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; Chromatids/ chromosomes are being pulled to (opposite) poles; (due to) contraction/ shortening of the spindle (fibres);	2
	(b)	(i)	Interphase;	1
		(ii)	The (quantity of) DNA has doubled / (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 halved (and halved again) / can describe with numbers /involves 2 (consecutive) divisions; Ignore reference to chromosomes	2
			Question 1 total	**[8]**

Question	Marking details	Marks Available

2. *(a)*

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

(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/ endocytosis; the (cell) membrane {invaginates/infolds/ surrounds/ wraps around/ engulfs} (to form a vesicle (allow vacuole))around the {food particle/ algae};	2
		(ii)	Golgi {Body/apparatus};	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. Smaller/70S ribosomes; 5. Cell wall; Reject reference to cellulose 6. Capsule/ flagellum/ plasmid; NOT reference to size (can be neutral)	Max 3
			Question 3 Total	**[9]**

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)		**Mark points must be comparative**	Max 2

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^2); The phospholipids are {arranged in/ formed} a {bilayer/ double layer} in the membrane; Ref to phospholipid bilayer alone- insufficient	2
			Question 4 Total	**[10]**

Question			Marking details	Marks Available
5.	*(a)*	(i)	*Oxygen* by (simple) diffusion; through the phospholipid (bilayer);	2
		(ii)	*Phosphate ions* by {facilitated diffusion/active transport}; through {carrier /channel}proteins/ protein pumps (active transport); (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) facilitated diffusion; Uptake {only begins/ occurs} when the external concentration is higher than the concentration inside the root hair cells/ down a concentration gradient;	2
	(c)		They are a {component of/required to synthesise} {DNA/ RNA/ ATP/ NAD/ FAD/ NADP/ nucleotides/ nucleic acids};	1
			Question 5 Total	**[12]**

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 hydrolysation (ignore reference to acid)	1
		(iii)	Glycosidic;	1
		(iv)	Glucose and galactose; ignore alpha/ beta	1
	(b)	(i)	An enzyme that has been fixed to an inert {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)	Heat with Benedict's solution/reagent; NOT warm/ water bath/ ref to acid Blue to{red/ orange/ green/ yellow/ brown};	2
	(ii)	Instrument/equipment that can detect a specific 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)		1. (The concentration of reducing sugars) would decrease; 2. {Lactose/ substrate} concentration is lower (in the sour milk); 3. Lactic acid lowers the pH; 4. Enzyme would be inactivated/denatured; 5. Hydrogen/ ionic bonds (maintaining the 3D shape) would break; 6. This will change the shape/charge of the active site (of lactase); 7. Fewer enzyme-substrate complexes would be formed/fewer successful collisions; 8. Benedicts would remain {blue/ change to {orange/ yellow/ green/ brown}/ negative}	Max 4
		Question 6 Total	**[16]**

Question		Marking details	Marks Available
7.	*(a)*	**Describe and explain the effect of inhibitors on enzyme action.**	**[10]**

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)	**Describe the effects of placing animal and plant cells in solutions of differing solute concentration.**	
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 higher 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 cytoplasm swells up/cell contents/plasma membrane pushes against the cell wall;	
G	(plant cells) becomes turgid/ψ_p>0/cell wall prevents osmotic lysis;	
H	Hypertonic solutions have a lower 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 cytoplasm shrinks / the (plasma) membrane is pulled away from the cell wall;	
L	Plant cell becomes plasmolysed/ ψ_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;	