

Mark Scheme January 2009

GCE

GCE Chemistry (8CH01)

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

<http://www.edexcel.com/Aboutus/contact-us/>

Alternately, you can speak directly to a subject specialist at Edexcel on our dedicated **Science** telephone line: **0844 576 0037**

January 2009

Publications Code UA020839

All the material in this publication is copyright
© Edexcel Ltd 2009

Contents

1. 6CH01/01 Mark Scheme	1
2. 6CH02/01 Mark Scheme	17

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 OWTTE means or words to that effect
- 6 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- show clarity of expression
- construct and present coherent arguments
- demonstrate an effective use of grammar, punctuation and spelling.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated "QWC" in the mark scheme BUT this does not preclude others.

6CH01/01

Section A

Question Number	Answer	Mark
1	C	1

Question Number	Answer	Mark
2	D	1

Question Number	Answer	Mark
3	C	1

Question Number	Answer	Mark
4	C	1

Question Number	Answer	Mark
5	B	1

Question Number	Answer	Mark
6(a)	D	1

Question Number	Answer	Mark
6(b)	C	1

Question Number	Answer	Mark
6(c)	A	1

Question Number	Answer	Mark
7	C	1

Question Number	Answer	Mark
8	A	1

Question Number	Answer	Mark
9	B	1

Question Number	Answer	Mark
10	B	1

Question Number	Answer	Mark
11	B	1

Question Number	Answer	Mark
12	C	1

Question Number	Answer	Mark
13	D	1

Question Number	Answer	Mark
14	B	1

Question Number	Answer	Mark
15	A	1

Question Number	Answer	Mark
16	D	1

Question Number	Answer	Mark
17	D	1

Question Number	Answer	Mark
18	B	1

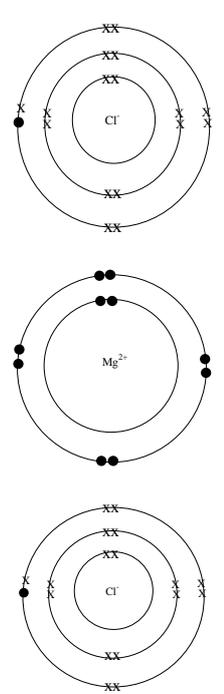
Section B

Question Number	Acceptable Answers	Reject	Mark
19(a)(i)	$(1s^2)2s^22p^63s^2$ ALLOW subscripts IGNORE capital letters ALLOW 2p as $p_x p_y p_z$ with two e^- in each	Noble gas core	1

Question Number	Acceptable Answers	Reject	Mark
19(a)(ii)	$(1s^2)2s^22p^63s^23p^5$ ALLOW subscripts IGNORE capital letters ALLOW 2p as $p_x p_y p_z$ with two e^- in each ALLOW 3p as $p_x p_y p_z$ with two, two, one e^- in each	Noble gas core	1

Question Number	Acceptable Answers	Reject	Mark
19(b)(i)	$Mg_{(s)} + Cl_{2(g)} \rightarrow MgCl_{2(s)}$ Species and balancing (1) State symbols CQ on correct species (1) NOTE $Mg_{(s)} + 2Cl_{(g)} \rightarrow MgCl_{2(s)}$ scores (1)		2

Question Number	Acceptable Answers	Reject	Mark
19(b)(ii)	Ionic / electrovalent IGNORE "lattice"/"bonding"/"giant"		1

Question Number	Acceptable Answers	Reject	Mark
19(b)(iii)	<p>Correct number of electrons on each ion (1) Correct charges and symbols for each ion (1) Correct ratio of ions (1)</p>  <p><i>ALLOW</i> all dots or all crosses <i>ALLOW</i> correct charges shown outside the ions <i>ALLOW</i> Cl⁻ correctly with “2” in front or after the Cl⁻</p>	<p>Any covalency shown (0) i.e. any overlap of circles (e.g. Mg with a Cl or a Cl with a Cl) scores (0) overall, even if correct charges on ions and/or ratio of ions has been shown</p>	3

Question Number	Acceptable Answers	Reject	Mark
19(c)	(Giant) metallic / metal		1

Question Number	Acceptable Answers	Reject	Mark
19(d) QWC	<p>Magnesium ion / Mg^{2+} has a larger charge (density) (than the sodium ion / Na^+)</p> <p>OR Magnesium/Mg/Mg atom/Mg^{2+} (ion) contributes two electrons/more electrons (to the “sea” of electrons) (1)</p> <p>magnesium ions / Mg^{2+} smaller (than sodium ions) (1)</p> <p>NOTE “Mg^{2+} is smaller than Na^+” would score first 2 marks above</p> <p>magnesium ions / Mg^{2+} have greater attraction for (“sea” of) electrons (than sodium ions / Na^+)</p> <p>OR More energy/heat required to overcome (attractive) forces/bonds (between cations and “sea” of electrons) in magnesium (compared to sodium) (1)</p> <p>Mark each point independently</p>	<p>Any references to the bonding being ionic scores (0) overall</p> <p>Any references to “molecules”/intermolecular forces scores (0) overall</p> <p>JUST “stronger bonds in Mg”</p> <p>JUST “stronger bonds in Mg”</p>	3

Question Number	Acceptable Answers	Reject	Mark
20 (a)(i)	<ul style="list-style-type: none"> Idea of impact by electrons, with energy: fast electrons strike sample / high energy electrons / accelerated electrons / electrons fired at sample/sample bombarded with electrons/blasted with electrons from electron gun (1) Idea of electron removal: removes an electron/knocks out electron(s)/$X \rightarrow X^+ + e^-$ (1) <p>Mark each point independently</p>	<p>“electron gun” alone</p> <p>an incorrect equation negates second mark</p>	2

Question Number	Acceptable Answers	Reject	Mark
20(a)(ii)	Electric field/electrostatic field / charged plates / voltage differential across plates/negative field/negatively charged plates	Electric current/electric coil/magnetic field	1

Question Number	Acceptable Answers	Reject	Mark
20(a)(iii)	Magnetic field / magnet / electromagnet / magnetic plates	“Negative magnetic field”	1

Question Number	Acceptable Answers	Reject	Mark
20(b)	$\frac{((50.0 \times 4.3) + (52.0 \times 83.8) + (53.0 \times 9.5) + (54.0 \times 2.4))}{100}$ <p>(1)</p> <p>= 52.1 (must be to 3 SF) (1)</p> <p>NOTE: 52.057/52.06 scores (1) with or without any working</p> <p>IGNORE g or g mol^{-1} but wrong units lose a mark</p> <p>Correct answer with no working (2)</p>		2

Question Number	Acceptable Answers	Reject	Mark
20(c)	Same electronic structures/same electronic configurations/same electronic arrangements/same number of electrons/same total number of electrons <i>ALLOW</i> "same number of protons and same number of electrons"	Just "same number of outer electrons" (0) OR Just "same number of protons" (0)	1

Question Number	Acceptable Answers	Reject	Mark
20(d)	d (block) <i>ALLOW</i> "D" (BLOCK) <i>IGNORE</i> "transition metal/element" if d (block) stated in answer <i>IGNORE</i> "group"	Just transition element(s) / transition metal(s)	1

Question Number	Acceptable Answers	Reject	Mark
21(a)	<p>Enthalpy / (heat) energy / heat required</p> <p>OR</p> <p>enthalpy / (heat) energy / heat change (1)</p> <p>to remove one electron (1)</p> <p>from each atom of one mole of gaseous atoms OWTTE</p> <p style="text-align: right;">(1)</p> <p>(e.g. “energy required to remove one mole of electrons from one mole of gaseous atoms” scores all three marks)</p> <p>NOTE: The equation: $X_{(g)} \rightarrow X^+_{(g)} + e^-$</p> <p>scores the last two marks.</p>	<p>“Energy given out....” for first mark.</p> <p>If an incorrect equation is given after a correct definition, (2) scored.</p>	3

Question Number	Acceptable Answers	Reject	Mark
21(b)	<p>$Na^+_{(g)} \rightarrow Na^{2+}_{(g)} + e^-$</p> <p>OR</p> <p>$Na^+_{(g)} - e^- \rightarrow Na^{2+}_{(g)}$</p> <p>Species (1) ALLOW “e” for “e⁻”</p> <p>State symbols (1)</p> <p>2nd mark is CQ on 1st</p> <p>The following score max (1):</p> <p>$X^+_{(g)} \rightarrow X^{2+}_{(g)} + e^-$ (1)</p> <p>OR</p> <p>$X^+_{(g)} - e^- \rightarrow X^{2+}_{(g)}$ (1)</p> <p>$Na_{(g)} \rightarrow Na^{2+}_{(g)} + 2e^-$ (1)</p> <p>OR</p> <p>$Na_{(g)} \rightarrow Na^+_{(g)} + e^-$ (1)</p> <p>OR</p> <p>$Na^+_{(g)} + e^- \rightarrow Na^{2+}_{(g)}$ (1)</p> <p>OR</p> <p>$Na^+_{(g)} - e^- \rightarrow Na^{2+}_{(g)} + e^-$ (1)</p>	<p>“e²⁻”</p> <p>$Na^{2+}_{(g)} + e^- \rightarrow Na^+_{(g)}$ (0)</p>	2

Question Number	Acceptable Answers	Reject	Mark
21(c)(i)	<p style="text-align: center;">ANSWER</p> <p>Correct line alone can score all 3 marks with no points specifically plotted</p>		3

Question Number	Acceptable Answers	Reject	Mark
21(c)(ii) QWC	<p>More protons / greater nuclear charge/proton number increases (1)</p> <p>ALLOW "effective nuclear charge increases across the Period"</p> <p>outer electrons in same shell / energy level OR same shielding OR similar shielding OR decrease in atomic radius OR outer electron closer to nucleus OR attracting the same number of (occupied) electron shells / energy levels (1)</p> <p>greater (force of) attraction between nucleus and (outer) electron(s) / (outer) electron(s) held more strongly by nucleus (1)</p> <p>Mark each point independently</p>	Just "increasing atomic number"	3

Question Number	Acceptable Answers	Reject	Mark
21(c)(iii) QWC	(Outermost) electron in (3-)p sub-shell/sub-level/orbital (1) of higher energy OR (slightly) shielded by (3-)s (electrons) OR (sub-shell) further from nucleus (1) <i>NOTE:</i> Penalise use of the terms “s-shell” or “p-shell” once only.		2

Question Number	Acceptable Answers	Reject	Mark
21(d)	S ⁻ S S ⁺		1

Question Number	Acceptable Answers	Reject	Mark
22(a)	(Electrostatic attraction between two nuclei and the) shared pair (1) of electrons (between them) (1)		2

Question Number	Acceptable Answers	Reject	Mark
22(b)	(Dative) pair of e ⁻ between N and O (1) Three bond pairs between N and N (1) Lone pair on left-hand N and three lone pairs on O atom (1) (1) <i>ALLOW</i> dots and crosses OR all dots OR all crosses Stand alone marks Non-bonding electrons on N and O do not have to be shown in pairs		3

Ignore sig figs in this question

Question Number	Acceptable Answers	Reject	Mark
23(a)(i)	Energy absorbed = $30 \times 4.18 \times 4.9 = 614$ (J) Note: 610 to 2 sig figs 614.5 to 4 sig figs 614.46 to 5 sig figs Ignore any signs, + OR - Answer alone scores the mark ALLOW "0.614 kJ"	615 "614 kJ" etc	1

Question Number	Acceptable Answers	Reject	Mark
23(a)(ii)	Moles = $\frac{2.00}{100} = 0.02(00)$ (mol) Answer alone scores the mark ALLOW 0.01998 etc for use of Mr = 100.1		1

Question Number	Acceptable Answers	Reject	Mark
23(a)(iii)	$\Delta H_2^\circ = \frac{\text{Answer to (a)(i) in kJ}}{\text{Answer to (a)(ii)}}$ $= \frac{0.614}{0.02(00)}$ $(\Delta H_2^\circ) = +31 / +30.7$ (kJ mol ⁻¹) (2) Positive sign (1) stand alone Answer (1) If mass of solution used is 32 g in a(i), answer is $\Delta H_2^\circ = +32.8 / +33$ (kJ mol ⁻¹) If mass of solution used is 2 g in a(i), $\Delta H_2^\circ = +2.05 / +2.0 / +2.048$ (kJ mol ⁻¹)		2

Question Number	Acceptable Answers	Reject	Mark
23(b)(i)	$\Delta H_1^\circ = 2 \times \Delta H_2^\circ - \Delta H_3^\circ$		1

Question Number	Acceptable Answers	Reject	Mark
23(b)(ii)	<p> $\Delta H^{\circ}_1 = 2 \times +31 - (-34)$ $(\Delta H^{\circ}_1) = +96 \text{ (kJ mol}^{-1}\text{)}$ OR $2 \times +30.7 - (-34) = +95.4 / +95$ Answer (1) Positive sign (1) </p> <p> NOTE: For +ve answers, penalise the omission of the “+” sign ONCE ONLY in (a)(iii) and (b)(ii) Consequential on (a)(iii) and formula in (b)(i) - the arithmetic must be checked </p> <p> ALLOW: +96 / +95.4 / +95 (kJ mol⁻¹) (2) EVEN IF $\Delta H^{\circ}_1 = \Delta H^{\circ}_2 - \Delta H^{\circ}_3$ GIVEN IN (b)(i) </p> <p> NOTE If use $\Delta H^{\circ}_1 = \Delta H^{\circ}_2 - \Delta H^{\circ}_3$ and mass of solution used is 30 g $\Delta H^{\circ}_1 = +65 \text{ (kJ mol}^{-1}\text{)}$ </p> <p> If use $\Delta H^{\circ}_1 = \Delta H^{\circ}_2 - \Delta H^{\circ}_3$ and mass of solution used is 32 g $\Delta H^{\circ}_1 = +67 \text{ (kJ mol}^{-1}\text{)}$ </p> <p> If use $\Delta H^{\circ}_1 = \Delta H^{\circ}_2 - \Delta H^{\circ}_3$ and mass of solution used is 2 g $\Delta H^{\circ}_1 = +36 \text{ (kJ mol}^{-1}\text{)}$ </p> <p> If use $\Delta H^{\circ}_1 = 2\Delta H^{\circ}_2 - \Delta H^{\circ}_3$ and mass of solution used is 32 g $\Delta H^{\circ}_1 = +100 \text{ (kJ mol}^{-1}\text{)}$ </p> <p> If use $\Delta H^{\circ}_1 = 2\Delta H^{\circ}_2 - \Delta H^{\circ}_3$ and mass of solution used is 2 g $\Delta H^{\circ}_1 = +38 \text{ (kJ mol}^{-1}\text{)}$ </p>		2

Question Number	Acceptable Answers	Reject	Mark
23(c)(i)	<p>Error for balance:</p> $= (\pm) 2 \times \frac{0.01}{2.00} \times 100\%$ $= (\pm) 1.00\%/1.0\%/1\% \text{ (1)}$ <p>ALLOW $(\pm) 0.5\%$ also scores (1)</p> <p>Correct answer with no working scores (1)</p> <p>Error for measuring cylinder:</p> $= (\pm) \frac{0.5}{30} \times 100\%$ $= (\pm) 1.7\%/1.67\% \text{ (1)}$ <p>Correct answer with no working scores (1)</p>	1.6(6)% (0)	2

Question Number	Acceptable Answers	Reject	Mark
23(c)(ii)	Pipette or burette	“biuret”	1

Question Number	Acceptable Answers	Reject	Mark
24(a)	C_nH_{2n+2}		1

Question Number	Acceptable Answers	Reject	Mark
24(b)(i)	Cracking		1

Question Number	Acceptable Answers	Reject	Mark
24(b)(ii)	Reforming / dehydrogenation		1

Question Number	Acceptable Answers	Reject	Mark
24(c)	Skeletal		1

Question Number	Acceptable Answers	Reject	Mark
24(d)(i)	C_9H_{20}	Structural / displayed formulae	1

Question Number	Acceptable Answers	Reject	Mark
24(d)(ii)	3-ethyl-4-methylhexane <i>ALLOW</i> methyl before ethyl 4-methyl-3-ethylhexane 3-methyl-4-ethylhexane 4-ethyl-3-methylhexane 3,4-ethylmethylhexane <i>IGNORE</i> incorrect "punctuation"		1

Question Number	Acceptable Answers	Reject	Mark
24(e)(i)	<p>Enthalpy change Step A:</p> $\bar{E}(\text{C-H}) + - \bar{E}(\text{H-Cl})$ $= + 413 + (-432)$ $= - 19 \text{ (kJ mol}^{-1}\text{)} \quad (1)$ <p>Correct answer with no working (1)</p> <p>Enthalpy change Step B:</p> $\bar{E}(\text{C-H}) + - \bar{E}(\text{C-Cl})$ $= + 413 + (-346)$ $= (+) 67 \text{ (kJ mol}^{-1}\text{)} \quad (1)$ <p>Correct answer with no working (1)</p> <p><i>NOTE</i></p> <p>Both values correct scores (3) One of the two values correct scores (2) <i>NOTE</i></p> <p>Neither value is correct, but a clear statement that</p> <p>$\Delta H = \text{bonds broken} + \text{bonds made}$ scores (1)</p>	<p>(+)19 scores (0) for this mark</p> <p>-67 scores (0) for this mark</p>	3

Question Number	Acceptable Answers	Reject	Mark
24(e)(ii)	<p>Step A as (ΔH) is negative/exothermic (compared with a positive/endothemic value for Step B)</p> <p>OR</p> <p>Step A as it is the more energetically favourable</p> <p>Mark CQ on the energy changes in (e)(i)</p> <p>e.g if +19 and -67 given in (e)(i), Step B will be justified for the CQ mark; e.g. if both values endothermic, selects the less endothermic value</p> <p>OR</p> <p>if both values exothermic, selects the more exothermic value</p> <p><i>IGNORE</i> statements such as “no harmful by-products” etc.</p>		1

Question Number	Acceptable Answers	Reject	Mark
24(f)	<p>Volume of bromomethane =</p> $\frac{5}{1\ 000\ 000} \times 2.5 \times 10^5$ <p>= 1.25 (dm³)</p> <p>Correct answer with no working scores the mark</p>		1

6CH02/01

Section A

Question Number	Correct Answer	Reject	Mark
1 (a)	A		1

Question Number	Correct Answer	Reject	Mark
1 (b)	A		1

Question Number	Correct Answer	Reject	Mark
1 (c)	C		1

Question Number	Correct Answer	Reject	Mark
2	A		1

Question Number	Correct Answer	Reject	Mark
3	C		1

Question Number	Correct Answer	Reject	Mark
4	D		1

Question Number	Correct Answer	Reject	Mark
5	D		1

Question Number	Correct Answer	Reject	Mark
6	C		1

Question Number	Correct Answer	Reject	Mark
7	B		1

Question Number	Correct Answer	Reject	Mark
8	D		1

Question Number	Correct Answer	Reject	Mark
9	C		1

Question Number	Correct Answer	Reject	Mark
10	B		1

Question Number	Correct Answer	Reject	Mark
11	A		1

Question Number	Correct Answer	Reject	Mark
12	D		1

Question Number	Correct Answer	Reject	Mark
13	D		1

Question Number	Correct Answer	Reject	Mark
14	C		1

Question Number	Correct Answer	Reject	Mark
15	A		1

Question Number	Correct Answer	Reject	Mark
16	B		1

Question Number	Correct Answer	Reject	Mark
17 (a)	B		1

Question Number	Correct Answer	Reject	Mark
17 (b)	A		1

Section B

Question Number	Correct Answer	Reject	Mark
18 (a)(i)	<p>(Dilute) Sodium hydroxide / potassium hydroxide / NaOH / KOH (1)</p> <p>(Heat/warm in)aqueous solution / Mixture of water and ethanol (1)</p> <p>Ignore references to pressure and temperature</p> <p>Allow 2nd mark for water without reference to sodium hydroxide etc unless contradicted by inappropriate reagent e.g. acids</p>	<p>Concentrated</p> <p>Ethanol</p>	2

Question Number	Correct Answer	Reject	Mark
18 (a)(ii)	<p>Ammonia / NH₃ (in ethanol) (1)</p> <p>Heat and pressure / heat in a sealed tube (1)</p>		2

Question Number	Correct Answer	Reject	Mark
18 (a)(iii)	<p>(concentrated) Sodium hydroxide / potassium hydroxide / NaOH / KOH (1)</p> <p>ignore dilute</p> <p>(heat and)dissolved in ethanol (1)</p>	aqueous solution	2

Question Number	Correct Answer	Reject	Mark
18 (b)	<p>Sulfuric acid is a (strong enough) oxidising agent (1)</p> <p>To oxidise iodide ions/hydrogen iodide (to iodine) (1)</p> <p>Allow reverse argument based on iodide ions as a reducing agent</p>	Oxidise iodine	2

Question Number	Correct Answer	Reject	Mark
18 (c)(i)	Bromochlorodifluoromethane Allow halogens not in alphabetical order Ignore 'correct' but unnecessary numbers given in name		1

Question Number	Correct Answer	Reject	Mark
18 (c)(ii)		Hydrogen atom shown in skeletal formula	1

Question Number	Correct Answer	Reject	Mark
18 (c)(iii)	Any two from Halogenoalkanes; Absorb heat from fire Prevent oxygen from reaching the fire/form a layer that excludes oxygen Absorb free radicals in combustion propagation Strength of C-F bond makes molecules inert / strength of C-F bond makes it hard to break	Reacts with oxygen	2

Question Number	Correct Answer	Reject	Mark
18 (c)(iv) QWC	<ul style="list-style-type: none"> • Halogenoalkanes such as CF_2ClBr can release Cl free radicals • Cl free radicals react with O_3 • Ozone layer depletes • Leading to greater levels of UV exposure • Greater risk of skin cancer <p>(Any 3 from above, in context and using correct terminology)</p> <p>AND</p> <p>CF_3CHF_2 has strong C-F bonds so does not release F radicals</p>		4

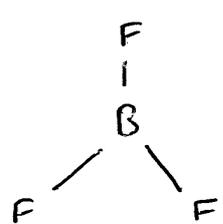
Question Number	Correct Answer	Reject	Mark
19 (a)	<p>Reduction (1)</p> <p>Has gained 1 electron / oxidation number has decreased (from (+)2 to (+)1) (1)</p> <p>Oxidation = 0</p>		2

Question Number	Correct Answer	Reject	Mark
19 (b)(i)	<p>Starch (1)</p> <p>Blue-black / Blue / black to colourless (1)</p>	Purple, clear	2

Question Number	Correct Answer	Reject	Mark
19 (b)(ii)	<p>Moles of thiosulfate = $(12.75/1000 \times 0.2) = 0.00255 \text{ mol}$ (1)</p> <p>Moles of iodine = $(0.00255 / 2) = 0.001275 / 1.275 \times 10^{-3} / 0.00128 / 1.28 \times 10^{-3}$ (1)</p> <p>Allow TE for correct use of ratio for 2nd mark</p> <p>Correct answer alone = 2 marks</p>		2

Question Number	Correct Answer	Reject	Mark
19 (b)(iii) QWC	<p>Moles of Cu^{2+} = 0.00255 (1)</p> <p>Allow TE from b (ii)</p> <p>$[\text{Cu}^{2+}] = 0.255 \text{ mol dm}^{-3}$ (1)</p> <p>Allow TE for scaling up correctly</p> <p>Correct answer alone = 2 marks</p> <p>3SF is the least accurate level of the measurements used in the calculation/experiment (1)</p> <p>OWTTE</p>		3

Question Number	Correct Answer	Reject	Mark
19 (b)(iv)	They are not reliable as the experiment was only carried out once so there is no evidence that the result is repeatable OWTTE		1

Question Number	Correct Answer	Reject	Mark
20 (a)	 <p>(1)</p> <p>Trigonal planar (1)</p> <p>120° (1)</p> <p>Allow TE (1 max) for both name and angle if BF₃ shown with lone pair</p>	Planar alone	3

Question Number	Correct Answer	Reject	Mark
20 (b)(i)	108° - 106°		1

Question Number	Correct Answer	Reject	Mark
20 (b)(ii)	<p>3 electron pairs around central B atom but 4 electron pairs around central N atom (hence less space) / ammonia has an extra pair of e- around N</p> <p>Statements regarding lone pairs repelling more than bond pairs should be regarded as neutral but are not worth credit on their own</p>		1

Question Number	Correct Answer	Reject	Mark
20 (b)(iii)	<p>Instantaneous dipole - induced dipole / temporary dipole - induced dipole / Induced dipole - Induced dipole / / London forces / van der Waals forces</p>		1

Question Number	Correct Answer	Reject	Mark
20 (b)(iv)	Hydrogen bonds / H-bonds	'Hydrogen' alone	1

Question Number	Correct Answer	Reject	Mark
20 (c)(i)	-3		1

Question Number	Correct Answer	Reject	Mark
20 (c)(ii)	<p>Curve with higher peak to left of 750 °C peak (1)</p> <p>Smaller area under curve above E_a (1)</p> <p>Reaction rate slower as fewer particles have $E \geq E_a$ (so fewer successful collisions per second) (1)</p>	500 °C line touching x axis on rhs	3

Question Number	Correct Answer	Reject	Mark
20 (d) QWC	<p>Provides alternative mechanism / route / pathway (1)</p> <p>Of lower activation energy (1)</p> <p>Hence a greater proportion of molecules can react (at a given T) (1)</p>		3

Section C

Question Number	Correct Answer	Reject	Mark
21 (a) (i)	$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$ (1)		1

Question Number	Correct Answer	Reject	Mark
21 (a) (ii)	$3\text{CH}_3\text{CH}_2\text{OH} + 2\text{Cr}_2\text{O}_7^{2-} + 16\text{H}^+ \rightarrow 3\text{CH}_3\text{COOH} + 4\text{Cr}^{3+} + 11\text{H}_2\text{O}$ 3:2 ratio (1) Rest of equation (1) Allow 2 nd mark if equation balanced but with water shown as both reactant and product		2

Question Number	Correct Answer	Reject	Mark
21 (b)(i)	To prevent the mixture heating too rapidly /prevent ethanol evaporating	'Makes the reaction too fast' alone	1

Question Number	Correct Answer	Reject	Mark
21 (b)(ii)	Suitable flask & heat indicated (1) Liebig Condenser (1) Correct water flow (1) Must be in the context of a reflux set-up	The apparatus would not work e.g. sealed apparatus -1 Poor diagram e.g. significant gap between condenser and flask -1	3

Question Number	Correct Answer	Reject	Mark
21 (b)(iii)	Green / blue		1

Question Number	Correct Answer	Reject	Mark
21 (c)(i)	They have a (very) high boiling temperature / are ionic compounds		1

Question Number	Correct Answer	Reject	Mark
21 (c)(ii)	Fractional distillation / distil of water then distil of ethanoic acid / absorb water with anhydrous drying agent		1

Question Number	Correct Answer	Reject	Mark
21 (d)(i)	Increase yield (1) As reaction moves to RHS as there are fewer (gaseous) molecules (1)	'less moles' alone	2

Question Number	Correct Answer	Reject	Mark
21 (d)(ii)	Any two considered suggestions e.g. Yield of lab process may be low Cost of oxidising agent Toxicity of oxidising agent Disposal of Cr ³⁺ Control of temperature/rate in scaled up reaction could be difficult The lab process has a lower atom economy Energy costs to separate ethanoic acid from reaction mixture Lab procedure is a batch process		2

Question Number	Correct Answer	Reject	Mark
21 (e) QWC	<p>Discussion of four aspects of processes</p> <p>e.g four from</p> <p>Cativa runs at lower P</p> <p>Hence less energy required (for compression)</p> <p>Cativa has 100% atom economy</p> <p>Methanol in cativa could be obtained from renewable sources</p> <p>Cativa produces only one product so less separation required</p> <p>Cativa runs at higher temp so greater energy requirements for heating</p> <p>Each discussion point may made be made using reverse argument but only awarded once</p> <p>2 additional pieces of information</p> <p>e.g 2 from</p> <p>Life cycle cost of catalysts</p> <p>Life cycle cost of capital equipment</p> <p>Yield of reactions</p> <p>Availability of renewable methanol.</p>		6

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code UA020839 January 2009

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

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