

		atomic number 原子序		relative atomic mass 相對原子質量	
1	2	3	4	5	6
H 1.0	He 4.0	Li 6.9	Be 9.0	B 10.8	C 12.0
11	12	13	14	15	16
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1
19	20	21	22	23	24
K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0
37	38	39	40	41	42
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9
55	56	57 *	72	73	74
Cs 132.9	Ba 137.3	La 138.9	Hf 178.5	Ta 180.9	W 183.9
87	88	89 **	104	105	
Fr (223)	Ra (226)	Ac (227)	Rf (261)	Db (262)	
5	6	7	8	9	10
B 10.8	C 12.0	N 14.0	O 16.0	F 19.0	Ne 20.2
13	14	15	16	17	18
Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5	Ar 40.0
31	32	33	34	35	36
Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9	Kr 83.8
49	50	51	52	53	54
In 114.8	Sn 118.7	Sb 121.8	Te 127.6	I 126.9	Xe 131.3
81	82	83	84	85	86
Tl 204.4	Pb 207.2	Bi 209.0	Po (209)	At (210)	Rn (222)
29	30	31	32	33	34
Cu 63.5	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0
47	48	49	50	51	52
Ag 107.9	Cd 112.4	In 114.8	Sn 118.7	Sb 121.8	Te 127.6
79	80	81	82	83	84
Au 197.0	Hg 200.6	Tl 204.4	Pb 207.2	Bi 209.0	Po (209)
65	66	67	68	69	70
Tb 158.9	Dy 162.5	Ho 164.9	Er 167.3	Tm 168.9	Yb 173.0
97	98	99	100	101	102
Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)
105	106	107	108	109	110
Lu 175.0	Hf 178.5	Ta 180.9	W 183.9	Re 186.2	Os 190.2
71	72	73	74	75	76
Lu 175.0	Hf 178.5	Ta 180.9	W 183.9	Re 186.2	Os 190.2

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

*

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Please stick the barcode label here.

Candidate Number

CHEMISTRY PAPER 1
SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

- 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.
- Refer to the general instructions on the cover of the Question Paper for Section A.
- This section consists of TWO parts, Parts I and II.
- 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.
- An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.
- 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.
- 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.



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.
- (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.

(3 marks)

(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)

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

(3 marks)

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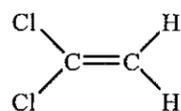
Answers written in the margins will not be marked.

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)

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



- (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)

3. (c) In terms of intermolecular force, explain why 'Saran' is more suitable than PE in making food wrap for use in microwave ovens.

(2 marks)

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

(1 mark)

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6. Petrol is a commonly used motor car fuel. It can be obtained from petroleum by fractional distillation.

(a) (i) Explain, from molecular level, why petrol can be obtained from petroleum by fractional distillation.

(ii) Other than directly obtaining petrol from fractional distillation of petroleum, suggest a way for producing extra petrol.

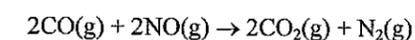
(iii) Octane (C_8H_{18}) is a component of petrol. Using octane as an example, state the meaning of the term 'standard enthalpy change of combustion' with the aid of a chemical equation.

(5 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:



The standard enthalpy changes of formation of $NO(g)$, $CO(g)$ and $CO_2(g)$ are as follows:

Compound	$\Delta H_f^\circ / \text{kJ mol}^{-1}$
$NO(g)$	+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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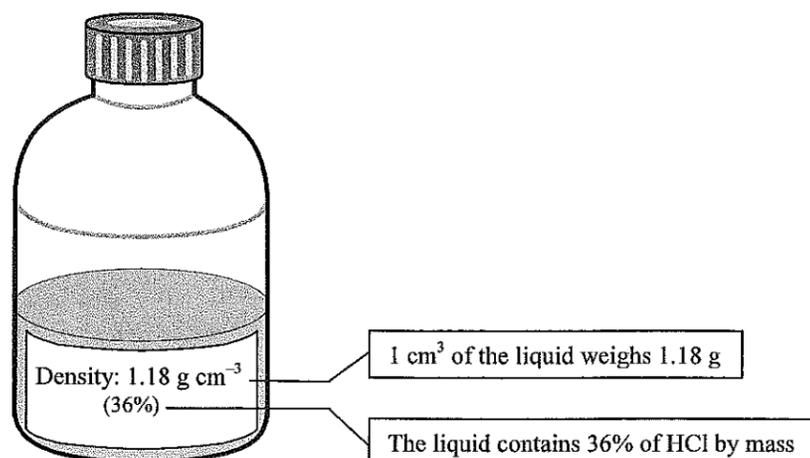
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7. A bottle of concentrated hydrochloric acid HCl(aq) is shown below:



(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.

Answers written in the margins will not be marked.

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)

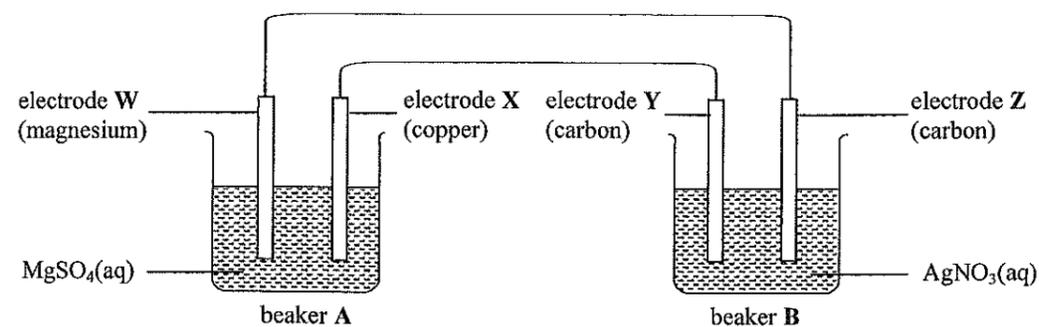
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8. The diagram below shows a set-up in which electrons are flowing through the electric wires. Moreover, one of the electrodes in beaker A is forming ions.



- (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

(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 $\text{MgSO}_4(\text{aq})$ in beaker A is replaced by ethanol.

(1 mark)

Answers written in the margins will not be marked.

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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)

- (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

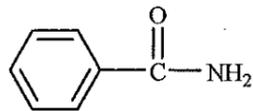
(2) write the ionic equation for the reaction.

(3 marks)

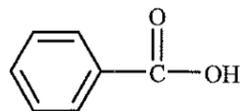
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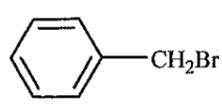
12. Benzamide, benzoic acid and benzyl bromide are commonly used organic compounds. Their structures are shown below:



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.

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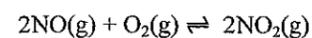
(3 marks)

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13. Consider the reaction represented by the equation below:



- (a) In an experiment, 1.02 mol of $\text{NO}(\text{g})$ and 1.29 mol of $\text{O}_2(\text{g})$ are mixed in a 50.0 dm^3 closed container maintained at 980 K. When equilibrium is attained, 61.0% of $\text{NO}(\text{g})$ 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 $\text{NO}(\text{g})$ is introduced into the above equilibrium mixture.

(4 marks)

- (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.

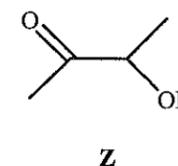
- (a) Draw the structure of the triglyceride of butanoic acid.

(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:



- (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