



# **GCE MARKING SCHEME**

## **INTRODUCTION**

The marking schemes which follow were those used by WJEC for the January 2012 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.

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

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## BY1

Question	Answer	Mark
1. (a) (i)	Mitochondrion/ mitochondria	1
(ii)	Respiration/ aerobic respiration	1
	stores {energy/ ATP}/ release energy/ {synthesis/produce ATP}/ release energy / ATP for respiration =2 marks NOT production of energy	1
(iii)	muscle / liver/ epithelial cells of small intestine / cells of proximal convoluted tubule/ neurones/ companion cells/ sperm/ secretory cells NOT muscle tissue/ the liver/ cardiac tissue	1
(b)	A	1
(c)	allows transport of { <u>messenger/ mRNA</u> }/ nucleotides/ ribosomes NOT out and in	1

**(Total 6 marks)**

Question	Answer	Mark
2. (a)	nitrogen (not: N)	1
(b) (i)	<u>heat/boil</u> with {Benedict's/ Fehlings A + B} solution; NOT boil with acid colour change from blue <u>to</u> {green/yellow/orange/brick red/ brown}	1 1
(ii)	A	1
(c)	C	1
(d) (i)	D	1
(ii)	saturated- no double bonds/ all carbon atoms have/attached to two hydrogens ; Fewer hydrogen atoms (or converse) Must have comparison for each	1 1

**(Total 8 marks)**

Question	Answer	Mark
3. (a) (i)	hydrogen/H	1
(ii)	{Holds/binds} {cellulose/glucose} {chains/molecules} together/ forms microfibrils; strengthens (the wall)/ (cellulose fibres are) strong/ rigid/ gives structural stability/ can resist turgor/ osmotic pressure/ prevents plant cells bursting.	1
(b) (i)	condensation/ polymerisation	1
(ii)	(Has) amino acid (added)/glucosamine (to form a mucopolysaccharide)/ amine/ NH <sub>2</sub>	1
(iii)	(exo)skeleton – strong/waterproof/ light/ rigidity/ tough  NOT exoskeleton gives protection	1
(c) (i)	glycogen	1
(ii)	starch (accept amylose/ amylopectin)	1

**(Total 8 marks)**

Question	Answer	Mark
4. (a) (i)	0.26	1
(ii)	concentration of substrate NOT amount/ availability of Active sites	1
(b) (i)	Less/low <u>kinetic</u> energy ; fewer successful collisions/ {enzyme substrate/ES} complexes formed/ ORA	1 1
(ii)	enzymes denatured/ alteration in tertiary structure/ 3D structure; breaking of H/ hydrogen bonds; NOT disulphide active site altered/ active site denatured; substrate cannot bind/ less enzyme substrate complexes formed (any three)	3
(c) (i)	Must be a curve starting at origin and may meet 30°C line but not levelling off	1
(ii)	{shape/structure} of inhibitor similar to substrate/complementary to active site; {Fits/ fills/ bonds/ attaches} to active site/ competes for active site; (As it has a similar shape to the substrate it competes for the active site = 2 marks.) <u>At higher substrate concentration</u> there is a greater chance of Enzyme substrate complexes forming / effect of inhibitor is diminished/ the substrate outcompetes the inhibitor/ ORA	3

**(Total 11 marks)**

Question	Answer	Mark
5. (a)	deoxyribose/ pentose/ 5 C sugar	1
(b) (i)	A-T-A-G-C	1
(ii)	Guanine pairs with cytosine/ G pairs with C = 60%/ G+ C = 60%; A+T= 40% A= 20% Correct answer = 2 marks	2

(any two)

**(Total 4 marks)**

Question	Answer	Mark
6. (a) (i)	J K L H I	1
(ii)	I = telophase	1
	L = metaphase	1
(b) (i)	interphase	1
(ii)	ATP production/ metabolically active; Replication of DNA; NOT synthesis/ doubling {Making/ replacing} new organelles/ replication of mitochondria/ chloroplasts NOT replication of organelles Protein synthesis; Cell increase in size (not growth) (any two)	2
(c)	DNA Doubled / DNA content increased from 20 to 40	1
	and then halved (to maintain DNA content) (in two daughter cells.) (ignore reference to chromosomes)	1
(d)	Two genetically identical daughter cells are produced; {Genetically identical/ clone} of parent cell.	2

**(Total 10 marks)**



Question	Answer	Mark
7. (a)	A = phospholipid head/hydrophilic head/phosphate/polar group;	1
	B = hydrophobic tails/ fatty acids/ non polar tails: (Not: tails/ lipid layer)	1
	C = transmembrane protein/ carrier protein/ channel protein/ intrinsic protein.	1
(b) (i)	As lipid solubility increases the rate increases; NOT rate of reaction  Membrane contains (a double layer) of phospholipids/  Lipid soluble substances can {move/pass/ diffuse} through the membrane (more easily than water soluble substances.)  (any two)	2
(ii)	small molecules diffuse faster(or converse);	1
	Higher kinetic energy/ easier to pass between phospholipid molecules.	1
(c)	concentration/ diffusion gradient/ concentration difference;  {amount/number} of carriers/ channel proteins/ larger surface area contains more carrier proteins;  temperature. (any two)	2

Question	Answer	Mark
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(d)	vitamin B <sub>1</sub> – polar/ ionic; Cannot pass through phospholipid layer/ hydrophobic region; Uses <u>protein</u> channels/ carriers/ transport <u>proteins</u> / Hydrophilic (lining to) channels; (any two)	2
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	Vitamin K - non polar/non ionic; dissolves in phospholipid/ hydrophobic regions; so can pass (directly) through phospholipid/ hydrophobic regions; (any two)	2
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**(Total 13 marks)**

Question	Answer	Mark
8. (a)	<p>A. enzyme (molecules) {fixed/ bound/ trapped} in an {inert support/ matrix}</p> <p>B alginate beads/ <u>gel</u> membrane, /adsorbed (NOT absorbed) onto nylon/ gel capsule/ cellulose</p> <p>C Product not contaminated</p> <p>D reuse of enzymes/recovery/ easily separated.</p> <p>E stable/ tolerate wider range of conditions</p> <p>F for example pH, temperature/ higher temperatures than normal/ denatured at higher temperatures</p> <p>G several enzymes can be used together/ with differing pH or temperature optima.</p> <p>H rapid/ greater productivity</p> <p><u>Biosensors</u></p> <p>I accurate/ specific</p> <p>J detect/sensitive to low concentrations/ clinistix</p> <p>K used in diagnosis of diabetics/ diabetes</p> <p>L {Biosensor/electrode probe} has a specific enzyme immobilised in a membrane/ glucose oxidase in context</p> <p>M glucose diffuses into the immobilised enzyme layer/ through selectively permeable membrane</p> <p>N (enzyme together with transducer) produces an electrical signal in response to substrate transformation/ chemical to electrical signal</p> <p>O size of signal proportional to concentration of product/ substrate</p>	
	(Any 10 out of 15 points)	

Question	Answer	Mark
8. (b)	A primary structure, {sequence/ order} of amino acids in its polypeptide chain	
	B linked by peptide bonds	
	C secondary structure consists of – $\alpha$ helix/ pleated sheet	
	D hydrogen bonds	
	E tertiary structure described - 3D folding/ irregular/ further folding	
	F as shown by globular <u>proteins</u>	
	G disulphide bridges/ ionic/ hydrogen/ hydrophobic (any two)	
	H Quaternary structure described- combination of two or more polypeptide chains	
	I Some proteins have non-protein groups/ prosthetic groups	
	J enzymes – <u>function or description of</u>	
	K antibodies/hormones/ plasmaproteins with <u>function</u>	
	L haemoglobin – <u>{carries/ transport} of oxygen</u>	
	M <u>fibrous</u> proteins + example connective tissue/ keratin/ collagen	
	N Function of fibrous protein - strength	
	O carriers in active transport/ facilitated diffusion /fibrinogen in blood clotting /histones/ ribosomal proteins	

(Any 10 out of 15 points)

## BY2

Question	Answer		Mark
1. (a)	Label parts <b>A</b> to <b>E</b> on the diagram.	all correct	1
	A    mouth / buccal cavity		
	B    oesophagus / gullet/ esophagus		
	C    stomach		
	D    small intestine / duodenum / ileum		
	E    large intestine / colon		
(b) (i)	digestion    A        C        D		1
(ii)	absorption    D        E		1
(c)	different parts carry out different functions / provide different conditions for enzymes/different food groups digested in different areas		1
(d) (i)	lives <u>in</u> or <u>on</u> another organism    NOT lives off of	max	2
	obtains nourishment/ nutrients/ products of digestion from the host		
	provides no benefit / causes harm to its host		
(ii)	region D has high concentration of products of digestion / tapeworm can absorb nutrients/ nourishment from the digested food		1
(e)	<b>peristalsis:</b> hooks / suckers / scolex to attach to the gut wall    NOT hookers		1
	<b>digestive enzymes:</b> (thick) cuticle / secretes mucus / secretes enzyme inhibitors    NOT coating/covering / waxy cuticle		1
(f)	increases chance of (species) survival / infecting a new (intermediate) host/ many eggs will not survive		1

**Question Total    10**

Question	Answer	Mark
2. (a) (i)	Arthropoda	1
	(ii) jointed legs exoskeleton fluid-filled body cavity / haemocoel/ open circulatory system Segmentation/ segmented body NOT large brain	max 2
(b) (i)	a group of organisms that can interbreed / breed with each other to produce fertile offspring	1
	(ii) <u>Genus</u>	1
	(iii) DNA base sequencing / hybridisation/ sequencing analysis/ DNA electrophoresis Not DNA analysis/ analysis alone genetic fingerprinting or profiling/ amino acid sequencing of proteins / differences in protein structure (not: biochemical methods unqualified) NOT compare DNA/ genes	1
	(iv) high level of <u>similarity</u> shows that they are closely related / converse argument. Needs to relate to 2 a (iii)	1
<b>Question Total</b>		<b>7</b>

Question	Answer	Mark									
3. (a) (i)	Transpiration/ evapotranspiration	1									
(b)	Potometer NOT podometer	1									
(c) (i)	graph: <b>Axes</b> Correct and labelled. Using labels from table, axes correct. 1 <b>Scale</b> Appropriate with over half of paper used. (1) <b>Plot</b> All correct, +/- 1 small square (1) <b>Curve/ Line</b> Well drawn through points (1)	4									
(ii)	as wind speed increased distance travelled increased; NOT rate of transpiration wind removed water vapour from leaf surface / removes diffusion shells / removes water molecules from the leaf's microclimate/ increased diffusion gradient between inside and outside of leaf (not: blows water away)	2 max									
(iii)	water lost from leaves / by transpiration; causes tension on water molecules; cohesive force between water molecules ; adhesive forces between water molecules and <u>xylem/vessel</u> walls; water molecules pulled into / up <u>xylem/ vessel</u> NOT hydrostatic / root pressure	max 3									
(d) (i)	Pumped/ moved out of guard cells/ no longer pumped in	1									
(ii)	increased water potential , so water moves out	1									
(iii)	decreased water, so decreases volume of cell/ flaccid/ cause walls to move together	1									
(e)	<table border="1"> <thead> <tr> <th>Factor</th> <th>Effect on rate of water loss</th> <th>Explanation</th> </tr> </thead> <tbody> <tr> <td>increased Humidity</td> <td><del>Increase</del> / <u>Decrease</u></td> <td>Reduces concentration/diffusion gradient/ water potential gradient between inside and outside leaf</td> </tr> <tr> <td>increased Temperature</td> <td><u>Increase</u> / <del>Decrease</del></td> <td>Greater rate of evaporation from surface of leaf / increased KE (of water molecules)</td> </tr> </tbody> </table>	Factor	Effect on rate of water loss	Explanation	increased Humidity	<del>Increase</del> / <u>Decrease</u>	Reduces concentration/diffusion gradient/ water potential gradient between inside and outside leaf	increased Temperature	<u>Increase</u> / <del>Decrease</del>	Greater rate of evaporation from surface of leaf / increased KE (of water molecules)	
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Question Total 18

Question	Answer	Mark
4. (a) (i)	Contraction of {left ventricle/ ventricular systole} causes a {surge / increase in blood pressure}; pressure drops when the {left ventricle relaxes/ ventricular diastole}; pressure in aorta does not fall to zero because of the closing of the {aortic / semi-lunar valve}; {elastic recoil/ elasticity} of the arteries maintains blood pressure.	3
(ii)	Friction/ resistance with vessel walls / increased cross-sectional / surface area of arterioles / blood vessels distance from heart increased causes progressive pressure drop/ Not reference to capillaries	1
(b) (i)	R; highest pO <sub>2</sub> / oxygen level OR lowest pCO <sub>2</sub> / carbon dioxide	2
(ii)	<b>at arterial end:</b> hydrostatic pressure (forcing liquid out of capillaries) greater than the osmotic pressure (drawing water in) <b>at venous end:</b> hydrostatic pressure has decreased; water potential gradient / high osmotic pressure in capillary or osmotic pressure greater than hydrostatic pressure causes an inward flow ORA; not all water (re)absorbed into capillary, reject all references to blood	max 3
(iii)	Drains/ removes (excess) tissue fluid from the tissues / prevents build up of tissue fluid / return (excess) tissue fluid to blood via lymphatic system NOT ref to waste products alone	1

**Question Total 10**



Question	Answer	Mark
5. (a)	1 mark each correct ROW	4

Statement	Fish	Amphibia	Reptiles	Birds	Mammals
1. Fertilisation is always internal			✓	✓	✓
2. Eggs are laid in an aquatic environment	✓	✓			
3. The embryo is surrounded by a membrane called the amnion			✓	✓	✓
4. Both fertilisation and embryo development are always internal					✓

- (b) (i) lowest supply of {nutrients / food}; max 2  
 embryo cannot complete development inside egg/ {poorly/less} developed at hatching;  
 embryo unable to care for itself after hatching / parents have to {feed / keep warm} (due to lack of feathers)/ cannot feed itself;
- (ii) more {time / energy/ resources} used to care for offspring/ more offspring would need too much {time / energy/ resources} to look after; 2  
 increased chance of survival of offspring/ less competition between offspring;
- (c) (i) incomplete metamorphosis      NOT stage metamorphosis 1
- (ii) nymphs / instars 1
- (iii) nymphs {go through a series of moults/ shed exoskeleton several times} (to become the adult);      NOT skin/ outer layer 3  
 exoskeleton is {hard/ limits growth};  
 exoskeleton can only {be stretched/ grow} when newly formed/  
 {length/ size} can only increase following a moult;  
 rapid increase in length before exoskeleton hardens
- (d) Tracheae/ tracheoles;      NOT trachea 1  
 spiracles 1

**Question Total 15**

Question	Answer	Mark
6. (a)	Describe the uptake of water by plants from the soil into the xylem	7
	Explain the role of ions in this process.	3
A	water absorbed by the root hair cells	
B	(water can be) {absorbed into / moves through} cell walls	
C	moves (across cortex) via apoplast route	
D	(can also move) across plasma membrane / into cytoplasm by osmosis	
E	(water) moves from the cytoplasm of one cell to the next via plasmodesmata	
F	(called the) symplast route	
G	(water can also) move through cytoplasm <u>and</u> vacuoles via vacuolar route	
H	Casparian strip / band in walls of endodermal cells	
I	made of suberin / waterproof	
J	stops apoplast route / water forced into symplast route	Max 7
<hr/>		
K	ions absorbed into root hair cells by active transport	
L	ions lowering water potential in root hair cells	
M	at the endodermis ions absorbed into cytoplasm by active transport/ uptake	
N	ions travel (through pericycle) into xylem	
O	lowers water potential in xylem	
P	ref to lower water potential in root hair cells or xylem increasing osmotic gradient between soil (solution) and cell contents / creates osmotic gradient across root	Max 3
<b>Question Total</b>		<b>10</b>

- (b) Explain why large, multi-cellular organisms have evolved specialised surfaces for gaseous exchange. 3
- Describe and explain how terrestrial mammals are adapted for gaseous exchange in air. 7
- A metabolic needs (approx) proportional to volume/ larger organisms need more oxygen
- B Larger organisms external surface insufficient for gas exchange
- C diffusion (of respiratory gases) proportional to surface area
- D surface area : volume ratio is too small/ larger animals have a smaller SA:vol ratio (to supply metabolic needs)
- E diffusion distances too large
- F not enough O<sub>2</sub> can diffuse / O<sub>2</sub> cannot diffuse fast enough (to the cells furthest from surface) (to meet metabolic needs)
- 
- G {gas exchange surface folded/ large number of alveoli} - to increase surface area
- H internal lungs
- I (to) reduce water / heat loss NOT prevent
- J gaseous exchange takes place in the alveoli
- K thin walls - reduce diffusion distance
- L (layer of) moisture – for gases to dissolve in
- M blood supply/ capillaries – {maintain concentration / diffusion gradient (between alveolar air and blood)/ transport absorbed gases}
- N haemoglobin (in erythrocytes) – transport of oxygen
- O ventilation mechanism/ description of ventilation mechanism
- P (to) replace stale air with fresh air / enable continuous exchange of gases max 7

**Question Total 10**

## BY4

Question	Answer	Mark
1. (a) (i)	<p>A = Dendrite(s), accept dendron;</p> <p>B = Axon/ axoplasm;</p> <p>C = Node(s) of Ranvier;</p> <p>D = Synaptic knob/motor end plate/ axon ending/ axon terminal/ synaptic bulb;</p> <p>NOT synapse/ dendrite/ nerve ending/ neuromuscular junction</p>	4
(ii)	Muscle;	1
	Gland; (name = neutral)	1
(iii)	Grey matter	1
(iv)	Ventral (root) (ref to ganglion = neutral).	1
(b) (i)	<p>Schwann cell;</p> <p>coils/ wraps/ folds/ spreads/ grows/ surrounds;</p> <p>NOT fuses/ binds/ accumulates</p> <p>(cell) membrane / (phospho)lipids</p>	3
(ii)	<p><u>Electrical</u> insulation;</p> <p>Increase distance of local circuits or currents/ saltatory conduction ( or description of);</p> <p>Speed up transmission/ impulses travel faster;</p> <p>Protection of axon / Dendron; NOT protection alone/ protection of nerve</p> <p>Reference to preventing ion exchange/ depolarisation/ action potential</p>	<i>Max 3</i>

Question	Answer	Mark
2. (a) (i)	Condensation / phosphorylation;	1
(ii)	Ribose;	1
(iii)	Adenine;	1
(b)	Hydrolysis/hydrolyse;  Enzyme / ATPase; NOT Synthetase  (ATP )to ADP and iP/ Pi/ phosphate;  Ref. 30.6 KJ; Accept answer in range 30 – 30.9	Max 3
(c) (i)	S;  R;  S;	3
(ii)	Codes (of primary structure) of protein or enzyme or  polypeptide/ allows mitochondria to replicate/ self replication	1
(iii)	Chemiosmosis;  Protons/ H <sup>+</sup> / hydrogen ions; Not hydrogen or atoms or molecules  Pumped (from matrix) into inter membrane space;  Using energy from passage of electrons along the ETC;  Accumulation of hydrogen ions;	Max 3

Question	Answer	Mark
3. (a) (i)	<p>Photosynthesis produces oxygen/ photolysis produces oxygen/ light dependent stage produces oxygen;</p> <p>Aerobic bacteria/ bacteria need oxygen for respiration;</p> <p>Most bacteria {move/ attracted} to (blue and) red regions;</p> <p>Most {photosynthesis/ photolysis occurs/ more oxygen is released} in the (blue and) red regions / at these wavelengths/ frequencies (650-700nm);</p>	Max 3
(ii)	<p>A Light Dependent stage;</p> <p>B (Absorbed) energy passed to reaction centre or primary pigment or chlorophyll a;</p> <p>C Excites electron or electron lost/ emitted;</p> <p>D Reference to PS II;</p> <p>E Photolysis;</p> <p>F Use of photolysis equation/ or description of;</p> <p>G Replace electrons lost (from PS II) ;</p> <p>H Oxygen released</p>	
(b)	Evenly/ equally (along strand)	Max 5
(c) (i)	Chlorophyll a; NOT A	1
(ii)	<p>Carotenoids; xanthophylls; chlorophyll b; chlorophyll c; carotene</p> <p>Accept phytochromes</p>	Max 2
(iii)	<p>Increases range of wavelengths/ frequencies (of light) used/ Absorb different wavelengths (of light);</p> <p>More photosynthesis/ increased rate of photosynthesis;</p> <p>More sugar/ carbohydrates/ glucose made;</p>	Max 2

Question	Answer	Mark
4. (a) (i)	A = Cortex; (nephron = neutral)	1
(ii)	X = (proximal) convoluted tubule / (distal) convoluted tubule; Y = Glomerulus / Malpighian body/ glomerular capillaries Z = Bowmans capsule;	3
(iii)	X transverse section, W = LS./ cut at different angles/ planes/ axes/ OWTTE	1
(iv)	loop of Henle; ascending or descending; collecting duct;	3
(b)	Increased/ high, blood/ hydrostatic <u>pressure</u> in <u>glomerulus</u> ;	1
(c)	Afferent arteriole/ Blood vessel wider than efferent/ (or description of process)/ ORA; Pores/ gaps/ fenestrations in endothelium / capillary wall; Pass through pores, in <u>basement membrane</u> ; Ref size/ charge allowing only certain substances through/ molecular sieve; 2 examples of substances which pass through; 2 examples of substances which do not; Filtration between (feet) of podocytes; Ref. Hydrostatic pressure having to overcome the water potential of blood;	Max 6

Question	Answer	Mark
5.	Bacteria / fungi / decomposers; Accept putrefication/ decomposition  Ammonium ions;  Nitrosomonas;  Nitrites/ $\text{NO}_2^-$ ;  Nitrobacter;  Rhizobium;  Azotobacter;	7



Question	Answer	Mark
6. (a)	<p>Glucose is a monosaccharide;</p> <p>(and so) can be used instantly/ OWTTE for <u>respiration</u> / directly into <u>glycolysis</u>/ primary metabolite;</p> <p>Glucose more easily absorbed/ ORA;</p> <p>Lactose is a disaccharide/ made of glucose and galactose;</p> <p>And so needs hydrolysis/ broken down/ digested (into monosaccharides) ; REJECT converted unqualified</p> <p>Enzyme/ Lactase needs to be synthesised or made/ ORA</p>	Max 3
(b)	<p>A Slow start/ lag phase;</p> <p>B Adjusting to surroundings/ synthesis of enzymes/ DNA replication/ small population size;</p> <p>C rapid increase in population/ log/ exponential phase;</p> <p>D No limiting factors/ excess glucose; NOT plenty of food</p> <p>E Levels off / second lag phase;</p> <p>F when glucose runs out</p> <p>G Synthesis of enzymes / lactase (to hydrolyse lactose);</p> <p>H To glucose and galactose;</p> <p>I Rapid rise (when lactose is hydrolysed);</p> <p>J Then levels off / stationary phase/ carrying capacity reached;</p> <p>K Reason for stationary phase/ lactose used up/ toxic waste produced/ oxygen running short;</p> <p>L Use of correct figures;</p>	Max 5

Question	Answer	Mark
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- |        |  |   |  |
|--------|--|---|--|
| 7. (a) | <p>A <u>Decarboxylase</u>;</p> <p>B which removes CO<sub>2</sub>;</p> <p>C in Link reaction / Krebs;</p> | } | Only award B and/ or C if an enzyme is mentioned |
|        | <p>D Dehydrogenase;</p> <p>E which removes hydrogen;</p> <p>F in Glycolysis / link / Krebs;</p>          | } | Only award E and/ or F if an enzyme is mentioned |
|        | <p>G ATP synth(et)ase; reject ATPase</p> <p>H which produces ATP from ADP and iP;</p>                    | } |  |
|        | <p>I NAD acts as hydrogen carrier/ is reduced</p> <p>J in Glycolysis / link /Krebs</p>                   | } |  |
|        | <p>K FAD acts as hydrogen carrier/ is reduced</p> <p>L in Krebs;</p>                                     | } |  |
|        | <p>M Reduced NAD/ FAD carry protons/ electrons to ETC;</p>   |   |  |
|        | <p>N Coenzyme A;</p> <p>O Joins with/ carries an acetyl/ acetate group;</p>                              | } |  |
|        | <p>P electron carriers in ETC.;</p>  |   |  |

ACCEPT mark points on a clearly annotated diagram

Max 10

Question	Answer	Mark
7. (b)	<p>A Sodium potassium pump;</p> <p>B 3 Na<sup>+</sup> out, 2K<sup>+</sup> in (must refer to ions)/ Membrane more permeable to potassium ;</p> <p>C creates a potential difference across membrane/ membrane polarised/ inside negative compared to outside/ inside -60 / -70 mV; ;</p> <p>D resting potential;</p> <p>E threshold reached ;</p> <p>F sodium (voltage gated) channels/ gates open/ more permeable to sodium;</p> <p>G sodium diffuses/ (accept floods) in;</p> <p>H Ref to depolarisation/ +40mV;</p> <p>I Potassium (voltage gated) channels/ gates open;</p> <p>J sodium channels close;</p> <p>K Ref to repolarisation;</p> <p>L Synaptic knob/ presynaptic membrane + Ca<sup>2+</sup> channels open/ membrane becomes more permeable;</p> <p>M Synaptic vesicles fuse with <u>presynaptic membrane</u>; NOT bind</p> <p>N Exocytosis/ Description of neurotransmitter secretion; NOT synaptic vesicles</p> <p>O Receptors on <u>post synaptic membrane</u>;</p> <p>P Sodium channels open on <u>post synaptic membrane</u></p>	<p>Max 7 A - K</p> <p>Max 3 L - P</p>

## HB2

Question	Answer	Mark
1.	D; E; B; A; C;	<b>(Total 4 marks)</b>
	(four marks for all five, three for four, two for three and one for two)	

Question	Answer	Mark
2. (a)	<p>blood travels through it twice during one complete circuit;  separate {pulmonary/ to lungs} and {systemic/ to body}  circulations;  maintains high blood pressure (to body);  rapid circulation of blood;  no mixing of oxygenated/deoxygenated blood;</p>	3 max
(b) (i)	<p>position of both in right atrium (accept on dotted lines);  AVN below SAN (only if both in right atrium);</p>	2
(ii)	<p>prevents direct transfer of wave of excitation to ventricles/  prevents atria and ventricles from contracting at the same  time;  allows time for ventricles to fill;  wave is picked up by AVN;  which transfers to bundle of His/Purkinje/Purkyne fibres;  causes contraction of ventricles from base;</p>	4 max
(c)	<p><u>60000</u>;  800  75 beats per minute;</p>	2

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
(d)	fat deposits/atheroma builds up on wall of artery (from cholesterol); narrows (coronary) artery lumen; increased risk of blood clot (in artery); ( reject 'clogs') glucose/oxygen/blood no longer supplied to (part of) heart <u>muscle</u> ;	3 max

**(Total 14 marks)**

Question	Answer	Mark
3. (a) (i)	<p>Small/ steady increase in first few years;  followed by rapid/ drastic increase; (general point for  increases between 1981-1990);  cases in homosexual/bisexual always lower;</p>	3 max
(ii)	<p>education/advertising campaigns/ greater awareness;  needle exchange schemes/ sterile needles available/ no  sharing of needles;  safer sex/greater use of condoms;  better drugs/ medication/ treatment available;</p>	3 max
(b)	<p>means they have antibodies to virus;  can be a long time before symptoms/ AIDS show;  latent/ dormant period;  immune system may still function;  low helper T cell count;</p>	3 max
(c)	<p>caused by a virus;  antibiotics not effective against viruses;  only effective against bacteria;  interfere with metabolic processes;</p>	2 max

Question	Answer	Mark
(d)	(RNA/nucleic acid not stable/)mutates; different strains/ antigenic types exist; so body would make wrong antibodies/antibodies not effective; takes time to develop vaccine;	2 max
(e)	virus destroys T helper cells; B cells not stimulated; fewer antibodies produced; fewer T killer cells; pathogen not destroyed; pathogen numbers increase.	3 max

**(Total 16 marks)**



Question	Answer	Mark
4. (a) (i)	absorbs carbon dioxide; prevents (high levels) of carbon dioxide being breathed in from chamber; which would affect breathing rate; could have adverse effect on body's cells/ causes harm;	2 max
(ii)	sterilize mouth piece/change mouth piece/change soda lime;	1
(b) (i)	1) 0.5dm <sup>3</sup> ; 2) 3.75dm <sup>3</sup> ;	2
(ii)	air in alveoli stationary; not all passes out at each expiration/ref dead space; inspired air has to exchange gases with alveolar air;	2 max
(c)	measure air movement/ description; lungs never completely deflate; therefore spirometer not able to measure volume of static air/ residual volume;	2 max
(d) (i)	reduces surface tension; prevents alveolar walls from sticking together/collapsing;	2
(ii)	oxygen can't reach exchange surface/blood becomes deoxygenated/carries less oxygen/lowers rate of respiration;	1

**(Total 12 marks)**

Question	Answer	Mark
5. (a)	no valves; small/narrow lumen; more elastic in walls; thick(er)/muscular walls/ tunica media; less collagen;	4 max
(b) (i)	artery;	1
(ii)	<u>ventricular</u> contraction/systole at X;	1
	<u>ventricular</u> relaxation/diastole at Y;	1
(iii)	greater distance from heart;	1
	ref to friction;	1
		<b>(Total 9 marks)</b>
6. (a) (i)	reaches maximum later/ quicker response/ longer latent period; higher maximum/ more antibodies (in saliva); decreases after 6/7 weeks; ref. comparative figures;	3 max
(ii)	antibodies made of protein; required to make new antibodies/ lack of protein/ no or fewer antibodies; process is energy dependent;	2 max
		<b>(Total 5 marks)</b>

Question	Answer	Mark
7. (a)	A	eliminate vector/mosquito;
	B	drain breeding grounds/increase flow of water;
	C	spray oil on water;
	D	prevents larvae from breathing through tube;
	E	spray with insecticides/synthetic pyrethroids;
	F	where mosquitoes gather;
	G	fish to eat larvae;
	H	use of <i>B. thuringiensis</i> /bacteria to kill mosquito;
	I	use of sterile males;
	J	stop mosquitoes from 'biting';
	K	mosquito nets;
	L	cover skin/use repellants;
	M	screen windows;
	N	use of anti-malarial drugs;
	O	possible use of vaccines;

**(Total 10 marks)**

Question	Answer	Mark
7. (b)	<p>A protein digestion (begins) in stomach;</p> <p>B enzyme pepsin (catalyses) breakdown;</p> <p>C secreted as pepsinogen;</p> <p>D activated by HCl in the stomach;</p> <p>E digestion continues in duodenum;</p> <p>F by trypsin;</p> <p>G secreted by pancreas;</p> <p>H activated by enterokinase;</p> <p>I prevention of autolysis;</p> <p>J large peptides/ polypeptides formed;</p> <p>K (peptides bonds) hydrolysed/ broken down by endo/exopeptidases;</p> <p>L amino acids produced;</p> <p>M absorbed by facilitated diffusion/active transport;</p> <p>N into capillaries/ blood;</p> <p>O travel via hepatic portal vein to liver;</p>	

**(Total 10 marks)**

## HB4

Question	Answer	Mark
1. (a)	Free living (living in soil) Nitrogen-fixing bacteria.	1
(b)	Convert nitrite to nitrate	1
(c)	Convert ammonia to nitrite	1
(d)	Nitrogen-fixing bacteria in legume roots (or root nodules)	1
		<b>Total 4 marks</b>

Question	Answer	Mark
2. (a) (i)	I. Arrows from high to low concentration	1
	II. A=Na <sup>+</sup> B=K <sup>+</sup>	1
(ii)	K <sup>+</sup>	1
(b) (i)	-70mV	1
(ii)	By means of sodium-potassium pumps	1
	Which transport sodium ions out and potassium ions in	1
	By active transport /using ATP	1
(c) (i)	Fast fatigue more quickly/ work anaerobically/ have less myoglobin/ fewer mitochondria/ smaller blood supply. Any two of these features. Must be expressed as a comparison.	1
		1
(ii)	Fast-bursts of speed and power-sprints, jumps, gymnastics, etc.	1
	Slow-prolonged effort, marathons, distance cycling, triathlons, etc.	1

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
(d) (i)	Motor Neurone Disease	1
(ii)	Paralysis /impaired use of arms and legs /difficulty in swallowing/breathing/ speaking writing. (Any two)	2
		<b>Total 14 marks</b>

Question	Answer	Mark	
3. (a)	Mitochondrion	Chloroplast	2
(b)	NADH (or FADH <sub>2</sub> )	Chlorophyll	2
(c)	Oxygen	NADP <sup>+</sup>	2
(d)	Inner membrane	Thylakoid membrane	2
(e)	Intermembrane space to Matrix	Thylakoid compartment to Stroma	2
(f)	Flow of protons through membranes/through stalked particles (ATPase)/synthesising ATP from ADP/both involve pumps (or any sensible suggestion) (Any two). ( not simply a repetition of the first part of question)		2

**Total 12 marks**



Question	Answer	Mark
4. (a) (i)	A known volume ( $X \text{ cm}^3$ ) is taken from culture and this is diluted (usually with $9 \text{ cm}^3$ ) of sterile culture medium - sample 1	1
	$X \text{ cm}^3$ are then taken from sample 1 and diluted in the same way.	1
	The process is repeated to give a series of cultures of progressively higher dilution, and a suitable sized sample ( $Y \text{ cm}^3$ ) is taken for counting.	1
(ii)	The number of cells in the original culture is too great to count.	1
(iii)	Four dilutions therefore the original concentration is $85 \times 10^4/\text{ml}$	1
	20ml culture therefore total number = $85 \times 20 \times 10^4$	1
	$17 \times 10^6$ or $1.7 \times 10^7$	1
(iv)	Viable counts don't include dead bacteria.	1

Question	Answer	Marks
(b) (i)	Lag phase, exponential or log phase, stationary phase, death phase.	1
(ii)	A - Few individuals present/Very low or no reproduction/period of acclimatisation.	1
	B - No limiting factors/surplus of resources/maximum rate of reproduction/birth rate >> death rate.	1
	C - Carrying capacity reached/birth rate = death rate/resources ( nutrients, oxygen) limiting.	1
	D - Carrying capacity declining/less nutrients or oxygen/pH change/death rate >> birth rate/toxic wastes accumulating.	1
	ALL ANSWERS MUST HAVE SOME EXPLANATION IN EACH CASE. JUST COMPARING BIRTH RATES AND DEATH RATES WITH NO REASONS GIVEN IS NOT ACCEPTABLE	
(c) (i)	Region B	1
(ii)	Region with - majority of viable/rapidly reproducing bacteria/fewest dead.	1

**(Total 15 marks)**

Question	Answer	Mark									
5. (a) (i)	Glycolysis	1									
(ii)	Cytoplasm/ cytosol	1									
(b) (i)	<table border="1"> <thead> <tr> <th>ATP used</th> <th>ATP Produced</th> <th>NADH produced</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>4</td> <td>2</td> </tr> </tbody> </table>	ATP used	ATP Produced	NADH produced	2	0	0	0	4	2	
ATP used	ATP Produced	NADH produced									
2	0	0									
0	4	2									
	(one mark for each correct column)	3									
(iii)	3 molecules of ATP	1									
(c)	NADH yields $3 \times 2 = 6$ ATP	1									
	+ 2 net gain - (phosphorylation etc.)	1									
	Total $8 \times 30 = 240$ kJ/Mol.	1									
(d) (i)	Pyruvate is decarboxylated/loses 1 mol of $\text{CO}_2$	1									
	Pyruvate is also dehydrogenated/loses hydrogen to form acetate	1									
	acetate + coenzyme A = acetyl coenzyme A	1									
(ii)	Mitochondrial matrix.	1									
(e)	Glycogen.	1									

**(Total 14 marks)**

Question	Answer	Mark
6. (a)	Cortex	1
(b) (i)	Removal of water from the lumen of the tubule.	1
(ii)	Since transport out of Na <sup>+</sup> still takes place	1
	a water potential gradient is produced across the membrane.	1
	and water diffuses out by osmosis.	1
(c)	90mg/100ml	1
(d) (i)	Homeostasis	1
(ii)	An elevated concentration of glucose is filtered into the tubule/there must be a maximum level that can be absorbed.	2
(e)	Loop of Henle - Ascending limb Distal convoluted tubule	Any 2

**(Total 11 marks)**

Question	Answer	Mark
7. (a) (i)	A. Prevent contamination of cultures and environment	1
	B. Sterilise work surfaces	1
	C. and disinfect after use.	1
	D. Autoclaved/gamma irradiated glassware.	1
	E. Open bottle by holding in one hand and removing cap with little finger of the other.	1
	F. Lighten Bunsen burner to create rising air current.	1
	G. Flame mouth of bottle	1
	H. Use of flamed inoculating loop.	1
	I. Minimum exposure of medium in Petri dish.	1
	J. Tape lid on to dish.	1
	K. Incubate at 25°C.	1
	(Seven marks can be awarded from the eleven available)	
(ii)	L, M & N. Use of clothing and masks/restricted access to selected personnel/access via sterile room and change of clothes/constant monitoring of laboratory/UV screens/regular health checks/any sensible additional suggestions.	3
	(Any three)	

Question	Answer	Mark
7. (b) (i)	A. CO <sub>2</sub> combines with ribulose biphosphate	1
	B. which is a 5C molecule	1
	C. The reaction is catalysed by the enzyme rubisco (RUBP carboxylase)	1
	D. The 6C molecule produced splits into two 3C molecules/glycerate-3-phosphate.	1
	F. These react with ATP	1
	G. and are then reduced by NADPH	1
	H. both of which have been produced in the light stage.	
	I. The product is a triose phosphate (glyceraldehyde phosphate)	1
	J. Most of which is used to regenerate ribulose biphosphate.	1
	K. The rest is used to synthesise glucose, other sugars, amino acids, etc.	1
(Seven marks can be awarded from the ten available)		
(ii)	L. Photosynthesis traps the only primary source of biological energy - sunlight.	1
	M. It uses up CO <sub>2</sub> (global warming) and regenerates oxygen.	1
	N. All food stuffs directly or indirectly traced back to photosynthesis.	1
	O. Source of fibre, coal, timber, oil. (Any examples of non-food materials)	1

(Three marks can be awarded from the four available)

**(Total 10 marks)**



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