ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme January 2003

GCE

Biology/ Human Biology A

Unit BYA6

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Unit 6: Physiology and the Environment

Question 1

(a) (i) No sense cells/ no rods and/or cones at P; 1

(ii) Maximum number of cones at Q; 1

(b) Several rods have connections with one neurone/ bipolar cell;
Idea of summation (of generator potentials);
Exceed threshold;
Individual (generator potentials) do not exceed threshold; max 3

Total 5 marks

Question 2

(a) (i) 98%;

(ii) 39%/ 40%; 1

(b) Correct answer, 120.4 (for 39%) 118.37 (for 40%) = 2 marks;;
Correct answer from candidate's (i) and (ii) = 2marks;;
Answer 120 cm^3 = 1 mark; [*Unless derived from candidate's (i) and (ii)*]
Correct working with wrong answers = 1 mark; 2

(c) Different base sequence/ nucleotide sequence;
Codes for different sequence of amino acids/ different polypeptide sequence;
Tertiary structure of globins/ proteins altered/ shape of globin/ protein;
Cannot bind with haem group effectively; max 2

Total 5 marks

Question 3

(a) Kingdom and Phylum; 1

(b) (Differences in) the results are unlikely to be due to chance/eq.;
Less than 0.1% probability/ less than 1 chance in a thousand/ eq. that they are due to chance/ 99.9% probability that they are not due to chance; 2
[*Note: 2nd mark is dependent on first*]

(c) Idea of conflict between effective gas exchange and excessive water loss;
Humid surroundings reduce concentration gradient;
So reduce water loss/ risk of dehydration/eq.; max 2
[*Note: Ignore reference to predation*]

Total 5 marks

Question 4

(a) Larva has varied diet/ described (to supply materials and energy) for growth;
Larva needs a range of enzymes to digest all nutrients in diet;
Adult only eats nectar/ sucrose as no growth/ only reproduction in adult phase
or adult only eats nectar/ sucrose as only needs energy for movement;
Adult only needs sucrase to hydrolyse sucrose (in nectar); max 3

(b) Carbohydrate stored in leaves as starch;
Hydrolysed to glucose/ converted by amylase to glucose; 2

Total 5 marks

Question 5

(a) Sensory neurone correctly drawn and labelled;
Relay neurone correctly drawn and labelled;
Motor neurone correctly drawn and labelled; 3
(Synapses need not be labelled)
[*Note: If relay neurone is positioned incorrectly, then can allow marks for the other two if they are drawn correctly and synapse with the relay neurone*]

(b) Transmitter substance/ neurotransmitter only produced in pre-synaptic neurone;
Receptor proteins for neurotransmitter only in post-synaptic membrane;
Enzymes in post-synaptic neurone hydrolyse neurotransmitter; max 2

Total 5 marks

Question 6

(a) (i) Many, small/ branching tracheoles; 1

(ii) Blood not involved in transport of respiratory gases in insects; 1

(b) Correct answer (ignoring working) 600x =2 marks;;
Answer correct for candidate's R = 1 mark;
Candidate clearly derives answer by dividing measured diameter by actual size = 1 mark; 2

(c) Higher concentration of oxygen at S than in muscle; 1
[*Not just concentration gradient: direction of gradient must be clear*]

Total 5 marks

Question 7

(a)	(i)	Made from <u>many</u> amino acids/ <u>many</u> monomers/ <u>many</u> identical molecules;		1
	(ii)	Deamination;		1
	(iii)	Converted to pyruvate/ converted to α ketoglutarate/ converted to respiratory intermediate/ eq.; Used in Krebs cycle/ respired/ converted to carbon dioxide and water/ converted to glucose/ converted to glycogen/ lipid;		2
(b)	(i)	Description of changes in relative proportions of ammonia and urea over the period; Changeover period identified as day 60/70 → day 100;		2
	(ii)	Change from aquatic to terrestrial environment/ eq.; Loses water more easily on land/ need to conserve water on land/ eq.; Excretes continuously in water/ periodically on land/eq.; Must store excretory product on land/ no need to in water; Ammonia is more toxic than urea/ reverse; Ammonia is more soluble than urea; Ammonia is converted to urea on land/ conversion to urea not necessary in water;	max	4
(c)	(i)	X are mitochondria which are sites of respiration/ release energy/ produce ATP; Needed for active transport;		2
	(ii)	(Water leaves epithelial cell) Passively/ no ATP required; [*Not just no energy formed - energy must clearly be from resperation*] Down concentration/ water potential gradient; Without the aid of carrier proteins/ transport proteins; [*Allow: reverse argument for sodium/ glucose*]	max	2
	(iii)	Increase surface area for absorption;		1

Total 15 marks

Question 8

(a)	(i)	Sodium ion channels open; Allowing rapid influx of sodium ions;		2
	(ii)	Sodium ion channels close <u>and</u> potassium ion channels open; Allowing efflux of potassium ions;		2
(b)		Nervous stimulated secretion; Begins quicker; Does not last as long/ described using times from graph; Is more intense/ peak is higher/ eq.; [*Allow: reverse arguments for hormone stimulated secretion*]	max	2
(c)	(i)	Proteins in cells of stomach lining; Would be digested if pepsin was secreted in an active form/ pepsin is a protease;		2
	(ii)	Endopeptidases hydrolyse/ break/ digest (peptide) bonds in middle of a protein molecule;		1
	(iii)	Exopeptidases hydrolyse/ break/ digest bonds at the ends of protein molecules; Endopeptidases create 'more ends'/ larger area (for exopeptidases to act on);		2
(c)		High pH denatures enzyme/ alters charge on active site; Breaks bonds; Alters tertiary structure of enzyme molecule; Changes shape of active site; Active site can no longer bind with/ form ES complexes with/ is no longer complementary to substrate;	max	4

Total 15 marks

Question 9

Quality of Communication

The answers to all sections of this question require the use of continuous prose. Quality of language should be considered in crediting points in the scheme. In order to gain credit, answers should be expressed logically and unambiguously, using scientific terminology where appropriate.

(a) (i)

A Root system:
Can absorb water from a wide area;
Quickly/ before water drains away;

B Leaves reduced to spines:
Reduces leaf area/ reduces number of stomata;
Reduces water loss by transpiration;

C Stem cells contain chlorophyll:
Can photosynthesise;
Compensates for reduced photosynthesis by leaf; 6

(ii) Mutation in allele(s) determining leaf shape in original population;
Those with leaves reduced to spines have an advantage due to reduced water loss;
Survive to reproduce better than other forms;
Increase in frequency with each generation;
Pass on advantageous alleles;
Advantageous alleles increase in frequency with each generation; max 4

(b) Reptiles are ectotherms; [*Reject: cold blooded*]
Body temperature varies with that of environment;
Temperature of desert fluctuates greatly over 24 hours;
Metabolic reactions controlled by enzymes;
Enzyme activity/ metabolic rate changes with body temperature;
Speed of bodily actions dependent on metabolic rate/ enzyme activity;
Reptiles seek shade/ water when hot/ reduce contact with hot surface;
Seek sun when cool; max 5

Total 15 marks