Geylang Methodist School (Secondary)
Preliminary Examination 2018

CHEMISTRY

6092/01

Paper 1 Multiple Choice

Sec 4 Express

Additional materials : OAS

1 hour

Setter : Mrs Loh Kim Woon

20 August 2018

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

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 Answer Sheet.

Read the instructions on the 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.
A copy of the Periodic Table is printed on page 16.

This document consists of **16** printed pages.

[Turn over

1   Which of the following pairs of substances can be separated by heating?

     A   ammonium chloride and potassium iodide

     B   copper (II) nitrate and potassium iodide

     C   ammonium chloride and iodine

     D   sodium chloride and copper (II) nitrate

2   The table shows the colours and the solubilities in water of four solids.

solid	colour	solubility in water
W	blue	insoluble
X	blue	soluble
Y	white	insoluble
Z	white	soluble

A mixture containing two of the solids is added to excess water, stirred and filtered.

A blue filtrate and a white residue are obtained.
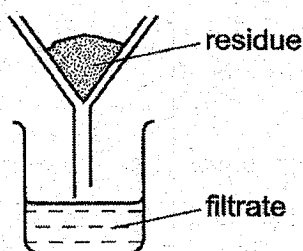
Which two solids are present in the mixture?

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

3   An experiment is carried out to investigate the rate of reaction when calcium carbonate reacts with hydrochloric acid.
The volume of carbon dioxide gas given off is measured at different intervals of time.
The diagram shows pieces of apparatus used to collect gases.

1	2	3
downward delivery	calibrated gas syringe	displacement of water with a graduated tube
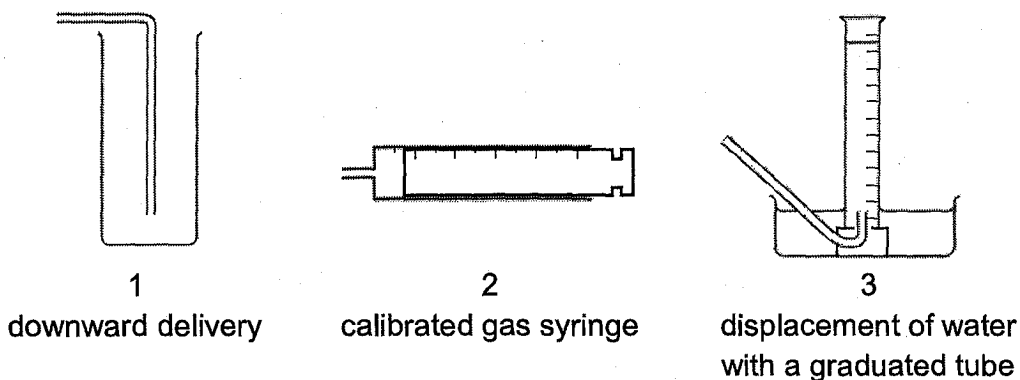
Which apparatus is suitable to collect and measure the volume of the carbon dioxide?

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

4   Solution X contains two anions. Tests are carried out as shown in the diagram below.
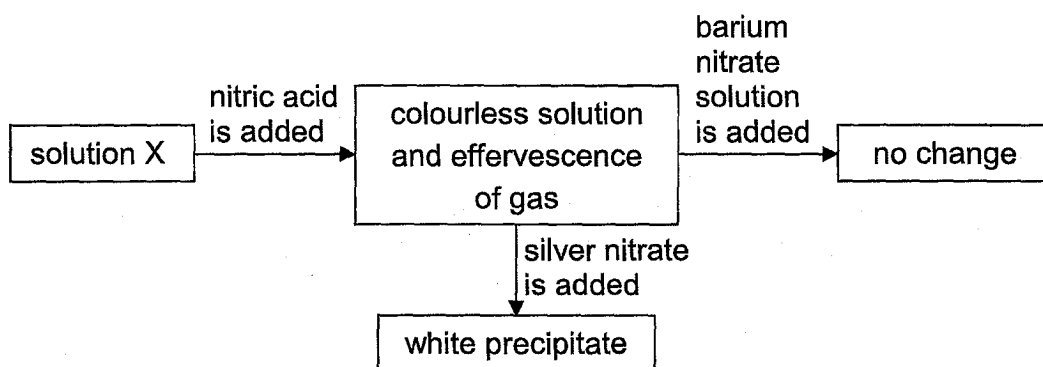
What anions are found in solution X?

A   sulfate ions and carbonate ions

B   carbonate ions and chloride ions

C   sulfate ions and chloride ions

D   nitrate ions and carbonate ions

5   Which statement correctly explains why chlorine, Cl_2, at 40°C diffuses more slowly than neon, Ne, at 20°C?

     A   Chlorine has a relative molecular mass of 71 whilst neon has a relative atomic mass of 20.
     B   Chlorine is at a higher temperature than neon.
     C   Chlorine is diatomic and neon is monatomic.
     D   Chlorine is more reactive than neon.

6   Four statements are being made about elements, compounds and mixtures by a student.
     Statement 1: Elements and compounds have fixed melting points.
     Statement 2: The properties of a compound are similar to that of its elements.
   Statement 3: A mixture can be separated into its components by physical means.
     Statement 4: Elements can exist either in the form of atoms or molecules.

     How many of the above statement(s) is/are **not** correct?

     A   one
     B   two
     C   three
     D   four

7   Deuterium, D, is an isotope of hydrogen.
     Which statement about deuterium is **not** correct?

     A   It reacts with ethene, C_2H_4, to form a compound CH_2DCH_2D.
     B   An atom of deuterium contains one proton.
     C   It has the same density as hydrogen.
     D   It forms the ion D^+.

8   A molecule of sulfuric acid has the structural formula shown.
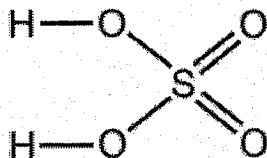
   How many electrons are involved in forming all the covalent bonds in one molecule of sulfuric acid?

     A   6   B   8   C   12   D   16

9   An investigation of the properties of the chlorides of Period III elements shows that the boiling points of sodium chloride and silicon tetrachloride are 1465°C and 57°C respectively. This difference in boiling points is a result of

A   covalent bonds being weaker than ionic bonds.
B   sodium chloride having strong metallic bonds.
C   silicon tetrachloride having weak intermolecular forces of attraction.
D   silicon forming weaker bonds with chlorine than does sodium.

10   Compound P is the only substance formed when two volumes of ammonia gas react with one volume of carbon dioxide gas (both volumes being measured at r.t.p.).

What is the formula of P?

A $NH_2CO_2NH_4$

B $(NH_2)_2CO$

C $NH_4CO_2NH_4$

D $(NH_4)_2CO_3$

11   When sugar (M_r = 342) is fermented using yeast, the following reaction takes place.

$$C_{12}H_{22}O_{11} + H_2O \rightarrow 4C_2H_5OH + 4CO_2$$
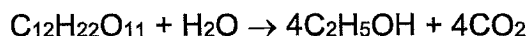
What volume of carbon dioxide, at r.t.p., would be produced by the complete fermentation of 1 kg of sugar?

A $\dfrac{342 \times 4 \times 24}{1000}$ dm³

B $\dfrac{1000 \times 24}{342 \times 4}$ dm³

C $\dfrac{342 \times 24}{1000 \times 4}$ dm³

D $\dfrac{1000 \times 4 \times 24}{342}$ dm³

12   On collision, airbags in cars inflate rapidly due to the production of nitrogen.
The nitrogen is formed, in two consecutive steps, according to the following equations.

Step 1: $2NaN_3 \rightarrow 2Na + 3N_2$

Step 2: $10Na + 2KNO_3 \rightarrow K_2O + 5Na_2O + N_2$
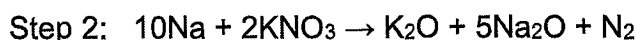
What is the **total** number of moles of nitrogen gas that can be produced from one mole of sodium azide, NaN_3?

A   1.5   B   1.6   C   3.2   D   4.0

13   Which property would all the hydrogen compounds of the Group VII elements possess?

    A   They form covalent compounds.
    B   They are solids at room temperature.
    C   They form alkaline aqueous solutions.
   D   They conduct electricity when molten.

14   The properties of the oxides of four elements K, L, M and N in the third period of the Periodic Table are given below.

    •   The oxide of K is insoluble in water and dilute acid but soluble in concentrated alkali.
    •   The oxide of L reacts with both dilute acid and dilute alkali.
    •   The oxide of M reacts with dilute alkali at room temperature.
   •   The oxide of N dissolves in water to form an alkaline solution.

If K, L, M and N are placed in order of increasing atomic number, which order is correct?

    A   K, L, M, N
    B   N, M, K, L
    C   N, L, K, M
    D   L, K, N, M

15   A coil of clean copper wire is suspended in aqueous silver nitrate. Crystals of silver are deposited on the copper wire.

Which statement is **not** correct?

    A   The copper is oxidised.
    B   The total mass of the crystals of silver increases gradually.
    C   The total number of positive ions in the solution is unchanged.
    D   The solution turns blue.

16   Which statement about the production of iron from iron oxide in a blast furnace is correct?

    A   Limestone is used to remove basic impurities.
    B   The reaction between the iron oxide and carbon monoxide liberates carbon dioxide.
    C   The iron is obtained using carbon monoxide as an oxidising agent.
    D   The iron oxide is reduced by carbon dioxide.

17   A known mass of potassium carbonate was placed in an open crucible and heated until
      there was no further change observed.
      Which graph shows the change in mass of the crucible and its contents?

A

mass / g

time / s

B

mass / g

time / s

C

mass / g

time / s

D

mass / g

time / s
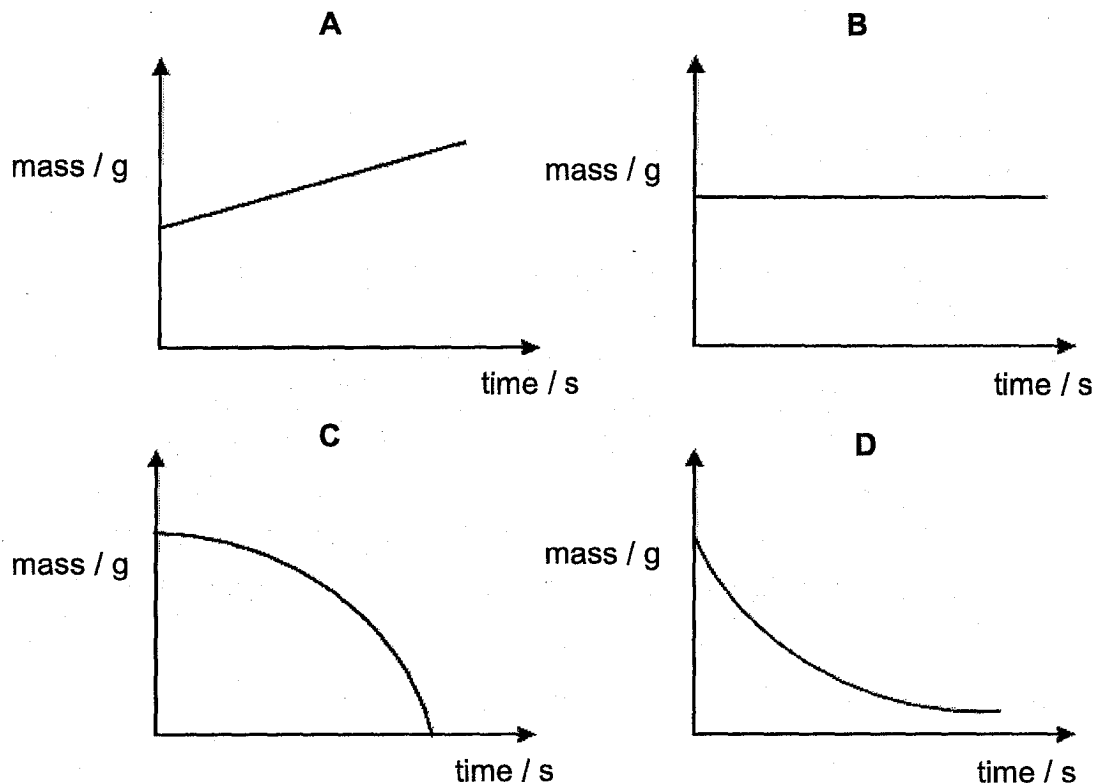
18   A sample of three gases was passed through the apparatus shown below. It was found
      that only one gas was collected in the gas jar at the end.

gases in

dilute
H_2SO_4

NaOH

water
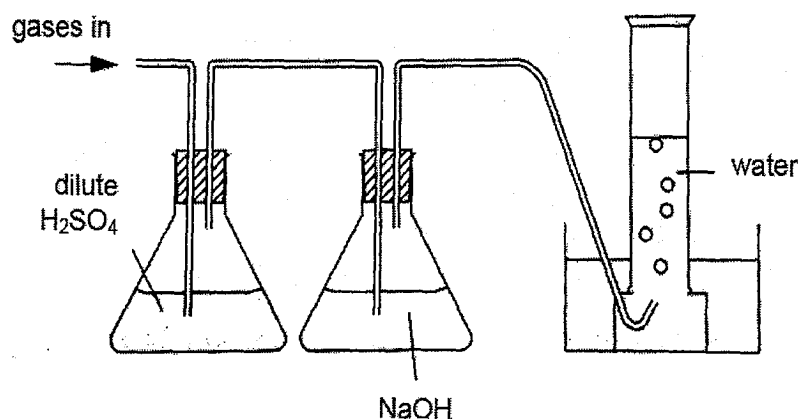
Which of the following could be the mixture of gases in the sample?

A   ammonia, hydrogen, carbon monoxide
B   ammonia, sulfur dioxide, carbon monoxide
C   nitrogen, helium, carbon dioxide
D   oxygen, nitrogen, hydrogen chloride

19　Nitrogenous fertiliser such as ammonium nitrate is used to increase crop yield.

Which substance can be added to increase the pH of acidic soil containing ammonium nitrate without causing a loss of nitrogen?

A　calcium carbonate
B　calcium hydroxide
C　magnesium hydroxide
D　potassium hydroxide

20　Which of the following does **not** show the appropriate reagents used for preparation of the named salts?

|	salt	reagents
A	barium sulfate	barium nitrate and sulfuric acid
B	lead(II) chloride	lead(II) nitrate and hydrochloric acid
C	lithium nitrate	lithium hydroxide and nitric acid
D	magnesium chloride	magnesium sulfate and hydrochloric acid

21　Which of the following is true about the Haber Process?

A　The catalyst in the reaction is iron(III) oxide.
B　The optimum temperature for the reaction is 450°C.
C　A pressure of above 600 atm will result in lower yields.
D　1 mole of nitrogen reacts with 3 moles of hydrogen to form 2 moles of ammonia.

22　Which of the following statements best describes the mechanism of a hydrogen-oxygen fuel cell?

A　Hydrogen and oxygen undergo redox reaction to generate electricity.
B　Hydrogen ions react with hydroxide ions to generate electricity.
C　Electricity is used to provide heat energy.
D　Electricity is used to generate hydrogen and oxygen.

23   The energy profile diagram for the forward direction of a reversible reaction is shown.
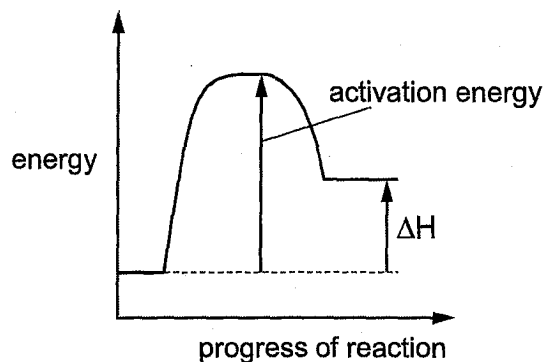
For the reverse reaction, which row correctly shows the sign of the activation energy and the type of enthalpy change?

	sign of activation energy	type of enthalpy change
A	negative	endothermic
B	negative	exothermic
C	positive	endothermic
D	positive	exothermic

24   In four separate experiments, 1, 2, 3 and 4, nitric acid was added to excess marble chips and the volume of carbon dioxide formed was measured.
In all four experiments the same volume of nitric acid was used.
Its concentration, or temperature, or both concentration and temperature, were changed.
The results of the experiments are shown on the graph.
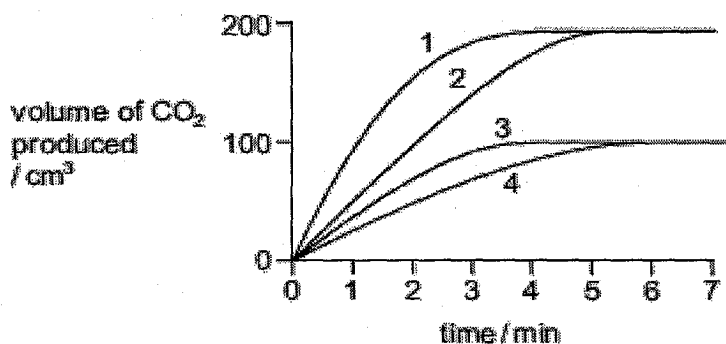
Which statement is correct?

A   A lower concentration of acid was used in experiment 3 than in experiment 1.
B   Experiment 4 was faster than experiment 3.
C   The acid used in experiment 2 was of a lower concentration than in experiment 1.
D   The temperature of the acid was the same in experiments 1 and 2.

25 The following changes could be made to the conditions in the reaction between zinc and hydrochloric acid.

    1   increase in concentration of the acid
    2   increase in particle size of the zinc
    3   increase in pressure on the system
    4   increase in temperature of the system

    Which pair of changes will increase the rate of reaction?

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

26 Disproportionation is a reaction in which the same element is both oxidised and reduced.

    Which reaction is an example of disproportionation?

    A $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
    B $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$
    C $2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$
    D $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

27 Aqueous potassium iodide, KI(aq), can be used as a test reagent in redox reactions.

    Iodide ions are readily ......X...... A positive result for the test is when the solution changes colour from ......Y...... to ......Z........

    Which words correctly complete gaps X, Y and Z?

	X	Y	Z
A	oxidised	brown	colourless
B	oxidised	colourless	brown
C	reduced	brown	colourless
D	reduced	colourless	brown

28 In an electrolysis experiment, the same amount of charge deposited 54.0 g of silver and 8.5 g of vanadium.

    What is the charge on the vanadium ion?

    A   1+
    B   2+
    C   3+
    D   4+

29 With reference to the diagram below, which of the following statements is correct?
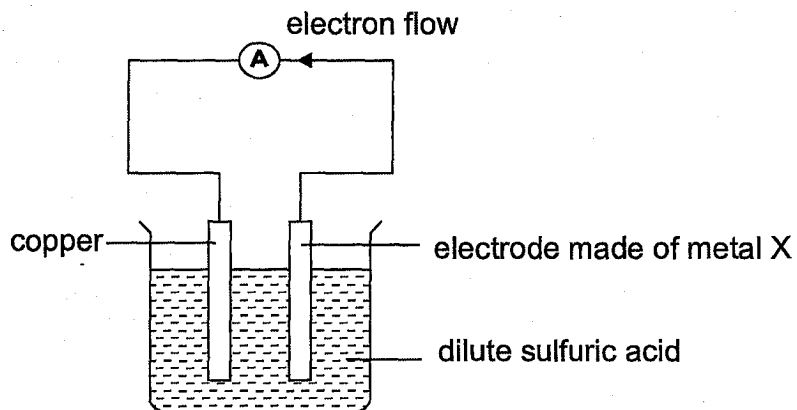
A Copper electrode is the negative electrode.
B Metal X is below copper in the reactivity series.
C The mass of the copper electrode decreases.
D The mass of the metal X electrode decreases.

30 When electrolysed using inert electrodes, which dilute solution would produce the greatest increase in mass of the cathode?


A	B	C	D
aluminium sulfate	copper(II) sulfate	lead nitrate	silver nitrate
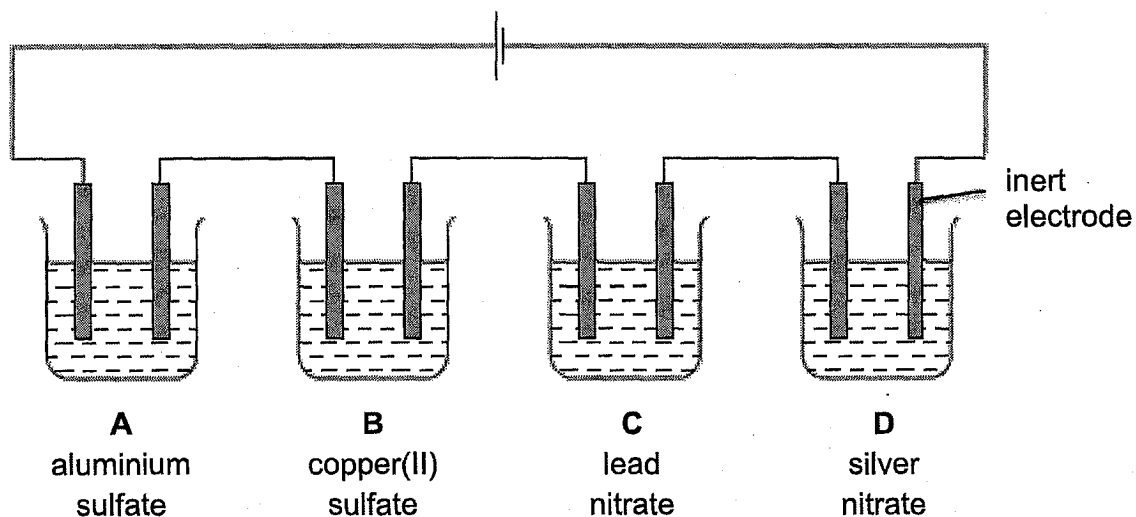
31 The table shows some atmospheric pollutants and their possible effects.

Which row is **not** correct?

	pollutant	effect
A	CFCs	cause depletion of the ozone
B	CO_2	layer forms photochemical smog
C	CO	is poisonous to humans
D	NO_2	forms acid rain

32 The diagram below represents a section of a catalytic converter on the exhaust system of a car. Harmful gases are converted into carbon dioxide, nitrogen and water vapour.

platinum and rhodium catalyst
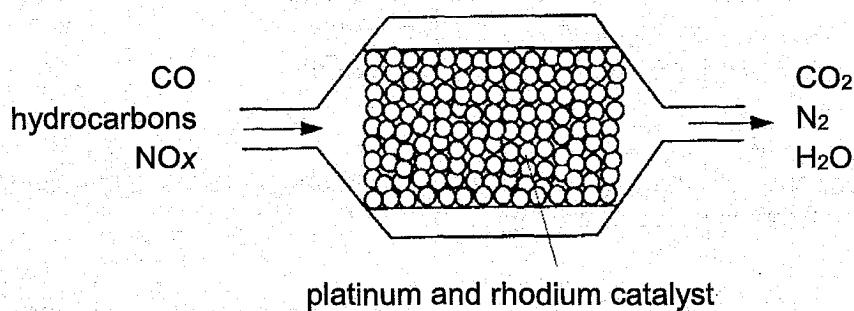
Which processes take place in this catalytic converter?

I   Carbon monoxide and hydrocarbons react together.

II   Carbon monoxide and nitrogen oxides react together.

III   Platinum and rhodium catalyse redox reactions.

A   I, II and III

B   I and II only

C   II and III only

D   I and III only

33   Which statement(s) best explains why bitumen has a higher boiling point than paraffin?

      1   Bitumen is more reactive than paraffin.
      2   Bitumen is a pure substance whereas paraffin is a mixture.
      3   Forces of attraction between the molecules of paraffin are weaker than that between the molecules of bitumen.
      4   There are smaller molecules in bitumen compared to the molecules in paraffin.

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

34   Which compound is the most viscous and the least flammable?

      A C_6H_{14} B C_8H_{18}
      C $C_{10}H_{22}$ D $C_{12}H_{26}$

35   The second member of a homologous series has the formula C_7H_8.

      What is the formula of the first member?

      A C_6H_6 B C_6H_8
      C C_6H_7 D C_7H_6

36   An ester is produced by reacting together the carboxylic acid HCO_2H and the alcohol $CH_3CH_2CH_2OH$.

      What is the name and structure of this ester?

	name	structure
A	methyl propanoate	$CH_3CH_2CO_2CH_3$
B	methyl propanoate	$HCO_2CH_2CH_2CH_3$
C	propyl methanoate	$CH_3CH_2CO_2CH_3$
D	propyl methanoate	$HCO_2CH_2CH_2CH_3$

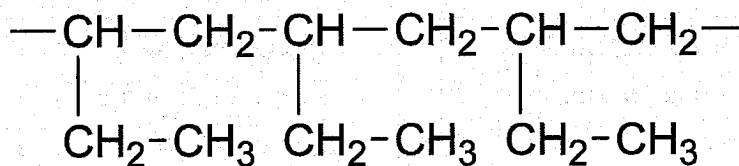**37**   Compound Y

- has the empirical formula CH_2,
- has an M_r of 56,
- forms two alcohols that have different structural formulae when reacted with steam.
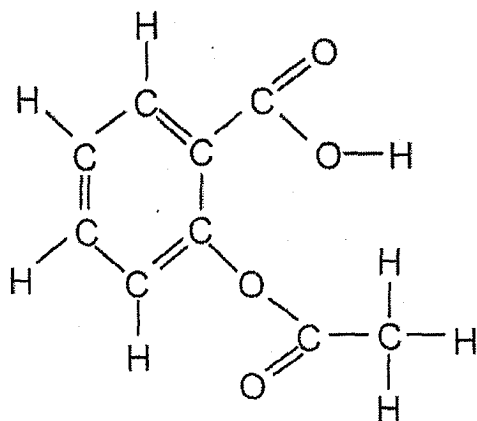
What is compound Y?

A   **B**

C   **D**
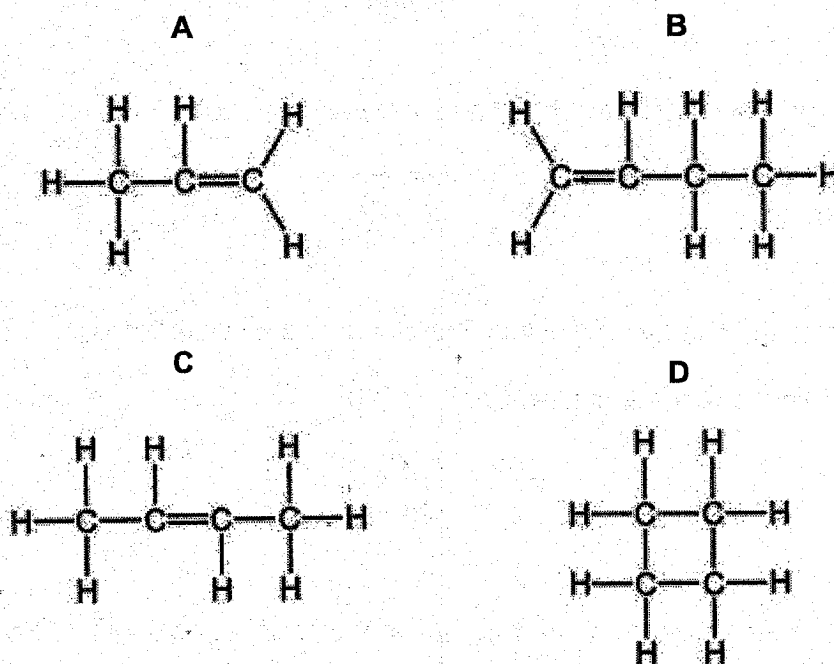
38   The structure of a polymer is shown below.

What is the molecular formula of the monomer?

A C_2H_4
B C_3H_8
C C_4H_8
D C_4H_{10}

39 Aspirin is a drug which is used as a general pain killer. The structural formula of aspirin is shown below.

Which of the following statements about aspirin is **false**?

A   Its aqueous solution reacts with sodium carbonate.
B   It decolourised aqueous bromine.
C   It is formed from an alcohol and a carboxylic acid.
D   It turns purple acidified aqueous potassium manganate (VII) colourless.

40 The diagrams show four monomers.

How many of these monomers would react with the molecule below to form a polymer?

A   1
B   2
C   3
D   4

End of Paper

Geylang Methodist School (Secondary)
Preliminary Examination 2018

Candidate
Name

Class

Index Number

CHEMISTRY

6092/02

Paper 2

Sec 4 Express

Additional materials : Writing papers

1 hour 45 minutes

Setter : Ms Tan Lay Ming

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 on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

Section B
Answer **all three** questions, the last question is in the form either/or.
Write your answers in the writing papers provided.

At the end of the examination, hand in Section A and Section B separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic Table is printed on page 19.

For Examiner's Use	
Section A	/50
B8	/12
B9	/ 8
B10	/10
Total	80

This document consists of **19** printed pages and **1** blank page.

[Turn over

Section A

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

A1 The following table shows some substances and their properties.

| substance	melting point (°C)	boiling point (°C)	solubility in water	electrical conductivity	
				when solid	when liquid
A	3550	4830	insoluble	poor	poor
B	-55.6	-78.5	slightly soluble	poor	poor
C	1085	2562	insoluble	good	good
D	801	1413	soluble	poor	good
E	-38.8	357	insoluble	good	good

(a) Using the letters **A**, **B**, **C**, **D** and **E**, which substance(s) is/are likely to have a

    (i) simple molecular structure, ... [1]

    (ii) giant covalent structure, ... [1]

    (iii) giant metallic structure. .... [1]

(b) Suggest a possible identity for element **E**.

.... [1]

(c) A student passed a current through molten substance **D** and after a while, a gas which rekindled a glowing splint was produced at the anode.

Write an ionic half-equation, including state symbols, for the reaction that happened at the anode.

.... [2]

[Total: 6]

A2   The bond dissociation energies of some hydrogen halides are shown in the chart below. Bond dissociation energy is the energy that must be provided to the molecule in order to break the bond.
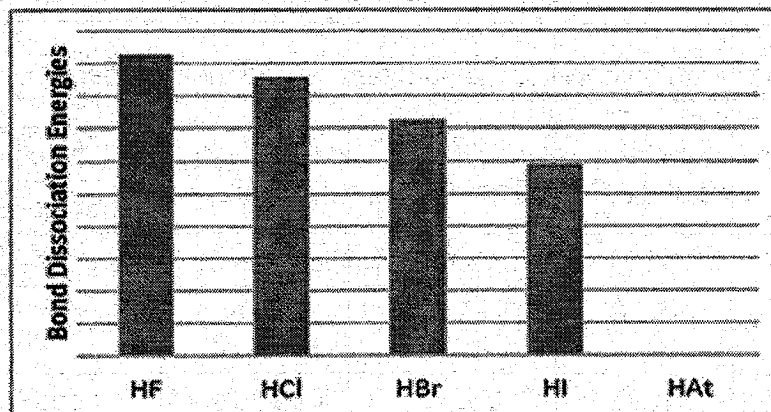
(a)   Describe the trend shown in the above chart.

.... [1]

(b)   Predict the bond dissociation energy of hydrogen astatide, HAt, by drawing the rectangular bar in the chart above.   [1]

(c)   **(i)**   Suggest which one of the hydrogen halides forms the strongest acid.

        .... [1]

     (ii)   Explain your answer to **(c)(i)**.

        ....

        .... [2]

(d)   Hydrogen bromide can be produced by reacting hydrogen and bromine according to the following reaction.

$$H_2 (g) + Br_2 (g) \rightarrow 2HBr (g)$$
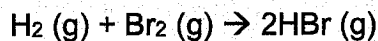
The bond energies of some bonds are shown in the table below.

bond	H-H	H-Br	Br-Br
bond energy (kJ/mol)	432	363	193

Calculate the enthalpy change of this reaction and state whether it is exothermic or endothermic.

[2]

[Total: 7]

**A3**   This information comes from a textbook about elderberries.

Elderberries are widely used in wine making. Extract of elderberries is a useful pH indicator and it can be separated by chromatography.

As an indicator, the colour of the extract changes to pink at a pH of 2 – 3 and to blue at a pH of 11 – 12.

elderberries

(a)   The chromatogram shown below was obtained when water was added to a drop of elderberries extract at the centre of a filter paper.
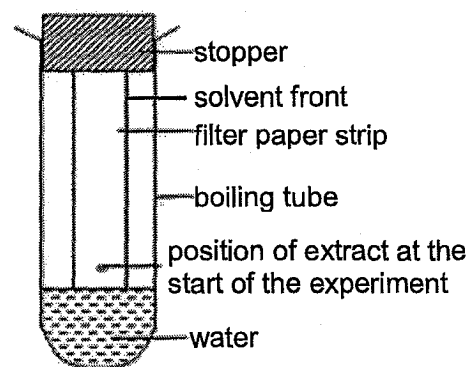

dark blue
dark pink
light blue
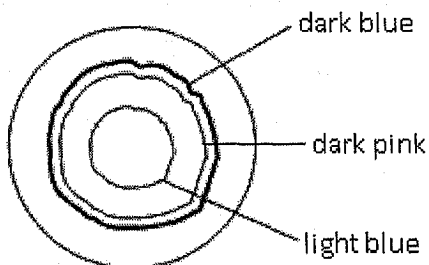
(i)   Predict the colour of the elderberries extract at pH 7.

....[1]

(ii)   An alternative set-up for the above experiment was shown below.

dye	R$_f$ value	distance travelled (cm)
light blue	0.2	
dark pink	0.4	1.00
dark blue	0.5	

stopper
solvent front
filter paper strip
boiling tube
position of extract at the start of the experiment
water

Given that the distance travelled by the dark pink dye is 1.00 cm, complete the table above by stating the distance travelled by the light blue and dark blue dyes.   [2]

(b)   The diagram below shows how pH values changed during a titration when an acid was added from a burette into a solution of an alkali. Some drops of elderberries extract were added at the start of titration.

Volume of acid added (cm³)
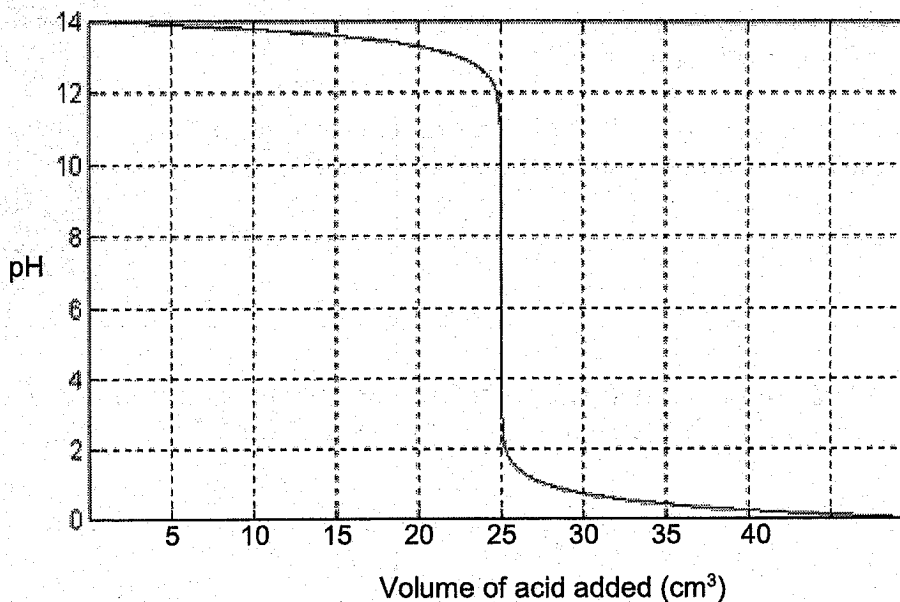
(i)   Suggest one possible chemical formula of the alkali.

.... [1]

(ii)   State the colour of the elderberries extract when the volume of acid added was

20 cm³, ...   [1]

30 cm³.   ....   [1]

[Total: 6]

A4   Most vehicles have petrol or diesel engines, but some use fuel cells.

The flow charts show the substances entering and leaving a petrol engine and a fuel cell.
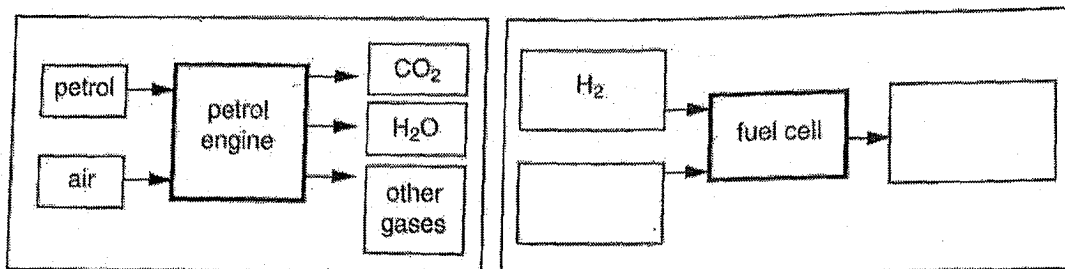
(a)   Complete the flow chart for the fuel cell by filling in the empty boxes.   [1]

(b)   The waste products from vehicles with petrol engines cause more harm to human health than those from vehicles with fuel cells.

Explain why this statement is true.

....

....

....

.... [3]

(c)   Hydrogen for fuel cells can be obtained from water by electrolysis.

Electricity is used to provide energy for the electrolysis.

Complete the energy profile diagram for the electrolysis of water.

Your diagram should include
*   the **formulae of the products** of the electrolysis,
*   a label for the **enthalpy change of reaction**.

energy↑

| H₂O

|
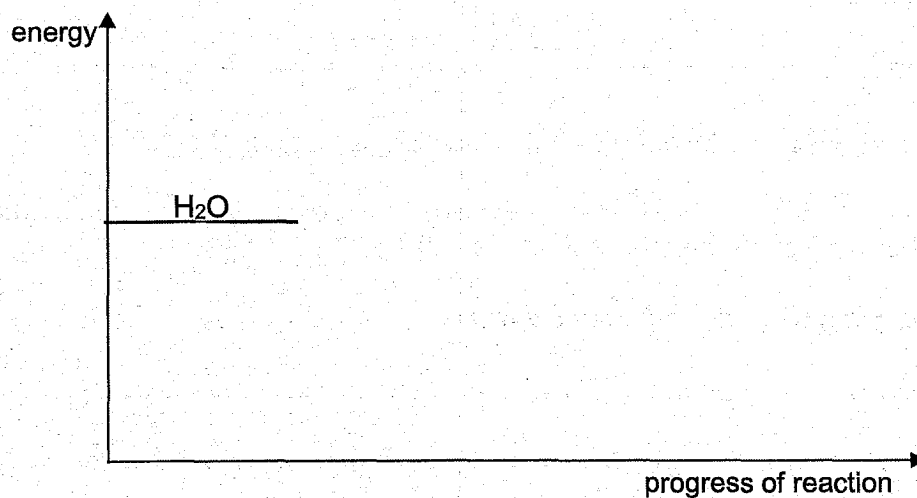
progress of reaction   [2]

[Total: 6]

A5   A laboratory assistant has six elements that are **consecutively** arranged in the Periodic Table. He randomly assigns each element a letter, T, V, W, X, Y and Z. The letters do not represent the atomic symbols and the order of the elements.

He carried out some experiments on the elements and found the following properties.

- V_2 reacts with X_2 to form a compound VX_3.

- Y forms a carbonate that decomposes to carbon dioxide and an oxide on heating.

- W reacts with T_2 to form W_2T. W_2T dissolves in water to form a solution that turns purple with addition of Universal Indicator.

- Z is a gaseous element. It is used in advertising strip lights.

(a)   Identify the following elements

    (i)   T, ...   [1]

    (ii)   W, ...   [1]

    (iii)   Z.   ....   [1]

(b)   Write down the product(s) formed from the reaction between

    (i)   Y and Cl_2, ...   [1]

    (ii) X_2 and $NaCl$.   ....   [1]
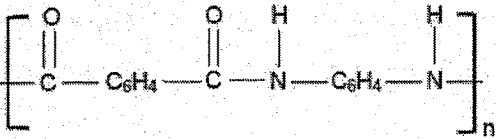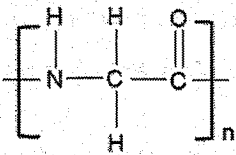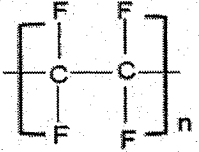
(c)   State the industrial conditions required to produce VH_3. (H is hydrogen).

....

....   [2]

[Total: 7]

A6 The table below shows some information regarding three materials. They are Kevlar, polyglycine and Teflon.

name of material	structure of polymer
Kevlar	(structure shown)
polyglycine	(structure shown)
Teflon	(structure shown)

(a) Identify the reaction that formed

(i) Kevlar, ... [1]

(ii) polyglycine, ... [1]

(iii) Teflon. .... [1]

(b) During polymerisation to form Kevlar and polyglycine, hydrogen chloride and water are released respectively.

Draw the structure of the monomer(s) that formed

(i) Kevlar,

[2]

(ii)   polyglycine.

[1]

(c)   Suggest the structural formulae of the products formed from a reaction between glycine and ethanol.

[2]

[Total: 8]

A7 A new type of electroplating is known as 'brush electroplating'.
It is used to electroplate zinc onto very large iron supports to be used in buildings.
The iron supports are too big to be plated in a normal electrolysis tank.

During the process, a metal brush spreads a layer of aqueous zinc sulfate over the iron surface.
A battery gives the brush a positive charge and gives the iron support a negative charge.
A layer of zinc forms on the surface of the iron support.
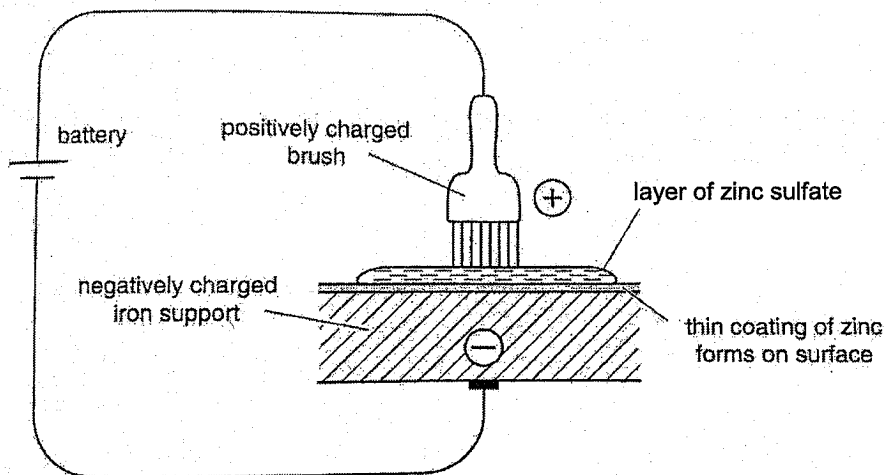
(a) The surface of the iron acts as a cathode.
Zinc ions from the solution form zinc on the surface of the iron.

Write an ionic half-equation, with state symbols, for this reaction.

.... [2]

(b) Two different designs of metal brush are available.
One type of brush is made from zinc, one type is made from platinum.
As the electrolysis takes place, each brush has a different effect on the concentration of zinc ions in the solution.

(i) What will happen to the concentration of the zinc ions during the electrolysis if the brush is made from platinum?

.... [1]

(ii) What will happen to the concentration of the zinc ions during the electrolysis if the brush is made from zinc?

.... [1]

(iii) Platinum brushes are much more expensive than zinc brushes.
However, zinc brushes need replacing regularly but platinum brushes do not.
Explain why.

....

.... [2]

(c) During the process, a worker needs to hold the brush.

Which of the following materials would be a good choice for the handle of the brush? Give a reason for your answer.

chromium   copper   graphite   iron   poly(ethene)

material .... [1]

reason .... [1]

(d) Explain why iron supports coated with zinc do not rust, even if the zinc coating is damaged.

....

.... [2]

[Total: 10]

End of Section A

Section B
Answer all **three** questions from this section.
The last question is in the form of an either/or and only **one** of the alternatives should be attempted.
The total mark for this section is 30.
Write your answers in the writing papers provided.

B8   Chlorofluorocarbons (CFCs) are inert on the Earth's surface. However in the stratosphere, they are very reactive. CFCs are part of a group of compounds which can be classfied as ozone depleting compounds. Other than CFCs, there are also hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs) and perfluorocarbons (PFCs). Some common examples of CFC and HCFC molecules are shown below with their names.

CFC-11   CFC-113a   HCFC-141
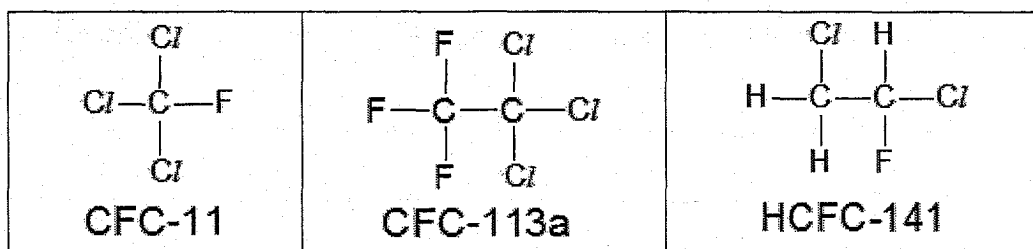
A naming system for these substances was devised several decades ago. The prefixes to the name tell us the elements present in the compound as shown in the table below.

prefix	elements present
PFC	carbon, fluorine
CFC	carbon, fluorine, chlorine
HFC	hydrogen, carbon, fluorine
HCFC	hydrogen, carbon, fluorine, chlorine

The numbers suffixed to the names of the compounds give us the number of each type of atom present in one molecule of the compound. The key to decoding the number is simply to add 90 to the number suffixed to the name.

For example, to decode the number of atoms in CFC-113a, we add 113 to 90 to obtain 203. The first number, 2, tells us the number of carbon atoms, the second number, 0, tells us the number of hydrogen atoms, and the third number, 3, tells us the number of fluorine atoms. Chlorine atoms make up the remaining bonds since all these compounds are saturated.

The letter 'a' in CFC-113a tells us about the structural formula of the compound. The arrangement of the type of atoms in the compound that most evenly distributes atomic masses has no letter. The second most even distribution is given the letter 'a', the third most even distribution is given the letter 'b', so on and so forth.

molecule	atomic mass on left carbon	atomic mass on right carbon
CFC-113	73.5	90
CFC-113a	57	106.5

Although most of these substances are harmful to the ozone layer, they can also be used to make polymers by first converting them to alkenes. For example, HCFCs react with potassium hydroxide which is dissolved in ethanol (solvent) to give an alkene, potassium chloride and water. An example of the reaction is shown below.
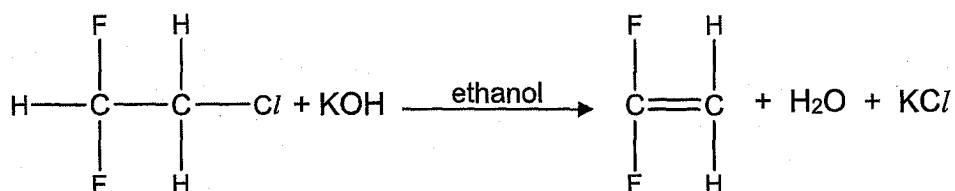
The alkene produced from the above reaction can be used to make useful polymers such as the one shown below.
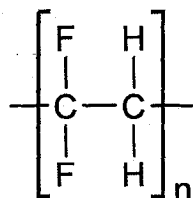
(a)   Draw the structure of a PFC molecule with two carbon atoms.   [1]

(b) Copy the table below and draw the other two isomers of HCFC-141 in the correct respective boxes. [2]

HCFC-141a	HCFC-141b

(c) A student comments that HFCs are safer alternatives to CFCs as HFCs do not harm the environment like CFCs do.

Explain why the student is correct. [1]

(d) Use the naming system discussed in the passage, write down the names of the following molecules.

(i)

[1]

(ii)
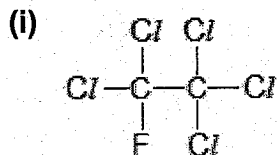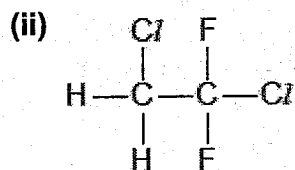
[2]

(e) **(i)** A scientist wants to produce the polymer, polyvinyl fluoride, using HCFCs.
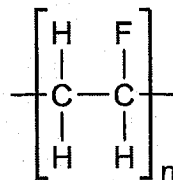
polyvinyl fluoride

Using a suitable HCFC, write down **two** equations showing the reactions he has to carry out to produce polyvinyl fluoride. Show the structures of all the organic compounds in your equations. [3]

(ii)   Samples of the polyvinyl fluoride polymer produced were analysed and found to have a maximum relative molecular mass of 12000.

What is the maximum number of repeating units for this polymer?   [2]

[Total: 12]

B9   Fats and oils such as butter, lard, tallow and coconut are compounds formed by the reaction between fatty acids and an alcohol. Fatty acids may be saturated or unsaturated in nature.

A student collected some data about fatty acids present in some common types of oil or fats, which are shown in the table below.

		% by mass of fatty acid present in substance				
types of oil or fats	types of fatty acids	lauric acid	palmic acid	stearic acid	oleic acid	linoleic acid
butter		2-3	23-26	10-13	30-40	4-5
lard		<1	28-30	12-18	41-48	6-7
tallow		<1	24-32	14-32	35-38	2-4
coconut		45-51	4-10	1-5	2-10	0-2

Lauric acid, palmic acid and linoleic acid are unsaturated fatty acids while stearic acid and oleic acid are saturated fatty acids. Fats and oils containing saturated fatty acids are less healthy than unsaturated ones.

(a)   Linoleic acid, $C_{17}H_{31}COOH$ is a fatty acid found mainly in sunflower or palm oil. Stearic acid has a molecular formula of $C_{17}H_{35}COOH$.

(i)   State the reagent and conditions required to form stearic acid from linoleic acid in the laboratory.   [2]

(ii)   Describe an experiment to show that all the linoleic acid had reacted completely to produce stearic acid. You are to include the expected observation.   [3]

(b)   Which types of oil or fats is the healthiest? Explain your answer.   [1]

(c)   10 g of oil (M_r = 800) completely reacted with 1.8 dm³ of hydrogen measured at room temperature and pressure.

Calculate the number of moles of hydrogen that react with one mole of the oil. Hence, deduce how many C = C bonds there are in one molecule of this oil.   [2]

[Total: 8]

EITHER

B10 Sulfur dioxide reacts with chlorine gas in the presence of a catalyst to form a single liquid product, sulfuryl chloride, SO_2Cl_2.

   (a) Draw a 'dot-and-cross' diagram for chlorine gas.
   Show the outer shell electrons only.   [2]

   (b) Student A says, "The sulfur in sulfur dioxide is oxidised."
   Student B says, "Sulfur dioxide is an oxidising agent."

   Do you agree with both of them, one of them or neither of them?
   Explain your answer.   [2]

   (c) Sulfuryl chloride can be heated to produce sulfur dioxide and chlorine.

   How can the identities of these two gases be confirmed?   [2]

   (d) Sulfuryl chloride reacts with water to form two strong acids. One is a dibasic acid while the other is a monobasic acid.

   (i)   Write down the equation for this reaction.   [1]

   (ii) Calculate the volume of 0.5 mol/dm³ of dilute sodium hydroxide required to completely neutralise the acidic solution produced by reacting one mole of sulfuryl chloride with water.   [3]

[Total: 10]

OR

B10 Calcium carbonate decomposes when it is heated.

$$CaCO_3 \text{ (s)} \rightarrow CaO \text{ (s)} + CO_2 \text{ (g)}$$

In an experiment, 10.5 g of calcium carbonate was heated to a constant temperature.

(a) Sketch a graph to show how the volume of carbon dioxide collected changes with time.
Explain your answer. [4]

(b) Calculate the maximum volume of carbon dioxide, at room temperature and pressure, that can be formed from 10.5 g of calcium carbonate. [2]

(c) The experiment was repeated under the same conditions using zinc carbonate instead of calcium carbonate.

(i) Describe how the rates of the reactions would be different.
Explain your answer. [2]

(ii) The same mass (10.5 g) of zinc carbonate was used. Would the total volume of carbon dioxide formed be the same?
Explain your answer. [2]

[Total: 10]

End of paper

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Marking Scheme
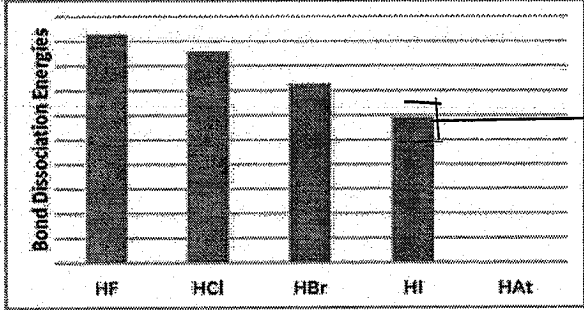
Geylang Methodist School (Secondary)
Preliminary Exam 2018
Chemistry 6092

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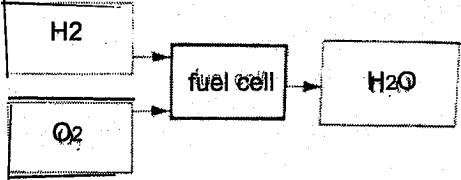
1	A	11	D	21	B	31	B
2	C	12	B	22	A	32	C
3	C	13	A	23	D	33	C
4	B	14	C	24	A	34	D
5	A	15	C	25	B	35	A
6	A	16	B	26	C	36	D
7	C	17	B	27	B	37	B
8	D	18	B	28	C	38	C
9	C	19	A	29	D	39	D
10	A	20	D	30	D	40	C
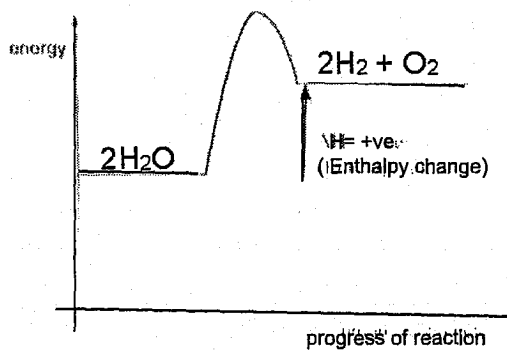
Paper 2
Section A

A1	(a)	i. B ii. A iii. C and E Note: both answers must be correct to award 1 mark.	[1] [1] [1]
	(b)	Mercury	[1]
	(c)	$2O^{2-}$ (l) $\rightarrow O_2$ (g) + 4e Note: [1] for chemically balanced ionic equation without state symbols.	[2]

A2	(a)	The bond dissociation energies of hydrogen halides decreases from HF to HAt.	[1]
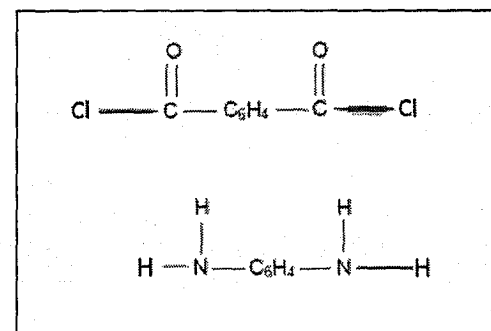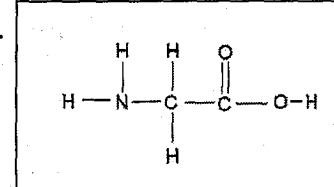
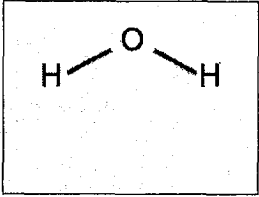| A2 | (b) | Accept if answer is between 200-275kJ/mol | [1] |
	(c)	i. HAt Note: chemical name is acceptable.	[1]
		ii. HAt has the lowest bond dissociation energy therefore hydrogen ions will be produced most easily.	[1] [1]
	(d)	Enthalpy change = 432 + 193 – 2(363) = -101 kJ	[1]
		Exothermic reaction	[1]
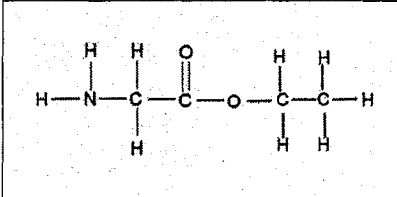
A3	(a) i	Purple / violet Acceptable: bluish-purple or purplish-blue	[1]
	(a) ii	Light blue – 0.500 (3sf)	[1]
		Dark blue – 1.25 (3sf)	[1]
	(b) i	Any strong alkali such as NaOH, KOH	[1]
	(b) ii	20 cm^3 – blue	[1]
		30 cm^3 - pink	[1]

A4	(a)	Note: Both answers must be correct to award 1 mark.	[1]
	(b)	Steam, which is the product of fuel cell, has no adverse effect on human health.	[1]
		Waste product, like carbon monoxide, from incomplete combustion of petrol, can react with haemoglobin in blood to form carboxyhaemoglobin. As a result, haemoglobin cannot transport oxygen to the rest of the body.	[1] [1]

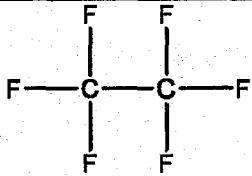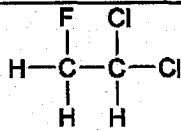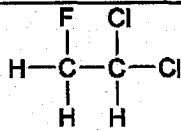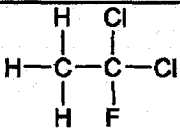| A4	(c)		[1] – correct graph [1] – for correct labelling	[2]

A5	(a)	i. Oxygen	[1]
		ii. Sodium	[1]
		iii. Neon	[1]
	(b)	i. YCl_2 Accept: magnesium chloride	[1]
		ii. NaX **and** Cl_2 Accept: sodium fluoride and chlorine	[1]
A5	(c)	200-250atm 400-500°C Iron catalyst Note: 2 marks for 3 correct answers; 1 mark for 2 correct answers.	[2]

A6	(a)	i. condensation polymerisation	[1]
		ii. condensation polymerisation	[1]
		iii. addition polymerisation	[1]
	(b)	i.	[1] [1]
		ii.	[1]

| (c) | | | [1] for each |

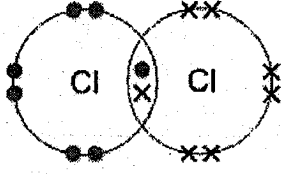| A7 (a)	Zn^{2+} (aq) + 2e → Zn (s)	[2]
(b)	i. Concentration of zinc ions will decrease over time.	[1]
	ii. Concentration of zinc ions will remain constant throughout electrolysis.	[1]
	iii. Zinc brush will form zinc ions during electrolysis and will be used up whereas platinum is an inert electrode therefore no change in mass.	[1] [1]
(c)	Material – poly(ethene)	[1]
	Reason – It does not conduct electricity.	[1]
A7(d)	Zinc is <u>more reactive</u> than iron and therefore **provides sacrificial protection** by corroding in place of iron.	[1] [1]

Section B

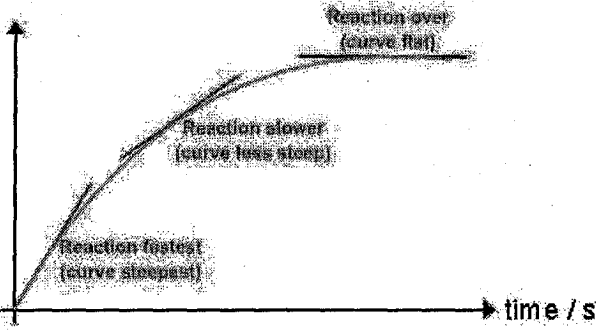| B8 (a)		[1]
(b)		HCFC-141a	HCFC-141b | [1] for each box.	[2]
(c)	HFCs do not contain <u>chlorine atoms</u> which will <u>deplete the ozone layer</u>.	[1]
(d)	i. CFC-111	[1]
	ii. HCFC-132a Note: 1 mark for 132, 1 mark for a	[2]
	i.	

B8(e)	1 mark for correct HCFC used; 1 mark for equation.	[2] [1]
(e)	ii. M_r of repeating unit: $12 \times 2 + 19 + 1 \times 3 = 46$ No. of repeating units: $12000/46 = 260$ (round down)	[1] [1]

B9(a)	i. Reagent: hydrogen gas Conditions: Nickel as catalyst, 200 °C ii. Add aqueous bromine to the reaction mixture. If all the linoleic acid has reacted, the reddish-brown colour of bromine remains. If some linoleic acid is present, the reddish-brown colour of bromine decolourises rapidly.	[1] [1] [1] [1] [1]
B9(b)	Coconut oil is the healthiest. It contains the highest percentage of unsaturated fatty acids/ It contains the lowest percentage of saturated fatty acids. Note: Explanation must be correct in order to award mark.	[1]
(c)	No. of moles of hydrogen reacted = 1.8/24 = 0.075 mol Number of moles of oil = 10/800 = 0.0125 mol ⎤ [1] Number of moles of hydrogen : number of moles of oil 0.075 : 0.0125 6 : 1 There are 6 double bonds in one molecule of oil. ⎤ [1]	[2]

Either

B10(a)	1 mark for correct bonding, 1 mark for correct number of electrons for each element.	[2]
(b)	Student A is correct as <u>the oxidation state of sulfur in sulfur dioxide increases from +4 to +6.</u>	[1]
	Student B is wrong <u>as sulfur dioxide reduces the oxidation state of chlorine from 0 to -1</u>, hence <u>sulfur dioxide is the reducing agent.</u>	[1]
(c)	SO_2, when bubbled through <u>acidifed potassium manganate(VII)</u>, will <u>decolourise</u> the purple solution.	[1]
	A <u>damp blue litmus paper</u> when placed near the heated liquid will <u>turn red before being bleached</u> by Cl_2.	[1]
(d) i.	$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$	[1]
(d) ii.	No. of moles of H_2SO_4 = 1 mole No. of moles of HCl = 2 moles $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ (equation not needed) No. of moles of NaOH needed to neutralise 1 mole of H_2SO_4 = 2 moles [1] $HCl + NaOH \rightarrow NaCl + H_2O$ (equation not needed) No. of moles of NaOH needed to neutralise 2 moles of HCl = 2 moles [1] Total moles of NaOH needed = 4 moles Volume of NaOH needed = 4 ÷ 0.5 = 8 dm^3 [1]	[3] Refer to marks allocation on the left.

OR

| B10(a) |

Note:
There isn't a need to indicate the reaction rate on the graph.

The initial rate of decomposition is the fastest therefore the gradient is the steepest. As the rate of decomposition slows down, the gradient becomes less steep. Finally reaction stops when all calcium carbonate is used up and gradient is zero. | [1] – graph

[1] - correct labels and units

[1]

[1] |
|---|---|---|
| (b) | No. of moles of $CaCO_3$ = 10.5 / 100 = 0.105 mol
Volume of CO_2 = 0.105 x 24 = 2.52 dm^3 | [1]
[1] |
| (c) | i. The rate of decomposition of zinc carbonate will be faster than the rate of decomposition of calcium carbonate.

Zinc carbonate is less thermally stable than calcium carbonate therefore it decomposes more readily than calcium carbonate.

Note: Ignore reference to metal reactivity, no mark will be awarded. | [1]

[1] |
| | ii. No.

Possible explanation:
  No. of moles of $ZnCO_3$ = 10.5 / 125 = 0.084 mol
  Volume of CO_2 = 0.084 x 24 = 2.02 dm^3

OR

  Since there are fewer moles of zinc carbonate therefore the volume of carbon dioxide collected will be lesser. | no mark

[1]
[1]

[1]
[1] |

END OF PAPER