OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced Subsidiary GCE

Unit **G641:** Remote Sensing and the Natural Environment

Mark Scheme for June 2013

Oxford Cambridge and RSA Examinations

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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.

Annotations available in scoris

Annotation	Meaning
	Unclear
	Benefit of doubt
	Incorrect response
	Error carried forward
	Example/Reference
	Ignore
	Not answered question
	Benefit of doubt not given
	Large dot (Key point attempted)
	Reject
	Contradiction
	Error in number of significant figures
	Correct response
	Omission mark

Annotations used in the mark scheme

Annotation	Meaning
/	Alternative and acceptable answers for the same marking point
(1)	Seperates marking points
reject	Answers which are not worthy of credit
not	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
––	Underlined words must be present in answer to score a mark
ecf	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Question			Answer	Marks	Guidance
1	(a)	(i)	The amount of **energy** trapped / stored (by an ecosystem); In the form of biomass;	2	ACCEPT: "locked up" etc IGNORE produced etc ACCEPT: organic matter etc Award second mark if biomass is clearly linked to productivity in some way
		(ii)	kJ $m^{-2}year^{-1}$;	1	ALLOW: other units involving energy per area per time eg J $km^{-2}month^{-1}$ ACCEPT mass per area per time
		(iii)	Stronger (sun)light; Warmer; Higher rainfall / wetter; Any 2	2	ACCEPT more sun etc NOT more hours of sun IGNORE humid MAX 1 mark if no comparison between rainforests
	(b)	(i)	Biodiversity;	1	
		(ii)	Different **layers**; (Provide variety of) **different niches / habitats** etc;	2	ACCEPT examples / descriptions of different layers; ACCEPT **specific** description of at least one niche / habitat e.g. different food source / conditions
		(iii)	**Potential** (owtte) to make (new) pharmaceutical drugs; Depletion of (food) resources; Absorbs less CO_2 / enhances global warming (owtte); Disrupt weather / reduces cloud formation; **Extinction / loss of** species / reduces biodiversity; AVP; Any 2	2	NOT loss of medicines alone ACCEPT any suitable named resource IGNORE releases less oxygen IGNORE habitat loss alone ACCEPT example of endangered species
	(c)		A. G**ene / mutation** (in an ancestor) allows them to tolerate cyanide; Plus any THREE from: B. Now has (an abundant) food supply denied to competitors / food is short so lemurs must eat bamboo / bamboo is only food available (owtte); C. Lemurs with mutation better able to survive / are more successful;	4	Need some indication that adaptation for tolerating cyanide is linked to a gene NEED to imply comparison with unadapted lemurs e.g. refers to some lemurs surviving

Question			Answer	Marks	Guidance
			D Mutation / genes / adaptation passed on t**o next generations / by reproduction**; E: (This process) occurs cumulatively **over many generations / long period of time**;		
			Total	**14**	

Question			Answer	Marks	Guidance
2	(a)		Reactants and products : A. reactants: CO_2 and H_20 AND products: O_2 and glucose / starch; Stages: B. Mention of either Light dependent stage OR Light independent stage details; C. Chlorophyll absorbs light ; D. Detail of light dependent stage e.g. water broken down to oxygen and hydrogen (atoms); E. Detail of light dependent: Hydrogen combines with CO_2 (to form glucose); Where it occurs: F. Chloroplast / thylakoid membrane;	5	Allow correct equation in words or symbols (chemical formulas must be correct) for 1 mark Any other reactant / product is CON IGNORE ATP / ADP / energy etc *Chlorophyll must be spelt correctly (see below)* Hydrogen gas/molecules / H_2 is CON *Chloroplasts must be spelt correctly (see below)* QWC If the following words are used, they must be spelled correctly: Carbon dioxide Water Oxygen Glucose Starch Chlorophyll Chloroplast
	(b)	(i)	Only red and blue absorbed; AW some is reflected / transmitted / light may miss chloroplasts);	1	ACCEPT wrong wavelength Mention of absorbed / diffracted is CON
		(ii)	0.27(%);	1	
		(iii)	Biosynthesis (of proteins); Producing / repairing, roots/ flowers / seeds / leaves ; Active transport; Movement of leaves / flowers etc (e.g. to follow sun);	2	Making starch / glucose is CON ACCEPT any valid structural feature/ mitosis ACCEPT moving molecules in and out of cells NOT movement alone without qualification

Question			Answer	Marks	Guidance
	(c)	(i)	Absence of air / oxygen AW waterlogged conditions; Warmth / suitable temperature; Presence of microorganisms/bacteria;	2	ACCEPT low oxygen levels ACCEPT hot / heat ACCEPT valid examples e.g. yeast
		(ii)	Methane / ethanol / alcohol;	1	
			Total	**12**	

Question			Answer	Marks	Guidance
3	(a)		Reflected Absorbed Scattered Refracted Electrical	3	ACCEPT reflected if not used earlier 5 right = 3 marks 4/3 right = 2 marks 2 right = 1 mark
	(b)		A. **Lens** (contains fluid which) has a different density (hence refracts light); B. Light hits / is focussed on retina / back of eyes; **C. Retina / back of eye** contains light sensitive cells / rods and cones; D. Detail about rods e.g. rods detect all (colours of) light / whole frequency range AW senses low level light; E. Detail about cones e.g. detect **specific** frequency ranges/ (different) colours / red + green +blue; Any 3	3	Mention of detecting colour is CON to low level mark
	(c)		A. Digital is sensitive to / can detect wider range of frequencies than eye (ora); B. Digital less sensitive to high frequency / visible light / (ora); C. Digital more sensitive to low frequency / infrared (ora); D. Digital slightly more sensitive to very high frequency / UV (ora); E. Peak sensitivity of camera occurs at lower frequency than eye (or gives **correct** numbers); Any 2 + F. Correctly names one type of radiation mentioned in **correct** marking points B-E;	3	REJECT higher range REJECT “uses visible light” etc Each marking point must make a comparison between the two sensors IGNORE numbers unless correct (e.g. 0.43×10^{15})

Question			Answer	Marks	Guidance
	(d)		Any colour but red;	1	REJECT white
			Total	**10**	

Question			Answer	Marks	Guidance
4	(a)		To make protein / amino acids / DNA / RNA;	1	
	(b)	(i)	Any 4 from: Nitrogen (from the air); Hydrogen; **Moderately** high temperature / 350-500^{o}C; High pressure / 100-200 atm; Iron (catalyst);	4	REJECT warm
		(ii)	Idea that producing raised temp and/or pressures requires a lot of fuel / energy; High pressures require expensive equipment (owtte); Hydrogen has to be made (from natural gas); Low **yield** (owtte); Any 2	2	
	(c)		A. Decomposers / bacteria / fungi; B. Break down (organic matter) to ammonium compounds / ammonification; C. Action of nitrifying bacteria; D. Nitrites / nitrates (produced); E. (nitrates / nitrites) <u>soluble</u> so can be taken in by plant roots; Any 4	4	IGNORE type of bacteria ACCEPT: Ammonia Mention of (de)nitrifying bacteria is CON for marking point B If marking point A is credited, candidate must imply that a second type of bacteria is then involved for marking point C QWC – sequencing;
	(d)		A. Nitrogen **from the air**; B. Converted to ammonia /ammonium compounds; C. (by action of) <u>Nitrogen-fixing</u> bacteria / rhizobia; D. In root nodules; Any 3	3	Must imply that nodule is underground
	(e)		Any 3 from: Fertiliser **runs off / leaches / washed into** rivers (owtte);	3	

Question			Answer	Marks	Guidance
			Increased growth of algae / plants / algal bloom AW/ eutrophication; (Decomposing) bacteria use up O_2; Leading to death of fish/ named species / decreases biodiversity;		
			Total	**17**	

Question			Answer	Marks	Guidance
5	(a)	(i)	1400 x 4 = 5600 (kJ); Correct calculation of % efficiency = 3360 x 100 / 5600; (ecf e.g. 3360 x 100 / 1400) = 60; **60% = 2 marks** = 60, so Solar water heating is more efficient (ecf)	3	AW 3360/4 = 840 (kJ) AW 840 x 100 / 1400 (can also be awarded for calculating 15% of 1400 = 210) Award 1 mark for 3360 x 100/1400 (if nothing further is correct) Must be based on a clear comparison between 15% and calculated value (<100%) for solar heating OR compares 840 and 210
		(ii)	(idea that) electricity is more useful than heat energy; AVP eg can sell electricity to National Grid / does not need water plumbing / work even when cloudy	1	Accept any reasonable suggestion
	(b)		Reflection by clouds / water droplets; Scattering; of blue light by molecules of N_2 and O_2 AW of green / red light by dust particles AW **water droplets** in clouds (if not mentioned in reflection above); Refraction by water droplets / air of different densities; Any 3	3	IGNORE absorption of UV or infrared for 1 mark. IGNORE reference to other gas molecules ACCEPT: raindrops NOT just “scattering by clouds”
			Total	**7**	

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