Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scéimeanna Marcála	Scrúduithe Ardteistiméireachta, 2007
Ceimic	**Gnáthleibhéal**

Marking Scheme	Leaving Certificate Examination, 2007
Chemistry	**Ordinary Level**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2007

Chemistry - Ordinary Level

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), (2 × 6); (d), (6); (e), (6); (f), (2 × 6)

Question 2
(a), (5); (b), (9 + 3); (c), (3 × 3), (3), (3); (d), (3), (2 × 3); (e), (9)

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

Question 5
(a), (3), (3), (6), (3); (b),(5), (6), (6 + 3 + 3); (c), (6), (6)

Question 6
(a), (5 + 3); (b), (6), (2 × 3); (c) (6); (d), (6); (e), (6), (3), (3); (f), (6)

Question 7
(a), (4), (4); (b), (2 × 3), (2 × 3), (2 × 3); (c), (3), (6); (d), (6 + 3); (e), (6)

Question 8
(a), (5); (b), (3 × 3); (c), (2 × 6), (6), (2 × 3); (d), (2 × 6)

Question 9
(a), (5); (b), (6); (c), (6 + 3 + 3); (d), (2 × 3), (6), (6); (e), (6); (f), (3)

Question 10
(a), (i), (4 + 3); (ii), (2 × 3); (iii), (3); (iv), (9)
(b), (i), (4 + 3); (ii), (4 × 3); (iii), (6)
(c), (i), (4 + 3); (ii), (3 × 3); (iii), (3); (iv), (2 × 3)

Question 11
(a), (5 × 5)
(b), (i), (6); (ii), (6); (iii), (6); (iv), (7)
(c) **A:** (i), (4 + 3); (ii), (2 × 3); (iii), (6); (iv), (2 × 3)
B: (i), (7); (ii), (2 × 3); (iii), (6); (iv), (6)

Question 1

(a)	(i) Which:	**B**		(4)
		A		(4)
(b)	Draw:	**Drawing should clearly show water entering through lower intake point**		(6)
(c)	Why:	**As solvent / to dissolve**		(6)
	What:	**Boiling chips / pumice stones / glass beads / anti-bumping agent**		(6)
(d)	Why:	**To maximise yield / to minimise loss**		(6)
(e)	Why:	**To remove any sodium hydroxide present**		(6)
(f)	What:	(i) **Lather**		(6)
		(ii) **No lather / scum / ppt**		(6)

Question 2

(a) Name: **A**: **Pipette** (5)

(b) (i) Which: **Base** / **sodium hydroxide** / **NaOH** //

(ii) Why: **Burette** (9 + 3)

(c) (i) What: **Rinse with** deionised **water** // **rinse with solution it is to measure** //
fill above line // **release liquid until meniscus rests on line** (3 × 3)

(ii) Why: **Caustic solution** / **not want to swallow** /
possible infection transfer / cut with (chipped) **glass** (3)

(iii) State: **Allow drain (empty under gravity)** / **don't blow out last drop** /
touch tip against side of flask (3)

(d) Name: **Methyl orange** / **methyl red** / **phenolphthalein** (3)

Colours: **Yellow to orange (peach or pink or red)** / **yellow to red** /
pink (violet) to colourless (2 × 3)

[Colours must be matched]

[unmatched or reversed colours or correct final colour only allow 3 marks]

(e) Calc.: **0.11** M (9)

$$\frac{\mathbf{27.5 \times 0.10}}{\mathbf{1}} (3) = \frac{\mathbf{25.0 \times M}}{\mathbf{1}} (3)$$

Concentration = **0.11 M** (3)

Question 3

(a) What: **Energy change** //
when 1 mole is reacted / **reaction according to balanced equation** (3 + 2)

(b) How: **Increase** (6)

(c) What: **Insulation** / **reduction of heat loss** (6)

(d) How: **Allow temperature equalisation in advance (average initial temperatures) //**
use accurate thermometer (short range / **0.1 deg calibrated)** //
mix (stir) //
measure quickly //
plot temperatures //
record highest temperature reached (any two 6 + 3)

(e) Calc: (i) **0.05** moles (6)

50 ÷ 1000 *or* **vol. in litres × molarity (conc.)** (3)

(ii) **56** kJ (6)

2.8 × **20** *or* **(2.8** × **1000)/50** *or* **2.8 /0.05** (3)

(iii) **– 56** kJ mol^{-1} (6)

(f) What: **Neutralisation** (6)

Question 4

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

(a) State: **V-shaped** / **angular** / **bent** (6)

[allow 3 marks for tetrahedral]

(b) What: **8** g (6)

$$\frac{\mathbf{11.2}}{\mathbf{22.4}}\ (3)\ \times\ \mathbf{16}\ (3) = \mathbf{8}$$

(c) Give: **Steam reforming / of methane // Electrolysis** / **of water** (2 × 3)

(d) Name: **Bomb** / **calorimeter** (6)

(e) Write: $\dfrac{[NH_3]^2}{[H_2]^3.\,[N_2]}$ (6)

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

(f) Dist: **Temporary removed by boiling** / **caused by $(HCO_3)^{2-}$ salts of Ca^{2+} etc.** (6)

(g) Express: **56** ppm (6)

$$\frac{\mathbf{0.028}}{\mathbf{500}}\ \times\ \mathbf{1000}\ \ (3)\ \times\ \mathbf{1000}\ \ (3)\ =\ \mathbf{56}$$

(h) How: **Add barium chloride solution** // **white precipitate** (2 × 3)

(i) Define: electron **loss** (6)

(j) What: **dehydration** / **elimination** (6)

(k) Give: **packing crisps** / **inert gas blanket** (6)

or

Name: (**Electric) arc process** (6)

Question 5

(a) How: (i) **19** (3)

(ii) **20** (3)

(iii) **2, 8, 8, 1** (6)

[Allow 3 marks for 2, 8 for inner shells]

(iv) **1** (3)

(b) (i) Name: **Becquerel** (5)

(ii) Name: **Marie Curie** (6)

(iii) Half: **Time taken for half // of a sample to disintegrate (decay) //**

Alpha: **Helium nuclei (or composition)** (6 + 3 + 3)

(c) (i) Name: **Rutherford** (6)

(ii) Name: **Gold** (6)

Question 6

(a) What: **Measure / of the ability of a fuel** //
to resist knocking (cause knocking) (auto-ignite) **(prevent auto-ignition)**
(5 + 3)

(b) Name: **A**: **Heptane** (6)
B: **2,2,4-trimethyl // pentane** / ***iso*-//octane** (2 × 3)

(c) Which: **B** (6)

(d) Suggest: **Reforming** / **dehydrocyclisation** / **cracking** / **isomerisation** (6)

(e) Draw:  (6)

[allow 3 marks for six-membered ring with no double bonds (no resonance structure)]

Would: **High** (3)

Reason: **Ring structure** / **unsaturated** / **aromatic** (3)

(f) What: **Knocking** / **pinking** / **miss-firing** / **low power / autoignition** (6)

Question 7

(a) Define: (i) Involving **sharing of electron** pairs (4)

(ii) Involves **the attraction of oppositely charged ions / transfer of electrons** (4)

(b) (i) **Cl_2**: **2 chlorine atoms each with 7 valence electrons** (3)
formation of 1 shared pair (3)

(ii) **HCl**: **1 hydrogen atom with 1 electron & 1 chlorine atom each with 7 valence electrons** (3)
formation of 1 shared pair (3)

(iii) **NaCl**: **1 sodium atom with 1 valence electron & 1 chlorine atom with 7 valence electrons** (3)
formation of Na^+ and Cl^- ions (3)

(c) Polar bond: **Involving unequal sharing of electrons** (3)

Explain: **Electronegativity difference of elements high //**
chlorine has a greater hold on the shared electron (6)

(d) Which: **Sodium chloride //**
Give: **Ionic substance and polar solvent** (6 + 3)

(e) Name: **Hydrochloric acid** (6)

Question 8

(a) Which: **C / Chloroethane / CH_3CH_2Cl** (5)

(b) Give: **A**: **Ethyne**
B: **Ethene**
C: **Chloroethane** (3 × 3)

(c) (i) Identify: **X**: **water / H_2O** (6)
Y: **Calcium dicarbide / Calcium carbide / CaC_2** (6)
[allow 3 marks if reversed]

(ii) Explain: **Collection over water** (6)
[No diagram – deduct 3 marks]

(iii) Describe: **Decolourises** //
bromine water / acidified potassium **permanganate** (2 × 3)

(d) Identify: **HCl / hydrogen chloride** (6)
State: **Addition** (6)

Question 9

(a) Give: **MnO_2 // manganese dioxide** (5)

(b) Write: **$H_2O_2 \rightarrow \frac{1}{2}O_2 + H_2O$** (6)

[formulae placed correctly – 3 marks, balancing – 3 marks]

(c) Draw: **Suitable reaction flask**
Delivery tube
Collection over water / gas syringe
Inverted graduated cylinder /inverted burette / calibration on syringe

(Any three 6 + 3 + 3)

(d) Plot: **Labelled axes** (2 × 3)
All points plotted correctly (6)
[Allow 3 marks if at least 5 points are plotted correctly]
Curve drawn (6)

(e) Use: **38 ± 2** (6)

(f) Why: **Reaction rate increases with temperature** (3)

Question 10

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

(ii) Give: **Universal indicator** / **pH paper** / **pH meter** / **pH probe** (2 × 3)

(iii) Is: **Basic** (3)

(iv) Calc.: **12** (9)

pOH = **$-\log_{10}[0.01]$** / **= 2** (3)	**$K_w = [H^+][OH^-] / 1 \times 10^{-14} = [H^+][OH^-]$** (3)
pH = 14 – 2 (3)	**$[H^+] = 1 \times 10^{-12}$** (3)
pH = 12 (3)	**pH = $-\log_{10}[1 \times 10^{-12}]$** / **= 12** (3)

(b) (i) What: **Separation technique** // **based on partition of components between stationary and mobile phases** (4 + 3)

(ii) Give: **medium** //
application of sample //
elution (development) //
separation (4 × 3)
[No labelled diagram – deduct 3 marks]

(iii) Which: **tlc** (6)

(c) (i) What: **coming together (clumping) of tiny suspended particles** //
aluminium sulphate [$Al_2(SO_4)_3$] / **polyelectrolytes** (4 + 3)

(ii) Outline: Water passed through **graded** // **sand (stones)**
What: **Suspended** // **solids** Any three (3 × 3)

(iii) What: **Lime** / **$Ca(OH)_2$** / **CaO** / **base** / **alkali** / **named alkali** (3)

(iv) How: **Addition of fluoride ion (F^-)** / **sodium fluoride (NaF)** /
sodium hexafluorosilicate (Na_2SiF_6) / **antimony hexafluoride (SbF_6)** (3)
What: **Preventing tooth decay** (3)

Question 11

(a) 1: **The Greeks**
2: **Dalton**
3: **Davy**
4: **Mendeleev**
5: **Bohr** (5 × 5)

(b) (i) Which: **secondary** (6)

(ii) Which: **primary** (6)

(iii) Which: **tertiary** (6)

(iv) Why: they cause **eutrophication** / they cause **enrichment** / they are **plant nutrients** / **environmental damage** (7)

(c) **A**

(i) What: **prevention of the radiation of // heat absorbed from the sun** (4 + 3)

(ii) Name: **Carbon dioxide // water // methane // CFC(s) // HCFC(s) // HFC(s) // chloromethane // chloroethane // dinitrogen oxide (nitrogen (I) oxide, nitrous oxide) // PFC(s) // ozone // sulphur hexafluoride** (2 × 3)

(iii) Why: **Keeps planet warm // prevents temperature fluctuations** (6)

(iv) Give: **Global warming // melting ice-caps // climate change // flooding** (2 × 3)

B

(i) Suggest: **Platinum // silver** [allow carbon] (7)

(ii) Identify: **Lead (Pb) // bromine (Br_2)** (2 × 3)

(iii) Name: **Poisonous (toxic) fumes (vapours)** (6)

(iv) Name: **Faraday** (6)