

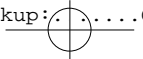


An Roinn Oideachais agus Eolaíochta

Leaving Certificate Examination 2002

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.
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), Why (5); (b), What (6); (c), Sketch (6); (d), Colours (2×6); (e), Why (6); (f), Gas, test (6, 3); (g), Name (6)

Question 2

(a), Names (2×4); (b), Which, (3), Washing (6, 3); (c), Name (3), Colours (2×3); (d), Calculation (9); (e), How (2×6)

Question 3

(a), Catalyst (5); (b), Diagram (3, 3, 6); (c), Graph (2×3 , 2×6); (d), Volume (3), Rate (6); (e), Why (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), (2×3); (d), (2×3); (e), (2×3); (f), (2×3); (g), (6); (h), (2×3); (i), (2×3); (j), (6); (k), (2×3)

Question 5

(a), Which (5); (b), Which (6); (c), Which (6); (d), Which (6); (e), Which (6); (f), Name, Formula (6, 3); (g), Diagram (3×3), Name (3)

Question 6

(a), Which, (4), What (4); (b), Names (9, 6, 3); (c), Which, what (9, 3); (d), Name (6); (e), Which (6)

Question 7

(a), State (5); (b), Describe (3×6 , 6); (c), Applications (2×6); (d), Principle (6, 3)

Question 8

(a), What (4), How (4); (b), How and why for four stages ($4 \times \{2 \times 3\}$); (c), What in each stage (3×6)

Question 9

(a), Which, (4), Draw (4); (b), Classify (3×6); (c), Which (6), Reason (6); (d), Which (6), Use (6)

Question 10

(a), Name (4), Element (3); (i), Order (6); (ii), Which (6); (iii), Use (6)
(b) Definitions (4, 3), Calculation (9), Type, name/formula (6, 3)
(c) Meaning (i) & (ii), (4, 3); (iii), Diagram & reagents (5×3); (iv), use (3)

Question 11

(a) State (4, 3); (i), Change (6); (ii), Change & colour (2×6)
(b) (i), How many moles (4); (ii), How many moles (6); (iii), What mass (6); (iv), What volume (9)
(c) **A** (i), Name & location (4, 3); (ii), Reason (6); (iii), Process and raw material (6, 3, 3)
(c) **B** (i), Name (4); (ii), Example, binding forces and use (6, 3, 3); (iii), Example and binding force (6, 3)

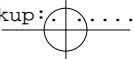
Section A

At least two questions to be answered from this section

Question 1

(50)

- (a) **Dilution**/because the reaction would be **too vigorous/slow down/control** (5)
- (b) **Ice-water/cold water/ice/cold tap/** (6)
[Accept water]
- (c) **F low of water indicated as in at the bottom and out at the top of the water jacket** (6)
[Accept text of "in the bottom and out the top" for 3 marks]
- (d) **Orange/Yellow** (6) // to **Green/dark green/green-black** (6)
- (e) T o drive the **reaction to completion / maximise (increase) yield / oxidise ethanal to ethanoic acid / ensure no ethanal remains / ensure only ethanoic acid results / heat the mixture without loss of vapour** (6)
- (f) **Carbon dioxide** // Turns **lime-water milky** (6, 3)
- (g) **Vinegar** (6)



Question 2

(50)

(a) **A = Burette (4)**

B = Pipette (4)

[Both names correct but in wrong order allow 4 marks]

(b) **Pipette / B (3) //**

Wash pipette with deionised water /

Wash pipette with sodium hydroxide/base/solution to be measured /

Use pipette filler / Bottom of meniscus on gold line / Not blowing out the last drop /

Touching tip off side of flask / Reading bottom of meniscus / Reading at eye-level / etc. /

Any precaution relevant to accuracy or safety re using the pipette (6, 3)

(c) **Methyl Orange / Methyl Red / Phenolphthalein etc. (3)**

Colour in base (3) Colour in acid (3) Must be matched with indicator.

[Allow 3 marks for reverse order, accept orange/yellow for colour of methyl orange in base. Accept peach as colour of methyl orange in acid at end-point]

(d) Concentration of hydrochloric acid = **0.125 / 0.13 mol dm⁻³ (9) //**

$\frac{V_1 \times M_1}{n_1} = \frac{V_2 \times M_2}{n_2} \quad (3)$
$\frac{25.0 \times 0.10}{1} = \frac{20.0 \times M}{1} \quad (3)$
$M = 0.125 (3) \text{ mol dm}^3$

(e) **Repeat titration with out indicator / using volumes of acid and base as in the titration /
Evaporate off water / Dry salt in oven (6, 6)**

**Question 3****(50)****(a) Manganese dioxide / MnO_2 / suitable alternative (5)****(b) Suitable reaction vessel set up (3) //
to deliver evolved gas for measuring (3) //
measuring device (6)****(c) Volume axis labelled and scaled correctly (3) //
Time axis labelled and scaled correctly (3)
All points plotted correctly (6) / [Allow 3 marks for 6 - 8 points plotted correctly]
Curve drawn through plotted points correctly (6) [Allow 3 marks for line segments]****(d) Volume = 45 - 49 cm^3 (3) //****15.0 - 16.3 $\text{cm}^3 \text{ min}^{-1}$ (6)****or**

$\frac{\text{Volume}}{3}$ (3) // = correctly calculated out (3)

(e) Concentration of hydrogen peroxide decreased / hydrogen peroxide used up / reactant used up (6)

Section B

See paper for instructions on number of questions to count

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, 8 (3) , 8, 2 (3)** [*correct s, p configuration acceptable also*]

(b) **Measure of the pulling power an atom / relative attraction of an atom (3) // of an element has for a shared pair of electrons in a covalent bond (3)**

(c) **Pyramidal (6)** [*Accept correct sketch*] [*Also accept tetrahedral for 3 marks*]

(d) At constant temperature **the volume** of a fixed mass of gas (3) // **is inversely proportional to its pressure (3)** [*Accept $PV = \text{constant}$ or $P_1V_1 = P_2V_2$*]

(e) **Name (3) // Formula (3)** [Matched]

(f) $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$ [LHS (3) // RHS (3)]

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

(g) **240 ppm (6)**

$120 \times 2 (3) = 240 (3) \text{ ppm}$
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(h) **Mass of an atom of an element (3) // relative to one twelfth of the mass of the carbon isotope C-12 (3)**

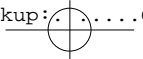
(i) **Name (3) // Use (3)** [Matched] [e.g. aspirin // pain killer]

(j) **3×10^{23} (6)**

$0.5 (3) \times 6 \times 10^{23} (3) // = 3 \times 10^{23} (6)$

(k) **A Produces healthcare products / disease treatments / crop pest control / etc. (2 x 3)**

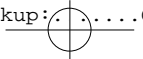
B Sorting / shredding / washing / drying / melting / re-extrusion (2 x 3)



Question 5

(50)

- (a) **Hydrogen / H / H₂ (5)**
- (b) **Sodium / Na (6)**
- (c) **Helium / He (6)**
- (d) **Sodium/ Na (6)**
- (e) **Helium / He (6)**
- (f) **Name / Formula (6, 3)**
- (g) **Correct arrangement of valence electrons of first element (3) //**
Correct arrangement of valence electrons of second element (3) //
Correct number of shared pairs of electrons formed (3) //
Name of compound (3) [must be matched]



Question 6

(50)

(a) **Methane / CH₄ / A (4) //**

Green House Effect / Global Warming (4)

[Accept risk of fire or explosion at dump or explosion or explosive]

(b) **A - Methane / natural gas //**

B - Butane / n-butane //

C - 2, 2, 4 - trimethylpentane / iso-butane (9, 6, 3)

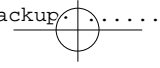
[Note: If more than 3 marks are available for C, then 2, 2, 4- may be split from trimethylpentane, and iso split from octane to allow the marks to be shared (6, 3) or (3, 3).]

(c) **C / 2, 2, 4 - trimethylpentane / iso-octane //**

**Knocking / pinking / un-smooth running / premature ignition / auto-ignition /
premature combustion (9, 3)**

(d) **Lead (6)**

(e) **B / Butane / n-butane (6)**



Question 7

(50)

- (a) **Measurement of atomic masses / Measurement of molecular masses / Separating isotopes / Determining structures / identification of elements / Identification of compounds / Water analysis / Analysis of waste gases / separation of ions / measure of abundance of isotopes / measurement of mass of isotopes (5)**

- (b) **Spot sample on plate (drawing line(s)) /
Place in chromatography tank /
Spot (line) on plate should be just above level of eluent (solvent) in tank /
Elute (let solvent run up plate) /
Remove plate from tank when eluted (solvent front nears top of plate) /
Allow plate to dry (solvent to evaporate) and examine Any Three (3 x 6)
*[Marks can be awarded to written statements or/and diagram]***

To examine (match) dyes and paints from crime scenes / drug purity testing / matching blood samples (6)

- (c) (i) **Separate compounds for analysis by mass spectrometry / Drug testing on athletes / Testing meat for growth promoters (hormones / anabolic steroids) / alcohol in blood (urine) / waste gases / etc. (6)**

(ii) **Separation of compounds / growth promoters / vitamins in food / etc. (6)**

- (d) **That different compounds have a different attraction / to the stationary / and mobile phases used and so can be separated (Any two points 6 + 3)**

Question 8

(50)

- (a) Name given to the water problem of there being a **difficulty in forming a lather with soaps** / presence of **dissolved Ca or Mg ions or compounds** / **lime** / **causes limescale** (4)
Ion-exchange / **distillation** / **washing soda** / **sodium carbonate** (4)

- (b) 4 × 6 from following matched:

Sedimentation: allowing water to settle / **in large tanks** (3) // **Allows solids to precipitate (sink)** (3)

OR

Flocculation: Addition of a flocculating agent (aluminium or iron salt) to water (3)
[Accept addition of chemical] //
To cause suspended materials (turbidity) to clump together (coagulate / form flocs) /
To cause suspended materials sink (settle) (3)

OR

Filtration: Passing of water through sand beds (3) // **Removes any suspended solids** (3)

OR

Chlorination: Addition of chlorine (3) // **Kills germs (bacteria) / disinfects water** (3)

OR

Fluoridation: Addition of fluoride ion (3) // **Prevents tooth decay** (3)

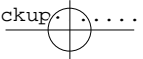
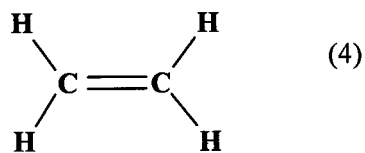
OR

pH adjustment: addition of acid (base) (3) // **to adjust the pH of the water** (3)
[Accept "to make water neutral" for 3 marks]

- (c) **Primary treatment: Sewage is screened** / **large solids removed** / goes through a **primary settling process** / **physical removal of solids** (3) (6)

Secondary treatment: Biological (oxidation / breakdown) of the sewage / **using microbes (activated sludge)** / **in presence of air** / **followed by a settling process** (6)

Tertiary treatment: removal of nitrates (phosphates) / compounds of N (P) from the sewage (6)
[Accept removal of N (P) for 3 marks]

**Question 9****(50)****(a) A / Ethene (4) //****(b) X = addition (6)****Y = elimination (6)****Z = substitution (6)****(c) C / ethanol / CH₃CH₂OH / C₂H₅OH (6) //****Ethanol is a polar compound / presence of OH / hydrogen bonding (6)****(d) A / ethene / CH₂CH₂ / C₂H₄ (6) //****Plastic bags / plastic tunnels / plastic crates / milk bottles / mineral bottles / plastics etc. (6)**

Question 10**(2 × 25)****(a) Marie Curie //****Polonium / Radium (4, 3)****(i) Alpha- (α -), beta- (β -), gamma- (γ -) radiation (6)**
[Allow 3 marks for reverse order or allow 3 marks for any two in correct order]**(ii) Alpha- (α -) radiation, (6)****(iii) Cancer treatment / irradiation of food /
irradiation (sterilisation) of medical instruments (6)****(b) (i) produces H^+ ions in solution****(ii) $-\log_{10} [H^+]$ / minus the log to the base ten of the hydrogen ion concentration (4, 3)**

2 (9)	$-\log_{10} [0.01] (6) = -(-2) = 2 (3)$
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Alkali / antacid / base //**Sodium hydrogen carbonate / sodium bicarbonate / $NaHCO_3$ / magnesium
hydroxide / $Mg(OH)_2$ / etc. / Milk of Magnesia / baking powder / bread soda etc (6, 3)**
[Name or formula accepted]**(c) (i) contains carbon and hydrogen only //****(ii) has double (triple) bonds / undergoes addition reactions (4, 3)****(iii) Combination of diagram and or text****Reaction vessel /****dropping funnel (water dropped) /****delivery tube in place to allow gas
collection /****gas collected over water (trough of water) Any Three (3 x 3)****calcium carbide / calcium dicarbide /
 CaC_2 (3)****Water (H_2O) (3) [no diagram -3]****(iv) Welding / cutting torches / oxyacetylene (3) [Accept fuel]**

Question 11

(2 × 25)

(a) When a system at equilibrium is disturbed (placed under a stress) // the position of the equilibrium shifts so as to minimise the disturbance (stress) (4, 3)

(i) The chloride ion concentration is increased / chloride ion are added (present) // Position of equilibrium shifts to the left to remove chloride ions (6)

(ii) Addition of heat energy favours the endothermic reaction / reverse reaction / production of species on left (6) // Mixture becomes more blue (6)

(b) (i) 0.5 moles (4)

$$32.5 \div 65 = 0.5$$

(ii) 1 mole (6)

$$0.5 (3) \times 2 (3) = 1$$

(iii) 68 g (6)

$$0.5 (3) \times 136 (3) = 68$$

(iv) 11.2 litres (9)

$$0.5 (3) \times 22.4 (6) = 11.2$$

(c) A (i) Ammonia / urea (4) // IFI Marino Point / Cobh / Co Cork (3)
Nitric acid / CAN (4) // IFI Arklow / Co Wicklow (3)
Magnesium oxide (4) // Premier Periclase Drogheda / Co Louth (3)
[Must be matched]

(ii) Matched advantage of location e.g. access to natural gas / port/ etc. (6)

(iii) Actual synthesis processes is a continuous process // Constant flow of reactant(s) in (product(s) out) / Raw materials added, product formed, product separated and unused reactants recycled continuously. // [If the candidate justifies why some stage(s) of any of these processes are done on a batch basis e.g. a purification stage - allow marks] Natural gas / air / ammonia / water / seawater / etc. (6, 3, 3) [Matched] [Accept feedstock instead of raw materials. Where candidates describe industrial visit rather than case study, mark it but do not allow the first (3) or (4) because specified case study was not mentioned]

B (i) Bragg (4)

(ii) Diamond / graphite / C / quartz / SiO₂ / etc. [name or formula] (6)
covalent bonds / van derWaals forces (graphite only) (3)
Cutting tools / lubricant / glass / etc. (3) [matched]

(iii) Water / H₂O / iodine / I₂ / Carbon dioxide / dry-ice / CO₂ / etc. (6)
van derWaals forces / hydrogen bonding / London dispersion forces (3) [matched]