OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced Subsidiary GCE

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

Mark Scheme for January 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.

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/ = alternative and acceptable answers for the same marking point
(1) = separates marking points
not = answers which are not worthy of credit
reject = 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

Annotation	Meaning
	Unclear
	Benefit of doubt
	Cross (incorrect response)
	Error carried forward
	Example/Reference
	Ignore
	Not answered question
	Benefit of doubt not given
	Large dot (Key point attempted)
	Reject
	Contradiction

Annotation	Meaning
	Error in no. of significant figures
	Tick (correct response)
	Omission mark

Highlighting is also available to highlight any particular points on the script.

Question			Answers	Marks	Guidance
1	(a)		(an organism that) produces complex organic compounds (from inorganic/simple compounds) ; Using an external source of <u>energy</u> ;	2	ACCEPT examples of complex organic compounds ACCEPT produces biomass NOT produces food ACCEPT energy from sunlight (needs to imply external in some way) NOT photosynthesis alone NOT produces its own energy
	(b)	(i)	Rises (rapidly) between June & Sept / in summer AW peaks in Sept ; Plus any <u>one</u> from: • Begins to rise <u>slowly</u> in April / spring ; • Declines <u>rapidly</u> after Sept/in autumn ; • No / low abundance between Dec-Jan and April/in winter ;	Max 2	**NOT just "in warmer months"** **Mention of Sept unnecessary if referred to for 1st marking point**
		(ii)	Any 2 from: • (Increased photosynthesis because)more sunlight in summer / spring daylight (ora) ; • Warmer in summer / spring (ora) ; • Increased nutrients washed into sea in spring (ora) ; **AVP** eg large number/size of consumers/fish in autumn (ora);	Max 2	ACCEPT more nutrients in summer
		(iii)	Any 2 from: • Increase in growth starts earlier in the year AW decrease in growth starts earlier (owtte) ; • Maximum abundance/peak occurs earlier in the year (in July rather than Sept) ; • Peak abundance (owtte) is higher ; • Rate of increase (in spring) is greater AW rate of decrease (in autumn) is greater ;	Max 2	NOT "increased" alone without reference to peak / maximum Needs to be a comparison between the two decades to award these marking points. Needs to discuss abundance patterns not just shape of graph

Question			Answers	Marks	Guidance
		(iv)	Any 2 from: • Increase in temperature / global warming ; • Increase in CO_2 concentrations ; • More fertilisers <u>washed into sea</u> (owtte)/ higher nutrient levels ; • Warms up earlier in the year ; • Fertilisers used earlier in the year ; • Changes in populations of other species eg decrease in competing algae / decrease in fish population etc ;	Max 2	NOT just climate change IGNORE reference to light intensity / sunlight
	(c)		By the action of bacteria / decomposer organisms ;	1	Must imply some kind of action or process occurring
	(d)		The number/ amount of different/separate species ; (Living) in an ecosystem/area ;	2	ACCEPT variety / range of species ACCEPT variety/ range of organisms Must imply that there is some quantifying involved
	(e)		Fewer codfish/puffins AND increase in krill ; AND any **two** correct consequence eg • (fewer codfish) so fewer sharks as they eat codfish ; • (fewer codfish) so more lobsters as they are eaten by codfish OR fewer lobsters as codfish eat them when herring unavailable; • (increase in krill) so more humpback whales/jellyfish as more krill to eat ; • (increase in krill) so fewer phytoplankton/copepods/crab larvae as they are eaten by krill ; **AVP**	Max 3	ACCEPT codfish / puffins die ACCEPT population of codfish remains stable (because they can eat other food sources) For two marks, candidates need one of the explanations to refer to feeding relationships
			Total	**16**	

Question			Answers	Marks	Guidance
2	(a)		Nitrate ; To make protein/amino acid/nucleic acid bases ; Phosphate ; To make DNA/nucleic acids/ATP ; Magnesium ; To make chlorophyll/essential for photosynthesis / present in some enzymes ; Potassium ; Reference to stomata/enhanced enzyme function / ion pumps across cell membrane ; Calcium ; Reference to cell metabolism/cell wall structure ;	2	Function must relate to the correct mineral ion for the second marking point. 2nd marking point can be awarded if mineral ion incorrectly named as nitrogen or phosphorus. ACCEPT ammonium, nitrite, iron, copper, etc IGNORE growth, repair etc
	(b)		A. • Passive transport / diffusion ; • Ion/molecule moves from high conc. to low conc./ down conc. gradient ; • Smaller molecules e.g. CO_2, O_2, through bilayer ; • Larger molecules (e.g. glucose) / ions (e.g. K+) through protein channels ; • No energy needed ; **3 MAX** B. • Active transport ; • Molecule / Ion moves from lower conc. to higher conc./up/against conc. gradient ; • Involves protein channels ; • Requires energy/ATP ; • Changes shape of protein ; owtte **3 MAX** (up to a total of 5)	Max 5	**QWC:** if used, the following words must be spelled correctly: **Active transport** **Passive transport** **Diffusion** **Concentration (gradient)** **Energy** **Molecules** **ATP** IGNORE reference to water / ions crossing phospholipid bilayer Reference to the concentration gradient must be correct for the type of transport. Mention of phospholipid layer in context of active transport is CON for protein channel mark

Question			Answers	Marks	Guidance
	(c)	(i)	Oxygen ;	1	
		(ii)	Needed for (aerobic) respiration ; To provide energy for active transport/cell processes/growth / valid named process ;	2	**IGNORE reference to photosynthesis**
	(d)		Any 3 from: Nitrates ; Converted to nitrogen (and lost to the air) ; (Because of) anaerobic conditions / action of anaerobic bacteria ; Nutrient ions also washed away/leaching ;	Max 3	Denitrification scores 1 mark NOT just “no air” Reference to other organisms / plant respiring anaerobically is CON ALLOW ‘run off’ for leaching **ACCEPT correct description of leaching from soil etc**
			Total	**13**	

Question			Answers	Marks	Guidance
3	(a)		Xray UV 1 mark Infrared Microwave 1 mark	2	
	(b)	(i)	(Microwave/e-m) wave emitted (owtte) by spacecraft ; Reflected/scattered from (Titan's surface) ; Picked up by sensors (on the spacecraft) ;	3	ALLOW valid description of sensing
		(ii)	Any 2: How rough the surface/terrain is ; Presence of mountains/valleys ; Distance of object/surface ;	Max 2	Allow: Presence of water or ice/ moisture content of the soil / presence of "rainfall" etc ALLOW how steep it is Reference to vegetation, temperature etc is CON for 2nd mark (1 max if it is mentioned) NOT landscape / terrain alone
		(iii)	Radiowave/digital signal ;	1	ALLOW microwave NOT infrared, visible etc
	(c)		Reflection by clouds ; Scattering ; By dust particles/pollution/water (droplets)/O_2/N_2 mols (must be linked to scattering) ;	3	**Reference to satellite signal / RADAR is CON** **ACCEPT refraction in context of "twinkling" ;** **IGNORE diffraction, absorption unless contradictory**
	(d)		Rods ;	1	**Cones is CON**
			Total	**12**	

Question			Answers	Marks	Guidance
4	(a)		Any 4 from: • Light absorbed by chlorophyll / chloroplasts ; • Light dependent stage ; • (water broken down) to form oxygen ; • (water broken down) to form hydrogen <u>atoms</u>/<u>ions</u> ; • Hydrogen (atoms/ions) react with CO_2 to form glucose / carbohydrates ; • ATP is formed in light-dependent stage / used up in 2nd stage / glucose formation / light-independent stage ;	Max 4	**QWC** correctly ordered sequence (max 3 if order is seriously incorrect)
	(b)		Increase ; Trees no longer absorbing CO_2 (in photosynthesis) ; Dead trees will rot / burn /combust ; Releasing CO_2 into the atmosphere (must be linked to a named process) ;	4	Increase must be stated explicitly
	(c)	(i)	(When a) <u>change</u> occurs (in a system) (owtte) ; The system responds by changing even more in the same direction (owtte) ;	2	ACCEPT CO_2 <u>increases</u>; system responds by producing even more CO_2 ora Marking points are independent of each other
		(ii)	• Increase in CO_2 could cause increased temperature/cause droughts ; • Increased <u>decay</u> of trees/ increased death of trees / more forest fires ; • Producing more CO_2/less CO_2 absorbed / releases CO_2 (must be linked to valid natural cycle);	3	IGNORE deforestation / cutting down trees
	(d)	(i)	<u>Near</u> infrared/ NIR ;	1	
		(ii)	F=c/wavelength AW correct substitution ; 3.8×10^{14} ; 2 sig. figs. ECF ; Hz/s^{-1} ;	4	3.8×10^{14} scores 3 marks, 3.79×10^{14} etc scores 2 marks Award SF mark if valid attempt at calculation using supplied data; answer needs to be consistent with the candidates working

Question			Answers	Marks	Guidance
	(e)		The loss of <u>potential</u> (owtte) pharmaceutical drugs ; Reducing biodiversity affects other organisms in food chain owtte ;	Max 1	
			Total	**19**	

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