



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scéimeanna Marcála

Scrúduithe Ardteistiméireachta, 2003

Ceimic

Gnáthleibhéal

Marking Scheme

Leaving Certificate Examination, 2003

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

Question 2

(a), (5); (b), (4×3) ; (c), $(6, 3)$; (d), (6); (e), (6); (f), (12)

Question 3

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

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

Question 5

(a), (i), (2×4) ; (ii), (2×6) ; (b), (i) (6); (ii), (6); (iii), (6); (iv), (6); (v), (6)

Question 6

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

Question 7

(a), (2×4) ; (i) (3×3) ; (ii), $(3 \times 3) + (2 \times 3)$; (b), (3×6)

Question 8

(a), (5); (b), (2×6) ; (c), (3×6) ; (d), (i), $(6, 3)$; (ii) (6)

Question 9

(a), $(7 + 3 \times 6)$; (b), $(7 + 3 \times 6)$

Question 10

(a), (i), $(6 + 4 \times 3)$; (ii), (7)

(b) (i), $(4 + 2 \times 3)$, (ii) (4×3) ; (iii), (3)

(c) (i), (7); (ii), (6); (iii), (6); (iv), (6)

Question 11

(a) (i), (4); (ii), (6); (iii), (6); (iv), $(6, 3)$

(b) $(4 + 3)$; (i), (6); (ii), (6); (iii), (2×3)

(c) **A** (i), $(6, 4)$; (ii), $(6, 3)$; (iii), (6)

(c) **B** (i), $(4, 3)$; (ii), (3×3) ; (iii), $(6, 3)$

Section A

At least two questions to be answered from this section

Question 1

(50)

- (a) **Dropping funnel / addition funnel** (5) [Accept separating funnel]
- (b) **Water / H₂O** (6)
Calcium carbide / calcium dicarbide / CaC₂ (6) [Accept carbide]
[Allow half marks if water and calcium carbide are reversed]
- (c) **Dirty solid / grey solid / brownish solid / stones** (3) [Accept indication of “off-white”]
- (d) They **contain** displaced **air** (6) // [Accept **impure** for 3 marks]
- (e) **Sooty flame / produces soot / smoky flame / dirty flame / black flame / luminous flame** (6)
- (f) **Alkynes / acetylenes** (6)
- (g) **Contains carbon and hydrogen (3) only** (3)
- (h) **Cutting torches / welding / carbide lamps / oxyacetylene torch (flame)** (6)

Question 2

(50)

(a) A solution whose exact **concentration is known** (5)

(b) **A = Beaker** (3)

B = Funnel (3)

C = Wash bottle (3)

D = Volumetric flask (3)

(c) **Accuracy** of the concentration of the resultant solution (6)

Washing with deionised (distilled) water / brushing with a camel hair brush (3)

(d) So as **not to add any other species / not to add contaminants / not to add other substances / not to add anything which might react / ensure purity (accuracy)** (6)

(e) **To mix / to make the solution homogeneous** (6) [Accept “help dissolve completely” for 3 marks]

(f) **0.05** (12) M

$$\frac{2.65 (3) \times 2 (3)}{106 (6)} = 0.05 \text{ M}$$

[Correct calculation of $M_r = 106$ for 3 marks]

Question 3**(50)**

(a) Matched any 2 × (4) and 2 × (3) as below

METAL	Lithium (Li)	Sodium (Na)	Potassium (K)	Copper (Cu)
FLAME COLOUR	crimson-red	orange-yellow	lilac	green

(b) Clean **platinum (or nichrome) wire (probe)** / clean **splint (lollipop stick)** (6) //

Dip in solution of sodium sulfate (salt) (6) //

Place in hottest part of **Bunsen flame** (6) and observe change in flame colour.

(c) **Street lights** (6)

(d) Add a solution of **barium chloride / BaCl₂ / barium ions / barium solution / Ba⁺⁺** (6) // a white **precipitate results** (6) [Allow 3 marks for barium or Ba]

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) (i) **17** (3)

(ii) **20** (3)

(b) If a system at **equilibrium is disturbed** (3) the position of the equilibrium **shifts so as to minimise** the disturbance (3).

(c) **Tetrahedral** (6) [*Accept correct sketch*]

(d) **gamma-(γ) > Beta- (β) > Alpha-(α)** (6) [*Allow 3 marks for any two in the correct order or all three in reverse order*]

(e) **CH₄ + 2O₂ → CO₂ + 2H₂O** [LHS (3) // RHS (3)]

[*If neither (3) is awarded allow 3 marks for balancing w.r.t. C or balancing w.r.t. H*]

(f) **12** (6) %

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

(g) **Mass of an atom** of an element relative to (3) **1/12 of the mass of the carbon-12 isotope** (3)

(h) **2** (6)

$$\text{pH} = -\log_{10} (3) [0.01] (3) = 2$$

(i) Robert **Boyle** (6)

(j)

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2] \cdot [\text{I}_2]} \quad (3)$$

[Allow 3 marks for inverted expression]

(k) **A** Electrical storms / lightning / legumes / nitrogen fixing bacteria / suitable example (6)

B Returning to ore state / combining with elements from the atmosphere / combining with oxygen / oxidation reactions of metals (6) [Allow rusting or other e.g. for (3)]

Question 5

(50)

- (a) (i) **In order of / increasing / according to (4) atomic mass (weight) (4)**
- (ii) Modern periodic table has elements in order of increasing **atomic number** //
Mendeleev **left gaps** for undiscovered elements //
Mendeleev **reversed** the sequence of some **pairs of elements** //
Modern table has **noble gases** //
Modern table has **separate block for d elements** [Accept other valid differences] (2 × 6)
- (b) (i) **Dalton (6)**
- (ii) **Rutherford (6)**
- (iii) **Curie (6)**
- (iv) **Thomson (6)**
- (v) **Bohr (6)**

Question 6

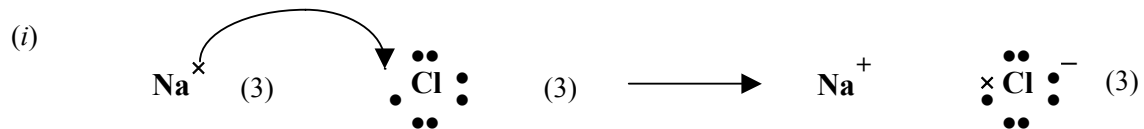
(50)

- (a) **Naphtha** (5) [Accept kerosene]
- (i) A measure of the **smoothness with which a petroleum spirit burns relative to a mixture of iso-octane (3) and heptane (3) //**
A measure of the tendency of a fuel (3) to autoignite (3) //
A measure of the tendency of a fuel (3) to cause knocking (resist knocking) (3)
- (ii) **Lead** (6)
Poisonous / toxic / environmental reasons / health / pollution (6)
- (iii) **Catalytic reforming / Dehydrocyclisation / Cracking / isomerisation (6)**
- (b) (i) **Kerosene** (6) [Accept "naphtha]
- (ii) **Residue** (6)
- (c) **Gas oil //**
Kills birds / sea life / damages beaches / etc. (6 + 3)

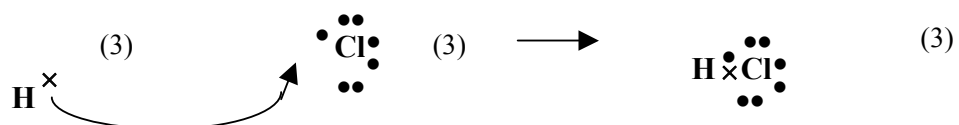
Question 7

(50)

- (a) A measure of the relative **pulling power (attraction) of (an atom) of an element** (4) **for a shared pair of electrons** in a covalent bond / **for the electrons in a covalent bond** (4)



(ii)



Sodium chloride, NaCl (3)

It is **ionic** (3)

- (b) Electron **loss** (6)

Chlorine (6)

Chlorine **gains electrons** (6)

Question 8

(50)

(a) **B** / CH_2CH_2 / C_2H_4 / **ethene** / **ethylene** (5)

(b) **X** = **elimination** (6)

Y = **addition** (6)

(c) **A** = **ethanol** / **ethyl alcohol** (6) [accept alcohol for 3 marks]

B = **ethene** / **ethylene** (6)

C = **1,2-dibromo** (3) **ethane** (3)

(d) (i) **Aluminium oxide** / **alumina** / Al_2O_3 (6) [allow 3 marks for Al_xO_y]

White (3)

(ii) To **prevent suck-back** (6)

Question 9

(50)

- (a) **1 = Arrhenius**
- 2 = hydrogen ions**
- 3 = neutralisation**
- 4 = salt (7 + 3 × 6)**

- (b) **5 = flocculation**
- 6 = chlorination**
- 7 = fluoridation**
- 8 = filtration (7 + 3 × 6)**

Question 10**(2 × 25)**

(a) (i) Separation experiment (following steps in own words)

Paper chromatography	Thin layer chromatography	Column chromatography
Spot sample on paper	Spot sample on plate	Apply sample to top column
Place in tank for elution	Place in tank for elution	Add eluent at top
Spot on paper above level of eluent	Spot on plate above level of eluent	Pass eluent through column
Allow elution to occur	Allow elution to occur	Collect samples
Different component move at different rates	Different component move at different rates	Different component move at different rates
6 + 4 × 3	6 + 4 × 3	6 + 4 × 3
No diagram –3 marks	No diagram –3 marks	No diagram –3 marks
Information can be got from suitably labelled diagram		

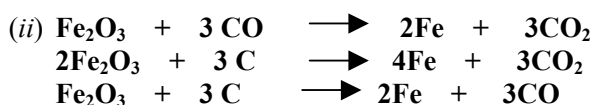
(ii) **analysing dyes / analysing paints / analysing drugs / etc.** (7)

- (b) (i) **A = pipette**
B = conical flask / titration flask
C = burette (4 + 2 × 3)

(ii) **A / pipette (3) //****Wash with deionised water (3) //****Wash with solution it is to measure (contain) (base) (sodium hydroxide) (NaOH) (3) //****Bottom of meniscus level with mark / read at eye level /****Use pipette filler / draw solution into pipette above mark / etc [one valid filling detail] (3)**(iii) Any suitable **named acid base indicator (3)**(c) (i) **0.1 (7) moles [Allow 3 marks for correctly identified atomic mass 24]**(ii) **0.05 (6) moles**(iii) **1.12 (6) litres**(iv) **4.0 (6) g [Allow 3 marks for correctly identified formula mass of 40]**

Question 11**(2 × 25)****(a) (i) B (4)****(ii) To bring reactions to completion / to speed up reaction / maximise yield / keep reactants****hot / maximise yield (6)** [allow 3 marks for “prevents escape of solvent (reactants / products)”]**(iii) Preparation of ethanoic acid / preparation of soap (6)****(iv) anti-bumping granules / pumice stones / boiling chips / pieces of porcelain (6) // prevent bumping (3)****(b) Rate of change of the concentration // of a product (or reactant) of a chemical reaction (4 + 3) // Change of concentration of reactant (product) [accept “substance”]// in unit time (over time) (4 + 3)****(i) B (6)****The acid (HCl) is more concentrated / because rate depends on concentration (6)**

[Accept “more acid” for 3 marks]

(ii) When carbon dioxide is passed through limewater (3) it turns milky (3)**(c) A****O₃ (6) //****Screens uv-light coming from the sun (4)****(i) Chlorofluorocarbons (6) //****Refrigerant gases / making expanded polystyrene/aerosol propellant (3)** [Accept fire extinguishers]**(ii) harmful uv-light reaching the earth’s surface / plant (animal) damage/damages plankton in the oceans/interferes with food chain/ cancer risks / can contribute to global warming (6)****B****catalysts // form coloured compounds // variable valencies (4 + 3)** [Accept “conduct” for 4 marks]**(i) Iron ore / named ore of iron / formula of an iron ore (3)****limestone / CaCO₃ (3)****coke / charcoal / carbon / C (3)**

Words or formulae. (6 + 3). Award 9 marks if fully correct. Award 6 marks for two reactants or two products or one of each correct.