



General Certificate of Secondary Education

Biology (Human) 3415/H

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Biology (Human) Higher Tier 3415/H

3415/H Q1

question	answers	extra information	mark
(a)(i)	C		1
(ii)	lack of nucleus / others have a nucleus or chromosome / DNA / genetic material free in cytoplasm	accept plurals do not accept just ‘has a strand of DNA’	1
(b)(i)	breathe in <u>air</u> / droplets exhaled by other people / breathe same air or higher concentration of bacteria in the <u>air</u> or more likely to be coughed on	mark for mechanism do not penalise reference to virus / TB / germ ignore answers involving proximity unqualified	1
(ii)	(bacteria / it) enter body / lungs by breathing / via air		1
(iii)	via the blood	accept via rbc or other components of blood accept lymph	1
(c)	any two from: • skin • scabs / clot • mucus / cilia • stomach acid / gut protease	accept tears do not accept ear wax / saliva / sebum apply list principle ignore nasal hair	2
total			7

3415/H Q2

question	answers	extra information	mark
(a)	34	ignore working or lack of working $\frac{10\ 200}{300}$ for 1 mark	2
(b)(i)	mouth / <u>small</u> intestine / duodenum / ileum		1
(ii)	<u>amylase</u>	accept phonetic spelling accept carbohyd <u>ra</u> se	1
(iii)	sugar / maltose / glucose / disaccharide / monosaccharide / dextrin		1
(iv)	<u>small</u> intestine / duodenum / ileum		1
total			6

3415/H Q3

question	answers	extra information	mark
	<p>Quality of written communication:</p> <p>any four from:</p> <ul style="list-style-type: none"> • tar present • (chemicals from smoke / tar) enter the blood • mutation • (lung) cancer / reference to carcinogen • bronchitis / emphysema • less surface area / less oxygen enters blood • circulatory disease / blood clots / blocked arteries / heart attack / stroke • carbon monoxide • less oxygen carried by blood / CO combines with Hb • damage cilia / alveoli • microbes or correct named e.g. remain in lungs 	<p>For <u>correct use of</u> scientific terms:</p> <p>at least two from: e.g. cancer, mutation, bronchitis, emphysema, arteries, atheroma, carbon monoxide, carcinogen, trachea, bronchus, bronchiole, cilia, alveoli, haemoglobin, mucus, red blood cell, white blood cell, ulcer, angina, nicotine, addiction, etc.</p> <p>annotate as Q ✓ or Q ✗</p> <p>do not accept just tar enters blood</p> <p>accept x from tar gets in the blood</p> <p>nb award less oxygen mark once only</p> <p>do not accept blocked by tar</p> <p>nb award less oxygen mark once only accept no oxygen</p>	<p>1</p> <p>4</p>
total			5

3415/H Q4

question	answers	extra information	mark
(a)(i)	oxygen / O ₂	do not accept O only	1
(ii)	photosynthesis	accept phonetic spellings	1
(b)	<u>Graph:</u> points	ACCURACY \pm ½-square minus 1 mark per error	2
	line	single line best fit <u>curve</u> , not straight line or ruled point-to-point must attempt to start at origin	1
(c)	any two from: • carbon dioxide (concentration) • temperature / too cold • water / moisture / rain / humidity	accept 'heat' do not accept temperature too high do not accept lack of chlorophyll	2
total			7

3415/H Q5

question	answers	extra information	mark
(a)	animal which / it kills/ hunts / catches (other animals)	ignore references to prey	1
	it / animal which eats other animals / it is a carnivore	animal kills <u>and</u> eats its prey = 2 marks an animal that preys on another animal = 0 marks	1
(b)	lemming population decreases before / when no owls present	accept converse	1
(c)	any three from: <ul style="list-style-type: none"> • lack of food • due to competition / due to over-eating by lemmings / due to high lemming population • disease • severe weather drought / flood / or too hot / too / very cold • other predators 	nb competition for food = 2 marks accept humans as predators	3
total			6

3415/H Q6

question	answers	extra information	mark										
	<p>Quality of written communication:</p> <p>any four from:</p> <table border="0" data-bbox="320 627 834 1883"> <thead> <tr> <th data-bbox="320 627 558 672">Substance</th> <th data-bbox="558 627 834 672">Effect</th> </tr> </thead> <tbody> <tr> <td data-bbox="320 694 558 1008">carbon dioxide</td> <td data-bbox="558 694 834 1008"> <ul style="list-style-type: none"> • greenhouse effect / global warming / mechanism described • sea-level rise / melting ice-caps / flooding / rainfall change </td> </tr> <tr> <td data-bbox="320 1008 558 1568">sulphur dioxide nitrogen oxides</td> <td data-bbox="558 1008 834 1568"> <ul style="list-style-type: none"> • acid rain / lowering soil pH / water acidification • damages leaves / trees kills plants / animals / breathing difficulties / bronchitis / eye irritation / deaths of people / damaging statues / buildings </td> </tr> <tr> <td data-bbox="320 1568 558 1702">carbon monoxide</td> <td data-bbox="558 1568 834 1702"> <ul style="list-style-type: none"> • combines with Hb / less O₂ carried in blood </td> </tr> <tr> <td data-bbox="320 1702 558 1883">soot / (smoke) particles</td> <td data-bbox="558 1702 834 1883"> <ul style="list-style-type: none"> • reducing light / photosynthesis </td> </tr> </tbody> </table>	Substance	Effect	carbon dioxide	<ul style="list-style-type: none"> • greenhouse effect / global warming / mechanism described • sea-level rise / melting ice-caps / flooding / rainfall change 	sulphur dioxide nitrogen oxides	<ul style="list-style-type: none"> • acid rain / lowering soil pH / water acidification • damages leaves / trees kills plants / animals / breathing difficulties / bronchitis / eye irritation / deaths of people / damaging statues / buildings 	carbon monoxide	<ul style="list-style-type: none"> • combines with Hb / less O₂ carried in blood 	soot / (smoke) particles	<ul style="list-style-type: none"> • reducing light / photosynthesis 	<p>Ideas given in a sensible order: at least one correct named substance linked to its correct effect</p> <p>annotate Q ✓ or Q ✗</p> <p>max 2 for named substances extra wrong substances cancel</p> <p>do not accept just climate change</p> <p>accept reduced mineral availability to plants</p> <p>do not accept toxic unqualified</p> <p>ignore ash</p> <p>correct substance and wrong effect = 1 mark only</p>	<p>1</p> <p>4</p>
Substance	Effect												
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total		5											

3415/H Q7

question	answers	extra information	mark
(a)(i)	any one from: <ul style="list-style-type: none"> both have two muscles both have rigid or hard skeleton 	accept both have muscles or antagonistic muscles	1
(ii)	any one from: <p>muscles external</p> <p>skeleton internal or implied</p> <p>tendons present</p> <p>no membrane joining skeleton</p>	unidentified answers refer to human	1
(b)(i)	muscle A contracts to cause thumb move towards fingers		1
	muscle B contracts to cause movement the other way or away from fingers	accept 'towards' and 'away from' as a description of direction	1
(ii)	(contracting) muscle unable to pull on bone		1
total			5

3415/H Q8

question	answers	extra information	mark
(a)	bones scattered by animals or buried or washed away by rain or water or damaged by (earth movement) or eaten by animals	accept in acid soils or conditions bones can dissolve or break up or similar description do not accept decay	1
(b)(i)	same number of teeth same type of teeth	accept have incisors, canines and molars ignore reference to jaw bone	1 1
(ii)	any one from: • jaw of Australopithecus narrower or thinner • teeth of Australopithecus slightly rounder	if not identified answer must refer to Australopithecus accept Homo sapiens wider or more curved or not so narrow accept Homo sapiens teeth squarer or similar description	1
total			4

3415/H Q9

question	answers	extra information	mark
(a)	C – 80 and D – 72	both answers for 1 mark	1
(b)	any one of: <ul style="list-style-type: none"> not enough persons used or only a small group non-smoker has a higher figure than a smoker or no significant difference in the figures 	accept should base conclusion on large or larger numbers accept a similar comment about the conflicting figures e.g. one smoker has the same figure as a non smoker or smoker and non smoker have similar results of 80 and 78 or may have different lifestyles or references to different ages	1
(c)	5040 (cm ³ per minute)	2 marks for correct answer incorrect answer or no answer showing calculation of 72 x 70 allow 1 mark or heart rate × stroke volume	2
(d)	increase in blood supply (to muscles)	accept more oxygen or nutrients (to muscle) or remove waste	1
(e)	heart can pump blood or oxygen to muscles for longer or aerobic respiration can continue for longer	accept delays start of anaerobic respiration accept reduces or stops lactic acid formation accept allows a bigger increase in cardiac output accept can pump more oxygen or glucose	1
total			6

3415/H Q10

question	answers	extra information	mark
(a)	4		1
	3		1
(b)	Quality of written communication: for correct linking of parts in sequence: scrotum → spongy tissue → penis	accept spongy tissue and penis in correct order	1
	A (scrotum) keeps testes cooler or at 35° so sperm can be made	accept cooler so more live sperm or sperm live longer	1
	C (spongy tissue) fills with blood or more blood enters (spongy tissue)	do not accept blood fills penis or blood enters penis	1
	B (penis) becomes erect (so can reach high in vagina or top of vagina or entrance of uterus)	accept penis stiff or rigid	1
total			6

3415/H Q11

question	answers	extra information	mark
(a)	cornea and lens	accept v / a humours	1
(b)	(muscle A) <u>contracts</u>		1
	<u>lens</u> gets fatter or <u>lens</u> bends light rays inwards more or <u>lens</u> becomes more converging / curved	do not accept lens expands / gets bigger	1
total			3

3415/H Q12

question	answers	extra information	mark
(a)(i)	mitosis	do not accept ‘meitosis’ / ‘miosis’ or other hybrid spellings	1
(ii)	D – B – A – C – E		1
(b)(i)	mutation		1
(ii)	radiation / UV / X-rays / γ -rays / tobacco smoke / formaldehyde / mustard gas / smoking	accept any correct named mutagen	1
total			4

3415/H Q13

question	answers	extra information	mark
	<p>any four from:</p> <ul style="list-style-type: none"> • fertilisers dissolve / washed / leached • growth of algae / water plants • block / reduce light • less photosynthesis / less O₂ produced • plants / algae die • rotting / decay caused by microorganisms / bacteria / saprotrophs • (microbes) use oxygen / are aerobic • less fish <u>respiration</u> • effect of hot weather <u>described</u> e.g. less O₂ dissolved in water or increased metabolism / growth of bacteria / increased fertiliser concentration 	ignore 'decomposers'	4
total			4

3415/H Q14

question	answers	extra information	mark
(a)	<p><u>on graph:</u></p> <p>‘X’ – between 1 h and 2 h</p> <p>‘Y’ – between 0.25 h and 1 h</p>		<p>1</p> <p>1</p>
(b)	<p>any two from:</p> <ul style="list-style-type: none"> • genetically-engineered is identical to human insulin • no immune reaction / no antibodies made / <u>wbcs</u> will not regard it as ‘foreign’ • no need to kill animals / reference to ‘easier to purify’ or can be made in large quantities • no disease transmission from animals 	<p>accept converse</p> <p>accept no rejection / no allergic reaction</p> <p>do not accept just ‘no reaction’</p> <p>need detail – not just ‘easier / cheaper to produce’</p>	<p>2</p>
total			<p>4</p>

3415/H Q15

question	answers	extra information	mark
(a)(i)	X = guard cell		1
	Y = stoma / stomata		1
(ii)	<p>1st Species B (no mark), because:</p> <p>any two from:</p> <ul style="list-style-type: none"> • fewer stomata / pores / Y / named from (a)(i) • sunken stomata / described • thick(er) cuticle • less mesophyll 	accept stomata further apart	2
(b)	water is lost by evaporation / transpiration		1
	water loss is <u>greater</u> than water intake	do not accept just no water uptake	1
	<u>cells</u> lose turgor or less pressure inside <u>cells</u> or need turgid <u>cells</u> for support or <u>cells</u> become flaccid / plasmolysed		1
total			7

3415/H Q16

question	answers	extra information	mark
	<p>any five from:</p> <ul style="list-style-type: none"> • (large number) of alveoli → large surface area • RBC has large surface area • diffusion / described re gradient • short distance or thin surface or one cell / two cells thick or closeness • (RBCs have) <u>haemoglobin</u> to combine with oxygen • formation of HbO₂ lowers (free) oxygen concentration / maintains concentration gradient • RBCs have no nucleus → more room for Hb / for O₂ • <u>blood flow</u> removes oxygen to maintain gradient • <u>breathing</u> supplies oxygen to maintain gradient • RBC's flow one at a time 	<p>ignore moisture</p>	<p>5</p>
<p>total</p>			<p>5</p>

3415/H Q17

question	answers	extra information	mark
(a)	any three from: <ul style="list-style-type: none"> • digestion / hydrolysis • use of enzymes / named eg. • secretion / external • absorption by diffusion / active transport • respiration 	do not accept excrete ignore CO ₂ release	3
(b)(i)	1025		1
(ii)	movement / warmth / digestion / excretion / active transport	accept internal movements – heart / peristalsis / breathing accept growth / reproduction / building molecules	1
(c)(i)	0.03 (%)	Correct answer: 2 marks $\frac{1.8 \times 100}{6000}$ or $\frac{180}{6000} = 1$ mark	2
(ii)	indoors: less movement warmer environment / less heat loss / need less energy to keep warm		1 1
(iii)	any two from: <ul style="list-style-type: none"> • disease more likely to spread • competition for food / for space • more aggressive behaviour between animals or stressful for animals • use of more fossil fuel → more CO₂ / SO₂ / NO_x • waste disposal • cost of buildings / maintenance / food / labour / fuel 	accept waste of energy resource	2
total			11

3415/H Q18

question	answers	extra information	mark
(a)(i)	protein molecule is too big (to pass through the filter) protein molecule cannot fit through filter	accept converse	1
(ii)	glucose is taken (back) into blood / is <u>reabsorbed</u>		1
	100%		1
	by active transport / description or by kidney tubule		1
(b)	any four from: <ul style="list-style-type: none"> • water lost in sweating / breathing • lower water (concentration) in <u>blood</u> or higher salt (concentration) in <u>blood</u> • detected by hypothalamus • causes release of ADH from <u>pituitary gland</u> • causes <u>increased</u> water (re)absorption by the kidney 		4
total			8

3415/H Q20

question	answers	extra information	mark
(a)(i)	HCG or human chorionic gonadotrophin		1
(ii)	progesterone from placenta		1
(b)	level of progesterone falls to cause menstruation	accept to cause placenta to lose connection with uterus	1
	oxytocin secreted or released (by pituitary gland)	accept oxytocin increases or fall in progesterone allows increase in oxytocin	1
	oxytocin causes <u>uterine wall</u> or <u>uterus muscles to contract</u>	do not accept uterus contracts incorrect sequence = MAX 2	1
total			5

3415/H Q21

question	answers	extra information	mark
(a)	obtain or remove DNA from a human, and from A and B	accept remove DNA from <u>all</u> organisms	1
	compare DNA of all organisms	accept compare structure of DNA of the organisms accept analyse DNA of the organisms	1
	the DNA of A or B which is most similar to the human DNA shows more closely related primate		1
(b)	X placed between C and modern humans		1
(c)(i)	element which releases radioactivity or radioenergy or is radioactive	accept chemical or isotope instead of element accept radiation	1
(ii)	Find or measure how much of radioisotope or radioactivity remains (in fossil) or find how much of radioactivity or radioisotope has decayed or find rate of decay	accept isotope for radioisotope	1
total			6

3415/H Q22

question	answers	extra information	mark
(a)(i)	<u>bones</u> separated or apart	accept <u>bones</u> detached or misaligned	1
(ii)	tear or break in ligament	accept ligament damaged	1
(iii)	cartilage worn away or cracked or ridges or thin	accept no cartilage or less synovial fluid accept swollen once only in (i), (ii) or (iii) accept bones rubbing together	1
(b)	in A load is foot fulcrum is joint between leg and foot	accept tibia or fibula for leg or at the ankle	1 1
	in B load is body or weight of body or leg or the leg bone or is in the middle of foot or lever		1
	fulcrum is the toe or foot on the floor	accept answers about the relative positions of fulcrum and load provided these are correctly identified in relation to parts of the body	1
total			7

3415/H Q23

question	answers	extra information	mark
(a)(i)	contracts or shortens	accept causes movement ignore relax	1
(ii)	any two from: <ul style="list-style-type: none"> • does not pull on a bone • contracts rhythmically • contracts continuously • does not become fatigued • all fibres contract together and fully • after contracting a long period of rest before can contract again • involuntary or not controlled by the will • myogenic or suitable description 	accept converse statements for skeletal muscle accept never stops accept muscle contracts fully do not accept you do not have to think about it accept automatic	2
(b)	part A / ventricle – contracts to increase pressure part B – blood flows through or out of A (causing pressure fall)	accept contracts to force the blood or press on the blood or pushes blood or pumps blood	1 1
(c)	increase pressure to force blood through (small cavity or past the extra layer)	accept increases resistance to flow or lumen is smaller accept has to pump blood through partly blocked arteries	1
total			6