

Mark Schemes for the Units

June 2009

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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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Advanced Subsidiary GCE Science (H178)

MARK SCHEMES FOR THE UNITS

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G641 Remote Sensing and the Natural Environment

Question		Expected Answers	Marks	Additional Guidance	
1	a	<p>BIOMASS: mass/ amount ; of (dry) organic matter ;</p> <p>BIODIVERSITY: the <u>variety</u> of organisms/<u>number</u> of species ; present in an ecosystem/area/habitat (owtte) ;</p>	2	amount must be linked to some kind of organic matter	
			2		
	b	i	coral reef is <u>much</u> higher ;	1	or quotes figures
		ii	<p>(2 max for factors + 1 for explanation)</p> <p>more light ; therefore more photosynthesis/growth of plants ; warmer ; because nearer surface/in shallow water ; more oxygen ; available for respiration ; more nutrients ;</p>	3	
	c		<p>pollution of the sea (eg. industrial, sewage/mud) / fishing / disruption from tourism / coastal development/rising sea temp, or any other sensible suggestion ; (not just pollution/global warming)</p>	1	pollution must be qualified eg. toxic waste etc.
	d		<p>loss of habitat ;</p> <p><i>plus any one from:</i> loss of biodiversity ; loss of producer organisms ; upsets food chain /loss of potential food organisms ; loss of resources that can be used by humans ;</p>	2	

Question		Expected Answers	Marks	Additional Guidance
1	e	burnt/destroyed areas of rainforest can be easily distinguished from healthy areas owtte ; water <u>above coral</u> (owtte) absorbs VNIR ; so changes cannot be detected in coral ;	3	
Total			14	

Question		Expected Answers	Marks	Additional Guidance
2	a	the spreading out of waves ; after they pass an obstacle/gap in a barrier ;	2	allow 'spreading out of light' 2 nd mark must be linked to a reference to waves/wavelength/light
	b	i	2	max 3 complete waves between gap and bottom of obstacle
		ii	1	do not allow straight lines
	c	red light has longer wavelength/smaller frequency (ora) ;	1	
	d	refracts ; retina ; rods then cones ; red, blue, green ;	4	
Total			10	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	March to June production rising steadily ; June to August/autumn falling, then rising ; falls steadily from Sept/Oct onwards ;	3	peaks in June 1 mark
		ii	temperature rising ; so microbes more active ;	2	accept decay/decomposition for second mark
	b		protein/DNA/chlorophyll ;	1	
	c	i	there is a shortage of nitrates then ;	1	must be reference to shortage
		ii	July onwards/winter months ;	1	or any named month between July and February
	d	i	leached out/washed off the land ;	1	accept denitrification
		ii	pollution of watercourses ; increased growth of algae/ <u>water</u> plants /eutrophication ; (leading to) anaerobic conditions/lack of O ₂ in the water ;	2 max	accept any named watercourse/aquatic ecosystem aquifers needs to be linked drinking water <u>pollution</u>
Total				11	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	VISIBLE LIGHT : sun ; RADAR: the satellite; (both needed)	1	
		ii	$\frac{5 \times 10^{-2}}{5 \times 10^{-7}}$; $10^5/100,000$;	2	
		iii	<i>any two from:</i> radar provides more information eg about roughness of surface/height of land ; not affected by clouds ; radar can be used at night ;	2	
	b	i	a component/part of a graphic image/picture ; representing a certain/fixed area ;	2	a 'picture element' scores 1 mark
		ii	greater definition/more detailed/ clearer image ;	1	do not allow better quality
		iii	information in the form of numbers ; 0-255 ; the number determines the brightness/shade of the pixel ; the higher the number, the brighter/lighter the pixel ora ;	3 max	1 st mark is for realisation that digital information involves numbers
Total				11	

Question		Expected Answers	Marks	Additional Guidance
5	a	<p><i>any five from:</i></p> <p>climate change will cause a change in the weather/ some change specified eg.hotter ;</p> <p>some animals (owtte) unable to cope/find food etc, so die out ;</p> <p>one individual has a characteristic/adaptation which allows it to survive better ;</p> <p>example of a specific adaptation which will allow it to survive climate change ;</p> <p>reproduces/breeds ;</p> <p>passes characteristic/ genes on (to offspring) ;</p>	5	<p>QWC Terms used may include: individual, adaptation, characteristic, evolve, reproduce, offspring</p> <p>e.g. changing migratory patterns in birds etc.</p>
	b	<p>we don't know how much the climate will change/which animals will have adapted/we don't know how many species there are ;</p>	1	
		Total	6	

Question		Expected Answers	Marks	Additional Guidance
6	a	oxygen + glucose ; carbon dioxide + water ; (ignore reference to energy)	2	allow chemical formulae if they are correct
	b	bacteria/organisms in the soil ; would also be using oxygen/respinding ;	2	allow 'giving out oxygen' if referenced to plants
	c	i	1	
		ii	2 max	
		iii	1	if "smaller apparatus"/less soil needs to be linked to absorption of heat
		Total	8	

G642 Science and Human Activity

Question			Expected Answers	Marks	Additional Guidance
1	a	i	0°C (+/- 5) ;	1	
		ii	<i>any two from:</i> 8km ; 35 km ; 65km ;	2	allow +/- 2km in each case
	b	i	K (Kelvin) ;	1	ignore °
		ii	volume increases ;	1	
		ii	gases are made up of particles which are in continuous random motion ; increase in temperature means particles move faster AW have more kinetic energy ; so take up more space ;	3	any correct statement of the molecular kinetic theory gets 3
	c		<i>any three from:</i> heat energy from sun ; is at its most concentrated at the equator ; energy increases kinetic energy of the gas in the atmosphere above equator decreasing the density of the gas ; the warmer less dense air rises ;	3	any mention of Hadley cell gets 1 mark hotter at equator gets 1 mark a statement of Charles' law that V prop to T if P constant gets 1 mark
Total				11	

Question		Expected Answers	Marks	Additional Guidance
2	a	<p><i>any two from:</i> high enthalpy of vaporisation ; high melting point ; high volume of solid form (ice) AW high density of liquid form (compared to solid) ; high specific heat capacity ;</p>	2	
	b	<p>i <i>Diagram:</i> O-H bond shown correctly ; lone pairs on O shown correctly ;</p> <p>ii <i>Labels:</i> covalent bond labelled correctly ; any non-bonding pair labelled correctly ;</p>	2 2	<p>covalent bond must show electron pair -1 if more than 8e- around O atom. BOTH lone pairs on O must be shown for second mark here</p>
	c	<p>i bond between O and H on separate molecules shown correctly ;</p> <p>ii H-bond increases attraction between molecules ; more energy required to separate molecules (stronger intermolecular forces) ;</p>	3	<p>if delta + and delta – shown on water molecule must be correct if hydrogen bonding described as VERY strong only 1</p>
	d	<p><u>energy</u> required ; to raise temperature of 1kg of water by 1°C ;</p>	1	allow 1g by 1 C

Question		Expected Answers	Marks	Additional Guidance
2	e	(high SHC means) water retains heat well (compared to land/rock) ; Gulf stream contains warm water ; this heat is transferred to atmosphere/wind/air ; UK has a higher average temperature as a result AW warmer in winter ;	4	Gulf stream heats up UK gets 1 only mention of thermo-haline conveyer belt alone gets 1 ignore reference to summer temperature
		QWC: Any link between mild climate of UK in winter due to energy transfer due to water's high SHC	1	any sense of making link between gulf stream and climate
TOTAL			15	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	$S + O_2 \rightarrow SO_2$ correct formula for O_2 ; completely correct ;	2	do not allow $S + O \rightarrow SO_2$
		ii	(+) 4 ;	1	
	b		$H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$ H^+ ; SO_4^{2-} AW HSO_4^- ; Balancing ie. $2H^+$;	3	
	c		<i>any two pairs of points eg.</i> reduces pH of soil ; affecting plant growth ; releases metal ions into soil ; toxic when absorbed by plants/trees ; reduces pH of lakes/ rivers ; affects aquatic animals ; react with limestone buildings ; causing corrosion ;	4	2 points and 2 amplifications Second point must be linked to first (ie. do not award unless first point is also made)
			TOTAL	10	

Question		Expected Answers	Marks	Additional Guidance
4	a	carbon dioxide levels have risen ; rate of growth increasing/growth (becoming) exponential ; average global temperature rising (roughly linear) ; but not constant/eg. drop between 1940-1960 ;	4	both graphs “go up” gets 2
	b	<p>Reliability of evidence: no figures for temperature before 1860 ; sites of temperature measurements may not be representative of true global temperature OWTTE ; % of CO₂ could not be directly measured in 18th century ; possibility of bias in research methodology suggest reason for bias eg. political</p> <p>Validity of conclusions two graphs are from different periods ; variation in temperature graph not matched by variation in CO₂ gives specific example of this eg. drop in global temperature between 1940-1980 no information about other greenhouse gases/other factors affecting global temperature gives an example of these eg. methane/sunspot activity</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>Any 4</p>	<p>many answers are not distinguishing between reliability and validity thus: a general mention of the fact that both increase (1) but the increase is not “in synch” (1) (ie get 2 max)</p> <p>any mention of indirect methods of CO₂ measurement e.g. tree rings gets 1</p> <p>if bias possibility mentioned the 1. If reason given for bias +1</p>
		QWC: Any specific conclusion clearly related to evidence OR a clear argument against a specific conclusion due to insufficient evidence.	1	any recognition of difference between reliability and validity gets QWC mark
Total			9	

Question		Expected Answers	Marks	Additional Guidance
5	a	structural AW gives example eg. muscle fibre/hair (allow growth and repair) enzymes antibodies transport AW gives example eg. transmembrane proteins hormones component of cell membrane/receptor sites on membrane /histones (component of DNA structure/OVP)	3	do not accept general statements such as “DNA replication” or “respiration” do not accept “ribosomes” but accept make part of ribosomes allow messengers (AW hormones) do not award <u>transmembrane</u> protein twice
	b	sequence of amino acid (residues) ;	1	allow pattern of AAs
	c	<i>labels:</i> LHS = (beta-pleated) sheet ; RHS = (alpha) helix ;	2	do not accept double helix for alpha helix
	d	S-S bonds/disulphide bridges ; covalent bonds AW bonds between cysteine amino acids ; hydrogen bonds ; form between H and O or N/between eg. OH and NH ₂ ; ionic bonds ; formed between COO ⁻ and NH ₃ ⁺ /eg: between arginine and glutamic acid ;	6	1 mark for naming type of bond, 1 mark for detail
Total			12	

Question		Expected Answers	Marks	Additional Guidance
6	a	atoms of same element/same number of protons/same atomic number ; different mass <u>number</u> /different number of neutrons/different neutron number ;	2	
	b	mass = 231 ; atomic no = 90 ;	2	
	c	i	2	do not accept mass of sample alone (ie must mention the radioactive isotope or count).
		ii	2	2.1 x 10 ⁶ scores 2
	d	<i>any three from:</i> product emits ionising radiation ; damaging to cells/living organisms ; if product leaks out ; or if gamma radiation is emitted ; waste may contain Uranium-235 ; long half-life so remains dangerous for a long time ;	3	
	e	i	1	do not accept no carbon produced in reaction allow any idea of carbon produced balanced by carbon taken in
		ii	2	
		Total	14	

Question			Expected Answers	Marks	Additional Guidance
7	a	i	voltage is increased ;	1	
		ii	so current is decreased ; and so power loss is reduced ;	2	If current decrease mentioned in (a)(i) but not here then mark can be awarded here
	b	i	needed because I^2 will still be quite high and so R must be low if power loss is to be low ;	1	
		ii	power loss = $(1450)^2 \times 0.025$; answer = 52562 (AW 52.562 if kW used as unit) ; unit = W AW kW if working shows division by 1000 ;	3	allow any no of sig. figs >2 52562/52.562 kW scores 3 marks
	c	i	alternating current AW direction of <u>current</u> flow changes in a repeating pattern OWTTE ;	1	
		ii	selects $W = V \times I$; rearranges: $I = W / V$; $3000/240 = 12.5$; unit = A ;	4	12.5 scores 3
Total				12	

Question			Expected Answers	Marks	Additional Guidance
8	a	i	serine ;	1	
		ii	methionine-histidine-alanine-alanine-alanine ;	2	-1 for one error eg. one amino acid wrong or omitted
		iii	polypeptide ;	1	allow protein
		iv	different amino acid produced ; specifically alanine replaced by glycine ; this could (would) effect the (tertiary) (3D) structure of the protein ;	3	
		v	tertiary structure may be different (protein may not fold properly) ; (may affect function of protein)/active site may be a different shape ; thus substrate cannot bind to enzyme ;	3	If code changes then enzyme will not work gets 1 only
	b	i	<i>any four from:</i> identify suitable gene/DNA and remove (from cells of donor organism) ; use restriction enzymes ; insert into vector AW gives example of vector e.g. plasmid, virus, nanoparticle ; vector inserts DNA into nucleus of plant cell ; gene causes new characteristics to be expressed ;	4	some example of insertion mechanism ie plasmid or vector must be given for this mark
8	b	ii	<i>any three from:</i> pest resistance ; drought resistance ; increased yield ; increased nutritional value ; causes plant to produce pharmaceutical product ;	3	do not accept 'better crops' accept can extend growing season
Total				17	

Grade Thresholds

Advanced GCE Science H178
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
G641	Raw	60	45	40	35	30	26	0
	UMS	90	72	63	54	45	36	0
G642	Raw	100	79	70	61	52	43	0
	UMS	150	120	105	90	75	60	0
G643	Raw	40	33	30	27	24	22	0
	UMS	60	48	42	36	30	24	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
H178	300	240	210	180	150	120	0

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

	A	B	C	D	E	U	Total Number of Candidates
H178	11.0	24.5	43.1	59.0	80.0	100.0	292

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.

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