HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

CHEMISTRY PAPER 1

8.30 am – 11.00 am (2 hours 30 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 45 minutes.

2. Section A consists of multiple-choice questions in this question paper, while Section B contains conventional questions printed separately in Question-Answer Book **B**.

3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**

4. A Periodic Table is printed on page 20 of Question-Answer Book **B**. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

2. When told to open this book, you should check that all the questions are there. Look for the words **'END OF SECTION A'** after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

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Not to be taken away before the end of the examination session

This section consists of two parts. There are 24 questions in PART I and 12 questions in PART II.

Choose the best answer for each question.

Candidates may refer to the Periodic Table printed on page 20 of Question-Answer Book B.

PART I

1. Which of the following substances CANNOT conduct electricity ?

   A. Pt(s)
   B. $PbBr_2(1)$
   C. C(graphite)
   D. $CH_3CH_2OH(l)$

2. A small amount of a powder can dissolve in water to form a clear solution. When this solution is mixed with $K_2CO_3(aq)$, a white precipitate is obtained. What can the powder be ?

   A. sodium sulphate
   B. calcium sulphate
   C. sodium hydroxide
   D. calcium hydroxide

3. In an oxide of metal **M**, the mass percentage of **M** is 55.0%. What is the chemical formula of this oxide ?

   (Relative atomic masses: O = 16.0, **M** = 39.1)

   A. MO_2
   B. M_2O
   C. M_2O_2
   D. M_2O_3

4. Which of the following statements concerning CH_3COOH and HCl is correct ?

   A. CH_3COOH is a stronger acid than HCl.
   B. The pH of 0.1 M $CH_3COOH(aq)$ is lower than that of 0.1 M HCl(aq).
   C. Both $CH_3COOH(aq)$ and HCl(aq) react with $NH_3(aq)$, each giving a salt.
   D. Both $CH_3COOH(aq)$ and HCl(aq) react with Ag(s), each giving a colourless gas.

5. Which of the following molecules is polar ?

   A. BF_3
   B. C_{60}
   C. NH_3
   D. SF_6

6. What is the oxidation number of Cu in $Cu(NH_3)_4Cl_2$?

A. 0
B. +2
C. +4
D. +6

7. The standard enthalpy changes of combustion of some substances are shown below :

Substance	Standard enthalpy change of combustion at 298 K / kJ mol^{-1}
$H_2(g)$	−286
C(graphite)	−394
$CH_3CH_2OH(l)$	−1371

The standard enthalpy change of formation at 298 K of $CH_3CH_2OH(l)$ is

A. −275 kJ mol^{-1}.
B. +275 kJ mol^{-1}.
C. +691 kJ mol^{-1}.
D. −3017 kJ mol^{-1}.

8. Silicon and carbon react to form silicon carbide. The crystal structure of silicon carbide is similar to that of diamond. Silicon carbide is very hard because

A. it has a high melting point.
B. silicon atoms and carbon atoms form triple bonds.
C. it has a giant network structure with strong covalent bonds.
D. both silicon and carbon atoms have four outermost shell electrons.

9. Which of the following statements concerning an aluminium ore consisting mainly of Al_2O_3 is correct ?

(Relative atomic masses: O = 16.0, Al = 27.0)

A. Carbon can be used to extract aluminium from this ore.
B. The abundance of this ore in the earth crust is very low.
C. This ore contains more than 55% of aluminium by mass.
D. Aluminium can be extracted from this ore due to the advancement of technology in applying electricity.

10. A sample of 1.02 g of potassium hydrogenphthalate ($C_8H_5O_4K$) is dissolved completely in distilled water, and then diluted to 250.0 cm^3. What is the concentration of the solution obtained ?

(Relative atomic masses: H = 1.0, C = 12.0, O = 16.0, K = 39.1)

A. 0.004 M
B. 0.010 M
C. 0.020 M
D. 4.080 M

Go on to the next page

11. Compound **X** has the following structure :

$CH_2=CHCH_2OH$

The systematic name of **X** is

A. prop-1-en-3-ol.
B. prop-2-en-1-ol.
C. 3-hydroxypropene.
D. 1-hydroxyprop-3-ene.

12. Which of the following molecules is planar ?

A. BF_3
B. NH_3
C. CH_4
D. PCl_5

13. The tendency of being reduced of six ionic species increases in the order as shown below :

$Ba^{2+}(aq) < Na^{+}(aq) < Mg^{2+}(aq) < H^{+}(aq) < Cu^{2+}(aq) < Hg^{2+}(aq)$

Which of the following statements is correct ?

A. Ba(s) does NOT react with $H^{+}(aq)$.
B. Na(s) has a stronger reducing power than Hg(l).
C. $Hg^{2+}(aq)$ is the weakest oxidising agent among the six species.
D. Displacement reaction occurs when Cu(s) is immersed in $MgSO_4(aq)$.

14. Which of the following pairs of reactants would react in water to give out the largest amount of heat ?

A. 1 mol of HCl and 1 mol of KOH
B. 1 mol of H_2SO_4 and 2 mol of KOH
C. 1 mol of $(COOH)_2$ and 2 mol of KOH
D. 1 mol of CH_3COOH and 1 mol of KOH

15. Which of the following statements concerning an ^{131}I atom and a ^{131}Xe atom is / are correct ?

(1) They have the same number of protons.
(2) They have different numbers of neutrons.
(3) They have different numbers of outermost shell electrons.

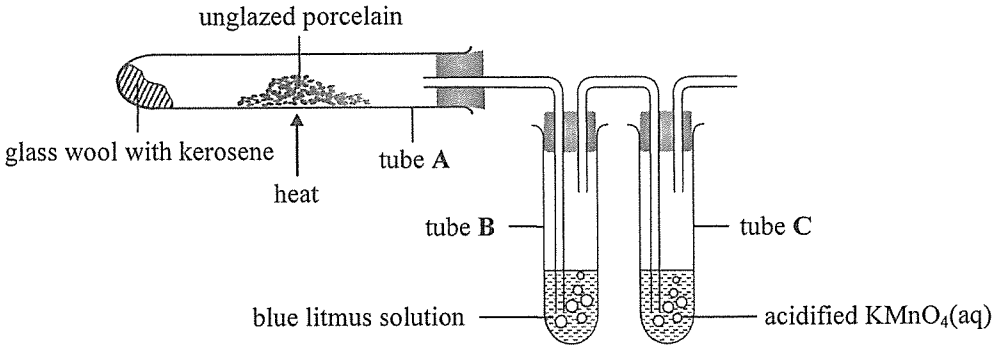
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

16. Which of the following combinations is / are correct ?

	Object	Corresponding corrosion prevention method / principle
(1)	aluminium window frames	cathodic protection
(2)	galvanised iron buckets	sacrificial protection
(3)	tin-plated iron cans	alloying

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

17. The diagram below shows the set-up of an experiment :



The unglazed porcelain in tube **A** is strongly heated and the glass wool is occasionally heated. Which of the following statements is / are correct ?

(1) A chemical reaction occurs at the glass wool.
(2) There is NO colour change in the solution in tube **B**.
(3) There is NO colour change in the solution in tube **C**.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

18. Which of the following statements concerning a hydrogen-oxygen fuel cell is / are correct ?

(1) It produces non-polluting product.
(2) The membrane in it selectively allows hydroxide ions to pass through.
(3) It can continuously produce electricity as long as hydrogen and oxygen are supplied under operating conditions.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

Go on to the next page

19. In which of the following processes would a colourless gas evolve ?

(1) Magnesium is added to dilute sulphuric acid.
(2) Ammonium chloride is heated with calcium hydroxide.
(3) Water is added to a solid mixture of citric acid and sodium hydrogencarbonate.

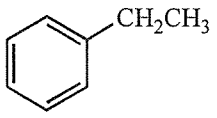
A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

20. Which of the following methods can be used to distinguish between $ZnCl_2(aq)$ and $CaBr_2(aq)$?

(1) adding $NH_3(aq)$
(2) performing flame test
(3) evaporating to dryness

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

21. Which of the following compounds can be used as monomers to make addition polymers ?

(1) $CF_2=CF_2$ (2) $CH_2=C(CH_2CH_3)CN$ (3) 

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

22. Which of the following processes involve redox reaction ?

(1) mixing methanol and ethanol
(2) mixing chlorine and methane under sunlight
(3) mixing ethene and acidified $KMnO_4(aq)$

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Directions : Each question below (Questions 23 and 24) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D according to the following table :

A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

	1st statement	**2nd statement**
23.	When iron and copper are separately immersed in hexane completely, iron corrodes faster than copper.	Iron can be oxidised more readily than copper.
24.	Burning fossil fuels can cause acid rain.	Burning fossil fuels produces carbon dioxide.

Go on to the next page

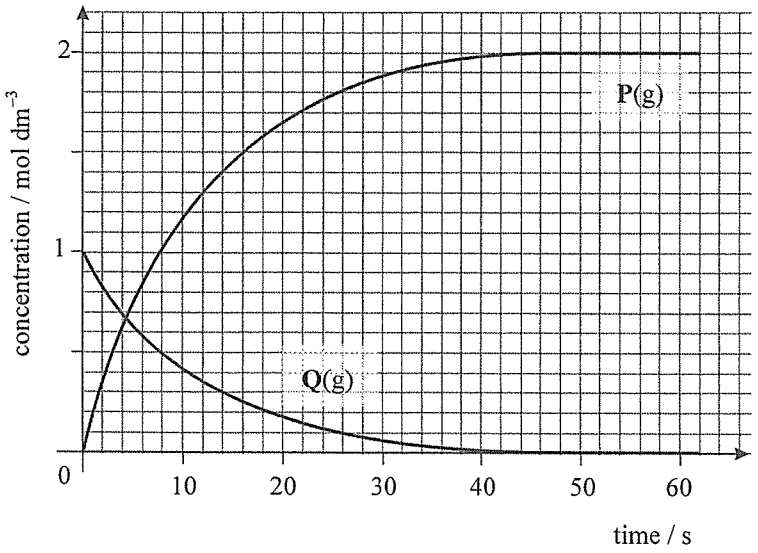
PART II

25. What is the theoretical volume of carbon dioxide that can be obtained, at room temperature and pressure, when 1.2 g of $Na_2CO_3(s)$ reacts with 50 cm^3 of 1.0 M HNO_3 ?

(Molar volume of gas at room temperature and pressure = 24 dm^3;
Relative atomic masses: H = 1.0, C = 12.0, N = 14.0, O = 16.0, Na = 23.0)

A. 272 cm^3
B. 544 cm^3
C. 600 cm^3
D. 1200 cm^3

26. The concentration-time graph for a certain chemical reaction in a closed vessel of fixed volume is shown below :



Which of the following chemical equations correctly represents the reaction ?

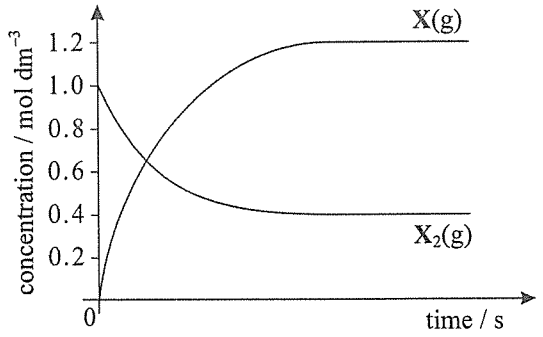
A. $\mathbf{P}(g) \rightarrow \mathbf{Q}(g)$
B. $\mathbf{Q}(g) \rightarrow \mathbf{P}(g)$
C. $\mathbf{P}(g) \rightarrow 2\mathbf{Q}(g)$
D. $\mathbf{Q}(g) \rightarrow 2\mathbf{P}(g)$

27. In a 1 dm^3 closed container, 1 mole of $X_2(g)$ undergoes decomposition to form X(g) until equilibrium is attained. The chemical equation concerned is shown below :

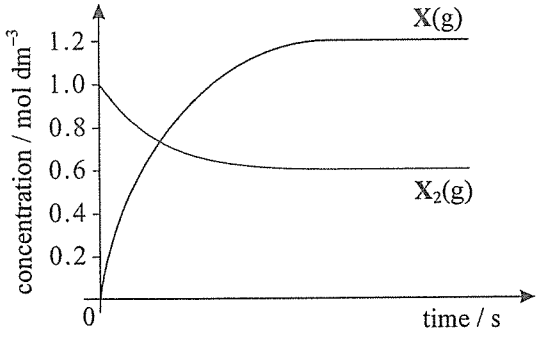
$$X_2(g) \rightleftharpoons 2X(g)$$

Which of the following graphs correctly shows the variation in concentrations of $X_2(g)$ and X(g) with time ?

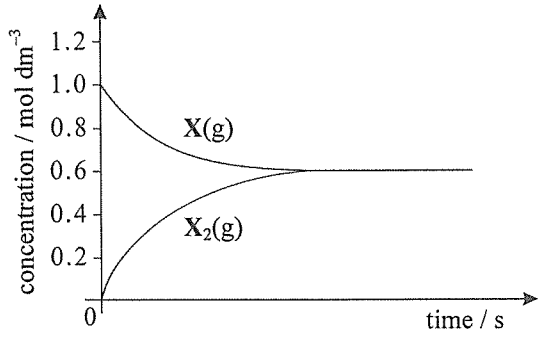
A.



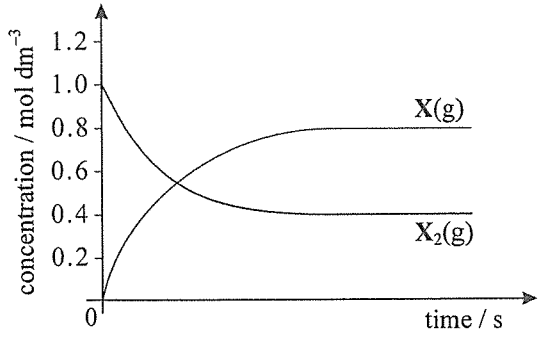
B.



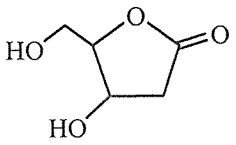
C.



D.



28. The structure of an organic compound is shown below :



Which of the following statements is correct ?

A. The compound does NOT show enantiomerism.
B. The molecular formula of the compound is $C_5H_6O_4$.
C. The compound contains a ketone group.
D. The compound can be oxidised by acidified $K_2Cr_2O_7(aq)$.

Go on to the next page

29. Which of the following statements concerning compound **U** ($CH_3CH_2CH{=}CHCH_2CH_2OH$) is correct ?

A. The empirical formula of **U** is C_3H_6O.
B. The systematic name of **U** is hex-4-en-1-ol.
C. **U** reacts with HCl to give a single product.
D. **U** can separately turn $Br_2(aq)$ and acidified $KMnO_4(aq)$ colourless.

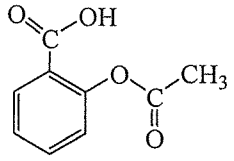
30. Which of the following ions can act as both an oxidising agent and a reducing agent ?

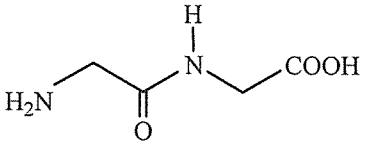
A. $Fe^{2+}(aq)$
B. $Cu^{2+}(aq)$
C. $Cr_2O_7^{2-}(aq)$
D. $MnO_4^-(aq)$

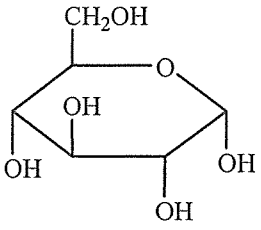
31. Which of the following oxides would form an acidic solution when added to water ?

A. carbon dioxide
B. silicon dioxide
C. aluminium oxide
D. lithium oxide

32. Which of the following structures represent(s) the active ingredient(s) in aspirin tablets ?

(1) 

(2) 

(3) 

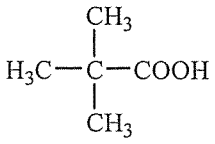
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

33. Which of the following compounds can be formed when $(CH_3)_2C(OH)CH_2CH_3$ is dehydrated ?

(1) $(CH_3)_2C{=}CHCH_3$
(2) $(CH_3)_2CHCH{=}CH_2$
(3) $CH_2{=}C(CH_3)CH_2CH_3$

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

34. The structure of a compound is shown below :



Which of the following statements concerning the compound are correct ?

(1) It can form a salt with aqueous ammonia.
(2) It can be reduced to an alkanol by using $LiAlH_4$.
(3) It can form an ester with methanol under suitable conditions.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Directions : Each question below (Questions 35 and 36) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D according to the following table :

A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

	1st statement	**2nd statement**
35.	Increasing reaction temperature can increase the yield for all reversible chemical reactions.	Increasing reaction temperature can shorten the time needed to attain equilibrium for all reversible chemical reactions.
36.	2-Chlorobut-1-ene shows geometrical isomerism.	2-Chlorobut-1-ene has a double bond.

END OF SECTION A

2012-DSE
CHEM
PAPER 1B

B

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

Candidate Number									

CHEMISTRY PAPER 1

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) This section consists of TWO parts, Parts I and II.

(4) Answer ALL questions in both Parts I and II. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.

(6) Supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this Question-Answer Book.

(7) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

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PART I

Answer **ALL** questions. Write your answers in the spaces provided.

1. Neon occurs naturally in three isotopes with the abundance of each isotope shown in the table below :

Isotope	Abundance (%)
^{20}Ne	90.48
^{21}Ne	0.27
^{22}Ne	9.25

(a) What is meant by the term 'isotope' ?

(1 mark)

(b) Calculate the relative atomic mass of neon.

(2 marks)

(c) Give one daily application of neon.

(1 mark)

(d) Explain why the boiling point of neon is lower than that of oxygen.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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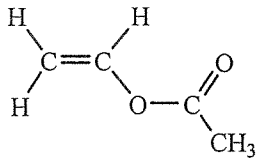
2. Poly(ethenyl ethanoate) is a polymer. Its monomer is ethenyl ethanoate with the structure shown below :



(a) Ethene is the raw material used in making ethenyl ethanoate. Ethene can be produced from hydrocarbons of higher molecular mass by an important industrial process.

(i) Name this industrial process.

(ii) Explain why this process is important.

(2 marks)

(b) Draw the structure of poly(ethenyl ethanoate).

(1 mark)

(c) Ethyl ethanoate is an organic solvent.

(i) Draw the structure of ethyl ethanoate.

(ii) Suggest a chemical test to show how to distinguish between ethenyl ethanoate and ethyl ethanoate.

(3 marks)

Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

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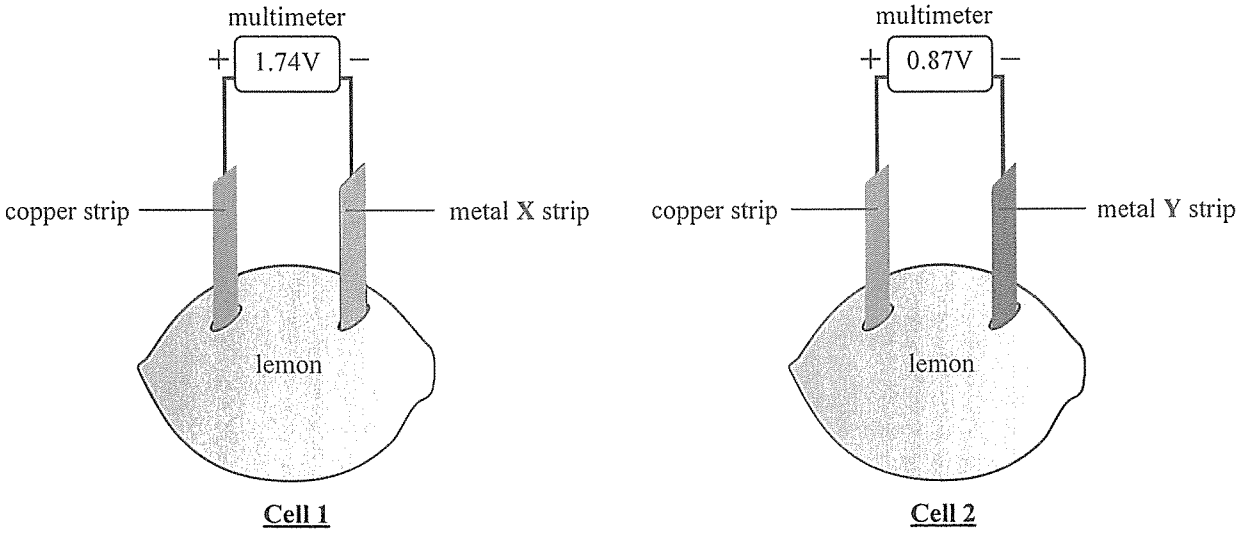
3. Consider the information concerning the lemon cells shown in the diagrams below :



(a) What is the function of the lemons in these cells ?

(1 mark)

(b) By completing the table below, arrange metal **X**, metal **Y** and copper in increasing order of reducing power.

Reducing power increasing →		

(1 mark)

(c) For **Cell 1**, write the half equation for the change that occurs at :

(i) metal **X** strip (**X** is a group II metal), and

(ii) copper strip.

(2 marks)

(d) For **Cell 2**, would the metal **Y** strip be the positive electrode if the copper strip is replaced with a silver strip ? Explain your answer.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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4. With the aid of a diagram, explain the formation of hydrogen bonding in hydrogen fluoride.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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5. In order to prepare 50 dm^3 of 0.1 M $CuSO_4(aq)$, an inexperienced electroplating worker added the required exact amount of $CuSO_4 \cdot 5H_2O(s)$ to water in a plastic container. He then stirred the mixture with an iron rod until the $CuSO_4 \cdot 5H_2O(s)$ dissolved completely. Finally, he sent a sample of the solution to the Quality Control Laboratory for analysis, but found that the concentration of $CuSO_4(aq)$ was lower than 0.1 M.

(a) With the aid of a chemical equation, explain why the concentration of the $CuSO_4(aq)$ prepared was lower than 0.1 M.

(2 marks)

(b) The worker used the prepared $CuSO_4(aq)$ to coat a layer of copper on a metallic object by electrolysis. He used an unreasonably high voltage, and found that some bubbles were formed on the object and the copper layer easily flaked off.

(i) Explain why copper can be coated on the metallic object by electrolysis.

(ii) Suggest what the bubbles were, and explain why the copper layer easily flaked off.

(3 marks)

(c) Draw a labelled diagram of the experimental set-up used in a laboratory for coating a layer of copper on a metallic object by electrolysis.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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*6. Outline the steps in preparing solid lead(II) sulphate from solid lead(II) nitrate. You have to state the additional chemical reagents that are required, but need NOT mention the apparatus involved.

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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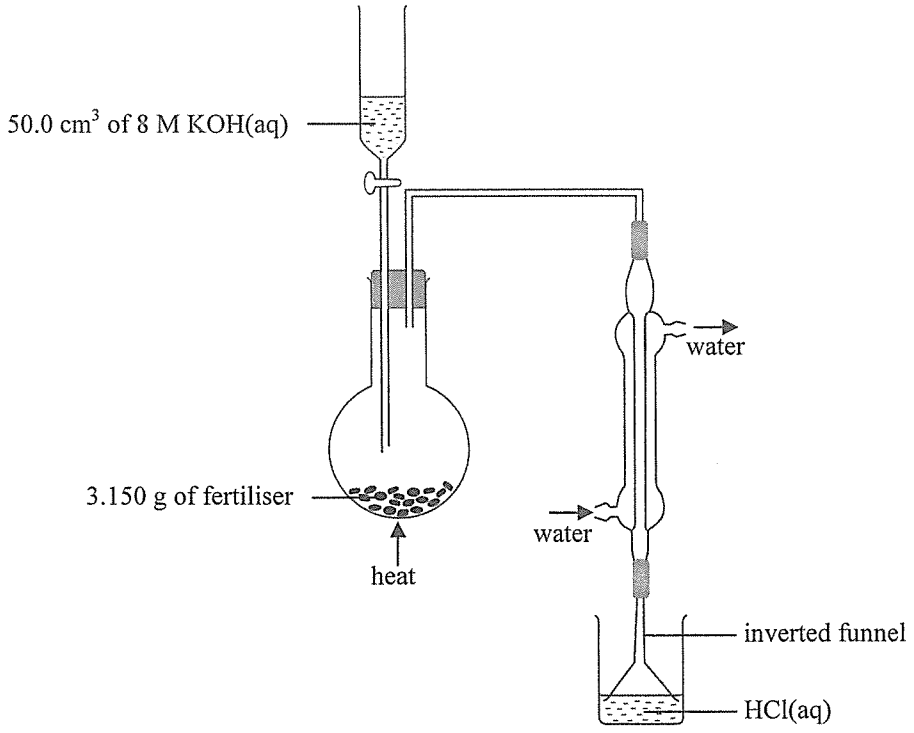
7. A fertiliser only contains ammonium nitrate (NH_4NO_3) and potassium chloride (KCl). An experiment was performed to determine the percentage by mass of NH_4NO_3 in this fertiliser. The set-up used is shown below :



The KOH(aq) was added slowly to the fertiliser and the mixture formed was heated gently. The ammonia liberated from the reaction between NH_4NO_3 and KOH was first cooled in a condenser, and then passed through an inverted funnel to a solution containing 0.0485 mol of HCl. The solution was finally made up to 100.00 cm^3 and labelled '**S**'.

(a) Write an ionic equation for the reaction between NH_4NO_3 and KOH.

(1 mark)

(b) Suggest the potential hazard of one of the chemicals used.

(1 mark)

(c) Given that ammonia is very soluble in water, state the advantage of using an inverted funnel.

(1 mark)

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7. (d) 25.00 cm^3 of 'S' was transferred to a conical flask, and then titrated with 0.100M NaOH(aq) using methyl orange as an indicator. 41.00 cm^3 of the NaOH(aq) was required to reach the end point.

(i) Name the apparatus that should be used to transfer 25.00 cm^3 of 'S'.

(ii) State the colour change at the end point of the titration.

(iii) Calculate the percentage by mass of NH_4NO_3 in this fertiliser.
(Molar mass of NH_4NO_3 = 80.0 g)

(5 marks)

(e) Suggest a test to show the presence of a potassium-containing compound in the fertiliser.

(1 mark)

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8. Potassium hydrogencarbonate ($KHCO_3$) can be used to bake bread. Upon heating, $KHCO_3$ decomposes into K_2CO_3, H_2O and CO_2.

(a) Explain the purpose of using $KHCO_3$ in bread baking.

(1 mark)

(b) Write the chemical equation for the decomposition of $KHCO_3$ upon heating.

(1 mark)

(c) The enthalpy change of decomposition of $KHCO_3(s)$ can be determined indirectly from the enthalpy changes of the following two reactions :

$KHCO_3(s) + HCl(aq) \rightarrow KCl(aq) + H_2O(l) + CO_2(g)$ -------- Reaction (1)

$K_2CO_3(s) + 2HCl(aq) \rightarrow 2KCl(aq) + H_2O(l) + CO_2(g)$ -------- Reaction (2)

In an experiment to determine the enthalpy change of Reaction (1), 3.39 g of $KHCO_3(s)$ was added to excess HCl(aq) in an expanded polystyrene cup. The experimental data obtained are shown below :

Initial temperature of the reacting solution:	25.8 °C
Final temperature of the reacting solution:	20.2 °C
Mass of the resulting solution:	27.5 g
Specific heat capacity of the contents:	4.3 $J\ g^{-1}\ K^{-1}$
Molar mass of $KHCO_3$:	100.1 g

(i) Assuming that the heat capacity of the cup used is negligible, calculate the enthalpy change of Reaction (1) from the above data.

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8. (c) (ii) In another experiment performed under the same conditions, the enthalpy change of Reaction (2) was found to be -49.1 kJ mol^{-1}. Calculate the enthalpy change of decomposition of $KHCO_3(s)$ under the experimental conditions.

(4 marks)

(d) According to the literature, the standard enthalpy changes of formation of $K_2CO_3(s)$, $KHCO_3(s)$, $CO_2(g)$ and $H_2O(l)$ are as follows :

Compound	$\Delta H_f^{\ominus}$, 298 / kJ mol^{-1}
$K_2CO_3(s)$	−1146
$KHCO_3(s)$	−959
$CO_2(g)$	−394
$H_2O(l)$	−286

(i) Using the given information, calculate the standard enthalpy change of decomposition of $KHCO_3(s)$.

(ii) Suggest why the answers obtained from (c)(ii) and (d)(i) are different.

(2 marks)

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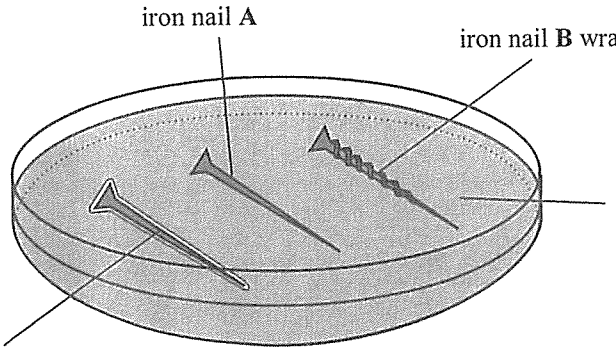
9. The diagram below shows an experimental set-up for investigating the factors affecting rusting.



(a) What would be observed if an iron nail in the above set-up rusts ?

(1 mark)

(b) Suggest which of the iron nails in the above set-up would NOT rust during the experiment. Explain your answer.

(3 marks)

10. Suggest THREE measures for reducing the emission of air pollutants upon using fossil fuels.

(3 marks)

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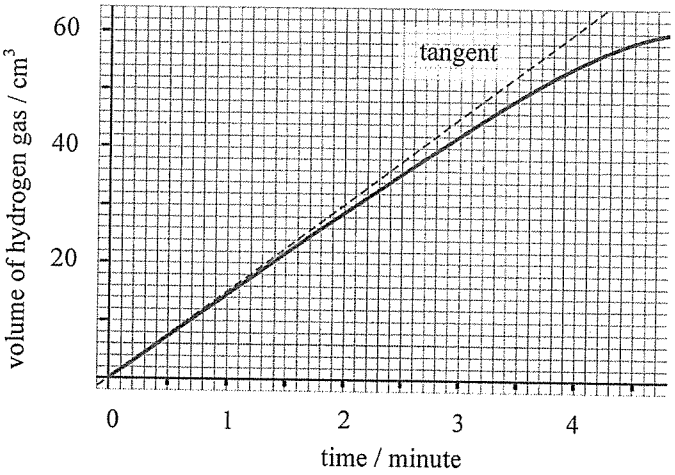
PART II

Answer **ALL** questions. Write your answers in the spaces provided.

11. In an experiment, 50 cm^3 of 2.0 M HCl(aq) was added to a conical flask containing 2.0 g of zinc powder. The curve in the graph below shows the volume, measured at room temperature and pressure, of the hydrogen gas liberated in the first few minutes of the experiment. The dotted line in the graph is the tangent to the curve at the start of the reaction.



(a) The 'initial rate' of a reaction is defined as the instantaneous rate at the start of the reaction. With reference to the graph above, calculate the initial rate of the reaction with respect to the volume of hydrogen gas liberated.

(1 mark)

(b) Explain qualitatively the effect on the initial rate of the reaction of replacing the 2.0 M HCl(aq) with 2.0 M H_2SO_4(aq).

(1 mark)

(c) Upon completion of the reaction, all the zinc powder was used up. Calculate the theoretical volume of hydrogen gas liberated, measured at room temperature and pressure.
(Molar volume of gas at room temperature and pressure = 24 dm^3;
Relative atomic mass: Zn = 65.4)

(3 marks)

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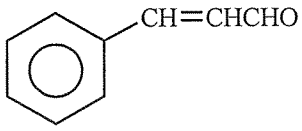
12. Cinnamon, which can be used as a flavouring, contains cinnamaldehyde (C_9H_8O). The structure of cinnamaldehyde is shown below :



(a) Draw the *trans*-isomer for the above structure.

(1 mark)

(b) Explain why ethyl ethanoate is a better solvent than water for dissolving cinnamaldehyde.

(1 mark)

(c) In an experiment to extract cinnamaldehyde from cinnamon, a solution containing only ethyl ethanoate and cinnamaldehyde is obtained after a series of steps. In order to separate these two compounds, simple distillation can be carried out. Draw a diagram for the set-up involved, and label the name of the distillate collected.
(Boiling points: cinnamaldehyde = 248 °C, ethyl ethanoate = 77 °C)

(2 marks)

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12. (d) Outline a synthetic route, with *no more than three steps*, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions (as appropriate) and structure of the organic product.

(2 marks)

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13. Consider the reaction represented by the equation below :

$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons Fe(SCN)^{2+}(aq)$

In an experiment, 25.0 cm^3 of 0.010 M $Fe_2(SO_4)_3(aq)$ and 25.0 cm^3 of 0.010 M KSCN(aq) were mixed in a conical flask at room temperature, and equilibrium was attained.

(a) The concentration of $Fe(SCN)^{2+}(aq)$ in the mixture was 0.0043 M when equilibrium was attained. Calculate the equilibrium constant K_c for the above reaction at room temperature.

(3 marks)

(b) It is known that $FePO_4(s)$ is insoluble in water. Suggest what would be the effect on the equilibrium position if $Na_3PO_4(s)$ is added to the equilibrium mixture.

(1 mark)

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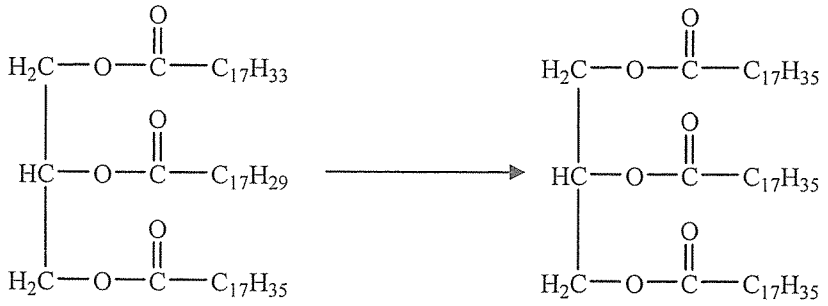
14. The diagram below shows the conversion of an oil molecule **X** to a fat molecule **Y**.



X **Y**

(a) (i) Given that all alkyl groups in both **X** and **Y** are straight chains, label the chiral carbon(s) by using '*' in the above diagram.

(ii) With reference to (i), explain whether a change in optical activity is involved in the above conversion.

(2 marks)

*(b) One of the products in the alkaline hydrolysis of **Y** has a cleansing property. Explain the cleansing property of this product.

(4 marks)

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15. Use electron diagrams to illustrate, step by step, how CH_4 reacts with Br_2 under sunlight to form CH_3Br. (Show electrons in the *outermost shells* only.)

(3 marks)

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16. Consider the following oxides :

Na_2O MgO Al_2O_3 SiO_2 P_4O_{10} SO_2 Cl_2O

(a) Which of the oxides listed above can conduct electricity in molten state ?

(1 mark)

(b) Explain why SiO_2 has the highest melting point among the covalent oxides listed above.

(2 marks)

(c) Write a chemical equation for the reaction between $Al_2O_3(s)$ and NaOH(aq).

(1 mark)

END OF SECTION B

END OF PAPER

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PERIODIC TABLE 周期表

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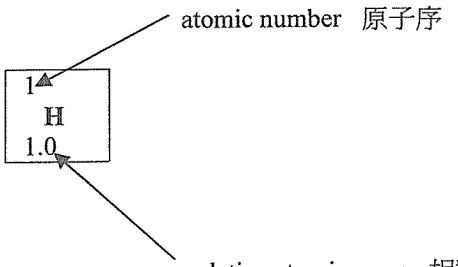

I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)