

B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2014

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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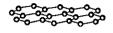
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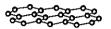


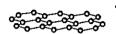
PART I

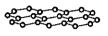
Answer ALL questions. Write your answers in the spaces provided.

1. Graphite is a form of carbon and has a layer structure. Graphene is an individual single layer of graphite. Their structures are shown below:









graphite

graphene

- (a) Thin sheets of graphene can be easily peeled off from graphite using adhesive tape.
 - (i) Explain why graphene can be easily peeled off.
 - (ii) Explain whether graphene can conduct electricity.
 - (iii) Draw the electron diagram for a molecule of the compound formed by complete combustion of graphene, showing electrons in the outermost shells only.

(3 marks)

Answers written in the margins will not be marked.

(b) Based on the fact that graphene can be easily peeled off from graphite, a student concluded that graphite should have a low melting point due to its layer structure. Explain whether you agree with this conclusion.

(1 mark)

1. (c) Fullerene (such as C_{60}) is another form of carbon. Briefly describe the structure of C_{60} , and suggest why it is soluble in some organic solvents.

(3 marks)

Answers written in the margins will not be marked.

2. Draw the structure of ethane-1,2-diol, and suggest whether it is soluble in water.

(3 marks)

- 3. Both polyethene (PE) and 'Saran' can be used to make food wrap, but 'Saran' is more suitable than PE in making food wrap for use in microwave ovens.
 - (a) The monomer of PE is ethene. Suggest a chemical test to show that ethene is an unsaturated compound.

(2 marks)

Answers written in the margins will not be marked.

(b) 'Saran' can be formed from the polymerisation of the compound shown below:

$$CI$$
 $C = C$

- (i) State the systematic name of this compound.
- (ii) Name the type of polymerisation involved in forming 'Saran'.
- (iii) Draw the structure of 'Saran', showing at least THREE repeating units.

(3 marks)

(2 marks)

Answers written in the margins will not be marked.

(d) When incinerated, why would food wrap made from 'Saran' cause more serious pollution problem than food wrap made from PE?

(1 mark)

| order of reactivity of these three metals. | copper, magnesium and silver from their oxides, deduc |
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| order of reactivity of these three metals. | (5 m |
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- 5. Concentrated acids are common reagents found in laboratories.
 - State a safety measure in handling concentrated acids in laboratories. (a)

(1 mark)

(b) Comment on the following statement:

'All concentrated acids are strong acids.'

(1 mark)

Answers written in the margins will not be marked.

(c) Explain how concentrated sulphuric acid, concentrated nitric acid and concentrated ethanoic acid can be distinguished by using copper granules.

Answers written in the margins will not be marked.

(3 marks)

- 6. (b) Motor cars powered by petrol emit air pollutants such as nitrogen monoxide and carbon monoxide. Installing a certain device in motor cars can convert these two oxides to less harmful substances.
 - (i) Name this device.
 - (ii) The equation for the reaction involved in the conversion is shown below:

$$2\text{CO}(g) + 2\text{NO}(g) \rightarrow 2\text{CO}_2(g) + \text{N}_2(g)$$

The standard enthalpy changes of formation of NO(g), CO(g) and CO₂(g) are as follows:

| Compound | $\Delta H_{\rm f}^{\rm e}$ / kJ mol ⁻¹ |
|---------------------|---|
| NO(g) | +90.3 |
| CO(g) | -110.5 |
| CO ₂ (g) | -394.0 |

Calculate the standard enthalpy change of the above reaction.

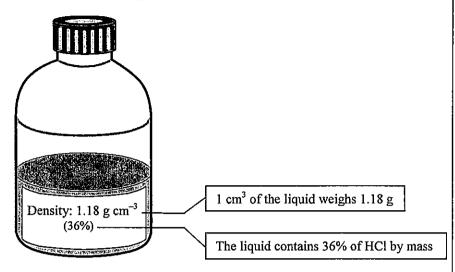
(4 marks)

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Answers written in the margins will not be marked.

9

7. A bottle of concentrated hydrochloric acid HCl(aq) is shown below:



(a) According to the information on the label, calculate the concentration of the concentrated hydrochloric acid in mol dm⁻³.

(2 marks)

- (b) To find out the concentration of the concentrated acid, a laboratory technician first drew from the bottle a sample of 10.00 cm³ of the concentrated acid and diluted it to 100.0 cm³ in a volumetric flask. The diluted acid sample was then used to titrate a standard sodium carbonate solution placed in a conical flask using methyl orange as an indicator. 10.00 cm³ of 1.06 mol dm⁻³ sodium carbonate solution required 20.30 cm³ of the diluted acid sample to reach the end point.
 - (i) Briefly describe the procedure in preparing a standard sodium carbonate solution.

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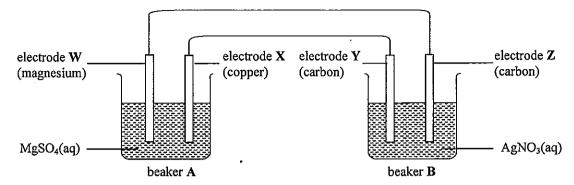
7. (b) (ii) Using the titration result, calculate the concentration, in mol dm⁻³, of the concentrated hydrochloric acid in the bottle.

(5 marks)

(c) Suggest a possible reason why the concentration of the concentrated hydrochloric acid in the bottle obtained from (b)(ii) would be smaller than that obtained from (a) above.

(1 mark)

8. The diagram below shows a set-up in which electrons are flowing through the electric wires. Moreover, one of the electrodes in beaker A is forming ions.



- (a) State an expected observation at each of the following electrodes:
 - (i) electrode W
 - (ii) electrode X

(2 marks)

- (b) Write the half equation for the expected change at each of the following electrodes:
 - (i) electrode Y

Answers written in the margins will not be marked.

(ii) electrode Z

(2 marks)

(c) Complete the following table by filling in 'anode' or 'cathode' to describe the electrodes.

| | electrode W | electrode Z |
|-----------------|-------------|--------------------|
| anode / cathode | | |

(1 mark)

(d) Predict, with reason, what would happen if the MgSO₄(aq) in beaker A is replaced by ethanol.

(1 mark)



- 9. Consider each of the experiments below and answer the questions that follow.
 - (a) Dilute sodium hydroxide solution is added to copper(II) sulphate solution.
 - (i) State the expected observation.

(ii) Write the chemical equation for the reaction that occurs.

(2 marks)

Answers written in the margins will not be marked.

- (b) Acidified potassium permanganate solution is added to sodium sulphite solution.
 - (i) State the expected colour change.

- (ii) For the reaction leading to the colour change,
 - (1) state the name of the type of reaction; and

(2) write the ionic equation for the reaction.

(3 marks)

| | 1 |
|---|---|
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| | PART II |
|-------|---|
| Answe | r ALL questions. Write your answers in the spaces provided. |
| *10. | You are provided with common laboratory apparatus, calcium carbonate and 1M hydrochloric acid Outline how you would perform a fair comparison in studying the effect of different concentrations of acid on the rate of production of carbon dioxide from the following reaction: |
| | $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$ |
| | (5 marks |
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| Formula | VO ²⁺ (aq) | V ³⁺ (aq) | V ²⁺ (aq) |
|---------|-----------------------|----------------------|----------------------|
| Colour | blue | green | violet |

(a) Based on the given information, suggest TWO properties of vanadium to characterise it as a transition metal.

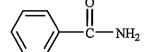
(1 mark)

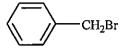
Answers written in the margins will not be marked.

- (b) Vanadium also forms the ion $VO_2^+(aq)$. In the presence of acid, 1.0 mol of $VO_2^+(aq)$ ions and 1.0 mol of $SO_2(g)$ react completely to form $SO_4^{2-}(aq)$ ions and one of the above aqueous vanadium-containing ions.
 - (i) By considering the amount of electrons transferred, deduce the final colour of the solution obtained.

(ii) Write a chemical equation for the reaction in (i).

(3 marks)





benzamide

benzoic acid

benzyl bromide

- (a) In an experiment, benzoic acid is prepared from benzamide in two steps:
 - Step 1: Benzamide is added to excess 1M NaOH(aq) and the mixture is heated gently. An organic compound X is formed.
 - Step 2: The resulting mixture is then treated with reagent Y until no more solid benzoic acid is given out.
 - (i) Name the type of reaction involved in Step 1.
 - (ii) Draw the structure of X.

- (iii) Suggest what Y would be.
- (iv) Suggest why X is more soluble than benzoic acid in water.

(v) Describe briefly how a dry benzoic acid sample can be obtained after Step 2.

(5 marks)

Answers written in the margins will not be marked.

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

(3 marks)

Answers written in the margins will not be marked.

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$$

- (a) In an experiment, 1.02 mol of NO(g) and 1.29 mol of O₂(g) are mixed in a 50.0 dm³ closed container maintained at 980 K. When equilibrium is attained, 61.0% of NO(g) is consumed.
 - (i) Calculate the equilibrium constant K_c for the above reaction under the experimental conditions.

(ii) Discuss whether K_c would change if additional NO(g) is introduced into the above equilibrium mixture.

(4 marks)

Answers written in the margins will not be marked.

(b) The values of K_c (in appropriate unit) for this reaction at different temperatures are shown below:

| Temperature / K | 600 | 700 | 800 | 900 |
|-----------------|----------------------|----------------------|----------------------|----------------------|
| K_c | 6.88×10 ⁶ | 2.97×10 ⁵ | 2.89×10^{3} | 4.68×10 ² |

Based on the above data, deduce whether the forward reaction is exothermic or endothermic.

(1 mark)

- 14. Butter contains a small amount of the triglyceride of butanoic acid.
 - (a) Draw the structure of the triglyceride of butanoic acid.

(1 mark)

(b) An organic acid Q is an isomer of butanoic acid. State the systematic name of Q.

(1 mark)

(c) The structure of **Z**, another isomer of butanoic acid, is shown below:

Z

- (i) Using '*', label ALL chiral centre(s) in the above structure of Z.
- (ii) Suggest a chemical test to show how to distinguish between Q and Z.

(3 marks)

(d) Margarine, a butter substitute, can be made from vegetable oils. What chemical reaction is involved in the production of margarine from vegetable oils?

(1 mark)

END OF SECTION B

END OF PAPER

PERIODIC TABLE 周期表

| | | | | | | _ | | _ | | _ | | | | | | | | | | | |
|-------|------------|------------|-----------|----|----------|------|---------------|----------|------|----|--------|------|----|----|-------|------|----------|-------|-------|----|-------|
| | 0 | 2 | He 4.0 | 10 | Ne | 20.2 | 18 | Ar | 40.0 | 36 | Ķ | 83.8 | 54 | Xe | 131.3 | 98 | Rn | (222) | | | |
| | | | VII | 6 | <u> </u> | 19.0 | 17 | ರ | 35.5 | 35 | Ŗ | 79.9 | 53 | Ι | 126.9 | 85 | Αt | (210) | | | |
| | | | VI | 8 | 0 | 16.0 | 16 | S | 32.1 | 34 | Se | 79.0 | 52 | Te | 127.6 | 84 | Po | (209) | | | |
| | | | Λ | 7 | z | 14.0 | 15 | ۵, | 31.0 | 33 | As | 74.9 | 51 | Sp | 121.8 | 83 | <u>B</u> | 209.0 | | | |
| | | | IV | 9 | Ç | 12.0 | 14 | Si | 28.1 | 32 | g | 72.6 | 20 | Sn | 118.7 | 82 | Pb | 207.2 | | | |
| | | | Ш | 5 | 8 | 10.8 | 13 | ¥ | 27.0 | 31 | Ğ | 69.7 | 49 | П | 114.8 | 18 | E | 204.4 | | | |
| | | | : | | | | | | | 30 | Zn | 65.4 | 48 | Ç | 112.4 | 80 | Hg | 200.6 | | | |
| | | | | | | | | | | 29 | ű | 63.5 | 47 | Ag | 107.9 | 62 | Αn | 197.0 | | | |
| | | | | | | | 質量 | | | 28 | Z | 58.7 | 46 | Pd | 106.4 | 78 | Pt | 195.1 | | | |
| | 105 | | | | | | 相對原子質量 | | | 27 | ပိ | 58.9 | 45 | Rh | 102.9 | 11 | Ţ | 192.2 | | | |
| | number 原子序 | | | | | | e atomic mass | | | 26 | F. | 55.8 | 44 | Ru | 101.1 | 92 | SO | 190.2 | | | |
| | | | | | | | relative aton | | | 25 | Mn | 54.9 | 43 | Ţ | (86) | 75 | Re | 186.2 | | | |
| | atomic | | | | / | / | relg | | | | | | 42 | | | | | | | | |
| | \ | <u>4</u> : | H 1.0 | | / | | | | | | | | | | | | | | | Ωp | (262) |
| | | L | | | | | | | | 22 | Ë | 47.9 | 40 | Zr | 91.2 | 72 | Hf | 178.5 | 104 | Rf | (261) |
| | | | | | | | | | | 21 | Sc | 45.0 | 39 | Y | 88.9 | 57 * | La | 138.9 | ** 68 | Ac | (227) |
| 棌 | | | II | 4 | Be | 0.6 | 12 | Mg | 24.3 | 20 | S S | 40.1 | 38 | Sr | 87.6 | 99 | Ba | 137.3 | 88 | Ra | (226) |
| GROUP | | | I | 3 | ï | 6.9 | 11 | Na Na | 23.0 | 19 | ¥ | 39.1 | 37 | Rb | 85.5 | 55 | ű | 132.9 | 87 | Fr | (223) |
| _ | | | | | | | | | | | | | | | | | | | | | |

| - | | | 103 | | |
|----|----------|-------|-----|--------|-------|
| 0/ | Χp | 173.0 | 102 | ž | (259) |
| 69 | Tm | 168.9 | 101 | Md | (258) |
| 89 | Ā | 167.3 | 100 | Fm | (257) |
| 29 | Ho | 164.9 | 66 | Es | (252) |
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| 65 | T | 158.9 | 26 | Bķ | (247) |
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| 63 | Eu | 152.0 | 95 | ЧΨ | (243) |
| 62 | Sm | 150.4 | 94 | Pu | (244) |
| 61 | Pm | (145) | 93 | S D | (237) |
| 09 | PN | 144.2 | 92 | Þ | 238.0 |
| 59 | <u>7</u> | 140.9 | | Pa | (231) |
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