Class	Register No.

Candidate Name_____

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SECONDARY FOUR NORMAL (ACADEMIC)

SCIENCE (CHEMISTRY) **5105/03, 5107/03**
Paper 3 (Multiple Choice) **26 July 2022**
Papers 3 and 4: 1 hour 15 minutes

Additional Materials: Multiple Choice Answer Sheet, Periodic Table

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Answer Sheet in the spaces provided unless it has been done for you.

There are **twenty** questions on this paper. 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 **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Answers to Paper 3 and Paper 4 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
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.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

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1 Which substance is a gas at 28°C?

	melting point/°C	boiling point/°C
A	−54	45
B	−21	23
C	32	78
D	43	123

2 Some students are asked to describe the differences between gases and liquids.

Three of their suggestions are:

1. gas molecules are further apart than liquid molecules
2. gas molecules are bigger than liquid molecules
3. gas molecules move freely but liquid molecules vibrate around fixed positions

Which suggestion(s) is/are correct?

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

3 Which method is used to obtain a sample of pure salt crystals from a solution of the salt?

A crystallisation
B distillation
C evaporation
D filtration

4 A student makes some crystals.

How should the student test the purity of the crystals?

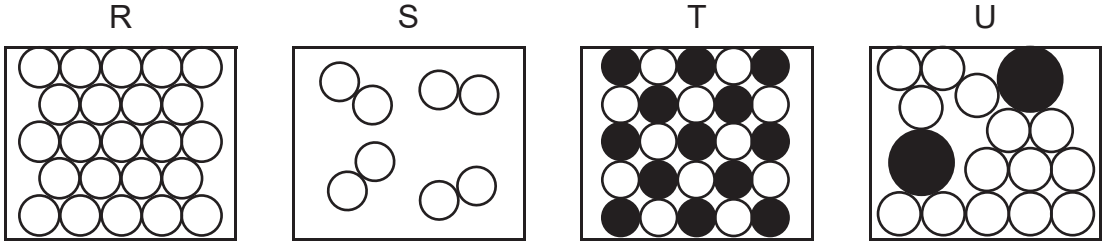
A colour of crystals
B melting point of crystals
C size of crystals
D solubility of crystals

5 Compounds contain two or more elements chemically combined.

Which list contains only compounds?

A CH_4 Cl_2 NaCl
B CH_4 H_2 H_2O
C Cl_2 CO H_2O
D HCl H_2O H_2SO_4

6 The diagrams show the arrangement of particles in four substances.



Which row correctly describes these four substances?

	R	S	T	U
A	compound	compound	element	element
B	element	compound	mixture	mixture
C	element	element	compound	mixture
D	mixture	mixture	compound	compound

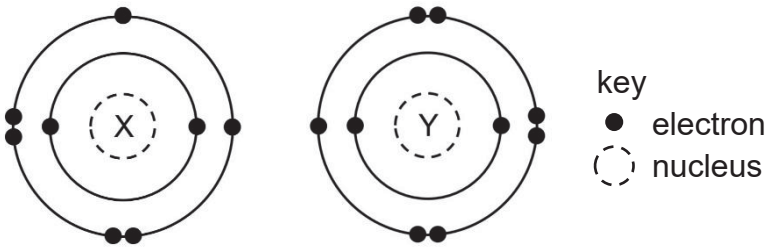
7 The table below shows the number of protons, electrons and neutrons of four different particles.

particle	number of protons	number of electrons	number of neutrons
W	19	18	18
X	15	15	18
Y	20	18	20
Z	15	15	16

Which pair of particles are isotopes?

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

8 The electronic structures of atoms X and Y are shown.



X and Y react to form a covalent compound. What is its formula?

A XY
B X_2Y
C XY_2
D X_2Y_2

9 Which row shows the general properties of an ionic compound?

	melting point	soluble in water	conducts electricity	
			solid	liquid
A	high	no	no	yes
B	high	yes	no	yes
C	low	no	no	no
D	low	yes	yes	yes

10 Ethane, C_2H_6, burns as shown.

$$2C_2H_6 + \ldots O_2 \rightarrow 4CO_2 + 6H_2O$$

Which number of oxygen molecules balances the equation above?

A 6
B 7
C 10
D 14

11 Carbon, $^{12}_{6}C$, and sulfur, $^{32}_{16}S$, form the compound carbon disulfide, CS_2.

What is the relative molecular mass, M_r of carbon disulfide?

A 6 + 16
B 6 + (2 × 16)
C 12 + 32
D 12 + (2 × 32)

12 Which of the following contains both an acidic oxide and a basic oxide?

A carbon dioxide and carbon monoxide
B carbon monoxide and magnesium oxide
C sulfur dioxide and magnesium oxide
D zinc oxide and water

13 Ammonium chloride is heated with substance X. Ammonia gas is given off.

What type of substance is X?

A acid
B base
C metal
D salt

14 Which salt is best prepared by precipitation?

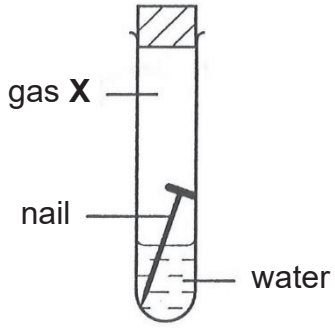
A barium nitrate
B calcium carbonate
C potassium chloride
D sodium carbonate

15 Which property do **all** metals have?

A They conduct electricity.
B They have a grey or silver colour.
C They have high density.
D They have high melting points.

16 An iron nail is placed in a closed test-tube, containing gas **X**.

The nail rusts.



What is gas **X**?

A argon
B carbon dioxide
C nitrogen
D oxygen

17 Which trends occur when moving down Group I of the Periodic Table?

	melting point	speed of reaction with water
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

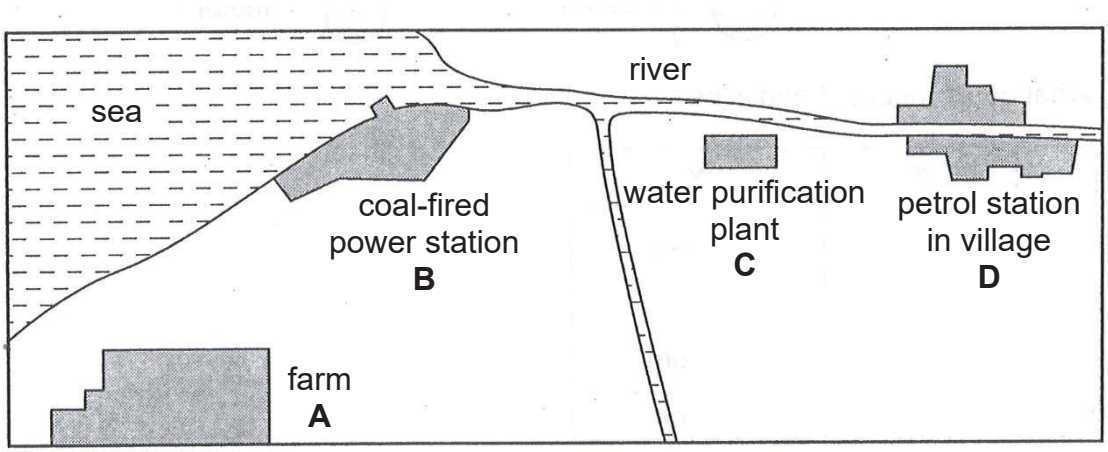
18 Some properties of Group VII elements are shown.

Group VII	melting point/°C	boiling point/°C
fluorine	−220	−118
chlorine	−101	**Y**
bromine	**X**	59
iodine	114	184

What could be the values of **X** and **Y**?

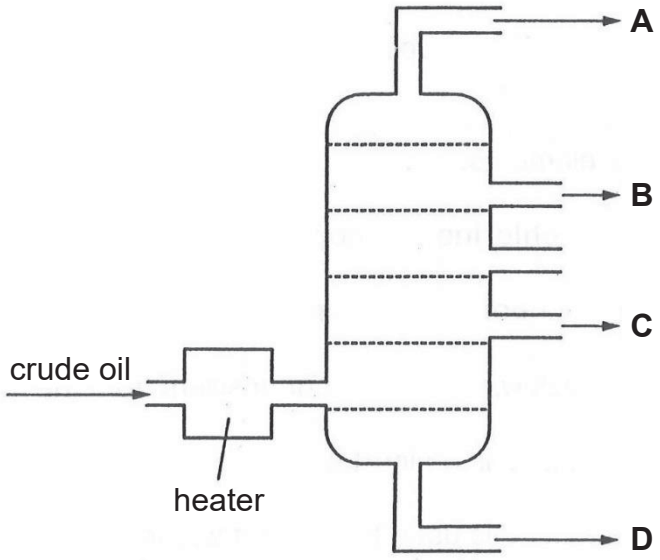
	X	**Y**
A	−150	−35
B	−150	103
C	−7	−35
D	−7	103

19 Which place on the map is most likely to be producing large quantities of sulfur dioxide?



20 The diagram shows a fractionating column.

From which level of the column is the substance used for making roads obtained?



B L A N K P A G E

Class	Register No.

Candidate Name_____

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SECONDARY FOUR NORMAL (ACADEMIC)

SCIENCE **5105/04, 5107/04**
Paper 4 Chemistry **26 Jul 2022**
Papers 3 and 4: 1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions in Section A and any two questions in Section B.
The use of an approved scientific calculator is expected, where appropriate.
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.

At the end of the examination hand in your answers to Paper 3 and Paper 4 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

PARENT'S SIGNATURE

For Examiner's Use	
Section A	
Section B	
Total	

Section A

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

1 **(a)** Complete the table to show the relative charge and the relative mass for each of the particles shown.

particle	relative charge	relative mass
electron		
neutron		
proton		

[3]

(b) Complete the table for sodium and fluorine atoms.

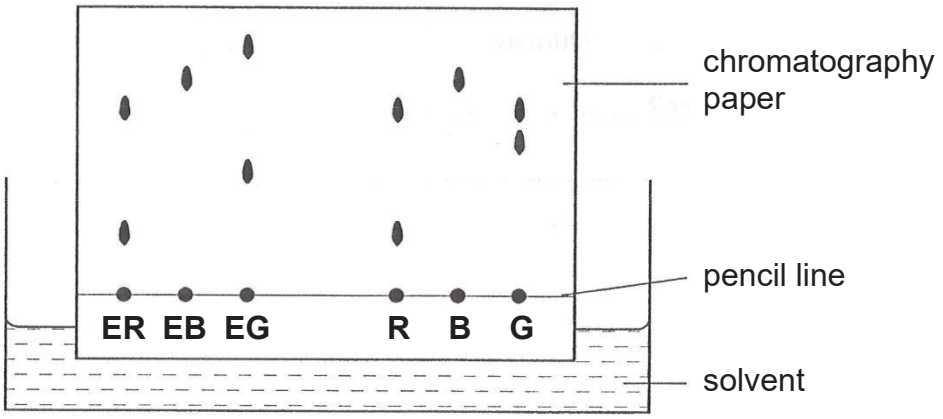
atom	relative atomic mass	number of protons	number of neutrons	number of electrons
sodium	23	11		
fluorine			10	9

[2]

(c) Draw “dot and cross” diagrams of the ions formed by the reaction between sodium and fluorine atoms. Show only the electrons in the outer shells.

[2]

2 A chemist in a food factory used chromatography to find out if three food colours, red (**R**), blue (**B**) and green (**G**) are safe to eat. He compared the chromatograms with those of safe edible colours, red (**ER**), blue (**EB**) and green (**EG**).



(a) (i) How many dyes are present in edible green? ……... [1]

(ii) Which of the food colours **R**, **B** and **G** would be safe to use in food?

……..

Explain your answer. ……..

……..

……. [2]

(b) Explain why the line is drawn in pencil and not in ink.

……..

……..

……. [1]

3 All the elements in Group VII of the Periodic Table react with hydrogen.

Fluorine reacts in the dark, explosively, at very low temperatures.

Chlorine reacts in the presence of sunlight, explosively, at room temperature.

Bromine reacts in the presence of sunlight if heated to about 200 °C.

(a) Suggest **two** conditions needed for iodine to react with hydrogen

1. ……..

2. …… [2]

(b) Each element in Group VII consists of molecules which are **diatomic**.

State the definition of **diatomic**.

……..

……..

…….. [1]

Section B

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

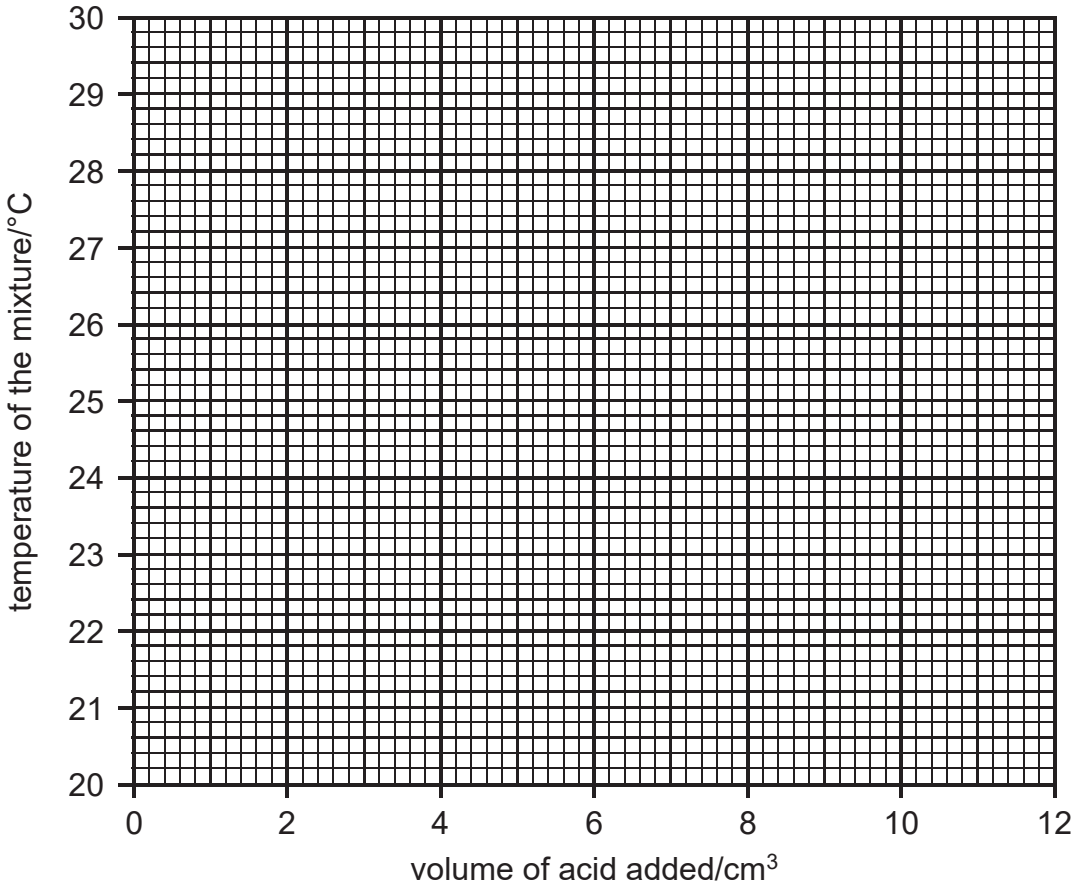
4 An experiment is carried out to investigate the reaction between sodium hydroxide and an acid. In this reaction sodium chloride is produced.

A solution of the acid is placed into a burette. A pipette is used to transfer a 10.0 cm^3 portion of sodium hydroxide to a conical flask. Five drops of Universal indicator are added to the flask.

The mixture is stirred, its temperature taken and its colour noted.

To this mixture, 2.0 cm^3 of the acid is added with stirring. Again the temperature is taken and the colour of the mixture is noted. This is repeated several times. The following results are obtained.

volume of acid added/ cm^3	0.00	2.00	4.00	6.00	8.00	10.00	12.00
temperature of the mixture/°C	20.0	22.4	24.8	27.2	28.0	26.4	24.8



(a) Plot a graph of the temperature of the mixture against volume of acid added. Draw **two** intersecting lines, taking into account all the relevant points, to show the rise and fall in temperature. [3]

(b) Use the graph to determine the volume of acid needed to completely neutralise the sodium hydroxide solution.

…….. cm^3 [1]

(c) What is the colour of the mixture after the addition of 12.0 cm^3 of acid?

……... [1]

(d) **(i)** Name the acid used in this experiment.

……. [1]

(ii) Write a chemical equation for the reaction of this acid with sodium hydroxide.

……. [1]

(e) Why is a burette used to add the acid in this experiment rather than a measuring cylinder?

……..

……..

……..[1]

5 **(a)** A student carried out experiments to find the order of reactivity of four metals. He placed a sample of each metal in the four solutions shown in the table. He recorded the results in the table.

metal / solution	copper	lead	silver	zinc
copper(II) nitrate	×	✓	×	✓
lead(II) nitrate	×	×	×	✓
silver nitrate	✓	✓	×	✓
zinc nitrate	×	×	×	×

key

✓ reaction took place

× no reaction

(i) Put the four metals in order of reactivity. Place the most reactive first.

most reactive ……

……

……

least reactive …… [2]

(ii) Suggest why it would be best to clean the metals with sandpaper before the start of the experiment.

……..

……..

…… [1]

(b) Calcium reacts with oxygen to form calcium oxide as shown in the equation.

$$2Ca(s) + O_2(g) \rightarrow 2CaO(s)$$

(i) What do the letters (s) and (g) stand for?

…… [2]

(ii) Calculate the number of moles of calcium if 4 g of calcium are burnt in oxygen.

number of moles of calcium = …… mol [1]

(iii) If the reaction produces 0.2 moles of calcium oxide. Calculate the mass of the calcium oxide produced.

mass of calcium oxide = …… g [1]

(c) Why is it important that metals are recycled?

……..

……..[1]

6 **(a)** The first two members of the alkane homologous series are methane, CH_4, and ethane, C_2H_6.

The first two members of the alkene homologous series are ethene, C_2H_4, and propene, C_3H_6.

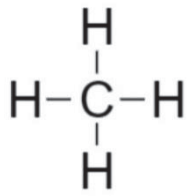
(i) Give the name and formula for the third member of the **alkane** series.

name ……..… formula ……..…… [1]

(ii) Give the general formula for the **alkane** homologous series.

……. [1]

(iii) The structural formula for methane is given as an example.
Draw the structural formula for ethane and ethene.

methane	ethane	ethene
		

[2]

(iv) Describe one test that could be used to distinguish between a sample of ethane and ethene. Name the reagent used and the result obtained.

reagent ……...

result with ethane …….

result with ethene ……[2]

(b) Cracking is used to break up large hydrocarbon molecules into smaller ones.

Decane, $C_{10}H_{22}$, is a large hydrocarbon molecule that can be cracked in the refinery.

$$C_{10}H_{22} \rightarrow \mathbf{X} + C_2H_4$$
decane ethene

(i) Give the chemical formula of **X**.

…… [1]

(ii) State the conditions required for cracking of hydrocarbons.

……..

……..

…… [1]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PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SECONDARY FOUR NORMAL (ACADEMIC)
MARKING SCHEME

SCIENCE (CHEMISTRY)
Paper 3 (Multiple Choice)

5105/03, 5107/03
26 Jul 2022

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

Paper 4 (Theory)

5105/04, 5107/04

S/No	Answers		Remarks
	Section A		
1(a)		[3]	[1] per row

particle	relative charge	relative mass
electron	−1	$\frac{1}{1840}$
neutron	0	1
proton	+1	1

Setter: Mr Tan Kok Heong

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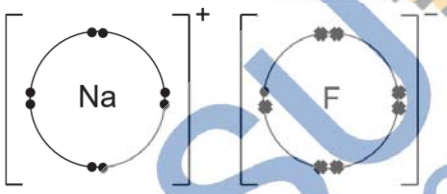
<table>
<tr><th>S/No</th><th>Answers</th><th></th><th>Remarks</th></tr>
<tr><td>1(b)</td><td>
<table>
<tr><td>atom</td><td>relative atomic mass</td><td>number of protons</td><td>number of neutrons</td><td>number of electrons</td></tr>
<tr><td>sodium</td><td>23</td><td>11</td><td>12</td><td>11</td></tr>
<tr><td>fluorine</td><td>19</td><td>9</td><td>10</td><td>9</td></tr>
</table>
</td><td>[2]</td><td>[1] per row</td></tr>
<tr><td>1(c)</td><td> 
</td><td>[2]</td><td>[1] per ion</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>2(a)(i)</td><td>2</td><td>[1]</td><td></td></tr>
<tr><td>2(a)(ii)</td><td>R and B [1]
R and B contains similar dyes as ER and EB respectively which are edible [1]</td><td>[2]</td><td></td></tr>
<tr><td>2(b)</td><td>Ink contains dyes that <u>will dissolve in the solvent and be separated</u> [1], affecting the chromatogram</td><td>[1]</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>3(a)</td><td>1. <u>Presence of sunlight</u>
2. <u>High temperature above 200 °C</u></td><td>[2]</td><td></td></tr>
<tr><td>3(b)</td><td><u>Molecule consists of 2 atoms chemically combined, the atoms can be the same or different</u></td><td>[1]</td><td></td></tr>
</table>

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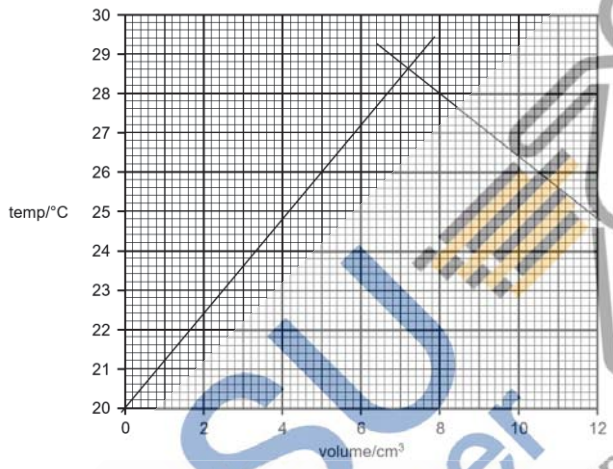
S/No	Answers		Remarks
	Section B		
4(a)		[3]	[1] plot points [1] per intersecting line
4(b)	7.2 cm^3	[1]	
4(c)	red	[1]	
4(d)(i)	Hydrochloric acid	[1]	
4(d)(ii)	$NaOH + HCl \rightarrow NaCl + H_2O$	[1]	
4(e)	Burette is **<u>more</u> accurate at measuring** the volume of acid added as compared to a measuring cylinder	[1]	

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S/No	Answers		Remarks
5(a)(i)	most reactive zinc lead copper least reactive silver	[2]	[2] 3-4 correct [1] 2 correct [0] 0-1 correct
5(a)(ii)	Sandpaper is used to remove the layer of oxide so that the metal can react with the solution	[1]	
5(b)(i)	(s) is solid state and (g) is gaseous state	[2]	[1] per physical state
5(b)(ii)	Number of moles of Ca = 4/40 = **0.1 mol** [1]	[1]	
5(b)(iii)	M_r of CaO = 40 + 16 = 56 Mass of Ca = 0.2 × 56 = **11.2 g** [1]	[1]	
5(c)	Conserve natural resources/ Reduce environmental problems related to extracting metals from their ores/ Saves cost of extracting metals from ores	[1]	Any 1 of 3 possible answers

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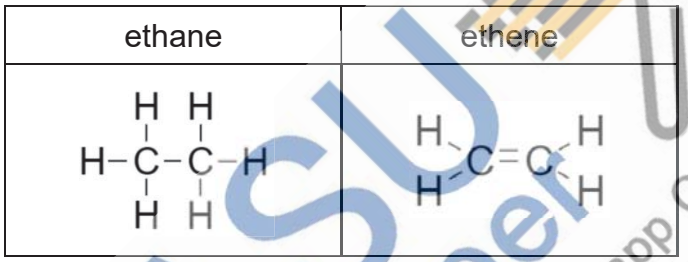
S/No	Answers		Remarks
6(a)(i)	name propane formula C_3H_8	[1]	Both answer must be correct
6(a)(ii)	C_nH_{2n+2}	[1]	
6(a)(iii)		[2]	[1] per organic compound
6(a)(iv)	reagent aqueous bromine (accept bromine water) result with ethane no reaction/no visible change result with ethene reddish-brown aqueous bromine is decolourised	[2]	[1] reagent [1] both results
6(b)(i)	C_8H_{18}	[1]	
6(b)(ii)	High temperature (about 600 °C) and catalysts of aluminium oxide and silicon dioxide	[1]	

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