edexcel
advancing learning, changing lives

Mark Scheme (Final)
Summer 2008

GCE

GCE Chemistry Nuffield (6251/01)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the mark scheme

1 / means that the responses are alternatives and either answer should receive full credit.
2 ( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
3 [ ] words inside square brackets are instructions or guidance for examiners.
4 Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
5 ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	0.002 or 2 x 10^{-3}(mol)	0.0020 or 2.0 x 10^{-3}(mol)		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)	Redox (1) Zinc (atoms) has/have lost (two) electrons **and** Fe^{3+}/iron ions have gained electrons (1) MUST be some reference to ions	 Zinc goes up in oxidation number and iron goes down in oxidation number. Oxidation or reduction if fully justified. Max 1		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)	Aldehyde(s)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)	(blue to) red(1) precipitate/solid (1)	green/yellow/ brown/orange instead of red		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(i)	112			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(ii)	$\frac{(188x15.2) + (189x17.4) + (190x26.4) + (192x41.0)}{100}$ (1) = 190.3 (1) Correct answer with no working (2) Ignore units	190.34/ 190.342 with no working=max1	190 190.34 190.342	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)	3 (1) peaks due to ions containing two ^{35}Cl atoms, one ^{35}Cl atom and one ^{37}Cl atom and two ^{37}Cl atoms. (1) OWTTE	4 peaks appropriately justified could score 2nd mark		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	thermal decomposition			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	NO_2 (g) – place **damp** litmus/UI paper in gas, litmus/UI paper is bleached/turns red OR brown gas is observed (1) O_2 (g) – place glowing splint in gas, splint relights (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iii)	moles of $Mg(NO_3)_2$ = 14.8/148 = 0.1 (1) hence moles of NO_2 produced = 0.2 (1) hence volume of NO_2 produced = 4800 cm^3 (1) 4800cm^3/ 4.8dm^3	Transferred errors, e.g. wrong number of moles loses 1st mark, but could score 2nd and 3rd. Or 0.1 mole leading to 2400cm^3 Loses 2nd mark. Correct answer alone = 3 marks	Incorrect/missing units e.g cm^3 mol^{-1}	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(i)	$Mg^{2+}(aq) + 2OH^-(aq) \rightarrow Mg(OH)_2(s)$ (1)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(ii)	White	Milky white Chalky white	Off white Cream white	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(i)	$MgCl_2$ (1) Ignore stage symbols	$MgCl_2$ (aq) $Mg^{2+} + 2\ Cl^-$ $Mg^{2+}\ (Cl^-)_2$	$Mg^{2+}Cl_2^-$ $Mg^{2+}Cl_2^{2-}$	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(ii)	• concentrate solution by heating/reduce volume of solution • leave to cool/crystallise/allow remaining water to evaporate/leave to dry • pick out crystals/decant solution/filter • pat dry with absorbent paper/blotting paper/filter paper/dessicator 4 points = 3 marks 3 points = 2 marks 2 points = 1 mark 1 or 0 points = 0 marks Stop marking key points when procedure stops working e.g. if <u>heated</u> to <u>dryness</u> 0/3. ignore filter at first stage	Oven at suitable temp eg ≤100° / 'oven at low temperature'	Heat alone for first bullet point	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	D and F (1) 2,2–dimethylbutan(e)-1-ol (1) conditional on the first mark IGNORE punctuation		But-1-ol and buta-1-ol	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(ii)	B / 2-methylpentan-2-ol (1) carbon atom joined to hydroxyl group is attached to three other carbon atoms (1) mark independently	Carbon atom joined to hydroxyl group has no hydrogens attached	More than one given loses first mark	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(iii)	same molecular formula/same number and type of atoms (1) different structural formula /different displayed formula/ different arrangement of atoms (1)		Same chemical formula Different structure (alone)	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(i)	D, F and C (1)	D and C or F and C		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(ii)	(complete)oxidation (1)	Redox	Reduction. partial	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iii)	orange to green/blue (1)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(i)	round-bottomed or pear-shaped flask + heat (1) condenser with correct water flow (1) collection vessel (1) Apparatus with no joints max 2	2 max for non working apparatus e.g. sealed		3

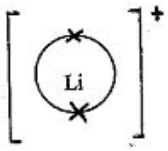
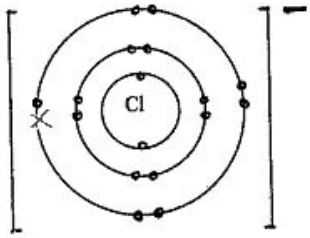
Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(ii)	moles of cyclohexanol =15 /100 = 0.15 AND moles of cyclohexene = 9.84/82 = 0.12 (1) % yield = $\frac{0.12}{0.15}$ x 100 = 80%(1) Correct answer alone (2)	moles of cyclohexanol =15/100 = 0.15 and mass of cyclohexene = 0.15 x 82 = 12.3 (1) % yield = $\frac{9.84}{12.3}$ x 100 = 80% (1)		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(i)	nuclear charge increases (hence attraction between nucleus and outer shell increases) (1) outer electrons being added to same main energy level/outer electrons are in same shell/ shielding remains the same (hence atomic radius decreases across a period) (1)	Increased number of protons	Larger nucleus	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(ii)	line sketched on axes showing similar trend but greater atomic radii (1) Any two from: • Similar trend as atomic radii exhibit periodicity • Greater radii as period three has an extra shell of electrons/ main energy level • Greater radii as there is more shielding of nuclear charge in period three • Greater radii as the attraction between nuclear charge and outer electrons is less in period three 2nd and 3rd marks are independent of 1st mark (2)		Repetition of justification of trend from (a)(i)	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(i)	metallic		Metal	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(ii)	attraction between ions and delocalised electrons is stronger in lithium (1) as lithium ion is smaller / lithium ion has greater charge density/ electrons closer to nucleus (1)	With reference to atoms 1 max Reverse argument		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (c)(i)	 (1)  **(1)**	All dots and crosses Charges next to element symbols	Correct electronic structure but wrong or no charges max 1 Covalent structures = 0	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (c)(ii)	**Electrons** are promoted (to higher energy level). (1) Then they fall back to lower levels (they emit light of particular wavelength). (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (c)(iii)	strontium / calcium	Rubidium		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(i)	3S (s) + O_2 (g) + $2H_2$ (g) correct entities (1) state symbols and balancing (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(ii)	Energy change when 1 mole of a compound is formed (1) from its elements (in their standard states) (1) at 298K/quoted temperature and 1atm (1)			3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(iii)	(2 x -285.8) – (-296.8 +(2 x -20.6)) (1) = -233.6/-234 (kJ mol^{-1}) (1) Allow transferred error for one minor slip (e.g. 20.4 instead of 20.6) but not for omission of multiples. Ignore units		-233 -230	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)(i)	Add **damp** blue litmus/**damp** UI paper(1) Goes red (1) OR Dissolve in water (1) Add named indicator and colour change/test with pH meter and value less than 7(1)	Mix with sodium carbonate solution (1) Effervescence/ CO_2 evolved (1)		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)(ii)	an acid in which very few protons are donated or ionises/ dissociates only slightly/an acid that interacts very little with water		partially not fully not readily/easily	1