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GCE

Science

Advanced Subsidiary GCE **AS H178**

Mark Schemes for the Units

January 2010

HX78/MS/R/10J

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	i	109 (MJ) ✓	1	
		ii	*any **two** from:* growth ✓ milk (production) ✓ movement ✓ pregnancy ✓ any other reasonable suggestion ✓	2	**Allow** biosynthesis
		iii	in an energy transfer ✓ total amount of energy remains unaltered ✓	2	**Allow** 'when energy is passed on' For 2nd mark **allow** energy can neither be created or destroyed / energy input = energy output (NOT balanced / conserved)✓
	b	i	methane ✓	1	No other answers allowed
		ii	*advantage* – do not require oxygen / air ✓ *disadvantage* – produces less energy / toxic products formed ✓	2	
	c	i	135 x 100 ✓ 350 = 38.57 / 38.6 / 39 (%) ✓	2	38.5 = 1 mark
		ii	spread on land / use as fertiliser / manuring ✓ to restore / provide nutrients e.g. nitrate etc. AW help growth of crops✓ **OR** allow to ferment anaerobically / AW ✓ to produce, methane / energy / biogas ✓ **OR** dry it and burn it ✓ to produce energy ✓	2	use = 1 mark explanation = 1 mark

Question			Expected Answers	Marks	Additional Guidance
1	d		humans could eat the grain / wheat AW humans don't eat grass✓ only a small proportion of the energy taken in by the cow is converted into meat ✓ eating grain directly represents less wastage / more efficient **ora owtte**✓	3	**Allow** 'more energy required to produce grain than grass' Idea of wastage must be linked to energy use
			Total	**15**	

Question			Expected Answers	Marks	Additional Guidance
2	a		the amount of energy ✓ trapped (**owtte**) as biomass / organic matter✓	2	Must imply that biomass is produced in some way
	b		*any **two** from:* high temperature / warm ✓ high levels of (sun)light / sunny ✓ high rainfall / wet ✓	2	If the candidate omits 'high' e.g. sunlight, temperature, score 1 mark for both together. (heat alone is not enough for 1 mark)
	c		*light:* (lower levels) shaded by the leaves / canopy (above) ora ✓ *humidity:* water evaporating AW from transpiration won't be blown away by wind / trapped by vegetation ✓	2	2nd mark needs implication that water vapour is involved
	d		(spectrum is) more green at forest floor / less red and blue AW sunlight contains complete spectrum of wavelengths ✓ blue and red are absorbed (by leaves) AW all wavelengths except green ✓ green is transmitted / reflected ✓	3	Need a comparison with sunlight for 1st mark **Ignore** reference to intensity **Ignore** dimmer Need a description of the process occurring
	e		*any **five** from* loss of biodiversity; ✓ because habitats destroyed✓ potential to make pharmaceutical drugs ✓ loss of trees to remove CO_2 ✓ so contributes to global warming✓ effect on cloud formation and hence rainfall ✓ loss of livelihoods for indigenous people ✓ may rely on nuts / fruits / animals of rainforest ✓ tourism affected ✓ soil erosion in deforested areas ✓ reduces fertility of land✓	5	**Allow** other reasonable points **Allow** extinction of species **Allow** other points linked to climate change e.g. bare ground absorbs more sunlight; allow reference to CO_2 released by burning trees
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
3	a		**A** decomposition / decay ✓ **B** leaching / run-off ✓ **C** (nitrogen) fixation ✓	3	At least one spelled correctly
	b	i	the level / amount (of the nutrient) ✓ remains constant ✓ **OR** (AW) input equals ✓ output ✓	2	**Not** just "it is constant". Example of quantity need not relate to nutrient. 2nd mark depends on 1st Mark for output is linked to comparing with input in some way. "Input and output are balanced" = 1
		ii	negative feedback ✓	1	
		iii	*any **three** from:* (increased) N <u>in soil</u> ✓ (greater)growth of plants / taken in by plants ✓ (greater) loss through leaching / run-off ✓ denitrification / return to atmosphere (by bacteria)✓	3	Could refer to diagram (leaching is B) Need some implication that other organisms are involved
	c	i	*LHS:* nitrogen + hydrogen ✓ *RHS:* ammonia ✓	2	Any extra names are CON ignore energy and iron catalyst
		ii	the process uses a lot of energy / AW fuel ✓ *plus any **two** from:* (relatively) high temperature / hot ✓ high pressure ✓ low yield ✓	3	**Accept** > 100C, >20 atm IF units are stated NOT just "heat"
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	a longer wavelength ✓	1	
		ii	travels at the same speed ✓	1	
	b		black absorbs all wavelengths / all energy of light ✓ so absorbs better than glass / glass reflects light ✓	2	**Ignore** reference to heat 2nd mark needs a comparison with glass (or unpainted bulb)
	c	i	as the wavelength increases (ecf from (a) (i)) so does the temperature / longer wavelength linked to higher temperature ✓	1	
		ii	may not have reached final temperature AW 10s is too short ✓ read to the nearest whole number owtte ✓ thermometers are not same distance from prism ✓ temperature rises are small ✓ colours may overlap / difficult to measure effect of just one colour ✓	2	Other valid points possible
	d		infrared ✓	1	
	e	i	refraction ✓	1	
		ii	line bent towards the normal (normal need not be shown) ✓	1	Must not exceed vertical. **Accept** wavefronts if correctly drawn
		iii	becomes shorter / decreases ✓	1	
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	a		weather forecasting / spying e.g. nuclear installations / land use / detect relief ✓	1	**Not** just one word answers e.g. weather / temperature etc. **Allow** determine terrain etc.
	b		*any **three** from:* sensors/CCD on a satellite detect radiation / e.g. light✓ converts to an electrical impulse owtte ✓ convert to a number (between 0 & 255) depending on intensity / brightness (of radiation) ✓ images made up of pixels ✓ number determines brightness / colour in image / black = 0, white = (high number) ✓	3	
	c		*any **two** from:* reflection by clouds / water droplets ✓ scattering by dust particles / molecules✓ absorption by gases / CO_2 etc. AW gases absorb✓ refraction by water droplets ✓	2	At least one statement must use an underlined word, spelled correctly
			Total	**6**	

G642 Science and Human Activity

Question			Expected Answers	Marks	Additional Guidance
1	a		oxygen 20% ✓ 2 s.f only i.e. 20 or 21 but not 20.8 ✓	2	
	b		volume increases ✓ lines drawn on graph ✓ volume increases by 0.20dm^3 (+/- 0.02) ✓	3	**ECF** from graph all 3 marks for correct answer
	c	i	temp in Kelvin (K) ^oC + 273 ✓	1	
		ii	Sun's rays transfer (radiation) energy to air molecules (or to air via emission from surface) ✓ molecules gain kinetic energy AW ✓ same mass of gas occupies bigger space so less dense and air rises ✓	3	
	d	i	Coriolis effect ✓	1	
		ii	air moves from high to low pressure ✓ due to Earth's rotation ✓ air rotates clockwise ✓	3	Deflection of air due to rotation
			Total	**13**	

Question			Expected Answers	Marks	Additional Guidance
2	a		activation energy of reaction high / N_2 (triple) bonds very strong and thus high energy needed to break ✓	1	
	b	i	$2NO + O_2$ ✓ $2NO_2$ ✓	2	
		ii	+4 ✓	1	Must state +
	c	i	acid is a H^+ donor ✓	1	
		ii	strong means(almost) completely, ionised / dissociated, (cf weak acid only partially dissociated) ✓	1	
	d		state clear problem ✓ give explanation of same problem ✓ e.g. damage (erosion) to buildings acidification of lakes (affecting aquatic habitat) acidification of (agricultural) land (implications for crops causes heavy metal ions to be made soluble and released into eco system	2	Must state clear problem for 1 mark and give explanation of same problem for the second mark.

Question			Expected Answers	Marks	Additional Guidance
2	e	i	(graduated) pipette ✓	1	Not a measuring cylinder accept burette
		ii	anomalous result = 28.00 ✓ some clear attempt to calculate an average using the 3 other results ✓ average = 23.4(2) ✓	3	1 mark only if average is calculated using all 4 results (24.6)
		iii	more repeats increases reliability ✓ by clearly identifying anomalous results ✓	2	
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	2300-2390 ✓	1	
		ii	C=O bond (any mention) ✓ vibrates when (a particular) wavelength of IR radiation, strikes / is absorbed ✓ results in increased (vibrational / kinetic) energy of the molecule ✓	3	
	b	i	carbon dioxide has double bonds, methane only single ✓ there are no lone pairs in methane but are in carbon dioxide ✓	2	
		ii	methane has C-H bonds (H has lighter mass) and not C=O bonds (has different bonds from CO_2) ✓ different bonds vibrate at different frequencies ✓ thus different frequencies of IR absorbed (different spectrum) ✓	3	
	c	i	*any **three** from:* greenhouse effect is heat energy from the Sun ✓ (penetrating) atmosphere and hitting Earth's surface ✓ Earth heats up and emits IR radiation ✓ greenhouse molecules absorb this heat (IR radiation) ✓	4	

Question			Expected Answers	Marks	Additional Guidance
3	c	i	**QWC** mark awarded for minimum of three stages mentioned in order e.g.: energy (radiation) from sun (1) heats earth surface (2) Earth surface radiates IR radiation which is trapped by green house gases (3)		Must be in logical order for QWC mark.
		ii	*CO_2 increase – any **one** from:* increased burning of fossil fuels ✓ large scale processing of limestone for building ✓ increased deforestation ✓ *CH_4 increase – any **one** from:* increase in cattle, ranching / grazing ✓ melting of permafrost ✓	2	For 2 marks must mention - **one** cause of CO_2 increase **and** - **one** cause of CH_4 increase
			Total	**15**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	two amino acids ✓ (covalently) bonded together ✓	2	
		ii	O=C-N-H bond identified ✓	1	Only circling C-N bond does not get mark
	b	i	pH =6 ✓	1	
		ii	control, temperature / concentration of enzyme / concentration of substrate / light conditions, etc. ✓	1	
		iii	*any **three** from:* acid = low pH ✓ stomach pH =1-2/ is (very) acidic ✓ data suggests that activity is (practically) zero at this pH ✓ thus enzyme unable to metabolize substrate ✓	3	
	c	i	relative activity of enzyme (appears) to be greatly reduced at optimum pH ✓ remains low at extreme pH values ✓	2	
		ii	inhibitor binds to enzyme ✓ at **active site** (competitive inhibition) ✓ prevents substrate getting to active site ✓ thus enzyme cannot, metabolize / bind, original substrate ✓	4	
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
5	**a**		a fuel formed from the decomposition of living organisms (200 million years ago) ✓ in the absence of oxygen / under anaerobic conditions ✓	2	
	b		H_2O ✓ **2** (H_2O) ✓	2	
	c		6 protons indicated ✓ 6 neutrons indicated ✓ total 6 electrons shown ✓ in 2 shells (2.4) ✓	4	
	d		7 ✓	1	
	e		237 ✓ mass =4 ✓ number =2 ✓	3	

Question			Expected Answers	Marks	Additional Guidance
5	f	i	nucleus of protons and neutrons occupies small area at centre of atom ✓ electrons orbit nucleus ✓	2	
		ii	*any **three** from:* beam of alpha particles (from radioactive source) ✓ fired at a thin gold leaf foil AW ✓ most particles pass straight through (show as flashes on ZnS screen) ✓ some particles deflected back (off at an angle) suggesting repulsive forces ✓ centred at a (very dense) nucleus ✓	4	
			QWC must show how evidence suggests model		i.e. most alpha particles pass through atom thus atom mostly space or small number of particles rebound thus all positive charge concentrated in very small nucleus
			Total	**18**	

Question			Expected Answers	Marks	Additional Guidance
6	a	i	direct current ✓ continuous flow (of electricity / electrons) in one direction ✓	2	
		ii	R=V / I 3.0 / 0.25 ✓ 12 ✓ ohms / Ω ✓	3	
	b	i	power = energy / time W=J/s ✓ 1.5 GW = 1.5 x 10^9J ✓ 1 min = 60 s so need to multiply by 60 ✓ 9.0 x 10^{10} J ✓	4	Correct answer gets all 4 marks
		ii	a.c. = alternating current electrical current changes direction ✓ 100 times a second / AW 50 cycles per second ✓	2	
		iii	so that current is stepped down ✓ energy loss is minimised as electricity with a high current loses energy in the form of heat ✓	2	
			Total	**13**	

Question			Expected Answers	Marks	Additional Guidance
7	a		phenotype is the appearance of the organism / AW ✓ as determined by genes (proteins) expressed ✓	2	
	b	i	recognise a particular sequence of DNA ✓ by recognising a particular base sequence ✓ thus cutting the DNA at that particular site ✓	3	
		ii	vectors are (constructions) for transferring DNA ✓ from one organism to another ✓ enabling novel DNA to be inserted in a target host ✓	3	
	c		*any **two** from:* increased protein content ✓ pest resistance ✓ drought resistance ✓	2	
	d		unforeseen impact on wider environment e.g. resistance may be transferred to other crops, may impact on wildlife unforeseen other consequences on metabolism of crop	3	
			Total	**13**	

Grade Thresholds

Advanced GCE Science H178
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
G641	Raw	60	44	38	33	28	23	0
	UMS	90	72	63	54	45	36	0
G642	Raw	100	80	70	60	50	40	0
	UMS	150	120	105	90	75	60	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	292

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums/index.html

Statistics are correct at the time of publication.

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