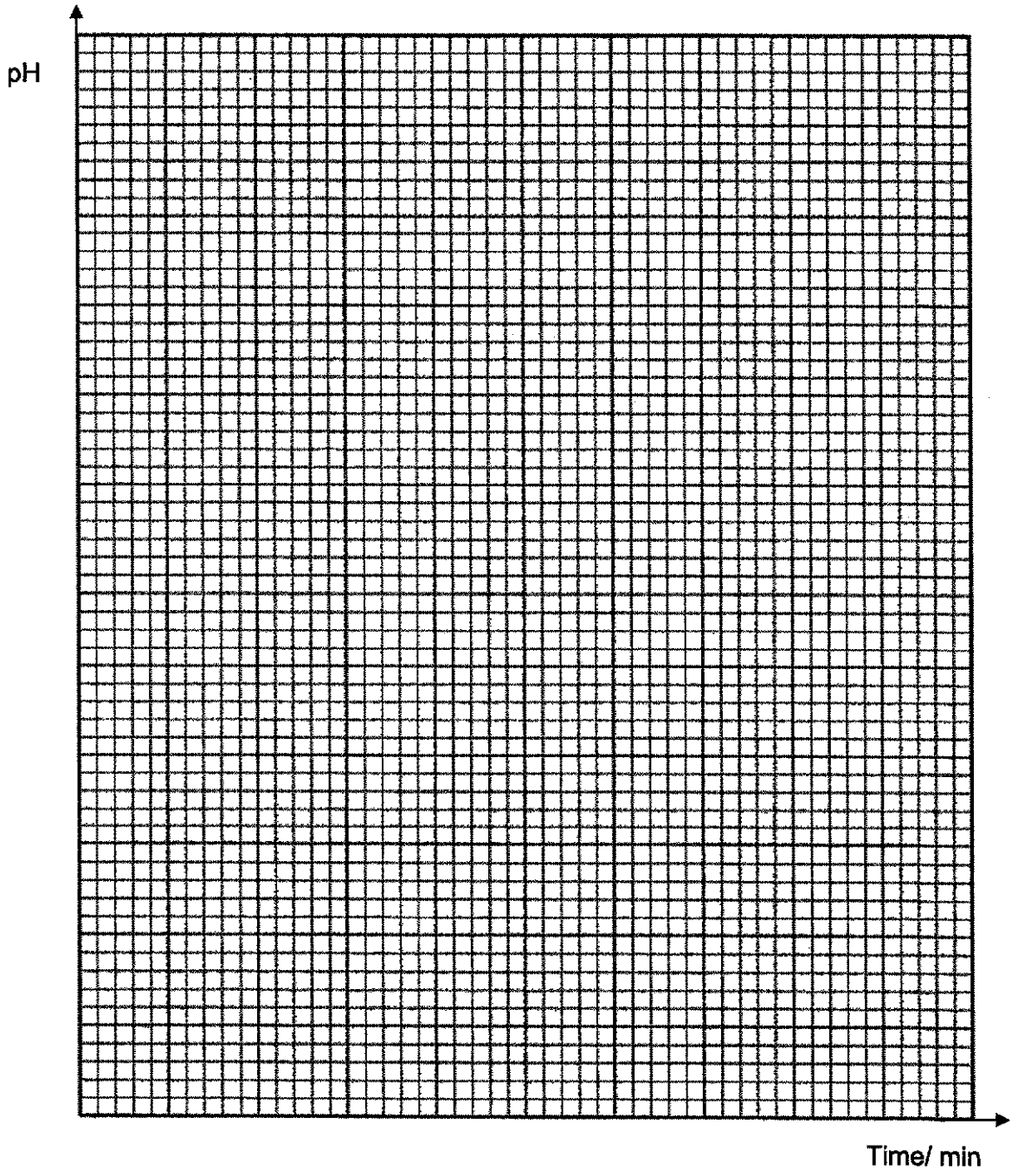
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13 The pH value of the saliva in a student's mouth was measured and found to be 6.9. The measurement was repeated at five-minute intervals after the student ate an apple.

The results are shown in the table below.

Time/ min.	0	5	10	15	20	25	30	35	40
pH	6.9	5.5	4.7	4.2	4.5	5.4	6.3	6.6	6.9

(a) Plot this information on the graph below and draw a smooth curve through the points. [3]



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(b) Use the graph to estimate the time taken for the saliva to return to the original pH value. [1]

..... mins

(c) The table below shows information about solutions of an acid and an alkali. Complete the table by filling in the empty boxes. [3]

solution	chemical formula of acid or alkali	colour change when mixed with Universal Indicator	name of ion that causes this colour change
dilute nitric acid	HNO_3		hydrogen
dilute sodium hydroxide		from green to violet	

14 **(a)** Complete the table below. [3]

chemical name of compound	**formula of compound**
zinc hydroxide	
	Na_2SO_4
	$FeCl_3$

(b) Balance the following chemical equations.

(i) ___K + ___H_2O → ___KOH + ___H_2 [1]

(ii) ___$Al_2(SO_4)_3$ + ___Mg → ___$MgSO_4$ + ___Al [1]

Section C

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The total mark for this section is 20.
Answer any **two** questions.

15 Atoms of non-metallic elements can combine with other atoms to form many different compounds.

(a) One of these compounds is carbon tetrachloride, CCl_4, an organic solvent with low melting and boiling point and is a non-conductor of electricity.

(i) Name the type of chemical bonding present in carbon tetrachloride.

..... [1]

(ii) Draw a 'dot-and-cross' diagram to show the arrangement of electrons in a molecule of carbon tetrachloride in the space below. Show only the outermost electrons. [Proton numbers: C, 6 ; Cl, 17]

[2]

(b) Another of these compounds is magnesium chloride. Unlike carbon tetrachloride, this compound has a high melting and boiling point and is a conductor of electricity when molten.

(i) Name the type of chemical bonding present in magnesium chloride.

..... [1]

(ii) Draw a 'dot-and-cross' diagram to show the arrangement of electrons in magnesium chloride. Show all the electrons.
[Proton numbers: Mg, 12 ; Cl, 17]

[2]

(c) Use your knowledge of the structure and bonding in carbon tetrachloride and magnesium chloride to explain the difference in their

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(i) melting and boiling points;

.....

.....

.....

.....[2]

(ii) electrical conductivity.

.....

.....

.....

.....[2]

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16 In an experiment, indigestion tablets are used to investigate the speed of reaction. When these tablets react with acid, carbon dioxide is given off.

Ten indigestion tablets are added to an excess solution of dilute sulfuric acid at temperature **G**, and the total volume of gas given off is measured at regular intervals.

The procedure is repeated using the same concentration of sulfuric acid at two different temperatures, **H** and **I**. In each experiment, an excess of the same sulfuric acid solution is used.

Fig 16.1 shows the result of these investigations.

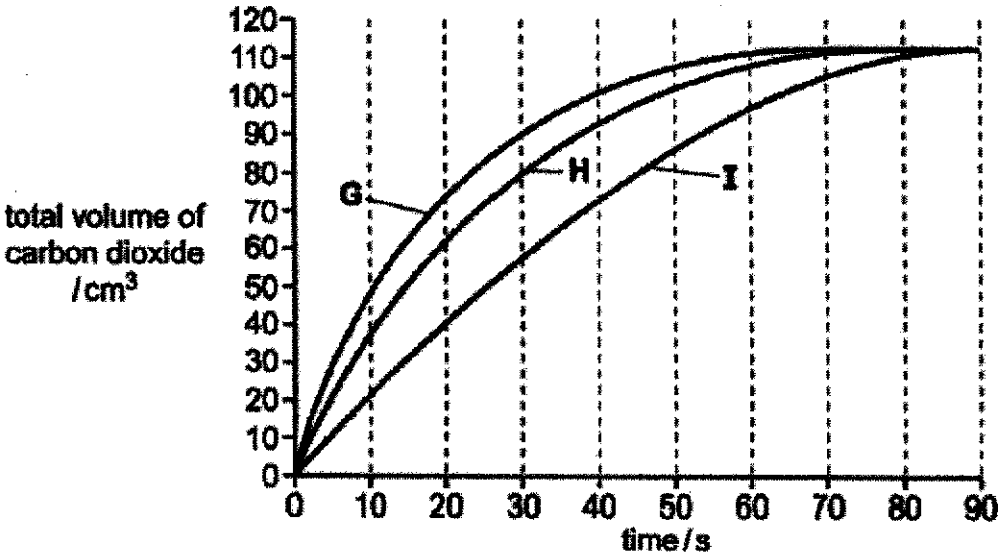


Fig. 16.1

(a) Which of the temperatures, **G**, **H** or **I** is the highest? Explain your reasoning. [2]

.....

.....

(b) How are the reactions at temperature **G** and temperature **I** different after about 75 seconds? [2]

.....

.....

(c) Draw on Fig. 16.1, the curve you would expect if the experiment was repeated at temperature **I** but with 5 tablets? [2]

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(d) Explain, using ideas about particles, why speed of reaction varies with changes in concentration of sulfuric acid. [2]

.....

.....

.....

.....

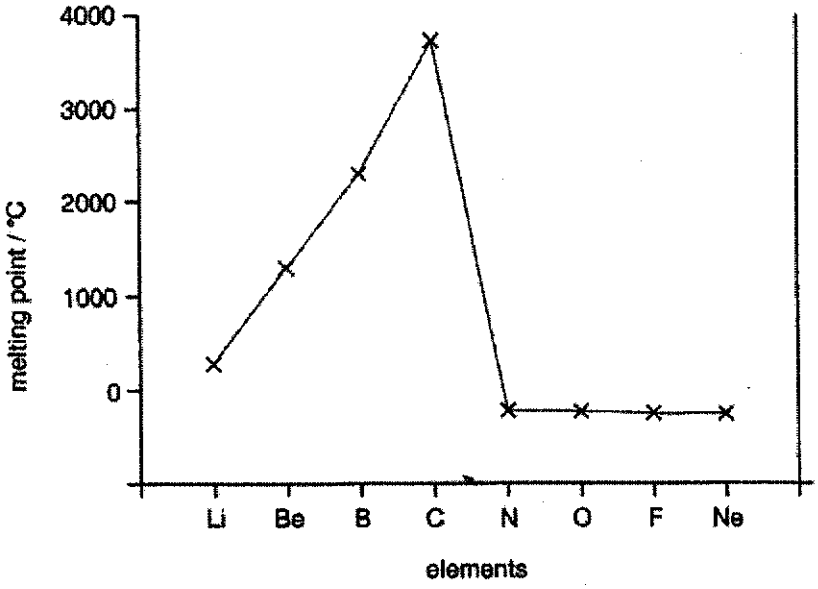
(e) Given that indigestion tablets contain magnesium carbonate, construct a balanced chemical equation for the reaction between magnesium carbonate and sulfuric acid. (State symbols are not required) [2]

.....

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17 (a) This information is about the elements in Period 2 of the Periodic Table.



Element	Electrical conductivity (at room temperature and pressure)
Li	good
Be	good
B	poor
C	good
N	does not conduct
O	does not conduct
F	does not conduct
Ne	does not conduct

(i) Use the information to describe the trends in melting point and electrical conductivity across Period 2.

.....

.....

.....

.....

[3]

(ii) How does the data show that the first four elements in Period 2 are solids at room temperature and pressure?

.....

..... [1]

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(b) The table shows some information about the oxides of element **A** to **E**. The letters are not the symbols of the elements.

element	state of oxide at room temperature and pressure	type of oxide	bonding in oxide
A	solid	basic	ionic
B	solid	acidic	covalent
C	gas	acidic	covalent
D	liquid	neutral	covalent
E	gas	neutral	covalent

(i) Which one of the elements **A** to **E** could be:

Hydrogen _____

Sodium _____ [2]

(ii) State the name of the reaction when the oxide of element **C** is added to sodium hydroxide.

_____ [1]

(c) Element **F** is an amphoteric oxide.

(i) Explain the meaning of the term amphoteric oxide.

_____ [1]

(ii) Suggest the name of an amphoteric oxide.

_____ [1]

(d) Chemicals are important in industry and in our everyday life. Give the reason for use of the following chemical.

Chemical: calcium hydroxide

Use: spread on farmers' field

Reason for use: _____

_____ [1]

END OF PAPER

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DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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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									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.).

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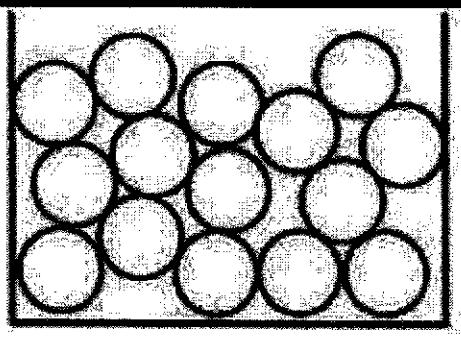
MARKING SCHEME (EYE 2019 SCIENCE (CHEMISTRY)

Kent Ridge Secondary School
End-of-Year Examination 2019
Sec 3 Express Science (Chemistry)

Section A

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

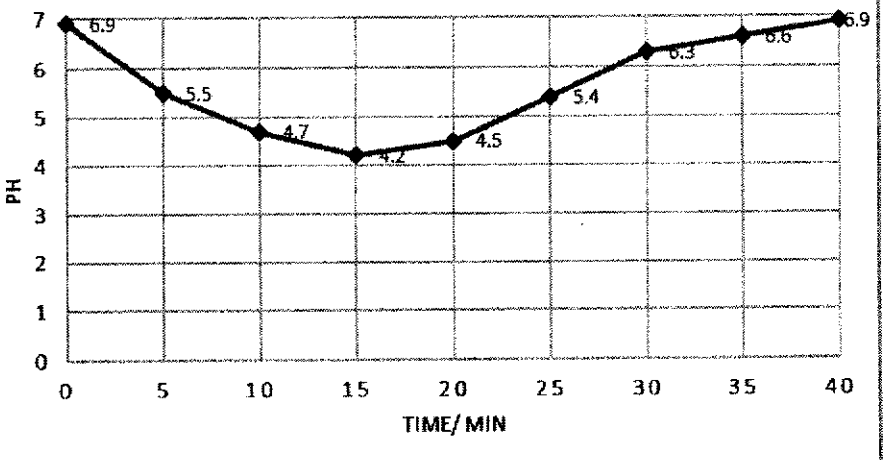
Section B

Qn		Answers	Comments
11	(a)	Hydrogen/ H	1
	(b)	Hydrogen/ H or Bromine/Br	1
	(c)	Magnesium /Mg	1
	(d)	Bromine / Br	1
	(e)	Hydrogen/ H	1
12	(a)	 - Particles to be of same size. - Gaps of particles should not be large enough for another particle to be drawn.	[1]
	(c)	As temperature at A increases, particles **gain energy and move faster.** When it reaches 100°C (or sufficient energy gained), it **overcomes** the strong **forces of attraction** and **moves further apart** in high speeds to become a gas.	1 1

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MARKING SCHEME (EYE 2019 SCIENCE (CHEMISTRY)

13 (a)



1 – correct plotting of points

1 – drawing of smooth curve through the points

1 - scale

(b) Time taken for saliva to return to original pH: **40 mins** — 1

(c)

solution	chemical formula of acid or alkali	colour change when mixed with Universal Indicator	name of ion that causes this colour change
dilute nitric acid	HNO_3	**From green to red**	*hydrogen*
dilute sodium hydroxide	**NaOH**	*from green to violet*	**hydroxide**

3

14 (a)

chemical name of compound	formula of compound
zinc hydroxide	$Zn(OH)_2$
Sodium sulfate	Na_2SO_4
Iron (III) chloride *no marks awarded for Iron chloride	$FeCl_3$

1
1
1

(b)(i) $2K + 2H_2O \rightarrow 2KOH + ___H_2$ — 1

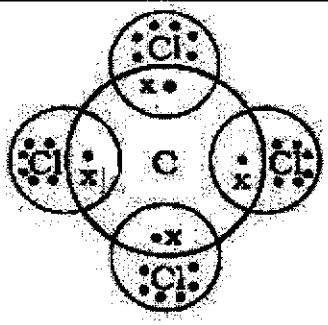
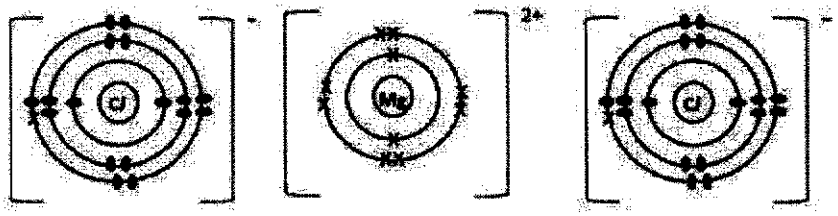
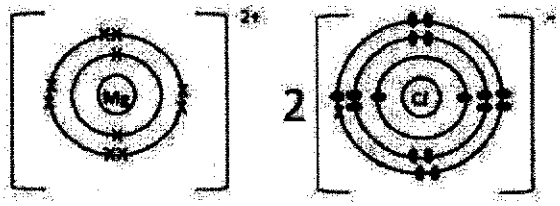
(b)(ii) $Al_2(SO_4)_3 + 3Mg \rightarrow 3MgSO_4 + 2Al$ — 1

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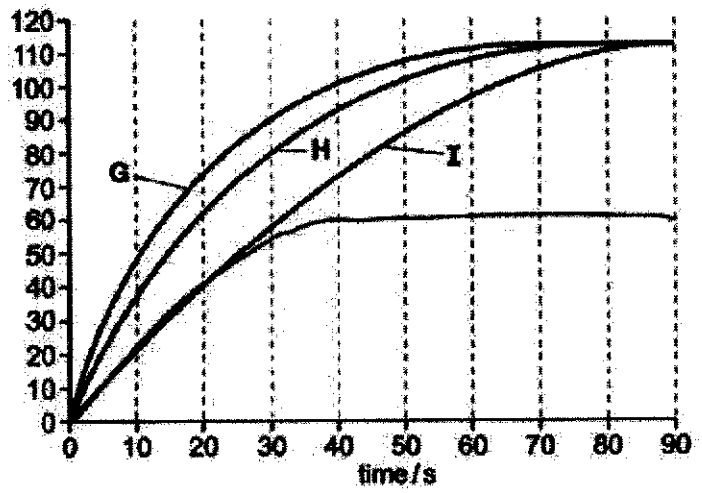
MARKING SCHEME (EYE 2019 SCIENCE (CHEMISTRY)

Section C

Qn		Answers	Marks
15	(a)(i)	**Covalent** bonding.	1
	(a)(ii)		1 – correct sharing of 1 electrons in each pair of C: Cl 1 – correct valence electrons for C and Cl
	(bi)	Ionic bonding	1
	(bii)	 Symbol X : electron of Mg ● : electron of Cl Accept if students have collapsed both chloride ions : 	1 – correct ratio of 1 Mg ion: 2 Cl ions 1 – correct charge of Mg^{2+} and Cl^-
	(c)(i)	CCl_4 has a low boiling point as it **has weak intermolecular forces of attraction**. $MgCl_2$ has a high boiling point as it has **strong electrostatic forces of attraction between its oppositely charged ions**. Hence, **a larger amount of energy** is required to **overcome the strong forces of attraction** in $MgCl_2$ than CCl_4.	1 – correctly stating the type of bonding in $MgCl_2$ and CCl_4 1 – comparing the larger energy required in $MgCl_2$ and CCl_4

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	(c)(ii)	**CCl_4 does not conduct electricity in any state** as it does not have **any free mobile ions.** However, **$MgCl_2$** can **conduct electricity in the molten or aqueous state as it has free mobile ions**	1 –stating that CCl_4 does not conduct electricity 1 –stating the condition where $MgCl_2$ conducts
16	(a)	**G.** It has the steepest gradient/ it took the shortest time to complete the reaction / reaction is the fastest.	1 1
	(b)	**Reaction is complete at G** but at **I, reaction was still on-going**.	1 1
	(c)		1 – graph to end at 55cm^3 1 – similar gradient with I
	(d)	As concentration increases, there are **more reacting particles per unit volume**, hence the **frequency of effective collisions increases**. Thus, speed of reaction increases.	1 1
	(e)	**$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + CO_2 + H_2O$** 1 – correct chemical symbols for all reagents 1 – correct chemical symbols for all products	2
17	(a)(i)	**Melting point:** Across the Period 2, the melting point **increases from Li to C**. The melting point then **drops to below 0ºC** from N to Ne. **decrease from C to N to Ne.** **Electrical conductivity:** Electrical conductivity is good from Li to C but it does not conduct from N to Ne.	[1] [1] [1]
	(a)(ii)	Their melting points are above room temperature/above 25ºC.	[1]
	(b)(i)	Hydrogen: **D**	[2]

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		Sodium: **A**	
	(b)(ii)	Neutralisation	[1]
	(c)(i)	An oxide that can **react as both an acid and a base** to form salt and water.	[1]
	(c)(ii)	Zinc oxide / Alumnium oxide/ Lead oxide	[1]
	(d)	To **neutralise acidic** soils.	[1]

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