



Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2009

MARKING SCHEME

CHEMISTRY

ORDINARY LEVEL



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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. A double solidus (//) separates points for which separate marks are allocated in a part of the question. Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable for a particular point. A word or phrase in bold, given in brackets, is an acceptable alternative to the preceding word or phrase. Note, however, that words, expressions or phrases must be correctly used in context and not contradicted, and where there is evidence of incorrect use or contradiction, the marks may not 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

- 1 (a) NAME, (5); (b) IDENTIFY, DESCRIBE, (9 + 2 × 3); (c) WHAT, DESCRIBE, (9 + 3); (d) WHY, (6); (e) IDENTIFY, WHAT, (9 + 3).
- 2 (a) NAME, (3 × 3); (b) HOW, (3 × 3); (c) NAME, (3); COLOUR CHANGE, (2 × 3); (d) WHAT, (6); (e) CALC., (9); (f) DESCRIBE, (5 + 3).
- 3 (a) WHAT, (5); (b) DRAW, (6 + 2 × 3); (c) GRAPH, (9); (d) FIND, (6); (e) HOW, (i), (6), (ii), (6).
- 4 (a) , (6); (b), (2 × 3); (c), (i), (3), (ii), (3); (d), (2 × 3); (e), (2 × 3); (f), (6); (g), (6); (h), (6);(i), (6); (j), (6); (k), A, (2 × 3); B, (2 × 3).
- 5 (a) DEFINE, (2 × 4); WHO, (6); (b) WHAT, (6); HOW, (i), (3), (ii), (3); USE, (2 × 3); GIVE,(2 × 3) (c) WHAT, (3); TYPE, (3); MOLECULE, (3); SHAPE, (3).
- 6 (a) EXPLAIN, (3 + 2); SELECT, (2 × 6); (b) (i), WHAT, (6); (ii), DRAW, (6); (iii), WHY, (6); (iv) WHY,(6); (c) GIVE, (2 × 3); STATE, (3).
- 7 (a) WHICH, (8); (b) NAME, (4 × 3) (c), (i), WHAT, (3); NAME, (3); (d), (i), IDENTIFY, DESCRIBE, (ii), HOW, (iii) WHY, (6 + 3 × 3); (e), WHAT, (6 + 3).
- 8 (a) DESCRIBE, 2 + [4 × (6 + 2 × 3)].
- 9 (b) WHAT, (5), WRITE, (5 × 3), X, Y, (2 × 3); (b) FIND, (6 + 2 × 3), OUTLINE, (6 + 2 × 3)
- 10 (a) MATCH (2 × 8 + 3 × 3); (b), (i), NAME, (4); (ii), WHAT, (2 × 3); (iii), NAME, (3), DESCRIBE, (2 × 3); (iv) GIVE, (3), USE, (3); (c), (i), DEFINE, (4 + 3); (ii), WHAT, (6); (iii), CALC., (6), WHAT, (6).
- 11 (a) DEFINITION, (4); (i), WHICH, (3), HOW, (3); (ii), STATE, (6 + 3); (iii), WHAT, (6); (b) (i) STATE, (4 + 3); (ii) USE, (9); (iii) HOW, (6); (iv), HOW, (3) (c) A: (i) GIVE, STATE, (4 + 3); (ii) GIVE, (2 × 3); HOW, (3); GIVE, (6 + 3) B: (i) NAME, (4 + 3); (ii) FROM, (6); (iii) NAME, (6); (iv) GIVE, (2 × 3).

SECTION A

At least two questions must be answered from this section.

QUESTION 1

- (a) NAME: **alkynes // acetylenes** (5)
- (b) IDENTIFY: **X: Water // H₂O**
Y: Calcium carbide // calcium dicarbide // CaC₂
[allow 3 marks for “carbide”]
DESCRIBE: **Greyish / brownish / blackish / dirty solid** (9 + 2 × 3)
- (c) WHAT: **decolourises / becomes colourless (paler)**
EXPL.: **ethyne is unsaturated / multiple bonds present / bromine addition occurs** (9 + 3)
- (d) WHY: **lots of soot / dark smoke / highly luminous flame** (6)
- (e) IDENTIFY: **oxygen**
WHAT: **cutting equipment / oxyacetylene torch** (9 + 3)

QUESTION 2

(a) NAME: **A: pipette**
B: burette
C: conical flask / Erlenmeyer flask / titration flask (3 × 3)

(b) HOW: **wash with deionised water / wash with solution to be measured / use pipette filler / fill to above mark / allow drain until bottom of meniscus rests on line / touch tip off side of beaker to remove any droplets on outside / read vertically (eye level) / drain under gravity into titration flask / do not blow out last drop** (3 × 3)

(c) NAME: **indicator** (3)
colour change at end-point (i.e. before & after) (2 × 3)
[indicator must be specified in order to get marks for colour]

methyl orange	orange (yellow) to red (accept peach)
Methyl red	yellow to red
phenolphthalein	pink (purple, violet, red) to colourless
thymolphthalein	blue to colourless
thymol blue	blue to yellow
cresol purple	purple (pink, violet) to yellow
neutral red	yellow-brown (yellow, brown) to red
phenol red	red to yellow
bromothymol blue	blue to yellow

(d) WHAT: **read bottom of meniscus / at eye level** (6)

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

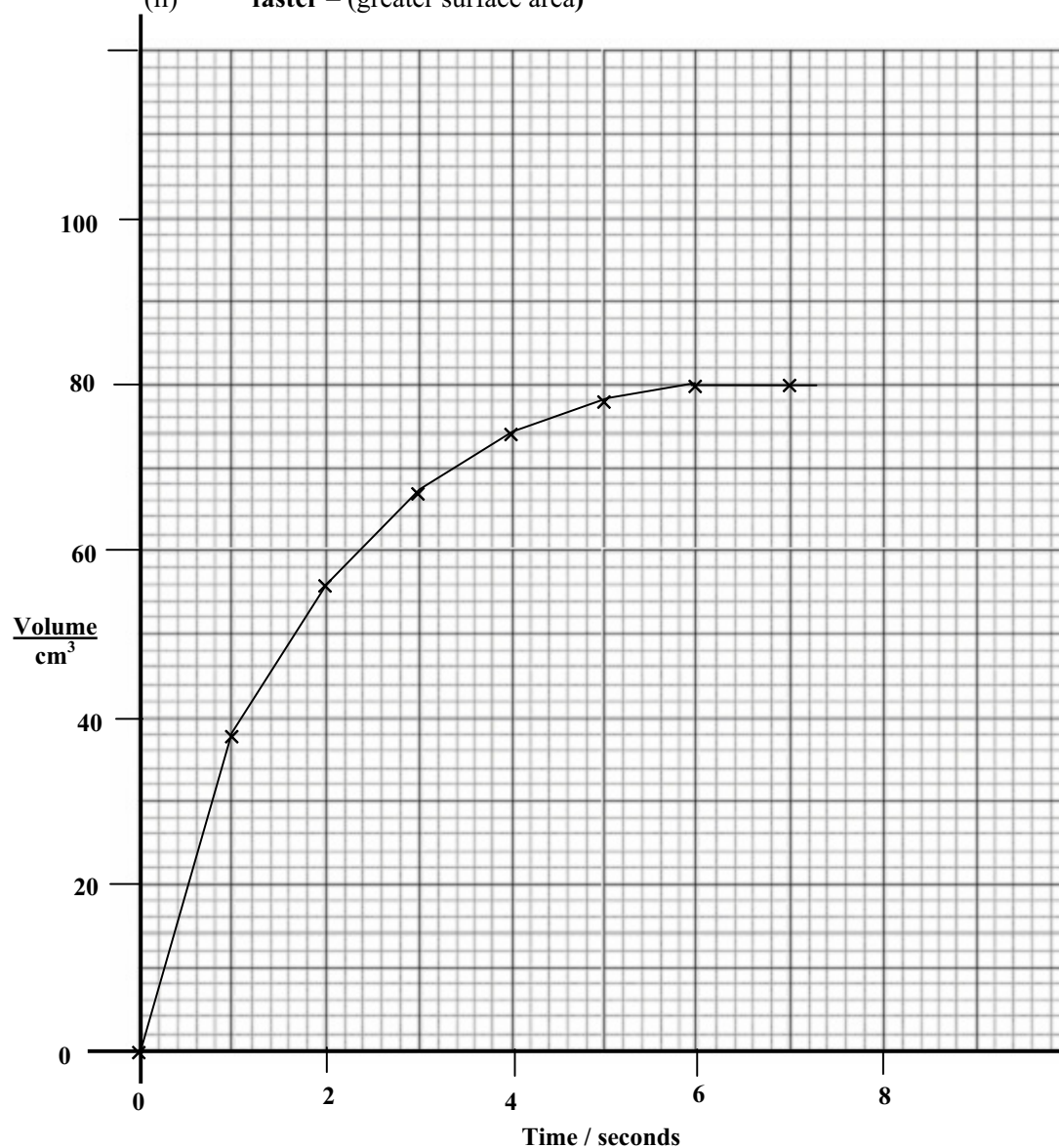
$$\frac{22.5 \times M}{1} \quad (3) = \frac{25.0 \times 0.10}{1} \quad (3) \quad M = 0.11 \quad (3)$$

[Allow 3 marks for calculation formula if no other marks are awarded]

(f) DESCRIBE: **repeat without indicator // repeat with volumes determined by titration // remove indicator using charcoal and filter // evaporate solution to small volume // allow pure salt to crystallise out (be produced)** (ANY 2 points 5 + 3)

QUESTION 3

- (a) WHAT: **catalyst** (5)
- (b) DRAW: **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]
- (d) FIND: **22.0 – 22.6 cm³ min⁻¹** (6)
[Award 3 marks for volume and 3 marks for dividing by 3]
- (e) HOW (i) **faster** (6)
(ii) **faster – (greater surface area)** (6)



SECTION B

QUESTION 4

Eight items to be answered. Six marks to be allocated to each item and one additional mark to be added to each of the first two items for which the highest marks are awarded.

- (a) **solid, liquid & gas** (6)
- (b) **air // water // fire** (2 × 3)
- (c) (i) **kill bacteria / disinfection** (3)
(ii) **help prevent tooth decay / harden teeth** (3)
- (d) **effective nuclear charge increases // screening effect remains constant** (2 × 3)
- (e) **relative (measure of) attraction / number expressing (giving) attraction // for a shared pair of electrons / for electrons in a covalent bond** (2 × 3)
- (f) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (6)
[reactants 3 marks, products 3 marks]
- (g) **exothermic** (6)
- (h) **catalyst** (6)
- (i) **9, 6, 4** (6)
- (j)
$$\frac{[HI]^2}{[H_2][I_2]}$$
 (6)
[Allow 3 marks for top / 3 marks for bottom / 3 marks if inverted]
- (k) **A liquefying (cool) air // fractionation (fractional distillation)** (2 × 3)
- B** WHAT: **metal (iron) dipped in molten zinc / iron coated with zinc** (3)
WHAT: **prevents corrosion / stops rusting / sacrificial metal** (3)

QUESTION 5

- (a) DEFINE: **number of protons // in the nucleus of an atom** of the same element (2 × 4)
- WHO: **Moseley** (6)
- (b) WHAT: **attraction between oppositely charged ions in a crystal // bonding involving the loss and gain of electrons** (6)
- HOW: (i) **12** (3)
(ii) **8** (3)
- USE: **oxygen: 2 electrons in first shell and 8 in second** (3)
magnesium: 2 electrons in first shell and 8 in second (3)
- GIVE: **high melting points / hard / conducts electricity when molten** (2 × 3)
- (c) WHAT: **tetrahedral** (3)
- TYPE: **covalent** (3)
- MOLECULE: **water / H₂O / any valid example** (3)
- SHAPE: **V-shaped / as appropriate** (3)

QUESTION 6

(a) EXPLAIN: **separating** // into samples **that have differing boiling ranges (points)** (3 + 2)

SELECT: (2 × 6)

Fraction	Major use
light gasoline (petroleum)	petrol
naphtha	petrol / plastics
kerosene (paraffin)	aviation fuel / heating
gas oil / diesel	cars / trucks / heating

(b) (i) WHAT: **liquid petroleum gas** (6)

(ii) DRAW: **CH₃CH₂CH₂CH₃** // **CH₃CH(CH₃)₂** (6)
[hydrogen atoms need not be shown in expanded drawing provided bonds are indicated]

(iii) WHY: **to give it an odour / specified safety consideration** (6)

(iv) WHY: **enhanced greenhouse effect // release of large quantities of carbon dioxide** (6)

(c) GIVE: *advantage:* **clean // renewable** depending how generated (3)

disadvantage: **expensive at present // hazardous (dangerous)** (3)

STATE: **hardening fats // manufacture of hydrochloric acid // manufacture of ammonia** (3)

QUESTION 7

- (a) WHICH: **B // ethanol** (8)
- (b) NAME: **A: ethene // ethylene** (3)
B: ethanol // ethyl alcohol (3)
C: ethanoic acid // acetic acid (3)
D: benzene (3)
- (c) (i) WHAT: **oxidation** (3)
NAME: **vinegar** (3)
- (d) (i) IDENTIFY: **alumina // aluminium oxide // Al_2O_3**
DESCRIBE: **white solid**
- (ii) HOW: **using glass wool // rock wool**
- (iii) WHY: **prevent suck-back** (6 + 3 × 3)
- (e) WHAT: **aromatic** (6 + 3)
WHAT: **carcinogenic // causes cancer**

QUESTION 8

(a) DESCRIBE:

ANY FOUR × (6 + 2 × 3)

Add 2 mark to the parts for which the highest mark has been awarded				
(a)	Separation using chromatography	Spot samples on plate // above level of solvent // place in tank // elute / allow solvent to rise // examine / see resultant separation (6 + 2 × 3) [No diagram – deduct 3 marks]		
(b)	Measuring pH	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; padding: 5px;"> spot sample / add drops of // on universal indicator paper / universal indicator solution // examine colour / compare colour to chart // read pH (6 + 2 × 3) </td> <td style="width: 30%; padding: 5px;"> use pH meter // place probe in sample // read pH (6 + 2 × 3) </td> </tr> </table>	spot sample / add drops of // on universal indicator paper / universal indicator solution // examine colour / compare colour to chart // read pH (6 + 2 × 3)	use pH meter // place probe in sample // read pH (6 + 2 × 3)
spot sample / add drops of // on universal indicator paper / universal indicator solution // examine colour / compare colour to chart // read pH (6 + 2 × 3)	use pH meter // place probe in sample // read pH (6 + 2 × 3)			
(c)	Test for K	introduce (impart) salt in Bunsen flame // using platinum (nichrome) wire (probe) / soaked splint / lollipop stick lilac (violet) colour (6 + 2 × 3)		
(d)	Test for sulfate	add barium chloride (BaCl₂) solution // white precipitate // insoluble in dilute hydrochloric acid (HCl) (6 + 2 × 3)		
(e)	Polarity of water & non-polarity of cyclohexane	burette with stream of liquid // charged rod brought close // water stream deflected // cyclohexane not deflected (6 + 2 × 3) [No diagram – deduct 3 marks]		

QUESTION 9

(a) WHAT: **difficult to form lather with soaps** (5)
[accept contains dissolved calcium (or magnesium) salts (ions)]

WRITE: **1: calcium hydrogen carbonate**
2: temporary
3: calcium sulfate
4: permanent
5: ion exchange (5 × 3)

X: carbon dioxide / CO₂
Y: limewater (2 × 3)

(b) FIND: **0.02 × 5 × 1000 = 100 ppm** (6 + 2 × 3)

OUTLINE: **weigh filter paper //**
filter sample //
wash through with distilled water //
dry filter paper //
reweigh filter paper (6 + 2 × 3)

QUESTION 10: Answer any two of the parts (a), (b) and (c).

- (a) MATCH: **A: Dalton**
 B: Le Châtelier
 C: Rutherford
 D: Marie Curie
 E: Arrhenius (2 × 8 + 3 × 3)
- (b) (i) NAME: **Becquerel** (4)
- (ii) WHAT: spontaneous **disintegration (breakdown) of nucleus of atom //**
 emitting radiation (2 × 3)
- (iii) NAME: **alpha / α / beta / β / gamma / γ** (3)
- DESCRIBE: **poor & positive / medium & negative / high & none [matched]** (2 × 3)
- (iv) GIVE: **Co-60 / Am-238 / C-14** (3)
- USE: **cancer treatment / smoke alarms / carbon dating [matched]** (3)
- (c) (i) DEFINE: **mass relative // to 1/12 the mass of the carbon isotope C-12** (4 + 3)
- (ii) WHAT: **CH₂O** (6)
- (iii) CALC.: **40 %** (6)
- $(72 \div 180) \times 100 = 40$
- WHAT: **C₂H₄O₂ // CH₃CO₂H** (6)

QUESTION 11: Answer any *two* of the parts (a), (b) and (c)

- (a) DEFINITION: **gain** (4)
- (i) WHICH: **Cu²⁺ // copper** (3)
HOW: **2** (3)
- (ii) STATE: **blue colour fades / decolourises // zinc dissolves // copper precipitated (coats the zinc) / brown (pink, reddish, copper ppt)** (6 + 3)
- (iii) WHAT: **electrochemical series** [accept activity series] (6)
- (b) (i) STATE : **volume / of a fixed mass of gas is inversely proportional to its pressure** (4 + 3)
- (ii) USE: **22408 ± 8** (9)
 $2 \times 10^5 \times 12230 \div 298 = 1 \times 10^5 \times V \div 273 = 22408$
[LHS - 3 marks, RHS - 3 marks, computation of V - 3 marks]
- (iii) HOW: **1 ± 0.005** (6)
- (iv) HOW: **6 × 10²³** (3)
[Allow range 6 ± 0.03]
- (c) Answer part **A** or part **B**.
- A**
- (i) GIVE: **carbon monoxide / CO**
STATE: **poisonous / toxic** (4 + 3)
- (ii) GIVE: **Any valid NO_x or SO_x** (2 × 3)
HOW: **bubble through water containing universal indicator (named indicator) // observation made (colour change observed)** (3)
- (iii) GIVE: **harm to stonework / harm to plants / harm to fish (aquatic life) / leaching of minerals from soil** (6 + 3)
- B**
- (i) NAME: **electric // arc process** (4 + 3)
- (ii) FROM: **carbon // graphite** (6)
- (iii) NAME: **carbon** (6)
- (iv) GIVE: **construction / reinforcing / car building** (2 × 3)

