PP-DSE
CHEM

PAPER 1A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER

CHEMISTRY PAPER 1

(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.

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. Element **X** occurs in nature in two isotopes, $^{69}\mathbf{X}$ and $^{71}\mathbf{X}$. The table below lists the relative abundance of each isotope:

Isotope	Relative abundance (%)
$^{69}\mathbf{X}$	60.0
$^{71}\mathbf{X}$	40.0

What is the relative atomic mass of **X** ?

A. 69.6
B. 69.8
C. 70.0
D. 70.2

2. Which of the species shown below does NOT follow the 'octet rule' ?

A. Na_2O
B. MgO
C. PCl_3
D. SCl_4

3. Which of the following species is NOT an appropriate example for illustrating dative bond formation ?

A. NH_3
B. NH_4^+
C. BF_4^-
D. BF_3NH_3

4. Which of the following statements about silicon dioxide is correct ?

A. It consists of discrete molecules.
B. It melts upon heating in a test tube.
C. It is ductile.
D. It is a poor conductor of electricity.

5. Which of the following processes is endothermic ?

A. $H_2O(\ell) \rightarrow H_2O(s)$
B. $CuSO_4(s) + 5H_2O(\ell) \rightarrow CuSO_4 \cdot 5H_2O(s)$
C. $2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$
D. $Ca(s) + 2H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g)$

6. **X**, **Y** and **Z** are three different metals. When these metals are placed separately into an aqueous solution of tin(II) nitrate, a spongy layer of tin is formed only on **X**. When each of the oxides of these metals is heated strongly, only the oxide of **Y** gives a metallic lustre. Which of the following represents the arrangement of these metals in decreasing order of reactivity ?

A. **X > Y > Z**
B. **X > Z > Y**
C. **Y > X > Z**
D. **Z > X > Y**

7. A scientist extracted a sample of 'nitrogen' from air by removing the oxygen and carbon dioxide. The scientist then compared the mass of a known volume of the 'nitrogen' sample (m_1) with that of the same volume of pure nitrogen (m_2) under the same set of conditions. The experiment was repeated a number of times. It was found that m_1 was consistently greater than m_2 .

Which of the following gases is likely to be present in the 'nitrogen' obtained to account for the result that m_1 is greater than m_2 ?

A. neon
B. argon
C. methane
D. water vapour

8. At 298 K, the pH of 0.10 mol dm^{-3} HCl(aq) is 1. Which of the following statements is correct ?

A. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 2.
B. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 0.5.
C. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 2.
D. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 0.1.

9. When 25 cm^3 of 1.00 mol dm^{-3} NaOH(aq) is mixed with 25 cm^3 of 1.00 mol dm^{-3} HCl(aq), the temperature of the mixture rises by 6°C. Which of the following reactants, when mixed under the same conditions, would give a similar temperature rise ?

A. 25 cm^3 of 2.00 mol dm^{-3} NaOH(aq) and 25 cm^3 of 2.00 mol dm^{-3} HCl(aq)
B. 50 cm^3 of 1.00 mol dm^{-3} NaOH(aq) and 50 cm^3 of 1.00 mol dm^{-3} HCl(aq)
C. 50 cm^3 of 0.50 mol dm^{-3} NaOH(aq) and 50 cm^3 of 0.50 mol dm^{-3} HCl(aq)
D. 100 cm^3 of 0.25 mol dm^{-3} NaOH(aq) and 100 cm^3 of 0.25 mol dm^{-3} HCl(aq)

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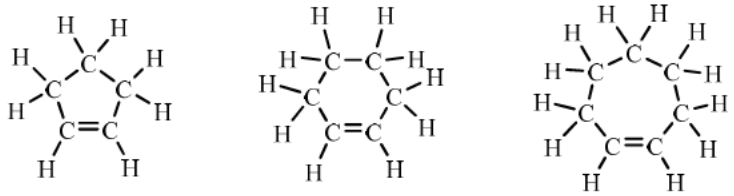
10. The structures of three cycloalkenes are shown below:



Cycloalkenes can be represented by a general formula. Which of the following is the general formula for cycloalkenes ? (In these formulae, n is an integer greater than 2.)

A. C_nH_{2n-4}
B. C_nH_{2n-2}
C. C_nH_{2n}
D. C_nH_{2n+2}

11. The equation below represents the cracking of a hydrocarbon:

$$C_{22}H_{46} \rightarrow C_{14}H_{30} + 2\mathbf{X}$$

What is the chemical formula of compound **X** ?

A. C_3H_6
B. C_4H_8
C. C_8H_{16}
D. $C_{14}H_{28}$

12. Consider the standard enthalpy changes of the following reactions:

$I_2(s) + Cl_2(g) \rightarrow 2ICl(s)$ $\quad \Delta H^{\ominus} = +14$ kJ mol^{-1}

$ICl(s) + Cl_2(g) \rightarrow ICl_3(s)$ $\quad \Delta H^{\ominus} = -88$ kJ mol^{-1}

What is the standard enthalpy change of formation of $ICl_3(s)$?

A. –81 kJ mol^{-1}
B. –74 kJ mol^{-1}
C. +74 kJ mol^{-1}
D. +81 kJ mol^{-1}

13. 10 cm^3 of 0.25 mol dm^{-3} calcium nitrate solution is mixed with 40 cm^3 of 0.10 mol dm^{-3} nitric acid. What is the concentration of nitrate ions in the resulting solution ?

A. 0.18 mol dm^{-3}
B. 0.13 mol dm^{-3}
C. 0.080 mol dm^{-3}
D. 0.050 mol dm^{-3}

14. Consider the following chemical equation:

$$\boldsymbol{p}SO_2(aq) + \boldsymbol{q}Ce^{4+}(aq) + \boldsymbol{r}H_2O(\ell) \rightarrow \boldsymbol{p}SO_4^{2-}(aq) + \boldsymbol{q}Ce^{3+}(aq) + 2\boldsymbol{r}H^+(aq)$$

(Ce is the chemical symbol for cerium.)

Which of the following combinations is correct ?

	p	***q***	***r***
A.	1	1	1
B.	1	1	2
C.	1	2	2
D.	2	1	2

15. Which of the following statements best describes metallic bonding ?

A. It is an attractive force between ions.
B. It is an attractive force between polar chemical species.
C. It is an attractive force between atomic nuclei and bond-pair electrons.
D. It is an attractive force between cations and delocalised electrons.

16. Which of the following molecules is non-polar ?

A. $BeCl_2$
B. NH_3
C. H_2O
D. HCl

17. Ammonia is very soluble in water. Which of the following statements best accounts for this phenomenon ?

A. Both ammonia molecule and water molecule are polar.
B. Ammonia molecule and water molecule are of comparable sizes.
C. Ammonia undergoes ionisation in water.
D. Ammonia forms hydrogen bond with water.

Go on to the next page

18. Barium (Ba) is an element in Group II of the Periodic Table. Which of the following is/are the expected observation(s) when a small piece of barium is added to a trough of water containing a few drops of phenolphthalein ?

(1) A colourless gas is liberated.
(2) The piece of barium floats on the water surface.
(3) The resulting solution in the trough is colourless.

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

19. Which of the following reagents would undergo neutralisation with limewater ?

(1) HCl(aq)
(2) $Na_2SO_4(aq)$
(3) $SO_2(g)$

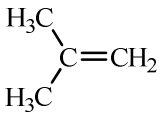
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

20. A salt has the formula $(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$. Which of the following is/are the expected observation(s) when an aqueous solution of this salt is treated with aqueous sodium hydroxide solution ?

(1) formation of a dirty green precipitate
(2) formation of a brown precipitate
(3) evolution of a gas with a pungent odour

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

21. Consider the following organic compound:



Which of the following statements about this compound is/are correct ?

(1) Its systematic name is 1,1-dimethylethene.
(2) It can decolourise an acidified solution of potassium permanganate.
(3) It is the monomer of Perspex.

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

22. Consider the electrolysis experiments using the following combinations of electrolyte solution, anode and cathode:

	Electrolyte solution	Anode	Cathode
(1)	copper(II) sulphate solution	copper	copper
(2)	copper(II) chloride solution	graphite	graphite
(3)	potassium sulphate solution	platinum	platinum

In which of these experiments will the concentration of the electrolyte solution remain UNCHANGED ?

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

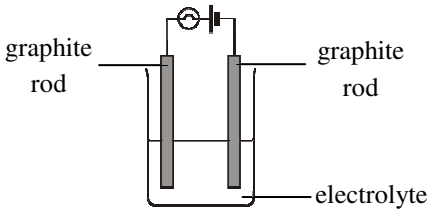
23. Which of the following statements about lithium-ion batteries is/are correct ?

(1) In lithium-ion batteries, the electrolyte is a lithium salt in water.
(2) Lithium-ion batteries are rechargeable.
(3) The disposal of lithium-ion batteries causes less harm to the environment than that of nickel-cadmium batteries.

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

24. Which of the following methods can be used to distinguish between 0.1 mol dm^{-3} HCl(aq) and 0.1 mol dm^{-3} CH_3CO_2H(aq) ?

(1) Add magnesium ribbon of the same length to each solution and compare the rate of evolution of gas bubbles.
(2) Add 10 cm^3 of 0.1 mol dm^{-3} NaOH(aq) to 10 cm^3 of each solution and compare the temperature change.
(3) Use each solution as electrolyte in the set-up shown on the right and compare the brightness of the bulb.



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

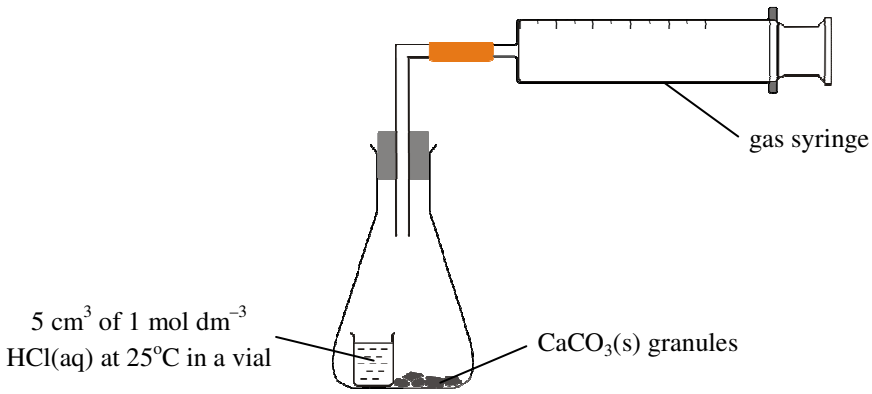
END OF PART I

Go on to the next page

PART II

25. The set-up shown below is used in an experiment to study the rate of the reaction:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$



The conical flask is shaken to overturn the vial in order to start the reaction. The initial rate of the reaction with respect to the gas liberated is determined. The experiment is then repeated with only one of the conditions changed while the others remain unchanged.

Under which of the following situations would the initial rate be the same as that in the original experiment ?

A. using 10 cm^3 of 1 mol dm^{-3} HCl(aq)
B. using 5 cm^3 of 2 mol dm^{-3} HCl(aq)
C. using 5 cm^3 of 1 mol dm^{-3} HCl(aq) which is preheated to 50°C
D. using powdered CaCO$_3$(s) of the same mass

26. A mixture of $N_2O_4(g)$ and $NO_2(g)$ is allowed to attain equilibrium in a gas syringe at room temperature:

$$\underset{\text{light brown}}{N_2O_4(g)} \rightleftharpoons \underset{\text{dark brown}}{2NO_2(g)}$$

The gas mixture in the syringe is compressed rapidly. Which of the following statements correctly describes the expected observation ?

A. The colour of the mixture becomes paler.
B. The colour of the mixture becomes darker.
C. The colour of the mixture becomes paler instantaneously and then darker.
D. The colour of the mixture becomes darker instantaneously and then paler.

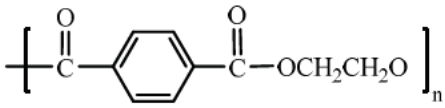
27. Consider the isomeric compounds shown below:

CH_3COCH_3 and CH_3CH_2CHO

Which of the following reagents can be used to distinguish between the two compounds ?

A. acidified potassium dichromate solution
B. lithium aluminium hydride
C. dilute sulphuric acid
D. pH indicator

28. The structure of polymer **X** is shown below:



Which of the following statements about **X** is correct ?

A. It possesses a ketone functional group.
B. It can undergo degradation in an acidic environment.
C. It has a giant covalent network structure.
D. It has a sharp melting point.

29. 0.40 g of an impure sample of zinc granules reacts with excess dilute sulphuric acid to give 100 cm^3 of hydrogen, measured at room temperature and pressure. Assuming that the impurities in the zinc granules do not react with sulphuric acid, what is the percentage by mass of zinc in the sample ?

(Relative atomic masses: H = 1.0, Zn = 65.4;
molar volume of gas at room temperature and pressure = 24 dm^3)

A. 25
B. 34
C. 68
D. 73

30. In which of the following reactions, is/are the transition metal species NOT acting as a catalyst ?

(1) action of acidified $MnO_4^-(aq)$ on $SO_3^{2-}(aq)$ at room temperature
(2) action of Ni(s) on a mixture of $H_2C{=}CH_2(g)$ and $H_2(g)$ at high temperature
(3) action of Pt(s) on a mixture of $CO(g)$ and $O_2(g)$ at high temperature

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

Go on to the next page

31. Which of the following is/are characteristic(s) of chemical equilibrium ?

(1) When a catalyst is added to an equilibrium mixture, the equilibrium position changes.
(2) When equilibrium is attained, the rate of forward reaction and that of backward reaction are equal.
(3) Equilibrium can be attained from either direction of the reaction.

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

32. Some brands of washing powder contain enzymes. Which of the following statements about the action of the enzymes is/are correct ?

(1) The activity of the enzymes increases with temperature.
(2) The enzymes facilitate the removal of specific kinds of dirt.
(3) The enzymes reduce the surface tension of water.

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

33. Consider the following organic conversion:

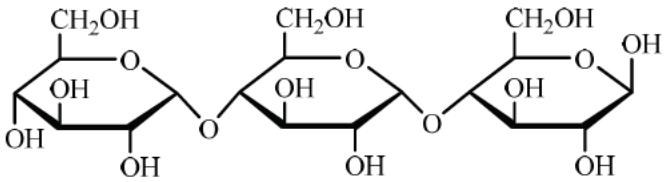
$$(CH_3)_3COH \xrightarrow{\mathbf{X}} (CH_3)_3CCl$$

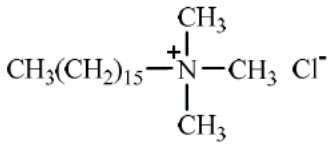
Which of the following reagents can **X** be ?

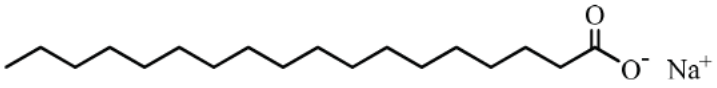
(1) $Cl_2(g)$
(2) $PCl_3(\ell)$
(3) concentrated HCl(aq)

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

34. Consider the following compounds:

(1) 

(2) 

(3) 

Which of these compounds can be used as active ingredients of detergents ?

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 to 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.	The melting point of the non-metals in Period 3 of the Periodic Table decreases from sulphur to argon.	The relative atomic mass increases from sulphur to argon in Period 3 of the Periodic Table.
36.	The structural formula $H_2C=CF_2$ can represent two different compounds.	The rotation of the CF_2 group relative to the CH_2 group in $H_2C=CF_2$ is restricted by the C=C bond.

END OF SECTION A

PP-DSE
CHEM
PAPER 1B

B

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

Candidate Number									

PRACTICE PAPER

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 effective communication is assessed.

(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.

* A 1 4 0 E 0 1 B *

PART I

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

1. An experiment on the preparation of hydrated zinc sulphate involves the following five steps:

Step 1: Warm 30 cm^3 of dilute sulphuric acid in a beaker. Add zinc oxide to the acid until in excess.

Step 2: Filter the reaction mixture and collect the filtrate.

Step 3: Heat the filtrate until it becomes saturated. Then allow it to cool to room temperature to crystallise out hydrated zinc sulphate.

Step 4: Filter off the crystals formed, and then wash them with a little amount of cold distilled water.

Step 5: Dry the crystals.

(a) For Step 1,

(i) write the chemical equation for the reaction that occurs,

(ii) suggest how one can know that zinc oxide is in excess, and

(iii) explain why zinc oxide rather than sulphuric acid is used in excess.

(3 marks)

(b) Suggest ONE way to show that a saturated solution has been obtained in Step 3.

(1 mark)

(c) Explain why **a little amount of cold distilled water** is used to wash the crystals in Step 4.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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1. (d) Suggest ONE way of drying the crystals in Step 5.

(1 mark)

(e) Suggest ONE chemical that can be used to replace zinc oxide in this experiment.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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2. (a) Wine in an opened bottle will become unpalatable if left to stand for some time. Suggest why this is so.

(1 mark)

(b) One common way of preserving wine in an opened bottle is to inject argon, a gas which is chemically unreactive, into the bottle and then stopper the bottle.

(i) Explain why argon is chemically unreactive.

(ii) State the principle behind the use of argon in preserving wine.

(iii) Helium gas is also chemically unreactive. Suggest why helium is NOT used for preserving wine in an opened bottle.

(3 marks)

(c) Another way of wine preservation involves pumping air out from an opened bottle of wine and then stoppering the bottle. Suggest ONE possible drawback of preserving wine in this way.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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3. (a) Nitrogen reacts with magnesium to give magnesium nitride (Mg_3N_2).

(i) Draw the electron diagram of magnesium nitride, showing electrons in the *outermost shells* only.

(ii) Magnesium nitride reacts with water to give magnesium hydroxide and ammonia.

Write the chemical equation for this reaction. Explain whether or not this reaction is a redox.

(3 marks)

(b) Consider the nitrogen compound NCl_3 .

(i) Draw the electron diagram of NCl_3 , showing electrons in the *outermost shells* only.

(ii) The shape of NCl_3 is similar to that of NH_3 . Explain why this is so.

(3 marks)

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Answers written in the margins will not be marked.

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4. A student was given a sample of a water-soluble metal carbonate, $\mathbf{M}_2CO_3(s)$. In order to deduce what **M** was, the student prepared a 100.0 cm^3 aqueous solution of the carbonate using 1.14 g of the sample. The student then withdrew several 10.0 cm^3 portions of the solution, and titrated each portion with 0.085 mol dm^{-3} HCl(aq) using methyl orange as indicator. The mean titre was 25.30 cm^3.

(a) Describe how the 100.0 cm^3 aqueous solution was prepared.

(3 marks)

(b) Based on the experimental results, determine the formula mass of $\mathbf{M}_2CO_3$ and deduce what **M** is.

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

5. The fuel used in the torch for the Beijing 2008 Olympic Games was an alkane **X** with the following composition by mass:

C, 81.8%; H, 18.2%

(a) Deduce what **X** could be.

(3 marks)

(b) Suggest an industrial process for obtaining **X.**

(1 mark)

(c) Kerosene was once used as a fuel for the Olympic torch. State ONE advantage of using each of the following substances as fuel for the torch.

(i) **X**

(ii) kerosene

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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6. The table below lists some information about six hydroxy compounds **A**, **B**, **C**, **D**, **E** and **F**:

Compound	Structural formula	Boiling point at 1 atm / °C	Density at 20°C / g cm^{-3}
A	CH_3OH	65	0.7914
B	CH_3CH_2OH	78	0.7893
C	$CH_3CH_2CH_2OH$	97	0.8035
D	$CH_3CH(OH)CH_3$	82	0.7855
E	$HOCH_2CH_2CH_2OH$	213	1.0597
F	$HOCH_2CH(OH)CH_2OH$	290	1.2613

(a) Give the systematic name of **E**.

(1 mark)

(b) Account for the variation in boiling points of **A**, **B** and **C**.

(2 marks)

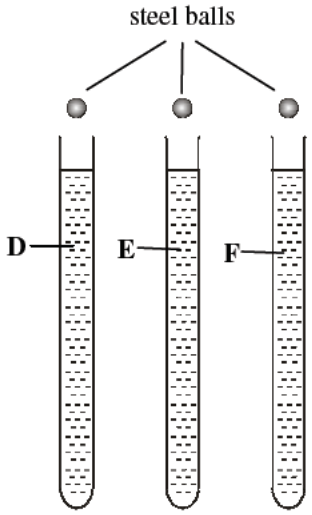
(c) Explain why the density of **C** is greater than that of **D**.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

6. *(d) Three identical steel balls are added separately to three identical vertical glass tubes each containing the same volume of **D**, **E** and **F** as shown in the diagram below.



In which tube will the steel ball take the longest time to reach the bottom ? Explain your answer. (You are required to consider the intermolecular attraction forces involved.)

Marker's Use Only	C

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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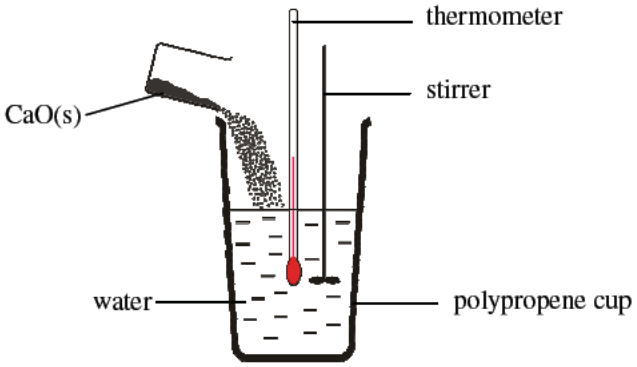
7. (a) A student carried out an experiment to determine the enthalpy change of the reaction of calcium oxide with water. The set-up used is shown in the diagram below:



The experimental results are as follows:

mass of CaO(s) used	= 3.0 g
volume of water in the cup	= 50.0 cm^3
initial temperature of water in the cup	= 28.2°C
highest temperature attained by the $Ca(OH)_2(aq)$ formed	= 46.7°C

(i) Calculate the enthalpy change, in kJ mol^{-1}, of the reaction of calcium oxide with water under the conditions of the experiment.
(Assume: density of water is 1.0 g cm^{-3} and specific heat capacity of the $Ca(OH)_2(aq)$ formed is 4.2 J $g^{-1}K^{-1}$;
the polypropene cup, thermometer and stirrer used all have negligible heat capacity.)

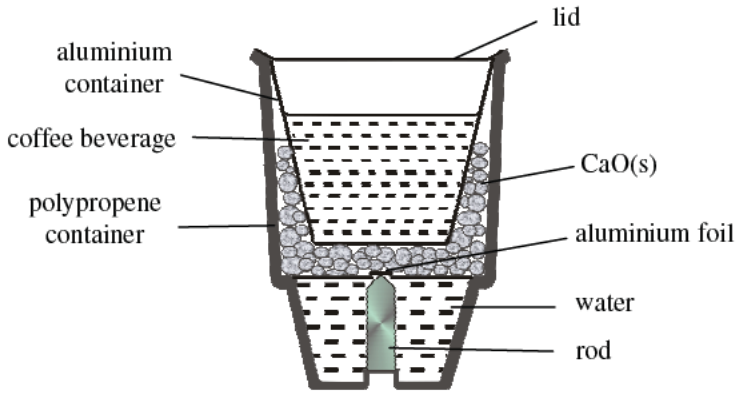
(ii) According to the literature, $\Delta H^{\ominus}$ for this reaction is –82.2 kJ mol^{-1}. Suggest ONE reasonable explanation for the discrepancy between the literature value and the value obtained in (i).

(5 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

7. (b) The diagram below shows the design of a can of self-heating coffee beverage. When the bottom of the can is pushed, the rod will pierce the aluminium foil and cause mixing of the water and calcium oxide. The coffee beverage in the can will then be heated up.



(i) With reference to the properties of the materials involved, explain why

(I) a polypropene container is used to contain the calcium oxide, and

(II) an aluminium container is used to contain the coffee beverage.

(ii) Suggest ONE reasonable explanation for using calcium oxide in this type of self-heating beverage can.

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (DMFC).

The operation of DMFC is based on the following reaction under an acidic condition:

$$2CH_3OH(aq) + 3O_2(g) \rightarrow 2CO_2(g) + 4H_2O(\ell)$$

(a) Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction

cathodic reaction

(2 marks)

(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

(ii) Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.


CORROSIVE 腐蝕性


TOXIC 有 毒


FLAMMABLE 易 燃


OXIDISING 氧化性

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. (c) Would you expect DMFC to be widely used in powering laptop computers ? Explain your answer.

(2 marks)

END OF PART I

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PART II

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

9. (a) Using the following notations to complete the table below so as to provide information about the structure and acid-base property of the oxides of Period 3 elements.

IC: ionic crystal **CN**: covalent network **SM**: simple molecular structure
AC: acidic **BA**: basic **AM**: amphoteric

	MgO	Al_2O_3	SiO_2	P_4O_{10}	SO_2
Structure					
Acid-base property					

(2 marks)

(b) By considering the trend of acid-base property and that of bonding of these oxides, state the relationship between the two trends.

(1 mark)

*(c) Outline chemical tests to show how these oxides can be classified into acidic, basic and amphoteric.

Marker's Use Only	C

(5 marks)

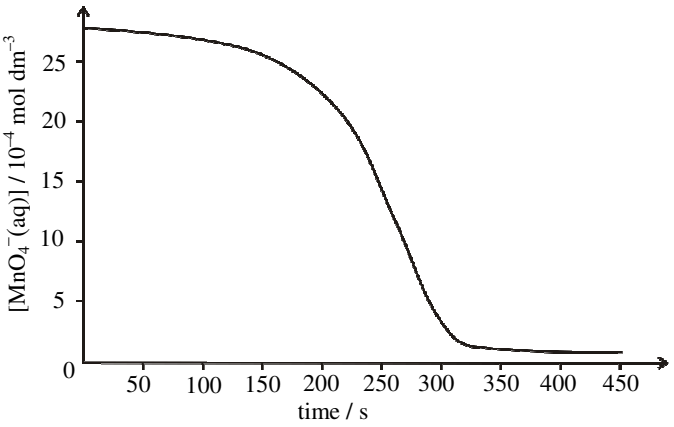
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

10. The equation below shows the reaction of potassium permanganate with sodium ethanedioate under acidic conditions:

$$2MnO_4^-(aq) + 5C_2O_4^{2-}(aq) + 16H^+(aq) \rightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(\ell)$$

A student conducted an experiment to study the rate of this reaction. The results are shown in the graph below:



(a) Suggest ONE physical method that can be used to monitor the concentration of $MnO_4^-(aq)$ ions in the reaction mixture.

(1 mark)

(b) Based on the experimental results, the student suggested that one of the products might have catalysed the reaction.

(i) What evidence from the above graph supports the student's suggestion ? Explain your answer.

(ii) Suggest how the student can show whether or not $Mn^{2+}(aq)$ is a catalyst for this reaction.

(4 marks)

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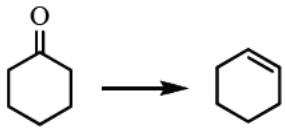
11. Outline a synthetic route, with *no more than three steps*, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions and structure of the organic product.



(3 marks)

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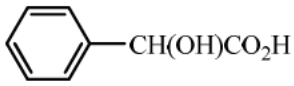
12. The structural formula shown below can represent two compounds with the same melting point and same solubility in water.



(a) (i) Draw a three-dimensional structure for each of the two compounds.

(ii) State ONE difference in physical properties of these compounds.

(3 marks)

(b) Both compounds can undergo polymerisation under suitable conditions. Draw the repeating unit of the polymer formed from one of these compounds.

(1 mark)

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13. In an experiment, excess aqueous ammonia is added to an aqueous solution of copper(II) sulphate. The following equilibrium is established and the resulting solution is deep blue in colour.

$$Cu^{2+}(aq) + 4NH_3(aq) \rightleftharpoons Cu(NH_3)_4^{2+}(aq)$$

(a) Write an expression of K_c for this reaction.

(1 mark)

(b) If the above equilibrium mixture contains 0.0020 mol dm^{-3} of $Cu^{2+}(aq)$ ions, 0.0014 mol dm^{-3} of $NH_3(aq)$ and 0.0800 mol dm^{-3} of $Cu(NH_3)_4^{2+}(aq)$ ions, calculate K_c under the conditions of the experiment.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

13. (c) When $H_2SO_4(aq)$ is added slowly to the equilibrium mixture until in excess, a blue precipitate is formed and the precipitate subsequently dissolves in the excess acid forming a blue solution. Account for these observations with the help of relevant chemical equation(s).

(5 marks)

END OF SECTION B

END OF PAPER

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

PERIODIC TABLE 周期表

GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

I	II											III	IV	V	VI	VII	0
				1 **H** 1.0													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)