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)

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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)

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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)

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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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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)

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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)

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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)

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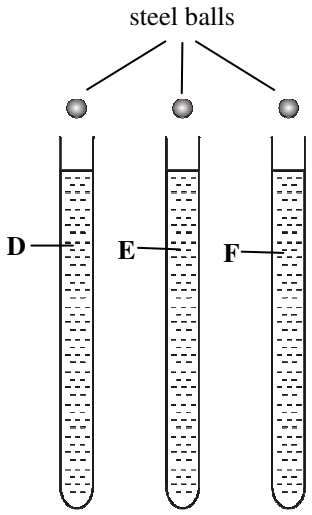
6. *(d) Three identical steel balls are added separately to three identical vertical glass tubes each containing the same volume of **D**, **E** and **F** as shown in the diagram below.



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)

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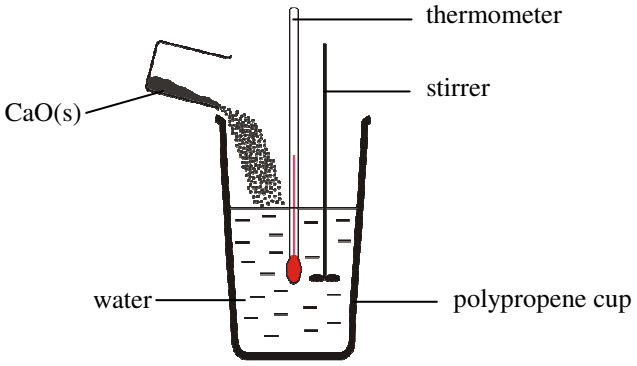
7. (a) A student carried out an experiment to determine the enthalpy change of the reaction of calcium oxide with water. The set-up used is shown in the diagram below:



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)

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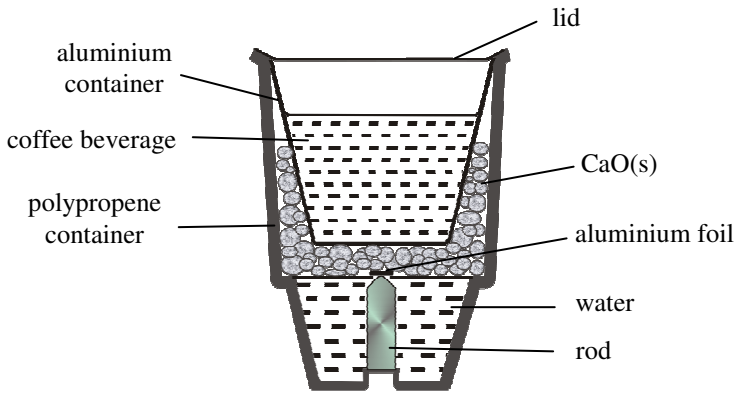
7. (b) The diagram below shows the design of a can of self-heating coffee beverage. When the bottom of the can is pushed, the rod will pierce the aluminium foil and cause mixing of the water and calcium oxide. The coffee beverage in the can will then be heated up.



(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)

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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

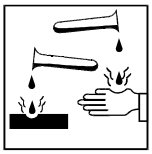
cathodic reaction

(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)

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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)

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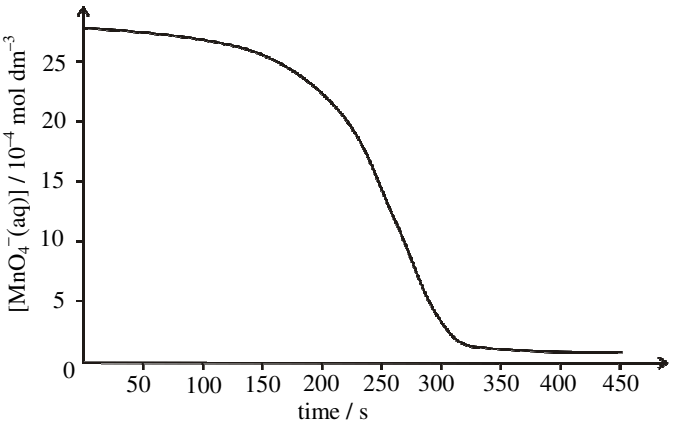
10. The equation below shows the reaction of potassium permanganate with sodium ethanedioate under acidic conditions:

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

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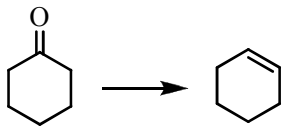
11. Outline a synthetic route, with *no more than three steps*, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions and structure of the organic product.



(3 marks)

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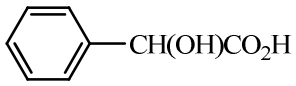
12. The structural formula shown below can represent two compounds with the same melting point and same solubility in water.



(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)

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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

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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)