



# GCE MARKING SCHEME

## INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCE BIOLOGY/HUMAN 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.

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

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GCE BIOLOGY - BY1

Mark Scheme - January 2013

Question	Marking details	Marks Available
1. (a)	(i) Stage A – telophase; Stage C – metaphase;	2
	(ii) Centromeres split/ divide; <u>Chromatids/ chromosomes</u> are being <u>pulled</u> to (opposite) poles; (due to) contraction/ shortening of the spindle (fibres);	2
(b)	(i) Interphase;	1
	(ii) The (quantity of) DNA has <u>doubled</u> / (quantity of) DNA changes from 6 to 12; NOT increase	1
	(iii) Meiosis; (correct spelling) (At the end of the cell cycle) the (quantity) of DNA has been <u>halved</u> (and halved again) / can describe with numbers /involves 2 (consecutive) divisions; Ignore reference to chromosomes	2
	<b>Question 1 total</b>	<b>[8]</b>

**Question****Marking details****Marks Available**

2. (a)

<b>DNA</b>	<b>RNA</b>
Double <u>stranded</u>	Single <u>stranded</u>
helical	Not helical
Deoxyribose/ $C_5H_{10}O_4$ / one less oxygen atom in pentose NOT deoxyribonucleic acid	Ribose/ $C_5H_{10}O_5$ / one more oxygen atom in pentose NOT ribonucleic acid
Contains thymine Not letters Can list all bases present	Contains uracil Not letters Can list all bases present
Only one type	3 types (mRNA, tRNA & rRNA)
(Relatively) long/ larger molecule	(relatively) short/ smaller molecule

Max 3

(b)

23% guanine therefore 23% cytosine;  
(54% made up of adenine and thymine)  
Adenine = 27%;  
Correct answer = 2 marks

2

**Question 2 total****[5]**

Question	Marking details	Marks Available
3. (a)	(i) Phagocytosis/ <u>endocytosis</u> ; the (cell) <u>membrane</u> {invaginates/infolds/ surrounds/ wraps around/ engulfs} (to form a vesicle (allow vacuole) )around the {food particle/ algae};	2
	(ii) Golgi { <u>Body/apparatus</u> };	1
	(iii) Exocytosis;	1
(b)	(i) (Site of aerobic) respiration / production of ATP; NOT production of energy alone	1
	(ii) Carry out {endo/exo/ phago}cytosis / synthesis of digestive enzymes/ movement/ form lysosomes; Reject active transport unqualified NOT digestion/ feeding	1
(c)	1.No nucleus/nuclear membrane/ DNA free in cytoplasm; 2. No membrane bound organelles / named example/ possess mesosome; 3. A loop of DNA / circular DNA/ ORA DNA {linear/ on chromosome/ associated with histone}; 4. <u>Smaller</u> /70S ribosomes; 5. Cell wall; Reject reference to cellulose 6. Capsule/ flagellum/ plasmid; NOT reference to size (can be neutral)	Max 3
<b>Question 3 Total</b>		<b>[9]</b>

Question	Marking details	Marks Available								
4. (a)	Quaternary/ 4°;	1								
(b)	(i) (Labelled) arrow in correct position;	1								
	(ii) COOH/ carboxyl/ carboxylic acid;	1								
	(iii) Disulphide {bond/ bridges} / ionic bonds / hydrogen / hydrophobic interactions / Van der Waals; (Any 2) NOT peptide / S-S (covalent – neutral)	1								
(c)	<b>Mark points must be comparative</b>	Max 2								
	<table border="1"> <thead> <tr> <th>phospholipid</th> <th>triglyceride</th> </tr> </thead> <tbody> <tr> <td>2 fatty acids</td> <td>3 fatty acids;</td> </tr> <tr> <td>phosphate (head)</td> <td>do not contain a phosphate (head)</td> </tr> <tr> <td>polar/hydrophilic head and non-polar/hydrophobic tails</td> <td>non-polar/hydrophobic;</td> </tr> </tbody> </table>	phospholipid	triglyceride	2 fatty acids	3 fatty acids;	phosphate (head)	do not contain a phosphate (head)	polar/hydrophilic head and non-polar/hydrophobic tails	non-polar/hydrophobic;	
phospholipid	triglyceride									
2 fatty acids	3 fatty acids;									
phosphate (head)	do not contain a phosphate (head)									
polar/hydrophilic head and non-polar/hydrophobic tails	non-polar/hydrophobic;									
(d)	(i) {Heads/ phosphates} are {hydrophilic/ polar} and are {attracted to/ in} the water; {Tails/ fatty acids} are {hydrophobic/ non polar} and are {repelled by/ above/ avoid} water; NOT react/ dissolve with water	2								
	(ii) 6.1(m <sup>2</sup> ); The phospholipids are {arranged in/ formed} a {bilayer/ double layer} in the membrane; Ref to phospholipid bilayer alone- insufficient	2								
	<b>Question 4 Total</b>	<b>[10]</b>								

Question	Marking details	Marks Available
5. (a)	(i) <i>Oxygen</i> by (simple) diffusion; through the phospholipid (bilayer);	2
	(ii) <i>Phosphate ions</i> by { <u>facilitated</u> diffusion/active transport}; through {carrier /channel}proteins/ <u>protein pumps (active transport)</u> ; (not channel proteins with active transport) NOT intrinsic Pass through hydrophilic pore; (not with active transport)	Max 2
(b)	(i) Active transport; (Between 0-30au) the concentration of phosphate ions is lower outside (the root)/higher inside (the root)/ Ions are being taken up against a concentration gradient; With oxygen present (aerobic) respiration can occur; Providing {ATP/ energy} (for active transport)/ active transport needs {energy/ ATP};	1 Max 2
	(ii) There are a {limited/fixed} number of {carriers/ proteins/ channels} (for phosphate ions) in the membrane; (The curve levels off/the rate of uptake becomes constant) when all of the {carriers/ channels/ proteins} are in use;	2
	(iii) (Ions are being taken up by) <u>facilitated</u> diffusion; Uptake {only begins/ occurs} when the external concentration is <u>higher</u> than the concentration inside the root hair cells/ <u>down</u> a concentration gradient;	2
(c)	They are a {component of/required to synthesise} {DNA/ RNA/ ATP/ NAD/ FAD/ NADP/ nucleotides/ nucleic acids};	1
	<b>Question 5 Total</b>	<b>[12]</b>

Question	Marking details	Marks Available
6. (a)	(i) Molecule of water (drawn with arrow towards the O atom of the glycosidic bond); NOT water going out Monosaccharides drawn with –OH groups in correct position on C1 and C4 (involved in bond);	2
	(ii) Hydrolysis; NOT hydrolysatation (ignore reference to acid)	1
	(iii) Glycosidic;	1
	(iv) Glucose <u>and</u> galactose; ignore alpha/ beta	1
(b)	(i) An <u>enzyme</u> that has been fixed to an <u>inert</u> {matrix/support/ substance};	1
	(ii) The enzyme can easily be recovered/ reused; The product is free from contamination; Enzyme is {stable at / tolerates/ withstand} higher temperatures/denatures at a higher temperature/ functions over a wide range of pH; NOT wider range of temperature alone Several enzymes with differing optima can be used at the same time; More control over the reaction/enzymes easily added or removed/ can be used in a continuous process;	Max 2



Question	Marking details	Marks Available
(c)	(i) <u>Heat</u> with <u>Benedict's</u> solution/reagent; NOT warm/ water bath/ ref to acid <u>Blue to{red/ orange/ green/ yellow/ brown};</u>	2
	(ii) Instrument/equipment that can detect a <u>specific</u> molecule/metabolite (in a mixture of molecules/bodily fluid).	1
	(iii) Any one from: The biosensor would give quantitative data/ it would detect {a particular product/glucose/galactose}/ Can detect even at {very low concentrations/ small volumes};	1
(d)	<ol style="list-style-type: none"> <li>1. (The concentration of reducing sugars) would decrease;</li> <li>2. {Lactose/ substrate} <u>concentration is</u> lower (in the sour milk);</li> <li>3. Lactic acid lowers the pH;</li> <li>4. Enzyme would be inactivated/denatured;</li> <li>5. Hydrogen/ ionic bonds (maintaining the 3D shape) would break;</li> <li>6. This will change the shape/charge of the active site (of lactase);</li> <li>7. Fewer enzyme-substrate complexes would be formed/fewer successful collisions;</li> <li>8. Benedicts would remain {blue/ change to {orange/ yellow/ green/ brown}/ negative}</li> </ol>	Max 4

**Question 6 Total**

**[16]**

Question	Marking details	Marks Available
7. (a)	<b>Describe and explain the effect of inhibitors on enzyme action.</b>	<b>[10]</b>
enzymes	A Enzymes are globular proteins/ <u>biological</u> catalysts;	
	B Active site (of the enzyme) has a specific 3D/ tertiary shape;	
	C lower activation energy of a reaction;	
	D Inhibitors reduce the rate of (an enzyme catalysed) reaction;	
competitive	E Competitive inhibitors;	
	F Have a shape similar to the substrate/complementary to the active site; NOT same shape	
	G Fit/ bind into the active site;	
	H Prevent the substrate molecule entering the active site/block the active site;	
	I Max. rate of reaction can be achieved at higher substrate concentrations/ Increasing the concentration of the substrate reduces the effect of the inhibitor; allow correctly labelled graph	
non-competitive	J Non-competitive inhibitors;	
	K Bind to the allosteric site/site other than the active site;	
	L Causes a change in the shape of the <u>active site</u> ;	
	M Substrate can no longer fit into the <u>active site/ active site is no longer complementary</u> ;	
	N Fewer/ no enzyme-substrate complexes form/ fewer successful collisions;	
	O Max. rate of reaction cannot be achieved/increasing the concentration of the substrate has no effect on inhibition; allow correctly labelled graph	

Question	Marking details	Marks Available
(b)	<b>Describe the effects of placing animal and plant cells in solutions of differing solute concentration.</b>	
A	Osmosis is the (net) movement of water molecules down a water potential gradient/from a higher water potential to a lower water potential;	
B	through a partially/selectively permeable membrane;	
C	Hypotonic solutions have a <u>higher</u> water potential than the (cytoplasm of the) cells;	
D	Water moves into the cells (by osmosis);	
E	Animal cells swell /burst/ref osmotic lysis; reject turgid	
F	Plant cells the <u>cytoplasm</u> swells up/cell contents/plasma membrane pushes against the cell wall;	
G	(plant cells) becomes turgid/ $\psi_p > 0$ /cell wall prevents osmotic lysis;	
H	Hypertonic solutions have a <u>lower</u> water potential than the (cytoplasm of the ) cells;	
I	Water moves out of the cells (by osmosis);	
J	Animal cells shrink/crenated; reject flaccid	
K	In plant cells the <u>cytoplasm</u> shrinks / the (plasma) membrane is pulled away from the cell wall;	
L	Plant cell becomes plasmolysed/ $\psi_p = 0$ ;	
M	Isotonic solutions have the same water potential as the cytoplasm of the cell;	
N	(In isotonic solutions) there is no net movement of water molecules;	
O	At incipient plasmolysis 50% of the cells in a plant tissue will be turgid and 50% will be plasmolysed;	



GCE BIOLOGY - BY2

Mark Scheme - January 2013

Question	Marking details	Marks Available
1 (a)	A species is a group of organisms that <u>{can interbreed/ reproduce}</u> ; (under natural conditions) produce <u>fertile offspring</u> ;	2
(b) (i)	birds;	1
(b) (ii)	Borneo {1.61/ 1.62/1.6};	1
(b) (iii)	(Least at poles to) {greatest/ increasing} at equator;	1
(c) (i)	X at second split from left or anywhere along that line;	1
(c) (ii)	Same genus( but different species)/ tells us the genus;	1
(d) (i)	homologous;	1
(d) (ii)	analogous;	1
	<b>Question 1 total</b>	<b>[9]</b>

Question	Marking details	Marks Available
2 (a)	<p>Thin – small diffusion distance;  Accept small diffusion distance/ pathway  Large surface area- (large contact with air) for <u>diffusion/ gas exchange/ OWTTE</u>;  Moist- allow gases to <u>dissolve/ gases go into solution</u> (to cross membrane); Not diffuse into  Permeable-to allow <u>gases</u> to pass through (the respiratory surface);  NOT blood supply</p>	3 max
(b)	<p>(i) Through {(general) body surface/skin}; NOT gills</p> <p>(ii) <u>Fast</u> flowing;  maintains {concentration/ diffusion} gradient/absorbs more oxygen at surface/ OWTTE;</p> <p>(iii) They dry out/ unable to remain moist/ lose water;  They clump together (because of surface tension.)/ collapse/ lie on top of each other;</p>	1  2  2
(c)	<p>Blood flows (across gill) in <u>opposite</u> direction to water;  NOT different direction  {Concentration/ diffusion} gradient is maintained across whole surface/ {concentration/ diffusion} gradient is maintained constantly/ blood always meets water with a higher oxygen concentration/ equilibrium is never reached ;  NOT concentration gradient maintained for longer/ maintains a high concentration gradient  A greater concentration of oxygen in the blood is achieved/  allows more oxygen to diffuse in/ higher % saturated blood/  allows more {diffusion/ exchange} of gases/ more take up of oxygen/ ORA;  NOT makes it more efficient alone</p>	3
<b>Question 2 total</b>		<b>[11]</b>

Question	Marking details	Marks Available
3 (a)	A – Cortex/ parenchyma B – Endodermis; C – Xylem; D – Phloem. 2 marks for all 4, 1 mark for 2 or 3	2
(b)	(i) Xylem } (ii) Phloem; } <b>Both</b> correct for 1 mark NOT letters only	1
(c)	(i) {Translocation/ movement/ transport/ carry NOT flow} of {products of photosynthesis/ sucrose/organic compounds/ sugars/ amino acids}/ description of source to sink/ translocation; (NOT nutrients/ other named sugar/ named ions)	1
	(ii) Carry out {metabolism/respiration} /to supply (sieve cells) with {energy/ATP}/ contain mitochondria for {ATP/ active transport}; NOT contain organelles that the sieve cells do not have/ not loading sieve cell	1
(d)	(i) Apoplast; – via cell walls; NOT plasmodesmata Symplast; – via {cytoplasm/ plasmodesmata}; [1 mark for name, 1 mark for correct route, for each]	2 2
	(ii) Makes the water pass through {symplast/living part of cell/ cytoplasm}/ prevents it going through {apoplast/ cell walls}; NOT impermeable alone/ makes water take another route	1
<b>Question 3 Total</b>		<b>[10]</b>

Question	Marking details	Marks Available
4 (a)	(i) A- incomplete metamorphosis B-complete metamorphosis <b>BOTH</b> ;	1
	(ii) X- {nymph/ larva/ instar} Y- pupa (accept chrysalis/ cocoon/ pupal stage) <b>BOTH</b> ;	1
(b)	(Exoskeleton is) {rigid/ hard/ non- living/ does not grow/ owtte}; They shed (the exoskeleton)/ ecdysis/ moult; Then grow (a new one)/ allows growth/ vulnerable whilst hardening ;	3
(c)	Fluid filled cavity (surrounded by a membrane); {Protective/ hard/ leathery} {shell/ outer covering/ coat}; (embryo within) yolk sac/ food store/ yolk for nutrition/ own internal nutrient supply; [any 2]	2
(d)	(the young are retained) for a {considerable/ longer} time in the mother's womb or uterus; (The embryo is) nourished there from {the mother's blood supply /the placenta}/ {unlimited nutrients/ OWTTE}; Protection – qualified; The young are {born in a relatively advanced state of development/ well developed/ more advanced growth in womb}; [Any 3] NOT parental care/ ref to number of offspring	3
<b>Question 4 Total</b>		<b>[10]</b>



Question	Marking details	Marks Available
5 (a)	(i) (Oxygen) dissociation (curve);	1
	(ii) similar shaped curve drawn to left of given curve; (must start/ end at same points) NOT above 100%	1
	(iii) {Foetal haemoglobin/ it} has {higher greater} affinity for oxygen (than adult)/ picks up oxygen easier/ more readily forms oxyhaemoglobin/ reaches saturation at lower partial pressures; NOT more quickly (this ensures) <u>oxygen moves from mother('s blood) to foetus</u> (in the placenta);	2
(b)	(i) Move to right;	1
	(ii) Bohr;	1
	(iii) (Muscles/ cells give off) more carbon dioxide/ higher partial pressure of carbon dioxide; carbon dioxide dissolves to make carbonic acid/lowering pH; which reduces affinity of Haemoglobin for oxygen/reference to Hydrogen displacing Oxygen from Haemoglobin/ oxygen dissociates more readily; (more) oxygen is released added demand when <u>muscles</u> need it (for aerobic respiration)/ OWTTE;	4
<b>Question 5 Total</b>		<b>[10]</b>

Question	Marking details	Marks Available
6 (a)	Parasites are organisms that (live on or in another organism called the host and) {obtain nourishment / feed on it}; at the expense of /causing harm to the host; NOT negative effect unqualified	2
(b) (i)	Hooks+ suckers <b>both</b> ;	1
(b) (ii)	Any 2 Attach the worm (to the wall of the gut)/ for attachment; the worm does not get moved along/ resisting peristalsis; passed out with undigested food remains/ prevents it being egested;	2
(c)	(It lives surrounded by) food that has been digested/ broken down by the {host/ human's digestive system/ OWTTE}; (It is very long –) gives a large surface area (to absorb digested food); (It is flat/ thin –) short distance for diffusion; NOT thin membrane	3
(d)	Any 2 It lays large numbers of {eggs/ larva/ embryos/ offspring}; eggs can resist adverse conditions/ OWTTE; correct reference to hermaphroditism; Not asexual reproduction	2
<b>Question 6 Total</b>		<b>[10]</b>

Question	Marking details	Marks Available
7 (a)	<p>A In buccal cavity/ mouth;</p> <p>B teeth (and tongue) {mechanically/ physically} break down food /to provide large surface area;</p> <p>C (Saliva added from) salivary glands;</p> <p>D (saliva) contains mucus to lubricate;</p> <p>E Amylase substrate is starch, product is maltose/ disaccharides;</p> <p>F Stomach adapted for protein digestion/ protein digestion {starts/ begins} in stomach/ proteins are partially digested in the stomach;</p> <p>G Produces hydrochloric acid/ low pH in stomach;</p> <p>H Peptidase/Pepsin's substrate is {protein/ polypeptides}, products are {polypeptides/peptides}; reject ref to other enzymes</p> <p>I Small intestine (is adapted to) completes (protein /carbohydrate) digestion/ Description of {disaccharide/ polpeptide} digestion in small intestine;</p> <p>J Named enzyme produced by small intestine;</p> <p>K Two named enzymes produced by pancreas;</p> <p>L correct reference to endo- exo- peptidases;</p> <p>M Absorption takes place in the ileum/small intestine;</p> <p>N Villi / microvilli increase surface area;</p> <p>O Glucose/ monosaccharides/ products are absorbed by diffusion <u>and</u> active transport;</p>	

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
<b>7</b> (b)	A Heart (muscle) is myogenic;	1
	B It can contract without any nerve stimulation;	1
	C The stimulus to contract originates in the sinoatrial node (SAN);	1
	D Which controls the rate of beating / acts as pacemaker;	1
	E It is situated in the wall of right atrium/auricle. (on diagram);	1
	F Electrical impulse from the SAN causes the two atria/auricles to contract;	1
	G Thin layer of connective tissue prevents the stimulus spreading to the ventricles;	1
	H At the bottom of the wall separating the two atria /auricles is the atrioventricular node AVN. (on diagram);	1
	I This delays the impulse ( about 0.1 sec) before passing it to the ventricles;	1
	J The impulse is sent to the apex /tip of the ventricles;	1
	K Along bundle branches / Bundle of His;	1
	L And is conveyed upwards along Purkinje/ Purkyne fibres;	1
	M Causing (a wave of) ventricular contraction starting from the lowermost part of the ventricles;	1
	N The SAN may be stimulated by various factors to change its pacing;	1
	O One example – hormones (adrenalin), exercise, body temperature, etc. (allow ref. autonomic nervous system);	1
	<b>Question 7 Total</b>	<b>[10]</b>

**GCE Biology BY4**  
**Mark Scheme – January 2013**

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
1	(a) (i) Photoperiod(ism)	1
	(ii) <u>Phytochrome NOT PR/ PFR</u>	1
	(iii) Leaves	1
	(b) (i) Ammonium/ $\text{NH}_4^+$ + nitrate (ions)/ $\text{NO}_3^-$ [both needed for 1 mark] NOT ammonia	1
	(ii) Denitrification	1
	(iii) <u>Azotobacter</u>	1
	<b>Question 1 total</b>	<b>6</b>

Question	Marking details	Marks Available
2 (a)	Gram positive: purple/ violet NOT crystal violet Gram negative: red / pink [both needed for 1 mark];	1
(b)	<u>Gram +ve:</u> (thick) {murein / peptidoglycan} cell wall (only)/ no lipopolysaccharide layer; {retains/ binds/ absorbs} crystal violet stain / purple colour; <u>Gram -ve:</u> {lipoprotein / lipopolysaccharide}{ layer / wall} (external to murein cell wall); Does not retain {crystal violet stain / purple colour}; Stains {red/pink} with {counter stain / safranin / carbol fuchsin};	3  max 2 if only discuss one type of bacteria
(c) (i)	Ignore references to Gram +ve / Gram -ve. A bacillus/ bacilli; NOT rod B spirillum/ spirilli; NOT spiral C coccus/ cocci; NOT round / staphylococcus	1 1 1
(ii)	(lipoprotein / lipopolysaccharide layer) protects against (some) {antibiotics} / penicillin / antibodies / makes them less susceptible to attack by lysozyme/ (lipid component) acts as an (endo)toxin;	1

Question	Marking details	Marks Available
(d) (i)	<p><i>Plate U</i> - enough colonies for reliable results/ - colonies easily countable; <i>NOT the right number/ we can see them</i></p> <p><i>Plate R/S</i> - cannot distinguish individual colonies;</p> <p><i>Plate T</i> - too many colonies to count reliably;</p> <p><i>Plate V</i> - not enough colonies for reliable estimate</p>	max 2
(ii)	<p>69 colonies x 10 000 (dilution factor) x 2 (or 1/0.5);</p> <p>1 380 000/ 1.38 x 10<sup>6</sup> colonies per cm<sup>3</sup>;</p>	2
(iii)	<p>does not include {dead / non-viable bacteria}/ cannot be sure that {each colony has grown from a single bacterium/ colonies are not clumped}/ ORA;</p>	1
(iv)	<p>need to count pathogenic bacteria / pathogenic bacteria more likely to grow at temperature close to body temperature/ want bacteria to grow quickly to identify to treat infection as quickly as possible;</p> <p>NOT want to grow them as quickly as possible without qualification</p>	1
<b>Question 2 total</b>		<b>[14]</b>

Question	Marking details	Marks Available
3	(a)	
	(i) {maximum number / density/ size} of a population; Sustained/ maintained (indefinitely) by a particular environment/ OWTTE;	2
	(ii) 24 to 26;	1
	(iii) <b><u>I.</u> Density Dependent</b> nutrient / food / yeast levels; oxygen level / concentration; disease/ infection/ contamination; toxins / waste products; accept pH NOT mates	max 2
	<b><u>II.</u> Density Independent</b> temperature; size of container; accept pH if not awarded in I	max 1
	(b) (i) competition for (same) food source/ niche; reject nutrients <i>P.aurelia</i> {more successful than/ outcompetes} <i>P.caudatum</i> ;	2
	(ii) Live in different locations in same habitat/ <i>P. caudatum</i> swims freely while <i>P. bursaria</i> lives at bottom of ponds/ <i>P. caudatum</i> feeds (on yeast suspended) in water while <i>P. bursaria</i> feeds (on yeast that have settled) at the bottom; Less interspecific competition;	2
	<b>Question 3 Total</b>	<b>[10]</b>



Question	Marking details	Marks Available
4 (a)		

Chloroplasts	Mitochondria
D;	H;
A;	F;
B;	J;
E;	G;

8

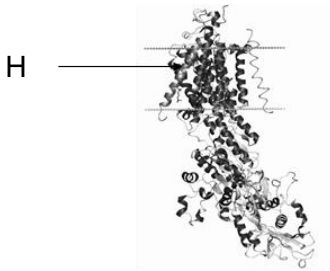
- (b) (i) Reference to a suitable function of ATP e.g. protein synthesis/  
active transport/ muscle contraction etc NOT movement  
Different types of energy can be transferred into a common  
form;  
Only 1 molecule needed to transfer energy to chemical  
reactions;  
Energy can be supplied in {small amounts/ packages/ approx  
30.6kJ} /less {energy/ heat} wasted;  
Easily transported (across membranes);  
{Single enzyme/ only ATPase} needed to release energy from  
ATP;  
{Single bond needed to be broken/ one step reaction} to  
release energy;
- (ii) used by all organisms/ species; NOT cells  
To provide {energy/ fuel} for (nearly all biochemical) reactions;  
NOT provide energy unqualified

max 3

2

**Question 4 Total**

**[13]**

Question	Marking details	Marks Available
5 (a)	(i) <b>A</b> + 40mV <b>C</b> - 70mV [both needed for 1 mark] (accept suitable alternatives eg., -60 / + 30)	1
	(ii) <b>depolarisation</b> Sodium / Na <sup>+</sup> (ion) channels open; Na <sup>+</sup> {flood / diffuse rapidly} into axon; (pd) inside axon becomes {positive/ +40};	max 2
	<b>repolarisation</b> Na <sup>+</sup> (ion) channels close and <u>K<sup>+</sup></u> (ion) channels open; K <sup>+</sup> {flood / diffuse rapidly} out of axon ; Must infer <u>sudden</u> movement out (pd) inside axon becomes {negative/ returns to-70};	max 2
	(iii) <u>threshold</u> potential not reached / all sub- <u>threshold</u> stimuli; stimulus / depolarisation not enough to open Na <sup>+</sup> (ion) channels; ref. to action potential being 'All or Nothing';	max 2
(b)	(i) {2 or more/ a number of/ several} <u>polypeptide</u> chains; NOT group {bonded/ joined} together; NOT held Reject if used 'wrong' bond – i.e. hydrogen (alone)/ glycosidic/ ester/ peptide to form functional protein/ OWTTE;	max 2
	(ii) 	1
	(iii) middle of cell membrane is composed of {lipid / fatty acid side chains / tails}/ non polar;	1

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
(c)	(i) Myelin; Accept phospholipid	1
	(ii) Schwann cell;	1
	(iii) Accept annotation on diagram myelin inhibits {loss of charge/ movement of ions} (from axon) / insulates (axon)/ prevents depolarisation; {gaps/ spaces} (between Schwann cells) called nodes of Ranvier; no myelin present in {nodes/ gaps/ spaces}; depolarisation only possible at Nodes of Ranvier / action potential can only form {at the nodes/ where there is no myelin}/ channels can only {open/close} in the nodes; action potential jumps from one node to the next / saltatory conduction/ lengthens local circuits/ OWTTE; nerve impulse transmission faster;	max 4
<b>Question 5 Total</b>		<b>[17]</b>

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
6 (a)	(i) Glycolysis                      cytoplasm; Link reaction                      matrix (of mitochondria); Krebs Cycle                      matrix (of mitochondria); [1 mark each row]	3
	(ii) Glycolysis;	1
(b)	(i) Carbon dioxide/ CO <sub>2</sub> ;	1
	(ii) Decarboxylase;	1
(c)	Substrate- level phosphorylation                      2; and 6; Glycerol can be converted to a 3C sugar which                      3; enters respiration at this point ATP is used in phosphorylation                      1;	4
<b>Question 6 Total</b>		<b>[10]</b>

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
7 (a)	<p>Describe how <b>the light-independent</b> stage of photosynthesis (Calvin cycle) leads to the production of triose phosphate. [7]</p> <p>Indicate the origin of the raw materials required for this stage of photosynthesis and the possible uses of the triose phosphate produced. [3]</p> <p>A In stroma (of chloroplast);</p> <p>B 5 carbon compound;</p> <p>C ribulose biphosphate / RuBP;</p> <p>D carbon dioxide <u>fixed/ fixation</u>;</p> <p>E By enzyme RuBisco;</p> <p>F To form hexose biphosphate / 6C compound;</p> <p>G (breaks down into 2 × 3C) glycerate 3 phosphate/PGA/GP;</p> <p>H (converted into 2 × 3C) triose phosphate/TP/GALP;</p> <p>I NADPH H<sup>+</sup>/reduced NADP / NADPH<sub>2</sub>;</p> <p>J supplies hydrogen/used for reduction;</p> <p>K ATP broken down into ADP and Pi supplies energy. (not ATP supplies energy).</p> <p>L ATP + NADPH<sub>2</sub> from <u>light dependent stage</u>,</p> <p>M CO<sub>2</sub> from {environment/respiration}</p> <p>N RuBP regenerated from TP.</p> <p>O Phosphate from ATP needed for this.</p> <p>P TP starting point for synthesis of: glucose, lipids, amino acids, chlorophyll, cellulose, starch etc. Any 2 products.</p>	<p>[Max 7]</p> <p>[max 3]</p> <p><b>[10]</b></p>
	<b>Question 7(a) Total</b>	

Question	Marking details	Marks Available
7 (b)	Give an account of how the kidney is involved in osmoregulation in mammals. [10]	
	A Antidiuretic hormone; NOT abbreviated	
	B (ADH) Is {secreted/ released} by the (posterior lobe of the) pituitary;	
	C (ADH) is carried in the bloodstream to the (distal convoluted tubule and) <u>collecting duct</u> ;	
	D When the blood is more concentrated / low $\Psi$ / more negative/ low blood volume;	
	E Detected by (osmo) receptors in hypothalamus;	
	F (more) ADH released;	
	G ADH levels increases the permeability of the (cells lining the) DCT/CD to water /explanation of water channels opening / aquaporins inserted into DCT membrane.;	
	H Water moves out of the DCT/CD by <u>osmosis</u> ;	
	I Into the {interstitial / tissue} fluid where it is rapidly removed by the capillary network/ vasa recta;	
	J This occurs because the {medulla of the kidney/ tissue fluid} has a high {solute/ salt/ ion} concentration/low $\Psi$ ;	
	K Due to the countercurrent multiplier system operating in the Loop of Henle/ correct reference of how counter current produced;	
	L This (conserves water and) produces {small volumes/ concentrated urine};	
	M Most water absorbed in the PCT;	
	N Length of loop of Henle effects the volume of urine produced	
	O Short loop of Henle results in less water reabsorbed/ ORA	
	P Correct ref to adaptation to their environment	

[max 10]

**Question 7b Total**

**[10]**

**GCE Biology - HB2**

**Markscheme – January 2013**

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
<b>1</b> (a)	70 (plus/minus 5); myogenic; right atrium; sino-atrial node; atrio-ventricular node; bundle of His/Purkinje/Purkyne fibres; contract;	<b>7</b>
(b) (i)	Carried/circulates in a system of tubes/vessels/ veins and arteries; blood pumped at high pressure; organs/tissues not in direct contact with blood;	<b>2</b>
(ii)	Separate pulmonary/ lungs and systemic/ body circulation; blood passes through heart twice in one complete circuit;	<b>2</b>
	<b>Question 1 total</b>	<b>[11]</b>

Question	Marking details	Marks Available
2 (a)	hooks <u>and</u> suckers; attach (head/scolex) to intestinal wall; can embed deeply into wall; can't be removed by passage of gut contents/ peristalsis/ egestion;	3
(b)	absorbs digested products of host; because it has a large surface area to volume ratio; no need to digest own food;	3
(c)	little/no oxygen (available in environment/host gut);	1
<b>Question 2 total</b>		<b>[7]</b>



Question	Marking details	Marks Available
3	<p>(a) (i) Homo sapiens;</p> <p>(ii) Homo sapiens dates back over 200,000 years in Africa; oldest ancestor Homo ergaster originated in Africa; Homo sapiens evolved from Homo rhodesiensis which is in Africa; Homo rhodesiensis evolved from Homo antecessor/mauritanicus were in Africa;</p>	1
	<p>(b) <i>Homo erectus</i> lived for a longer period of time/ figures quoted; therefore more of them; lived more recently; 200,000 years ago as opposed to 700,000 years ago;</p>	3
<b>Question 3 Total</b>		<b>[7]</b>

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
<b>4</b> (a)	gram negative;	1
(b)	via faecal – oral route/faeces of infected person to mouth of uninfected person/via contaminated water/food/flies;	1
(c)	water not absorbed/reabsorbed/water lost from body; low conc. of solutes/ions in blood; low blood volume; dehydration; poor nerve conduction; poor heart activity/failure;	3
(d)	sewage treatment/ better sanitation; clean water supply/chlorination; good food hygiene; transmission cycle broken;	2
(e) (i)	stops growth/division/protein synthesis;	1
(ii)	resistance of bacterium; Reject immune can recover with ORT only;	2
<b>Question 4 Total</b>		<b>[10]</b>

Question	Marking details	Marks Available
5	(a) (i) one peak and trough marked on appropriate part of trace;	1
	(ii) peak and trough marked on appropriate part of trace;	1
	(b) addition of all tidal volumes/ $0.5 \times 4$ ; $2\text{dm}^3$ ;	2
	(c) to absorb carbon dioxide breathed out; otherwise results are affected; high level of carbon dioxide are toxic;	2
	(d) sterilize mouthpiece ; to prevent passing of (pathogenic) bacteria/micro-organisms/ spread of disease; replenish oxygen; otherwise damage to cells/ tissues; replace soda lime; to ensure all of the carbon dioxide is absorbed;	2
	(e) dead space; trachea/bronchi/bronchioles;	2
(f) all air can't be forced out; lungs therefore never completely empty; residual volume;	2	
<b>Question 5 Total</b>		<b>[12]</b>

Question	Marking details	Marks Available
6	(a) (i) suitable axes; axes labelled; points plotted;; -1 each incorrect plot lines labelled;	5
	(b) (i) correct point;	1
	(ii) Bohr shift/effect;	1
	(iii) release of carbon dioxide during aerobic respiration; forming carbonic acid/ more H <sup>+</sup> ;	2
	(iv) <u>more</u> oxygen released;	1
	(c) (i) curve to the left of ones drawn;	1
	(ii) more saturated than maternal haemoglobin/greater affinity for oxygen; at all oxygen partial pressures; oxygen will pass from maternal to foetal blood;	2
<b>Question 6 Total</b>		<b>[13]</b>

Question	Marking details	Marks Available
7 (a)	<p>A active immunity caused by introduction of antigen;</p> <p>B antibody production stimulated;</p> <p>C antigen is bacteria/virus/pathogen;</p> <p>D vaccination;</p> <p>E killed organism/live attenuated organism;</p> <p>F toxoid;</p> <p>G (Life)long protection from disease;</p> <p>H ref memory cells;</p> <p>I passive immunity;</p> <p>J antibody can be injected;</p> <p>K temporary/short term protection;</p> <p>L antibody crosses placenta;</p> <p>M also in colostrums/breast milk;</p> <p>N provides immediate protection;</p> <p>O until own antibody produced;</p>	

Question	Marking details	Marks Available
7 (b)	<p>A stomach is a muscular sac;</p> <p>B enables churning and mixing of food;</p> <p>C expands to accommodate food;</p> <p>D small intestine/ileum long/ thrown into folds/villi/microvilli;</p> <p>E increases surface area;</p> <p>F two layers of muscle/longitudinal and circular muscles;</p> <p>G for peristalsis;</p> <p>H glands outside of gut/pancreas, secrete enzymes;</p> <p>I glands in gut wall secrete enzymes;</p> <p>J liver/gall bladder supplies bile;</p> <p>K for emulsification of fats/lipids;</p> <p>L thin epithelial lining;</p> <p>M (sub mucosa) of capillaries and lymph vessels/lacteals;</p> <p>N to remove absorbed digested food/soluble molecules/ glucose/ amino acids/fatty acids/glycerol;</p> <p>O inner mucosa/ goblet cells secrete mucus;</p> <p>P for lubrication/ease of passage of food/ prevents autolysis/ autodigestion;</p>	
<b>Question 8 Total</b>		<b>[10]</b>

**GCE Biology - HB4**

**Markscheme – January 2013**

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
1	<p>(a) (i) Calculation % increase 1600 – 1800 (0.5 billion); Calc. % increase 1800 – 2000 (5.8 billion);</p> <p>(ii) Lag phase, Log phase; Both correct for 1mk.</p>	2
	<p>(b) (i) Increased food production; Improved removal waste / sanitation; Medicine / disease control;</p> <p>(ii) Birth control; Disease; New diseases which humans cannot find cure eg. HIV; Government intervention on pop. Size; Warfare; Lack food / water / climate change; AVP;</p>	Max 2
	<p>(c) (i) Human pop. lag and log phase ; Not yet reached plateau / stationary phase; No decline / death phase; Not reached carrying capacity;</p> <p>(ii) 234 x 10 000 ; 2.3 million per cm<sup>3</sup>;</p>	Max 3
	<b>Question 1 total</b>	<b>[12]</b>

Question	Marking details	Marks Available
2	(a)	
	(i) Cytoplasm;	1
	(ii) C; C; A; B;	4
	(iii) 2;	1
	(iv) Accept hydrogen / reduced by; NADH <sub>2</sub> / reduced NAD / NADH H+; Lactate/ lactic acid;	3
	(b)	
	(i) Fats to fatty acids and glycerol; Glycerol into glycolysis; Fatty acids to 2C fragments; Acetyl group into Krebs; oxidative phosphorylation; More hydrogen in a substrate more for oxidative phosphorylation; Ref.Chemiosmosis;	3
	(ii) CO <sub>2</sub> / urea;	1
	(iii) More O <sub>2</sub> ; More CO <sub>2</sub> ; For blood to supply and remove; Anaerobic;	2
	<b>Question 2 total</b>	<b>[15]</b>



Question	Marking details	Marks Available																								
3 (a)	(i) A= Myofibril; B = Z line; C = mitochondrion / accept T system; D = sarcomere;	4																								
	(ii) I band A band Both for 1 mark	1																								
	(iii) Glycogen;	1																								
(b)	<table border="1"> <thead> <tr> <th>Band</th> <th>increase</th> <th>decrease</th> <th>same</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>x</td> <td>✓</td> <td>x</td> </tr> <tr> <td>A</td> <td>x</td> <td>x</td> <td>✓</td> </tr> <tr> <td>H</td> <td>x</td> <td>✓</td> <td>x</td> </tr> </tbody> </table>	Band	increase	decrease	same	I	x	✓	x	A	x	x	✓	H	x	✓	x	3								
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(d)	Detaching myosin bridge from actin binding site; Return of myosin head to original position; Pumping Ca <sup>2+</sup> back into sarcoplasmic reticulum; Creation of creatine phosphate from creatine;	Max 2																								

**Question 3 Total**

**[15]**

Question	Marking details	Marks Available
4 (a)	amino acids / polypeptides / proteins; DNA; RNA; ATP; NAD / FAD; urea	Max 2
(b)	Nitrobacter, nitrites to nitrates; Nitrosomonas, ammonium ions to nitrites;	2
(c)	create aerobic conditions; encourage nitrification; prevent denitrification; allow aerobic respiration in roots for active uptake;	Max 2
(d)	crops absorb nitrate; No / less decay; Less nitrification;	2
(e)	Leguminous plants / any named leguminous plant; Rhizobium / nitrogen fixing bacteria (in root nodules); Reject nitrate fixing Convert nitrogen gas into ammonium/ ammonia/ amino acids; Left to decay, ploughed in;	Max 3
<b>Question 4 Total</b>		<b>[11]</b>

Question	Marking details	Marks Available
5	(a) (i) Cortex;	1
	(ii) X = Proximal convoluted tubule / distal convoluted tubule; Reject PCT Y = Bowmans capsule; Z = Glomerulus;	3
	(iii) Microvilli; Large numbers mitochondria; Folded basement membrane; Large number ribosomes;	3
	(b) arterial pressure high/ high blood pressure; Afferent vessel wider diameter than efferent; Increase in pressure in glomerulus; Pores between endothelial cells; Pores in basement membrane; Filtration slits podocyte feet; Eg. of a substance not filtered and one which passes through;	Max 4
	<b>Question 5 Total</b>	<b>[11]</b>

<b>Question</b>	<b>Marking details</b>	<b>Marks Available</b>
<b>6</b>	(a)	
	(i) Respiration Combustion; Both for 1 mk. Accept deforestation	1
	(ii) Chloroplast;	1
	(iii) Light independent; Calvin cycle; RUBP; Rubisco; (unstable 6 C substance) 2 mols of GP;	2
	(b)	
	(i) Produces carbohydrate / glucose / respiratory substrate;	1
	(ii) Produces oxygen;	1
<b>Question 6 Total</b>		<b>[6]</b>

**Question****Marking details****Marks Available****7 (a)**

- A Sodium potassium pump;
- B 3 Na<sup>+</sup> out, 2K<sup>+</sup> in;
- C creates a pd across membrane;
- D inside -60 / -70 mv;
- E resting potential;
- F membrane allows Na<sup>+</sup> in, threshold reached;
- G sodium voltage gated channels open;
- H Na<sup>+</sup> in causes depolarisation;
- I Potassium voltage gated channels open;
- J repolarisation;
- K Ref. ATP;
- L Synaptic knob, Ca<sup>+</sup> channels open;
- M Ca<sup>+</sup> in;
- N Synaptic vesicles fuse with presynaptic membrane;
- O Exocytosis;
- P Receptors on post synaptic membrane;

Question	Marking details	Marks Available
(b)	<p>Parkinson's</p> <ul style="list-style-type: none"> <li>A. Caused by death of brain cells;</li> <li>B. That produce dopamine / lack of dopamine;</li> <li>C. A neurotransmitter/ involved in synaptic transmission;</li> <li>D. Affects part of brain that controls movements;</li> <li>E. Symptoms repetitive shaking / slowness of movement/ muscle stiffness;</li> <li>F. Drug treatment/ levadopa that is converted into dopamine in brain;</li> <li>G. Longer term physiotherapy / therapy to manage condition / stem cells.</li> </ul> <p>Motor Neurone disease</p> <ul style="list-style-type: none"> <li>H. Degeneration;</li> <li>I. Motor neurones;</li> <li>J. Impairment use of arms / legs;</li> <li>K. Muscle twitch;</li> <li>L. Throat and chest muscles affected;</li> <li>M. Cause unknown;</li> <li>N. No cure;</li> <li>O. Drugs relieve symptoms;</li> <li>P. Therapy;</li> </ul>	[10]
<b>Question 7 Total</b>		<b>[10]</b>



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