

**MARK SCHEME for the May/June 2009 question paper
for the guidance of teachers**

5070/02

5070 CHEMISTRY

Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Page 2	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

Section A

- A1 (a)** Vanadium(V) oxide / V_2O_5 / vanadium oxide ;
NOT: MnO_2
ALLOW: vanadium
- (b)** copper(II) chloride / $CuCl_2$ / copper chloride / copper ; [1]
- (c)** ethanoic acid / ethanoic / correct formula ; [1]
- (d)** potassium dichromate(VI) / (potassium) dichromate / correct formula ;
NOT: potassium [1]
- (e)** chlorine / (potassium) dichromate(VI) / manganese(IV) oxide ;
ALLOW: (concentrated) sulfuric acid [1]

[Total: 5]

- A2 (a)** weak forces between layers / van der Waals forces between layers ; [1]
ALLOW: weak bonds between layers
NOT: the forces are weak / has weak forces between atoms
NOT: no forces / bonds between layers
NOT: has layers and weak forces
NOT: weak forces between molecules
NOT: weak electrostatic forces between layers
- layers can slide / slip ; [1]
NOT: atoms slide over each other
- (b)** no mobile / no moving electrons / no delocalised electrons /
(all) electrons in covalent bonds ; [1]
ALLOW: no free electrons / no sea of electrons
IGNORE: no ions
- (c)** Any two of: [2]
- hard
IGNORE: strong / tough
 - high melting point
IGNORE: high boiling point
 - lots of strong (covalent) bonds
ALLOW: giant structure of strong bonds
ALLOW: has strong bonds throughout
ALLOW: all the bonds are difficult to break / takes a lot of energy to break all the bonds
ALLOW: ideas of all the atoms held together strongly
NOT: has covalent bonds / has strong bonds (without qualification)
NOT: rigid arrangement of tetrahedral structure
NOT: strong forces of attraction between atoms / strong electrostatic forces

[Total: 5]

Page 3	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

- A3 (a) (i)** anode: oxygen / O₂ ;
 NOT: O
 cathode: copper / Cu ;
 ions: H⁺, OH⁻, SO₄²⁻ ;
 (all three needed for the mark)
- (ii)** hydrogen lower in reactivity series (than sodium) / [1]
 hydrogen lower in discharge series (than sodium) /
 easier to reduce hydrogen ions (than sodium) /
 hydrogen ions gain electrons more easily ;
 ALLOW: it is lower in reactivity series
 NOT: hydrogen is easier to discharge (than sodium)
- (iii)** chloride ions lower in discharge series than hydroxide ions/ [1]
 idea of selective discharge of chloride ions/
 chloride ion concentration greater than hydroxide ion concentration ;
 NOT: reference to chlorine / chlorine ions
 NOT: lower in discharge series than oxygen
 NOT: chloride ions lower in reactivity than hydroxide
- (b) (i)** purification of copper/ [1]
 making high grade copper/
 IGNORE: uses of copper / for coating metals / for electroplating
- (ii)** temperature: no effect / no change [1]
 current: increasing current increases mass (of copper) ORA [1]
 ALLOW: mass proportional to current
 ALLOW: increase of 1 amp doubles the mass
 time: increasing time increases mass (of copper) ORA [1]
 ALLOW: mass proportional to time
 ALLOW: with the passage of time mass increases

[Total: 9]

- A4 (a) Charges:** neutron = 0 / zero / none **AND**
 proton = + / plus 1 / +1 ; [1]
- Relative mass: electron = 0 / negligible / 1/1840 / 1/2000 / 0.0005 **AND**
 neutron = 1 / one [1]
- (b)** ¹¹₅B [2]
 1 mark for correct nucleon and proton number as shown ;
 1 mark for correct symbol ;
- (c)** 5 electrons in two shells **AND** 5 protons shown ; [1]
 number of neutrons other than 6 ; [1]
 ALLOW: between 3 and 10 neutrons

[Total: 6]

Page 4	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

- A5 (a)** each of 4 chlorine atoms bonded to carbon by pair of electrons ;
rest of structure correct i.e. 6 unbonded electrons on each chlorine ;
- (b)** Ca^{2+} as 2,8,8 and Cl^- as 2,8,8 in diagram or as numbers ; [1]
correct charges at top right of each structure ; [1]
ALLOW: correct ions shown as Ca^{2+} and Cl^-
- [Total: 4]**
- A6 (a)** KNO_3 / $\text{Ca}(\text{NO}_3)_2$ / $\text{Fe}(\text{NO}_3)_2$; [1]
- (b)** acidic because H^+ / hydrogen ions present ; [1]
(both acidic and hydrogen ions needed)
NOT: hydrogen and nitrate ions
- (c)** moles = $25 \times 0.450 = 11.25$ / 11.3 / 11 ; [1]
mass = $56 \times 11.25 = 630$ (g) ; [1]
- (d)** (grey-) green precipitate ; [1]
of iron(II) hydroxide ; [1]
NOT: iron(III) hydroxide / ppt of iron / ppt due to iron(II) ions
white precipitate / ppt of calcium hydroxide formed ; [1]
ALLOW: idea of calcium hydroxide precipitate masked / cannot be seen
NOT: white ppt dissolves in excess
- (e)** add (excess) sodium hydroxide (solution) ; [1]
add aluminium / Dervarda's alloy ; [1]
heat / warm ; [1]
gas given off turns (moist) red litmus blue/ [1]
ALLOW: ammonia gas given off /
NOT: smelly gas given off
NOTE: this mark is consequential on both the reagents Al and sodium hydroxide being correct
- OR**
mix solution with (freshly made) iron(II) sulfate (solution) ; (1 mark)
add concentrated sulfuric acid ; (1 mark)
idea of making layer of sulfuric acid over the solution / idea of two layers ; (1 mark)
brown ring (at interface) ; (1 mark)
NOTE: this mark is consequential on both the reagents being correct but sulfuric acid does not have to be concentrated

[Total: 11]

Page 5	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

- A7 (a)** correct structure of chloroethene ;
ALLOW: $\text{CH}_2=\text{CHCl}$
NOT: CH_2CHCl
- (b) (i)** $2 - \text{C}_2\text{H}_3\text{Cl} + 5\text{O}_2 \rightarrow 2\text{HCl} + 4\text{CO}_2 + 2\text{H}_2\text{O}$ [1]
ALLOW: multiples / fractions
- (ii)** calcium chloride ; [1]
ALLOW: CaCl_2
- (c)** correct name of condensation polymer ; [1]
correct use of the named polymer ; [1]
e.g. nylon (1)
clothing / fishing lines / fishing nets / ropes / stockings / parachutes / toothbrush (bristles) / balloons / guitar strings / racquet strings / petrol tanks (1)
IGNORE: fibres without qualifications
polyester / terylene / mylar / PET (1)
terylene: clothing / sheets / pillowcases / furniture coverings / curtains / carpets / ropes / sails / machinery belts
PET: bottles and any of the above
mylar: balloons
polyester: any of the above (1)
IGNORE: fibres without qualifications
Kevlar (1)
bullet proof vests / canoes / racquets / car tyres (as composite) (1)
IGNORE: fabrics / textiles / fibres without qualifications

[Total: 5]

Page 6	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

Section B

- B8 (a)** crude oil / petroleum heated in fractionating column / idea of fractional distillation ;
NOT: ideas of simple distillation / reference to distillation in the lab
Any one of:
- separated according to different boiling point (from other fractions) / fractions have different boiling points / has specific range of boiling points ;
NOT: incorrect references to petrol e.g. petrol has the lowest boiling points so comes off at the top
 - separated according to size of molecules (from other fractions) / fractions have different chain lengths ;
 - petrol made by cracking of long chained hydrocarbons / gas oil / kerosene ;
 - equation showing cracking [1]
- (b) (i)** 10 800 g / 10.8 kg [1]
- (ii)** moles carbon dioxide = $10\,800 / 44 = 245.45$; [1]
moles octane = $245.45 / 8 = 30.68$; [1]
ALLOW: 1 mark for showing division of moles of carbon dioxide by 8 or $16/2 M_r$ of octane 114 ; [1]
Mass of octane = $114 \times 30.68 = 3497.5$ (g) / 3498 (g) / 3500 (g) [1]
ALLOW: 1 mark for multiplying moles of octane by 114 with correct answer for that calculation.
- (c)** CO converted to carbon dioxide ; [1]
NO / nitrogen oxide(s) converted to nitrogen ; [1]
ALLOW: $\text{CO} + \text{NO} \rightarrow \text{CO}_2 + \frac{1}{2}\text{N}_2$ = 2 marks (even if not correctly balanced)
- (d)** acid rain / effect of acid rain/ smog ; [1]
IGNORE: breathing difficulties / irritation of nose and throat

[Total: 10]

Page 7	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

- B9 (a)** Any three of: (1 mark each)
- have general formula / each member differs by CH₂ group / by *M_r* of 14
 - have same functional group
 - have similar chemical properties
 - physical properties show a trend / example of physical property showing trend e.g. boiling points increase with longer carbon chain
- (b) (i)** any value between 105 and 130°C (actual = 117°C) [1]
- (ii)** C₆H₁₃OH [1]
- (c) (i)** C₂H₄ + H₂O → C₂H₅OH [1]
IGNORE: state symbols
- (ii)** addition [1]
ALLOW: hydration / additional
NOT: exothermic
- (d)** use of moles e.g. 180 g glucose → 2 × 46 or 92 g ethanol [1]
OR
100 moles glucose (18000 / 180) → 200 moles ethanol ;
- theoretical yield calculated e.g. 18 kg glucose → 9.2 kg ethanol [1]
OR
200 × 46 = 9200 g ethanol ;
- % yield calculated e.g. 100 × 0.92/9.2 = 10% ; [1]

[Total: 10]

Page 8	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

B10(a) Correct M_r values: $(\text{NH}_4)_2\text{SO}_4 = 132$ **AND** $\text{KNO}_3 = 101$;

% N in $(\text{NH}_4)_2\text{SO}_4$ ($2 \times 14 / 132$) = 21.2% / 21.21% ;

OR

mass of N in 500 g = $500 \times 28/132 = 106.1$ g

% N in KNO_3 ($14 / 101$) = 13.9% / 13.86% ;

OR

Mass N in 500 g $\text{KNO}_3 = 500 \times 14/ 101 = 69.3$ g

[1]

overall percentage = 17.6% / 17.5(5)% / ;

ALLOW: 18 %

[1]

(b) Any **three** from: (one mark each)

[3]

- rapid growth of algae / water weeds / algal bloom

ALLOW: rapid growth of (green) plants

NOT: plants grow, unqualified (must be increased/ rapid etc)

- blocks (sun)light so plants die

- bacterial growth increases

- bacteria use up oxygen

NOT: algae / plants use up oxygen

- aquatic life dies / aquatic animals die / fish die because of lack of oxygen

NOT: marine organisms die

(c) add potassium carbonate solution / potassium hydroxide (solution) ;

[1]

titration / description of titration **AND** repeat titration without indicator ;

[1]

ALLOW: titration with indicator then remove indicator with charcoal

crystallise / description of crystallisation **AND** dry with filter paper /

[1]

evaporate off some water **AND** dry in oven / put in oven to allow evaporation of water /

allow water to evaporate completely / boil off all the water

[Total: 10]

Page 9	Mark Scheme: Teachers' version	Syllabus
	GCE O LEVEL – May/June 2009	5070

www.PapaCambridge.com

- B11(a) (i)** Electrons lost/ oxidation number (of iron) increases / oxidation number goes from 0 to +2 ;
 NOT: incorrect oxidation numbers
- (ii)** $\text{Fe}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s})$ [2]
 correct balanced equation = 1 mark
 correct state symbols = 1 mark
 (mark for state symbols dependent on correct formulae)
- (b) (i)** stops water from getting to the surface (of the iron) / [1]
 stops oxygen getting to surface (of the iron) /
 stops oxygen / water getting to the iron /
 stops air getting to the iron /
 ALLOW: acts as a protective barrier / layer
 NOT: ideas about sacrificial protection
 NOT: tin does not react with water / air / tin less reactive than iron
- (ii)** with tin: oxygen / water can react with the iron (where it is scratched) ; [1]
 NOT: iron more reactive than tin
 with zinc any **two** of: [2]
- zinc more reactive than iron
 NOT: zinc oxide protective layer
 - zinc is sacrificial metal / idea of sacrificial protection i.e. zinc corrodes more readily than iron / zinc reacts first
 NOT: zinc rusts more readily than iron
 - zinc loses electrons more readily than iron
 NOT: zinc displaces iron
- (c)** has layer of (aluminium) oxide that will not flake off / [1]
 layer of insoluble / unreactive (aluminium) oxide /
 layer of impermeable (aluminium) oxide / protective oxide layer /
 NOT: oxide coating without further qualification
 NOT: forms a protective layer with oxygen
- (d)** correct use ; [1]
 e.g. drink cans / car bodies / aircraft bodies / high voltage electricity cables /
 cooking foil / window frames / ladders /
 ALLOW: cooking utensils / mirrors (as does not corrode)
 NOT: for cutlery
- correct explanation related to specific use stated ; [1]
 e.g. drinks cans → will not react with water / acids
 car bodies → will not corrode
 aircraft bodies → lightweight / low density
 electricity cables → lightweight / good conductor of electricity

[Total: 10]