

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

COMBINED SCIENCE — CHEMISTRY

(Sample Paper)

Time allowed: 1 hour 40 minutes

This paper must be answered in English.

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. Section A carries 24 marks and Section B carries 56 marks. You are advised to finish Section A in about 30 minutes.
2. Section A consists of multiple-choice questions in this question book, 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 must be handed in separately at the end of the examination.**

SECTION A (MULTIPLE-CHOICE QUESTIONS)

INSTRUCTIONS FOR SECTION A

1. Read carefully the instructions on the Answer Sheet. Stick a barcode label and insert the information required in the spaces provided.
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.
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

Choose the best answer for each question.

Candidates may refer to the Periodic Table printed on the back of this Question Book.

1. Upon cracking, one molecule of decane ($C_{10}H_{22}$) gives two molecules of propene and one molecule of an alkane (X). What is X ?

- A. C_4H_6
- B. C_4H_{10}
- C. C_7H_{14}
- D. C_7H_{16}

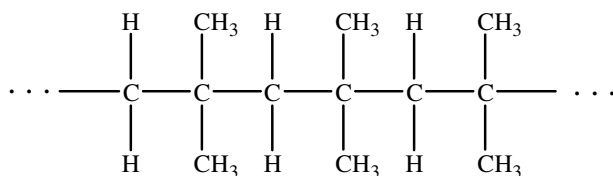
2. In which of the following compounds does sulphur exhibit the lowest oxidation number ?

- A. $Na_2S_2O_3$
- B. $MgSO_4$
- C. $KHSO_3$
- D. $H_2S_2O_7$

3. Which of the following correctly describes the sequence of procedures to separate sand, salt and water from a mixture of sand and salt solution ?

- A. filtration, evaporation
- B. filtration, distillation
- C. crystallisation, filtration
- D. crystallisation, filtration, distillation

4. The structure of polymer X is shown below.



What is the monomer of X ?

- A. 1,1-dimethylethene
- B. 1,2-dimethylethene
- C. methylpropene
- D. but-1-ene

Directions: Questions 5 to 6 refer to the following experiment.

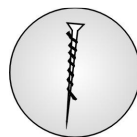
Rust indicator containing potassium hexacyanoferrate(III) solution was poured into the following glass dishes, cover the iron nails, which were wrapped with different metal strips. The dishes were allowed to stand in air for some time.



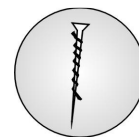
silver strip
dish 1



zinc strip
dish 2

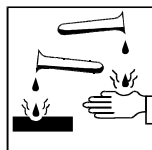


copper strip
dish 3



magnesium strip
dish 4

5. If the iron nail rusts, what would the colour of the rust indicator be around the nail ?
- yellow
 - brown
 - red
 - blue
6. In which of the dishes would the iron nail rust ?
- dish 1 only
 - dish 2 only
 - dish 1 and dish 3 only
 - dish 2 and dish 4 only
7. The atomic number of an element X is 18. An atom of X has a mass number of 40. The atom has
- 18 protons, 22 neutrons and 18 electrons.
 - 18 protons, 22 neutrons and 22 electrons.
 - 18 protons, 40 neutrons and 18 electrons.
 - 22 protons, 22 neutrons and 18 electrons.
8. The following hazard warning labels are displayed on the reagent bottle of an acid.



What information about this acid can be obtained from the labels ?

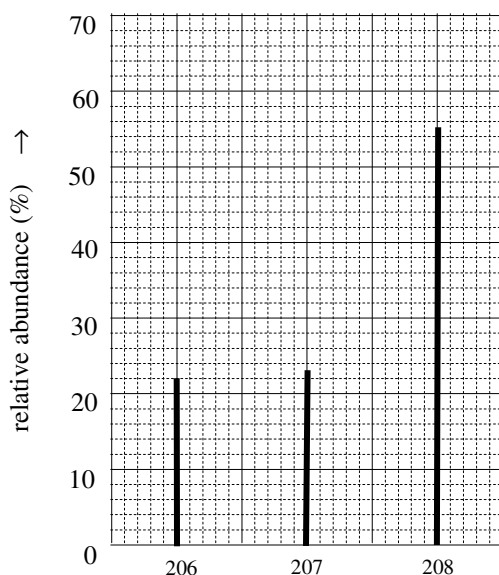
- It is very concentrated and flammable.
- It is very concentrated and oxidising.
- It is flammable and corrosive.
- It is corrosive and oxidising.

9. Which of the following statements concerning alkenes is INCORRECT ?
- A. They can decolourise a solution of bromine.
 - B. They can decolourise red litmus solution.
 - C. They can decolourise acidified potassium permanganate solution.
 - D. They can be polymerised to form addition polymers.

10. Which of the following reactions is endothermic ?

- A. $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$
- B. $\text{CaCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g})$
- C. $2\text{C}_4\text{H}_{10}(\text{g}) + 13\text{O}_2(\text{g}) \rightarrow 8\text{CO}_2(\text{g}) + 10\text{H}_2\text{O(l)}$
- D. $\text{C}_9\text{H}_{20}(\text{l}) \rightarrow \text{C}_2\text{H}_6(\text{g}) + \text{C}_3\text{H}_6(\text{g}) + \text{C}_4\text{H}_8(\text{g})$

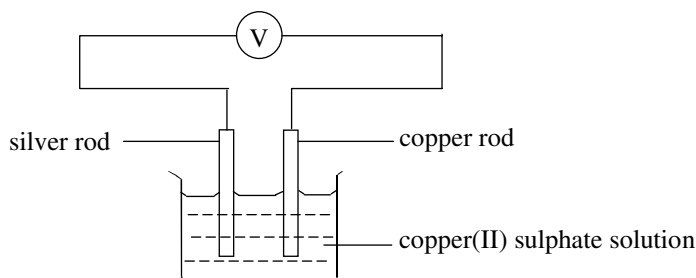
11. Element X has three isotopes, ^{206}X , ^{207}X and ^{208}X . The graph below shows the relative abundances of the isotopes.



What is the relative atomic mass of X ?

- A. 206.8
- B. 207.0
- C. 207.3
- D. 207.5

12. Which of the following combinations concerning the set-up shown below is correct after a current is flowed through the external circuit for some time ?



- | | <u>Mass of anode</u> | <u>Colour of copper(II) sulphate solution</u> |
|----|----------------------|---|
| A. | increases | no change |
| B. | decreases | no change |
| C. | increases | becomes lighter |
| D. | decreases | becomes lighter |
13. Standard enthalpy changes of several reactions, as denoted by x, y and z respectively, are listed in the table below.

Reaction	Standard enthalpy change / kJ mol^{-1}
$\text{C(s)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$	x
$\text{H}_2\text{(g)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{H}_2\text{O(l)}$	y
$\text{C(s)} + 2\text{H}_2\text{(g)} \rightarrow \text{CH}_4\text{(g)}$	z

For the reaction $\text{CH}_4\text{(g)} + 2\text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(l)}$, which of the following is a reasonable estimate of its standard enthalpy change ?

- A. $x + y - z$
 B. $-x - y + z$
 C. $x + 2y - z$
 D. $-x - 2y - z$
14. 500 cm^3 of calcium hydroxide solution contains 3.7 g of calcium hydroxide. What is the molarity of the solution ?

(Relative atomic masses : H = 1.0, O = 16.0, Ca = 40.1)

- A. 0.05 M
 B. 0.10 M
 C. 0.13 M
 D. 0.26 M
15. Which of the following samples of gases contains the smallest number of molecules ?
- (Relative atomic masses : H = 1.0, C = 12.0, N = 14.0, O = 16.0, S = 32.1)

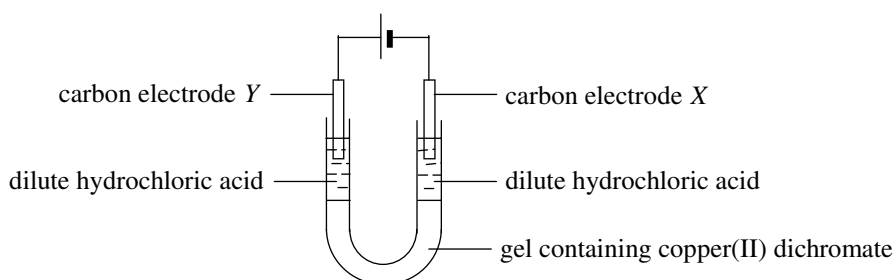
- A. 10 g of NO_2
 B. 10 g of CO_2
 C. 10 g of H_2S
 D. 10 g of C_2H_4

Directions: Questions 16 to 18 refer to the following information.

In an experiment to determine the concentration of sulphuric acid in a brand of toilet cleaner, 25.0 cm^3 of the cleaner was first diluted to 250.0 cm^3 with distilled water. Upon titration with 0.950 M sodium hydroxide solution using phenolphthalein as indicator, 25.0 cm^3 of the diluted cleaner required 27.1 cm^3 of the sodium hydroxide solution to reach the end point.

16. Which of the following types of apparatus should be used to measure 25.0 cm^3 of the toilet cleaner ?
- A. pipette
 - B. burette
 - C. measuring cylinder
 - D. volumetric flask
17. What is the colour change at the end point of the titration ?
- A. from colourless to pink
 - B. from pink to colourless
 - C. from yellow to red
 - D. from red to yellow
18. What is the concentration of sulphuric acid in the undiluted toilet cleaner ?
- A. 1.29 M
 - B. 2.58 M
 - C. 5.15 M
 - D. 10.3 M
19. A compound with an ester functional group has a molecular formula of $\text{C}_4\text{H}_8\text{O}_2$. What is the number of possible structures of the compound ?
- A. 3
 - B. 4
 - C. 5
 - D. 6
20. A black powder is suspected to be carbon or a mixture of carbon and copper(II) oxide. Which of the following methods can be used to identify the black powder ?
- (1) adding dilute sulphuric acid to the powder
 - (2) adding sodium hydroxide solution to the powder
 - (3) heating the powder strongly
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only

21. Consider the following experiment :



Which of the following statements concerning the experiment are correct ?

- (1) Gas bubbles are evolved at electrode X.
 (2) An orange colour gradually appears in the solution around electrode Y.
 (3) The experiment can be used to show that ions migrate towards oppositely charged electrodes.
- A. (1) and (2) only
 B. (1) and (3) only
 C. (2) and (3) only
 D. (1), (2) and (3)
22. Iodine is a solid at room temperature and pressure. Which of the following statements concerning the structure of iodine is/are correct ?
- (1) Iodine has a giant covalent structure.
 (2) Iodine molecules are held together by van der Waals' forces.
 (3) Iodine atoms are held together in pairs by covalent bonds.
- A. (1) only
 B. (2) only
 C. (1) and (3) only
 D. (2) and (3) only

Directions : Each question below (Questions 23 to 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. Bromine water can be used to distinguish between sodium sulphate solution and sodium sulphite solution. | Bromine can be reduced by sodium sulphite to colourless bromide ions, but not by sodium sulphate. |
| 24. Carbon dioxide and silicon dioxide have similar physical properties. | The atoms of carbon and silicon have the same number of electrons in their outermost shells. |

END OF SECTION A

PERIODIC TABLE 週期表

GROUP 族

atomic number 原子序

1 H 1.0

relative atomic mass 相對原子質量

I		II														0			
3 Li 6.9	4 Be 9.0													2 He 4.0					
11 Na 23.0	12 Mg 24.3													5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
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)

B

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COMBINED SCIENCE — CHEMISTRY (Sample Paper)

SECTION B : Question-Answer Book B

This paper must be answered in English.

INSTRUCTIONS

- (1) Write your Candidate Number in the space provided on Page 1.
- (2) Stick barcode labels in the spaces provided on Pages 1, 3 and 5.
- (3) This section carries 56 marks. Answer ALL questions.
- (4) 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) 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. Tie them loosely but securely with a string INSIDE this Question-Answer Book.
- (6) A Periodic Table is printed on the back of this Question-Answer Book. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

Please stick the barcode label here.

Candidate Number

	Marker's Use Only	Examiner's Use Only
	Marker No.	Examiner No.
Question No.	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
9		
Total		

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

1. State whether each of the following statements is true or false. Explain your answer in each case.

(a) The melting point of sodium chloride is much higher than that of methane because the ionic bonding in sodium chloride is much stronger than the covalent bonding in methane.

(b) When concentrated sulphuric acid is diluted, water should be added slowly to the acid.

(c) A is a stronger acid than B, so that pH of an aqueous solution of A must be lower than that of B.

(6 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.

Please stick the barcode here.

2. Polyethene is used in making shopping bags and its monomer is ethene.

- (a) Draw the electronic diagram of ethene, showing electrons in the *outermost shells* only.
- (b) Name the type of polymerisation involved in the production of polyethene.
- (c) State ONE property of polyethene that makes it suitable for making shopping bags.
- (d) (i) Suggest ONE way to dispose of polyethene wastes.
- (ii) Give ONE advantage and ONE disadvantage of the way you have suggested in (i).

(6 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.

3. X , Y and Z are three different metals. The table below lists the results of three experiments carried out using the metals or their oxides.

Experiment	X	Y	Z
Adding metal to cold water	formation of a colourless gas	no observable change	no observable change
Adding metal to copper(II) sulphate solution	formation of a colourless gas and a reddish brown solid	formation of a reddish brown solid	no observable change
Heating metal oxide with carbon powder	no observable change	formation of a solid with metallic lustre	formation of a solid with metallic lustre

- (a) What is the colourless gas formed when X is added to cold water ? Suggest a test for the gas.
- (b) Name the type of reaction that occurs when the oxide of Y is heated with carbon powder.
- (c) Arrange the three metals in order of increasing reactivity. Explain your answer.
- (d) Why is a colourless gas formed when X is added to copper(II) sulphate solution ?

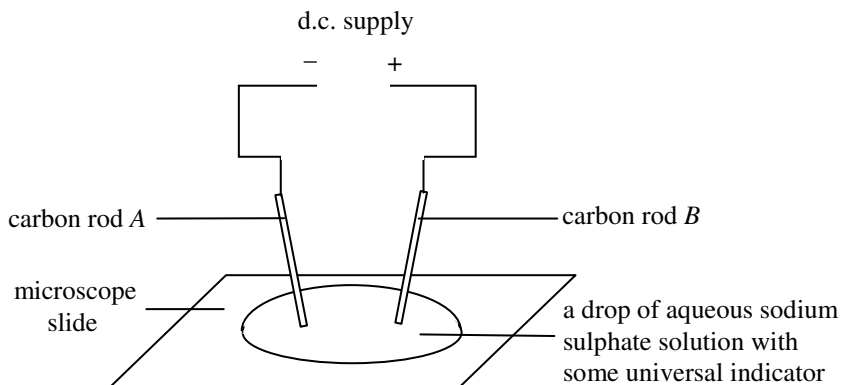
(7 marks)

Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

4. A student used the set-up shown below to conduct a microscale experiment on electrolysis.



- (a) (i) The initial colour of the drop shown above was green. State the colour change of the liquid around carbon rod A after a current was passed through the circuit for some time. Explain your answer with the help of a half equation.
- (ii) A gas was liberated at carbon rod B. What was the gas? Explain its formation.
- (b) Some objects readily available in daily life contain carbon rods which can be used in this experiment. Suggest ONE such object.

(6 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.

5. The standard enthalpy changes of combustion ($\Delta H_{c, 298}^{\ominus}$) of cyclohexa-1,3-diene (C_6H_8), cyclohexane (C_6H_{12}) and hydrogen are as follows:

$$\Delta H_{c, 298}^{\ominus} [C_6H_8(l)] = -3584 \text{ kJ mol}^{-1}$$

$$\Delta H_{c, 298}^{\ominus} [C_6H_{12}(l)] = -3924 \text{ kJ mol}^{-1}$$

$$\Delta H_{c, 298}^{\ominus} [H_2(g)] = -286 \text{ kJ mol}^{-1}$$

Write a chemical equation to represent the complete hydrogenation of cyclohexa-1,3-diene. Hence, calculate the standard enthalpy change of hydrogenation of cyclohexa-1,3-diene.

(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.

6. Ethyl ethanoate is an ester. It can be prepared by heating a mixture of ethanoic acid and ethanol under reflux in the presence of a catalyst.

- (a) What is the catalyst used in the preparation ?
- (b) Draw a labelled diagram of the set-up used for heating the mixture under reflux.
- (c) Ethyl ethanoate is commonly used as a solvent. Explain why ethyl ethanoate can dissolve iodine but cannot dissolve sodium iodide.
- (d) Draw the structure of another ester which has the same molecular formula as ethyl ethanoate, and give its systematic name.

(8 marks)

Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

7. Complete the table below by

- (a) drawing a three-dimensional diagram for the structure of each solid substance, and
(b) giving an explanation of whether the solid substance is an electrical conductor.

Solid substance	Three-dimensional diagram for the structure of the solid substance	Explanation of whether the solid substance is an electrical conductor
diamond		
graphite		
caesium chloride		

(6 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.

8. For each of the following experiments, state an expected observation and write a chemical equation for the reaction involved.

(a) adding dilute hydrochloric acid to zinc granules

(b) adding sodium hydroxide solution to iron(II) sulphate solution

(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.

