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WELSH JOINT EDUCATION COMMITTEE
CYD-BWYLLGOR ADDYSG CYMRU

General Certificate of Education

Tystysgrif Addysg Gyffredinol

MARKING SCHEMES

JANUARY 2007

AS/Advanced
BIOLOGY

WJEC
CBAC

INTRODUCTION

The marking schemes which follow were those used by the WJEC for the January 2007 examination in GCE BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

The WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

UNIT BI1

Question	Answer/Explanatory Notes	Marks Available
1.	(a) III should show two arms of membrane surrounding particle and meeting/almost meeting. IV should show restored membrane surface and vesicle enclosed in cell.	2 marks
	Label 'vesicle' vacuole/plasma or cell membrane.	1 mark
	(b) Surface area is reduced.	1 mark
	(c) (i) Phagocytosis	1 mark
	(ii) Exocytosis/secretion	1 mark
Total 6 marks		
2.	(a) (i) $12\text{cm}^3 \text{O}_2 \text{min}^{-1}$	1 mark
	(ii) Increase of 11.75 or 48 times	1 mark
	(b) (i) Concentration of enzyme (Not amount)	1 mark
	(ii) Concentration of substrate (Not amount)	1 mark
	(c) (i) 'Small quantity', so line more than half way up to original line and same shape. Line above 5 on y axis.	1 mark
	(ii) Lowered position because low concentration alters the structure of some of the enzyme molecules rendering them non-functional (lowers number of active sites ok, but lowers the amount of enzyme is not acceptable.)	1 mark
	(iii) Non-competitive because inhibitor molecule does not compete with substrate for active site.	1 mark
	Attaches elsewhere on the enzyme, distorting the active site.	1 mark
	(d) Breaks tissue/cell walls to release enzyme/increases surface area for substrate contact.	1 mark
	(e) pH changes may otherwise occur during the experiment/ which alter the shape of the protein and affects the efficiency of the active sites.	1 mark
	(f) Reaction may take up or produce heat, causing changes in rate./Fluctuations in external temperature have same effect.	1 mark
	(g) Denaturation/breakdown of active site.	1 mark
	Total 13 marks	

Question	Answer/Explanatory Notes	Marks Available
3.	(a) (i) Hexose	1 mark
	(ii) Maltose	1 mark
	(iii) Water	1 mark
	(iv) 1 and 4	1 mark
	(b) (i) The positions of -OH and -H are reversed on C1	1 mark
	(ii) Structurally different molecules with the same general formula.	1 mark
	(c) β -glucose	1 mark
	(d) Long chains strengthened by cross linkages/microfibrils.	1 mark
	(e) Cellulose cell walls confer strength/rigidity/structural support.	1 mark
Total 9 marks		

Question**Answer/Explanatory Notes****Marks Available****4.**

	Smooth endoplasmic reticulum	Mitochondria	Golgi body	Rough endoplasmic reticulum
Surrounded by a double membrane		✓		
Produces glycoprotein			✓	
Buds off lysosomes			✓	
Manufactures hormones and enzymes				✓
Most abundant at sites of active transport		✓		
Abundant in cells secreting lipids	✓			
Closely associated with ribosomes				✓
				(Total 7 marks)

1 mark per line correct

Question	Answer/Explanatory Notes	Marks Available							
5.	(a) (i) B								
	(ii) D or DC								
	(iii) A, B (and C) (allow: C in (ii) or (iii) but not both)	3 marks							
	(b) Synthesis of DNA Synthesis of ATP Synthesis of protein Replication of organelles, (Any three)	3 marks							
	(c) DNA has halved because two separate cells have now been formed	2 marks							
	(d) No	1 mark							
	In both the diploid amount of DNA is present/the reduction division does not take place until meiosis 2.	1 mark							
	(e) Chromosomes at the end of the meiosis 1 are still double structures/ consist of chromatids still attached at centromere/ are a random assortment of paternal and maternal chromosomes/ have rearranged DNA as a result of crossing over. (Any two)	2 marks							
(Total 12 marks)									
6.	(a) (i) CTTAAG	1 mark							
	(b) Four arrows drawn; one at each site on I and II where G is adjacent to A	1 mark							
	(c) (i)								
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px 5px;">A</td> <td style="padding: 2px 5px;">A</td> <td style="padding: 2px 5px;">T</td> <td style="padding: 2px 5px;">T</td> <td style="padding: 2px 5px;">C</td> <td style="width: 50px;"></td> <td style="padding: 2px 5px;">G</td> </tr> </table>	A	A	T	T	C		G	
A	A	T	T	C		G			
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px 5px;">G</td> <td style="width: 50px;"></td> <td style="padding: 2px 5px;">C</td> <td style="padding: 2px 5px;">T</td> <td style="padding: 2px 5px;">T</td> <td style="padding: 2px 5px;">A</td> <td style="padding: 2px 5px;">A</td> </tr> </table>	G		C	T	T	A	A	1 mark
G		C	T	T	A	A			
	(ii) The bases in one are in the reverse order to those in the other.	1 mark							
	(d) Sticky end	1 mark							
	(e) Restriction enzyme/restriction endonuclease	1 mark							
	(f) (i) Plasmid	1 mark							
	(ii) Ligase	1 mark							
	(g) (i) Reverse transcriptase	1 mark							
	(ii) DNA polymerase	1 mark							

Question	Answer/Explanatory Notes	Marks Available
6.	(g) (iii) Contains only the gene required/not unwanted genes/ doesn't carry 'junk' DNA (introns)/shorter and easier to fit/ process doesn't produce variety of other fragments which first have to be screened out.	1 mark
	(h) The project is the human genome project.	1 mark
	Complete base sequence of DNA recorded./difficulty with genetic engineering is identification of required sequence <i>and</i> its location/now if identification known (e.g. from cytoplasmic mRNA) location is less of a problem.	1 mark
(Total 13 marks)		

Question	Answer/Explanatory Notes	Marks Available	
7. (a)	A Phospholipid bilayer (correct orientation)	1 mark	
	B Hydrophilic phosphate heads. Hydrophobic lipid tails.	1 mark	
	C Intrinsic protein channels/transmembrane/channel/carrier or	1 mark	
	D Extrinsic proteins (Any two for C and D)	1 mark	
	E Mention of glycocalyx (carbohydrate) on surface/or cholesterol in membrane	1 mark	
	F Mention of fluid mosaic.	1 mark	
	(Four marks can be awarded from the six available)		
	G Diffusion from high external to low internal concentration	1 mark	
	H Only lipid soluble molecules can pass through phospholipids layer	1 mark	
	I Other small molecules can diffuse through intrinsic protein channels	1 mark	
	J By means of facilitated diffusion.	1 mark	
	K Proteins can also act as carriers	1 mark	
	L Pick up molecule which changes protein configuration and ejects molecule on the other side of the membrane ('flip-flop')	1 mark	
	M This is active transport against concentration gradient	1 mark	
N Active transport requires energy/uses ATP	1 mark		
O Water molecules enter by facilitated diffusion along a WP gradient/by osmosis	1 mark		
P Or by pinocytosis involving the formation of membrane vesicles	1 mark		

(Six marks can be awarded from the ten available)

(Total 10 marks)

Question	Answer/Explanatory Notes	Marks Available
7. (b)	A The code for formation of a protein is on one strand of nuclear DNA	1 mark
	B Free nucleotides base-pair with relevant section	1 mark
	C Forming mRNA which carries code out of nucleus/to ribosome	1 mark
	D Ribosome made of rRNA	1 mark
	E Ribosome's two piece structure encloses mRNA	1 mark
	F Each triplet of mRNA is a codon	1 mark
	G Ribosome passes along mRNA exposing space for two codons	1 mark
	H Protein synthesis requires linking of amino acids in correct order	1 mark
	I Each different amino acid is coded by its own codon	1 mark
	J Brought to ribosome by tRNA	1 mark
	K tRNA molecules, have attachment site for one amino acid (or labelled in diagram)	1 mark
	L At the other end an anticodon	1 mark
	M Attachment to site and anticodon specify one amino acid	1 mark
	N At ribosome mRNA codon base pairs with appropriate tRNA anticodon	1 mark
	O A second tRNA brings its amino acid to the adjacent ribosome site and a peptide bond forms (between the amino acids)	1 mark
P Ribosome moves one codon along (and repetition of the process starts the peptide chain growing)	1 mark	

(Ten marks to be awarded from the fifteen available)

(Total 10 marks)

UNIT BI2

Question	Answer/Explanatory Notes	Marks Available
1.	D;	1 mark
	C;	1 mark
	B;	1 mark
	G;	1 mark
	F;	1 mark
		Total 5 marks
2.	(a) cardiac;	1 mark
	myogenic;	1 mark
	sino-atrial node;	1 mark
	atrio-ventricular node	1 mark
	bundle of His/Purkinje/Purkyne fibres;	1 mark
	contract;	1 mark
	pulmonary artery;	1 mark
	(b) large surface area to volume ratio; substances/oxygen/carbon dioxide through membrane; short diffusion pathway; low metabolic rate; diffusion supplies sufficient quantities; fast enough;	4 max
		(Total 11 marks)
3.	(a) (i) $\frac{1.20}{5.00} \times 100$; 24 (-1 if wrong units given)	2 marks
	(ii) low(er) oxygen levels at higher altitudes; more red blood cells, more haemoglobin; haemoglobin carries oxygen; more oxygen carried; to maintain/support (aerobic) respiration; maintain activities/named activities of person;	3 marks

Question	Answer/Explanatory Notes	Marks Available
3.	(b) (i) oxyhaemoglobin;	1 mark
	(ii) $92 \pm 2\%$	1 mark
	(iii) C;	1 mark
	(c) (i) curve B; left of C; greater affinity/attraction for oxygen;	2 max
	(ii) takes oxygen from mother's blood; at all partial pressures of oxygen; if to right/same as maternal haemoglobin oxygen wouldn't pass	2 marks
	(d) store of oxygen; holds on to oxygen/high O ₂ affinity; even at low partial pressures/only release oxygen at low partial pressures; when haemoglobin has given up its oxygen; maintains aerobic respiration;	2 max
(Total 14 marks)		
4.	(a) (i) axes labelled; appropriate scale to axes; correct plots; curve of best fit drawn/allow ruled lines (no extrapolation)	4 marks
	(ii) part of graph between 2 days and 8 days; (allow: 0-2 if graph extrapolated)	1 marks
	(b) no accumulation of toxins/bacteria accumulate toxins; plenty of food/makes own food/leaves needed for photosynthesis; bacteria run out of food;	2 max
(Total 7 marks)		
5.	(a) (i) both follow similar pattern; both peak at same time; 15.00 - 15.30 hours; 29.5 and 20g peaks rate of absorption greater between 0000 and 0400 hours or 19.00 and 24 hr or rate of transpiration greater between 0400 and 1900 hours;	3 max

Question	Answer/Explanatory Notes	Marks Available	
5.	(a) (ii) rise from $4 - \frac{20g}{20}$ 4		
	5 times (-1 if wrong units used)	2 marks	
	(iii) 0400-1900 hours more water transpired than absorbed; loss of water from leaf or plant cells; cells no longer turgid/became flaccid; (not : plasmolysed)	1 mark 3	
	(b) K^+ moved into guard cells; active process/pumped in/requires energy; conversion of starch to malate; lowers water potential; water flows in by osmosis; guard cells become turgid;	4 max	
(Total 13 marks)			
6.	(a) (i) 8 dm^3 ; (± 0.5)	1 mark	
	(ii) tidal (air/volume);		
	(iii) person breathed in/inhaled deeply as far as he could; exhaled/breathed out as much as possible; (not: increased depth of breathing)		
	(b) oxygen being taken in by person; exhaled carbon dioxide absorbed; overall volume of air/gas in spirometer falls; shown by trace moving down;	2 max	
	(c) closer; bigger; (must refer to trace not breathing)	2 marks	
	(d) some air always remains in the lungs/called residual air; so can't be recorded on the trace as no movements/only measures air taken in and out.	2 marks	
	(Total 10 marks)		

Question	Answer/Explanatory Notes	Marks Available
7. (a)	<u>deforestation</u>	
	A less photosynthesis;	
	B less carbon dioxide <i>absorbed</i> from atmosphere/more CO ₂ remains in atmosphere (not: producing more CO ₂);	
	C reduced transpiration;	
	D reduced rainfall;	
	E soil erosion;	
	F desertification;	
	G loss of habitats;	
	H reduction in biodiversity/extinction;	5 max
	<u>fossil fuels</u>	
	I increase in carbon dioxide in the air/combustion releases CO ₂ ;	
	J (increases greenhouse effect) by gases forming a layer in the atmosphere;	
	K leads to increase atmospheric temperature/ reference global warming;	
	L results in ice cap melt;	
	M sea levels rise/flooding;	
	N destruction of <i>agricultural</i> land;	
	O loss of human life/homes;	5 max
(Total 10 marks)		

Question	Answer/Explanatory Notes	Marks Available
7. (b)	<p>A over fishing results in depletion of fish stocks;</p> <p>B population becomes too low to recover;</p> <p>C loss of biodiversity/extinction;</p> <p>D regulator methods include exclusion zones;</p> <p>E fishing quotas;</p> <p>F reduction in size of trawler fleet/number of boats/subsidies;</p> <p>G allow only boats to put to sea on certain days/fishing seasons;</p> <p>H careful control of mesh sizes;</p> <p>J allows smaller fish to escape;</p> <p>K discarding of young fish that are caught;</p> <p>L regulate use of fishing gear/explanation;</p> <p>M landing size regulations introduced;</p> <p>N allows some fish to return for breeding;</p> <p>O encourage fishing of non-traditional varieties;</p> <p>P encourage consumer pressure/persuade supermarkets to stock ethically fished supplies;</p>	

Total 10 marks

UNIT BI4

Question	Answers/Explanatory Notes	Marks Available	
1.	(a) (i) organism that transfers pathogen from one host to another; (not : transfer disease)	1	
	(ii) rhythmic muscle contraction (of gut);	1	
	(iii) receiving antibodies.	1	
	(b) (i) chlorosis/less chlorophyll production; (not : affects production of chlorophyll)	1	
		(ii) stunted growth;	1
		(iii) open wounds/lack of healing. (Allow scurvy.) /weakened connective tissue; (not : weakened immune system / unhealthy skin)	1
			[6]
	2.	(a) is specific to an antigen; binds to antigen and clones/divides by mitosis; produce plasma cells; which release antibodies; memory cells; remain in the body (for a long time); available for secondary response.	Max. 4
		(b) (i) similar antigens; (not : same antigen); immune system recognised smallpox virus (as cowpox virus); (effective) secondary response or description.	Max. 2
(ii) not a controlled experiment/no scientific basis/based on folklore; use of eight-year old boy; deliberately infecting him with a potentially fatal disease; AVP; e.g. no repeats/other infection risk.			Max. 2
(c) influenza caused by virus and pneumonia caused by bacterium; influenza (virus) has high mutation rate and pneumonia bacterium has low mutation rate; (comparative statement needed); many antigenic types in viruses/fewer strains of pneumonia; antigenic types in bacteria are very similar; ref. introduction of virus from Far East to bring in new strains.		3	
Total		[11]	

Question	Answers/Explanatory Notes	Marks Available
3. (a)	starts in the mouth/ref. saliva/mechanical digestion (once only); amylase converts starch to maltose; (further) digestion in small intestine/duodenum; amylase from pancreas; maltase converts maltose to glucose; sucrase converts sucrose to glucose and fructose; digestion of disaccharides to monosaccharides in or on epithelial cells; ref. hydrolysis.	Max. 5
(b)	(i) (sphincter) muscle/sphincter; (not : flap/peristalsis) (ii) disinfectant/kills bacteria; optimum pH/correct pH; activation of enzymes/named enzyme; acid digestion/acid helps breakdown; ref. absorption of ions (not : stops amylase action)	1
	(iii) covered with mucus/alkaline layer.	1
	(iv) food (and acid) remain in stomach for 2-4 hours; acid contents being mixed with food (in stomach); more acid production stimulated once food in stomach; pH falls as more acid moves up into oesophagus.	Max. 2
	Total	[12]

Question	Answers/Explanatory Notes	Marks Available	
4.	(a) (i) rod shaped;	1	
	(ii) grows/survives/respire in the presence or absence of oxygen/can survive without oxygen (not : can survive in presence of oxygen/ref. to anaerobe/aerobe);	1	
	(iii) purple/blue/violet; Red/pink.	2	
	(b) (i) inhibits formation of cross linkages in (positive) cell wall; (not : affects/weakens/breaks) peptidoglycan/murein affected; wall is weakened; (not : broken down) osmotic uptake/water taken up; lysis/cell walls break; bacteriocidal/kills bacteria; Gram negative walls protected by layer of lipoprotein/ lipopolysaccharide.	Max. 5	
	(ii) act on (wide) range/types of bacteria; interferes with protein synthesis carried out by all bacteria; acts on common metabolic process; success not dependent on feature only possessed by some bacteria.	Max. 2	
	(c) (i) all correct = 2, 1 error = 1, 2 or more errors = 0; (no tolerance)	2	
	(ii) once the nutrients/glucose begins to run out; (not : in short supply)	1	
	(iii) reduces competition (in crowded conditions/when food is scarce);	1	
	(iv) prevent entry of micro-organisms/contaminants/maintain aseptic conditions; provides oxygen for respiration/mixing;	2	
	(v) pH; temperature.	2	
	Total		[19]

Question	Answers/Explanatory Notes	Marks Available	
5.	(a) (i) thylakoid/granum/lamellae/antenna complex/ light harvesting units; (not : reaction centre/photosystems)	1	
	(ii) chlorophyll a;	1	
	(iii) absorb light energy/photon; pass (energy) onto primary pigment/reaction centre/chlorophyll a; increase range of wavelength absorbed.	Max. 2	
	(b)	(i) A reduced NADP; B ATP;	2
		(ii) oxygen;	1
		(iii) C ribulose bisphosphate; D triose phosphate/GALP;	2
		(iv) glucose/amino acids/lipids or other correct.	1
	(c)	(i) the factor in the <u>shortest</u> supply/ <u>nearest</u> to its minimum value (and therefore the most likely to determine the rate of photosynthesis);	1
		(ii) photosynthesis/Calvin cycle uses enzymes; enzyme action is affected by temperature/ref. to enzyme kinetics; high temperature denatures enzymes/low temperature slows enzyme action;	Max. 2
		(iii) X light; (intensity) Y carbon dioxide (concentration).	2
	Total		[14]

Question	Answers/Explanatory Notes	Marks Available
6. (a)	A acetyl CoA (enters/starting point);	1
	B combines with 4C (acid) to produce 6C (acid);	1
	C CoA regenerated/breaks off (not : reused);	1
	D correct ref. to decarboxylation;	1
	E correct ref. to dehydrogenation;	1
	F correct ref. to carbon dioxide produced;	1
	G correct ref. to reduced NAD and FAD;	1
	H pass hydrogens to electron transport chain;	1
	I correct ref. to ATP formed directly in Krebs;	1
	J energy from electrons fuel proton pump;	1
	K protons pumped/actively transported into inter-membrane space;	1
	L diffuse/flow down concentration gradient;	1
	M through ATP synthetase;	1
	N stalked granules/particles;	1
	O oxygen is the final acceptor;	1
	P chemiosmosis;	1
	Q $ADP + P = ATP$;	1
	R correct ref. to no of ATP produced per NAD/FAD;	1
	S AVP; e.g. no of pumps associated with NAD/FAD.	1

Any of the 12 of the 19 available marks

Question	Answers/Explanatory Notes	Marks Available
(b)	A <u>both</u> caused by (Gram negative) bacterium;	1
	B cholera by <i>Vibrio cholerae</i> <u>and</u> salmonellosis by <i>Salmonella sp.</i> ;	1
	C toxins affect gut lining in <u>both</u> ;	1
	D treatment by rehydration in <u>either</u> ;	1
	<i>Cholera</i>	
	E diarrhoea; (not : vomiting)	1
	F dehydration and death;	1
	G water borne from infected people/human faeces/carriers; (not : faeces unqual)	1
	H prevented by water treatment/provision of clean drinking water;	1
	I <u>and</u> good hygienic practices; or example	1
	J possible use of antibiotics/vaccines provide temporary protection;	1
	<i>Salmonellosis</i>	
	K diarrhoea <u>and</u> vomiting;	1
	L spread from infected animal intestines/faeces;	1
	M bacterium multiplies in infected food;	1
	N ref. poor food storage/bad hygienic practices;	1
	O prevented by cool storage/thorough cooking/preventing contamination;	1
	P second method of prevention;	1
	Q antibiotics rarely used because of resistance build-up;	1
	R vaccines ineffective because many antigenic types;	1
	S AVP.	1
	Any 12 of the 19 available marks	
	Total	[12]

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