OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced Subsidiary GCE **AS H178**

Mark Schemes for the Units

June 2009

HX78/MS/R/09

Oxford Cambridge and RSA Examinations

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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		**BIOMASS:** mass/ amount ; of (dry) organic matter ; **BIODIVERSITY:** the variety of organisms/number of species ; present in an ecosystem/area/habitat (owtte) ;	2 2	amount must be linked to some kind of organic matter
	b	i	coral reef is much higher ;	1	or quotes figures
		ii	*(2 max for factors + 1 for explanation)* more light ; therefore more photosynthesis/growth of plants ; warmer ; because nearer surface/in shallow water ; more oxygen ; available for respiration ; more nutrients ;	3	
	c		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)	1	pollution must be qualified eg. toxic waste etc.
	d		loss of habitat ; *plus any **one** from:* loss of biodiversity ; loss of producer organisms ; upsets food chain /loss of potential food organisms ; loss of resources that can be used by humans ;	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' 2nd mark must be linked to a reference to waves/wavelength/light
	b	i	semicircular arc **;** wavelength remains the same **;**	2	max 3 complete waves between gap and bottom of obstacle
		ii	less curvature of the wavefront/only curved near edge **;**	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 watercouses ; 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	*any **two** from:* 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	1st mark is for realisation that digital information involves numbers
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	a		*any **five** from:* climate change will cause a change in the weather/ some change specified eg.hotter **;** some animals (owtte) unable to cope/find food etc, so die out **;** one individual has a characteristic/adaptation which allows it to survive better **;** example of a specific adaptation which will allow it to survive climate change **;** reproduces/breeds **;** passes characteristic/ genes on (to offspring) **;**	5	QWC Terms used may include: individual, adaptation, characteristic, evolve, reproduce, offspring e.g. changing migratory patterns in birds etc.
	b		we don't know how much the climate will change/which animals will have adapted/we don't know how many species there are **;**	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/respiring **;**	2	**allow** 'giving out oxygen' if referenced to plants
	c	i	heat <u>produced</u> during respiration (owtte) **;**	1	
		ii	6 woodlice wouldn't produce much heat **;** dissipated (owtte) over a large area **;** water/apparatus <u>absorbs heat</u> **;** insulated by apparatus **owtte AW** temperature probe is a long way from the source of heat (woodlice)	2 max	
		iii	more woodlice/probe in amongst woodlice or any other reasonable suggestion **;**	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^{o}C (+/- 5) ;	1	
		ii	*any **two** from:* 8km ; 35 km ; 65km ;	2	**allow** +/- 2km in each case
	b	i	K (Kelvin) ;	1	**ignore** ^{o}
		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		*any **three** from:* 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		*any **two** from:* 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 **;**	2	
	b	i	***Diagram:*** O-H bond shown correctly **;** lone pairs on O shown correctly **;**	2	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
		ii	***Labels:*** covalent bond labelled correctly **;** any non-bonding pair labelled correctly **;**	2	
	c	i	bond between O and H on **separate** molecules shown correctly **;**	3	if delta + and delta – shown on water molecule must be correct
		ii	H-bond increases attraction between molecules **;** more energy required to separate molecules (stronger intermolecular forces) **;**		if hydrogen bonding described as VERY strong only 1
	d		<u>energy</u> required **;** to raise temperature of 1kg of water by 1^{o}C **;**	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		*any **two** pairs of points eg.* 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		***Reliability of evidence***: no figures for temperature before 1860 ; sites of temperature measurements may not be representative of true global temperature OWTTE ; % of CO_2 could not be directly measured in 18th century ; possibility of bias in research methodology suggest reason for bias eg. political ***Validity of conclusions*** two graphs are from different periods ; variation in temperature graph not matched by variation in CO_2 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	1 1 1 1 1 1 1 1 1 Any 4	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) any mention of indirect methods of CO_2 measurement e.g. tree rings gets 1 if bias possibility mentioned the 1. If reason given for bias +1
			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>trans</u>membrane protein twice
	b		sequence of amino acid (residues) **;**	1	**allow** pattern of AAs
	c		*labels:* 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 number/different number of neutrons/different neutron number ;	2	
	b		mass = 231 ; atomic no = 90 ;	2	
	c	i	time taken for mass/number of atoms of a radioactive isotope ; to fall to half (of original value) ;	2	**do not accept** mass of sample alone (ie must mention the radioactive isotope or count).
		ii	700 x 10^6 = 3 half-lives ; 2100 x 10^6/2.1 billion 2.1 x 10^9 years ecf from calculation of number of half-lives ;	2	2.1 x 10^6 scores 2
	d		*any **three** from:* 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	no **net** CO_2 produced ;	1	**do not accept** no carbon produced in reaction **allow** any idea of carbon produced balanced by carbon taken in
		ii	CO_2 is a greenhouse gas ; generating electricity by nuclear power does not cause global warming ;	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 = $(1450)^2$ x 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 x 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	*any **four** from:* 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	*any **three** from:* 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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