Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2006

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), (i), (5); (ii), (6); (iii), (2 × 3); (iv), (3); (b), (i), (2 × 6); (ii), (6); (iii), (3); (c), (3 × 3)

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

Question 3
(a), (i), (8); (ii), (6); (b), (4 × 3); (c), (4 × 3 + 6); (d), (2 × 3)

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

Question 5
(a), (i) & (ii) (3 × 3 + 2); (b),(i), (6); (ii), (2 × 3); (iii), (2 × 3 + 6); (c), (2 × 3); (i), (3); (ii), (3); (iii), (3)

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

Question 7
(a), (i), (5); (ii), (6); (iii), (2 × 3); (iv), (2 × 3 + 3); (b), (i), (2 × 3); (ii), (9); (iii), (9)

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

Question 9
(a), (2 × 4) + (4 × 3); (b), (5 × 6)

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

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

Question 1

(a) (i) Identify: **Glass wool** / **roc(k)wool** (5)

(ii) Give: **Alumina** / **aluminium oxide** / **Al_2O_3** (6)

(iii) What: **Remove delivery tube from trough** / **dismantle apparatus** (3)
Why: **Prevent suck-back** (3)

(iv) Give: **Manufacture polythene (polyethene, plastic)** / **make ethylene glycol (ethane-1,2-diol, antifreeze)** / **make terylene** / **organic synthesis** / **ripen fruit** (3)

(b) (i) Identify: **X** = **Calcium carbide / calcium dicarbide / CaC_2** (6)
[accept any suitable carbide][allow 3 marks for *carbide*]
Y = **Water / H_2O** (6)

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

(iii) Give: **Welding torches** / **cutting torches** / **carbide lamps** (3)

(c) Describe: **Add** / **shake** / **bubble** //
Bromine solution / acidified **permanganate solution //**
Decolourises / **matched correctly specified colour change** (3 × 3)

Question 2

(a) Name: **A**: **Volumetric flask** (5)

(b) What: **Invert** [allow "shake" for 3 marks]

Why: **Mix / homogeneous solution** (6 + 3)

(c) What: **Solution whose concentration is known** (6)

(d) Calculate: **6.36** g (6)

Formula Mass = 106 (3)

106 × 0.06 = 6.36 g (3)

(e) Name: **B: Pipette** (3)
C: Burette (3)

(f) Indicator: **Methyl orange / methyl red** (3)

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

[Colours must be matched with indicator.]

(g) What: **Wash down walls with deionised water / swirl** (3)

(h) Conc.: **0.10** M (9)

$$\frac{25 \times 0.06}{1} \quad (3) \quad = \quad \frac{30.0 \times M}{2} \quad (3)$$

Concentration = **0.10 M** (3)

Question 3

(a) (i) Why: **To remove dissolved solids** [accept "salts" for dissolved solids] (8)

or

Wash / through dissolved solids (4 + 4)

(ii) Express: **880** ppm (6)

$$\frac{\mathbf{1000 \times 0.44}}{\mathbf{500}} \text{ (3)} \times \mathbf{1000 = 880} \text{ (3)}$$

(b) Describe: **Weigh a beaker** //
Evaporate water //
Filtrate //
Reweigh the beaker //
Increase in mass is mass of dissolved solids (any 4 × 3)

(c) Describe: **Sample of solid / paste of solid** //
P**reparatory step (clean wire / soak splint) //**
On nickel (nichrome, steel, wire) probe / **wood splint** //
Placed in Bunsen **flame** //
Colour imparted to flame (any 4 × 3)

Colour: **Yellow / orange** (6)

(d) How: With **silver nitrate** solution / **$AgNO_3$** (3)

White (pale) **precipitate** results (3)

Question 4

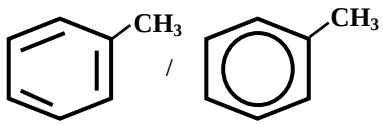
Add one mark to the mark awarded to the first two items for which the highest mark is awarded.

(a) Identify: **Argon** / **Ar** (6)

(b) What: **Takes in (absorbs) heat** [accept *temperature drops*] (6)

(c) What: **Increase** (6)

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

(e) Give: **$CH_3C_6H_5$** / **structure drawn i.e.**  (3)

Use: **Petrol** component / **solvent** (3)

(f) Name: J J **Thomson** (6)

(g) Define: **Loss** (6)

(h) Write: $$\frac{[SO_3]^2}{[SO_2]^2.\,[O_2]}$$ (6)

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

(i) Calc.: **20**% (6)

$$\frac{\mathbf{24}}{\mathbf{120}}\ (3)\ \times\ \mathbf{100}\ (3) = \mathbf{20\%}$$

(j) **Clove oil** / **eugenol** / **Orange oil** / (6)

(k) **Signage** / **issue ppe to staff** / **fines (dismissal) for unsafe practice** / **awards (rewards)** (2 × 3)

or

Conduct electricity / **conduct heat** / **lustre** / **malleable** / **ductile** / tend to **lose electrons** (2 × 3)

Question 5

(a) Define: (i) Number of **protons** in //
The nucleus of / an atom
(ii) Average **mass** of atoms of an element **relative to** //
1/12 of the mass of the **carbon isotope C-12** (3 × 3 + 2)

(b) (i) What: Atomic **mass** number (6)

(ii) Name: **Neutron** (3)
Many: **8** (3)

(iii) Explain: **Electron** // coming **from the nucleus** (2 × 3)
Give: **Carbon dating** / or an example (6)

(c) Define: **Number (measure) of the hold (pulling power, relative attraction)**
of an atom of an element /
f**or a pair of electrons in a covalent bond** / **for a shared pair of electrons** (2 × 3)

(i) **Covalent** / **non-polar** (3)

(ii) **Ionic** (3)

(iii) **Polar** covalent (3)

Question 6

(a) (i) What: **Compounds containing carbon and hydrogen** only (4)

Give: Crude **oil** / **natural gas / fossil fuels** (4)

(ii) Explain: **Greenhouse gas** / **global warming** (6)

(b) **Structure of $CH_3CH_2\ CH_2\ CH_3$** (3)

Butane (3)

Structure of $CH_3CH(CH_3)CH_3$ (3)

2-methylpropane (3)

(c) 1: **Minimum** [accept beaker or flask]

2: **insoluble** / **suspended**

3: **soluble** / **dissolved**

4: **recrystallisation** (4 × 6)

Question 7

(a) (i) Identify: **Arrhenius** (5)

(ii) Define: **Source of hydroxide ions** in solution (6)

(iii) Give(acid):**Any mineral acid** / **any common organic acid** (3)

Give(base):**Any common alkali or base** (3)

(iv) What: **Reaction of acid and base** // **to produce a salt and water** (2 × 3)

Example: **Any everyday example** (3)

(b) (i) Define: **minus the log** to the base ten // **of the hydrogen ion concentration** (2 × 3)

(ii) What: **0.1** M (9)

$\frac{\mathbf{4.0}}{\mathbf{40}}$ (3) = **0.1** (3)

(iii) Calc.: **13** (9)

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

pH = 14 – 1 = 13 (3)

$\mathbf{1 \times 10^{-14} = [H^+]\,[OH^-]}$ (3)

$\mathbf{[H^+] = 1 \times 10^{-14} \div [0.1] = 1 \times 10^{-13}}$ (3)

$\mathbf{pH = -\log_{10}[1 \times 10^{-13}] = -(-13) = 13}$ (3)

Question 8

(a) Which: **X / Ethanol / CH_3CH_2OH** (5)

(b) Give: X: **Ethanol** / **ethyl alcohol**
Y: **Ethanal** / **acetaldehyde**
Z: **Ethanoic acid** / **acetic acid** (3 × 3)

(c) Which: (i): **X** / **ethanol** / **ethyl alcohol / CH_3CH_2OH** (6)
(ii): **Z** / **ethanoic acid** / **acetic acid / CH_3COOH** (6)

(d) What: (i): **Oxidation** (6)
(ii): Potassium **chromate** / potassium **dichromate** / potassium **manganate** VII // **Sulphuric acid** / **acid** / **H^+** (2 × 6)
[Formulae, ions or other salts acceptable]

(e) Observation: Brick **red** /
Precipitate (6)

Question 9

(a) Any three: **Screening** // **Flocculation** //
Sedimentation (settling) // **pH adjustment**
Chlorination (ozone treatment) // **Fluoridation** // **Filtration**

Why: **Remove large debris** // **encourage coagulation of suspended solids** //
allow suspended material to settle //
readjust pH to one suitable for transmission //
disinfect (kill pathogens) // **for tooth strength** // **removal of insoluble solids**

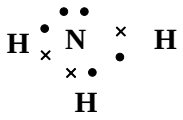
$(2 \times 4) + (4 \times 3)$

[answers must be matched]

(b) 1: **Solid** (6)
2: **Sedimentation** (6)
3: **Biological** (6)
4: **Nitrates** (6)
5: **Eutrophication** (6)

Question 10

(a) (i)



Correct valence electrons (N)	(3)
Correct valence electron (H)	(3)
3 Covalent bonds	(4)

(10)

(ii) **Pyramidal** (6)

[accept *tetrahedral* for 3 marks]

(iii) **Soluble** //
Polar (6 + 3)

(b) (i) Give: **Atomic mass measurement / molecular mass measurement / molecule (compound) identification / analyse gases from dumps / analyse organic pollutants in water** (4)

(ii) Give: **Dye identification (separation) / drug identification** (6)

(iii) Give: **Growth promoter identification / vitamin identification** (6)

(iv) State: **Different substances (components) have different affinities /**
For the stationary and /
Mobile phases (3 × 3)

(c) (i) Explain: **Alters the rate of a chemical reaction** (4)

(ii) Name: **Rhodium / platinum / palladium** (2 × 3)
What: **Reduces harmful emissions / or example** (6)

(iii) Name: **Lead / sulfur /** (3)

(iv) Give: **Nitrogen / carbon dioxide / N_2 / CO_2** (2 × 3)

Question 11

(a) (i) Outline: Solids – particles **not free to move**
Liquids – **some movement allowed**
Gases – particles **can move freely** (3 × 3)

(ii) What: **Movement** / spontaneous **spreading out** // **from high to low concentration** / due to **natural movement** of particles / to **fill a space** / to make **concentration uniform** (2 × 3)

(iii) Describe: **Potassium permanganate crystal** //
At bottom of beaker of water //
Colour movement is evidence for diffusion (4 + 2 × 3)

(b) Define: **The of change of the concentration of a product (or reactant)** //
with time (4 + 3)

or

The change in concentration in unit time // **of a reactant (or product)** (4 + 3)

or

The rate of change of concentration // **of a reactant (or product)** (4 + 3)

(i) Product: **Sulfur** / **S** (6)

(ii) Would: **Less** (3)
Explain: **Rate is proportional (increases with) to concentration / faster reaction** (3)

(iii) Would: **Greater** (3)
Explain: **Rate increases with temperature / slower reaction** when cold (3)

(c) **A**

(i) Feedstock: **Reactants** (7)
[*The raw material* // *prepared for process* (4 + 3)]

(ii) Factors: **Availability of raw materials** / **available workforce** / **infrastructure** / **market access** / **tax relief** (2 × 3)

(iii) Explain: **Static or fixed over time** // **can vary significantly over time** (by example)(2 × 3)

(iv) Way: **Appropriate examples e.g. pharmaceuticals** (2 × 3)

B

(i) Explain: **Small molecules joined together** // **to make giant molecules** (4 + 3)

(ii) Give: **Plastics (suitable examples e.g. cups)** / **packaging** / **insulation** (2 × 3)

(iii) State: **Collection** / **sorting** / **washing** / **drying** / **shredding** / **extrusion (melting)** (2 × 3)

(iv) Name: **Polythene** / **polyethene** / **polytetrafluoroethene** / **PTFE** **terylene** / **polyester** / **nylon** / (6)