

## 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>

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2. (a)	<table border="1"> <thead> <tr> <th>DNA</th> <th>RNA</th> </tr> </thead> <tbody> <tr> <td>Double <u>stranded</u></td> <td>Single <u>stranded</u></td> </tr> <tr> <td>helical</td> <td>Not helical</td> </tr> <tr> <td>Deoxyribose/ <math>C_5H_{10}O_4</math>/ one less oxygen atom in pentose NOT deoxyribonucleic acid</td> <td>Ribose/ <math>C_5H_{10}O_5</math>/ one more oxygen atom in pentose NOT ribonucleic acid</td> </tr> <tr> <td>Contains thymine Not letters Can list all bases present</td> <td>Contains uracil Not letters Can list all bases present</td> </tr> <tr> <td>Only one type</td> <td>3 types (mRNA, tRNA &amp; rRNA)</td> </tr> <tr> <td>(Relatively) long/ larger molecule</td> <td>(relatively) short/ smaller molecule</td> </tr> </tbody> </table>	DNA	RNA	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
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(b)	<p>23% guanine therefore 23% cytosine; (54% made up of adenine and thymine) Adenine = 27(%) Correct answer = 2 marks</p>	2														
<b>Question 2 total</b>		<b>[5]</b>														

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} <u>proteins/ 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 lower</u> (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
<b>Question 6 Total</b>		<b>[16]</b>

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;	