



Coimisiún na Scrúduithe Stáit State Examinations Commission

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Scrúduithe Ardteistiméireachta, 2005

Ceimic

Gnáthleibhéal

Marking Scheme

Leaving Certificate Examination, 2005

Chemistry

Ordinary Level



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State Examinations Commission**

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Marking Scheme

Introduction

In considering the marking scheme the following should be noted.

1. In many cases only key phrases are given which contain the information and ideas that must appear in the candidate's answer in order to merit the assigned marks.
2. The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable.
3. The detail required in any answer is determined by the context and the manner in which the question is asked, and by the number of marks assigned to the answer in the examination paper, and in any instance, therefore, may vary from year to year.
4. The bold text indicates the essential points required in the candidate's answer. Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable. A word or phrase in bold, given in brackets, is an acceptable alternative to the preceding word or phrase. Whilst only key words and phrases are indicated in the marking scheme they must be presented in answers in a correct context if full marks are to be awarded.
5. In general names and formulas of elements and compounds are equally acceptable except in cases where either the name or the formula is specifically asked for in the question. However, in some cases where the name is asked for, the formula may be accepted as an alternative.
6. There is a deduction of one mark for each arithmetical slip made by a candidate in a calculation.

Outline Marking Scheme

Eight questions to be answered in all. These *must* include at least two questions from Section A.

Section A

Question 1

(a), (2×4) ; (b), (6); (c), (6); (d), (6); (e), (6); (f), (6); (g), (6); (h), 6

Question 2

(a), (2×4) ; (b), $(3 + 3 \times 3)$; (c), (3×3) ; (d), (9); (e), $(6 + 2 \times 3)$

Question 3

(a), (2×4) ; (b), $(6 + 2 \times 3)$; (c), $(2 \times 3 + 9 + 3)$; (d), (6); (e), (6)

Section B

Question 4

Eight highest scoring items to count.

One additional mark to be added to the first two items for which the highest marks are obtained.

(a), (6); (b), (6); (c), (2×3) ; (d), (2×3) ; (e), (6); (f), (6); (g), (6); (h), (6); (i), (6); (j), (6); (k), (2×3)

Question 5

(a), (7); (b), (7); (c), (6); (d), (6); (e), (6); (f), (6); (g), (6); (h), (6)

Question 6

(a), (i), $(3 + 2)$; (ii), (6); (iii), (6); (b) (i), (2×6) ; (ii), (6); (iii), (3×3) ; (iv), (6)

Question 7

(a), (2×4) ; (b), (i), (3×3) ; (ii), (3×3) ; (c), (6); (d), (6); (e), (2×6)

Question 8

(a), (5); (b), (6); (c), (2×6) ; (d), $(6 + 2 \times 3 + 3)$; (e), (2×6)

Question 9

(a), (6×6) ; (b), $(6 + 2 \times 4)$

Question 10

(a), (7, 6, 6, 6)

(b), $(4 + 3, 9, 9)$

(c), $(6 + 4 \times 3, 4 + 3)$

Question 11

(a), $(6 + 3 \times 3, 5, 5)$

(b), $(4 + 3, 6, 6, 6)$

(c), **A**, $(4, 3, 3, 3 \times 3, 6)$

B, $(4, 6, 2 \times 3, 6, 3)$

Question 1

- (a) Identify: **Pumice stones / Porcelain pieces / Glass beads / Boiling chips / Anti-bumping chips** (4)
Purpose: **Prevent bumping** (4)
- (b) Ox. Agent: **Sodium chromate / Sodium dichromate / Corresponding potassium salts potassium permanganate [manganate(VII)], etc. name or formula** (6)
- (c) Colour: **Matched with choice of oxid. agent in (b)** (6)
[Chromates: yellow; dichromates: orange; permanganate: purple]
- (d) Colour: **Green // In case of permanganate: colourless / pale pink / muddy brown** (6)
- (e) Distill: **Prevent excess oxidation / prevent oxidation of product / avoid production of ethanoic acid / due to volatility of product** (6)
- (f) Not heated: **Reaction is exothermic** (6)
- (g) Cooled: **Product volatile / Ethanal low B.P.** (6)
- (h) Colour: **Brick red** (6)
[Accept "brown"]

Question 2

(a) A: **Burette** (4)

B: **Pipette** (4)

(b) Which: **Acid** (3)

Rinsing: Wash with deionised **water** / distilled **water** //

Use funnel when filling //

Wash with **hydrochloric acid** / **solution it is to contain** //

Make sure tap region is free of air bubbles //

Bottom of meniscus level with zero mark / **read bottom of meniscus** /

read at eye-level (any 3 × 3)

(c) Indicator: **Methyl orange** / **methyl red** / **phenolphthalein** (3)

Colours: **Yellow** / **orange** / **pink (purple)** to (3)

Pink [Accept **peach**] / **red** / **colourless** (3)

[Colours must be matched with indicator. If colours reversed allow 3 marks]

(d) Conc.: **0.11 M** (9)

$$\frac{25 \times 0.10}{1} \quad (3) = \frac{22.6 \times M}{1} \quad (3)$$

$$\text{Concentration} = \mathbf{0.11 M} \quad (3)$$

(e) Salt: **Repeat using volumes of acid and base from the titration** /

No indicator is added this time /

Evaporate to dryness /

By heating in a beaker (or evaporating dish) (6 + 2 × 3)

Question 3

- (a) Catalyst: **Alters the rate of a chemical reaction** not consumed in the process (4)
Name: **Manganese dioxide** [Accept formula] (4)
- (b) Diagram: **Reaction vessel //**
Reagent(s) identified in vessel //
Delivery tube from reaction vessel to suitable means of gas collection //
Graduated collection vessel (6 + 2 × 3)
[No diagram – deduct 3 marks; diagram to have at least one correct label]
- (c) Graph: **Labelled and scaled axes** (2 × 3)
Points plotted correctly (9)
[allow 6 marks if 6 or 7 points plotted correctly;
allow 3 marks if 4 points plotted correctly]
Curve drawn (3)
- (d) Why?: **Concentration of hydrogen peroxide decreases** (6)
[Allow 3 marks for “*reactants being used up*”]
- (e) Volume: **45 ± 3 cm³** (6)

Question 4

Add one mark to the mark awarded to the first two items for which the highest mark is awarded.

- (a) Name: **Mendeleev** (6)
- (b) Nature: **Helium nuclei // Two protons + two neutrons** (6)
- (c) Define: **Measure of the force of attraction** that the nucleus of an atom of an element //
Has for a **pair of electrons in a covalent bond (shared pair of electrons)** (2 × 3)
- (d) Name: **Bomb // Calorimeter** (2 × 3)
- (e) Acid: **Methanoic acid / Formic acid / HCOOH** (6)
- (f) Conc.: **960 p.p.m.** (6)

$$\frac{0.480}{500} \times 1000 (3) \times 1000 (3) = 960$$

- (g) El. Config.: **2, 8, 8, 2** (6)

[Allow 3 marks for filling the first two shells correctly i.e. 2, 8]

- (h) cm³: **12 cm³** (6)

$$\frac{30}{100} (3) \times 40 (3) = 12$$

- (i) K_c: (6)

$$\frac{[\text{NH}_3]^2}{[\text{H}_2]^3 \cdot [\text{N}_2]}$$

[Allow 3 marks for top or bottom correct or 3 marks for inverted expression]

- (j) Redn.: Reduction involves the **gain** of electrons (6)

- (k) Ozone: **O₃** (3)

Benefit: **Screens harmful uv / Lower skin cancer incidence / etc.** (3)

or

Props.: Exhibit **variable valency (oxidation no.) // Form coloured compounds //**
Are often **catalysts** (2 × 3)

Question 5

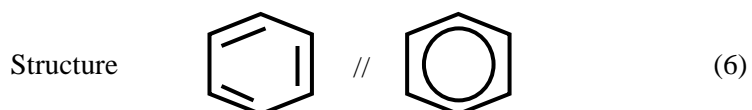
- (a) **The Greeks** (7)
- (b) **Dalton** (7)
- (c) **Thomson** (6)
- (d) **Rutherford** (6)
- (e) **Bohr** (6)
- (f) **Becquerel** (6)
- (g) **Curie** (6)
- (h) **Moseley** (6)

Question 6

(a) (i) Homol.: Compounds with the **general formula (same functional group) //**
Differing in formula by CH₂ (3 + 2)

(ii) Structure: **H-C ≡ C-H** (6)

(iii) Product: Name or structure:
Benzene //



[Allow 3 marks for a 6-membered ring]

(b) (i) Solid: **Calcium carbide / calcium dicarbide / calcium acetylide / CaC₂ /**
any correctly named dicarbide (6)

[Accept "carbide" for 3 marks]

Liquid: **Water / H₂O** (6)

(ii) Describe: **Soot / smoke / luminous flame** (6)

(iii) Describe: **Add / bubble //**

Bromine water to sample of gas //

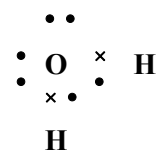
Bromine water solution **decolourises** (3 × 3)

(iv) Give: **Welding / cutting** steel (6)

Question 7

- (a) (i) ionic: Involving **oppositely charged ions** (4)
covalent: Involving **shared pair(s) of electrons** (4)

- (b) Describe (i): **Valence shell of oxygen with 6 electrons //**
Hydrogen atom with one valence electron //
Oxygen combined with two hydrogen atoms with a single
shared pair of electrons between each hydrogen and oxygen (3 × 3)



- Describe (ii): **Valence shell of sodium with 1 electrons //**
Valence shell of chlorine with 7 electrons //
Electron transfer from sodium to chlorine / formation of a sodium ion and a
chloride ion (3 × 3)

- (c) What?: **Bent / angular / “v”-shaped** (6)
[Words like “planar” do not merit marks but do not invoke cancelling]

- (d) Colour: **Yellow / Orange** (6)

- (e) Observation: **Stream of water attracted to rod / Stream of water deflected** (6)
[Allow 3 marks for deflected away from rod]

- Property: **Polarity** (6)

Question 8

- (a) Which?: **Y / Ethene / C₂H₄ / CH₂CH₂** (5)
- (b) Name: **Ethene** (6)
- (c) Conv. (i): **Elimination** (6)
Conv. (ii): **Addition** (6)
- (d) Diagram: **Horizontal test tube //**
Delivery tube connected //
Collection of gas over water //
Ethanol held at back of test tube //
Bunsen burner for heating (6 + 2 × 3)
[minimum of one label required – no labels deduct 3 marks]
- Identify: **Aluminium oxide / Al₂O₃ / alumina** (3)
- (e) Reagent (i): **HCl / hydrogen chloride** (6)
[Allow 3 marks for hydrochloric acid]
Reagent (ii): **Sodium / Na** (6)

Question 9

- (a) 1: **Flocculation** (6)
2: **Sedimentation** (6)
3: **Chlorination** (6)
4: **pH adjustment** (6)
5: **Fluoridation** (6)
6: **Filtration** (6)

- (b) Two subst.: **Nitrates // Phosphates**
State: **Eutrophication / algal bloom** (6 + 2 × 4)
[Allow 3 marks for “*enrichment*”]

Question 10

- (a) (i) **Residue** (7)
(ii) **Refinery gas** (6)
(iii) **Kerosene / naphtha** (6)
(iv) **Gas oil / kerosene** (6)

- (b) (i) Define: **Minus the log to the base 10 // of the hydrogen ion concentration** (4 + 3)

- (ii) What?: **0.1 molar** (9)

$$3.65 \div (3) \mathbf{36.5} (3) = 0.1 (3)$$

[i.e. allow 3 marks for getting the correct M_r for HCl and 3 marks for knowing that the 3.65 is to be divided by the M_r]

- (iii) pH: **1** (9)

$$\mathbf{pH} = -\log_{10} (3) \mathbf{[0.1]} (3) = \mathbf{1} (3)$$

- (c) (i) Describe: **Two methods**

Comparator (6 + 4 × 3)	Colorimeter (6 + 4 × 3)
Take known volume of water / fill the compartment(s) with water // Add DPP tablet(s) // Crush / stir // Colour develops // Add sample to cuvette // Compare colour with colour card	Take known volume of water // Add iodide and acid // to release iodine / colour develops // Add sample to cuvette // Insert in colorimeter // Take reading // Compare value with calibration graph

- (ii) Outline: **Colour developed // is directly related to the concentration** (4 + 3)

Question 11

(a) (i) Describe: **Three methods**

Paper Chromatography	Thin-layer chromatography	Column chromatography
Apply mixture using dropper (capillary tube) / spotting on paper //	Apply mixture using dropper (capillary tube) / spotting on plate //	Dissolve mixture in solvent (eluent) / apply mixture to top of column //
About 2 cm above bottom of sheet / just above eluent (or from top – see below) //	About 2 cm above bottom of plate / just above eluent //	Add to top of column / add solvent to top of column //
Place in eluent (solvent, mobile phase) in tank (sample above solvent) //	Place in eluent (solvent, mobile phase) in tank (sample above solvent) //	Continue to add eluent (solvent, mobile phase) so that it flows down through column //
Elute (solvent moves up – or down – see below) //	Elute (solvent moves up) //	Separation occurs / bands shown //
Remove when eluted //	Remove when eluted	Collect different components / show separation into bands
State or show separation of components of mixture	State or show separation of components of mixture.	
All (6 + 3 × 3) written or through a labelled diagram or diagrams (See N.B. below.)		

Note: in paper chromatography, the solvent may be at the top of the tank with the mobile phase moving down.

N.B. no diagram – or diagram not having at least one label – : deduct 3, if at least 3 marks have been awarded.

(ii) Stat. phase: **Water on paper / water / paper / silica gel / alumina** (as appropriate) (5)

(iii) Use: **Separation of dyes (paints) / analysis of drugs** (5)

- (b) (i) Formula: **CuSO₄**
 Colour: **Blue** (4 + 3)
- (ii) State: **Loses weight / gets thinner / corrodes** (6)
- (iii) Electroplate: **B** (6)
- (iv) Purify: **A** (6)

- (c) **A**
- (i) How?: **Liquefaction / fractional distillation/ diffusion** (4)
- (ii) State (O): **Cutting torches (tools) / specified medical use** (3)
- State (N): **Ammonia synthesis / as an inert gas** (3)
- (iii) Nit. Fix.: **Conversion of atmospheric nitrogen // To nitrogen compounds that can be used (chemically reactive)** (2 × 3)
- Important: **Generates plant nutrients / chemically active sources of nitrogen** (3)
- (iv) Way: **Electrical storms / legumes / nitrogen fixing bacteria** (6)

B

- (i) Name: **Davy** (4)
- (ii) Corrosion: **React with environment to form compounds / oxidise** in the atmosphere (6)
- (iii) Galv: **Dipping in molten / coating with // zinc** (2 × 3)
- (iv) Prevent: **Sacrificial metal / zinc corrodes instead / protective barrier** (6)
- (v) State: **Oiling / greasing / painting / tin plating / electroplating** (3)