Exam Paper Format

The latest HKCE Chemistry Examination, starting from 2005, consists of two papers.

	Paper 1	Paper 2
Types of questions	Conventional questions	Multiple-choice questions
Duration	1 hour 45 minutes	1 hour
Percentage share of the total subject marks	64%	36%
Details of the papers	Section A • 60% of paper mark • All questions are compulsory. • Consists of questions set on the Core part of the syllabus. Section B • 40% of paper mark • All questions are compulsory. • Consists of questions set on the whole syllabus.	Section A • 60% of paper mark • All questions are compulsory. • Consists of questions set on the Core part of the syllabus. Section B • 40% of paper mark • All questions are compulsory. • Consists of questions set on the whole syllabus.

(c) Extension parts of the syllabus

Some parts of the syllabus form the extension. Only questions in Section B of the examination paper will involve these parts.

Sections	Topics of the extension part
1 Planet Earth	——
2 The Microscopic World	• Predicting the chemical properties of unfamiliar elements in Groups I, II, VII and 0 of the Periodic Table
3 Metals	• Empirical formulae derived from experimental data • Corrosion resistance of aluminum • Anodisation as a method to enhance corrosion resistance of aluminium
4 Acids and Alkalis	• Strength of acids and alkalis • Preparation of soluble and insoluble salts based on neutralisation • Simple volumetric work involving acids and alkalis • Rate of reaction
5 Chemical Cells and Electrolysis	• Nitric acid of different concentrations as oxidizing agent to give NO and NO_2 • Reactions in chemical cells consisting of half cell(s) other than metal-metal ions systems • Reactions in zinc-carbon cell • Electrolysis
6 Products from Important Processes	• Manufacture of chlorine by electrolysis of brine • Designing and performing experiments to make chlorine bleach • Molar volume of gases at room temperature and pressure • Calculations involving molar volume of gases • Chemical plants
7 Fossil Fuels and Carbon Compounds	——
8 Plastics and Detergents	• Condensation polymerization as exemplified by the formation of nylon and polyester • Production of soaps by reacting fats or oils with an alkali • Cleaning abilities of soaps and soapless detergents in hard water • Environmental problems associated with the use of detergents
9 Detection and Analysis	• Designing and performing an investigation to deduce the chemical nature of a given sample

Distribution of

Topic \ Year	1993	1994	1995	1996	1997	1998
Planet Earth	—	—	—	—	—	—
The Microscopic World	2b, 4a	1(a-b), 7b	1a, 4	7a	—	1a, 7a
Metals	1(ai, ii)	1(bi, c-d, eii), 6a	3(bi, ii, vi), 6(biii)	4, 6(aiii)	1a	8(bi-vi)
Acids and Alkalis	1b, 3b, 4b	1, 5a, 8a	5, 7a	1, 6b	3, 7a	3, 4, 6a, 8
Chemical Cells and Electrolysis	2a	7a	9a	6a, 9b	9b	6b, 9b
Products from Important Processes	5b	8b	8b	8(biii)	8a, 6b	9b, 8a
Fossil Fuels and Carbon Compounds	—	6a	8a, 7b	2, 3(a-b, d)	9a, 5	2(a-b), 9a
Plastics and Detergents	1e	3	9a, 6(aiv)	7b	1c, 7(bi-iii)	7b
Detection and Analysis	—	1(ei), 8b	8(bii)	6(ai), 8(biii)	7(aiii), 9(aii2)	—

Exam Questions

Topic \ Year	1999	2000	2001	2002	2003	2004
Planet Earth	—	—	—	—	—	—
The Microscopic World	4	1, 2(a-b), 8c	8a	6b, 8b	1(a-b), 3(a, bii)	5, 6(bii), 9a
Metals	2c	3(a, b), 9(ai)	4, 5	—	2, 3(bi)	1, 8(a-b)
Acids and Alkalis	7b	1, 4, 6a, 7a	2, 6a	6a, 7a, 9(a-b)	6a, 8b	2b, 7(a, ci)
Chemical Cells and Electrolysis	6a, 8a	6a	8(aiii), 9(a-b)	9c	7a, 9a	6(a, bi, iii)
Products from Important Processes	9a	8(cii)	9(c-d)	9b	7(ci), 6(aiv)	9(av), 7(ci) 8(aii)
Fossil Fuels and Carbon Compounds	3, 6(bii-iii), 9b	8(a-b), 9b	3c, 7b	5, 6c, 8a	7b, 9c	3(a, b),4, 8c, 9b
Plastics and Detergents	1	6(cii), 7b	6(a, c), 7a	8c	5	6c, 7(b, cii)
Detection and Analysis	4, 5, 6(aiii), 8(aiii)	—	9(aii)	—	2a, 7c	2(a-b)

Practice

Section A

1. Crude oil can be separated into various fractions by fractional distillation. The following diagram shows one part of an industrial plant that provides with an important source of fuels and raw materials.

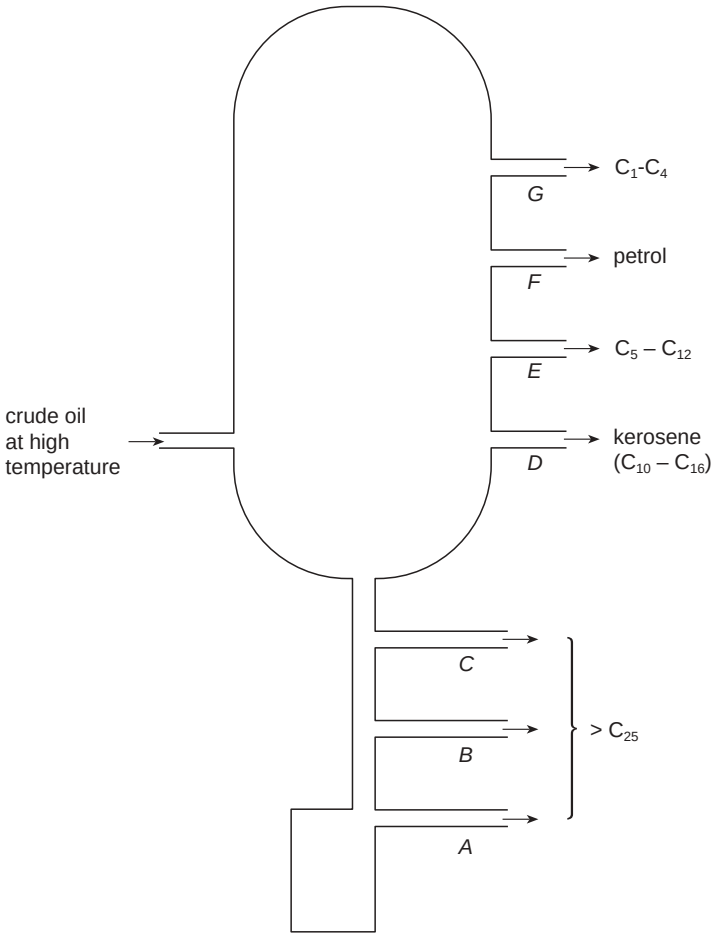


Figure 7.14

(a) Describe the principle underlying the fractional distillation of crude oil.

(b) Give ONE example of a product at each of the outlets *A*, *E* and *G*.

(c) The annual production of petrol is not sufficient to meet the annual consumption requirements.
   (i) Explain why there is insufficient petrol for the global demand.
   (ii) Catalytic cracking of kerosene can produce petrol. State the conditions required for the catalytic cracking.

(d) In Hong Kong, the fraction ($C_5 – C_{12}$) instead of coal is used to manufacture town gas.
   (i) State ONE advantage of using the fraction ($C_5 – C_{12}$) instead of coal for the manufacturing of town gas. Hint 1
   (ii) State TWO potential hazards associated with the use of town gas.

(11 marks)

8 Plastics and Detergents

Review

8.1 Plastics

Introduction of plastics

- The following table lists the differences between addition polymerization and condensation polymerization:

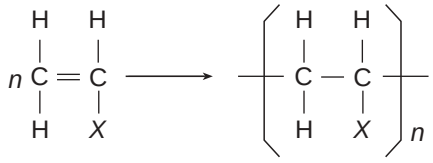
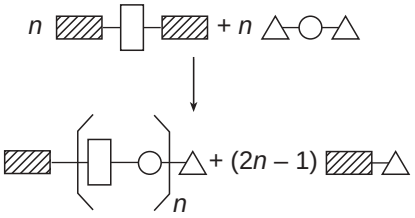
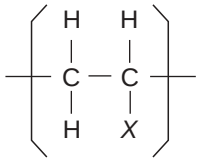
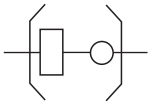
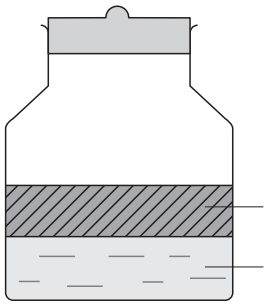
	Addition polymerization	Condensation polymerization
Definition	A process in which monomers join together to form a polymer.	A process in which monomers react together to form a polymer and a small molecule.
Monomers	Contain a C = C double bond	The reaction generally involves two different monomers. Each monomer generally contains a bi-functional group.
General equations		
Repeating unit		

Table 8.1

Demonstration

Section A

1.



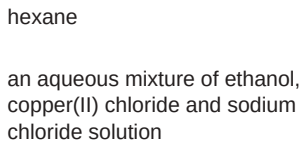


Figure 9.3

The above reagent bottle contains chemical waste in school laboratory. Describe and explain how you would obtain sodium chloride solution from the chemical waste.

(6 marks)

Suggested Answer

Add the chemical waste to a *separating funnel*. 1
Separate the hexane layer from the aqueous solution because *hexane and water are immiscible*. 1
Separate the ethanol from the aqueous solution by *fractional distillation / simple distillation*. 1
Add *excess sodium hydroxide solution* to the aqueous layer, 1
then the copper(II) ions will form *a bluish white precipitate* of copper(II) hydroxide. 1
Filter off the copper(II) hydroxide precipitate. 1
Finally, sodium chloride solution will be obtained from the filtrate.

Guidelines

The formation of copper(II) hydroxide is due to precipitation:
$Cu^{2+}(aq) + 2OH^{-}(aq) \rightarrow Cu(OH)_2(s)$

2. The following table provides some information about the oxides of carbon, silicon and sulphur:

Oxides	Carbon dioxide	Silicon dioxide	Sulphur dioxide
Boiling point	Low	High	Low
Solubility in water	Slightly soluble	Insoluble	Very soluble

Table 9.9

(a) Explain why silicon dioxide has a high boiling point but carbon dioxide and sulphur dioxide have a low boiling point.

Guidelines

Silicon dioxide has a giant covalent structure but carbon dioxide has a simple molecular structure.

CE

CHEM

Mock Examination 1

CHEMISTRY PAPER 1

Question-Answer Book

$1\frac{3}{4}$ hours

This paper must be answered in English

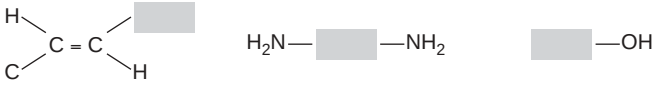
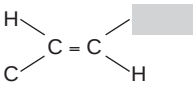
1. This paper consists of TWO sections, Section A and Section B. Section A carries 54 marks and Section B carries 36 marks.

2. Answer ALL questions in each section.

3. A Periodic Table is printed on page 1 of this Question-Answer Book. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

Question Commands

The following table lists the question command(s) which showing the requirements of answering questions:

Question commands	Examples
What / Which ... (Simple answer is usually required.)	What gas evolves? Correct answer: Sulphur dioxide / SO_2 What is the direction of electron flow in the external circuit? Correct answer: From left to right Which of the following compounds can be used to make an addition polymer?  Correct answer: 
Suggest a formula ...	The oxide of aluminium is insoluble in water, suggest the formula for this oxide. Correct answer: Al_2O_3 Incorrect answer: Aluminium oxide
Name ... (Formula / Structure is NOT accepted.)	Name an element which is a metalloid. Correct answer: Boron Incorrect answer: B
Write the chemical equation ... (Although either chemical / ionic equation is accepted. The best answer should be a chemical equation.)	Write a chemical equation for the reaction when adding dilute hydrochloric acid to zinc granules. Correct answer: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (chemical equation) Poor answer: $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$ (ionic equation)
Write the chemical equation ...	Write a chemical equation for the reaction between sodium and water. State symbols should be given. Correct answer: $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ (Score 2 marks) Poor answer: $2Na + 2H_2O \rightarrow 2NaOH + H_2$ (Score 1 mark only) (Remarks: 1 mark for equation and 1 mark for state symbols)
Write an ionic equation ...	Write an ionic equation for the reaction when adding hydrochloric acid to sodium carbonate. Correct answer: $2H^+ + CO_3^{2-} \rightarrow H_2O + CO_2$ Incorrect answer: $2HCl + Na_2CO_3 \rightarrow H_2O + CO_2 + 2NaCl$

Solution Guide

5 Chemical Cells and Electrolysis

Section A

1. (a) $Cr_2O_7^{2-}(ag)$ is ***dichromate***. 1
   The colour of $Cr_2O_7^{2-}(ag)$ is ***orange***. 1

   (b) (i) The oxidation number of chromium in $Cr_2O_7^{2-}$ is +6. 1
   (ii) The oxidation number of chromium in CrO_4^{2-} is +6. 1

   (c) (i) $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ 1
   (ii) ***No***, there is ***no change in the oxidation number***. 1 + 1

   (d) (i) ***Zinc metal*** would dissolve and 1
   the solution would change from green to blue. 1
   (ii) $Zn(s) + 2Cr^{3+}(aq) \rightarrow Zn^{2+}(aq) + 2Cr^{2+}(aq)$ 2

   Reminder
   - M: equation
   - M: state symbols

2. (a) Chlorine is ***oxidized*** and ***reduced*** at the same time 1
   because the ***oxidation number of chlorine changes from 0 to +1 and –1.*** 1

   (b) (i) $3NaClO \rightarrow NaClO_3 + 2NaCl$ 1
   (ii) $3Cl_2 + 6NaOH \rightarrow NaClO_3 + 5NaCl + 3H_2O$ 1

   (c) A daily use for ClO^- is bleaching agent. 1

3. (a) (i) To ensure better electrical conduction. 1
   OR To remove any oxide layer that may have formed on the surface of the metal. 1
   (ii) Voltmeter / Multimeter / Galvanometer / Ammeter 1

   (b) (i) $X < Y < W < Z$ 4
   (ii) $Z \rightarrow Z^{2+} + 2e^-$ 1
   (iii) No, because liquid benzene does not conduct electricity. 1 + 1

4. Both reduction and oxidation must occur together. This type of reaction is called a redox reaction. 1
   Redox reactions can be defined in terms of oxygen transfer.
   - Oxidation: the addition of oxygen to a substance.
   - Reduction: the removal of oxygen from a substance. } 1

   $$CO + ZnO \xrightarrow{\text{reduction}} CO_2 + Zn$$
   (oxidation) 2

   Reminder
   - M: equation
   - M: showing reduction and oxidation

   Redox reaction can also be defined in terms of electron transfer.
   - Oxidation: loss of electrons
     $Mg \rightarrow Mg^{2+} + 2e^-$ } 1