

GCE

Science

Advanced GCE A2 7885

Advanced Subsidiary GCE AS 3885

Mark Schemes for the Units

June 2007

3885/7885/MS/R/07

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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Advanced Subsidiary GCE Science (3885)

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**Mark Scheme 2841
June 2007**

INSTRUCTIONS ON MARKING SCRIPTS

Excerpts from the Instructions for Examiners booklet.

For many question papers there will also be subject or paper specific instructions which supplement these general instructions. The paper specific instructions follow these generic ones.

1 Before the Standardisation Meeting

Before the Standardisation Meeting you must mark a selection of at least 10 scripts. The selection should be drawn from several Centres. The preliminary marking should be carried out **in pencil** in strict accordance with the mark scheme. In order to help identify any marking issues which might subsequently be encountered in carrying out your duties, the marked scripts must be brought to the meeting.

2 After the standardisation meeting

- a) Scripts must be marked in **red**, including those initially marked in pencil for the Standardisation Meeting.
- b) All scripts must be marked in accordance with the version of the mark scheme agreed at the standardisation meeting.
- c) **Annotation of scripts**

The purpose of annotation is to enable examiners to indicate clearly where a mark is earned or why it has not been awarded. Annotation can, therefore, help examiners, checkers, and those remarking scripts to understand how the script has been marked.

Annotation consists of:

- the use of ticks and crosses against responses to show where marks have been earned or not earned;
- the use of specific words or phrases as agreed at standardisation and as contained in the final mark scheme either to confirm why a mark has been earned or indicate why a mark has not been earned (e.g. indicate an omission);
- the use of standard abbreviations e.g. for follow through, special case etc.

Scripts may be returned to Centres. Therefore, any comments should be kept to a minimum and should always be specifically related to the award of a mark or marks and be taken (if appropriate) from statements in the mark scheme. General comments on a candidate's work must be avoided.

Where annotations are put onto the candidates' script evidence, it should normally be recorded in the body of the answer or in the margin immediately adjacent to the point where the decision is made to award or not award the mark.

d) Recording of marking: the scripts

- i) Marked scripts must give a clear indication of how marks have been awarded, as instructed in the mark scheme.
- ii) All numerical marks for responses to part questions should be recorded unringed in the right-hand margin. The total for each question (or, in specified cases, for each page) should be shown as a single ringed mark in the right-hand margin at the end of each question.
- iii) The ringed totals should be transferred to the front page of the script, where they should be totalled.
- iv) Every page of a script on which the candidate has made a response should show evidence that the work has been seen.
- v) Every blank page should be crossed through to indicate that it has been seen.

e) Handling of unexpected answers

The standardisation meeting will include a discussion of marking issues, including:

- a full consideration of the mark scheme in the context of achieving a clear and common understanding of the range of acceptable responses and the marks appropriate to them, and comparable marking standards for optional questions;
- the handling of unexpected, yet acceptable answers.

There will be times when you may not be clear how the mark scheme should be applied to a particular response. In these circumstances, a telephone call to the Team Leader should produce a speedy resolution to the problem.

Mark Scheme Page 1 of	Unit Code 2841	Session June	Year 2007	Version 2
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Question	Expected Answers			Marks
1 (a)	feeding relationship/producer/consumer ; energy transfer/nutrient transfer			2
(b)	biomass/uneaten material/roots/material below ground/excreta/dead material/decay; heat/respiratory losses/energy for movement or reproduction/dissipation			2
(c) (i)	energy before and after (a transfer); are equal AW: energy is neither created ; nor destroyed (during a transfer)			2
(ii)	proportion/fraction of energy ; (is transferred in) a less useful form/dissipation/heat loss AW: entropy/disorder (of energy) ; increases (as result of transfer)			2
Total: 8				

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Question	Expected Answers			Marks
2 (a)	Nitrogen/potassium/calcium/other correct nutrient element (any two - element required, not ion or compound)			2
(b) (i)	steady state			1
(ii)	negative ; feedback			2
(iii)	uptake (by plants)/denitrification/erosion/harvesting/burning			1
(c) (i)	<ul style="list-style-type: none"> • valid match to explanation; • valid match to explanation 			2
(ii)	phosphorus removed from site in trees ; leaching negative feedback would not come into effect/cycle broken/no uptake/no return/colonisation effect/erosion effect			2
Total: 10				

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Question	Expected Answers	Marks		
3 (a)	(a set of) ecosystems/habitats; with similar climate conditions/large region/example given	2		
(b)	biomass/dry organic matter/plant material	1		
(c)	altitude/nutrient availability/light intensity/amount of sunlight/aspect/drainage/carbon dioxide concentration/soil pH (2 points from above list)	2		
(d) (i)	greater chance of survival ; more likely to reproduce/breed ; and pass on characteristics to offspring/offspring inherit characteristic ; process is cumulative/builds up over time/natural selection	4		
(ii)	root system is more able to reach/find water ; (smaller proportion of biomass in leaves reduces) transpiration/evaporation/water loss	2		
		Total: 11		

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Question	Expected Answers			Marks
4 (a)	aerobic : with air/oxygen ; respiration: transfer/release (not 'making') of energy; from glucose/food/starch/sugars			3
(b)	stop/reduce extent of ploughing of cropland; grow more grass/convert cropland to grassland/plant trees			2
(c) (i)	separate bars drawn and use of above & below line style ; bars drawn to correct values (+/-50)			2
(ii)	use of 170 or 750 – 580 or 750÷580 - 1 29% (allow ecf)			2
(iii)	mass of carbon in soil has decreased ; carbon has not gone to above ground matter; atmosphere is only other available reservoir/carbon must have gone somewhere/other valid point			3
Total: 12				

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Question	Expected Answers			Marks
5 (a)	rocks/granite/soil/food (that is, any non-pure material)/any named naturally occurring isotopes/cosmic rays/stars/the Sun (2 points from above list)			2
(b)	location irradiation - outside object ; after irradiation - not radioactive/unchanged, contamination - is radioactive			2
(c)	nucleon/particle from nucleus/sub-atomic particle/no charge (not 'neutral atom')/1 (amu) mass (2 points from above list)			2
(d)	top line 60 ; bottom line 28			2
(e)	γ radiation drawn at right hand end of spectrum ; two other regions named: X rays, ultraviolet/UV, visible light, infrared/IR, microwaves, radiowaves ; these two regions in correct order in relation to γ radiation			3
(f)	α radiation Identity: Emitted by radioactive decay/from nucleus; 2 protons; 2 neutrons ; helium ; nucleus ; positive charge; 2+ charge ; 4 (amu) mass ; ${}^4_2\text{He}$; moving (max of 4 marks for identity) Property: low penetrating ability ; illustration of penetrating power (eg stopped by paper);			

Mark Scheme 2842
June 2007

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Question	Expected Answers			Marks
1 (a) (i)	Particles consist of (two) <u>atoms</u> ; Joined together (mention of molecules joined is CON);			2
(ii)	80%			1
(iii)	Movement; in a straight line/in one direction;			2
(iv)	Vibrate; Rotate;			2
(b)	900 (K) (2 marks for correct answer) 1 mark for working: <u>use of</u> $P_1V_1/T_1 = P_2V_2/T_2$ AW $PV = nRT$ or realisation that pressure change causes T to <i>increase</i> x6 AND volume change causes T to <i>decrease</i> x 2			2
(c) (i)	volume stays the same;			1
(ii)	same number of <u>molecules</u> ;			1
(d)	has an unpaired electron/odd number of electrons/7 e in (outer) shell of N;			1
Total: 12				

Mark Scheme Page 2 of 5	Unit Code 2842	Session June	Year 2007	Version 6 (final)
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Question	Expected Answers			Marks
2 (a)	Close to water for <u>cooling</u> ; <u>Raw materials/crude oil</u> can be easily imported by sea; Good links (e.g rail) for transport (of products) ; Close to source of skilled labour; Large area of land available for expansion of the plant; ANY 3			3
(b)	Is converted into sulphur (di)oxide/SO _x ; Causes acid rain/is a toxic gas/photochemical smog (mark depends on realisation that S is converted into a new substance). Mention of other environmental effect is CON;			2
(c) (i)	Lowers the activation energy; So reaction can be carried out at a lower temperature; Reduces fuel costs; AW reduces number of products; Reduces purification/waste disposal costs;			2
(ii)	Hydrogen sulphide should be used elsewhere in the plant/sold/prevented from escaping into the atmosphere AW catalyst should be recycled AW (excess) hydrogen should be used as a fuel <i>Mention of sulphur is con</i>			1
Total: 8				

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Question	Expected Answers			Marks
3 (a)	Loses H ⁺ ions; Completely/easily/high proportion of; (contains H ⁺ scores 1 only) CO ₂			2
(b) (i)	Ions close together; Regularly arranged;			1
(ii)	+ ions next to – ions; in a giant structure/giant lattice; <i>diagram alone(2 ions pairs or more)</i> <i>scores 1 max</i>			
	0.13 (accept 0.10-0.16)m ³ hr ⁻¹ tangent shown on graph AW use of curve to calculate $\Delta v/\Delta t$;			3
(c) (i)	1;			2
(ii)	It would decrease; To half of the original value/to 0.0055 m ³ hr ⁻¹ ecf			1
(iii)	("rate halves" alone scores 2)			
(d)	porous limestone has a large surface area AW reaction can only occur at surface; collisions occur more frequently/more chance of collisions; ANY 2 points			2
(e)	important habitat (sea-bed) will be destroyed AW acid may kill organisms AW products of reaction may be toxic to organisms; AW new coastal defences may affect tides AW CO ₂ given off which may cause global warming			2
	Total: 13			1

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Question	Expected Answers			Marks
4 (a) (i)	$1200^2 \times 2;$ $= 2,880,000 \text{ W}/2.88 \times 10^6 \text{ W};$			2
(ii)	Reduces the strength of the (magnetic) field beneath the cable AW reduces the level of electromagnetic radiation/ radio waves emitted from cable			1
(b)	Network: all points interconnected/linked to each other; Through a variety of routes; Ensures continuity of supply; Voltage: difference in potential/potential difference Energy per unit charge/given to charge AW causes charges to move; High voltage reduces power loss; Relevant use of Voltage = power/current ; Alternating current: direction of current/flow of charge <u>reverses</u> periodically/oscillates; Charge flow is due to movement of electrons; A.c. allows use of transformers to step-up voltage Frequency: no of cycles per second; e.g. a.c. completes cycle 50 times per second; QWC: Organization and vocabulary 2 marks A: answer is clearly and coherently organized throughout and B: appropriate specialist vocabulary is used (e.g. charge, potential, periodic, cycle, oscillates, electrons, power, energy, transformer, step-up, interconnection) 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 B: appropriate specialist vocabulary is not used			6
	Total: 11			2

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Question	Expected Answers			Marks
5 (a) (i)	Glucose/any other named sugar			1
(ii)	Starch/glycogen/amylopectin;			1
(b) (i)	Enzymes; Growth/repair; AW Present in cell membrane; AW muscles/hair hair;			2
(ii)	insulation; component of cell membrane; AW protection of internal <u>organs</u> ;			2
(c)	amino acids; hydrolysis; peptide; primary;			4
(d) (i)	glycerol/propane-1,2,3-triol; fatty acids;			2
(ii)	energy in 200g of carbohydrate = 3400 kJ AW uses 17x 200/38 ; mass of fat broken down = 3400/38 = 89(.47) g;			2
(e)	diet may not provide minerals/vitamins; large amounts of protein may be dangerous/toxic bad breath; constipation;			1
Total: 15				

**Mark Scheme 2843/01
June 2007**

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Question	Expected Answers			Marks
1 (a)	118/many <u>islands</u> ; within a <u>lagoon</u>			2
(b) (i)	acquae alte (correct spelling)			1
(ii)	when spring tides coincide with storm surges in the Adriatic			1
(c)	visitors come to see treasured/medieval/old buildings(owtte); the water in Venice is a tourist attraction; (any one answer from the above) residents do not like their houses being flooded; nor their work/businesses being disrupted (any one answer from the above)			2
(d) (i)	porous rock/rocky sponges; containing water; (when water is removed) the pores compress and the ground sinks			3
(ii)	natural subsidence/ground sinking (caused by plate tectonics); <u>rising</u> sea level			2
(iii)	acquae altae/floods are becoming more frequent; the land is sinking/(effective)sea level is rising; (resident) population of Venice is decreasing; so Venice's predicament has worsened more rapidly in recent years; (any three points)			3
Total: 14				

Question	Expected Answers	Marks
2 (a) (i)	catastrophic/very severe flooding in 1966	1
(ii)	10 years	1
(iii)	100 years	1
(iv)	£35 million (per year)	1
(b) (i)	79 barriers spanning the 3 inlets to the Venetian lagoon	1
(ii)	£3.5 billion ÷ 79 = £44 million per barrier/ 45 x 79 = £3.5 billion	2
(iii)	hollow flood barrier; lying on bottom of lagoon; on flood warning, barrier floats to surface of lagoon; as compressed air is pumped into the barrier (any 3 points, 2 max if it doesn't work)	3
Total: 10		
3 (a)	the land surface would rise unevenly potentially destroying the city;	1
(b) (i)	seismic measurements; measurements taken from a borehole	2
(ii)	porous rock; with layers of clay above and below it	2
(iii)	the ground level should rise more evenly; the clay above should retain the pumped fluid within the aquifer	2
(c)	gas fields/rocks containing gas contract as the gas is extracted; rebound again as water flows back where the gas once was	2
Total: 9		

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Question	Expected Answers			Marks
4 (a) (i)	circle of 12 vertical wells/boreholes; 8 horizontal wells arranged as the spokes of a wheel			2
(ii)	help Italy meet its climate change obligations; by locking up 23 million tonnes of greenhouse gas per year			2
(iii)	injecting seawater gave the greatest lift; cheapest/simplest;			2
(iv)	injecting water is more likely to fracture rocks than injecting carbon dioxide			1
(b)	much of Venice lacks a proper sewerage system; so sewage goes untreated into the lagoon; the flood barriers may slow down the dilution of sewage/mixing of sewage and lagoon water			3
(c)	raising the city will mean that the flood barriers/gates will have to be used less frequently so there will be less pollution; also it could counteract/mitigate decades of rising sea level (thus buying Venice time)/extend the life of the MOSE flood barriers;			2
	Total: 12			

**Mark Scheme 2844
June 2007**

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.
 - x = incorrect response (errors may also be underlined)
 - ^ = omission mark
 - bod = benefit of the doubt (where professional judgement has been used)
 - ecf = error carried forward (in consequential marking)
 - con = contradiction (in cases where candidates contradict themselves in the same response)
 - sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

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Question 1	Expected Answers			Marks
a (i)	Phosphate/phosphate groups			1
(ii)	Deoxyribose sugars/sugars			1
(iii)	Correct drawing - backbone on outside; Bases paired; Correct base pairs (TCG);			3
(iv)	H / hydrogen			1
b	Double stranded DNA unzipped; Complementary base pairing of nucleotides with free nucleotides; New strand Joined by DNA ligase; One old one new strand;			4
c (i)	3 bases/ 3 nucleotides; coding for specific amino acids; allow correct description of start/stop codon (2 marks)			2
(ii)	Universal – codons/ sequence of bases code for same amino acids in all species;			1
d (i)	mRNA			1
(ii)	DNA unzipped; Complementary base pairing with free <u>RNA</u> nucleotides; U instead of A; Ribose instead of Deoxyribose; Single strand produced;			3
(iii)	mRNA binds to ribosome; tRNA brings specific amino acids; tRNA has anticodons to mRNA codons; amino acids added to chain at ribosome; with peptide bonds;			4
Total: 21				

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Question 2	Expected Answers			Marks
a	Bond breaking involves taking in energy; Forming of bonds releases energy; Endothermic reactions involve a gain in energy of the system; So in photosynthesis overall gain in energy; More energy taken in to break bonds in reactants than is released by forming bonds in products;			4
b	Reactants and products clearly labelled with reactants before products; reactants lower level than products; Change in energy / delta H labelled;			3
c (i)	400 – 450 and 650 – 700 (or figures within this range);			1
(ii)	blue/violet and red absorbed; green reflected;			2
Total: 10				

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Question 3	Expected Answers			Marks
a (i)	Contain chloroplasts or chlorophyll / absorb light			1
(ii)	Allows CO ₂ to diffuse into leaf / oxygen to diffuse out;			1
(iii)	binds with CO ₂ ; Forms 2 molecules of PGA;			2
b	RuBisCo catalyses reaction between RuBp and CO ₂ ; CO ₂ cannot bind / Competitive inhibition of enzyme;			2
c	In C4 plants, CO ₂ does not directly enter chloroplasts of mesophyll cells; But is converted to malic acid / 4C compound; Which is sent to bundle sheath cells; away from the O ₂ ; Malic acid then releases CO ₂ into bundle sheath cell chloroplasts; Into C3 cycle;			4
d	Long/wide reaching roots enables it to reach available water(2 marks); Leaf rolling firing cuts down transpiration rate (2 marks); Few, sunken stomata, cuts down transpiration (2marks); Any 2 <u>structural</u> adaptations with reason			4
Total: 14				

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Question 4	Expected Answers			Marks
a i)	2,8,8,1 configuration;			1
ii)	extends further from centre so more room;			1
iii)	Outside shell			1
b (i)	Electrons at lowest energy levels;			1
(ii)	temperature;			1
c	Light from lamp which emits emission spectrum of atom under investigation ; Is shone through flame containing atoms of element being analysed; Intensity of light which emerges from flame is detected; Amount of absorption measured;			4
d	Concentration of atoms is directly proportional to ; Absorbance; Or absorbance = $\log(I_0/I)$ (2 marks for correct formula)			2
e	Arrows on diagram to show electron moving to two higher energy levels; Explanation; Allow electron moving up, then falling back with correct explanation; Explanation in terms of quantisation			2
Total: 13				

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Question5	Expected Answers			Marks
a i)	All molecules moving; Water molecules can move through semi permeable membrane, solute molecules do not; Concentration of solute higher side A / Water potential higher side A; More water molecules hit membrane side B; So more water molecules move from B to A; More water and solute molecules side A so higher level;			4
ii)	Pressure applied side A; Would overcome water pressure; Would force water molecules to go back to side B;			2
b	If conditions of a system at equilibrium are altered, the system will oppose the change (or AW); pressure applied to osmotic system leads to water movement to oppose the pressure change;			2
c	Maple syrup one side of semi permeable membrane Pure water other side; Apply pressure to maple syrup side;			2
d	MED involves a series of distillation vessels; First vessel is heated and steam condensed; Energy released from condensation is transferred to heat second vessel; In normal distillation this energy is wasted; And so on for several stages; Pressure increases may be used to reduce boiling point in later vessels;			4
Total: 14				

Mark Scheme Page 6 of 6	Unit Code 2844	Session June	Year 2007	Version
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 6	Expected Answers			Marks
a	CO ₂ is used to make sugars; Which are stored as biomass			2
b	Leaf clamped in leaf chamber; Air entering chamber can have measured amount of CO ₂ ; CO ₂ in air leaving chamber is measured by IR spectroscopy; Difference is net amount of CO ₂ assimilated by leaf; CO ₂ taken in by photosynthesis; Given out by respiration; To measure effect of changing CO ₂ concentration choose several different concentrations of CO ₂ ; Keep all other conditions the same; Record CO ₂ assimilation over several hours at different concentrations; To measure effect of light intensity; Choose several different light intensities; Keep all other factors the same; Measure CO ₂ over several hours at diff light intensities; Repeat experiments for more accurate results;			6

QWC	<p>organization & vocabulary 2 marks A answer is clearly and coherently organized throughout and B appropriate specialist vocabulary is used extensively;</p> <p>1 mark A answer shows a degree of organization and B some appropriate use of specialist vocabulary is made;</p> <p>0 mark A answer is not organized and B appropriate specialist vocabulary is not used;</p> <p>legibility & grammar 2 marks A text is clearly legible and B spelling, punctuation, grammar are accurate throughout;</p> <p>1 mark A text is untidy but can be read without difficulty and B spelling, punctuation, grammar show some mistakes;</p> <p>0 mark A text is difficult to read; and B spelling, punctuation, grammar show extensive mistakes;</p> <p>(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.)</p>	4
c i)	<p>Bonds absorb IR of certain frequencies; Change vibration patterns; Wavelengths of IR which are absorbed; Correspond to dips in transmittance;</p>	4
	<p>ii)</p> <p>IR radiation source beam split into 2 beams; passed through the sample gas and reference; sample absorbs IR of certain wavenumbers/4 and 14 approx; transmitted IR detected; comparison of 2 beams;</p> <p style="text-align: right;">Total: 18</p>	2

Mark Scheme 2845
June 2007

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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)	1 mark for variable - rainfall; 2 marks for explanation (2 points from list below) water is a reactant in photosynthesis; photosynthesis produces biomass; AW needed to transport nutrients into roots; nutrients are dissolved in water; AW transport chemicals around plants; nutrients are dissolved; AW keep plant cells turgid; plant would wilt otherwise;	3		
(b)	500% (allow 400% if <u>increase</u> in vapourisation clearly shown as a %);	1		
(c) (i)	1 mark for correctly labelled & scaled horizontal axis; 1 mark for correctly plotted points;	2		
(ii)	vaporization is directly proportional to temperature/vaporization increases as temperature increases/positive correlation ; energy is required to break bonds between molecules ; AW greater fraction of molecules have enough energy to vaporise ; AW application of Le Chatelier; AW greater kinetic energy increases rate of diffusion and hence transpiration;	2		
(d) (i)	temperate grassland and desert ;	1		
(ii)	plants need to be <u>adapted</u> to store water/reduce water loss/maximise access to water ; AW gives example of specific adaptation e.g. long roots	1		
		Total: 10		

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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
2 (a)	density of water is greater; density = mass ÷ volume so volume will be smaller; AW molecules will be closer together so volume will be smaller ora; AW uses density = mass ÷ volume; in calculation to show reduction in volume			2
(i)	Use of factor of 10^6 to convert area to m^2 ($=1.31 \times 10^{13}$) AND multiplies by 2 to calculate volume; Gives answer (2.62×10^{13}) in <u>standard form</u> ; <i>ecf if some working shown</i>			2
(ii)	$2.41 \times 10^{13} m^3$ AND given to 3 sig. figs. ; (<i>ecf</i> answer to (i) $\times 0.918$)			1
(iii)	$2.38 \times 10^{13} m^3$; (<i>ecf</i> answer to (i) $\times 0.91$)			1
(iv)	Difference = $2.41 \times 10^{13} - 2.38 \times 10^{13} = 3 \times 10^{11} m^3 / 0.03 \times 10^{13}$; <i>ecf</i> from (ii) and (iii) (i.e. answer to (ii) – answer to (iii))			1
(v)	Volume = area \times height so height = $3 \times 10^{11} / 3.6 \times 10^{14} = 0.0008 m$; (<i>ecf</i> answer to (iv) $/ 3.6 \times 10^{14}$)			1
(c)	none of the glacier ice lies below sea level / doesn't displace water ora ; there is no space below sea level to be filled by melted ice ora ; all the water produced increases sea level; (2 points from above list)			2
Total: 10				

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Question	Expected Answers			Marks
3 (a)	sulphur dioxide is released from volcanoes and human activity; + detail of this process e.g. burning of fossil fuels containing sulphur impurity AW sulphur dioxide is present in magma phytoplankton are marine organisms / organisms present in the; sea <i>(need some indication that phytoplankton are living)</i> ; they <u>absorb</u> / <u>trap</u> sunlight; and <u>release</u> dimethyl sulphide ; + detail of this process e.g. absorption of sunlight occurs in photosynthesis sulphur dioxide / dimethyl sulphide are <u>converted</u> to sulphuric acid ; (these sulphur compounds are) present in form of haze / clouds; <i>(needs implication that sulphuric acid haze has been produced from other pollutants)</i> ; + detail of this process e.g. reaction is an oxidation AW reaction with oxygen and water; <u>some</u> sunlight is reflected by clouds / haze; + detail of this process e.g. because they contain small particles of liquid / solid AW have a high albedo; (7 points from the above list of 11)			7
(b)	Statement of negative feedback: increased <u>temperature</u> causes a <u>process</u> which reduces temperature <i>(can be implicit in details of description)</i> Details of the process: higher temperatures could lead to <u>increased</u> phytoplankton activity / productivity / growth; <u>increased</u> dimethyl sulphide released ; leading to <u>greater</u> reflection of sunlight / <u>less</u> sunlight reaching surface / increased albedo ; (3 points from the above list)			3
Total: 10				

	<p>if in terms of <i>ocean circulation</i>:</p> <p>name of process (transfer of energy NOT ocean circulation); em radiation <u>absorbed</u> by water occurs most effectively near equator; water can store large amounts of energy; releases energy as it cools AW energy released at high latitudes;</p> <p><u>deep-water</u> circulation system;</p> <p>water evaporates from sea; increases salinity of water; hence increases density; allows sinking of water to occur/drives vertical circulation;</p> <p>greenhouse effect / global warming / raising temperature of the Earth;</p> <p>Earth absorbs short wavelength radiation/ultraviolet/visible light; emits (thermal) infrared radiation; carbon dioxide/greenhouse gases absorb; in troposphere AW causes molecules to vibrate/re-emit infra-red;</p> <p style="text-align: right;">Total: 10</p>	<p>5</p> <p>5</p>
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Question	Expected Answers			Marks
5	<p>Concept of carbon sinks / sources Gives example(s) of carbon source e.g. burning fossil fuels; (second example) e.g. respiration; Gives example of carbon sink e.g. dissolving of CO₂; (second example) e.g. photosynthesis; <i>Must refer to a process</i></p> <p>science of ecosystems <i>general structure:</i> ecosystem consists of habitat (area of land) + organisms; many different populations/range of niches; habitat of marine ecosystem = ocean; organisms arranged in trophic levels/food chain/food web; phytoplankton/plants are called producers; use of other terms e.g. consumers (<i>not predators</i>); decay chain also present;</p> <p><i>energy/carbon transfer:</i> producers/plants/autotrophs absorb sunlight/carry out photosynthesis; CO₂ converted into glucose/biomass; Energy transfers between trophic levels; By feeding/biomass transfer; Some energy/biomass lost in respiration/decay; produces carbon dioxide (and water); can be aerobic or anaerobic; decomposers/bacteria also break down dead matter by decay;</p> <p><i>other points</i> ecosystem is sustainable/remains in steady state; because energy continually supplied; and nutrients are recycled; <u>ecosystem</u> disrupted if factors change e.g. pH, temperature, CO₂ levels.; factors can be biotic or abiotic AW pH is an abiotic factor; deep water ecosystem will be much simpler than other ecosystems/may have fewer trophic levels/may not use light as energy source ;</p>			

	<p>reversible reactions & equilibrium reversible reaction can go either way/forward or reverse direction; equilibrium reached when rates of forward & reverse reactions are equal; concentrations/amounts of reactants and products remain constant; occurs in a closed system; Le Chatelier's Principle predicts effect of changes; position of equilibrium alters to oppose change in conditions; if pressure is increased equilibrium shifts to produce fewer (gas) molecules ; if temperature is decreased equilibrium shifts to favour exothermic direction ; AW position of equilibrium depends on whether reaction is exothermic or endothermic;</p> <p>acids acid are associated with presence of H⁺ /hydrogen ions/protons; acids <u>donate</u> H⁺ /dissociate to produce H⁺; pH of acids is <7; pH = -lg[H⁺]; high [H⁺] produces low pH ora ; strong acids dissociate completely/react completely ; weak acids incomplete dissociation/react incompletely with water/CO₂ doesn't dissociate completely; presence of carbon dioxide solution lowers pH of water;</p> <p>reasons for changes in pH affecting ecosystems: activity of enzymes is pH dependent; shells may dissolve in acid; pH will affect <u>population balance</u>/some species are better adapted to low pH;</p> <p>other points about extract CO₂ will remain at bottom because liquid CO₂ is more dense than water; Global ocean circulation is slow so CO₂ won't reach surface for centuries;</p>	
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	<p>for quality of written communication</p> <p>organization & vocabulary</p> <p>2 marks A answer is clearly and coherently organized throughout</p> <p> and</p> <p> B appropriate specialist vocabulary is used extensively;</p> <p>1 mark A answer shows a degree of organization</p> <p> and</p> <p> B some appropriate use of specialist vocabulary is made;</p> <p>0 mark A answer is not organized</p> <p> and</p> <p> B appropriate specialist vocabulary is not used;</p> <p>legibility & grammar</p> <p>2 marks A text is clearly legible</p> <p> and</p> <p> B spelling, punctuation, grammar are accurate throughout; (at least 4 sentences)</p> <p>1 mark A text is untidy but can be read without difficulty</p> <p> and</p> <p> B spelling, punctuation, grammar show some mistakes;</p> <p>(at least 4 sentences)</p> <p>0 mark A text is difficult to read;</p> <p> and</p> <p> B sp, punct, gram show a high proportion of mistakes;</p>	
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Question	Expected Answers			Marks
6	<p>Points about obsidian formation Made of ions but ions are not arranged regularly; Because it froze rapidly; Diffusion takes a long time / slow process; Slowed down by high viscosity; Diffusion would convert random arrangement into regular arrangement; Would be unlikely as entropy would decrease;</p> <p>science of ions & ionic solids</p> <p>ions are charged <u>particles</u> (atoms) [molecules is CON]; can be (atoms or) groups of atoms / gives example of silicate – Si and O / SiO_4^{4-}; positive or negative + = cation, - = anion Electrons are gained and lost positive ions formed by loss of electrons / negative ions formed by gain of electrons; AW electrons transfer; between atoms when ions form; electrons lost / gained by <u>outer shell</u>; often have “full” outer shell / $8e^-$ / noble gas structure;</p> <p>crystals consist of a <u>giant structure</u>; 3-D; lattice / regular arrangement; cations and anions alternate in position; close together; <i>(these 4 points can also be scored from a suitable labelled diagram)</i> not moving around / vibrating ; attractions / bonding between ions of opposite charge ; strong bonding (compared to e.g. imf); overall no charge / charges balance out;</p> <p>science of liquid structure particles can move in liquid; particles are randomly arranged; particles are close together in both liquid and solid / slightly further apart in liquid; <i>(can also be scored from suitable labelled diagram)</i></p>			18

	<p>diffusion (particles) spread out / mix / move from high concentration to low concentration; diffusion occurs when particles are able to move / only occurs in fluids / liquids + gases; movement is random / collisions alter direction of movement; entropy increases during diffusion;</p> <p>structure of the Earth Earth has layered structure / names sequence of layers; lithosphere; is outer layer / consists of crust and outer mantle; is solid; asthenosphere is beneath lithosphere / plates / is lower mantle ; behaves like <u>thick / viscous</u> liquid / is semi-solid; surface consists of plates;</p> <p>formation of lava lava is magma that has been erupted from a volcano; magma contains gases / under pressure; (lava could be formed at) destructive boundary; where two plates meet / move together subduction occurs / AW one plate moves under another; plate melts forming magma; rises through cracks / fissures / vents to reach surface; (lava could be formed at) constructive / divergent boundary; where plates are moving apart; magma in asthenosphere / lower mantle moving due to convection currents; magma rises up to fill gap;</p> <p>for quality of written communication</p> <p>organization & 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;</p> <p>legibility & grammar (in at least 4 sentences) 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 sp, punct, gram show a high proportion of mistakes;</p>	4
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**Mark Scheme 2846/01
June 2007**

INSTRUCTIONS ON MARKING SCRIPTS

Excerpts from the Instructions for Examiners booklet.

For many question papers there will also be subject or paper specific instructions which supplement these general instructions. The paper specific instructions follow these generic ones.

1 Before the Standardisation Meeting

Before the Standardisation Meeting you must mark a selection of at least 10 scripts. The selection should be drawn from several Centres. The preliminary marking should be carried out **in pencil** in strict accordance with the mark scheme. In order to help identify any marking issues which might subsequently be encountered in carrying out your duties, the marked scripts must be brought to the meeting.

2 After the standardisation meeting

- a) Scripts must be marked in **red**, including those initially marked in pencil for the Standardisation Meeting.
- b) All scripts must be marked in accordance with the version of the mark scheme agreed at the standardisation meeting.
- d) **Annotation of scripts**

The purpose of annotation is to enable examiners to indicate clearly where a mark is earned or why it has not been awarded. Annotation can, therefore, help examiners, checkers, and those remarking scripts to understand how the script has been marked.

Annotation consists of:

- the use of ticks and crosses against responses to show where marks have been earned or not earned;
- the use of specific words or phrases as agreed at standardisation and as contained in the final mark scheme either to confirm why a mark has been earned or indicate why a mark has not been earned (e.g. indicate an omission);
- the use of standard abbreviations e.g. for follow through, special case etc.

Scripts may be returned to Centres. Therefore, any comments should be kept to a minimum and should always be specifically related to the award of a mark or marks and be taken (if appropriate) from statements in the mark scheme. General comments on a candidate's work must be avoided.

Where annotations are put onto the candidates' script evidence, it should normally be recorded in the body of the answer or in the margin immediately adjacent to the point where the decision is made to award or not award the mark.

d) Recording of marking: the scripts

- i) Marked scripts must give a clear indication of how marks have been awarded, as instructed in the mark scheme.
- ii) All numerical marks for responses to part questions should be recorded unringed in the right-hand margin. The total for each question (or, in specified cases, for each page) should be shown as a single ringed mark in the right-hand margin at the end of each question.
- iii) The ringed totals should be transferred to the front page of the script, where they should be totalled.
- iv) Every page of a script on which the candidate has made a response should show evidence that the work has been seen.
- v) Every blank page should be crossed through to indicate that it has been seen.

e) Handling of unexpected answers

The standardisation meeting will include a discussion of marking issues, including:

- a full consideration of the mark scheme in the context of achieving a clear and common understanding of the range of acceptable responses and the marks appropriate to them, and comparable marking standards for optional questions;
- the handling of unexpected, yet acceptable answers.

There will be times when you may not be clear how the mark scheme should be applied to a particular response. In these circumstances, a telephone call to the Team Leader should produce a speedy resolution to the problem.

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Question	Expected Answers	Marks		
1 (a)	two continental plates shown, with Eurasian plate above, and correctly labelled; subduction zone shown (and labeled); relative movement of plates correctly shown; mountains shown on overlying plate; destructive margin / boundary shown and labelled (4 points from the above list)	4		
(b)	outer layer of Earth; consisting partly of crust; and partly of outer mantle; made of tectonic plates (3 points from above list)	3		
(c)	one plate of oceanic lithosphere; sinks under continental lithosphere plate; because oceanic lithosphere is denser; AW: two plates pull / move apart / sea-floor spreading; material flows up to fill gap; constructive / divergent boundary / margin AW: conservative boundary; plates slide past each other; no creation or destruction of plates / rock	3		
(d) (i)	Earth has a liquid outer/part core / can locate liquid boundary	1		
(ii)	in longitudinal wave, displacement is backwards & forwards / in direction of movement of wave / displacement and wave travel are parallel; in transverse wave, displacement is up & down / at right angles to direction of movement of wave;	2		
(iii)	longitudinal wave - sound wave; transverse wave - electromagnetic wave / light wave (or other electromagnetic radiation) / water ripple;	2		
		Total: 15		

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Question	Expected Answers			Marks
2 (a)	Brazil current shown flowing in anticlockwise direction; sub-tropical gyre shown in area enclosed by currents;			2
(b)	land masses; Earth's rotation/Coriolis force;			2
(c)	Air is dry (for 1 mark); Benguela current is a cold current; has low evaporation; wind has passed over continent/land before reaching this region/prevailing wind from SE; water vapour has already precipitated out/already rained; cold currents are associated with sea fogs; (3 further points from above list)			4
(d) (i)	2 H atoms bonded to central O atom; bent shape shown with bond angle greater than 90°, less than 120°; correct location of δ+ on H atoms and δ- on O atom;			3
(ii)	bonding occurs between ions and water; due to opposite charges; + charge/cation with δ- /ora			3
(iii)	nutrients are in lower ocean (source of nutrients); and are ionic compounds/minerals ; they <u>dissolve</u> in (upwelling) water; (2 points from above list)			2
Total: 16				

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Question	Expected Answers			Marks
3 (a)	diagram showing ions labelled + and – / cations and anions; in regular pattern, with +ve and –ve adjacent; close together / or bonds shown; 3D shown or indicated in words ('lattice' not sufficient – indication of 3D required);			4
(b) (i)	diagram showing needle-like bodies; interlocking / crystals; filling space between aggregate			3
(ii)	pockets of water / voids are left in final concrete / some compounds are in solution in water / aggregate grains pushed further apart;			1
(c) (i)	molecular structure			1
(ii)	hydrogen bonding (ignore covalent); ionic bonding;			2
(iii)	ice bonds weaker ora; ice bonds easier to break ora; ice bonds broken at lower temperature ora; higher temperature correlates with higher energy (4 points from above list)			4
Total: 15				

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Question	Expected Answers			Marks
4(a)(i)	v = s ÷ t (or correct rearrangement of this);			1
(ii)	use of correct value of 1.5 h for time/calculation of decimal value for 1 h 29 min; correct substitution into equation; correct value of 1000 km h ⁻¹ (apply ecf throughout)			3
(b)(i)	axes drawn and correctly labeled, time on x-axis; upwardly curving shape of graph (allow ecf);			2
(ii)	correct rearrangement ; correct substitution; value of 1500 km (apply ecf throughout)			3
(c)(i)	height / change in distance from centre of Earth;			1
(ii)	E _{KE} = 1/2 mv ² 1 mark for factor of a half; 1 mark for dependence on v squared;			2
(iii)	tsunami has more <u>kinetic</u> energy to transfer ; kinetic energy depends on v ² (so speed makes a big difference)			2
Total: 14				

**Advanced GCE Science 3885/7885
June 2007 Assessment Series**

Unit Threshold Marks

<i>Unit</i>		Maximum Mark	a	b	c	d	e	u
2841	Raw	60	46	40	34	28	22	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	40	35	30	25	20	0
	UMS	90	72	63	54	45	36	0
2843 A	Raw	120	83	73	63	54	45	0
	UMS	120	96	84	72	60	48	0
2843 B	Raw	120	83	73	63	54	45	0
	UMS	120	96	84	72	60	48	0
2844	Raw	90	58	50	43	36	29	0
	UMS	90	72	63	54	45	36	0
2845	Raw	90	49	43	37	31	25	0
	UMS	90	72	63	54	45	36	0
2846 A	Raw	120	87	78	70	62	54	0
	UMS	120	83	73	63	54	45	0
2846 B	Raw	120	87	78	70	62	54	0
	UMS	120	83	73	63	54	45	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. 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	11.6	24.9	43.1	63.4	82.2	100	546
7885	7.1	20.6	38.9	61.1	88.9	100	128

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication

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