

# **Human Biology**

Advanced GCE

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

## **Mark Scheme for January 2012**

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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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## Annotations

Annotation	Meaning
	Correct answer
	Cross
	Benefit of doubt
	Benefit of doubt not given
	Error carried forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Correct response
	Ignore
	Poorly expressed
	Contradiction
	Unclear
	Example/Reference

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text:  
1bi 1bii 1c 2a 2biii 3a 3aii 3av 3b 4aiii 4b 5aii 5b 6aii

- I. The Comments box  
The comments box will be used by your PE to explain their marking of the practice scripts for your information. Please refer to these comments when checking your practice scripts.  
You should only type in the comments box yourself when you have an additional object of the type described in Appendix B of the Handbook for Assistant Examiners and Subject Markers.  
Please do not use the comments box for any other reason.  
Any questions or comments you have for your Team Leader should be communicated by phone, SCORIS messaging system or e-mail.
- II. Please send a brief report on the performance of the candidates to your Team Leader (Supervisor) by the end of the marking period. The Assistant Examiner's Report Form (AERF) can be found on the Cambridge Assessment Support Portal. This should contain notes on particular strengths displayed, as well as common errors or weaknesses. Constructive criticisms of the question paper / mark scheme are also appreciated.
- III. Accept phonetic spelling throughout Q1 unless otherwise specified

Question		Answer	Marks	Guidance
1	(a)	<p><b>A</b> – seminiferous tubule ;</p> <p><b>B</b> – Leydig cell ;</p>	2	<p><b>Mark the first answer on each prompt line.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b></p> <p><b>ACCEPT</b> interstitial cell</p>
	(b)	(i)	4	<p><b>ACCEPT</b> cervix</p> <p><b>ACCEPT</b> Cowper's gland</p>
		(ii)	2 max	<p><b>DO NOT CREDIT</b> produce or create energy</p>

Question		Answer	Marks	Guidance
	(c)	1 acrosome / sperm, comes into contact with, <b>zona pellucida / glycoprotein</b> ; 2 acrosome (releases) <b>enzymes</b> ; 3 (enzymes are) <b>hydrolytic</b> ; 4 digest / breakdown / penetrate, <b>zona pellucida</b> ; 5 sperm (head) reaches, <b>cell surface / plasma, membrane</b> (of oocyte) ; 6 sperm <b>nucleus</b> enters oocyte ;	3 max	
		<b>QWC</b> ;	1	<b>3</b> of the emboldened terms used and spelt correctly <b>enzyme(s)</b> <b>hydrolytic</b> (and derivatives) <b>zona pellucida</b> <b>cell surface membrane or plasma membrane</b> <b>nucleus</b> <b>glycoprotein</b>
		<b>Total</b>	<b>12</b>	

Question		Answer	Marks	Guidance
2	(a)	cross sectional / AW ; mitochondria / mitochondrion ; oxygen ; ATP ; glycogen ; myoglobin ;	6	<b>IGNORE</b> surface  <b>DO NOT CREDIT</b> energy (as energy is not produced)
	(b)	(i)	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>
		(ii)	1	
		(they are in conditions of) high oxygen concentration / oxygenated blood ;		

Question	Answer	Marks	Guidance
	<p>(iii)</p> <p><i>describe</i></p> <p>D1 cause red blood cells to, change shape / become less flexible  <b>or</b>            haemoglobin crystallises ;</p> <p>D2 (red blood cells), cannot pass through easily / cause blockage ;</p> <p>D3 in <u>capillaries</u> ;</p> <p style="text-align: right;"><b>max 2</b></p> <p><i>symptoms</i></p> <p>S4 fatigue / tiredness / dizziness ;</p> <p>S5 pain / cramps ;</p> <p>S6 swelling (in parts of body) ;</p> <p>S7 hypertension / less oxygen delivered to cells /            increase in heart rate / increase in breathing rate ;</p> <p style="text-align: right;"><b>max 2</b></p>	4 max	<p><b>ACCEPT</b> cells become sickle shaped</p> <p><b>ACCEPT</b> haemoglobin molecules stick together</p>
	<b>Total</b>	<b>12</b>	



Question			Answer	Marks	Guidance										
3	(a)	(i)	<p><b>Award 2 marks</b> if all 4 boxes are correct.  <b>Award 1 mark</b> if 2 or 3 boxes are correct.  <b>Award 0 mark</b> if only 1 box correct.</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>contents of dishes</th> <th>ATP produced</th> </tr> </thead> <tbody> <tr> <td>mitochondria + ADP + pi + acetyl CoA + oxygen</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>mitochondria + ADP + pi + acetyl CoA</td> <td style="text-align: center;">✗</td> </tr> <tr> <td>mitochondria + ADP + pi + low concentration of protons (H<sup>+</sup>)</td> <td style="text-align: center;">✗</td> </tr> <tr> <td>mitochondria + ADP + pi + high concentration of protons (H<sup>+</sup>)</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table> <p style="text-align: right;">;;</p>	contents of dishes	ATP produced	mitochondria + ADP + pi + acetyl CoA + oxygen	✓	mitochondria + ADP + pi + acetyl CoA	✗	mitochondria + ADP + pi + low concentration of protons (H <sup>+</sup> )	✗	mitochondria + ADP + pi + high concentration of protons (H <sup>+</sup> )	✓	2	<p><b>DO NOT CREDIT</b> absence of cross for mp2 and mp3</p>
contents of dishes	ATP produced														
mitochondria + ADP + pi + acetyl CoA + oxygen	✓														
mitochondria + ADP + pi + acetyl CoA	✗														
mitochondria + ADP + pi + low concentration of protons (H <sup>+</sup> )	✗														
mitochondria + ADP + pi + high concentration of protons (H <sup>+</sup> )	✓														

Question		Answer	Marks	Guidance
	(ii)	1. water potential ; 2. mitochondria absorb water and burst / ora ;  <b>or</b>  3. temperature ; 4. enzymes denatured / membrane structure affected / <i>idea of effect on formation of ES complexes ;</i>  <b>or</b>  5. pH ; 6. enzymes denatured / AW ;	2	<b>Mark first condition and its associated reason.</b> <b>DO NOT CREDIT</b> ADP + P <sub>i</sub> <b>IGNORE</b> fair test / control as the reason
	(iii)	final electron acceptor (in ETC) / AW ;	1	
	(iv)	ATP synthase / ATP synthetase ;	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>  <b>DO NOT CREDIT</b> ATPase

Question		Answer	Marks	Guidance
	(v)	1. (site of) electron transport chain / electron acceptors / cytochromes ; 2. protons / H <sup>+</sup> , build up in inter-membrane space ; 3. (allows formation of) electrochemical / proton, gradient ; 4. channel protein(s) / stalked particles ; 5. (allows) protons, diffuse / move down concentration gradient ;	3 max	<b>DO NOT CREDIT</b> H <sub>2</sub> / H
	(b)	1 ATP, hydrolysed / broken down, to release energy ; 2 (molecules / ions) against concentration gradient ; 3 carrier / transport, protein (in membrane) <b>or</b> (pyruvate) binds to (specific) protein <b>or</b> protein changes shape / AW ;	2	<b>DO NOT CREDIT</b> energy produced or created <b>IGNORE</b> substances <b>DO NOT CREDIT</b> channel protein <b>CREDIT</b> correct ref to intrinsic protein
		<b>Total</b>	<b>11</b>	

Question			Answer	Marks	Guidance
4	(a)	(i)	Calvin cycle / light independent stage ;	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>
		(ii)	<u>stroma</u> ;	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>
		(iii)	1. RuBP is a CO <sub>2</sub> acceptor / AW ; 2. CO <sub>2</sub> is not combining as much with RuBP ; 3. extra detail ;	2 max	eg TP converted to RuBP
		(iv)	0.01 ;;	2	If the answer is incorrect or given to the incorrect number of decimal places, then <b>ACCEPT</b> correct working for one mark eg $1.8 \div 150$

Question		Answer	Marks	Guidance
	(b)	1 GP converted to TP ; 2 amine group / NH <sub>2</sub> , added (to TP) ; 3 <b>amino</b> acids formed ; 4 chain of amino acids / <b>polypeptide</b> , formed ; 5 by <b>condensation</b> reactions ; 6 peptide bonds ; 7 secondary structure forms alpha helix ; 8 (secondary structure) folds ; 9 (becomes) 3D shape / specific shape / <b>tertiary</b> structure <b>or</b> <b>globular</b> protein ; 10 AVP ;	5 max	<b>ACCEPT</b> other nitrogen sources eg nitrate / ammonia  <b>ACCEPT</b> primary structure  <b>IGNORE</b> beta pleated sheet  <b>ACCEPT</b> ref. active site has specific shape  eg detail of bonding (H bonds / ionic bonds / disulfide bridges)
		<b>QWC</b> ;	1	<b>2</b> of the emboldened terms used and spelt correctly <b>amino</b> <b>polypeptide</b> <b>condensation</b> <b>tertiary</b> <b>globular</b>
		<b>Total</b>	<b>12</b>	

Question			Answer	Marks	Guidance
5	(a)	(i)	fatty acid ;	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>  <b>IGNORE</b> tail
		(ii)	1. unsaturated hydrocarbons have less H (than saturated hydrocarbons) ;  2. unsaturated hydrocarbons have double bonds between carbons <b>or</b> saturated hydrocarbons have no double bonds between carbons ;  3. unsaturated hydrocarbon chains have kinks / saturated hydrocarbon chains have no kinks ;	2 max	
		(iii)	1. reduction in carbon dioxide produced ;  2. little energy needed to produce biodiesel ;  3. <i>idea of</i> oils produced directly by plants therefore carbon recycled ;	2	<b>ACCEPT</b> carbon monoxide

Question		Answer	Marks	Guidance
	(b)	1 switch to renewable energy ;	2	
		2 switch off unused, lights / appliances <b>or</b> use energy saving light bulbs <b>or</b> replace old appliances ;		
		3 ref. home insulation <b>or</b> turn down heating ;		
		4 ref. transport ;		
		<b>Total</b>	<b>7</b>	eg use public transport / car sharing / cycling <b>IGNORE</b> electric cars

Question			Answer	Marks	Guidance
6	(a)	(i)	increasing pregnancy rate as sperm count increases ; two paired figures with units for both rate and sperm count ;	2 max	
		(ii)	1. <i>idea that</i> sperm has long(er) distance to travel ; 2. vagina / cervix, (more) hostile environment / AW ; 3. sperm more likely to exit body / AW ;	2 max	Assume <b>ICI</b> , but <b>CREDIT</b> ora if <b>IUI</b> mentioned first
	(b)	(i)	freezing / cryogenics ;	1	<b>Mark the first answer.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b>
		(ii)	limited by law ; lack of viability / AW ;	1 max	
<b>Total</b>				<b>6</b>	



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