Geylang Methodist School (Secondary)
Preliminary Examination 2018

5076/01

SCIENCE (PHYSICS/CHEMISTRY)

Paper 1 Multiple Choice

Sec 4 Express
Sec 5 Normal (A)

Additional materials: Optical Answer Sheet

1 hour

Setter :
Mr Iskander

24 August 2018

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the Optical Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Read the instructions on the Optical Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Gravitational field strength is assumed to be 10 N/kg unless otherwise specified.

A copy of the Periodic Table is printed on page .

This document consists of printed pages.

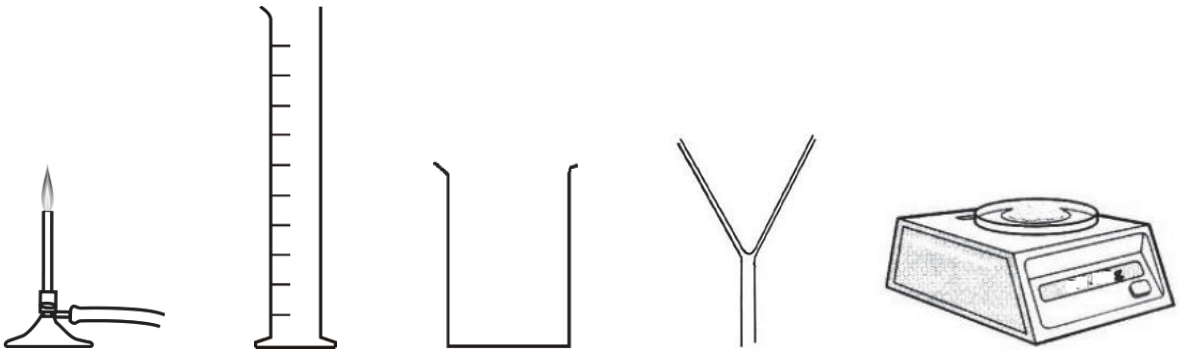
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1 Silver chloride is insoluble in water.

Silver chloride is made by adding 20.0 cm^3 of aqueous silver nitrate to 20.0 cm^3 of dilute hydrochloric acid.

Which pieces of apparatus are needed to obtain solid silver chloride from aqueous silver nitrate and dilute hydrochloric acid?

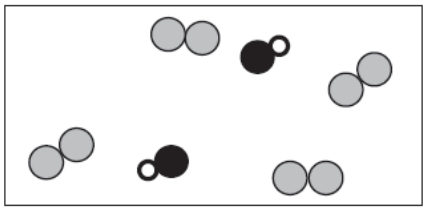


1 2 3 4 5

A 1, 2 and 4
B 1, 4 and 5
C 2, 3 and 4
D 2, 4 and 5

2 The diagram below shows the arrangement of gases in a balloon.

Which pair of gases could be in the balloon?



A argon and hydrogen chloride
B argon and nitrogen
C hydrogen and nitrogen
D hydrogen chloride and nitrogen

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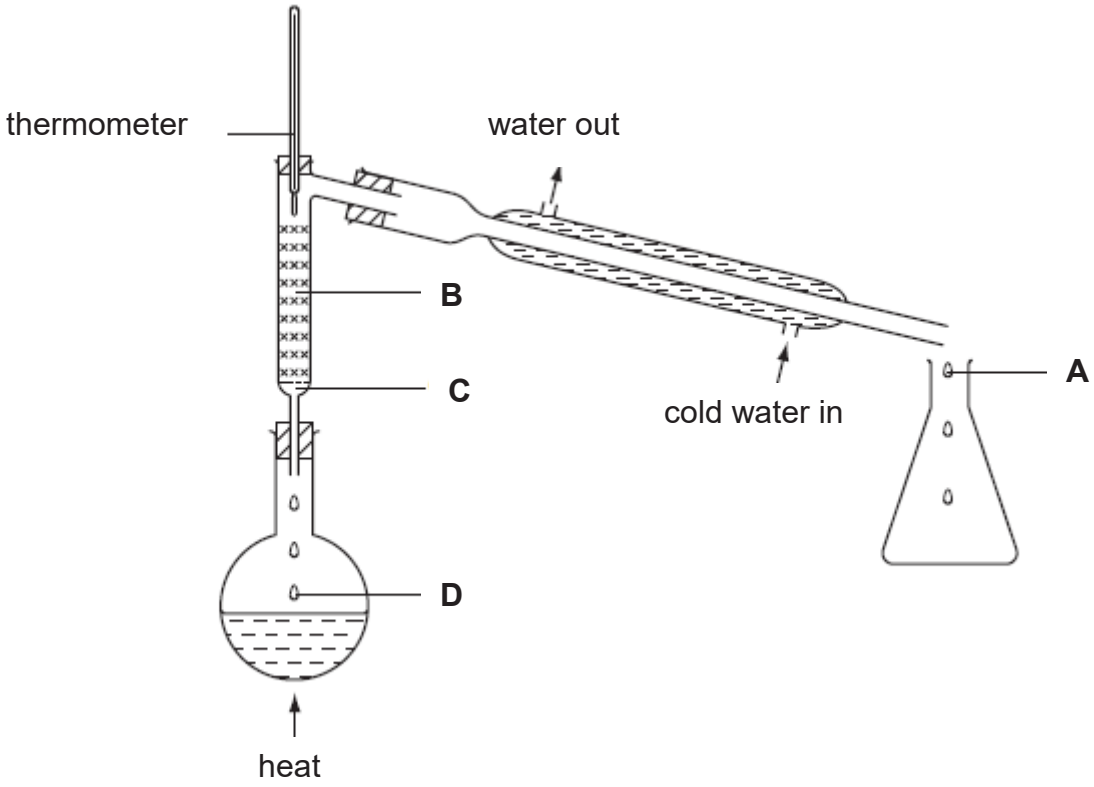
3 Salt can be separated from sand by using the processes shown.

What is the correct order for the processes?

	first →			last
A	filter	dissolve	evaporate	crystallise
B	dissolve	evaporate	crystallise	filter
C	dissolve	evaporate	filter	crystallise
D	dissolve	filter	evaporate	crystallise

4 A mixture containing equal volumes of two liquids that mix completely but do not react together is placed in the apparatus shown and heated until the thermometer first shows a steady reading.

At which position will there be the highest proportion of the liquid with the lower boiling point?



5 Which of the following changes will result in the particles moving at a higher speed?

A I_2 (g) → I_2 (s)
B CO_2 (s) → CO_2 (g)
C H_2O (*l*) → H_2O (s)
D N_2 (g) → N_2 (*l*)

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6 An imaginary element Gemsium(Gm) contains 111 protons and 141 neutrons.

Which one of the following represents an atom of Gemsium?

A $^{141}_{30}Gm$

B $^{141}_{111}Gm$

C $^{111}_{141}Gm$

D $^{252}_{111}Gm$

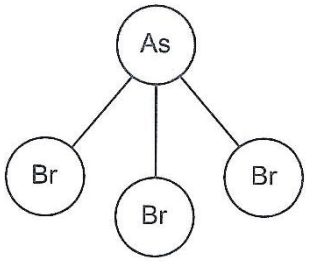
7 The nucleon number and proton number of an atom of P and atom of Q are shown.

	P	Q
nucleon number	85	80
proton number	37	35

Which statement about P and Q is correct?

A An atom of P has fewer electrons than an atom of Q.
B An atom of P has more neutrons than an atom of Q.
C P is above Q in the same group of the Periodic Table.
D P is in the same period in the Periodic Table as Q.

8 A molecule of arsenic bromide, $AsBr_3$, has the structure shown.



Which properties could be correct for arsenic bromide?

	melting point/^oC	electrical conductivity at room temperature
A	31	does not conduct
B	39	conducts
C	650	conducts
D	755	does not conduct

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9 A student thinks that element Q is a metal because it has a high melting point and a high boiling point.

What other properties could element Q have if it is a metal?

1 Q conducts electricity when solid.
2 Q forms an acidic oxide, QO_2.
3 Q is malleable.

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

10 In the Periodic Table, caesium, lithium and sodium are in the same group.

Which statement about caesium is likely to be correct?

A It forms a nitrate, $Cs(NO_3)_2$.
B It forms an insoluble hydroxide.
C It has a density greater than potassium.
D It reacts slowly with water at room temperature.

11 Astatine is at the bottom of Group VII in the Periodic Table.

Which of the following is a property of astatine?

A It forms a basic oxide.
B It is a good conductor of electricity.
C It forms a covalent compound of formula NaAt.
D It is displaced by chlorine from aqueous potassium astatide.

12 When two aqueous solutions are mixed in a test-tube, a reaction occurs and the test-tube feels hot.

Which statement is correct?

A An exothermic reaction takes place as the reacting chemicals gain energy.
B An exothermic reaction takes place as the reacting chemicals lose energy.
C An endothermic reaction takes place as the reacting chemicals gain energy.
D An endothermic reaction takes place as the reacting chemicals lose energy.

13 2.0 g of magnesium are completely burnt in pure oxygen.

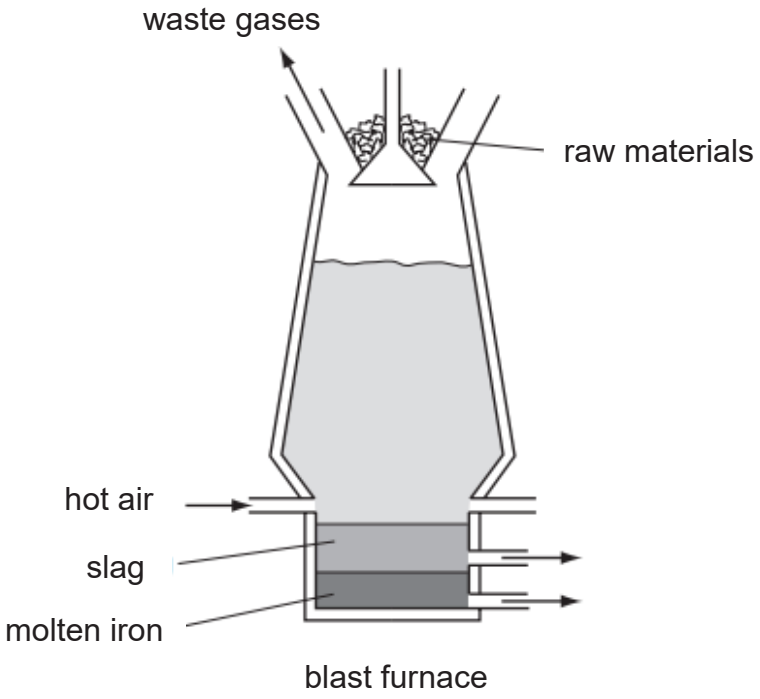
$$2Mg + O_2 \rightarrow 2MgO$$

Which volume of oxygen is used in this reaction at room temperature and pressure?

A 0.5 dm^3
B 1.0 dm^3
C 1.5 dm^3
D 2.0 dm^3

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14 Iron is produced in a blast furnace as shown in the diagram below.

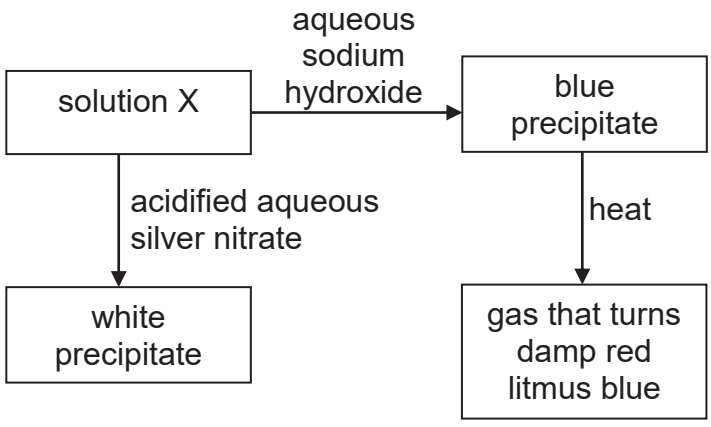


blast furnace

Which statement about this process is correct?

A Carbon is oxidised to carbon dioxide.
B Carbon monoxide is produced by the thermal decomposition of calcium carbonate.
C Haematite is reduced by calcium carbonate.
D Impurities are removed by the hot air blast.

15 The diagram below shows some of the reactions of solution X.



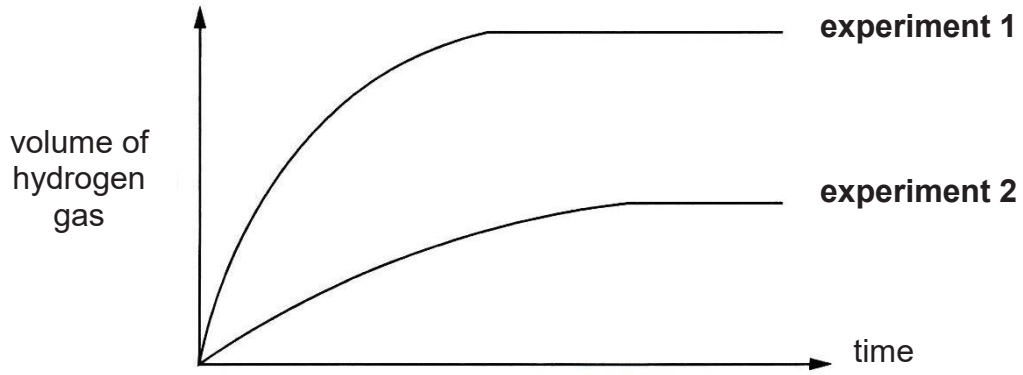
Which of the following the substance(s) is/are present in solution X?

A copper(II) nitrate only
B ammonium chloride only
C zinc nitrate and copper(II) nitrate
D ammonium chloride and copper(II) chloride

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16 Zinc powder was added to excess dilute sulfuric acid at room temperature. The volume of hydrogen gas produced was measured over a period of time.

The graph labelled **experiment 1** shown below was obtained.



Which change was made to obtain the results shown in **experiment 2**?

A Half the mass of zinc granules was used.
B Half the concentration of dilute sulfuric acid was used.
C Larger zinc strip of the same mass was used.
D Dilute sulfuric acid at lower temperature was used.

17 Crude oil is fractionally distilled into useful fractions.

Which option matches the fraction to its use?

	fraction	use
A	bitumen	feedstock for the petrochemical industry
B	diesel oil	fuel for aircraft engines
C	petrol	fuel for engines in buses, lorries and trains
D	petroleum gas	fuel for cooking and heating

18 Many countries have taken measures to ensure that the amount of sulfur in unleaded petrol and diesel fuels are kept low.

Which of the following could be the reason for such measures?

A To cut down the amount of fuel used in vehicles.
B To reduce the acidity of the rain.
C To reduce incomplete combustion.
D To prevent the pH of soil from increasing.

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19 Which reaction describes the following equation?

$$C_{15}H_{32} \rightarrow C_{10}H_{22} + C_3H_6 + C_2H_4$$

A addition
B cracking
C oxidation
D substitution

20 The table shows the observations made when an organic compound X reacts with aqueous bromine and acidified potassium manganate (VII).

reagent	observation
aqueous bromine	no change
acidified potassium manganate(VII)	purple solution turns colourless

What is compound X?

A ethane
B ethanoic acid
C methanol
D propene

End of paper

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DATA SHEET
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 162	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 –	91 Pa protactinium –	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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Geylang Methodist School (Secondary)

End of Year Examination 2018

Candidate Name			
Class		Index Number	

SCIENCE **5076/03, 5078/03**

Paper 3 Chemistry **Sec 4 Express**
Sec 5 Normal (A)

Additional Materials : Writing Paper **1 hour 15 minutes**

Setter: Miss Ng Sio Ying **17 August 2018**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

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

A copy of the Periodic Table is printed on page 14.

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

For Examiner's Use	
Section A	/45
Section B	
.....	/10
.....	/10
Total	/65

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[Turn over

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Section A

Answer all the questions in this section.
Write your answers in the spaces provided on the question paper.

1 The diagram shows part of the Periodic Table. Only some of the elements are shown.

							H										
													C	N		F	
													Si	P	S	Cl	
			Ti				Fe			Cu	Zn			As		Br	

(a) Answer each of the following questions using only those elements shown in the diagram. Each element may be used once, more than once or not at all.

Give one element which

(i) oxidises in the presence of water and air to form rust,

……...

(ii) forms an ion of $\mathbf{Y}^-$ which has only three completely filled shells of electrons,

……...

(iii) forms an oxide which is amphoteric,

……...

(iv) is a colourless diatomic gas,

……...

(v) is found as an impurity in fossil fuels and burns in air to produce an air pollutant that causes acid rain.

……...
[5]

(b) Element **X** is a noble gas with two electron shells. Label this element as **X** in the Periodic Table above. [1]

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2 Fig. 2.1 shows some reactions of copper(II) nitrate, $Cu(NO_3)_2$.

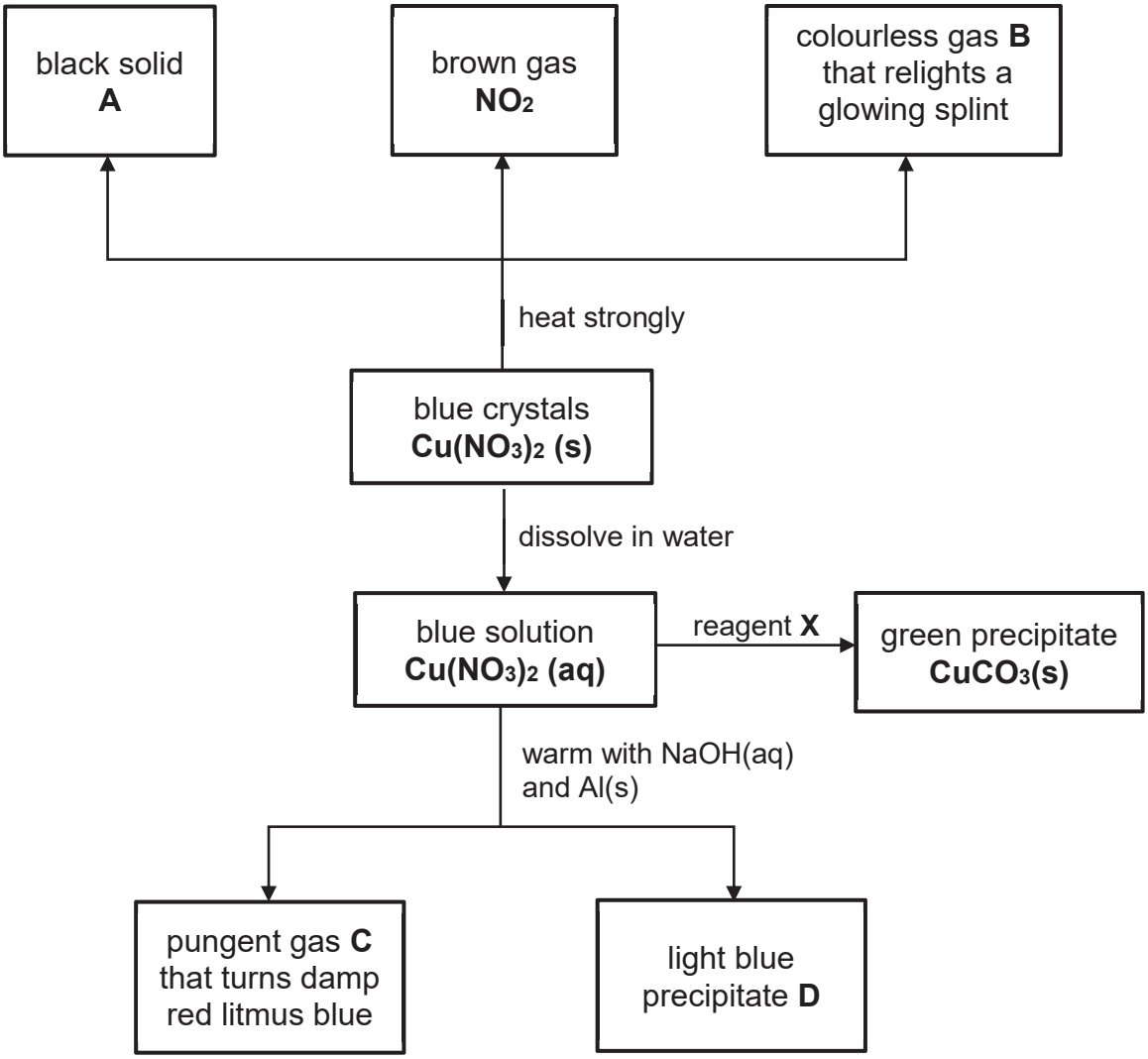


Fig. 2.1

(a) Identify the substances **A** – **D**.

A .....

B .....

C .....

D .....

[4]

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(b) Copper(II) nitrate solution reacts with reagent **X** to form copper(II) carbonate.

(i) Suggest the name of reagent **X**.

……..
[1]

(ii) Construct the balanced chemical equation, with state symbols, for the reaction between copper(II) nitrate solution with reagent **X** to form copper(II) carbonate.

……..
[2]

(iii) Describe the steps used in a laboratory to prepare a pure sample of powdered copper(II) carbonate from copper(II) nitrate solution and reagent **X**.

……..

……..

……..

……..

……..

……..

……..
[3]

(c) Describe how hydrochloric acid and limewater can be used to show that carbonate ions are present in copper(II) carbonate.

……..

……..

……..

……..
[2]

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3 Titanium, Ti, is a metal used in the aerospace industry. It exists naturally as titanium-iron oxide, $FeTiO_3$, in a mineral called ilmenite. To extract titanium, the compound is first converted to titanium tetrachloride, $TiCl_4$, which is being heated to 2000°C with magnesium in an atmosphere of a noble gas, argon.

The extraction of titanium from its chloride is represented by the following equation.

$$TiCl_4 + 2Mg \rightarrow 2MgCl_2 + Ti$$

(a) What is the mass of magnesium chloride formed when 12 kg of titanium is extracted?
[Relative atomic masses: A_r: Ti, 48; Mg, 24; Cl, 35.5]

mass of magnesium chloride = …… kg [2]

(b) Calculate the smallest mass of titanium-iron oxide, $FeTiO_3$, needed to produce 12 kg of titanium.
[Relative atomic masses: A_r: Ti, 48; Fe, 56; O, 16]

mass of titanium-iron oxide = …… kg [2]

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4 Fig. 4.1 shows the materials used to make ballpoint pen.

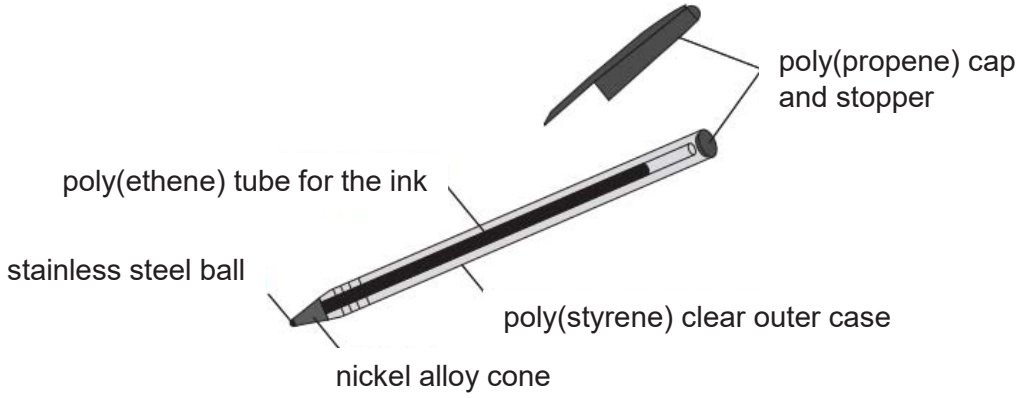


Fig. 4.1

(a) With reference to the arrangement of atoms, explain why alloys such as steel are used as materials in the pen, instead of pure metals.

……..

……..

……..

……..

[2]

(b) Give one advantage and one disadvantage of recycling the materials from this ballpoint pen.

……..

……..

……..

……..

[2]

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5 **(a)** Use your knowledge of electronic structures to explain the following statements.

(i) Elements in Group II have similar chemical properties.

……...

(ii) Elements in Group 0 lack chemical reactivity.

……...
[2]

(b) Element **Z** with an atomic number of 85 is a highly unstable radioactive element.

(i) Suggest two ways in which chlorine differs in properties from element **Z**.

……...

……...

……...

……...
[2]

(ii) Excess chlorine is bubbled through a solution of Na**Z**.

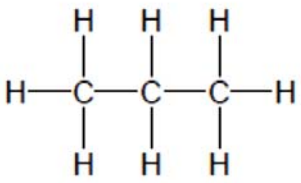
Write a chemical equation for the reaction. State symbols are not required.

……...
[1]

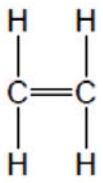
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6 The structures of five organic compounds are shown below.

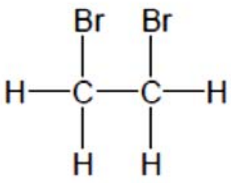
A



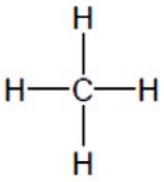
B



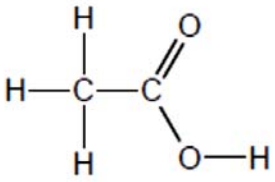
C



D



E



(a) Answer each of the following questions using the letters that represent each compound.

(i) Which two compounds are in the same homologous series?

……..

(ii) Which compound is formed when ethanol reacts with atmospheric oxygen?

……..

(iii) Which compound reacts with steam to form ethanol?

……..

[3]

(b) A solution of ethanol can be made by fermentation of glucose.

(i) Draw the structural formula of ethanol.

[1]

(ii) State two conditions required for the fermentation of glucose.

……..

……..

[2]

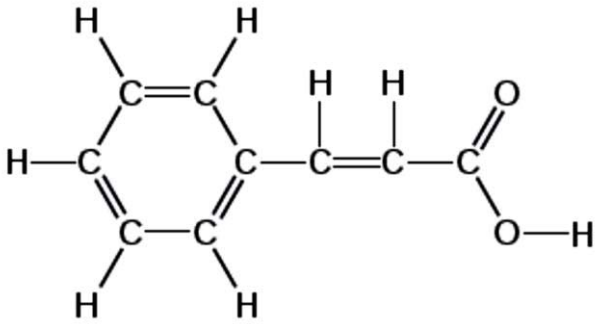
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(iii) Calculate the relative molecular mass of ethanol and the percentage by mass of carbon in each molecule of ethanol.
[Relative atomic masses: A_r: H, 1; C, 12; O, 16]

[2]

7 Cinnamic acid is found in plants called balsams.

The structure of cinnamic acid is shown below.



(a) Cinnamic acid is an unsaturated compound.

(i) What is meant by the term *unsaturated*?

……..
[1]

(ii) Describe a chemical test to show that cinnamic acid is unsaturated.

chemical test

……..

……...

result with cinnamic acid

……..

……..
[2]

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(b) Balsam flowers contain a mixture of pigments.

A student uses chromatography to separate the pigments in balsam flowers. He puts the pigment mixture on a sheet of chromatography paper as well as five spots of pure pigments **A**, **B**, **C**, **D** and **E**.

The results are shown as a chromatogram in Fig. 7.1.

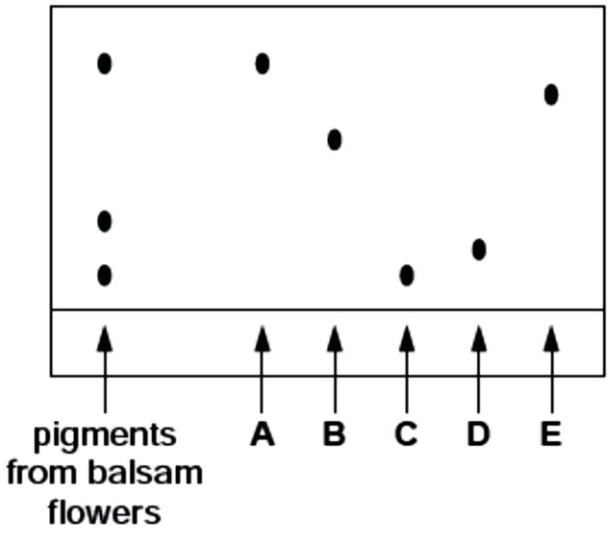


Fig. 7.1

(i) Which of the pigments are present in balsam flowers?

……..
[1]

(ii) Draw the apparatus that could be used to produce this chromatogram.

[2]

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Section B

Answer any **two** questions in this section.

Write your answers in the writing papers provided.

8 Fluorine is the lightest halogen and exists as a highly reactive pale yellow diatomic gas at room temperature and pressure. Fluorine is found in nature in the form of calcium fluoride crystals, called fluorite.

(a) The following equation describes the reaction between fluorine gas and water.

$$2F_2\ (g) + 2H_2O\ (l) \rightarrow O_2\ (g) + 4HF\ (aq)$$

Given that 48 cm^3 of fluorine gas reacts with excess water, calculate the **volume** and **mass** of oxygen gas produced at room temperature and pressure. [2]

(b) Draw and label the electronic structures of fluorine gas and calcium fluoride.
[Proton numbers: F, 9; Ca, 20] [4]

(c) Use these structures to explain why, at room temperature and pressure, calcium fluoride is a solid and fluorine is a gas. [4]

9 **(a)** The reaction of metal **X** with water places it between calcium and iron in this order of reactivity. Explain why **X** would displace copper if added to a solution of copper(II) sulfate. [2]

(b) Aluminium does not react with cold water. Does this give a true indication of the reactivity of this element? Explain your answer. [2]

(c) Iron is produced in the blast furnace by heating a mixture of iron(III) oxide, coke and limestone with air.

Describe the reactions involved in this extraction.
Include an equation of a redox reaction. [6]

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10 Dilute hydrochloric acid reacts with calcium carbonate to produce carbon dioxide.

(a) **(i)** With the aid of a diagram, design and describe an experiment in a laboratory to show how the rate of reaction between these two substances depends on the particle size of calcium carbonate. [4]

(ii) Describe the measures you would take to ensure that your experiment is fair. [2]

(iii) State and explain how the rate of reaction between two substances is affected by the particle size of one substance. Use your knowledge of reacting particles in your explanation. [2]

(b) Increasing the concentration of acid can change the speed of a reaction. State and explain how it affects the speed of the reaction. Use your knowledge of reacting particles in your explanation. [2]

End of Paper

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Geylang Methodist School (Secondary)
Preliminary Examination 2018
Secondary 4E5N Science (Chemistry) Answer Scheme

Paper 1

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

11	12	13	14	15	16	17	18	19	20
D	B	B	A	D	A	D	B	B	C

Paper 3 Section A

Question			Marking Point	Marks
1	(a)	(i)	Fe	1
		(ii)	Cl	1
		(iii)	Zn	1
		(iv)	H or N	1
		(v)	S	1
	(b)		*Position of **X**: Group 0, 2nd element* (Ne)	1
			Total:	**6**
2	(a)		**A** – copper(II) oxide **B** – oxygen gas **C** – ammonia gas **D** – copper(II) hydroxide	4 (1M each)
	(b)	(i)	Any soluble carbonate e.g. sodium carbonate / potassium carbonate	1
		(ii)	$Cu(NO_3)_2$ (aq) + Na_2CO_3 (aq) → $CuCO_3$ (s) + 2 $NaNO_3$ (aq) Balanced chemical equation – 1 State symbols – 1	2
		(iii)	Mix the solutions together and stir.	1
			Filter the mixture to obtain copper(II) carbonate as the residue.	1
			Wash the residue with distilled water.	1
	(c)		Add hydrochloric acid to copper(II) carbonate.	1
			Effervescence observed, gas produced forms white precipitate when passed into limewater.	1
			Total:	**12**

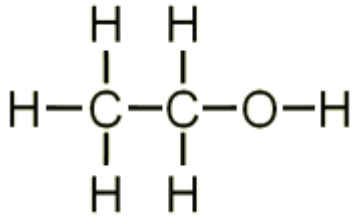
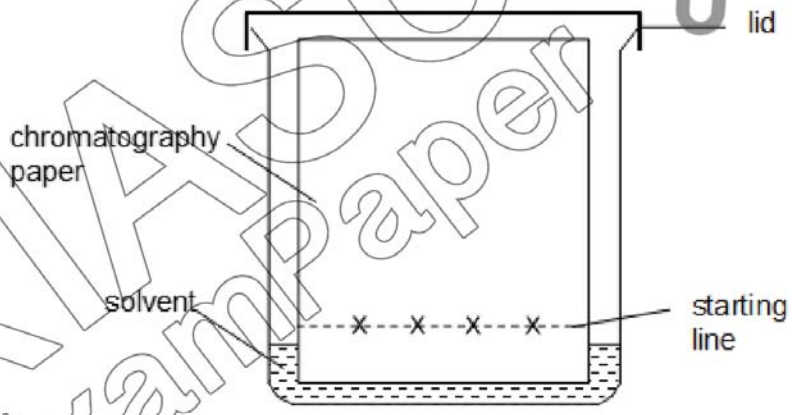
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Question			Marking Point	Marks
3	**(a)**		No. of moles of titanium = 12 000 / 48 = 250 moles No. of moles of $MgCl_2$ = 250 x 2 = 500 moles	1
			Mass of $MgCl_2$ = 500 x (24 + 35.5 x 2) = 47500 g = 47.5 kg	1
	(b)		% mass of Ti in $FeTiO_3$ = 48 / (56+48+16x3) x 100% = 31.57894 %	1
			Mass of $FeTiO_3$ to produce 12kg of Ti = 12/31.57894 x 100 = 38 kg	1
			Total:	**4**
4	**(a)**		Alloys are harder than pure metals.	1
			The different sized atoms disrupt the orderly arrangement of atoms, Hence making it difficult for the metal atoms to slide over one another.	1
	(b)		Advantage: • Conserves finite resources of crude oil/metal ores. • Reduces use of landfill. • Less problems caused from disposal. • Materials used are non-biodegradable. • Less expensive than producing from raw materials.	Any 1
			Disadvantage: • Difficulty / high cost to separate the materials. • Not all materials can be recycled.	Any 1
			Total:	**4**
5	**(a)**	(i)	They all have 2 valence electrons.	1
		(ii)	They all have complete/full valence shell.	1
	(b)	(i)	• Chlorine has lower boiling/melting point than astatine/**Z**. OR Chlorine is a gas at room temperature but astatine/**Z** is a solid at room temperature. • Chlorine is greenish yellow in colour but astatine/**Z** is black in colour. • Chlorine is more reactive than astatine/**Z**.	Any 2
	(b)	(ii)	$Cl_2 + 2\ NaZ \rightarrow Z_2 + 2\ NaCl$	2
			Total:	**6**
6	**(a)**	(i)	A and D	1
		(ii)	E	1
		(iii)	B	1

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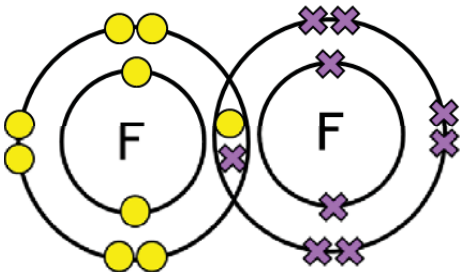
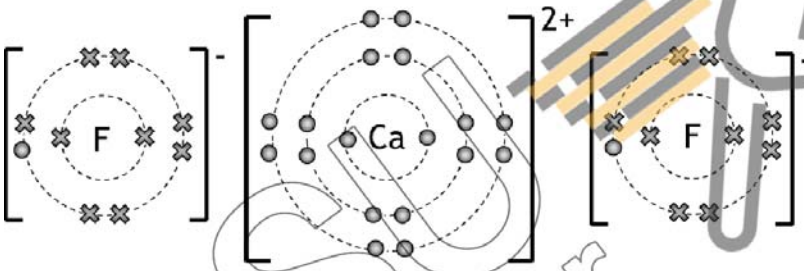
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Question			Marking Point	Marks
	(b)	(i)		1
		(ii)	37^{o}C, absence of oxygen, presence of yeast	Any 2
		(iii)	Mr of ethanol = 2x12 + 6 + 16 = <u>46</u> (no units)	1
			%mass of carbon = 24/46 x 100% = <u>52.2%</u> (3sf)	1
			Total:	**8**
7	**(a)**	(i)	Compound consists of at least one C=C bond	1
		(ii)	Add compound to aqueous bromine/ bromine solution/ bromine water.	1
			Reddish brown aqueous bromine decolourises.	1
	(b)	(i)	A and C (both must be correct)	1
		(ii)	 Proportional drawing – 1 Appropriate labels – 1	2
			Total:	**6**

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Section B

Question			Marking Point	Marks
8	(a)		Volume of oxygen = 48/2 = 24 cm^3	1
			No. of moles of oxygen = 0.024 / 24 = 0.001 Mass of oxygen = 0.001 x 32 = 0.032 g.	1
	(b)		 Fluorine gas Correct sharing – 1 Correct number of valence electrons – 1  Calcium fluoride Correct calcium ion – 1 Correct fluoride ion – 1	4
	(c)		Fluorine is a covalent molecule. It has weak intermolecular forces of attraction	1
			which requires small amount of energy to overcome/ has low boiling point hence it is a gas at r.t.p.	1
			Calcium fluoride is an ionic compound. It has strong electrostatic forces of attraction between the ions	1
			which requires large amount of energy to overcome/ Has high melting point hence is a solid at room temperature.	1
			Total:	**10**

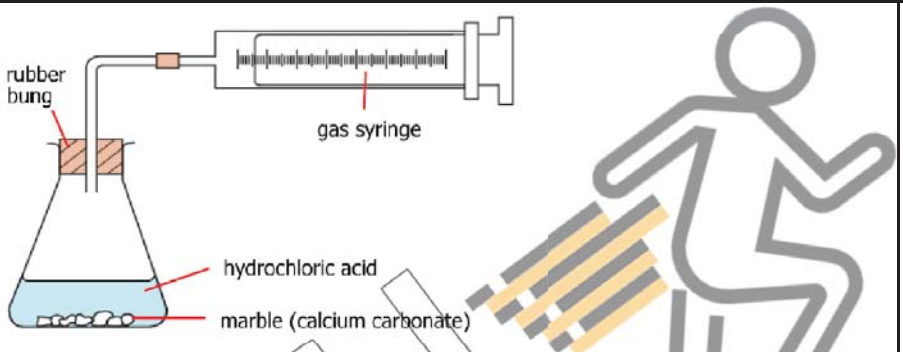
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Question			Marking Point	Marks
9	(a)		X is more reactive than iron, which is more reactive than copper.	1
			Hence X is more reactive than copper.	1
	(b)		No. Aluminium reacts with oxygen to form a layer of aluminium oxide	1
			which is unreactive and hence prevents the aluminium metal from reacting with water.	1
	(c)		Coke burns in air to form carbon dioxide	1
			Carbon dioxide reacts with more coke to form carbon monoxide.	1
			Carbon monoxide reacts with iron(III) oxide to form iron and carbon dioxide.	1
			Limestone decomposes to form calcium oxide and carbon dioxide.	1
			Calcium oxide reacts with sand (silicon dioxide) to form calcium silicate/molten slag.	1
			Equation of Redox reaction • $C + O_2 \rightarrow CO_2$ • $CO_2 + C \rightarrow 2\ CO$ • $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$	Any 1
			Total:	**10**

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Question			Marking Point	Marks
10	(a)	(i)	 Weigh **2.0 g** of calcium carbonate **lumps** and place in a conical flask. Add **50cm^3** of **1mol/dm^3 dilute hydrochloric acid** into the flask. Record the **time taken for effervescence to stop / time taken to collect 10 cm^3 of gas** Repeat experiment with **powdered** calcium carbonate and compare the time taken for both experiments. Marking points (1M each): • Appropriate **diagram** with suitable labels • Use of **appropriate mass** of calcium carbonate and **volume** of acid • Use of different particle size of calcium carbonate (**lumps vs powdered** or **large lumps vs small lumps**) in two experiments. • Observation or change that is measured to compare the rate of reaction (**time taken for effervescence to stop / time taken to collect fixed volume of gas**)	4
		(ii)	• **Concentration** of dilute hydrochloric acid used is the same. • **Mass** of calcium carbonate used is the same. • **Temperature** of both experiments is the same. *Reject*: Equal volume of dilute hydrochloric acid Shake the acid to ensure reaction is complete Repeat experiment and obtain average of results.	Any 2
		(iii)	The smaller the particle size, the larger the total surface area for particles to collide,	1
			resulting in increased number of effective collisions and hence higher speed of reaction. (opposite is true)	1
	(b)		The higher the concentration of acid, the higher the speed of reaction	1
			The more concentrated the acid, the more acid particles per unit volume, resulting in increased number of effective collisions	1
			Total:	**10**

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