

Mark Schemes for the Units

January 2008

3885/7885/MS/R/08J

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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Advanced GCE Science (7885)

Advanced Subsidiary GCE Science (3885)

MARK SCHEMES FOR THE UNITS

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2841 Science and the Natural Environment

Question 1

(a) (i)	water + carbon dioxide -> glucose + oxygen Accept symbol eq but O ₂ not O Symbol equation OK if not balanced provided molecular formulae are OK	Reactants, 1 mark; Products, 1 mark	2
(ii)	2 marks for observations based on data including: <ul style="list-style-type: none"> • Time lag before Photosyn starts • Time lag shorter with brighter light • No light = no photosyn Then rate A faster than B Oxygen production/ reaction/photosyn reaches a steady state. Rate of Photosyn greater/ proportional to light intensity/ increases with intensity. (This needed for 4th mark)	1 1 1 1 1 Max 4	4
(b) (i)	Chloroplasts <ul style="list-style-type: none"> • sites of photosynthesis • where light is absorbed • to make energy store 	Any 2 from 3 points for 1 mark each	2
(ii)	Mitochondria <ul style="list-style-type: none"> • sites of respiration • where energy is transferred from storage/glucose • glucose is broken down • ATP is made (not energy is made/or contained) Krebb's cycle or even citric acid cycle accepted!!	Any 2 from 4 points for 1 mark each	2
TOTAL			10

Question 2

(a)	Infrared and visible in correct relative order Infrared in correct space Visible in correct space (IR and visible must be contiguous) Allow Far IR the near IR	1 1 1	3
(b) (i)	Bright area suitable labelled (must be on 2.2a)	1	1
(ii)	Dark area suitably labelled(see (i))	1	1
(iii)	<ul style="list-style-type: none"> • Infrared is emitted by the Earth (allow heat given off) • Visible is reflected sunlight • Nothing reflected by Earth at night 	1 1 1 (Any 2 from 3)	2
(iv)	<ul style="list-style-type: none"> • Random changes in direction take place/multiple reflections/ dispersion • due to water drops or the granular nature of the medium 	1 1	2
(c) (i)	<ul style="list-style-type: none"> • Higher cloud significantly cooler than land but low cloud at similar temperature 	1	1
(ii)	B – grey intermediate/medium height C white – low (choice must make sense in relative context)	1 mark for both correct in columns 1&2 second mark for both correct in column 3	2
(d)	$f = c / \lambda$ (allow correct symbols in triangle) $= 3 \times 10^8 / 1 \times 10^{-5}$ (award 1 mark if division is correctly processed) $= 3 \times 10^{13}$, Hz (or s^{-1}) or in words. Correct answer and units = 4 even without working)	1 1 1 1	4
TOTAL			16

Question 3

(a) (i)	A: Electron B: Electron pathway/orbit/shell/energy level	1 1	2
(ii)	The simplest appropriate model is the best one to use/a model is not correct or incorrect but is used for its predictive value/use different models for different purposes/example given	Any 1 point, 1 mark	1
(b) (i)	p: proton	1	2
(ii)	n: neutron	1	
(c)	Nucleus drawn with only 1 proton labelled p or proton	1	1
(d)	The following drawn Alpha emission: 2 particles produced only One particle looks “approximately” like original particle minus 4 nucleons Alpha particle correctly represented ie 4 particles or 4_2 Notation used. Nuclear fission: <ul style="list-style-type: none"> Nucleus splits into two smaller nuclei (nucleon detail not required) These are of similar size Free neutron(s) Incoming neutron 	1 1 1 1 1 1 1 (max 3)	6
(e)	Products of reaction unstable <ul style="list-style-type: none"> radioactivity involves emission, of ionising radiation, (or named alpha/beta) which is harmful to the cells/causes tissue damage products are smaller nuclei and free neutrons, free neutrons are absorbed by surrounding materials and can make them radioactive, long half-life materials remain active for very long times (and hence create a storage problem), 	1 1 1 1 1 1 1 Any 4 points for 4 marks	4
TOTAL			16

Question 4

(a)	Speciation	1	1
(b) (i)	third box/or 4 th box	1	1
(ii)	separate species do not breed OR if species can interbreed then dominant/recessive type inheritance consistent with box 3 or "multiple allele (owtte) inheritance shows continuous variation. (answer must be consistent with b (i))	1	1
(c)	Adapted/suited to its environment	1	1
(d)	B adapted/suited to its environment (not advanced)	1	1
(e) (i)	Natural selection	1	1
(ii)	nature of food source or other valid answer/ allow mutation/ change in habitat/ geographical isolation. If habitat or environment mentioned must be in connection with change. Allow migration	1	1
TOTAL			7

Question 5

(a) (i)	Any single chain of 3 organisms identified and labelled Or written below diag.	1	1
(ii)	Names clearly linked to each level on the diagram: <ul style="list-style-type: none"> • Producer/autotroph/plant • Herbivore/primary consumer • Carnivore/secondary consumer/predator 	1 1 1	3
(b)	Any 5 points from the following points (or any other valid point) Any mention of nutrient cycle (not C) Decomposition by named organism eg fungi/bacteria OR scavenger consumes body Nutrients returned to soil Nutrients taken up/ absorbed by plants <ul style="list-style-type: none"> • Energy dissipates directly as body cools • Scavengers utilise chemical/stored energy Energy dissipates/ is not recycled/ any mention of 2 nd law or entropy	1 1 1 1 1 1 1 5 max	5
	QWC for organisation and vocabulary For 2 marks: Clear, coherent organisation, argument/observations sequenced Specialist vocabulary used fully and appropriately (any specialist vocab, suggestions highlighted above) For 1 mark: A degree of organisation Some appropriate use of specialist vocabulary For 0 marks: No organisation No use of appropriate specialist vocabulary (Anything less than 5 lines = 0) most will probably get 1 so 2 nd mark should mention both nutrient cycle and mention/imply energy not being recycled.	2	2
TOTAL			9 +2

2842 Science and Human Activity

Mark Scheme Page 1 of 6	Unit Code 2842	Session Jan	Year 2008	Version 4 (post- standardisation)
Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit ___ = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument			
Question	Expected Answers			Marks
1 (a)	Boxes filled in from top: Cold, dry (accept cool) Warm/hot , wet Warm dry Cool, wet			4
(b) (i)	A: Expand and become less dense			
(ii)	C: Troposphere			
(iii)	B: a region of high pressure			
(iv)	D: High pressure			4
(c) (i)	Arrow pointing from between S and SE to between N and NW AW arrow follows direction of isobars			1
(ii)	Wind blows from high pressure to low pressure Deflected by rotation of Earth/Coriolis effect Clockwise (around high pressure)/to the right in N. Hemisphere (CON if third marking point is not scored)			
(d) (i)	8 dm ³ (allow 1 mark for working: use of ratio 240/300) AW use of $P_1V_1/T_1 = P_2V_2/T_2$ AW use of $PV = nRT$			3
				2
				TOTAL: 14

Mark Scheme Page 2 of 6	Unit Code 2842	Session Jan	Year 2008	Version 4 (post- standardisation)
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Question	Expected Answers			Marks
2 (a) (i)	Coal contains sulphur (impurities) S reacts with oxygen/combusts/is oxidised			2
(ii)	4 marks for two pairs of points. Second point must be linked to the first Lakes/rivers become acidic and fish/plant life dies; aquatic life can only survive in narrow <u>pH range</u> AW Trees die; Acid absorbed through leaves/needles AW nutrients have been lost from soil (if not scored elsewhere) AW Crops/plants do not grow well; Plants are adapted to grow in narrow pH range AW Aluminium is released from soil/into lakes; by ion exchange/aluminium is toxic AW nutrients/calcium/ammonium lost from soil ; By ion exchange AW Statues/buildings corrode; Calcium carbonate reacts with acids OVP: 1 mark for stating effect + 1 mark for detail			4
(b)	Types of pollutant and environmental effect: (effect must be linked to specific, correct pollutant) CO; Is toxic Causes breathing difficulties/causes photochemical smog CO ₂ ; Contributes to global warming/greenhouse effect mentions one effect of global warming but CON if other incorrect effects mentioned eg destruction of ozone layer; Metal ions; Toxic Build up in food chain Solvents; Toxic Kills aquatic life			

	<p>Hot water Deoxygenates water Kills fish/aquatic animals</p> <p>Phosphates; Cause eutrophication/build up of algae; Kills fish/aquatic animals</p> <p>NO_x,nitrogen oxides; Causes photochemical smog Causes breathing difficulties</p> <p>Mark first three substances listed; no marks for fourth or subsequent pollutant listed</p> <p>Ways of reducing environmental impact (mark independently of choice of pollutant) Scrubbers in chimney/flues; to absorb gases/valid example of a gas;</p> <p>Low temperature reactions/use of catalysts; Reduce amount of fuel burnt</p> <p>Recycle unreacted chemicals/heat So that they are not released/reduces requirements for raw materials or energy</p> <p>Use unwanted products eg as fuel/sell on to other industries</p> <p>Use renewable energy <u>in place of fossil fuels</u> To provide <u>electricity</u> (eg for heating reaction)</p> <p>Use enzymes; Enzymes produce fewer by-products/purer product</p> <p>Treat or contain waste after release; eg build ponds for waste metals</p> <p>CON (no marks) if answer refers to non-industrial sources of pollution eg catalytic converters</p> <p>QWC: Legibility and grammar 2 marks: A: Text is clearly legible and B: Spelling, punctuation and grammar are accurate throughout (allow 1 or 2 minor errors) 1 mark: A: Text is untidy but can be read without difficulty and B: Spelling, punctuation and grammar shows some mistakes 0 marks: A: text is difficult to read and B: spelling punctuation and grammar show a high proportion of mistakes</p>	<p>7</p> <p>2</p> <p>TOTAL: 15</p>
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Mark Scheme Page 3 of 6	Unit Code 2842	Session Jan	Year 2008	Version 4 (post- standardisation)
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Question	Expected Answers			Marks
3 (a)	Kinetic to electrical;			1
(b) (i)	Energy = power x time; 2 hours = 7200 s; Energy = 28800000/2.88 x 10 ⁷ ecf; Unit = J; AW 28.8 MJ/ 28800 kJ/8 kWh <i>n.b 8000 without working scores 0, with some working may score 1 or 2 out of 3</i>			4
(ii)	Distance = work/force AW 8 x 10 ⁶ /4 x 10 ⁵ ; 20m;			2
(c)	Covers only a small area of the country; Most wind is in uninhabited places; People object to the appearance/noise of wind turbine; Cannot generate power on still days; Not very efficient Would not be able to supply energy for industry			2
				TOTAL: 9

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Question	Expected Answers			Marks
4 (a) (i)	C=C bond circled			1
(ii)	Addition Polymerization			2
(b)	Lighter/less dense More durable More flexible/less brittle Safer			1
(c) (i)	Glucose/sucrose/lactose/fructose etc			1
(ii)	<u>Source</u> of energy			1
(iii)	Protein			1
(iv)	Meat/nuts /cheese/milk/fish etc			1
(e)	Cohort study Identify a group of people of same age/class etc Monitor health over a period of years Measure exposure to acrylamide during this period AW identify two groups of people with similar ages etc One group exposed to more acrylamide than the other (CON if not ethically done) Monitor health of both groups OR Case-control study Identify group of people with cancer And similar group without cancer Measure exposure in the past of both groups to acrylamide (3 points out of 4 for each type of study)			3
				TOTAL: 11

Mark Scheme Page 5 of 6	Unit Code 2842	Session Jan	Year 2008	Version 4 (post- standardisation)
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Question	Expected Answers			Marks
5 (a)	High temperature increases energy of <u>molecules/particles/collisions</u> ; Collisions more likely to be successful/overcome activation energy; ora			2
(b) (i)	A biological catalyst AW protein which speeds up a reaction and is not used up			1
(ii)	High temperature denatures enzymes/causes bonds maintaining the structure to break Tertiary structure/shape of active site is altered Substrate molecule can no longer fit/is not complementary to active site			3
(c) (i)	<u>Shape</u> of active site changes H ⁺ ions bond to enzyme/amino acid side groups forces of attraction/bonds holding enzyme together are altered/broken these forces are ionic bonds/hydrogen bonds NOT peptide NH ₂ and COOH groups affected Any 2 points			2
(ii)	presence of inhibitors/concentration of enzyme /concentration of substrate /presence of co-factors			1
(d)	breakdown of sugar AW fermentation/anaerobic respiration to produce CO ₂ /alcohol OR breakdown of starch to produce sugars			2
				TOTAL: 11

2844 Science and Environmental Management

Question	Expected Answers	Marks
1 (a) (i)	One of two or more alternative forms of a gene (at a given locus)./an expressed variant of a gene	1
(a) (ii)	Long – stemmed; T dominant Short-stemmed; both recessive	4
(b)	Any two ALL genotypes in offspring the same/heterozygous Tt So dominant gene expressed (in phenotype)	2
(c)	75 25 in order clear working	3 TOTAL: 10

Question	Expected Answers	Marks
2 (a)	(Having only) one/unpaired set of chromosomes/ Accept half a set of chromosomes	1
(b)	Chromosomes duplicate Form 2 chromatids Chromosomes condense (however worded) Nuclear membrane breaks down Chromosomes/chromatids pair up in middle of cell then move to opposite ends of cell new nuclear membrane forms cytoplasm/cell membrane splits cells identical Any 6 from above	6
(c) (i)	Fertilisation random Crossing over and independent assortment	2
(c) (ii)	Three from: Variation(described) presence of individual genomes/ora wider gene pool survival of new changes	3
(e) (i)	Fertilisers Pesticides; = agricultural acceptable for one only Domestic sewage Any relevant industrial pollutant	2
(e) (ii)	(nitrate) promotes growth	1
(e) (iii)	Four from: More food/population growth Decay of dead plants removes oxygen Anoxic conditions develop Change in dominant species Production of toxins/poisoning/ammonia/hydrogen sulphide	4
		TOTAL: 19

Question	Expected Answers	Marks
3 (a)	Nucleus clearly drawn; 2 electrons inner shell; clearly opposite; 8 electrons outer shell; clearly evenly distributed; indication that outer shell has highest energy	4
(b)	$f = e/h;$ $= 8.221 \times 10^{-19} / 6.63 \times 10^{-34}$ $= 1.24(0)$ Hz	4 TOTAL: 8

Question	Expected Answers	Marks
4 (a)	1 spot original pesticide(identified) other two breakdown products	2
(b)	Two from Two spots; Indicating breakdown products; No spot corresponding to original pesticide	2
(c)	compare chromatogram from soil sample; to chromatogram of DDT; check for breakdown	3
(d)	Answers between 0.85 and 0.9 Working shown	2
(e)	Gas vs. liquid for mobile phase; Column vs.plate High temperature glc uses a chart/computer to record results glc measures retention times Accept other reasonable answers. Reject references to accuracy and cost	3 TOTAL: 12

Question	Expected Answers	Marks
5 (a) (i)	Energetically neutral; Exothermic; Endothermic All three correct	1
	(ii) +0.3; -82.9; +26.8 Allow 1 mark if first one is correct.	2
(b)	bonds broken in water; Bonds broken in solute; Bond breaking is endothermic/requires energy Causing temperature drop; Hydration/bonds formed between water and solute (ions); Hydration is exothermic; Energy change causes temperature rise; In sodium fluoride (no temp change) nett energy is near zero; In calcium chloride (temp rise) nett energy change is <u>negative</u> In ammonium nitrate temp fall nett energy change is positive Any 8 of the above	18
(b)	QWC organisation & vocabulary 2 marks A answer is clearly and coherently organized throughout and B appropriate specialist vocabulary is used extensively; 1 mark A answer shows a degree of organization and B some appropriate use of specialist vocabulary is made 0 mark A answer is not organized and B appropriate specialist vocabulary is not used legibility & grammar 2 marks A text is clearly legible and B spelling, punctuation, grammar are accurate throughout 1 mark A text is untidy but can be read without difficulty and B spelling, punctuation, grammar show some mistakes; 0 mark A text is difficult to read and B spelling, punctuation, grammar show extensive mistakes (Candidates must satisfy both strands A and B to gain the marks at a particular level. Otherwise the marks for a lower level should be awarded.)	4

(c)	Hydration; Water is “held closer”/more tightly bound to ions; Hence smaller volume; Explanation in terms of smaller particles fitting in gaps between larger particles Accept for 1 mark.	3
		TOTAL: 18

Question 6	Expected Answers	Marks
(a)	1 sugar/deoxyribose 2 phosphate	2
(b)	Adenine;19 any order as long as number Thymine;19 matches base Cytosine;31 Allow 2 marks for A,C and T	6
		TOTAL: 8

Question 7	Expected Answers	Marks
(a)	Chromosome Characteristic Protein Restriction DNA Plasmid Ligase Vector modified	9
(i)	Chance of cross – pollination with organic crops Cost of seed to farmer; Less variation etc	3
(b) (ii)	eg new pharmaceuticals more predictable outcome less use of pesticides greater crop yield etc	3
		TOTAL: 15

Grade Thresholds

Advanced GCE Science (3885/7885)
January 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
2841	Raw	60	46	41	36	32	28	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	46	41	36	31	26	0
	UMS	90	72	63	54	45	36	0
2844	Raw	90	71	63	55	48	41	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3885	300	240	210	180	150	120	0
7885	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3885	0	11.1	55.6	77.8	100.0	100.0	9
7885	0	0	0	0	0	0	0

9 candidates aggregated this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

Facsimile: 01223 552627

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Head office
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Facsimile: 01223 552553

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