



**General Certificate of Education (A-level)**  
**June 2013**

**Human Biology**

**HBIO5**

**(Specification 2405)**

**Unit 5: The Air We Breathe, The Water We  
Drink, The Food We Eat**

**Final**

***Mark Scheme***

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Question	Marking Guidance	Mark	Comments
1 (a)	Chloroplast;	1	Ignore: thylakoid(s) Reject: granum/grana Reject: chlorophyll
1 (b)	1. ATP; 2. Reduced NADP;	2	Accept: NADPH, NADPH + H <sup>+</sup> or NADPH <sub>2</sub>
1 (c) (i)	Terminal electron acceptor / accepts electrons from ETC/ETS/ oxidises cytochrome (a <sub>3</sub> );	1	Allow: accepts hydrogen <u>atoms/ions</u> Ignore unqualified references to oxidises
1 (c) (ii)	1. No electron transfer chain / no proton transfer / no oxidative phosphorylation; 2. Which produces most of the ATP; 3. Only glycolysis takes place / incomplete breakdown of respiratory substrate/glucose;	2 max	1. Accept ETC for electron transfer chain 2. Reject: no ATP produced unless clearly in context of electron transfer chain 3. Accept: no Krebs's (cycle) Ignore: no link reaction

Question	Marking Guidance	Mark	Comments
2 (a) (i)	<ol style="list-style-type: none"> <li>1. Bacteria (from A) do not grow in any tube / do not grow with any of the antibiotics;</li> <li>2. (Bacteria from A) not resistant (to any of the antibiotics);</li> </ol>	2	<ol style="list-style-type: none"> <li>1. Must have idea of no growth, therefore ignore 'no bacteria'</li> <li>2. Accept bacteria have been killed by (all) antibiotics. Reject: 'person not resistant' Reject: 'bacteria not immune'</li> </ol>
2 (a) (ii)	(Tube with) culture medium and bacteria but no antibiotic;	1	
2 (b)	<ol style="list-style-type: none"> <li>1. B because bacteria (from B) <u>resistant</u> to ampicillin and methicillin/2 antibiotics / B because there are (more antibiotic) <u>resistant</u> bacteria in hospitals;</li> <li>2. (Because more) exposure to/contact with antibiotics (in hospital) <u>selects</u> resistant bacteria/strains;</li> </ol>	2	

Question	Marking Guidance	Mark	Comments
3 (a)	<p>Primary contribution: from domestic consumption/travel / the part which a person has direct control over</p> <p>Secondary contribution: from manufacture/transport/purchase/use of products;</p>	1 max	Both points required for one mark
3 (b)	<p>1. Total in India is 1020 (kg per year) and total in UK is 9805 (kg per year);</p> <p>2. Primary contribution is about two-thirds of total in India and less than a half of total in UK;</p>	2	<p>1. Accept correct use of figures eg UK total nearly 10x / 9000 (kg per year) more than India total Do not accept qualitative statements that make no use of numerical data</p> <p>2. Ignore primary/secondary contribution less in India than in UK Reject higher primary contribution in India than UK / lower primary contribution in UK than in India</p>
3 (c)	<p>1. Trees take up/fix/use carbon dioxide/ CO<sub>2</sub> in <u>photosynthesis</u>;</p> <p>2. Carbon (from CO<sub>2</sub>) becomes part of biomass of trees/is sequestered / trees are carbon sinks;</p>	2	<p>1. Do not accept trees take up carbon</p> <p>2. Accept any named organic component of a tree for 'part of biomass' Ignore 'trees trap/store carbon'</p>

Question	Marking Guidance	Mark	Comments
4 (a) (i)	<ol style="list-style-type: none"> <li>1. Competition between species / interspecific competition / greys outcompete reds / competitive exclusion;</li> <li>2. For habitat/food/niche;</li> </ol>	2	<p>Reject: intraspecific competition</p> <p>Ignore: competition unqualified</p> <p>Accept alternative answer:</p> <ol style="list-style-type: none"> <li>1. Grey squirrels carry pox <u>virus</u>;</li> <li>2. Which doesn't harm them but which kills red squirrels;</li> </ol> <p>Ignore references to greys being aggressive or attacking reds</p>
4 (a) (ii)	Sea is a barrier to grey squirrels / grey squirrels unable to cross sea / unable to get to island;	1	<p>Ignore: no competition from greys</p> <p>Accept geographical isolation in correct context</p>
4 (b)	<ol style="list-style-type: none"> <li>1. In P higher breeding success/higher percentage giving birth <u>in summer</u> / (some) squirrels breed twice;</li> <li>2. In P no competition with grey squirrels (for food) / nesting site/habitat;</li> <li>3. (So red squirrels in P) have bigger body mass;</li> <li>4. (So) have more nutrients/energy/resources for reproduction/breeding/named aspect of reproduction;</li> </ol>	4	<ol style="list-style-type: none"> <li>1. Accept converse for Q Accept answers correctly quoting relevant values</li> <li>2. Accept: no competition with greys for territory</li> <li>4. Accept gamete formation/ovulation/mating/giving birth/lactation</li> </ol>

Question	Marking Guidance	Mark	Comments
5 (a) (i)	<ol style="list-style-type: none"> <li>As amount of coal burnt increases number of bronchitis deaths increase;</li> <li>There is a probability of &lt;0.001/one in a thousand/0.01% that this (correlation) is due to chance;</li> </ol>	2	<ol style="list-style-type: none"> <li>Must name variables for mark</li> <li>Accept: significant because <math>P &lt; 0.001</math>/0.01%/one in a thousand</li> </ol>
5 (a) (ii)	Same amount of coal burnt (in A and B) but death rate (much) higher in A;	1	Answer must include both variables for the mark
5 (a) (iii)	<p>Any valid possible reason for greater death rate from bronchitis in A eg</p> <p>Higher proportion of old people;</p> <p>More smokers;</p> <p>More air pollution from other sources;</p> <p>Poorer diets;</p> <p>More people with cardiovascular disease;</p> <p>Poorer general health;</p> <p>Poor health care;</p> <p>Greater population density in A;</p> <p>A in valley, B on hilltop;</p>	1	<p>Accept any converse statement for B</p> <p>Ignore: unqualified references to different lifestyles / socioeconomic factors / factories / industry</p>
5 (b)	<ol style="list-style-type: none"> <li>(In CVD) heart <u>muscle</u> has poor oxygen supply;</li> <li>Bronchitis reduces efficiency of gaseous exchange / uptake of oxygen / results in less oxygen in blood;</li> <li>So people with CVD more likely to have/die of <u>MI/myocardial infarction</u>;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>Ignore difficulty in breathing</li> <li>Must be linked to effects of bronchitis</li> </ol>

Question	Marking Guidance	Mark	Comments
6 (a)	<ol style="list-style-type: none"> <li>At first little vegetation / bare ground;</li> <li>Pioneer/coloniser/first plants change environment/abiotic factors;</li> <li>(Pioneer/coloniser/first plants) replaced/outcompeted by other <u>species/types</u> of plant;</li> <li>Variety/diversity of plants increases / climax community reached;</li> </ol>	3 max	<ol style="list-style-type: none"> <li>Accepts examples of change eg add humus Ignore 'make conditions less harsh'</li> <li>Ignore 'more plants' Ignore references to animals</li> </ol>
6 (b) (i)	<ol style="list-style-type: none"> <li>Water content of plants may vary;</li> <li>Removal of water allows comparison with other sites/plants;</li> <li>Dry mass is a measure of amount of growth / amount of organic material (produced);</li> </ol>	2 max	<ol style="list-style-type: none"> <li>Ignore 'to remove water'</li> <li>Accept suitable named example of organic product</li> </ol>
6 (b) (ii)	5;;	2	<p>If no answer / answer incorrect but working shows <math>\frac{3250}{650}</math></p> <p>or answer given a 1 : 5 give 1 mark</p>
6 (b) (iii)	<p>Horse manure : (no mark)</p> <ol style="list-style-type: none"> <li>Increases organic content/humus/bacteria/ decomposers in soil;</li> <li>Improves soil structure/water retention/drainage;</li> <li>Contains <u>more</u> (plant) nutrients / greater variety of plant nutrients;</li> <li>May contain <u>seeds</u>;</li> <li>Not leached from soil/provides sustained release of plant nutrients;</li> <li>May have added more horse manure than inorganic fertiliser;</li> </ol>	2 max	<p>Accept converse statements for inorganic fertiliser</p> <ol style="list-style-type: none"> <li>Ignore 'horse manure contains plant material/organic waste'</li> <li>Accept correct named plant nutrient(s) Ignore minerals</li> </ol>



Question	Marking Guidance	Mark	Comments
7 (a)	<ol style="list-style-type: none"> <li>As number of people (per 1 km<sup>2</sup>) increases, number of foxes (per 1 km<sup>2</sup>) decreases / negative correlation (between number of foxes and number of people);</li> <li>(But) points scattered / points not on (trend) line / only 5 points;</li> <li>No statistical test/SD/SE/error bars;</li> <li>Other factors may affect fox numbers;</li> <li>Fox numbers only an estimate / don't know method/reliability of estimating fox numbers / fox numbers small so not reliable;</li> </ol>	4 max	<ol style="list-style-type: none"> <li>Accept use of figures from graph that illustrate scatter</li> <li>Accept any factor that might affect fox numbers eg disease / time of year / availability of food</li> <li>Ignore 'correlation doesn't prove causation'</li> <li>Ignore 'need more data / only one study / only one city'</li> </ol>
7 (b)	<ol style="list-style-type: none"> <li>Some individuals/foxes have resistance (to sarcoptic mange) because of a <u>mutation</u>;</li> <li>(Individuals with mutation/resistance) more likely (to survive) to reproduce;</li> <li>(More likely to) pass on (advantageous) <u>allele/allele</u> for resistance;</li> <li><u>Allele</u> for resistance (completely) replaces original allele (in population) / (greatly) increased frequency of advantageous allele / allele for resistance;</li> <li>Over many generations;</li> </ol>	4 max	<ol style="list-style-type: none"> <li>3. &amp; 4. Ignore 'gene'</li> <li>Reject 'resistant allele' once only</li> <li>5. Ignore 'over time'</li> </ol>

Question	Marking Guidance	Mark	Comments
8 (a)	<p>On south-facing bank (no mark)</p> <ol style="list-style-type: none"> <li>1. More light/sun for <u>photosynthesis</u> / more <u>photosynthesis</u>;</li> <li>2. Greater variety / more species of <u>plants</u>;</li> <li>3. More habitats/niches/shelter;</li> <li>4. Greater variety of food / food sources;</li> </ol>	3 max	<p>Accept converse for north-facing bank, but it must be clear to which bank the answer is referring</p> <ol style="list-style-type: none"> <li>2. Do not credit more plants unqualified</li> <li>3. Accept 'less exposure to predators'</li> <li>4. Ignore 'more food'</li> </ol>
8 (b) (i)	<ol style="list-style-type: none"> <li>1. (Field mice/small mammals) unable to cross road / road divides population into two;</li> <li>2. No interbreeding / no exchange of alleles / separate gene pools / no gene flow (between separated populations);</li> <li>3. Different <u>selection</u> pressures / different alleles/mutations <u>selected</u> (in different areas/populations);</li> </ol>	3	<ol style="list-style-type: none"> <li>1. Accept 'road acts like a geographical barrier'</li> <li>2. Ignore reproductively isolated</li> </ol>
8 (b) (ii)	<ol style="list-style-type: none"> <li>1. Capture/trap/put together (a large number of) field mice from each field/from opposite sides of the motorway;</li> <li>2. See if they (field mice from opposite sides of the motorway) can interbreed;</li> <li>3. To produce fertile offspring;</li> </ol>	3	<p>Accept for 1 mark: DNA/base sequencing / DNA hybridisation / serology / immunological testing / amino acid sequencing of named protein</p> <p>Accept for 1 mark: see if they have the same named anatomical feature</p>

Question	Marking Guidance	Mark	Comments
9 (a)	<ol style="list-style-type: none"> <li>1. Allergen causes <u>IgE</u> production by B cells;</li> <li>2. <u>IgE</u> binds to mast cells;</li> <li>3. Mast cells release histamine when allergen/pollen binds to IgE/antibody on mast cell;</li> <li>4. Histamine causes leaky capillaries / swelling / (excess) mucus production / inflammation;</li> </ol>	3 max	<ol style="list-style-type: none"> <li>4. Accept: contraction of smooth muscle / oedema / rashes Ignore: causes allergic response/reaction / runny nose / sneezing / narrowing of airways / symptoms of hay fever</li> </ol>
9 (b) (i)	<ol style="list-style-type: none"> <li>1. Most cases in June (and July) when highest level of grass pollen;</li> <li>2. But in June/July/August much of pollen is not grass pollen / is from trees and other plants;</li> <li>3. No cases in March / not many cases in April/May when high level of tree pollen / when no/little grass pollen;</li> </ol>	3	1., 2. and 3. Must be clear to which months answer relates
9 (b) (ii)	<ol style="list-style-type: none"> <li>1. Test <u>large number/many</u> hay fever patients/people;</li> <li>2. Prick/scratch <u>skin</u> and put on different allergens/pollens;</li> </ol>	2	Ignore: patch test
9 (c)	<ol style="list-style-type: none"> <li>1. Suitable statement about number of cases eg more cases because more pollen/plant growth/longer flowering season;</li> <li>2. Suitable statement about timing/geography of cases eg earlier/later/different times of year because flowers produced/ pollen released earlier/later/at different time;</li> </ol>	2	Each mark is for a possible effect on incidence of hay fever <u>and</u> the change in plants/pollen production responsible for it

Question	Marking Guidance	Mark	Comments
10 (a)	<p>Production and effects of carbon dioxide in the body and in the environment.</p> <p>Topic list</p> <ol style="list-style-type: none"> <li>1. Product of (aerobic) respiration</li> <li>2. Change in blood pH</li> <li>3. Control of ventilation</li> <li>4. Control of heart rate</li> <li>5. Burning of fossil fuels</li> <li>6. Carbon footprint – primary and secondary contributions</li> <li>7. Climate warming</li> <li>8. Temperature rise effect on enzyme activity</li> <li>9. Changes in species distribution</li> <li>10. Changes in breeding seasons</li> <li>11. Possible effects on food supplies</li> <li>12. Selection pressure</li> <li>13. Photosynthesis and plant growth</li> <li>14. Carbon sequestration in tree biomass</li> <li>15. Production of biofuels</li> <li>16. Burning of biofuels</li> <li>17. Other valid topic</li> </ol>	25	

10 (b)	<p>There are many types of interaction and relationships between humans and other organisms.</p> <p>Topic list</p> <ol style="list-style-type: none"> <li>1. Food as parts of other organisms</li> <li>2. Salmonellosis – causes, symptoms and control</li> <li>3. Tuberculosis – causes, symptoms and control</li> <li>4. Action of antibiotics</li> <li>5. HIV</li> <li>6. Immunity and vaccines</li> <li>7. Parasites</li> <li>8. Deforestation</li> <li>9. Cultivation of crops and domestication of animals</li> <li>10. Production of GM organisms</li> <li>11. Human use of bacteria</li> <li>12. Coliforms and faecal streptococci as indicators of pollution</li> <li>13. <i>Cryptosporidium</i> and water supplies</li> <li>14. Ecology of the skin</li> <li>15. Acne and its treatment</li> <li>16. Ecology of the gut</li> <li>17. Antibiotic resistance</li> <li>18. Brownfield sites</li> <li>19. Urban environment</li> <li>20. Introduced species</li> <li>21. Other relevant topic</li> </ol>	25	
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