



# **GCE MARKING SCHEME**

## **BIOLOGY - HUMAN BIOLOGY AS/Advanced**

**SUMMER 2013**

## INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 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

Question			Marking details	Marks Available
1.	(a)	(i)	A <u>amino/amine</u> ; B <u>carboxyl</u> ;	2
		(ii)	variable group/side chain OR description of; NOT element/ hydrocarbon chain/ R group	1
	(b)	(i)	Dipeptide; NOT polypeptide	1
		(ii)	peptide (bond);	1
	(c)	(i)	hydrogen bonds; NOT H bond	1
		(ii)	<b>Alpha/ α</b> helix; NOT double helix	1
		(iii)	secondary/ 2° (structure) NOT second	1
	<b>Question 1 total</b>			<b>[8]</b>

Question			Marking details	Marks Available
2.	(a)	(i)	Lock and key;	1
		(ii)	Theory 1/ induced fit;	1
	(b)	Enzyme substrate complex; NOT ESC/ ES complex	1	
	(c)	Lower the <u>activation</u> energy/eq;	1	
	(d)	Enzyme/ active site is unchanged/can be re-used; NOT active sites are a specific shape unqualified	1	
	(e)	Temperature (not heat); pH; NOT acidity Enzyme concentration; Substrate concentration; NOT amount	3	
	(f)	Intracellular: inside the <u>cell</u> + Extracellular:outside the <u>cell</u> ; NOT inside body	1	
<b>Question 2 total</b>			<b>[9]</b>	

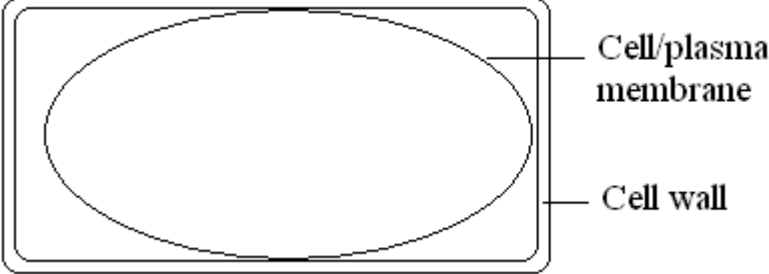
Question			Marking details	Marks Available
3.	(a)	(i)	<p>A Mitochondrion/ mitochondria <b>Plus</b> ATP synthesis/aerobic respiration; NOT produce/ create energy</p> <p>B Golgi Body/ complex/ apparatus NOT golgi alone <b>Plus one of</b></p> <ul style="list-style-type: none"> <li>• Modification of {proteins/lipids}/ Addition of sugar chains/ produces glycoprotein</li> <li>• {Transport/storage} of {lipids/digestive enzymes}</li> <li>• Synthesis of {(secretory) vesicles/lysosomes}/ packaging proteins;</li> </ul> <p>NOT transport(ation) of proteins/ synthesis of proteins</p>	2
		(ii)	Liver/muscle/nervous tissue/ meristem;	1
	(b)	<p>Nuclear pores + Allows {mRNA/ribosomal RNA/ribosomes} to <u>pass out/through</u> of nucleus; NOT substances</p> <p>Nucleolus + Synthesis of ribosome (components);</p> <p>(Double) nuclear membrane/nuclear envelope + Separates the DNA from the rest of the cellular contents/ holds DNA/ chromosomes;</p> <p>Chromatin+ condenses to form chromosomes/ {involved in/ code for} protein synthesis;</p> <p><b>Matched pair = 1 mark</b></p>	2	
	(c)	<p>D presence of ribosomes + no ribosomes on E; D {<u>membranes/ cisternae</u>} in parallel/regular lines/ more organised + {open network of <u>membranes/ cisternae</u>}/ less organised/ or description in E;</p> <p><b>Question 3 Total</b></p>	2	
				<b>[7]</b>

Question		Marking details	Marks Available
4.	(a)	Root <u>tip</u> / shoot <u>tip</u> / meristem;	1
	(b)	A Anaphase; B Prophase; C Telophase; D Metaphase;	4
	(c)	Interphase; It is the longest phase;	2
	(d)	(All cells) would be {haploid/half the number of chromosomes};  NOT cells have fewer/ less chromosomes  (All cells) would be <b>genetically</b> different;	2
	<b>Question 4 Total</b>		<b>[9]</b>

Question		Marking details	Marks Available
5.	(a)	(i) <u>two layers/ double layer</u> of <u>phospholipids</u> ; NOT bilayer	1
		(ii) <u>fatty acid</u> ;	1
		(iii) Any 2 from: transport/ form hydrophilic pores/ active transport/ channel proteins/ facilitated diffusion; receptors/ cell recognition; enzyme systems;	2 max
	(b)	Decreased fluidity/ rigid membrane - cells/ membranes more easily damaged (as blood flows)/ cannot pass through capillaries so easily;  Membrane proteins change shape / denatured {carriers/ receptors/membrane enzymes} - so {reduced/no} {transport/movement} of molecules;	2
(c)	Any 2 from: {Unrestricted/ uncontrolled} {Cell division/mitosis}; Forming a mass of cells/ tumour; Preventing {normal cells/ organs} from functioning;	2 max	
		<b>Question 5 Total</b>	<b>[8]</b>

Question		Marking details	Marks Available
6.	(a)	<p>Causes change in <u>shape</u> of enzyme/active site;</p> <p>So substrate no longer fits into active site;</p> <p>{No/ fewer} enzyme substrate complexes;</p>	2 max
	(b)	<p>{{(Insoluble) enzymes/ (enzyme) aggregates} cannot pass through the filter/ ORA;</p> <p>So the product is uncontaminated with enzymes/ ORA;</p>	2
	(c)	<p>Can tolerate {<u>higher</u> temperatures/greater <u>range</u> of pHs}; NOT range of temperatures</p> <p>Easily <u>recovered</u> for reuse/ enzymes stay in aggregates/ reused qualified/ uncontaminated product/ separated from product; NOT reused unqualified/ enzymes reused</p> <p>Several enzymes can be used together;</p> <p>Easy addition/removal of enzymes;</p>	3 max
	(d)	<p>Any one from :</p> <p>Gel capsule/alginate beads/ gel beads;</p> <p>cellulose fibres;</p> <p>gel membrane;</p> <p>porous glass beads;</p> <p>NOT inert matrix unqualified/ encapsulation unqualified</p>	1 max
		<b>Question 6 Total</b>	<b>[8]</b>



Question			Marking details	Marks Available
7.	(a)	(i)	{0.0M/distilled water} increase in <u>mass</u> and {1.0M/ sucrose solution} decrease in <u>mass</u> ;	1
		(ii)	Turgid;	1
		(iii)	Water moves out of the {cell/ potato};  By <b>osmosis</b> ;  The external solution has a {lower water potential than the cell/is hypertonic/ more negative}/ ORA ;  Potato becomes flaccid/cells are plasmolysed;	3 max
		(iv)	Isotonic;	1
		(v)	1. Where the line crosses the {X/ horizontal axis} there is no change in {mass/weight};  2. So $\Psi_{\text{cell}} = \Psi_{\text{external}}$ solution (can be expressed in words);  3. This is <u>0.3</u> (M) sucrose; (must be linked to point 1 or 2)  4. And converts to -860kPa from the (conversion) table;  5. (So $\Psi_{\text{cell potato}} = -860\text{kPa}$ ;	3 max
	(b)		 <ul style="list-style-type: none"> <li>• 1 mark for correct drawing of a plasmolysed plant cell(at any stage); (cell wall must be double line)</li> <li>• 1mark for correct labelling of a plasmolysed plant cell (plasma membrane pulled away from cell wall – both labelled correctly/ accurately);</li> </ul>	2
<b>Question 7 Total</b>				<b>[11]</b>

Question		Marking details	Marks Available
8.	(a)	<p>A. Monosaccharides / single sugars plus 2 suitable examples;</p> <p>B. Diagram of hexose/glucose;</p> <p>C. Alpha and beta forms of glucose shown; (can be description)</p> <p>D. Pentoses/deoxyribose/ribose and presence in DNA/RNA;</p> <p>E. Trioses in photosynthesis/respiration/metabolic pathways;</p> <p>F. Disaccharides plus 2 suitable examples;</p> <p>G. Correct formation of glycosidic bond (stated or diagrams, labelled);</p> <p>H. 2 suitable examples of where disaccharides are found (milk sugar/germinating seeds/transport in plant stems);</p> <p>I. Starch in plant cells for storage of <u>glucose</u>; NOT energy</p> <p>J. Correct reference to starch structure (alpha glucose/amylose &amp; amylopectin/1 -4 and 1 – 6 linkages/amylose spiral chain/amylopectin branched);</p> <p>K. Glycogen in <u>animal</u> cells for <u>glucose</u> storage ;</p> <p>L. Glycogen has branched chains;</p> <p>M. Cellulose in <u>plant</u> cell walls/structural polysaccharide;</p> <p>N. Correct reference to cellulose structure (beta glucose/microfibrils/ chains held together by H – bonds/alternate 180° glucose);</p> <p>O. Correct reference to chitin (amino groups/ use in {exoskeleton/ fungal cell walls})</p>	

Question		Marking details	Marks Available
	(b)	<p>A. Ref to DNA <b>and</b> RNA;</p> <p>B. Diagram/description of a nucleotide with correct labels/terms (phosphate &amp; pentose sugar &amp; nitrogenous/eq base);</p> <p>C. DNA named sugar Deoxyribose; must link to DNA</p> <p>D. Ref to purines and pyrimidines;</p> <p>E. Correct identification of purines and pyrimidines (Full names only);</p> <p>F. Ref to Uracil replacing thymine in RNA;</p> <p>G. Correct base pairing A-T, C-G (<i>Allow letters; allow from diagram</i>)</p> <p>H. Description/labelled diagram of <u>double</u> helix in DNA;</p> <p>I. Held together by H – bonding;</p> <p>J. Functions of DNA (i) replication in dividing cells;</p> <p>K. (ii) code/ template for protein synthesis;</p> <p>L. Description of RNA as a single chain/ strand (of nucleotides); NOT single helix</p> <p>M. Ref correct sugar Ribose in RNA; correctly linked</p> <p>N. mRNA carries genetic code from the nucleus to the ribosome;</p> <p>O. correct reference to tRNA/ribosomal RNA;</p>	
		<b>Question 8 Total</b>	<b>[10]</b>

**BIOLOGY BY2**

Question		Marking details				Marks Available	
1.	(a)		Kingdom	Phylum	Class	Genus	4
			Planta(e)/ plant(s);				
				Annelid(s)/ annelida			
				Vertebrate/ vertebrata/ chordate/ chordata;			
					Insect/ insecta;		
	(b)	(i)	A = Fungi; B = Protoctist(a)/ protoctists/ protists; NOT protozoa				2
	(ii)	A (reproduce by) spores/ hyphae/ mycelium/ chitin walls/ heterotrophic/ saprophytic/ eukaryotic; Accept description of saprophytic B membrane bound organelles present/ eukaryotic/ no tissue differentiation/ (mainly) single celled organisms/ unicellular;				2	
		<b>Question 1 total</b>				<b>[8]</b>	

Question		Marking details	Marks Available
2.	(a)	loss of water <u>vapour</u> / <u>evaporation</u> of water; from (surface of) leaf /through stomata; Accept lenticels	2
	(b)	(i) TWO precautions and TWO reasons <ul style="list-style-type: none"> <li>• Shoot cut under water/inserted under water/flood inside of apparatus with water/ assemble under water; to prevent air entering/ bubbles;</li> <li>• Shoot with large number of leaves; to ensure measurable rate of transpiration;</li> <li>• Avoid wetting leaves/ ensure leaves are dry; blocks stomata/ reduces rate of transpiration;</li> <li>• Leave time for apparatus to settle down; allow plant to adapt to new conditions/ to equilibrate;</li> <li>• Seal joints with Vaseline/ ensure screw clip is closed; to prevent air entering apparatus/ prevent leakage;</li> <li>• Ensure bubble set at appropriate position/ right hand end; to enable a (suitable) reading to be taken;</li> </ul> Reference to not allowing air bubbles to enter = 1 mark ( if no precautions are given)	4 max
	(c)	(i) Sun(light);	1
		(ii) Molecules of water moving together/ water pulled up; Because of <u>cohesion</u> of <u>molecules</u> ; <u>adhesion</u> to (walls of) { <u>xylem</u> / hydrophilic lining/ vessel wall}; root pressure {forces/ pushes} water upwards; IGNORE capillarity	2 max
	(d)	(i) A= phloem; B= xylem;	2
		(ii) {Xylem/ vascular <u>tissue</u> } is at the centre/ xylem is star shaped/ central stele; NOT bundle No vascular <u>bundles</u> / peripheral vascular <u>bundles</u> in stem; Endodermis visible in root/ no pith;	2 max
<b>Question 2 total</b>			<b>[13]</b>

Question		Marking details	Marks Available
3.	(a)	<p>Any 4            Intercostal muscles <u>contract and</u> ribs move <u>up and out</u>;</p> <p>Diaphragm (muscles) <u>contract and</u> diaphragm <u>flattens</u>;</p> <p>(Internal) volume of <u>thorax</u> increases;            accept chest reject lungs</p> <p>Pressure in lungs/ thorax decreases;</p> <p>{Higher/ <u>difference</u> in} air <u>pressure</u> outside {forces/ pushes/ moves/ drawn} air into lungs;</p>	4
	(b)	<p>(i) blood flows across (gills/ filaments/ lamellae/ gill plates) in opposite direction to water;            water always has more oxygen than blood/ (oxygen) {diffusion/ concentration} gradient maintained;            oxygen passes from water into blood;            across entire {gill/ gas exchange} surface; NOT longer higher saturation of blood with oxygen/ more oxygen taken up;</p> <p>(ii) Parallel (flow);</p> <p>(iii) Equilibrium is reached (part way across the gill plates/ lamellae)/{diffusion/ concentration} gradient not maintained;            {Lower percentage saturation with/ <u>only</u> 50% saturation} oxygen/ less oxygen uptake/ less diffusion of oxygen; NOT slower</p>	4  1  2
	(c)	<p>gills dry out;            prevents oxygen from dissolving on surface of gills;</p> <p>gills may {stick together/not open as easily/ collapse};            decrease in surface area;</p> <p>(Explanation cannot be accepted alone)</p> <p><b>Question 3 Total</b></p>	2 max      <b>[13]</b>

Question		Marking details	Marks Available
4.	(a)	(i) C/ D;	1
		(ii) K <u>and</u> F;	1
		(iii) C;	1
		(iv) E;	1
		(v) F;	1
		(vi) J;	1
	(b)	(i) Herbivorous/ herbivore;	1
		(ii) {large/ridged/WM shape} {molars/premolars} for <u>grinding</u> ;  {diastema/space with no teeth/ gap between teeth} to assist with {chewing/ (tongue to) manipulate food/ cud};  {well developed/ sharp/ long} incisors for {biting/ cutting/ slicing/ tearing} (vegetation);  loose articulation/ jaw moves in a {horizontal/ circular} plane;  Very small/ no canines;  open roots to allow continuous growth of molars;	3max
		(iii) Four <u>chambered</u> stomach (NOT four stomachs) / rumen/ large caecum; Contain cellulose digesting bacteria/ have cellulase producing bacteria; NOT cellulose eating bacteria Long gut {to allow extra time for digestion of cellulose/ cellulose harder to digest}; Cud is regurgitated for further chewing;	2
		<b>Question 4 Total</b>	<b>[12]</b>

Question		Marking details	Marks Available
5.	(a)	Parasites (are organisms that) live {on/ in} {another organism/ host} <u>and</u> obtain {nourishment/ nutrients} from it; at the expense of /causing harm to the host;	2
	(b)	attaches to gut wall by {hooks <u>and</u> suckers/ scolex}; { <u>large/ high/ increased</u> } <u>surface area to volume</u> ratio; {digested products/ nutrients} in host gut absorbed into tapeworm; short diffusion pathway;	3 max
		<b>Question 5 Total</b>	<b>[5]</b>



Question			Marking details	Marks Available
6.	(a)	(i)	sucrose is produced in (photosynthesising) leaf/ leaves are the source of sucrose; sucrose travels in phloem; phloem removed (by the ringing process); sucrose cannot flow to roots/ is blocked;	3 max
		(ii)	amino acids/hormones/ florigen;	1
	(b)	sucrose used for {cell wall formation/ cell division/ mitosis/ respiration}; {Less/ no} sucrose used (by growing areas/sinks as they have been removed); therefore more will pass down stem; NOT accumulation	2 max	
	(c)	sucrose not replaced from above (the ring); so concentration decreases; as movement towards root continues; and sucrose used in respiration/storage/ converted to starch/ growth/ active transport;	3 max	
<b>Question 6 Total</b>				<b>[9]</b>

Question		Marking details	Marks Available
7.	(a)	<p>(i)</p> <p>Fish/ amphibians</p> <ul style="list-style-type: none"> <li>A. Fish/ amphibians show external fertilisation;</li> <li>B. Fertilised {egg/ zygote/ embryo} develops outside body of parent;</li> <li>C. Many eggs/ young produced;</li> <li>D. Ensures some survive;</li> </ul> <p>Reptiles/ birds mammals</p> <ul style="list-style-type: none"> <li>E. Reptiles / Bird / Mammals internal fertilisation;</li> <li>F. This allows gametes to be independent of water;</li> <li>G. Increased chance of fertilisation/ fewer gametes {needed/ wasted};</li> </ul> <p>Reptiles/ birds</p> <ul style="list-style-type: none"> <li>H. (Evolution of an) amniote egg;</li> <li>I. eggs surrounded by protective shell/ preventing dessication;</li> </ul> <p>mammals</p> <ul style="list-style-type: none"> <li>J. Birds incubate eggs outside mothers body;</li> <li>K. Mammals – development inside mothers body;</li> <li>L. Nutrients/ oxygen via placenta;</li> <li>M. Young born well developed;</li> <li>N. Birds/ mammals exhibit parental care;</li> <li>O. Relationship between parental care and number of offspring produced;</li> </ul> <p><b>Question 7 Total</b></p>	<b>[10]</b>

Question		Marking details	Marks Available
	(b)	<p>A. wall consists of three layers/ diagram of artery + vein labelled correctly;</p> <p>B. <u>smooth endothelial</u> (lining);</p> <p>C. to reduce friction;</p> <p>D. {outer layer/ tunica externa} of <u>collagen</u> ( can be on diagram)</p> <p>E. to resist/prevent overstretching;</p> <p>F. artery has a thick wall to resist pressure;</p> <p>G. contain a <u>thick</u> layer of <u>elastic</u> tissue;</p> <p>H. { for <u>elastic recoil/ small lumen</u>} to maintain pressure;</p> <p>I. Smooth muscles in {small arteries/ arterioles} {regulate blood flow/pressure/ ref to vasoconstriction};</p> <p>J. arteries closer to the heart have more elastic tissue;</p> <p>K. semilunar valves in aorta/ pulmonary artery;</p> <p>L. Veins have valves to {<u>prevent backflow of blood/ to maintain unidirectional flow</u>};</p> <p>M. Walls are thin(ner) because blood at lower pressure;</p> <p>N. (skeletal) muscle contraction returns blood to heart;</p> <p>O. Large lumen reduces resistance to flow/ friction;</p> <p><b>Question 7 Total</b></p>	<b>[10]</b>

**GCE HUMAN BIOLOGY - HB2**

<b>Question</b>		<b>Marking details</b>	<b>Marks Available</b>
<b>1</b>	<i>(a)</i>	Endemic;	<i>1</i>
	<i>(b)</i>	carrier;	<i>1</i>
	<i>(c)</i>	vector;	<i>1</i>
	<i>(d)</i>	bacteriostatic;	<i>1</i>
	<i>(e)</i>	Infectious;	<i>1</i>
		<b>Question 1 total</b>	<b>[5]</b>

Question			Marking details	Marks Available
2	(a)		Mammalia/ mammals/ mammalian;	1
	(b)		a group of organisms (with similar characteristics) that can <u>interbreed</u> ; NOT breed alone/ reproduce and produce <u>fertile</u> offspring;	2
	(c)	(i)	reference to <u>shape of skull/jaw/cranium/ teeth</u> being similar (allow converse for Gorilla);	1
		(ii)	<i>Homo erectus</i> ; ( <i>erectus</i> and <i>sapiens</i> ) share same genus; allow converse	2
	<b>Question 2 total</b>			<b>[6]</b>

Question		Marking details	Marks Available															
3	(a)	(i) ileum	1															
		(ii) <u>Hepatic portal vein</u> ;	1															
		(iii)	4															
		<table border="1"> <thead> <tr> <th>Letter</th> <th>Name</th> <th>Role in digestion</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>Microvilli;</td> <td>Increases surface area</td> </tr> <tr> <td>C</td> <td>Mucosa;</td> <td>Contains glands that release secretions</td> </tr> <tr> <td>D</td> <td>Submucosa;</td> <td>Contains vessels to transport products of digestion</td> </tr> <tr> <td>E</td> <td>Muscle layer</td> <td>Peristalsis/ or description;</td> </tr> </tbody> </table>	Letter	Name	Role in digestion	B	Microvilli;	Increases surface area	C	Mucosa;	Contains glands that release secretions	D	Submucosa;	Contains vessels to transport products of digestion	E	Muscle layer	Peristalsis/ or description;	
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	(b)	<p>(coeliac disease results in) {flattening/truncating/blunting/damage} to villi;</p> <p>reduced surface area for <u>absorption</u>; NOT uptake</p> <p>(fatigue due to) <u>less</u> nutrients <u>absorbed</u>/less glucose for respiration; NOT less food absorbed</p> <p>(diarrhoea due to) less water absorbed;</p> <p><b>Question 3 Total</b></p>	<p>Max 3</p> <p><b>[9]</b></p>															

Question		Marking details	Marks Available								
4	(a)	large surface area; thin walls; NOT cell wall { <u>extensive/large</u> } <u>capillary</u> network; (NOT good blood supply)	3								
	(b)	Any one from <table border="1" data-bbox="427 465 1241 855"> <thead> <tr> <th>Adaptation</th> <th>Explanation</th> </tr> </thead> <tbody> <tr> <td>large surface area</td> <td>increases area over which <u>diffusion</u> can occur;</td> </tr> <tr> <td>thin walls</td> <td>reduces <u>diffusion</u> distance/ short diffusion paths; Not diffusion occurs faster</td> </tr> <tr> <td>extensive capillary network</td> <td>maintains <u>diffusion</u> gradient;</td> </tr> </tbody> </table>	Adaptation	Explanation	large surface area	increases area over which <u>diffusion</u> can occur;	thin walls	reduces <u>diffusion</u> distance/ short diffusion paths; Not diffusion occurs faster	extensive capillary network	maintains <u>diffusion</u> gradient;	1 max
	Adaptation	Explanation									
	large surface area	increases area over which <u>diffusion</u> can occur;									
	thin walls	reduces <u>diffusion</u> distance/ short diffusion paths; Not diffusion occurs faster									
extensive capillary network	maintains <u>diffusion</u> gradient;										
(c)	reduced surface area/fewer alveoli/ alveoli {coalesce/ merge}; alveoli walls are <u>thicker</u> ; increases diffusion distance; loss of elasticity; reduces tidal volume/reduces recoil; less oxygen absorbed; (cannot supply sufficient oxygen) for <u>aerobic</u> respiration;	4 max									
(d)	surfactant not produced/ lack surfactant/ less surfactant; surfactant reduces surface tension; alveoli close/stick together/ collapse Accept converse;	2									
<b>Question 4 Total</b>			<b>[10]</b>								

Question		Marking details	Marks Available
5	(a)	<p>A = collagen (fibres); Accept <i>tunica externa/adventitia</i>            B = (elastic) muscle (layer); Accept <i>tunica media</i>            C= endothelium; Accept <i>tunica intima/ interna</i></p> <p>Three correct 2 marks            Two correct 1 mark</p>	2
	(b)	(i) (High cholesterol diet) causes fat deposition/ atheroma/ plaques; NOT cholesterol Causes atherosclerosis; causes thrombosis/ blood clot;	2 max
		(ii) Smoking/stress/lack of exercise;	1
	(c)	(i) Little change/ slight increase 1961-1971; Large increase / ref to nearly doubling {1971-1981/ in 1981}; Decrease 1981-2009 (decade on decade); to the same level as 1961;	3
		(ii) (better treatments) e.g. use of clot busting drugs/warfarin/ streptokinase/ any valid drug; Angioplasty; By-pass surgery; Improved {awareness/ education} as to risks of smoking / poor diet; Better/ improved monitoring qualified e.g. blood pressure checks/ cholesterol	Max 3
		<b>Question 5 Total</b>	<b>[11]</b>



Question		Marking details	Marks Available	
6	(a)	<p>sanitation/ safe disposal of sewage/ good hygiene;  provision of {clean/ safe} drinking water/ bottled water;  vaccine;  Reject-antibiotic use/ oral rehydration therapy</p>	Max 2	
	(b)	(i)	<p>lipoprotein;  lipopolysaccharide;  (Accept: porins)</p>	2
		(ii)	X= peptidoglycan/ murein;	1
		(iii)	red/ pink;	1
		(iv)	<p>Penicillin prevents <u>formation</u> of {cross linkages/peptidoglycan}  in cell wall;  (Cholera) is a gram negative bacterium;  therefore has <u>very little</u> peptidoglycan;  lipopolysaccharide layer protects cell from penicillin action;</p>	3
<b>Question 6 Total</b>			<b>[9]</b>	

Question		Marking details	Marks Available
7	(a)	4;	1
	(b)	{variable region/ antigen binding site} is <u>complimentary</u> to antigen;	1
	(c)	Humoral;	1
	(d)	AIDS is end stage HIV infection; <u>helper T-cells</u> {attacked/ targeted/ destroyed}/ less helper T cells; can't {cooperate with/ stimulate/ activate} B lymphocytes; (allow converse) which produce antibodies;	Max 3
	(e)	active immunity individual <u>produces</u> antibodies; in response to infection / vaccination; (allow description for vaccination or infection) passive immunity individual { <u>receives/ acquires/ given</u> } antibodies; from placenta/breast milk / via antibody injection; active immunity gives longer lasting protection than passive (allow converse); due to production of <u>memory cells</u> /or converse;  <i>Max 2 if no comparison made</i>	4
		<b>Question 7 Total</b>	<b>[10]</b>

Question		Marking details	Marks Available
8	(a)	<p>A. Endoparasite definition i.e. lives inside body of/ within host causing <u>harm</u>/at expense of host;</p> <p>B. <u>Malaria caused by</u> Plasmodium spp;</p> <p>C. parasite multiplies in red blood cells/ liver, bursting to release more parasites;</p> <p>D. <u>female</u> mosquitoes feeding {transmit parasite to new host/ act as vectors};</p> <p>E. {Blood flukes/<u>Schistosomes</u>} live in blood vessels;</p> <p>F. supplying bladder/intestine;</p> <p>G. (intermediate) host is snail, releases (infective) larvae (in freshwater);</p> <p>H. larvae able to penetrate human skin and enter bloodstream;</p> <p>I. (adult flukes) produce many eggs and shed via faeces/urine;</p> <p>J. {Ascaris/ roundworms} lives in small intestine;</p> <p>K. (female worm) releases 200,000 eggs/ very large numbers per day (via faeces);</p> <p>L. {(Pork) tapeworm/ Taenia solium} has a large surface area to absorb nutrients; NOT food</p> <p>M. has {suckers/hooks/scolex} for attachment to <u>intestine wall</u>;</p> <p>N. has thick cuticle to withstand {digestive enzymes/ production of inhibitory substances};</p> <p>O. produces large numbers of eggs/ has resistant stages to overcome period away from host;</p> <p><b>Question 8 Total</b></p>	[10]

Question		Marking details	Marks Available
8	(b)	<p>A. Oxygen combines with haemoglobin;</p> <p>B. to form oxyhaemoglobin;</p> <p>C. inside red blood cell;</p> <p>D. Ref to adaptation e.g. large SA/no nucleus/biconcave;</p> <p>E. Some carbon dioxide carried in RBC/ as carbamino-haemoglobin;</p> <p>F. Most carried as bicarbonate ions/HCO<sub>3</sub><sup>-</sup>;</p> <p>G. Conversion of CO<sub>2</sub> to HCO<sub>3</sub><sup>-</sup> (in RBC);</p> <p>H. HCO<sub>3</sub><sup>-</sup>- carried <u>dissolved</u> in plasma;</p> <p>I. Ref to chloride shift;</p> <p>J. which maintains electrochemical neutrality;</p> <p>Max 7</p> <p>K. (during exercise) <u>increased</u> carbon dioxide <u>in blood</u>;</p> <p>L. lowers pH of blood;</p> <p>M. <u>haemoglobin's</u> oxygen <u>affinity reduced</u>;</p> <p>N. <u>Bohr</u> effect/ shift;</p> <p>O. {causes oxyhaemoglobin to dissociate/ oxygen released more} {readily/easily};</p> <p>Max 3</p> <p><b>Question 7 Total</b></p>	<b>[10]</b>

## GCE BIOLOGY - BY4

Question		Marking details	Marks Available
<b>1</b>	(a)	effectors /{carry out/ bring about} the response/ react to a stimulus;	1
	(b)	only have a nerve net /no CNS / (nerve fibres) non-myelinated/ branching neurons/ narrower axons; NOT shorter neurons/ no reflex arc	1
	(c)	phytochrome;	1
	<b>Question 1 total</b>		<b>[3]</b>

Question		Marking details	Marks Available
2	(a)	axes correctly assigned with correct labels; appropriate linear scales; all points correctly plotted and joined with a curve or ruled straight lines; (tolerance ½ small square)	3
	(b)	birth rate must be greater because {population rose/ sensible explanation};	1
	(c)	(i) Any two from nesting / roosting sites (in oakwoods)/ space in habitat; NOT habitat destruction/ shelter source of food/ number of prey; mates; parasites / disease ;	2
		(ii) Extreme climate/ severe weather / harsh winter /drought/ wind farms/fires/shooting/poisoning/pesticides/egg collecting/ habitat destruction/ deforestation/ flooding/ new top predator;	1
<b>Question 2 total</b>			<b>[7]</b>

Question			Marking details	Marks Available
3	(a)	(i)	A;	1
		(ii)	A <u>and</u> D;	1
		(iii)	C;	1
	(b)	(i)	{RuBP/ 5C compound} and carbon dioxide linked together / carbon dioxide is fixed with RuBP; RuBP carboxylase / RUBISCO {is the enzyme / catalyses the reaction}; unstable 6C {substance/compound} {initially formed/ splits into two 3C};	2 max
		(ii)	Glycerate 3 phosphate reduced; using reduced NADP; ATP also required (to supply energy) / Glycerate 3 phosphate is phosphorylated; {reduced NADP / ATP} from the light dependent reactions;	3 max
	(c)	(i)	some (triose phosphate) needed to {regenerate/ make more} RuBP;	1
		(ii)	six times;	1
			<b>Question 3 Total</b>	<b>[10]</b>

Question		Marking details	Marks Available
4	(a)	(improves) aeration / ensures all parts of the culture receive oxygen; helps to mix the contents / prevent {sedimentation/ clumping}; improves contact with nutrients;	2
	(b)	(i) Monitor pH; used to determine whether acid or alkali must be added; to maintain optimal pH/ pH required for growth;	2
		(ii) carbon dioxide;	1
		(iii) heat needed at the start to speed up {enzyme reactions/ growth/ metabolic rate}; removal of heat produced by respiration/ more microbes at the end so more respiration/heat ;	2
	(c)	competition for nutrients/ oxygen; NOT food lower yield; toxic products; contamination of <u>product</u> ;	2
<b>Question 4 Total</b>			<b>[9]</b>



Question		Marking details	Marks Available
5	(a)	(i) phosphate / Pi / inorganic phosphate/ iP/ PO <sub>4</sub> <sup>3-</sup> ;	1
		(ii) W is outer (mitochondrial) membrane; Z is the (mitochondrial) matrix;	2
		(iii) most concentrated in part X;	1
	(b)	(reduced NAD) supplies protons; and brings (high energy) electrons; electrons {supply energy for proton pumping/ fuels proton pumps};	2
	(c)	(i) P = ADP/ ADP + Pi } Q = ATP }	1
		(ii) cytoplasm/ cytosol;	1
		(iii) glucose is phosphorylated by ATP; two phosphorylations / production of hexose/fructose (bi)phosphate; hexose (bi)phosphate is <u>split</u> (from 6C to two 3C);	3
	(d)	(i) allows reduced NAD to be converted back to NAD/ regenerate reduced NAD/ without oxygen reduced NAD not converted to NAD by {electron transport chain/ krebs/ link reaction}; allowing ATP production/ without oxygen no ATP production by oxidative phosphorylation; allows {glycolysis/ substrate level phosphorylation} to continue/ ORA; No O <sub>2</sub> to act as the final {hydrogen/ electron} acceptor/ NADH {must find an alternative hydrogen acceptor/ must use pyruvate};	3
		(ii) Only glycolysis required/ shorter metabolic pathways; oxygen supply too slow/ no need for oxygen {supply/diffusion}; no need to carry out Krebs cycle/ electron transport / oxidative phosphorylation; no need to build up a proton gradient; no need to transport pyruvate into the mitochondrion;	Max 1
			<b>Question 5 Total</b>

Question		Marking details	Marks Available	
6	(a)	X is the node of <u>Ranvier</u> ; Y is axon /axoplasm;	2	
	(b)	Schwann (cell);	1	
	(c)	-60 <u>mV</u> ;	1	
	(d)	(i)	(voltage-gated) sodium channels open/ increase in sodium ion permeability; {sodium ions / Na <sup>+</sup> } {diffuse/ flood/ rush/ sudden influx} <u>in</u> ;	2
		(ii)	repolarisation;	1
	(e)	resting potential is lower / more negative in {B/ the cardiac muscle fibre}/ ORA; slower repolarisation / time taken to get back to resting potential is longer in {B/ the cardiac muscle fibre}/ ORA; higher peak of depolarisation /more positive potential reached in {A/ neurone}/ ORA; {no hyperpolarisation/ refractory period/ undershoot} in Trace B;	2 max	
	(f)	contraction; NOT contract faster	1	
	(g)	Frog has right to life / {suffering/ pain/ distress/ harm} of frog / frogs scarce in the wild; NOT cruel benefits to <u>medicine/ health of heart</u> research;	2	
	<b>Question 6 Total</b>			<b>[12]</b>

Question		Marking details	Marks Available
7	(a)	renal artery;	1
	(b)	many {pores/ gaps} in the {capillary wall/endothelium / fenestrated wall}; basement membrane with {pores / molecular sieve} (through which large molecules cannot pass); efferent arteriole has {smaller <u>diameter</u> / narrower <u>lumen</u> } than afferent;	2 max
	(c)	(all) glucose (selectively) reabsorbed; (reabsorption)in the proximal convoluted tubule; (reabsorption) by active transport;	2 max
	(d)	(i) <ul style="list-style-type: none"> <li>A. water {reabsorbed from filtrate/removed from filtrate};</li> <li>B. less urea reabsorbed / urea not reabsorbed;</li> <li>C. {sodium / mineral ions} reabsorbed in proximal convoluted tubule;</li> <li>D. therefore water reabsorbed by osmosis in proximal convoluted tubule;</li> <li>E. {active transport/ pumping} of Na<sup>+</sup> ions in the ascending limb of the loop of Henle;</li> <li>F. water reabsorbed from filtrate in the descending limb of loop of Henle/ descending limb is permeable to water/ ascending limb impermeable;</li> <li>G. hypertonic conditions /high solute concentrations in the medulla/ lowering water potential of medulla/ correct description of concentration gradient towards apex of loop;</li> <li>H. therefore water reabsorbed in the collecting duct/distal convoluted tubule;</li> </ul>	5 max
		(ii) less water lost (in urine)/ conserves water; reduces risk of dehydration; useful in dry habitats/ adaptation to terrestrial life;	2 max
(e)	ADH /anti diuretic hormone; {increases reabsorption of water/ increases permeability of collecting duct to water / opens more aquaporins} <u>so increases ion concentration</u> ;	2	
<b>Question 7 Total</b>			<b>[14]</b>

Question		Marking details	Marks Available
8	(a)	<p>A absorption of light {in photosystems/by pigments};</p> <p>B energy transferred to reaction centre of photosystem /antenna complex;</p> <p>C (a molecule of) chlorophyll a is the reaction centre;</p> <p>D electrons excited / electrons {raised to higher energy level / emitted}/ high energy electrons produced;</p> <p>E {high energy / excited} electrons passed to electron acceptor/ first carrier in chain};</p> <p>F electrons (from Photosystem II) pass along {a chain of electron carriers/ electron transport chain};</p> <p>G energy from electrons used to pump protons;</p> <p>H higher concentration of protons <u>inside thylakoid</u> (than in the stroma)/ concentration gradient of protons from thylakoid to stroma;</p> <p>I used to produce ATP;</p> <p>J Photosystem I receives electrons from{ the chain of carriers / from Photosystem II};</p> <p>K Electrons {used to reduce NADP /to produce reduced NADP};</p> <p>L photolysis of water provides electrons to replace those lost by Photosystem II;</p> <p>M oxygen produced {by photolysis /by splitting of water};</p> <p>N cyclic photophosphorylation only involves Photosystem I/ non cyclic involves both photosystems;</p> <p>O light dependent reactions take place {in thylakoid (membranes)/ in (membranes of) grana};</p> <p>[Marks can be awarded for points made using an annotated diagram]</p>	

Question		Marking details	Marks Available
	(b)	<p><i>Nitrogen cycle</i></p> <p>A death of plant / shedding of {leaf/other part of plant};</p> <p>B consumers feed on plant material then {die / excrete /defecate/ egest};</p> <p>C putrefaction due to bacteria/ decomposition due to{ fungi/ bacteria};</p> <p>D digestion of protein to amino acids;</p> <p>E deamination of amino acids/ ammonification;</p> <p>F nitrification is conversion of {ammonia/ ammonium} to nitrate;</p> <p>G <i>Nitrosomonas</i> convert {ammonia/ ammonium} to nitrite;</p> <p>H <i>Nitrobacter</i> convert nitrite to nitrate;</p> <p>I plants absorb nitrate from the soil;</p> <p><i>Roles of nitrogen in metabolism</i></p> <p>J in amine/ amino group;</p> <p>K needed to make amino acids / proteins;</p> <p>L part of (organic) bases ;</p> <p>M needed to make DNA / RNA / nucleic acids/ nucleotides;</p> <p>N part of chlorophyll;</p> <p>O part of NADP/ ATP;</p> <p><b>Question 8 Total</b></p>	<b>[10]</b>

**GCE HUMAN BIOLOGY - HB4**

<b>Question</b>		<b>Marking details</b>	<b>Marks Available</b>
<b>1</b>	<i>(a)</i>	colony;	1
	<i>(b)</i>	living;	1
	<i>(c)</i>	Gram positive;	1
	<i>(d)</i>	spirillum;	1
		<b>Question 1 total</b>	<b>[4]</b>

Question		Marking details	Marks Available
2	(a)	mitochondrion; matrix;	2
	(b)	(i) pyruvate to acetyl Co-A; iso citrate to oxaloglutarate and oxaloglutarate to succinate;	2
		(ii) decarboxylation;	1
		(iii) diffuses out of mitochondria; into blood/ tissue fluid/ plasma; carried as hydrogen carbonate ions; breathed out;	3 max
	(c)	dehydrogenation/ dehydrogenase activity/ oxidation of intermediates/compounds; removal of hydrogen ions; stepwise/series of reactions; five pairs of hydrogens; NAD to NADH <sub>2</sub> / reduced NAD/ NADH <sup>+</sup> +H <sup>+</sup> ;	3 max
(d)	Pyruvate is used to form lactic acid; Regenerate NAD;	2	
		<b>Question 2 total</b>	<b>[13]</b>

Question		Marking details	Marks Available
3	(a)	maintenance/control of internal environment; at set point/constant/stable; despite external changes;	2 max
	(b)	hypothalamus; Posterior; Pituitary; ADH; Collecting duct walls/ distal convoluted tubules; Increases/ rises/ high;	6
		<b>Question 3 Total</b>	<b>[8]</b>



Question		Marking details	Marks Available	
4	(a)	anaerobic respiration; lactate/lactic acid produced; accumulates in muscle/not removed into blood rapidly enough; low pH in muscle; enzymes less effective; exhaustion of energy glycogen;	3 max	
	(b)	endurance events are aerobic; oxygen debt does not develop; little anaerobic respiration; no lactate/lactic acid; maximum energy; from fat/glycogen; longer to reach fatigue; improved blood supply;	3 max	
	(c)	(i)	improves supply of oxygen; improves removal of carbon dioxide; improves removal of lactic acid; decreases diffusion distance; increases surface area for exchange;	2 max
		(ii)	increase in number/size of mitochondria; increase in enzymes of Krebs cycle; increase in size of muscle fibres; increase in ETC molecules; increase in myoglobin	2 max
	<b>Question 4 Total</b>			<b>[10]</b>

Question		Marking details	Marks Available
5	(a)	improves aeration / ensures all parts of the culture receive oxygen; helps to mix the contents / prevent sedimentation; improves contact with nutrients;	2
	(b)	(i) used to monitor pH/to measure pH ; used to determine whether acid or alkali must be added; to maintain optimal pH;	2
		(ii) carbon dioxide;	1
		(iii) heat needed at the start to speed up enzyme reactions; removal of heat produced by respiration; more microbes at the end so more respiration/heat;	2
<b>Question 5 Total</b>			<b>[7]</b>

Question		Marking details	Marks Available	
6	(a)	(i) A = collecting duct; B = efferent arteriole; C = glomerulus; D = afferent arteriole; E = Bowman's/renal capsule; F = loop of Henlé; (one mark for every two correct)	3	
		(ii) line to proximal convoluted tubule;	1	
		(iii) line to proximal convoluted tubule;	1	
		(iv) causes increase in blood pressure; forces components of plasma into Bowman's capsule; ultrafiltration;	2	
	(b)	(i) same concentration of both in plasma and filtrate; forced from plasma/ glomerulus into capsule; small molecules; so can pass through gaps;	3 max	
		(ii) concentration of urea increases in tubule; so water is reabsorbed; figs to support (1.0 – 1.7); into capillaries; urea not reabsorbed;	4 max	
		(iii) glucose normally reabsorbed in proximal convoluted tubule; ratio falls from 1.0 to 0.0 in untreated kidney; prevented by chemical Z; ratio in untreated kidney therefore rises from 1.0 to 1.4; because of water reabsorption;	3 max	
		(iv) inhibits active transport/ blocks protein pores; Respiratory inhibitor/ less ATP/Affects co transport;	1 max	
	<b>Question 6 Total</b>			<b>[18]</b>

Question		Marking details	Marks Available
7	(a)	inner membrane/crista;	1
	(b)	ref to NADH/FADH; membrane impermeable to protons; pumped across membrane; to intermembrane space;	3 max
	(c)	accepts electrons and protons; final acceptor of ETC; forms water; to maintain flow of electrons;	2 max
	(d)	substrate level phosphorylation; glycolysis; triose phosphate to pyruvate; by dehydrogenation; 2 ATP per glucose formed;	4 max
	<b>Question 7 Total</b>		<b>[10]</b>

Question		Marking details	Marks Available
8	(a)	<p>A = resting potential;</p> <p>B = -60 to -70mV;</p> <p>C = sodium potassium pump sends sodium ion out and potassium ions in;</p> <p>D = potassium ions diffuse/ pass out;</p> <p>E = depolarisation of membrane;</p> <p>F = +40mV;</p> <p>G = opening of sodium channels/gates;</p> <p>H = sodium ions rush in;</p> <p>I = sodium channels close;</p> <p>J = potassium channels open;</p> <p>K = potassium ions flow out;</p> <p>L = resting potential restored/repolarisation;</p> <p>M = ref to local circuits( at nodes of Ranvier);</p> <p>N = refractory period;</p> <p>O = ref to myelination and speed of conduction;</p>	

Question		Marking details	Marks Available
8	(b)	<p>A = light energy converted to chemical energy;</p> <p>B = light trapped by chlorophyll/photosystems;</p> <p>C = electron emitted;</p> <p>D = passed along a chain of carriers;</p> <p>E = ATP produced;</p> <p>F = reduced NADP produced;</p> <p>G = hydrogen from photolysis of water;</p> <p>H = electron from photolysis replaces that lost from PSII; 5 max</p> <p>I = carbon dioxide combines with RuBP;</p> <p>J = enzyme RUBISCO/RuBP carboxylase;</p> <p>K = two molecules of GP/PGA formed;</p> <p>L = converted to triose phosphate;</p> <p>M = using ATP and reduced NADP;</p> <p>N = triose phosphate converted to hexose/glucose;</p> <p>O = RuBP regenerated 5 max</p> <p><b>Question 8 Total</b></p>	<b>[10]</b>

GCE BIOLOGY BY5

SUMMER 2013

Question		Marking details	Marks Available
1.	(a)	<p><b>Seminiferous tubule</b> - (meiosis) sperm production/ spermatogenesis; <i>Accept spermatids</i></p> <p><b>Seminal vesicles</b> - produce nutrient (solution) for sperms; <i>Accept aids sperm motility/ mobility</i></p> <p><i>Reject Neutralise acidic urine</i></p>	2
	(b)	<p><b>Ligase</b> - {splices / joins} two {sections of DNA/ groups of nucleotides/ sugar phosphates} together;</p> <p><i>Accept joins (donor) DNA into a {plasmid/ vector}</i></p> <p><i>Reject joins strands of DNA</i></p> <p><b>Polymerase</b> - joins single nucleotides to end of a DNA chain;</p> <p><i>Accept addition of {free/single} nucleotides to {exposed (DNA) bases/ template};</i></p>	2
	(c)	<p><b>Gene</b> - {section of DNA / chromosome} which codes for a {single polypeptide / protein/ sequence of amino acids};</p> <p><b>Allele</b> - {different/ specific} {forms/ versions} of {a/same} gene;</p> <p><i>Accept different types of the <u>same</u> gene</i></p>	2
	(d)	<p><b>Primary succession</b> {Colonisation of/ introduction of species to} an area where no living organisms have lived before;</p> <p><b>Secondary succession</b> colonisation of area where living organisms had previously lived/ recolonisation / reintroduction of species.</p> <p><b>Question 1 total</b></p>	2
			<b>[8]</b>

Question			Marking details	Marks Available
2.	(a)	(i)	<p>A. <u>Variation</u> in age at which sexual maturity is reached;</p> <p>B. Caused by mutation;</p> <p>C. Reach sexual maturity earlier/ Small fish {have a selective advantage/ pass through net}/ ora;</p> <p>D. Breed/ reproduce; <i>reject mate</i></p> <p>E. Pass on alleles to offspring; <i>reject genes</i></p> <p>F. Allele frequency for earlier maturity / hence small size at maturity increases;</p> <p>G. Figs quoted from graph (in context);</p>	Max 5
		(ii)	<p>Very few large cod survived/ ORA; <i>reject none</i></p> <p>reduced gene pool;</p> <p>{No/ little} mutation (to increase size) / insufficient time for genetic drift (to increase size) / No gene flow from another gene pool;</p> <p>Small fish produce less gametes/ difficulty in breeding/ few fish remain to reproduce/ reproductive isolation;</p> <p>Not enough food/ increased competition for food/ increased predation/ disease;</p> <p>Change in {temperature/ pH}/ pollution;</p>	Max 3
	(b)	<p>Restricted fishing times/ hours;</p> <p>Quotas/ licenses;</p> <p>Exclusion zones/ OWTTE;</p> <p>Limiting numbers of fishing vessels/ international agreements limiting catches;</p> <p>Limiting season;</p> <p>Restriction of <u>area</u> of nets;</p> <p>Closing spawning and/ or nursery areas;</p> <p><i>REJECT any reference to mesh size</i></p>	2	



Question		Marking details	Marks Available
	(c)	(i) Eutrophication/ pollution; {Disease/ parasites} more likely (to spread) in {cultivated fish/ overcrowded conditions}/ disease may spread to wild fish; {Antibiotics/ pesticides} qualified e.g. can harm other marine organisms/ bioaccumulation of pesticides/ enters food chain/ high cost; Problems associated with flow of alleles into wild population; Higher level of dioxins/ PCBs in farmed fish;	2
		(ii) Three of each type of chromosome / {odd/uneven} number of chromosomes/ unpaired chromosomes; No pairing of <u>homologous</u> chromosomes/ no bivalent formed; Prophase 1 meiosis; Meiosis does not take place; No gametes produced;	Max 4
		<b>Question 2 total</b>	<b>[16]</b>

Question		Marking details	Marks Available																				
3.	(a)	(i) (Genes) on the {X/ Y} chromosomes; Reject sex chromosomes Accept (genes) on sex chromosomes not on the autosomes	1																				
		(ii) <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Parents</td> <td colspan="2"><math>X^H Y</math></td> <td colspan="2"><math>X^H X^h</math> ;</td> </tr> <tr> <td>Gametes</td> <td><math>X^H</math></td> <td>Y</td> <td><math>X^H</math></td> <td><math>X^h</math> ;</td> </tr> <tr> <td>Offspring</td> <td><math>X^H X^H</math></td> <td><math>X^H X^h</math></td> <td><math>X^H Y</math></td> <td><math>X^h Y</math> ;</td> </tr> <tr> <td></td> <td>Normal female</td> <td>Normal/ Carrier female</td> <td>Normal male</td> <td>Haemophiliac/ sufferer/ affected} male;</td> </tr> </table> <p><i>Suitable symbols with key eg. <math>X^N X^n</math> max 3</i>  <i>Suitable symbols with no key max 2</i>  <i>Reject crosses not involving X and Y chromosomes</i>  <i>If wrong genotypes ecf apart from phenotype of offspring which must correctly identify a haemophiliac son</i></p>	Parents	$X^H Y$		$X^H X^h$ ;		Gametes	$X^H$	Y	$X^H$	$X^h$ ;	Offspring	$X^H X^H$	$X^H X^h$	$X^H Y$	$X^h Y$ ;		Normal female	Normal/ Carrier female	Normal male	Haemophiliac/ sufferer/ affected} male;	4
		Parents	$X^H Y$		$X^H X^h$ ;																		
		Gametes	$X^H$	Y	$X^H$	$X^h$ ;																	
Offspring	$X^H X^H$	$X^H X^h$	$X^H Y$	$X^h Y$ ;																			
	Normal female	Normal/ Carrier female	Normal male	Haemophiliac/ sufferer/ affected} male;																			
(iii) None;	1																						
(iv) 0.25 / 25%; <i>Accept 1 in 4/ ¼</i> <i>Reject 1:3</i>	1																						
(b)	<table style="width: 100%; border: none;"> <tr> <td style="padding: 0 20px;">AB</td> <td style="padding: 0 20px;">ab</td> <td style="padding: 0 20px;">AB</td> <td style="padding: 0 20px;">ab ;</td> </tr> <tr> <td style="padding: 0 20px;">AABB</td> <td style="padding: 0 20px;">AaBb</td> <td style="padding: 0 20px;">AaBb</td> <td style="padding: 0 20px;">aabb ;</td> </tr> </table> <p>3:1 ;  <i>Genotypes must show some correct indication of linkage between a and b for ecf</i>  <i>Award 0 if dihybrid cross is completed</i></p>	AB	ab	AB	ab ;	AABB	AaBb	AaBb	aabb ;	3													
AB	ab	AB	ab ;																				
AABB	AaBb	AaBb	aabb ;																				

Question		Marking details	Marks Available
	(c)	<p>Incomplete linkage;</p> <p>Genes {further/ far} apart on same chromosome;</p> <p>{Crossing over/ chiasmata} can occur;</p> <p>Four types of gametes produced( but not in equal numbers);</p> <p>Small numbers of recombinants / large numbers parental types;</p> <p>Recombinants equal in numbers / parental equal in numbers;</p> <p><b>Question 3 Total</b></p>	<p>Max 2</p> <p><b>[12]</b></p>

Question		Marking details	Marks Available
4.	(a)	(i) A = Primary oocyte/ Primary follicle; B = Graafian follicle; <i>Accept secondary follicle/ theca</i> C= Corpus luteum; <i>reject yellow body</i>	3
		(ii) Ovulation;	1
		(iii) HCG/ human chorionic gonadotrop(h)in;	1
	(b)	(i) W = Oogonium/ oogonia; X = primary oocyte; Y = Secondary oocyte; Z = (first) Polar body; <i>reject nucleus accept polar cell</i>	4
		(ii) Mitosis;	1
		(iii) Correct number of chromosomes in each; X = 4 Y =2 Cell X Prophase 1 drawn correctly; chromosomes inside nuclear membrane, not on equator Cell Y Metaphase 2 drawn correctly; must be clearly on equator	3
	(c)	Polar bodies produced/ reduction in genetic material at each stage of meiosis; ecf from bi – accept polar nucleus if used in bi Functional gamete retains (most of) the cytoplasm; (Cytoplasm) acts as a food store for zygote/ provide mitochondria for zygote; needed until implantation takes place/ obtained from placenta;	2
	<b>Question 4 Total</b>		<b>[15]</b>

Question		Marking details	Marks Available
5.	(a)	(i) repeat experiments; Same area of grassland used for each test/ Same grass covering/ sludge injected to same depth/ Same {volume / mass/ concentration} of sludge/ same sludge applied/ Same soil {type/ gradient/ aspect/ exposure}/ same soil nitrate concentration/ same time of year; NOT temperature/ pH	2
		(ii) increase in rainfall increases {leaching/ nitrate concentration in soil water}; greater effect on injected sludge with increased rainfall/ ORA; only a small effect at low rainfall;	2 max
		(iii) apply (to surface) when {dry / little rainfall/ rainfall is less than [any figure less than 120]};	1
	(b)	Algal growth/ algal bloom/ overgrowth of plant; Less <u>light</u> , so {algae/ plants} <u>die</u> ; <u>{Bacteria/ saprobionts/ saprotrophs/ fungi} decompose {plants/ organic material}</u> (and increase in number); (Reject decomposers) Using up <u>oxygen</u> in <u>respiration</u> ;	3 max
	(c)	Leguminous plants/ any named leguminous plant; Rhizobium/ nitrogen fixing bacteria (in root nodules); <i>Reject nitrate fixing Azotobacter</i> Convert nitrogen (gas) into ammonium/ ammonia/ amino acids; Plants {left to decay/ ploughed in};	3
		<b>Question 5 Total</b>	<b>[11]</b>

Question		Marking details	Marks Available	
6.	(a)	Rate of Conversion of light energy into chemical energy (by producers /by photosynthesis); <i>Accept rate at which {products/ organic materials} are formed/ produced</i>	1	
	(b)	(net primary production) decreases; More {carbohydrate/ glucose} is {broken down/ used by} respiration (than is produced by photosynthesis);	2	
	(c)	(i)	(heat lost in) respiration; Excretion; egestion/not all parts of the material are digestible; not all parts eaten;	Max 2
		(ii)	Herbivores: {difficult to digest/ less efficient at digesting} cellulose/ have more {indigestible/ fibrous} material (in diet)/ ; <i>Reject cannot digest cellulose</i> Carnivores:{easily digest/ more efficient at digesting } {protein/ fat}; More { <u>egested</u> material/ faeces} (lost) by herbivores/ less { <u>egested</u> material/ faeces} lost by carnivores;	Max 2
	(d)	Productivity of producers higher/ primary productivity higher; Secondary productivity higher/ more energy stored in consumers; {Less energy {used/wasted} /respiratory rate is lower} + qualification eg.in cold blooded animals/ buoyancy; Higher {temperature/ light} higher rate of photosynthesis;	Max 1	
<b>Question 6 Total</b>			<b>[8]</b>	

Question		Marking details	Marks Available
7.	(a)	<p>A. {nucleotide/ base} sequence of DNA contains code for {primary structure of polypeptide/ amino acid sequence};</p> <p>B. Triplet base hypothesis/ 3 bases = 1 amino acid/ triplet code;</p> <p>C. transcription;</p> <p>D. RNA polymerase links to DNA;</p> <p>E. DNA unwinds / unzips;</p> <p>F. (One of) DNA strands acts as {coding/ template/ sense} strand;</p> <p>G. {mRNA } synthesised;</p> <p>H. complementary base pairing + detail of A-U C-G;</p> <p>I. mRNA leaves nucleus through a <u>nuclear pore</u>;</p> <p>J. translation;</p> <p>K. mRNA {held by/ attaches to} a ribosome/ ribosome moves along mRNA molecule;</p> <p>L. Two tRNA binding sites on each ribosome;</p> <p>M. each tRNA has its own specific amino acid;</p> <p>N. tRNA molecules bind to codon on mRNA via an anticodon;</p> <p>O. peptide bond formed between amino acids on adjacent tRNA;</p> <p>P. Reference to ATP use {in Amino acid activation/ formation of peptide bonds};</p>	

Question		Marking details	Marks Available
	(b)	<p>A. Asexually produced and genetically identical;</p> <p>B. Artificial, cuttings ;</p> <p>C. micropropagation;</p> <p>D. meristem removed;</p> <p>E. meristem is {able to differentiate/ give rise to different cell types/ totipotent}</p> <p>F. cut into <u>small pieces</u>/ explants;</p> <p>G. Culture under sterile conditions;</p> <p>H. On a nutrient {medium/ agar jelly};</p> <p>I. (Cells divide to form a) Callus ;</p> <p>J. Callus divided and {allowed to differentiate into a plantlet/ treated with plant growth substances to promote root and/or shoot growth};</p> <p><i>Max 8</i></p> <p>Advantages,</p> <p>K. speed of production;</p> <p>L. Production of large numbers;</p> <p>M. {Identical/ desired} line/ crop uniform/ disease free;</p> <p>Disadvantages</p> <p>N. Must maintain sterile conditons to avoid introduction of pathogens;</p> <p>O. Genetic instability/ increased mutation rate;</p> <p>P. loss of <u>genetic</u> variation/ reduction gene pool/ all susceptible to same diseases;</p> <p><i>Candidates must attempt an advantage and a disadvantage in order to be awarded full marks.</i></p> <p><b>Question 8 Total</b></p>	
			<b>[10]</b>





WJEC  
245 Western Avenue  
Cardiff CF5 2YX  
Tel No 029 2026 5000  
Fax 029 2057 5994  
E-mail: [exams@wjec.co.uk](mailto:exams@wjec.co.uk)  
website: [www.wjec.co.uk](http://www.wjec.co.uk)