



GCE

Human Biology

Unit **F224**: Energy, Reproduction and Populations

Advanced GCE

Mark Scheme for June 2014

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning of annotation
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.

Question	Answer	Mark	Guidance
1 (a)	(organ) is a, collection of / AW, tissues,- _____carrying out / AW, a (specific) function / AW ; <i>idea that</i> named tissue(s) allow the placenta to carry out a named function ;	2	<p><u>Must mention tissue and function</u> <u>DO NOT CREDIT cells instead of tissues</u></p> <p>CREDIT a statement such as ‘the placenta contains maternal blood which allows oxygen to be transported to the fetus’</p> <p>CREDIT reference to other types of tissue e.g. <i>idea that</i> endocrine tissue of placenta secretes hormones</p> <p><u>ACCEPT ref. to muscle in context of blood vessels</u> <u>DO NOT CREDIT reference to muscle tissue</u></p>
(b)	 <u>zygote</u> ; <u>mitosis</u> ; <u>fallopian tube / oviduct</u> ; endometrium / <u>lining</u> ;	5	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks</p> <p><u>IGNORE fertilised, oocyte / egg</u></p> <p><u>IGNORE binary fission</u></p> <p><u>DO NOT CREDIT</u> wall <u>ACCEPT lining</u></p> <p><u>ACCEPT specialise</u></p>

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Question			Answer	Mark	Guidance
			<i>differentiate / specialise;</i>		
	(c)		maintains / AW, the corpus luteum ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks <i>Look for the idea that HCG stops the corpus luteum degenerating OR keeps / stimulates, the corpus luteum secreting progesterone.</i>

Question		Answer	Mark	Guidance
	(d)	<u>multiple pregnancy</u> ;	1	DO NOT CREDIT if given as part of a list with multiple births
	(e) (i)	monochorionic-diamniotic / MoDi ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks ACCEPT correct description
	(ii)	dichorionic-diamniotic / DiDi ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks ACCEPT correct description
	(iii)	<i>idea that</i> only one placenta AND higher / AW, (oxygen) demand, (as twins, grow / develop later in pregnancy) ; umbilical cords tangle (so restricted oxygen) ; AVP ;	1	ACCEPT <u>only one, exchange system / blood supply</u>
	(iv)	ultrasound (scan) / <u>sonogram</u> / listen for 2 heartbeats ;	1	
Total			13	

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Question		Answer	Mark	Guidance
2	(a)	succession ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks IGNORE 'primary' or 'secondary'
	(b)	<p>1 nitrogen (compounds) / <u>named examples</u> <u>AW</u>, _____ converted to / <u>AW</u>, ammonia / ammonium ions OR ammonification of (organic) compounds ;</p> <p>2 <u>(ammonium (ions)-)</u> converted to nitrite, by Nitrosomonas ;</p> <p>3 nitrite converted to nitrate, by Nitrobacter ;</p> <p>4 <i>idea that nitrifying bacteria</i> are responsible for formation of nitrate ;</p>	3	
		<p>QWC ;</p>	1	Award if any 3 of the following are used correctly with correct spelling ammonia / ammonium ions / ammonification nitrite Nitrosomonas (IGNORE upper or lower case) Nitrobacter (IGNORE upper or lower case) nitrifying bacteria
	(c)	<p><i>idea that</i> rising population requires more, housing / <u>buildings qualified</u> OR <u>less controversial than building on green field sites</u> OR more likely to obtain planning permission ;</p> <p>(losing land to building results in) loss of, biodiversity / _____ <u>species</u> / <u>habitat</u> ;</p>	2	Needs both the idea of increase in population and need for more housing CREDIT <u>reasons such as 'cheaper' if this is qualified</u> <u>e.g.- green field sites used for,</u> _____ _____ <u>food production / agriculture</u>

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Question	Answer	Mark	Guidance
	AVP $\frac{2}{7}$		

Question	Answer	Mark	Guidance
(d)	<p><i>idea that</i> (trees) photosynthesise, <u>uses / AW,</u> and so reduce carbon dioxide ; <u>(this) can offset carbon (dioxide) production /</u> <u>(trees) act as a carbon sink ;</u></p> <p><i>idea that</i> less fruit would need to be transported ; (this) cuts down fuel use ;</p>	2	<p>ACCEPT reduced, net / overall, CO₂ production</p> <p>ACCEPT <u>reduction in food miles</u></p>
	Total	9	

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Question		Answer	Mark	Guidance
3	(a)	palisade (mesophyll) ;	1	CREDIT spongy (mesophyll DO NOT CREDIT cell (s)) (guard cell)
	(b) (i)	X carbon dioxide AND Z oxygen ;	1	Both responses correct for 1 mark. ACCEPT CO ₂ ACCEPT O ₂ IGNORE-Do not penalise incorrect formatting (e.g. CO2, O2)
	(ii)	Y water ;	1	ACCEPT H ₂ O Do not penalise incorrect formatting (IGNORE H2O)
	(iii)	W adenosine diphosphate ;	1	ACCEPT ADP
	(c)	letter C within stroma of the chloroplast ; letter D within matrix of the mitochondrion ;	2	Majority of the letter must be in the correct area Award a maximum of 1 mark if BOTH letters appear within the correct organelle but not in the correct region
	(d)	reduced NAD ;	1	CREDIT NADH / NADH ₂ / NADH and H ⁺ / red NAD

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Question		Answer	Mark	Guidance
	(e)	<p><i>idea that</i> it is an immediate energy source ;</p> <p>small molecule ; soluble ; <u>can be easily regenerated / can be re-phosphorylated</u> ;</p> <p>releases energy in <u>1</u> (fixed <u>1</u>) small <u>1</u> quantities ;</p> <p>AVP ;</p>	1	<p>DO NOT CREDIT 'reference to energy production'</p> <p>CREDIT <i>idea that</i> energy is released , when phosphate is removed / ATP is converted to ADP / _____ _____ in a one- step process</p> <p>ACCEPT idea that it releases (around) 30.5 kJ. IGNORE ref to producing energy</p>
		Total	8	

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Question		Answer	Mark	Guidance
4	(a)	B ; C ;	2	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks
	(b)	Z (lines) , move closer / AW ; (as) sarcomere, shortens / AW ; I (band) and H (zone) , decrease / get shorter / AW ; A (band) stays the same, size / length ;	2	Both I band and H zone needed for the mark
		QWC ;	1	Award if any 3 of the following are used correctly with correct spelling Z line sarcomere I band A band H zone

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Question		Answer	Mark	Guidance
(c)	(i)	<p>1</p> <p>4 <i>idea that (mutation causes) a change in, a DNA_ triplet / code / sequence ; - /</i> DNA triplet code / base sequence ;</p> <p>2 (leading to) a change in_ a mRNA_ / codon / AW ;</p> <p>3 (leading to) a <i>different change in,</i> tRNA / anticodon_ pairing up / AW_ ; (at ribosome) ;</p> <p>4 (leading to) a different_ amino acid_ / in the _____ primary structure / AW sequence of amino acids ;</p> <p>5 (different amino acids have) different R groups ;</p> <p>6 different bond(ing)s form-in (protein) tertiary structure ;</p> <p>7 <i>idea that</i> (change) leads to (protein_) changing its shape / described_ / losing its specific shape ;</p> <p>8 <i>consequence for protein action described ; 8</i> — AVP ;</p>	5	<p>ACCEPT <i>idea of 'wrong' or 'incorrect' for 'different' or 'changed' throughout</i></p> <p>1. ACCEPT <i>mutation might lead to a stop codon inserted</i></p> <p>2_ — CREDIT <i>idea of a triplet or 3 mRNA bases</i></p> <p>4 — CREDIT <i>idea of a different amino acid in a sequence</i></p> <p>6. ACCEPT <i>'bonding / folding altered in tertiary structure'</i></p> <p>DO NOT CREDIT <i>'no protein made'</i></p> <p>8 CREDIT <i>examples e.g. (enzyme) no enzyme substrate complex forms, (antibody) variable region not binding to antigen, (protein channel) no hydrophilic R groups lining channel</i> e.g. mutation might lead to a stop codon inserted</p>
(c)	(ii)	DMD is not a chromosome mutation ;	1	IGNORE <i>'DMD is a gene mutation' (as this is given in the stem of the question)</i>

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Question	Answer	Mark	Guidance
	<p>(amniocentesis / CVS) used to obtain karyotypes ;</p> <p>(karyotypes) (amniocentesis or CVS) show detect, chromosome mutations</p> <p>_____ / described ;</p> <p>≠ DMD is not a chromosome mutation ;</p> <p>A_</p>		<p>CREDIT description e.g. changes in chromosome number or structure.</p>

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Question		Answer	Mark	Guidance
	(d)	calcium ions / Ca^{2+} / Ca^{++} , are not reabsorbed / AW ; (calcium ions / Ca^{2+} / Ca^{++}) stay bound to / <u>not released from,</u> troponin ; (so) binding sites, on actin, (still) exposed / AW ; cross bridges / AW, keep forming ;	2	IGNORE reference to release of calcium ions CREDIT tropomyosin still displaced CREDIT a description 'myosin stays bound to actin,
Total			13	

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Question		Answer	Mark	Guidance																								
5	(a)	(substances) broken down / <u>AW</u> (by respiratory enzymes) to release energy ;	1	Look for idea of breakdown (in a metabolic pathway or named pathway) for energy release e.g. 'A substance broken down (in glycolysis or Krebs) to ———make ATP' = 1 mark DO NOT CREDIT reference to energy production																								
	(b)	<table border="1"> <thead> <tr> <th>RQ value</th> <th>Carbohydrate (%)</th> <th>Fat (%)</th> </tr> </thead> <tbody> <tr> <td>0.70</td> <td>0.0</td> <td>100.0</td> </tr> <tr> <td>0.75</td> <td>14.7</td> <td>85.3</td> </tr> <tr> <td>0.80</td> <td>31.7</td> <td>68.3</td> </tr> <tr> <td>0.85</td> <td>48.8</td> <td>51.2</td> </tr> <tr> <td>0.90</td> <td>65.9</td> <td>34.1</td> </tr> <tr> <td>0.95</td> <td>82.9</td> <td>17.1</td> </tr> <tr> <td><u>1.00</u> ;</td> <td>100.0 ;</td> <td>0.0</td> </tr> </tbody> </table>	RQ value	Carbohydrate (%)	Fat (%)	0.70	0.0	100.0	0.75	14.7	85.3	0.80	31.7	68.3	0.85	48.8	51.2	0.90	65.9	34.1	0.95	82.9	17.1	<u>1.00</u> ;	100.0 ;	0.0	2	Award 1 mark if both figures are correct but have the wrong number of decimal places
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	(c) (i)	spirometer ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks																								
	(ii)	body mass-mass / <u>BMI</u> ; ref to health / smoking ; gender ; duration / <u>type</u> of activity ; <u>ref to diet composition</u> ; AVP ; ;	2	e.g. fitness level <u>OR resting heart rate</u> / BMI / BMR / diet / <u>ethnicity</u> / <u>how often they exercise</u> / <u>muscle to fat ratio</u>																								
	(iii)	(<u>because</u>) <u>protein / amino acids</u> , also provide energy used (in <u>respiration</u>) ;	1																									

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Question		Answer	Mark	Guidance
	(d) (i)	<p><i>idea that</i> fats contain more <u>large number of</u>, hydrogen (atoms) <u>/</u></p> <p><u>carbon hydrogen bonds</u> ;</p> <p>hydrogen needs <u>and</u> -oxygen to form water <u>(in aerobic respiration)</u> ;</p> <p><i>idea that</i> metabolic pathway (for fat respiration) is in <u>mitochondria</u> ;</p> <p>(mitochondria) use oxygen as terminal acceptor (for hydrogen ion / electron) ;</p>	2	IGNORE <u>DO NOT CREDIT</u> H ⁺
	(ii)	<p><u>glycogen</u> ;</p> <p>carbo(<u>hydrate</u>)depletion / described <u>(for around 10 days before event)</u> ;</p> <p>(followed by) carbo(<u>hydrate</u>)loading / described <u>(for around 3 days before event)</u> ;</p>	3	<p>Correct spelling only</p> <p>CREDIT a description of diet high in protein and low in carbohydrate or foods which meet this description</p> <p><u>DO NOT CREDIT</u> 'eat only protein' for 'carbodepletion'</p> <p>CREDIT a description referring to foods high in carbohydrate such as rice, pasta etc.</p>
Total			12	

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Question		Answer	Mark	Guidance																					
6	(a)	mitochondrial, (membrane / envelope) ; acrosome (membrane) ;	2	DO NOT CREDIT endoplasmic reticulum / Golgi apparatus (as these are not present in spermatozoa) CREDIT lysosome only if candidate indicates that the acrosome is a modified lysosome																					
	(b) (i)	(cryopreservation) causes a drop in viability / AW ; correct data quoted for <u>two named samples and two</u> <u>percentages</u> AND units(<u>mean</u>) <u>percentage / %</u> ;		Only CREDIT if 'mean-percentage' or 'mean-%' is used with the figures <u>at least once</u> . <table border="1"> <thead> <tr> <th>Semen sample</th> <th>Mean percentage fluorescing green</th> <th>Mean percentage fluorescing red</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>47.6</td> <td>49.3</td> </tr> <tr> <td>2</td> <td>56.0</td> <td>37.0</td> </tr> <tr> <td>3</td> <td>47.3</td> <td>48.7</td> </tr> <tr> <td>4</td> <td>50.4</td> <td>45.5</td> </tr> <tr> <td>5</td> <td>52.8</td> <td>40.9</td> </tr> <tr> <td>6</td> <td>47.7</td> <td>49.2</td> </tr> </tbody> </table>	Semen sample	Mean percentage fluorescing green	Mean percentage fluorescing red	1	47.6	49.3	2	56.0	37.0	3	47.3	48.7	4	50.4	45.5	5	52.8	40.9	6	47.7	49.2
Semen sample	Mean percentage fluorescing green	Mean percentage fluorescing red																							
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6	47.7	49.2																							

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Question	Answer	Mark	Guidance
(ii)	<p><i>yes because</i> <i>idea that Bull 5 (data) shows large s.d. compared to the difference between the means ;</i> <i>idea that S.D. indicate data overlaps</i> OR <i>idea that difference between the means is small ;</i></p> <p><i>no because</i> <i>idea that a S.D only overlaps slightly</i> OR<i>and there is a</i> difference between the means OR <i>the SD of one bull does not overlap with the mean of the other bull here is a difference between the means ;</i></p>	1	<p>No mark available for stating 'yes' or 'no' DO NOT CREDIT ref. to green fluorescing sperm</p> <p>Only CREDIT if a reference has been made to both the mean and standard deviation</p>
	Total	5	

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