Candidate's Name : _____ Class Register No.

TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2016
SECONDARY FOUR

5073 **CHEMISTRY**

Friday 16 September 2016 1h

Additional Materials: Optical Answer Sheet (OAS)
Soft clean eraser
Soft pencil (type B or HB recommended)

INSTRUCTIONS TO CANDIDATES

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

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number 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**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate optical answer sheet.

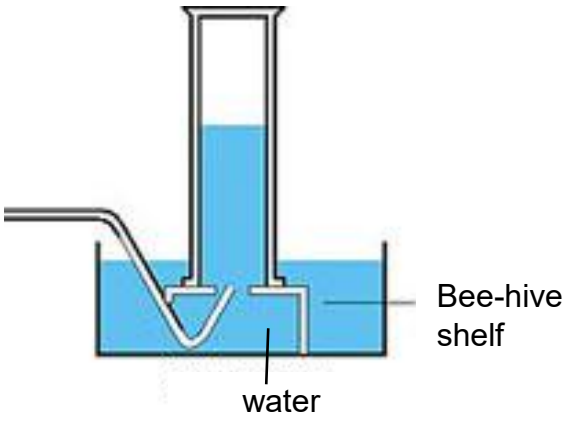
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 18.

Setter(s) : Mrs Lee-Ng Suan Ching

This Question Paper consists of 18 printed pages, including this page.

1 The diagram below shows the apparatus used for collecting a sample of gas in the laboratory.



Which set of gases can be collected using this method?

A ammonia and chlorine

B hydrogen chloride and hydrogen

C carbon monoxide and nitrogen

D sulfur dioxide and ammonia

2 Naturally occurring silver (proton number: 47; relative atomic mass: 108) consists of a mixture of two isotopes ^{107}Ag and ^{109}Ag.

Which of the following statements about silver atoms is likely to be correct?

A All silver atoms have a relative atomic mass of 108.

B Atoms of ^{107}Ag are more abundant than those of ^{109}Ag.

C Both ^{107}Ag and ^{109}Ag atoms form positive ion with the same charge.

D Both ^{107}Ag and ^{109}Ag atoms have the same number of neutrons.

3 Substance **X** melts at 53°C and boils at 100°C. It dissolves in water but does not react with water.

Which of the following method is most suitable for separating **X** from a mixture of **X** and water?

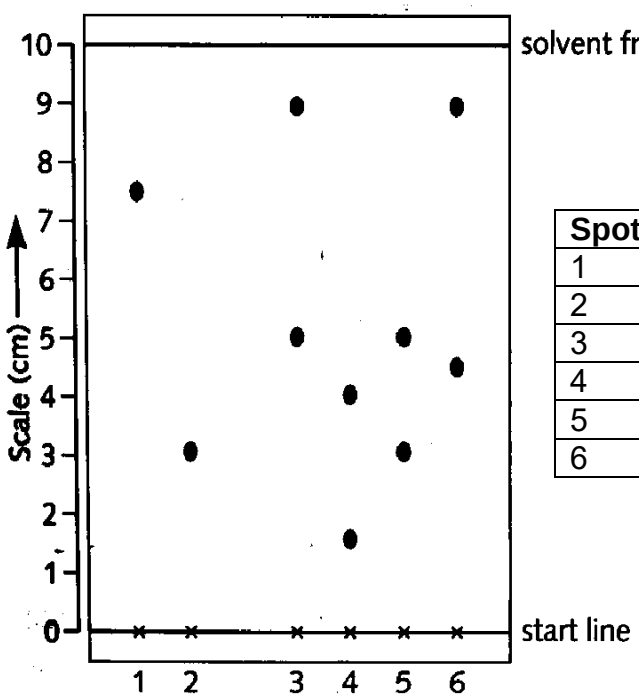
A distillation

B fractional distillation

C filtration

D crystallisation

4 Prior to a race, urine samples from race horses are collected to test for the presence of caffeine and cortisone. If these banned drugs were found in the urine samples, the horses would be disqualified. The chromatogram below is obtained from the chromatography performed on caffeine, cortisone and urine samples from 4 different horses, **W**, **X**, **Y** and **Z** that are competing at a turf club.



Spot	Description
1	Caffeine
2	Cortisone
3	Urine sample of horse **W**
4	Urine sample of horse **X**
5	Urine sample of horse **Y**
6	Urine sample of horse **Z**

Which of the following analysis is correct?

A The R_f value of cortisone is 3.33.

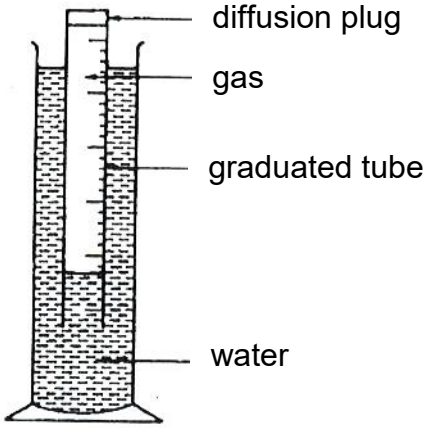
B The R_f value of caffeine is 0.75.

C Horses **W** and **Y** should be disqualified from the competition.

D The caffeine spot in urine sample of horse **Z** could be invisible and requires a locating agent.

5 The diagram below shows an apparatus for measuring the rates of diffusion of gases. The time taken for 100 cm^3 of some gases at room temperature and pressure to diffuse from this apparatus is shown in the table.

Gas	Time/ s
CO	132
Cl_2	211
CH_4	100
O_2	141



What will be the time taken for nitrogen gas to diffuse from this apparatus?

A 66

B 72

C 100

D 132

6 Which statement explains why sodium chloride, NaCl has a lower melting point than magnesium oxide, MgO?

A Sodium chloride is covalent but magnesium oxide is ionic.

B Sodium is more reactive than magnesium.

C The melting point of sodium is lower than that of magnesium.

D The forces of attraction between Na^+ and Cl^- is weaker than that between Mg^{2+} and O^{2-}.

7 Which one of the following represents the most likely structural formula for the covalent compound disulfur dichloride, S_2Cl_2?

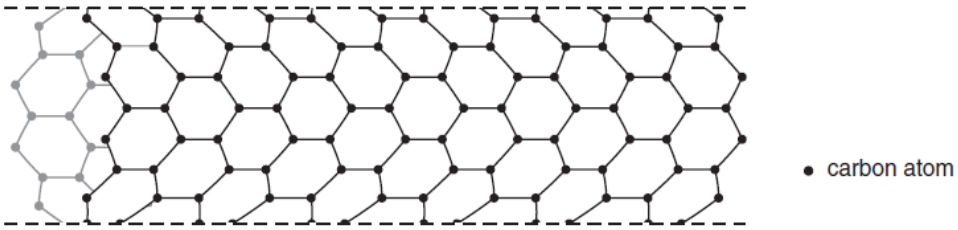
A S—Cl—Cl—S

B S—Cl—S—Cl

C Cl=S—S=Cl

D Cl—S—S—Cl

8 Carbon nanotubes have been made by scientists in recent years. The structure is shown below.



Which one of the following would most likely be the properties of nanotubes?

	melting point	**solubility in organic solvents**	**electrical conductivity as a solid**
A	high	insoluble	good
B	high	soluble	poor
C	low	insoluble	poor
D	low	soluble	good

9 In an experiment, 5 cm^3 of a gaseous hydrocarbon reacted with excess oxygen to form 30 cm^3 of carbon dioxide and 15 cm^3 of steam.

Assuming all volumes of gases were measured at the same temperature and pressure, what is the formula of the hydrocarbon?

A CH_4

B C_2H_4

C C_3H_6

D C_6H_6

10 Zinc oxide is produced by heating zinc carbonate.

$$ZnCO_3 \rightarrow ZnO + CO_2.$$

What is the percentage yield of zinc oxide if 125 g of zinc carbonate on heating produces 75 g of zinc oxide? (*Mr* $ZnCO_3$ = 125, *Mr* ZnO = 81)

A $125 \times \frac{81}{75} \times 100$

B $125 \times \frac{75}{81} \times 100$

C $\frac{1}{125} \times \frac{75}{81} \times 100$

D $\frac{75}{81} \times 100$

11 **X**, **Y** and **Z** are in the same period of the Periodic Table. **Y** forms an oxide which reacts with aqueous sodium hydroxide. **Z** forms an oxide which reacts with dilute hydrochloric acid. **X** forms an oxide which is amphoteric. If **X**, **Y** and **Z** were placed in order of increasing atomic number, the order would be

A **X**, **Y**, **Z**.

B **Y**, **X**, **Z**.

C **Z**, **Y**, **X**.

D **Z**, **X**, **Y**.

12 Which one of the following statements about the elements lithium, sodium and potassium is correct?

A They are in the same period of the Periodic Table.

B Lithium has a higher melting point than potassium.

C They react with cold water to form oxides and hydrogen.

D Lithium reacts more rapidly with water than potassium does.

13 9 g of magnesium metal is added to a beaker containing 250 cm^3 of 2 mol/dm^3 aqueous hydrochloric acid. The pH of the mixture in the beaker is measured as the reaction proceeds.

$$Mg\ (s) + 2HCl\ (aq) \rightarrow MgCl_2\ (aq) + H_2\ (g)$$

What is the final pH of the mixture and the volume of hydrogen gas produced at room temperature and pressure (r.t.p.)?

	Final pH of mixture	**Volume of hydrogen gas at r.t.p. (dm^3)**
A	1	9
B	3	9
C	7	6
D	9	6

14 When citric acid $C_6H_8O_7$ dissolves in an organic solvent, the solution formed ……

A contains both covalent molecules and ions.

B contains only covalent molecules.

C contains low concentration of hydrogen ions.

D produces carbon dioxide when reacted with carbonates.

15 The labels on two bottles fell off. One bottle was known to contain sodium chloride solution and the other sodium nitrate solution.

Which of the following test would most likely identify the solutions?

A Addition of blue litmus paper

B Addition of aqueous ammonia

C Addition of aqueous silver nitrate

D Addition of dilute sulfuric acid

16 In each of three experiments, a halogen was added to separate solutions containing ions of one of the other two halogens. The table below shows the results.

Experiment	Halogen added	X^-	Y^-	Z^-
1	X_2	-	Black ppt	Reddish brown solution
2	Y_2	No reaction	-	No reaction
3	Z_2	No reaction	Black ppt	-

What were the halogens **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	Br	Cl	I
B	Br	I	Cl
C	Cl	I	Br
D	Cl	Br	I

17 Which of the following should **not** be used with nitric acid to prepare silver nitrate?

A silver carbonate **B** silver hydroxide

C silver metal **D** silver oxide

18 Which of the following salts can be prepared by an acid-alkali titration method?

A Aluminium nitrate

B Ammonium chloride

C Iron(III) sulfate

D Calcium sulfate

19 A solution containing Pb^{2+} ions can be distinguished from a solution containing Zn^{2+} by adding any of the following solutions except

A aqueous potassium chloride

B aqueous sodium sulfate

C dilute sulfuric acid

D aqueous sodium hydroxide

20 An excess of sodium hydroxide is added to an aqueous solution of salt **X** and boiled. No observable change seen. However, ammonia gas is only given off after aluminium foil is added to the hot solution.

What could **X** be?

A ammonium chloride **B** sodium chloride

C ammonium nitrate **D** sodium nitrate

21 In the Haber Process, the quantity of ammonia can be increased by

A using iron as a catalyst.

B increasing the pressure to 400 atmospheres.

C increasing the temperature of the reaction to 600^{o}C.

D using a mixture containing 3 parts nitrogen to 1 part hydrogen.

22 The equation below represents the reaction which takes place in a light sensitive photographic film. This photographic film was used before the invention of digital photography.

$$2AgBr \rightarrow 2Ag + Br_2$$

In this reaction,

A electrons are transferred from the bromide ions to the silver ions.

B silver ions are oxidised to silver atoms.

C bromide ions are reduced to bromine molecules.

D there is no electron transfer.

23 Small portions of aqueous potassium iodide and of acidified aqueous potassium manganate(VII) were added to four solutions. The colour changes seen are shown in the table.

Solution number	Potassium iodide	Acidified potassium manganate(VII)
1	Colourless to brown	Purple to colourless
2	Colourless to brown	No change
3	No change	Purple to colourless
4	No change	No change

Which solutions contained an oxidising agent?

A 1 only **B** 1 and 2 only

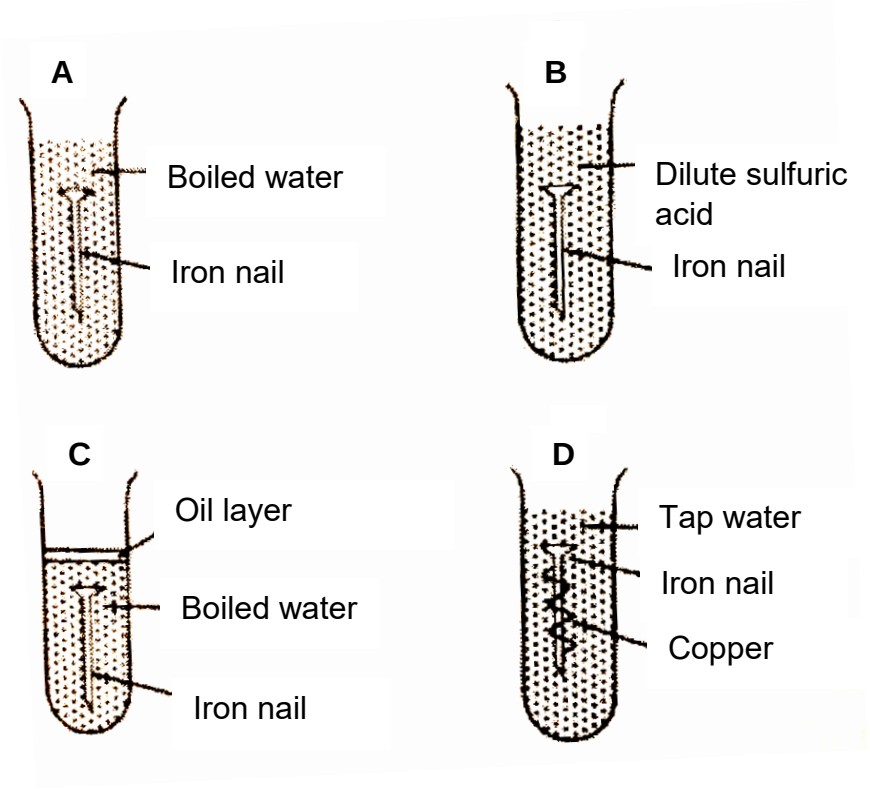
C 1 and 3 only **D** 2 and 4 only

24 The heat-reflecting shields of some space rockets are gold plated, using electrolysis.

Which electrodes and electrolyte would be used to gold-plate the heat shield?

	Negative electrode	Positive Electrode	Electrolyte
A	carbon	heat shield	copper compound
B	gold	heat shield	gold compound
C	heat shield	carbon	copper compound
D	heat shield	gold	gold compound

25 Which of the following conditions will the iron nail rust most slowly?



26 Manganese(IV) oxide (MnO_2) acts as a catalyst in the following reaction.

Hydrogen peroxide → water + oxygen

Several experiments were carried out using the same mass of manganese(IV) oxide and the same volume of hydrogen peroxide (H_2O_2) solution.

Experiment	Concentration of H_2O_2 (mol/dm^3)	Temperature (^oC)	Particle size of MnO_2
1	0.5	20	Powder
2	1.0	30	Lump
3	1.5	30	Lump
4	1.5	30	Powder
5	0.5	20	Lump
6	2.0	20	powder

Which two experiments should be used to study the effect of particle size on the speed of reaction?

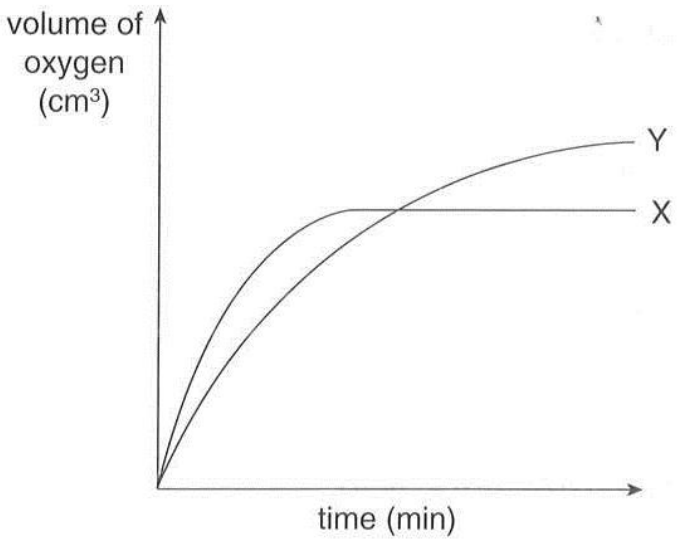
A Experiments 1 and 5

B Experiments 1 and 3

C Experiments 2 and 4

D Experiments 3 and 6

27 The results of an experiment involving the decomposition of 10 cm^3 of 0.40 mol/dm^3 hydrogen peroxide at 30°C is represented by graph **X** below.



Which of the following produced the graph **Y**?

	Volume of hydrogen peroxide (cm^3)	**Concentration of hydrogen peroxide (mol/dm^3)**	**Temperature (°C)**
A	10	0.25	30
B	12.5	0.40	30
C	20	0.25	30
D	20	0.40	40

28 Which of the following is the reason for recycling aluminium?

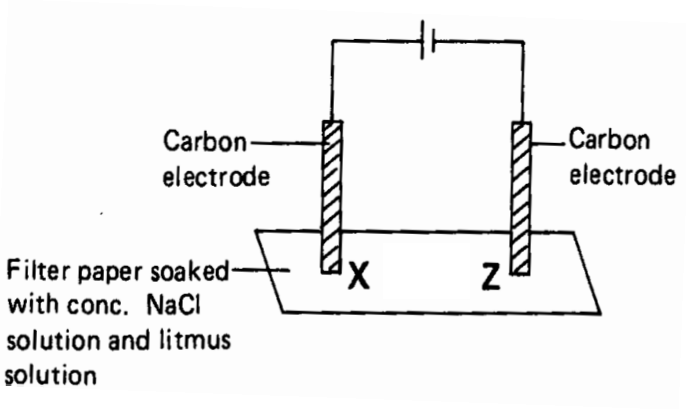
A Aluminium ore is expensive.

B Recycling metal helps to reduce wastage of limited raw materials.

C Recycling metals is generally not a costly operation.

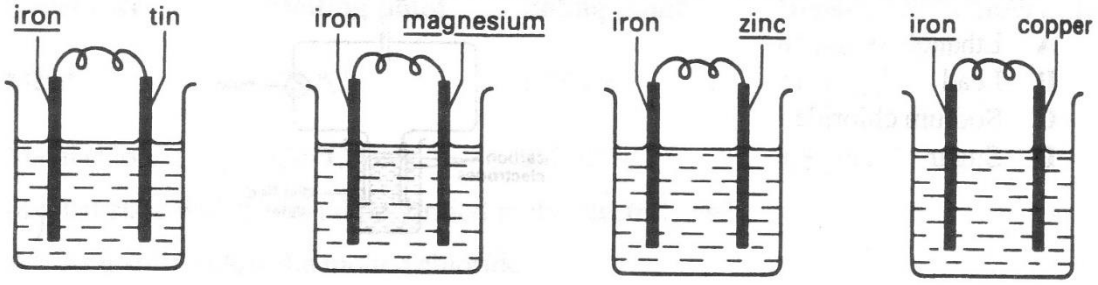
D Low cost of transporting the scrap metal to the recycling plant.

29 Referring to the diagram below, what colours would be observed on the filter paper at the two points, **X**, and **Z** after a current is passed through for about 10 minutes?



	X	Z
A	blue	white
B	white	red
C	white	blue
D	red	blue

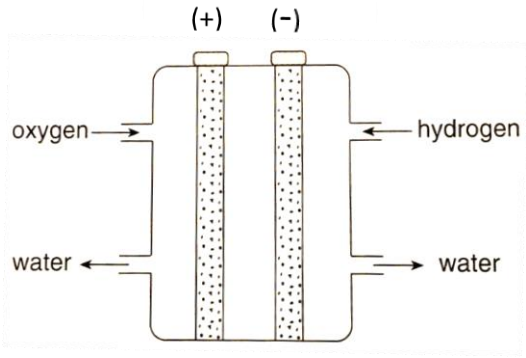
30 Four electric cells were set up using aqueous sodium chloride as the electrolyte as shown in the diagrams.



In each cell, only the underlined electrode dissolved. To establish the order of reactivity of the metals, it is necessary to set up two or more cells. Which of the following pairs of cells are needed in addition to the four cells above?

	First cell electrodes	Second cell electrodes
A	iron/iron	iron/zinc
B	tin/copper	magnesium/zinc
C	tin/magnesium	zinc/copper
D	tin/zinc	magnesium/copper

31 In the hydrogen fuel cell, hydrogen and oxygen gas flow into the anode and cathode respectively.



Which of the following shows the correct reaction at the cathode?

A $O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$

B $4OH^-(aq) \rightarrow O_2(g) + 2H_2O(l) + 4e^-$

C $2H_2(g) + 4OH^-(aq) \rightarrow 4H_2O(l) + 4e^-$

D $4H_2O(l) + 4e^- \rightarrow 2H_2(g) + 4OH^-(aq)$

32 Reactions of unknown metals, **P**, **Q**, **R** were studied. Zinc oxide was used in three of the experiments. It was found that

$\mathbf{Q} + HCl \rightarrow \mathbf{Q}Cl_2 + H_2$

$\mathbf{R} + ZnO \rightarrow \mathbf{R}O + Zn$

$\mathbf{Q} + ZnO \rightarrow \mathbf{Q}O + Zn$

$\mathbf{Q} + \mathbf{R}(NO_3)_2 \rightarrow$ no reaction

$\mathbf{P} + ZnO \rightarrow$ no reaction

$\mathbf{P}_2CO_3 \rightarrow \mathbf{P} + CO_2 + O_2$

Which of the following shows the most appropriate method of extraction for the metal?

A **Q** is extracted by electrolysis of aqueous solution of its compound.

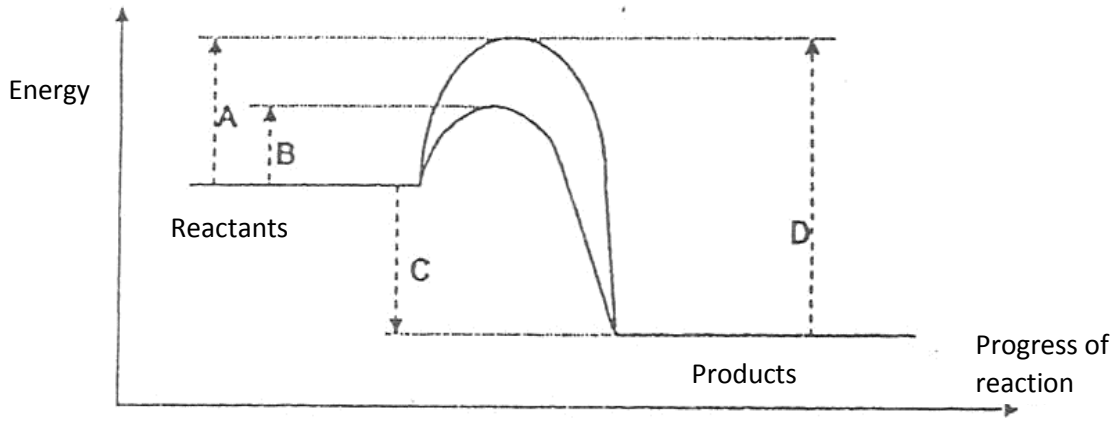
B **R** is extracted by electrolysis of molten compound.

C **P** is extracted by reduction with hydrogen.

D **P** is extracted by reduction with carbon.

33 The diagram shows an energy profile diagram for a chemical reaction.

Which energy change (**A**, **B**, **C** or **D**) represents the activation energy for the non-catalysed reaction?



34 The table compares the strengths of the bonds for reactions of the type below.

$$R_2 + Q_2 \rightarrow 2RQ$$

Which reaction is the most exothermic?

	Bonds in R_2	**Bonds in Q_2**	**Bonds in RQ**
A	Strong	Strong	Strong
B	Strong	Strong	Weak
C	Weak	Weak	Strong
D	Weak	Weak	Weak

35 Identify the type of reaction below and where the reaction takes place.

$$2CO + 2NO \rightarrow 2CO_2 + N_2$$

	Type of reaction	**Location of reaction**
A	Neutralisation	Blast furnace
B	Redox	Blast furnace
C	Neutralisation	Catalytic converter
D	Redox	Catalytic converter

36 Which of the following is **not** responsible for the destruction of the ozone layer in the stratosphere?

A CFCs **B** Fluorine atoms

C Chlorine atoms **D** UV light

37 Amines are organic compounds with the functional group $–NH_2$.

The first four members of the amine homologous series is shown below.

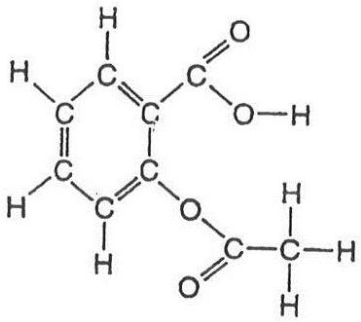
Name	**Chemical formula**
methylamine	CH_3NH_2
ethylamine	$CH_3CH_2NH_2$
propylamine	$CH_3CH_2CH_2NH_2$
butylamine	$CH_3CH_2CH_2CH_2NH_2$

What is the general formula for amines?

A $C_nH_{2n+3}N$ **B** $C_nH_{2n+1}NH_2$

C $C_nH_{2n-1}NH_2$ **D** $C_nH_{2n+1}CHNH_2$

38 Aspirin is a drug which is used as a general painkiller. The structural formula of aspirin is shown below.



Which statement about aspirin is **incorrect**?

A One mole of aspirin in aqueous solution reacts with one mole of sodium hydroxide.

B One mole of aspirin in aqueous solution reacts with 106 g of sodium carbonate, Na_2CO_3.

C It will turn green universal indicator yellow.

D It can be formed from a reaction between ethanoic acid and an alcohol.

39 Water can be formed from a number of reactions involving organic substances.

Which reaction does **not** produce water?

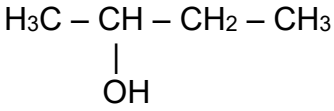
A Incomplete combustion of methane

B Reaction of ethanoic acid with ethanol

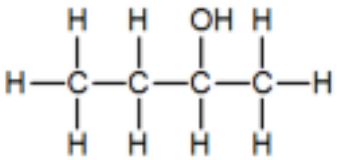
C Oxidation of ethanol to ethanoic acid

D Fermentation of sugar solution

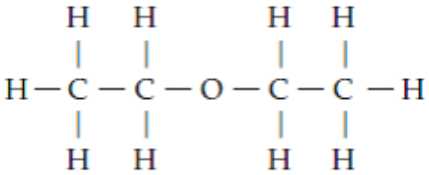
40 A chemical **X** with the formula, $C_4H_{10}O$, has the following structure.



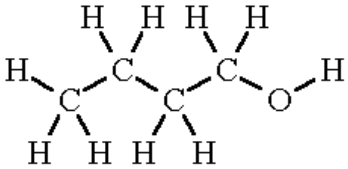
Which one of the following structure is **not** an isomer of **X**?



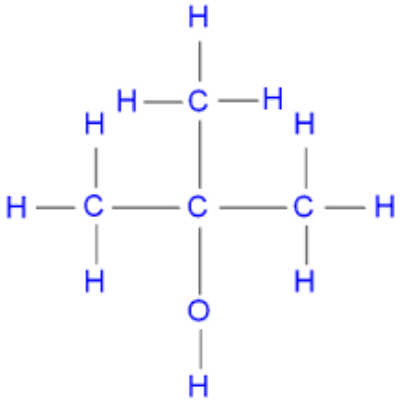
A



B



C



D

DATA SHEET
The Periodic Table of Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

* 58–71 Lanthanoid series
† 90–103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = atomic (proton) number

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

Answer to 2016 TKGS Chemistry Prelim Paper 1

1	2	3	4	5	6	7	8	9	10
C	C	D	B	D	D	D	A	D	D
11	12	13	14	15	16	17	18	19	20
D	B	C	B	C	C	C	B	D	D
21	22	23	24	25	26	27	28	29	30
B	A	B	D	C	A	C	B	C	B
31	32	33	34	35	36	37	38	39	40
A	B	A	C	D	B	B	B	D	A

Class Register No.

Candidate's Name : _____

TANJONG KATONG GIRLS' SCHOOL

PRELIMINARY EXAMINATION 2016
SECONDARY FOUR

5073/02 **CHEMISTRY**
Paper 2

Wednesday 14 September 2016 1hr 45 min

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use papers clips, glue or correction fluid.

Section A
Answer all questions in the space provided.

Section B
Answer all the questions in the space provided, the last question is in the form of either/ or.

At the end of the examination, fasten all your work securely together. The number of marks is given in brackets [ ] at the end of each question or part question.

INFORMATION FOR CANDIDATES

A copy of the Periodic Table is printed on page 24.

For Examiner's Use	
Section A	50
B9	
B10	
B11 Either	
B11 Or	
Total	80

The total marks for this paper is 80.

Setter(s) : Dr Munira
Marker(s): Mrs Chan P H, Mrs Cheong PY, Mrs Lee SC, Mr Goh SY, Dr Munira

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This Question Paper consists of 24 printed pages, including this page.

Section A

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 50.

A1 Each of the statements below is incorrect but can be corrected by changing **one** word. **Underline one word** in each statement that should be changed and give a correct **word** in the space provided. [4]

(a) An element that reacts with water to give an alkaline solution is chlorine.

……

(b) Steel is a compound containing iron and carbon.

……

(c) Silicon forms an amphoteric oxide.

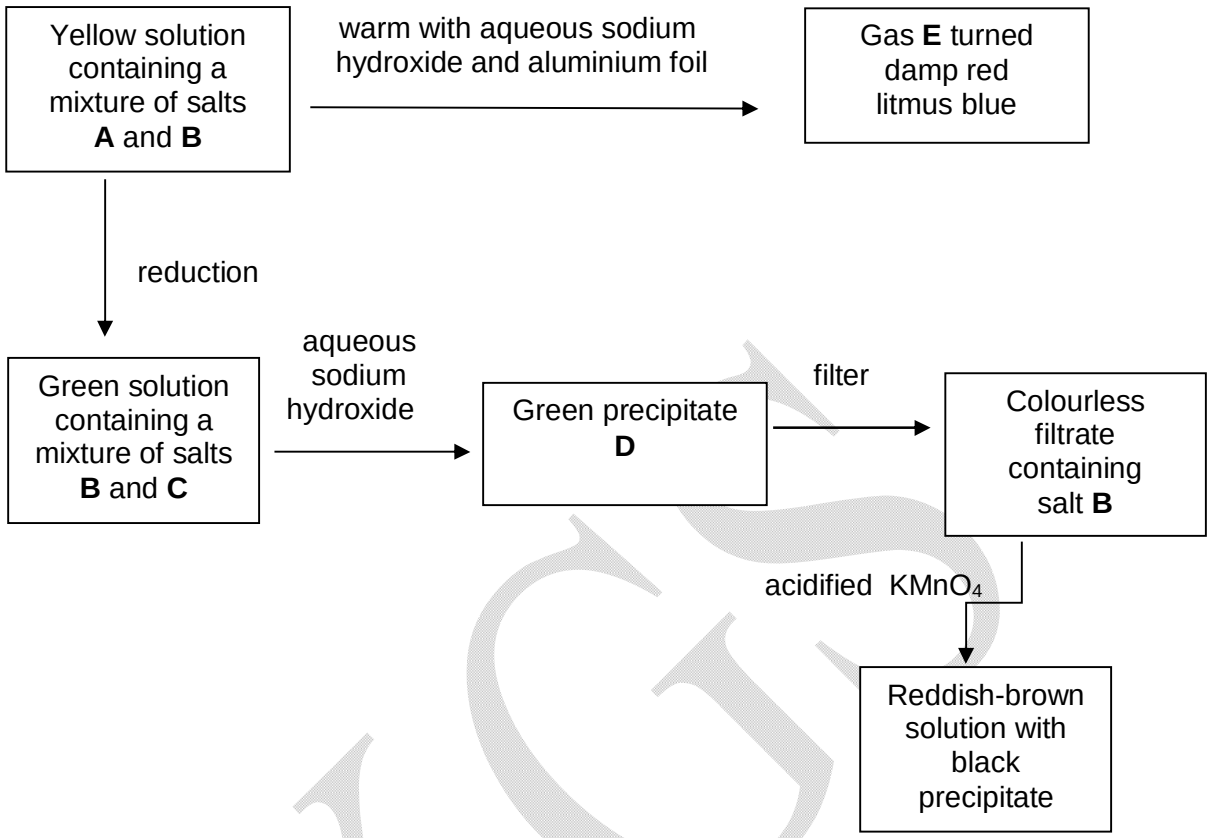
……

(d) A fluoride ion has nine electrons.

……

[Total: 4 marks]

A2 The flow diagram below shows some reactions and properties of substances **A, B, C, D** and **E.**



(a) Identify the <u>ions</u> present in **A, B** and **C** that accounts for the various colour change in the scheme. [3]

A: …… **B**: …… **C**: ……

(b) (i) Gas **E** is bubbled into aqueous nitric acid. A salt that is used as a fertiliser is formed. One mole of gas **E** reacts with one mole of nitric acid to produce one mole of the fertiliser. State the chemical formula of the fertiliser formed. [1]

……

(ii) If 10 kg of nitric acid is used, what is the mass of the fertiliser formed? [2]

(c) John has written a laboratory report for the preparation of pure and dry lead (II) chloride and sodium nitrate crystals.

> *'Lead (II) nitrate solution was mixed with sodium chloride solution and the precipitate obtained was filtered off; the residue left in the filter paper was scraped onto a watch glass and dried in an oven at 110 °C.*
>
> *The filtrate was heated until it was saturated. Crystals of sodium nitrate were formed when the solution was cooled down. The crystals were filtered off, washed and then dried in the same oven.'*

(i) Based on the report above, state **two errors** in John's experiment. [2]

……

……

……

……

(ii) Give reasons for your answers in (c)(i). [2]

……

……

……

……

[Total: 10 marks]

A3 The Alhambra is a beautiful monument in Granada, Spain. It comprises buildings made of limestone. The life of this monument can be extended by treatment with an aqueous mixture of barium hydroxide, $Ba(OH)_2$ and urea, $CO(NH_2)_2$.

As this solution mixture soaks into the porous marble/limestone structures, the urea slowly hydrolyses (i.e reacts with water) forming ammonia and carbon dioxide. The carbon dioxide that is released reacts with the barium hydroxide forming barium carbonate.

The solubilites of the sulfates and carbonates of calcium and barium salts are shown below.

Substance	**$CaCO_3$**	**$CaSO_4$**	**$BaCO_3$**	**$BaSO_4$**
Solubility in water (mol dm^{-3})	1.5×10^{-4}	4.6×10^{-2}	9.0×10^{-5}	9.4×10^{-6}

(a) Use the information from the table to explain how the formation of barium carbonate will help to slow down the rate of erosion of the monument. [2]

……

……

……

Finally, surface barium carbonate on the treated monument can react with sulfur dioxide in the air to form a layer of barium sulfate and carbon dioxide.

(b) (i) Construct the chemical equation for the reaction between barium carbonate and sulfur dioxide, in the presence of oxygen. [1]

……

(ii) Will the above reaction speed up or slow down the corrosion process? Explain briefly. [2]

……

……

……

[Total: 5 marks]

A4 At room temperature and pressure, 1 dm^3 of a gaseous compound **X** has a mass of 1.125 g.
X burns in oxygen to give water, carbon dioxide and nitrogen as the only products. On complete combustion, 24 dm^3 of **X** give 9.0 g of water and 12.0 dm^3 of nitrogen. **X** reacts slowly with water in the presence of sodium hydroxide to give ammonia and the sodium salt of acid **Y** of molecular formula CH_2O_2 as the only products.

(a) Calculate the relative molecular mass of **X**. [1]

(b) Using the information above, calculate, in one mole of **X**,

(i) the number of moles of nitrogen atoms, [1]

(ii) the number of moles of hydrogen atoms, [1]

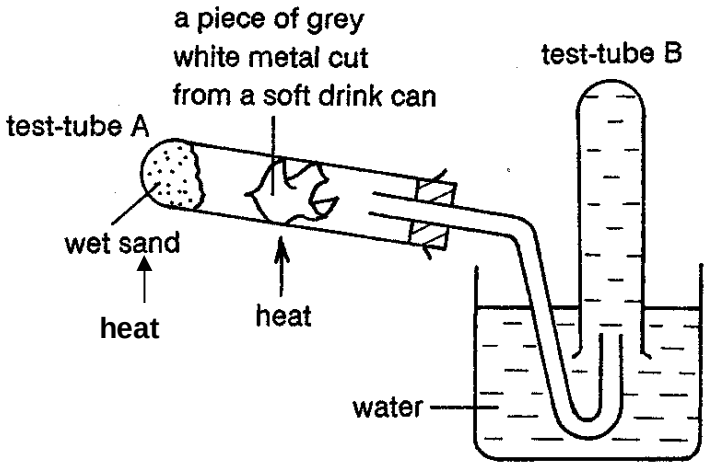
(iii) the number of moles of carbon atoms and hence, show that the molecular formula of **X** is **HCN**. [2]

(c) Based on your answer in (b), draw a 'dot and cross' diagram to show the bonding in **X**. You only need to show outer shell electrons. [2]

[Total: 7 marks]

A5 A student intended to prepare hydrogen in the laboratory.

He set up the apparatus as shown below. After a while, he found that no hydrogen was collected.



(a) Name the most likely grey white metal that the student used in this experiment. [1]

……

(b) Explain why no hydrogen gas was collected in test-tube **B** during the actual experiment. [1]

……

(c) What substance must he change in test-tube **A** in order for hydrogen to be collected in test-tube **B**? [1]

……

[Total: 3 marks]

A6 In the modern Periodic Table, elements are arranged in the order of increasing proton numbers. A student tried to re-arrange the elements in the order of increasing relative atomic masses and got nearly the same arrangement.

However, the elements, argon and potassium would have their positions in the Periodic Table **reversed**. This is because potassium, though having a larger proton number, has a smaller relative atomic mass than argon.

(a) Compare the reactivity of argon and potassium, with reference to their electronic structures. [2]

……

……

……

(b) By referring to the Periodic Table, write down **another pair** of elements whose positions would have been reversed if arranged according to relative atomic masses. [1]

……

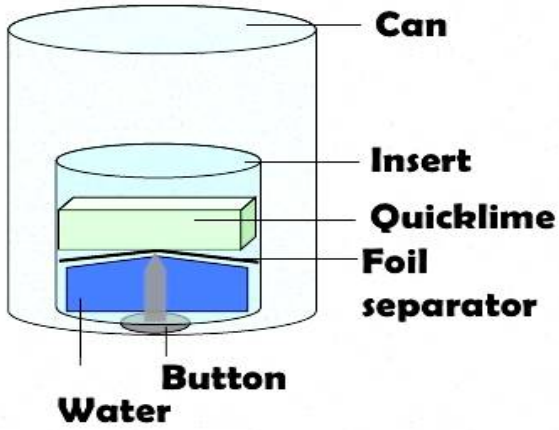
(c) Suggest a reason why the elements in the modern Periodic Table are **not** arranged according to relative atomic masses. [1]

……

[Total: 4 marks]

A7 Neskopi have recently launched a self-heating can of coffee.

(a) In order to heat up the coffee, a button is pressed which mixes the heating ingredient: water and quicklime (calcium oxide). The can then warms up 210 cm^3 of coffee by approximately 40 °C.



(i) Write an equation for the reaction between calcium oxide and water. [1]

……

(ii) State and explain, using ideas of collisions between particles, if powdered calcium oxide would react faster or slower than lumps of calcium oxide in this experiment. [2]

……

……

……

……

(iii) In the design of the self-heating can, the amount of heat produced may be controlled by adding acid or alkali to water before it reacts with calcium oxide. Predict whether adding acid or alkali would give the greater amount of heat. Explain your reasoning.

[2]

Prediction: ……

Reasoning: ……

……

……

……

(b) Three separate experiments were carried out using aqueous hydrogen peroxide. It decomposes exothermically to form oxygen gas. Different amounts of copper (II) oxide were added as a catalyst. The mass of copper (II) oxide, the concentration and volume of hydrogen peroxide are given below.

$$2\ H_2O_2\ (aq) \rightarrow 2\ H_2O\ (l) + O_2\ (g)$$

Expt	**Concentration of H_2O_2/ mol/dm^3**	**Volume of H_2O_2/ cm^3**	**Mass of CuO/ g**	**Volume of O_2/ cm^3**	**Max. temperature change when reaction completed/ °C**	**Time taken for the reaction to complete /s**
1	1.0	10	5	120	4	6
2	2.0	10	5	240	8	12
3	2.0	10	10			

(i) Suggest a method to investigate the rate of reaction in these experiments other than measuring the temperature change. [1]

……

(ii) Arrange Experiments 1, 2 and 3 in order of increasing rate of reaction. [1]

……

(iii) Would the mixture become hot or cold? [1]

……

(iv) Predict the volume of oxygen gas produced, the maximum temperature change and the time taken for the reaction to complete in experiment 3. [2]

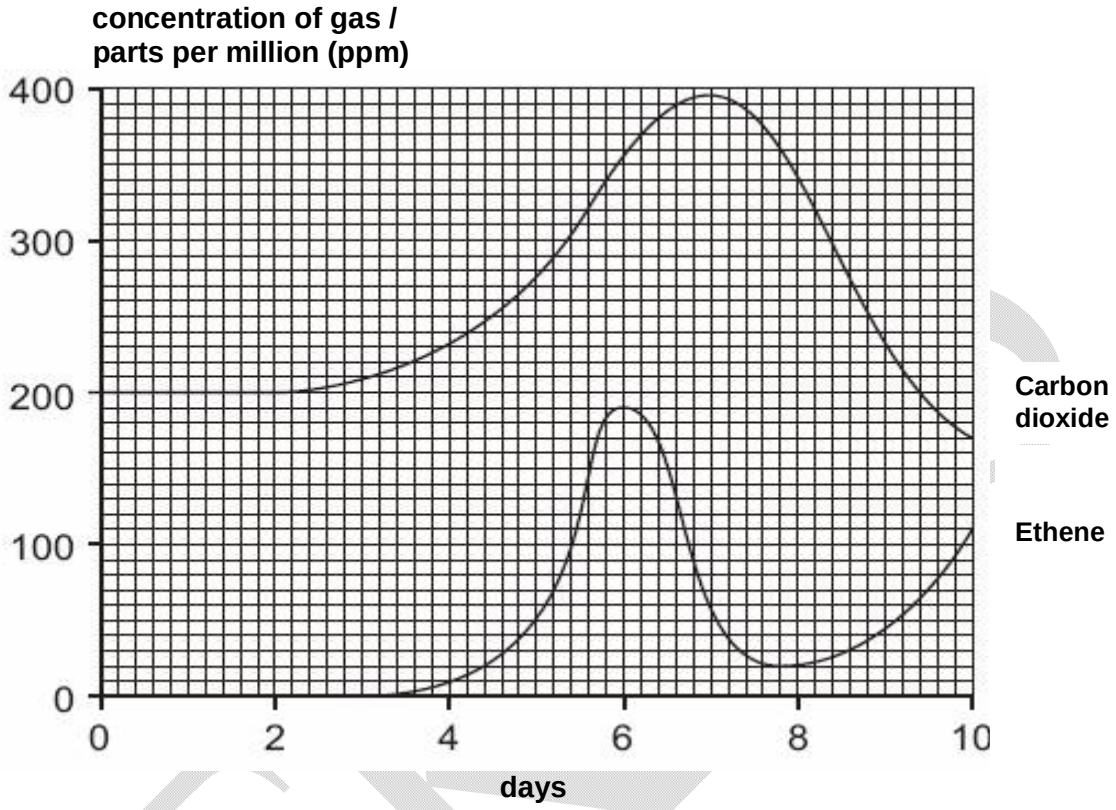
……

[Total: 10 marks]

A8 Fruits such as bananas and strawberries produce ethene naturally.

(a) A scientist left some green bananas to ripen. He measured the concentration of ethene and carbon dioxide produced by the bananas over a ten-day period.

The graph below shows the results.



(i) Between which two days does the rate of ethene production increase most rapidly? [1]

……

……

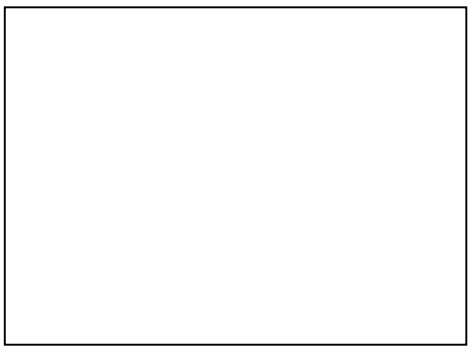
(ii) How does the carbon dioxide concentration above 350 ppm affect the production of ethene by the fruits? [1]

……

……

(b) Ethene can be converted into ethane through an addition reaction.

(i) Draw the structure of [1]



ethane

ethene

(ii) Describe a test that you would perform to differentiate between these two hydrocarbons.

[2]

……

……

(iii) The table shows the bond energies of covalent bonds.

bond	bond energy in kJ/mol
C-C	346
C=C	610
C-H	413
H-H	432

Using the bond energies given above, **show** by calculation that the conversion of ethene to ethane is exothermic. [2]

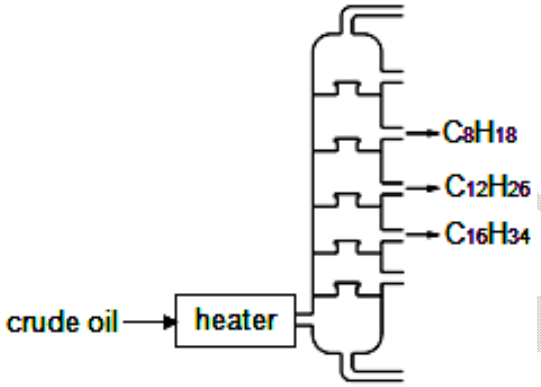
[Total: 7 marks]

Section B

Answer all **three** questions in this section.

The last question is in the form of either/or and only one of the alternatives should be attempted.

B9 The diagram shows how crude oil is processed and then manufactured into other useful products.



(a) Fractional distillation of crude oil produces three fractions containing the following compounds: octane, dodecane and hexadecane. The table below shows some information about the boiling point, melting point and viscosity of these compounds.

Compound	**Molecular Formula**	**Boiling point / °C**	**Melting point / °C**	**Viscosity / mPa·s**
octane	C_8H_{18}	126	-57	0.576
dodecane	$C_{12}H_{26}$	218	-10	1.34
hexadecane	$C_{16}H_{34}$	287	18	3.00

unit of viscosity: millipascal-second (**mPa·s**)

(i) Using the information from the table, comment on the relationship between the boiling point and the position of these fractions collected from the column. [2]

……

……

……

(ii) Describe the trend in viscosity for these compounds and use the data to explain this trend. [2]

……

……

……

(iii) Limited crude oil means that new fuels will be needed for cars. Alternative fuels include ethanol and hydrogen gas.
Other than reducing pollution problems, state **one** advantage that both ethanol and hydrogen gas have over petrol as a fuel. [1]

……

……

(b) Read the information about mass spectroscopy:

Mass spectroscopy is an analytical technique that can be used to find the molecular mass of organic compounds.

In this method, energy is used to change molecules into positive ions. If enough energy is supplied, some bonds break and smaller ions are produced.

The mass spectrometer machine separates the ions and records their relative formula/molecular masses as a bar chart. The pattern of bars is called mass spectrum and each bar corresponds to a particular mass.

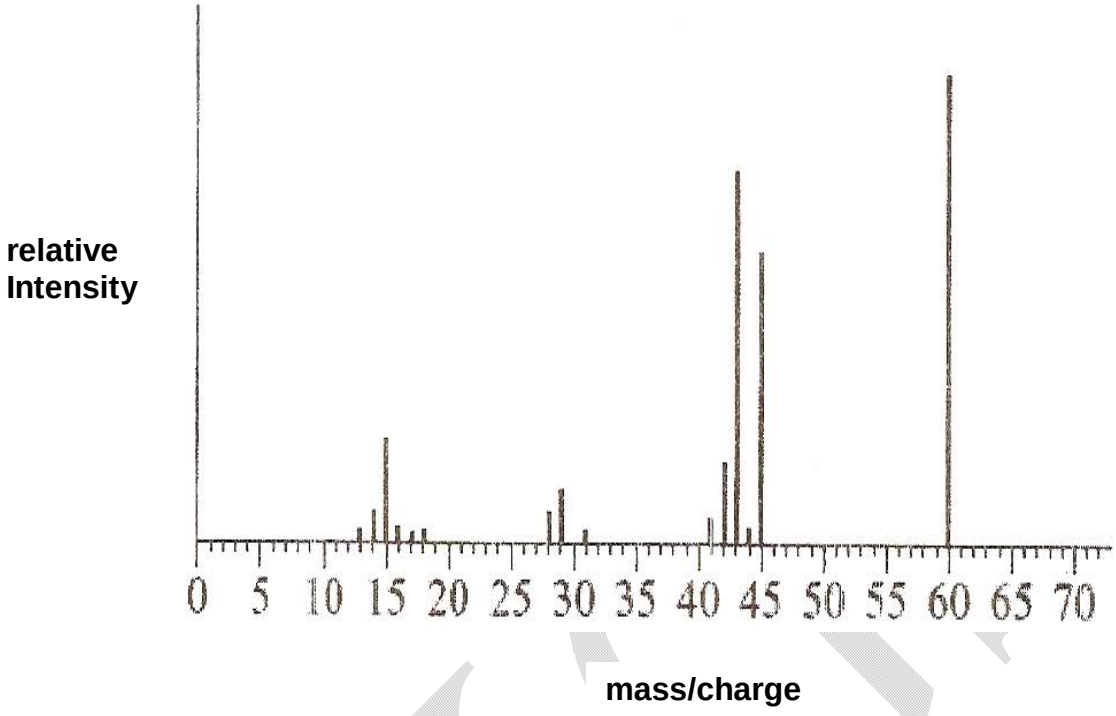
The bar produced by the heaviest ion (the one with the highest mass/charge) gives the relative formula/molecular mass of the compound.

(i) Suggest the name of the sub-atomic particle that must be lost from a molecule to change it into a positive ion. [1]

……

……

Methanoic acid (HCOOH), ethanoic acid (CH_3COOH) and propanoic acid (C_2H_5COOH) are carboxylic acids. The mass spectrum below gives the molecular mass of one of the carboxylic acids.

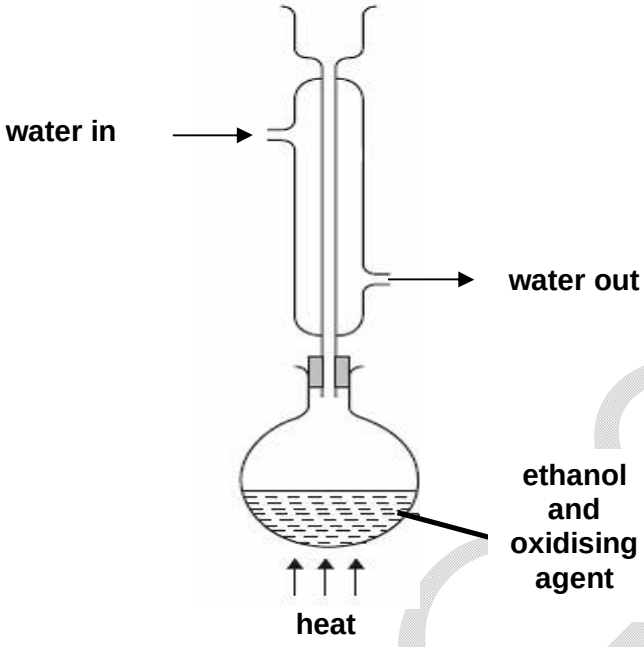


(ii) Use the information given and the relative atomic masses from the Periodic Table, show the identity of this carboxylic acid. [2]

Carboxylic acid: ……..

(iii) Draw the structural formula of propanoic acid. [1]

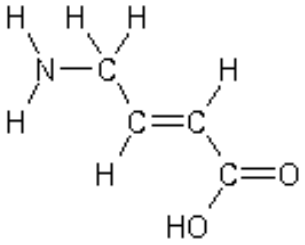
(c) A student used the apparatus shown below to oxidise ethanol. A small volume of ethanol was placed in the flask together with an oxidising agent. The mixture was warmed.



(i) State **one** error the student made in setting up the apparatus. [1]

……

(ii) Ethanol can react with compound **Z** (shown below) to form a sweet-smelling compound.



compound **Z**

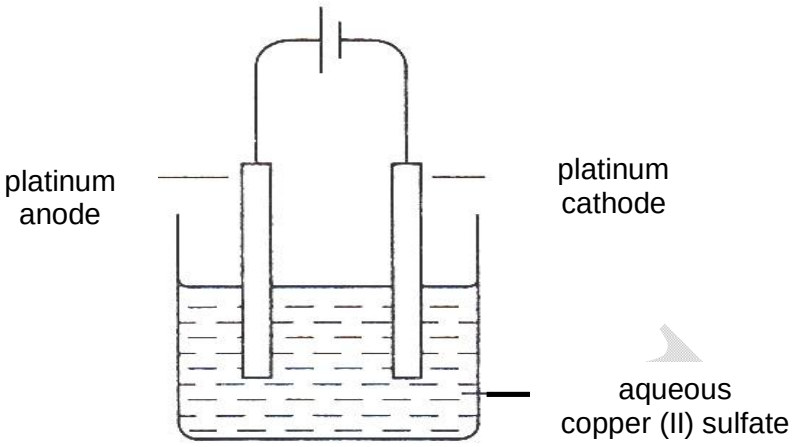
State the conditions essential for the formation of this sweet-smelling compound and draw the full structural formula of the sweet-smelling compound.

conditions: …… [1]

structure: [1]

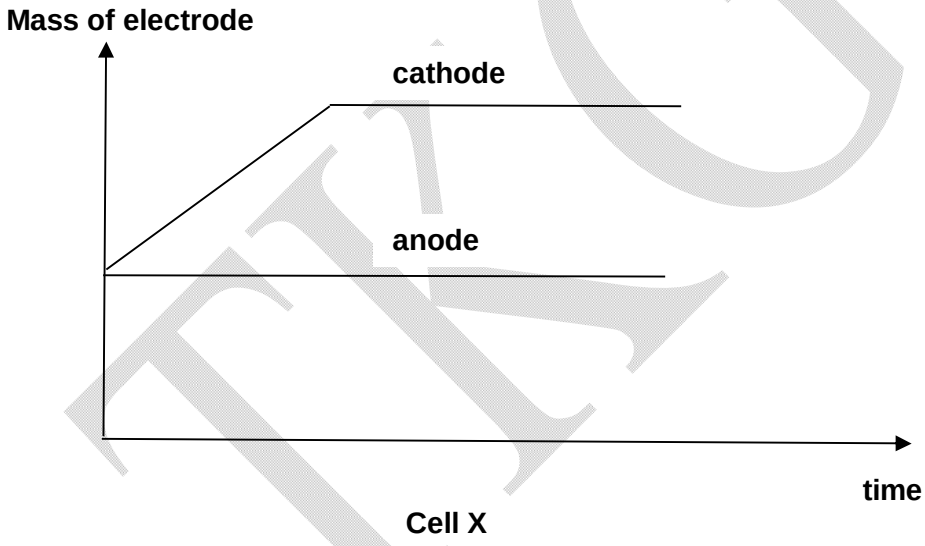
[Total: 12 marks]

B10 An experiment is carried out to electrolyse an aqueous solution of copper (II) sulfate.



Cell X

(a) A constant current was passed through aqueous copper (II) sulfate using platinum electrodes in cell **X**. At regular intervals, the cathode and anode were removed, dried and weighed. The results were plotted on the graph below.



Cell X

Explain why the cathode

(i) shows an increase in mass initially, [1]

……

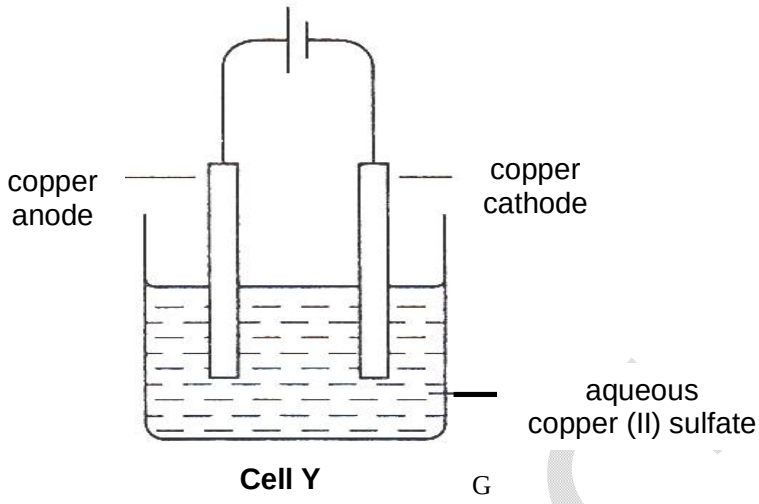
……

(ii) does not increase in mass after some time. [1]

……

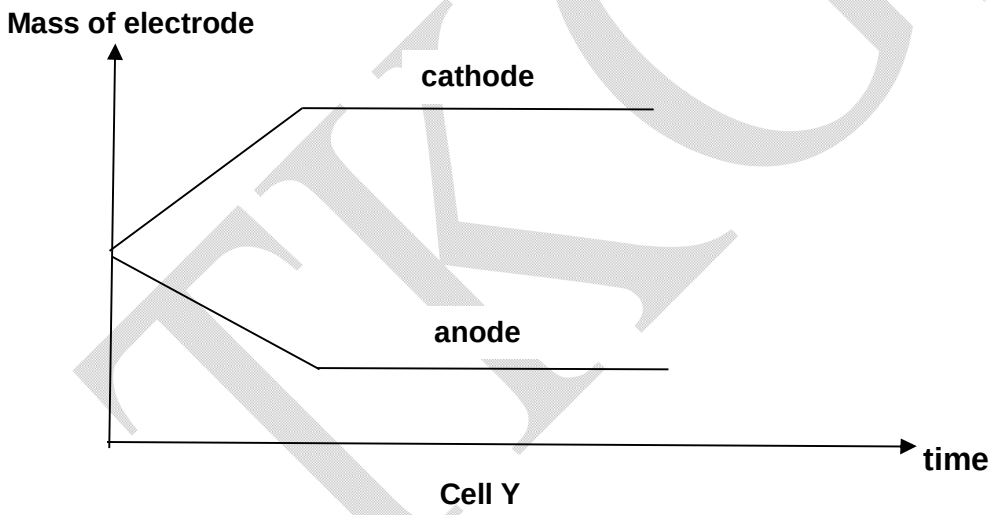
……

The experiment was repeated with aqueous copper (II) sulfate of the same concentration as before, but this time using copper electrodes in cell **Y**.



Cell Y

The same current was passed for the same length of time. At regular intervals, the cathode and anode were removed, dried and weighed. The results were plotted in the graph shown below.



Cell Y

(iii) Explain why the platinum anode does not change in mass in cell **X** but the copper anode shows a decrease in mass in cell **Y.** [2]

……

……

……

……

(b) An experiment is set up to electroplate a fresh flower with silver.

(i) Suggest why the fresh flower must be coated with carbon particles first. [1]

……

(ii) Briefly explain how you would set up the cathode and the anode. You should also name the choice of the electrolyte and write equations for the reactions that occur at the two electrodes. [3]

……

……

……

……

……

……

[Total: 8 marks]

B11 Either

(a) Titanium is a shiny grey metal which is normally used in aircraft and engines.

Pure titanium can be extracted from its metal ore, rutile, through the steps below.

Step	Description
1	Heat the rutile (titanium dioxide) with chlorine and coke at a temperature of about 900 °C to form titanium chloride and carbon monoxide.
2	Titanium chloride (melting point: -25^{o}C) is then heated with potassium in an argon atmosphere, according to the equation: $TiCl_4 + 4K \rightarrow 4KCl + Ti$ However the above reaction does not occur when potassium is replaced with zinc.

(i) Construct a balanced chemical equation to show the reaction occurring in **Step 1**. [1]

……

(ii) Based on the information given, predict the position of titanium in the reactivity series relative to potassium and zinc. Explain your answer. [1]

……

……

(iii) Molybdenum is often added in order to change the physical properties of titanium. State one physical property that may be changed by the addition of molybdenum. Explain your answer. [3]

……

……

……

……

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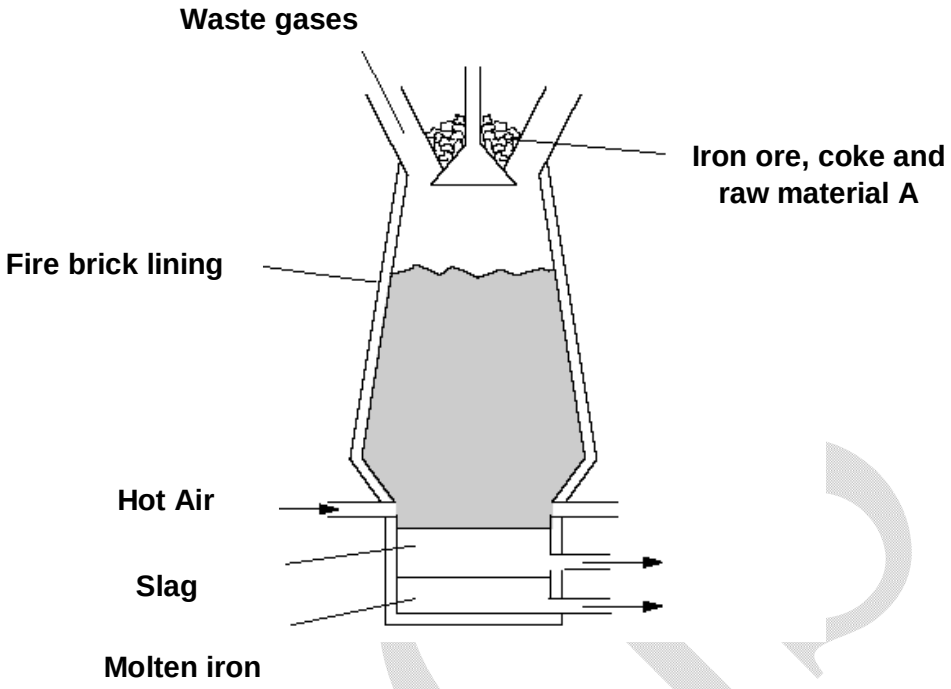
……

(b) No one knows where iron was first isolated. It appeared in China, the Middle East and Africa. It was obtained by reducing iron ore with charcoal. In 1705, Abraham Darby showed that iron ore could be reduced using coke in a blast furnace.



(i) Name the raw material **A**. Explain why raw material **A** is added to the blast furnace. [2]

……

……

……

(ii) Write the main chemical equation for the extraction of iron in the blast furnace. [1]

……

(iii) Would this method be suitable to extract sodium from its ore? Explain your answer. [2]

……

……

……

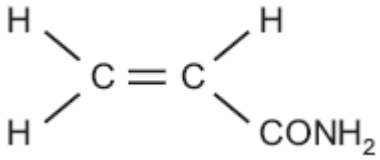
……

[Total: 10 marks]

B11 Or

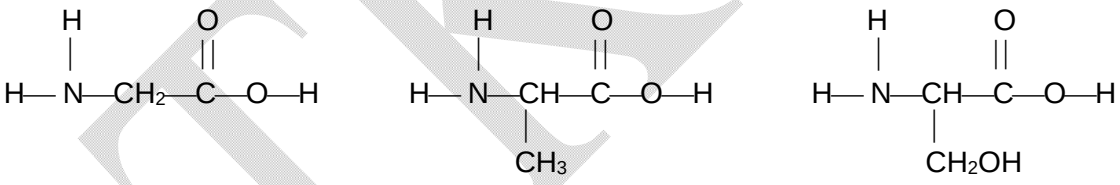
Researchers in Europe and the United States have found the presence of acrylamide in certain foods that were heated to temperature above 120 °C. Potato chips and french fries were found to contain high levels of acrylamide.

Acrylamide, which is thought to be harmful to human health, has the following structure.



(a) Acrylamide readily polymerises to polyacrylamide. Draw the structure of this polymer. [1]

(b) A silk protein is composed of many identical protein chains, which are mainly made from equal amounts of the following three amino acid monomers, glycine, alanine and serine.

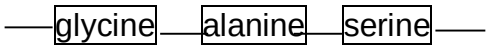


glycine alanine serine

(i) What type of polymerisation will take place when the monomers polymerise? [1]

.....

One possible structure of the silk protein is shown below.



(ii) Give the structural formula for the repeating unit of the silk protein, containing the three amino acids. [1]

(c) What are the differences between these two polymerisation reactions in (a) and (b)? [2]

……

……

……

(d) Acrylamide reacts with water to form acrylic acid and ammonium ions.

(i) Describe the test for the ammonium ion. [2]

……

……

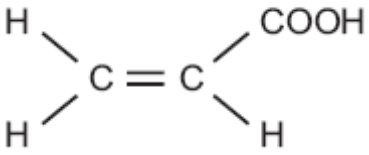
……

(ii) Given an aqueous solution of concentration 0.1 mol / dm^3, how could you show that acrylic acid is a weak acid? [1]

……

……

(e) The structural formula of acrylic acid is shown below.



It forms compounds called acrylates. Acrylic acid reacts with aqueous sodium hydroxide to form sodium acrylate. Write a structural formula of sodium acrylate. Write a balanced equation to represent the reaction. [2]

[Total: 10 marks]

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

Marking Scheme

Name of Setter/s: Siti Munira Bte Haidad Ali

Name of Assessment: Chemistry 5073 Prelim 2016 Duration: 1 h 45 min

No. of Papers: P2 Date of Sep: 14 Sep 2016

Legend: **CAO** **Correct answer only**
OWTTE **Other words to that effect**
ECF **Error carried forward**

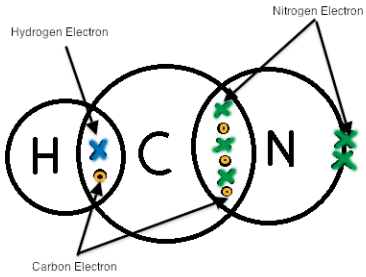
Section A [50 marks]

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A1(a)	Chlorine/ Any Group I elements/calcium or alkaline acidic	CAO	1
A1(b)	compound alloy/mixture	CAO	1
A1(c)	amphoteric acidic or silicon Lead/aluminium/zinc	CAO	1
A1(d)	nine ten or electrons protons	CAO	1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A2(a)	A: Fe^{3+} B: I^- C: Fe^{2+}	CAO CAO CAO	1 1 1
A2(b)(i)	NH_4NO_3	CAO	1

A2(b)(ii)	No of moles of HNO_3 = 10 x1000/ [1+ 14 + (16x3)] =158.7 mol No of moles of NH_4NO_3 = 158.7 mol Mass of NH_4NO_3 = 158.7 x [(2x 14) + 4 + (3x16)] = 12 696 g =<u>12.7kg</u>	CAO	1 1
A2(c)(i)	The residue was not washed with distilled water. The residue of lead (II) chloride and crystals of sodium nitrate should not be dried in the oven. Lead (II) nitrate and sodium chloride may be in excess and present in the filtrate. Therefore, crystals of sodium nitrate may not be formed when the solution was cooled down.	CAO OWTTE	1 1
A2(c)(ii)	The residue should have been washed to remove any soluble impurities. Lead (II) chloride and sodium nitrate may decompose in the oven due to the high temperature.	CAO OWTTE	1 1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A3(a)	$BaCO_3$ is less soluble than $CaCO_3$, and can act as a protective layer.	CAO OWTTE	1 1
A3(b)(i)	$2BaCO_3 + 2SO_2 + O_2 \rightarrow 2BaSO_4 + 2CO_2$	CAO	1
A3(b)(ii)	Slow down as reaction consumes SO_2. Less H_2SO_3 formed reduces the reaction with $CaCO_3$. or $BaSO_4$ is even less soluble than $BaCO_3$ and forms a better protective layer.	CAO OWTTE	1 1

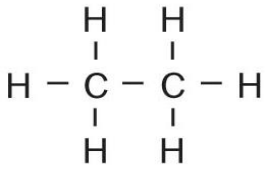
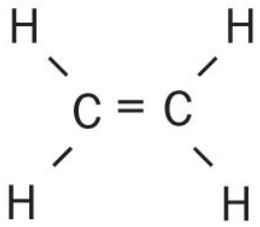
Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A4(a)	Mr=1.125 x 24 = 27	CAO	1
A4(b)(i) (ii) (iii)	No. of moles of nitrogen atoms in one mole of **X**= $\frac{12}{24}$ **x** 2=1 No. of moles of hydrogen atoms in one mole of **X** = $\frac{9}{18}$ **x** 2 = 1 Mass of carbon in one mole of **X** = 27-1-14 =12 No. of moles of carbon atoms in one mole of Q = 12/12=1 Molecular formula of **X** is <u>HCN</u> (shown).	CAO OWTTE [Allow ECF]	1 1 1 1
A4(c)	Draw covalent bond of HCN.  	CAO Legend: x- electron from H atom • - electron from C atom ×- electron from N atom	2

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A5(a)	Aluminium	CAO	1
A5(b)	Aluminium reacts with oxygen to form oxide and this protective layer of oxide prevents Al from reacting with steam.	CAO	1
A5(c)	change to any acid (e.g H_2SO_4, HCl, HNO_3) or change metal to Mg	CAO	1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A6(a)	Argon: Electronic structure is 2.8.8 or Full octet structure or noble gas configuration Argon is unreactive. Potassium: Electronic structure is 2.8.8.1 Can lose the valence electron easily. Potassium is very reactive.	OWTTE	1 1
A6(b)	Tellurium and Iodine	CAO	1
A6(c)	Any one of the following: Elements with similar chemical properties / same number of valence electrons would not be in the same Group No two elements share the same proton number, but some elements may share the same mass number (e.g. Co and Ni) The Ar of some elements could not be accurately determined (e.g. Fr, At)	OWTTE	1

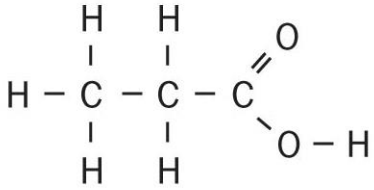
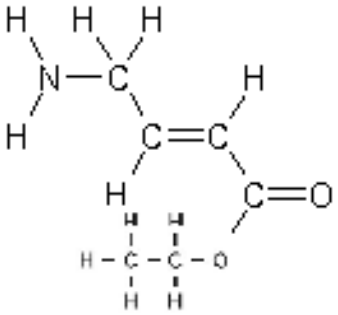
Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A7(a)(i)	$CaO + H_2O \rightarrow Ca(OH)_2$	CAO	1
A7(a)(ii)	Powdered CaO has larger surface area. More effective collisions, rate is faster.	OWTTE	1 1
A7(a)(iii)	Acidic> basic condition. The amount of heat given out is the greatest when acid is added as <u>heat is given out due to neutralisation of $Ca(OH)_2$</u> in addition to heat given out when CaO reacts with water.	CAO OWTTE	1 1
A7(b)(i)	measuring the time taken for a fixed volume of gas produced/ time taken for maximum volume of gas produced/ time taken for mass of content to stop dropping/reach constant	CAO OWTTE	1
A7(b)(ii)	1, 2, 3	CAO	1
A7(b)(iii)	Hot	CAO	1
A7(b)(iv)	240 cm^3 ; 8 °C ; between 6-12 sec	CAO 2 out of 3 correct	2 1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
A8(a)(i)	Between 5 th and 6 th day.	CAO	1
A8(a)(ii)	It decreases the production of ethene by the fruits.	CAO	1

A8(b)(i)	Correct structures of ethane  <u>and</u> ethene 	CAO	1
A8(b)(ii)	Bromine solution is added to both ethane and ethene separately, the reddish brown colour remains for ethane but turns colourless for ethene.	OWTTE	1 1
A8(b)(iii)	C – H: 413 x 4 = 1 652 kJ C=C H-H 610 kJ 432 kJ Total energy absorbed = 2 694 kJ C – C 346 x 1 = 346 kJ C – H 413 x 6 = 2 478 kJ Total energy released = 2 824 kJ ΔH = 2694-2824 = <u>- 130</u> kJ (shown) (negative value = exothermic) <u>Or</u> $\Delta H = E_{BB}-E_{BF}$ = (610+432)-(346+2(413)) = <u>-130</u> kJ	OWTTE [Allow ECF]	 1 1 1 1

Section B [30 marks]

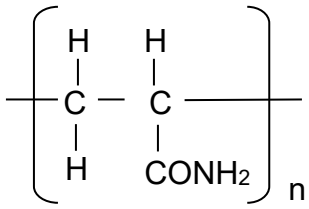
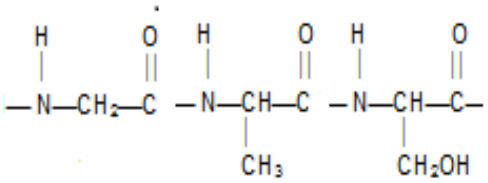
Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
B9(a)(i)	Octane has the lowest boiling point among the fraction hence it is collected from the top of the column while hexadecane has the highest boiling point among the fractions hence it is collected from the bottom of the column.	OWTTE	1 1
B9(a)(ii)	There is an increase in viscosity from octane to dodecane to hexadecane. As the relative molecular mass of the compounds increases, the intermolecular forces of attraction also increases. Thus, lots of energy needed to weaken/overcome strong forces. Hence, there is greater resistance for liquid to flow. Or Longer molecule will get tangled up.	OWTTE	1 1
B9(a)(iii)	Both ethanol and hydrogen are renewable sources of energy (ie. ethanol can be obtained from fermentation of glucose and hydrogen from cracking of alkane.	OWTTE	1
B9(b)(i)	electron	CAO	1
B9(b)(ii)	highest m/z v alue is 60. Total Mr of (CH_3COOH) =12 x 3(1) + 12 + (16 x 2) + 1 = 60 Ethanoic acid	CAO	1 1

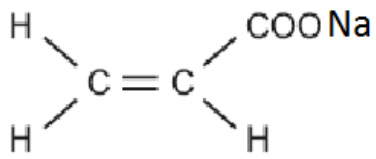
B9(b)(iii)	Draw 2-carbon with COOH group propanoic acid 	CAO	1
B9(c)(i)	The water should flow in from the bottom of the condenser and out from the top.	OWTTE	1
B9(c)(ii)	conditions: concentrated sulfuric acid, warm. structure: 	OWTTE	1 1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
B10(a)(i)	At the cathode, Cu^{2+} ions gains electrons/reduces to form Cu which is deposited at the cathode. So the mass of cathode increase.	OWTTE	1
B10(a)(ii)	When all the Cu^{2+} ions in the solution are discharged at the cathode, no additional deposit of copper.	OWTTE	1
B10(a)(iii)	In Cell **X**, the anode does not change in mass because the platinum anode is an inert/unreactive electrode. It does not dissolve in the electrolyte. In Cell **Y**, the copper anode slowly dissolves in the electrolyte forming Cu^{2+} by losing electrons. Hence it decrease in mass.	OWTTE	1 1
B10(b)(i)	Carbon is a conductor of electricity. When coated, the flower can act as an electrode.	OWTTE	1
B10(b)(ii)	Cathode : flower electrolyte : aqueous silver nitrate Equations: Anode: $Ag \rightarrow Ag^{+} + e^{-}$ Cathode: $Ag^{+} + e^{-} \rightarrow Ag$	CAO CAO	1 1 1

Either

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
B11(a)(i)	$TiO_2 + 2Cl_2 + 2C \rightarrow TiCl_4 + 2CO$	CAO	1
B11(a)(ii)	Below potassium but above zinc. Potassium is able to displace titanium from titanium chloride but not zinc.	OWTTE	1
B11(a)(iii)	Titanium become stronger/harder. Pure titanium is made up atoms that are orderly arranged. The layer of atoms slides past each other easily when force is applied. Molybdenum disrupts the orderly arrangement of titanium and hence preventing the layers of atoms from sliding past when a force is applied. Or The melting point of the mixture will be lower. The melting point of pure titanium is higher as there is strong metallic bond between the positive ions and sea of delocalized electrons. Adding impurities like Molybdenum will lower the melting point of the mixture.	OWTTE	1 1 1
B11(b)(i)	Raw material A is limestone, which is added to remove the acidic impurities. The calcium oxide then reacts with the acidic oxide in the impurities/acidic impurities to form calcium silicate which is removed as slag.	OWTTE	1 1
B11(b)(ii)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	CAO	1
B11(b)(iii)	No. The compound with sodium as the metal is more stable and cannot be extraction by reduction.	OWTTE	1 1

Q/No.	Answer	Comments/Instructions/ Suggestions	Marks
B11(a)		CAO	1
B11(b)(i)	Condensation polymerisation	CAO	1
B11(b)(ii)	Structure of repeating unit 		1
B11(c)	In the addition polymerisation of acrylamide, it involves the breaking up of the double bond in the monomers to form a single product that is the polymer. In the condensation polymerisation reaction to form silk protein, water is also formed besides the silk protein.	OWTTE	1 1
B11(d)(i)	Add aqueous sodium hydroxide to the solution containing ammonium ions. Warm mixture gently. If a gas produced turns damp red litmus paper blue, then ammonium ions are present.	OWTTE	1 1
B11(d)(ii)	Add magnesium/metal carbonate Rate of bubbling is slower. Or Add universal indicator and observe the colour change from green to orange/yellow.	OWTTE	1

B11(e)	Structural formula of sodium acrylate  C_2H_3COOH (aq) + NaOH (aq) → C_2H_3COONa (aq) + H_2O (l)	CAO	1 1