

Mark Scheme (Results)

Summer 2008

GCE

GCE Chemistry Nuffield (6255/5A-5E)

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)(i)	An amino acid which is not able to be synthesised by the body/ which must be obtained through the diet			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(ii)	Alanine can be synthesised (from glucose) via pyruvate (1) Leucine cannot be synthesised (from glucose via pyruvate and acetyl coA) because there is no reaction from acetyl coA to leucine (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(iii)	A route exists from glucose (1) via pyruvate, acetyl coA and fatty acids to fats (1)	must have 3 substances to get second mark	From glycogen	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(iv)	Glycerol/propan(e)-1,2,3-triol (1) IGNORE punctuation CH ₂ OHCHOHCH ₂ OH (1)	Other layouts Correct displayed formulae	1,2,3-propanetriol Molecular formula Prop-1,2,3-triol Propa-1,2,3-triol	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	$\text{NH}_2\text{CONH}_2 + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 2\text{NH}_3$	Balancing multiplied		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(ii)	Perspiration is acidic due to fatty acids (1) Acids react with -NH ₂ groups in the active site/ Substrate does not fit active site (1) • Weak alkali neutralises acid (1) Ammonia neutralises acid (1)			4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(i)	Rate increases at first... (1) Due to increasing collision rate/energy (1) Rate decreases above 50°C... (1) Due to enzyme denaturing/changing shape (1)	Increases between 20°C and 50°C	If no implication of limit	4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(ii)	Graphs do not show zero conductivity at time zero			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(iii)	Calculate the gradient/slope of each graph IGNORE any calculations			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(iv)	Copper(II) sulphate solution is highly conducting/contains many ions	Copper ions could complex / precipitate with ammonia	Copper ions denature/inhibit enzyme	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(v)	Reaction does not occur/ (much) slower (1) Methylurea fits active site less well / does not fit active site (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(vi)	A peptide consists of amino acids joined.. (1) By CONH bonds/links (1) Non-competitive inhibitors bind strongly/covalently to the active site of an enzyme... (1) And cannot easily be displaced by excess substrate (1)	amide	peptide reference to allosteric inhibition	4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (d)(i)	Progressive: (symptoms) become worse over time (1) Genetic: caused by (faulty) genes (1)	inherited		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (d)(ii)	Any two Base missing from sequence (1) Wrong base incorporated in sequence (1) Start/stop codon inserted or missing (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (d)(iii)	Whether to allow the child to be born when he/she will develop disease (1) OR How widely should screening be available? (1) OR How widely should the information be available eg to insurance companies? (1) OR Stress of concern about future development of the disease. (1)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	Reflux ratio = reflux rate/distillation rate			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	Establish an appropriate temperature gradient in the fractionating column (by reducing heat loss)	Without insulation the top of the column will not get hot enough	Just "Heat loss"	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(iii)	To provide a surface for vapour and liquid to reach equilibrium			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(iv)	Read the temperature (on the thermometer nearest to D) and .. (1) Read the corresponding composition from the liquid line on the phase diagram (1)	Answer drawn on a diagram		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(v)	To condense all the vapour which reaches it and return the liquid to the fractionating column (1) The rate at which liquid is being refluxed (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(vi)	The reflux ratio is reduced (1) The composition of the distillate becomes poorer in the lower boiling constituent (1)	Reverse argument		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	Mass flow rate = 200 g min^{-1} = 12 kg hr^{-1}			1

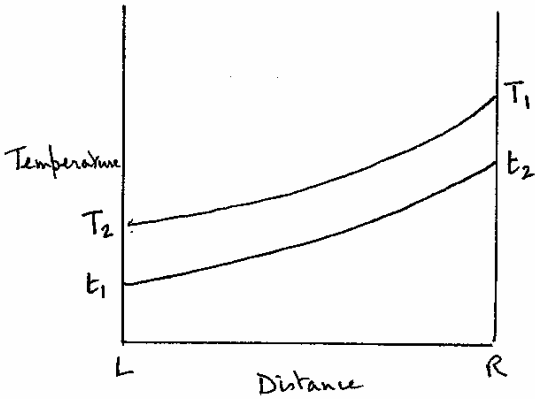
Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	Heat transferred from hot water = Mass flow rate x shc x temp diff = $12 \times 4.2 \times 40 \text{ kJ hr}^{-1}$ = $2016 \text{ (kJ hr}^{-1}\text{)}$			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(iii)	Heat transfer coefficient			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(iv)	$U = 2016/0.03 \times 24$ $= 2800$ (1) $\text{kJ hr}^{-1}\text{m}^{-2}\text{K}^{-1}$ (1)	Transferred error from (ii)		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(v)	Material of condenser/thickness of condenser walls/(thermal) conductivity of material (any one)	Mass flow rate (affects boundary layer)		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(vi)	Greater surface area/more compact design (any one)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(vii)	 <p>T graph increasing, t graph also increasing (1) t graph below T graph (1) Ignore: gradients and curvature of lines</p>			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(i)	Time for the reaction (1) + time to fill and empty tank (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	Average time a molecule spends in the reactor			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(iii)	Batch: concentration decreases (1) Continuous: concentration remains the same (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(iv)	Movement of fluid along tube without overall /back mixing	All constituents move at the same rate		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(v)	Each 'disc' of solution is like a separate batch moving up the tube (1) No transfer of material occurs into or out of each 'disc' (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (d)(i)	mathematics(1) eg calculation of flow rates etc(1) physics/hydrodynamics(1) eg understanding flow(1) materials science(1) plant design(1) economics(1) capital and running costs(1) Any 1 subject and associated remark.			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (d)(ii)	Knowledge of the plant operation/ability to communicate/working as a team/other sensible suggestion (any 2)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(i)	Starch (1) Protein (1)		carbohydrate	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(ii)	Bran/pericarp/aleurone			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(iii)	C=C/carbon-carbon double bond	unsaturated		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(iv)	Glycerol/propan(e)-1,2,3-triol (1) IGNORE punctuation CH ₂ OHCHOHCH ₂ OH (1)	Other layouts Correct displayed formula	1,2,3, propanetriol Molecular formula Prop-1,2,3-triol Propa-1,2,3-triol	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(v)	protein			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(vi)	It is a preservative	Antioxidant / reducing agent		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(i)	$6.0 \times 18/12 = 9.0 \text{ (g dm}^{-3}\text{)}$			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(ii)	Blue colour fades (1) White precipitate forms (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(iii)	Glucose is an immediate source of energy			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(iv)	Oxygen is involved		'air'	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(v)	$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$ Formulae (1) Balancing (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(vi)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ Formulae (1) Balancing (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(vii)	Any two Flour improver (1) improves visco-elastic properties of dough (1) allows expansion of gas bubbles (1)	Breaks/prevents reformation of -s-s-bonds.	Provides vitamin C / antioxidant / acid	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(i)	Any one Vitamin C decomposes on storage (1) OR fresh food has greater vitamin C content (1) OWTTE			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(ii)	Any two More people live in towns/away from sources of food production (1) Increased awareness of more exotic foods (1) other sensible suggestions	People busier so need to shop efficiently/ better transport/more pre-prepared foods		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(iii)	Any two Limited range (1) Uncertain quantities (1) Less available out-of-season (1)		Effect on 'LEDC's	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(iv)	Oxidation (1) Hydrolysis/reaction with water (1) Freezing slows all reactions/makes water less available (1)	Bacteria dormant	Specific examples <u>only</u>	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(v)	Any three Ingredients (1) Sell by/best before date (1) Storage conditions (1) Name of manufacturer/packer/seller (1)	nutritional info. quantity user instructions		3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	Hexagonal close packed/packing			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	Increase of density (1) BCC is not close packed (1) When structure changes there a decrease of volume (1)			3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iii)	12			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iv)	One eighth			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(v)	Columnar: long thin crystals (1) Formed when crystal grows into hot Liquid/when there is a temperature Gradient (1) Equiaxed: symmetrical crystals (1) Formed when crystals grow with equal temperature in all directions /no temperature gradient (1)			4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(i)	Threads (of carbon fibre) (1) Embedded in polymer/in polymer matrix (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(ii)	Tensile: outside of curve (1) Compressive: inside of curve (1)		Compressive at bottom	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(iii)	When the stress is below the elastic limit			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(i)	Pink, blue (1) Pink around copper, blue round iron (1) OH ⁻ causes pink (1) Fe ²⁺ causes blue (1)			4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(ii)	Unrealistic because the conditions, (e.g of concentration), are not standard (1) Series derived by experiment (using the apparatus shown) and comparing metals in pairs (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(iii)	To improve the electrical conductivity of the solution			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(iv)	Blue at the stressed area (1) Pink on the unworked areas (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(i)	Analysis of materials involved in manufacture and disposal (1) Analysis of energy involved in manufacture and disposal (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(ii)	Any two Polythene is: Cheaper (1) Impervious to water/liquids and air (1) Impervious to bacteria (1)	Can see nature/condition of contents		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(iii)	Any one method and comment Incineration (1)produces energy/poisonous gases (1) OR melting and reforming into objects (1)cheap material/poor quality (1) OR pyrolysis to give monomers (1)expensive/really needs sorting prior to treatment (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	<p>Magmatic segregation: magma cools, crystals form and accumulate in layers (1) Example: iron oxide/ chromium oxide/titanium oxide (1)</p> <p>Evaporites: aqueous solution evaporates depositing salts (1) Example: sodium chloride/ potassium chloride/ magnesium chloride/ calcium sulphate (1)</p> <p>Weathered ore deposits: mineral deposits affected by acidic rain (1) Example: aluminium oxide (1)</p>	<p>Mineral names Correct formulae</p>		6

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(ii)	<p>Chemical analysis of samples from rocks etc (1)results plotted on a map (1)</p> <p>Either Analysis by physical properties (1) such as density/ magnetic fields/ electrical conductivity/ radioactivity (1) ORseismic survey (1) use of shock waves (1)</p>	<p>satellite survey (max 1)</p>		4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(i)	WO ₃			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(ii)	WO ₄ ²⁻			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iii)	Boiling water bath	Refluxing		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iv)	Iron(III) oxide/iron(III) hydroxide / Fe ₂ O ₃ / Fe(OH) ₃			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(v)	Displacement/cementation using a metal (1)more reactive than tungsten (1) OR Reduction using carbon (1)in a blast furnace (1) OR convert to a soluble salt (1)use electrolysis (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(i)	In (i) and (ii) penalise units once only Mass of copper ore = 50 000 x 2500 kg (day ⁻¹) = 1.25 x 10 ⁸ (day ⁻¹) (1) Mass of copper = 50 000 x 2500 x 0.50/100 kg (day ⁻¹) = 0.625 x 10 ⁶ kg (day ⁻¹) (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(ii)	1.25 x 10 ⁸ - 0.625 x 10 ⁶ (day ⁻¹) (1.244 x 10 ⁸) kg (day ⁻¹)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(iii)	Any two Low grade (1) Low value (1) Shallow overburden (1)	Safety considerations/ cost, if justified		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(iv)	Grinding/reducing particle size			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(v)	2CuS + 3O ₂ → 2CuO + 2SO ₂ formulae (1) balancing (1)			2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(vi)	copper(II) sulphate (1)react with sulphuric acid (1)	reasonable alternatives		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(vii)	Waste rock: Backfilling/landscaping (1) Re-planting (1) Gases: Usually acidic (1) Absorb using alkali/calcium carbonate (1)			4