

GCE

Science

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

Advanced Subsidiary GCE

Mark Scheme for June 2015

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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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| Question | | Expected Answer | | | | Mark | Rationale/Additional Guidance | | | | | | | | | | | |
|---------------------|------------------------------|--|---|---------------------|------------------------------|---|--|---------|--------------|--------------------------|----------|-----------|-----------|---|---|--|---|---|
| 1 | a | A cytoplasm; B plasma membrane; C mitochondrion; | | | | 3 | ACCEPT membrane ACCEPT mitochondria | | | | | | | | | | | |
| | b | i | <table border="1"> <thead> <tr> <th>Type of respiration</th> <th>Where it happens in the cell</th> <th>Products (other than ATP)</th> <th>Number of ATP molecules produced</th> </tr> </thead> <tbody> <tr> <td>Aerobic</td> <td>mitochondria</td> <td>Carbon dioxide AND water</td> <td>About 38</td> </tr> <tr> <td>Anaerobic</td> <td>cytoplasm</td> <td>Lactic acid OR Ethanol AND carbon dioxide</td> <td>2</td> </tr> </tbody> </table> | Type of respiration | Where it happens in the cell | Products (other than ATP) | Number of ATP molecules produced | Aerobic | mitochondria | Carbon dioxide AND water | About 38 | Anaerobic | cytoplasm | Lactic acid OR Ethanol AND carbon dioxide | 2 | | 4 | For each row, 3 boxes correct = 2 marks For each row, 2 boxes correct = 1 mark Accept any number between 30 and 40 IGNORE ATP IGNORE second response if lactic acid given |
| Type of respiration | Where it happens in the cell | Products (other than ATP) | Number of ATP molecules produced | | | | | | | | | | | | | | | |
| Aerobic | mitochondria | Carbon dioxide AND water | About 38 | | | | | | | | | | | | | | | |
| Anaerobic | cytoplasm | Lactic acid OR Ethanol AND carbon dioxide | 2 | | | | | | | | | | | | | | | |
| | | ii | Biosynthesis; OR active transport; | | 1 | ACCEPT examples of biosynthesis e.g. protein synthesis/muscle (cell) contraction /nerve cell impulses/cell replication DO NOT ACCEPT movement | | | | | | | | | | | | |
| | c | Through protein channels (in cell membrane); Down concentration gradient/passive transport/facilitated diffusion; | | | 2 | IGNORE carrier proteins Reference to “against concentration gradient” or active transport is CON | | | | | | | | | | | | |
| | | Total | | | | [10] | | | | | | | | | | | | |

| Question | | Expected Answer | Mark | Rationale/Additional Guidance |
|--------------|----------|---|-------------|---|
| | a | Sun; | 1 | ACCEPT sunlight |
| | b | Lack of water; Nutrient deficiency / AW; Disease; | 1 | ALLOW pests etc |
| | c | (Near) infrared; | 1 | |
| | d | i | | ALLOW 400-680 nm ALLOW 500-580 ALLOW strong reflectance between 700 and 1100 ALLOW increase at 680-800nm ALLOW 950-1010 ALLOW 1060-1100 |
| | | ii | | ALLOW 400-750 OR any wavelength in this range ALLOW 700-1150 OR any wavelength in this range NOT just "above 700" Must be a comparison to gain any marks |
| | e | Photosynthesis (in the leaf/leaves); In chloroplasts/using chlorophyll; A Light-dependent stage; Water (from the soil) is split; (into) hydrogen <u>atoms/ions</u> ; B Light-independent; (hydrogen atoms/ions) react with CO ₂ (from the air); To produce glucose; | 5 | <i>Maximum two marks from each of A or B</i> QWC technical terms: Photosynthesis, hydrogen, ion, chloroplast, chlorophyll, ALLOW sucrose |
| Total | | | [13] | |

| Question | | Expected Answer | Mark | Rationale/Additional Guidance | | |
|--------------|---|---|-------------|--|---|--|
| 3 | a | <p>Any five from the following:</p> <p>Geographical/reproductive, isolation; Different conditions AW in the different lakes or an example of a difference;</p> <p>Individual fish AW have a characteristic / gene (mutation); That means they are better adapted AW to its environment;</p> <p>(Breeds and) passes on the characteristic/gene to its offspring; Subsequent generations show the characteristic / cumulative effect over many generations (owtte); OR populations without the gene die out ;</p> | 5 | <p>Accept description of geographical isolation Accept any reasonable example of a difference - more food, warmer, less competition etc</p> <p>ACCEPT example of suitable characteristic Must be correctly linked to existence of mutation / gene / characteristic ACCEPT description of how characteristic is adapted to the environment</p> <p>QWC technical terms: Geographical isolation, reproductive isolation, characteristic, gene, mutation, adaptation</p> | | |
| | b | Increase in (water) temperature/global warming; | 1 | Accept overfishing /increase in fishing | | |
| | c | i | | <p>(Phosphate/sewage) encourages the growth of algae/ plants on surface of lake / eutrophication; Block out sunlight; (plants / algae) die and decompose; (decomposing) bacteria use up oxygen (so fish cannot survive);</p> | 4 | <p>IGNORE ref to nitrates</p> <p>ALLOW rotting Decomposition can be in context of dead plants or action of bacteria</p> |
| | | ii | | To make ATP/ADP/DNA/RNA/ phospholipids / (plasma) membranes; | 1 | |
| Total | | | [11] | | | |

| Question | | Expected Answer | | | | | Mark | Rationale/Additional Guidance | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------|-------------------------|--|--|----------------------------|-------------------------|-------------------------|-------------------------|--|---|------|-----|-----|------|-------------|-----|-----|-----|-----------------|------------|-----|-----|------|-----|-------------|-----|------|-----|-------|--|--|--|--|
| 4 | a | CCD converts (information) into an electrical impulse; Convert to a number(between 0 & 255); Depending on intensity (of radiation); (Numbers) relayed to Earth using radio waves; Pixels represent an area of the ground; Number determines brightness of pixel / Black = 0, white = high number ; any 4 | | | | | 4 | ACCEPT microwave Reference to numbers must be in context of pixel or squares in image | | | | | | | | | | | | | | | | | | | | | | | | |
| | b | i | <table border="1"> <thead> <tr> <th>Feature</th> <th>Reflection of Band 1...</th> <th>Reflection of Band 2...</th> <th>Reflection of Band 3...</th> <th>Colour it appears on image</th> </tr> </thead> <tbody> <tr> <td>Sediment</td> <td>High</td> <td>Low</td> <td>Low</td> <td>Blue</td> </tr> <tr> <td>Clear water</td> <td>Low</td> <td>Low</td> <td>Low</td> <td>Black/Dark Blue</td> </tr> <tr> <td>Vegetation</td> <td>Low</td> <td>Low</td> <td>High</td> <td>Red</td> </tr> <tr> <td>Bare ground</td> <td>Low</td> <td>High</td> <td>Low</td> <td>Green</td> </tr> </tbody> </table> | Feature | Reflection of Band 1... | Reflection of Band 2... | Reflection of Band 3... | Colour it appears on image | Sediment | High | Low | Low | Blue | Clear water | Low | Low | Low | Black/Dark Blue | Vegetation | Low | Low | High | Red | Bare ground | Low | High | Low | Green | | | | 1 mark for each correct row Allow <i>medium</i> for band 1 vegetation |
| Feature | Reflection of Band 1... | Reflection of Band 2... | Reflection of Band 3... | Colour it appears on image | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sediment | High | Low | Low | Blue | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clear water | Low | Low | Low | Black/Dark Blue | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation | Low | Low | High | Red | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bare ground | Low | High | Low | Green | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ii | Snow reflects all wavebands (equally) OR green, blue and NIR; Blue + green + red = white; | | | | | 2 | NOT wavelengths Must refer to the three colours in the display | | | | | | | | | | | | | | | | | | | | | | | |
| | c | i | One wavelength correctly labelled; | | | | | 1 | Peak to peak or trough to trough | | | | | | | | | | | | | | | | | | | | | | | |
| | | ii | The number of waves passing a point; In one second; | | | | | 2 | ACCEPT complete oscillations ACCEPT in a fixed time interval AW | | | | | | | | | | | | | | | | | | | | | | | |
| | | iii | F = c/wavelength or correct substitution; 5.9×10^{14} ; Hz or s^{-1} ; | | | | | 3 | 5.89×10^{14} or 5.8×10^{14} without working scores 1 | | | | | | | | | | | | | | | | | | | | | | | |
| | d | | After they pass an obstacle/gap in a barrier; Waves spread out/bend/change direction; | | | | | 2 | Credit a correct diagram showing wavefronts and gap / edge of barrier 2 nd MP depends on 1 st | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Total | | | | | [17] | | | | | | | | | | | | | | | | | | | | | | | | |

| Question | | Expected Answer | Mark | Rationale/Additional Guidance |
|--------------|---|---|------------|---|
| 5 | a | The amount of <u>energy</u> trapped by an ecosystem (per unit area per yr); In the form of <u>biomass</u> ; | 2 | |
| | b | i | | 4 correct = 2 3 or 2 correct = 1 1 or 0 correct = 0 |
| | | | 2 | |
| | | ii | 1 | |
| | c | <p>A. Increase in CO₂:</p> <ul style="list-style-type: none"> Carbon dioxide is needed for photosynthesis; so increase in productivity; Carbon dioxide makes oceans more acidic so decrease in productivity <p>B. Increase in temperature:</p> <ul style="list-style-type: none"> faster photosynthesis/ faster reactions / enzymes work better so increase in productivity OR reduces enzyme activity owtte / so decrease in productivity faster decay so decreases (net) productivity faster release of nutrients (e.g. from decay) so increases productivity Increase in desertification AW so decrease in productivity; kills coral (habitats) in oceans so decrease in productivity | 4 | <p>ACCEPT more photosynthesis (in presence of CO₂) 2 marks max from section A and B</p> <p>Comment about productivity must be clearly and unambiguously linked to valid reason</p> <p>In each case, 2nd marking point cannot be awarded unless the 1st marking point has already been scored</p> <p>Accept OVP</p> |
| Total | | | [9] | |

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