

**GCE**

**Human Biology**

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

Advanced GCE

**Mark Scheme for June 2017**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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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Question		Answer	Marks	Guidance												
1	(a) (i)	A (band) ;	1	<b>DO NOT ACCEPT</b> if given as part of a list												
	(ii)	<table border="1"> <thead> <tr> <th>Feature of muscle cell</th> <th>Biceps muscle</th> <th>Triceps muscle</th> </tr> </thead> <tbody> <tr> <td>H zone is visible in the sarcomere</td> <td></td> <td>✓</td> </tr> <tr> <td>Myosin heads are cross-linking with actin molecules</td> <td>✓</td> <td></td> </tr> <tr> <td>Calcium ions are inside the sarcoplasmic reticulum</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Feature of muscle cell	Biceps muscle	Triceps muscle	H zone is visible in the sarcomere		✓	Myosin heads are cross-linking with actin molecules	✓		Calcium ions are inside the sarcoplasmic reticulum		✓	3	<i>One mark for each correct row</i> If ticks and crosses given in the same row, award only the ticks and <b>IGNORE</b> crosses <b>DO NOT ACCEPT</b> hybrids cross-ticks ✗
Feature of muscle cell	Biceps muscle	Triceps muscle														
H zone is visible in the sarcomere		✓														
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Calcium ions are inside the sarcoplasmic reticulum		✓														
	(b) (i)	ATP / adenosine triphosphate ;	1	<b>Mark the first answer only.</b> If additional incorrect answer given = 0 marks												
	(ii)	condensation OR (substrate linked / substrate level) phosphorylation ;	1	<b>DO NOT ACCEPT</b> oxidative phosphorylation												
	(iii)	RNA / Ribonucleic Acid ;	1	<b>DO NOT ACCEPT</b> DNA / Deoxyribonucleic acid <b>IGNORE</b> type of RNA												
	(c)	glycogen ;	1													
<b>Total</b>			<b>8</b>													

Question		Answer	Marks	Guidance												
2	(a) (i)	<p><i>General statement:</i> High levels of saturated fat(ty acids) increase the risk of CHD</p> <p>; <b>OR</b></p> <p>High levels of polyunsaturated fat(ty acids) decrease the risk of CHD</p> <p>;</p> <p><i>In support:</i> 1. Rape oil low(er/est) in saturated fat(ty acids) ; 2. Rape oil higher in polyunsaturated fat(ty acids) than olive oil</p> <p>;</p> <p><i>Against:</i> Sunflower oil is higher in polyunsaturated fat(ty acids) than rape seed</p> <p>;</p> <p>Data in support with correct units ;</p>	2	<p>One mark for general statement and one mark for argument in support or against. <b>IGNORE</b> references to monounsaturated fatty acids</p> <p><b>ACCEPT</b> ORA low levels decrease risk</p> <p><b>IGNORE</b> reverse argument</p> <p>1. <b>ACCEPT</b> '16:0 <u>and</u> 18:0' instead of 'saturated fat' 2. <b>ACCEPT</b> '18:2 <u>and</u> 18:3' instead of 'polyunsaturated fat'</p> <p><b>ACCEPT</b> correct data quotes <b>or</b> a calculated difference as follows:</p> <table border="1"> <thead> <tr> <th></th> <th>Saturated(%)</th> <th>Polyunsaturated(%)</th> </tr> </thead> <tbody> <tr> <td>Rape oil</td> <td>5.9</td> <td>28.6</td> </tr> <tr> <td>Olive oil</td> <td>15</td> <td>10</td> </tr> <tr> <td>Sunflower oil</td> <td>12.5</td> <td>66.1</td> </tr> </tbody> </table>		Saturated(%)	Polyunsaturated(%)	Rape oil	5.9	28.6	Olive oil	15	10	Sunflower oil	12.5	66.1
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Question			Answer	Marks	Guidance
2	(b)	(i)	475 ;;	2	If answer is incorrect look for: $3.8 \div 0.8$ or 4.75 for one mark.
	(b)	(ii)	<i>Idea that (%) increase in crops treated with insecticide is greater than (%) increase in crops grown (shows more insecticide used in 2010) ;</i>	1	<b>ACCEPT</b> an answer which refers to calculated (%) increases using answer to (b)(i). % increase in crop area = 107%
	(c)	(i)	1. (random) mutation gives resistance ; 2. Insecticide is <u>selective</u> pressure ; 3. Resistant beetles, reproduce / breed  <b>OR</b> Resistance <u>allele(s)</u> passed on (to next generation) ;	2	1. <b>DO NOT ACCEPT</b> insecticide causes mutation  3. <b>ACCEPT</b> insects / individuals
	(c)	(ii)	<i>Idea of increase availability of <u>nitrate</u> ;</i>	1	<b>IGNORE</b> no need for fertilisers <b>DO NOT ACCEPT</b> nitrogen
<b>Total</b>				<b>13</b>	

Question			Answer	Marks	Guidance
3	(a)	(i)	A;	1	<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 <b>= 0 marks</b>
		(ii)	E ;	1	<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 <b>= 0 marks</b>
		(iii)	D and E ;	1	<b>Mark the first two answers on each prompt line.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer <b>= 0 marks</b>
	(b)		Sperm, stored in / cannot leave D ;  (macrophages) engulf sperm cells ;	2	<b>ACCEPT</b> epididymis <b>ACCEPT</b> accumulated <b>IGNORE</b> E
	(c)		<i>Vein</i>  Transports <u>blood</u> from testis (back to the heart) ;	1	<b>DO NOT ACCEPT</b> in context of other blood vessel (artery, capillary, venule) <b>ACCEPT</b> E <b>IGNORE</b> any other named structure

	(d)	(i)	Secondary / 2 <sup>o</sup> , oocyte ;	1	<b>DO NOT ACCEPT</b> primary oocyte <b>IGNORE</b> ovum / egg																		
		(ii)	Zona pellucida ;	1																			
		(iii)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Description</th> <th style="width: 50px;"></th> <th style="width: 50px;"></th> </tr> </thead> <tbody> <tr> <td>There are 23 pairs of chromosomes each consisting of two chromatids.</td> <td></td> <td></td> </tr> <tr> <td>The chromosomes are in metaphase 2 of meiosis.</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">;</td> </tr> <tr> <td>The chromosomes are in metaphase 1 of meiosis.</td> <td></td> <td></td> </tr> <tr> <td>The chromosomes are in metaphase of mitosis.</td> <td></td> <td></td> </tr> <tr> <td>There are 23 chromosomes each consisting of two chromatids.</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">;</td> </tr> </tbody> </table>	Description			There are 23 pairs of chromosomes each consisting of two chromatids.			The chromosomes are in metaphase 2 of meiosis.	✓	;	The chromosomes are in metaphase 1 of meiosis.			The chromosomes are in metaphase of mitosis.			There are 23 chromosomes each consisting of two chromatids.	✓	;	2	<p>If all rows are ticked = <b>0 marks</b></p> <p>If more than two ticks given, each incorrect tick contradicts a correct one.</p> <p>If ticks and crosses given, award only the ticks and <b>IGNORE</b> crosses.</p>
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		(iv)	FSH / follicle stimulating hormone ; LH / luteinising hormone ;	2	<ul style="list-style-type: none"> <li><b>IGNORE</b> the numbered prompt lines and mark the first 2 distinct hormones, whether they are on the same line or on separate lines.</li> </ul>																		
<b>Total</b>				<b>12</b>																			

Question			Answer		Marks	Guidance
4	(a)	(ii)	Statement	Letter(s)	2	3 correct rows = 2 marks 2 correct rows = 1 mark
			peptide bonds are formed	E and R		
			DNA is transcribed	E ;		
			complementary base pairing occurs between DNA and RNA triplets	E ;		
			complementary base pairing occurs between RNA triplets	E and R ;		
		(ii)	substrate level phosphorylation ;		1	<b>ACCEPT</b> from glycolysis OR from anaerobic respiration <b>IGNORE</b> phosphorylation <b>DO NOT ACCEPT</b> oxidative phosphorylation

Question		Answer	Mark	Guidance
4	(b)	arteries have thick walls so no gas exchange occurs ;	1	<b>ACCEPT</b> Oxygen cannot, diffuse out/ leave <b>ACCEPT</b> Oxygen cannot dissociate from oxyhaemoglobin
	(c) (i)	8.4 <u>kPa</u> ;	1	<b>ACCEPT</b> 8.2-8.6 <u>kPa</u>
	(ii)	<i>Idea that curve drops steeply to the left of the ICU point ;</i>	1	<b>ACCEPT</b> a description such as 'percentage saturation of haemoglobin drops steeply to the left of this point'
	(d) (i)	(P50) increases ;	1	<b>DO NOT ACCEPT</b> 'it will shift to the right' since the question is about a value on the curve and not the curve itself
	(ii)	<ol style="list-style-type: none"> <li>1. carbon dioxide and water form <b>carbonic acid</b>, <b>catalysed</b> by / using, <b>carbonic anhydrase</b> ;</li> <li>2. carbonic acid, <b>dissociates / breaks down</b>, to form, <b>hydrogen carbonate</b> (ions) / <math>\text{HCO}_3^-</math> , and , <b>hydrogen ions</b> / <math>\text{H}^+</math> ;</li> <li>3. <b>hydrogen ions</b> / <math>\text{H}^+</math>, bind to haemoglobin to form haemoglobinic acid ;</li> <li>4. (Haemoglobin) affinity for oxygen decreases ;</li> </ol> <p><b>QWC</b> ;</p>	<p>2</p> <p><b>ACCEPT</b> Hb for haemoglobin throughout</p> <p>1. <b>ACCEPT</b> <math>\text{CO}_2 + \text{H}_2\text{O}</math> form <math>\text{H}_2\text{CO}_3</math> using carbonic anhydrase</p> <p>2. <b>ACCEPT</b> splits</p> <p>3. <b>ACCEPT</b> hydrogen ions protonate Haemoglobin <b>ACCEPT</b> picked up</p> <p>1</p> <p>Any <b>three</b> of the following terms:</p> <p><b>catalysed OR catalyst / carbonic anhydrase / carbonic acid / dissociate / hydrogen carbonate / hydrogen ion</b></p>	
<b>Total</b>			<b>10</b>	

Question			Answer	Marks	Guidance
5	(a)	(i)	<p>biotic component / AW, interactions / AW ;</p> <p>(and) its interaction / AW, with abiotic component / AW ;</p>	2	<p><b>ACCEPT</b> 'living' for 'biotic' and 'non-living' for 'abiotic'</p> <p><b>ACCEPT</b> description of biotic component e.g. community of organisms</p> <p><b>ACCEPT</b> description of abiotic component e.g. minerals / soil / light / temperature</p> <p><b>IGNORE</b> environment</p>
		(ii)	<p><i>idea of improvements in:</i></p> <p>(maternal / infant) nutrition / sanitation / clean drinking water / education ;</p>	1	<p><b>ACCEPT</b> any other reasonable suggestion that does <b>not</b> involve some form of medical intervention.</p>
		(iii)	<p>only, women / 50% of population, have children ;</p>	1	<p><b>ACCEPT</b> Idea of two children to replace each parent (in the next generation)</p> <p><b>OR</b></p> <p>'men and women die but only women have children'</p>
		(iv)	<p>infant mortality (rate) is higher ;</p>	1	<p><b>ACCEPT</b> alternative wording e.g. 'fewer children survive to adulthood'</p>
	(b)	(i)	<p><i>Idea that</i> largest population increases are in LEDCs / countries with a low carbon footprint</p> <p><b>OR</b></p> <p><i>Idea that</i> countries are switching to low carbon economies ;</p>	1	<p>e.g. introduction of, sustainable / renewable, energy sources</p>
		(ii)	<p><i>Idea that</i> warmest years / higher rainfall / droughts / AW, coincide with high(er) levels of atmospheric carbon dioxide ;</p>	1	<p><b>ACCEPT</b> alternative arguments using alternative evidence.</p> <p><b>IGNORE</b> descriptions of the effects of high levels of CO<sub>2</sub> e.g. greenhouse effect / increase in global temperature</p>
			<b>Total</b>	<b>7</b>	

Question			Answer	Marks	Guidance
6	(a)	(i)	1. (pyruvate decarboxylated) acetyl coenzyme A formed ; 2. (CO <sub>2</sub> and) reduced NAD produced ; 3. (by) dehydrogenase ;	2	2. <b>ACCEPT</b> reduced NADH / NADH+H / NADH <sub>2</sub> <b>DO NOT ACCEPT</b> in context of glycolysis
	(a)	(ii)	citrate ;	1	<b>ACCEPT</b> isocitrate, alpha-ketoglutarate
	(b)	(i)	soda lime / potassium hydroxide / sodium hydroxide / calcium hydroxide ;	1	
		(ii)	temperature / mass of seeds ;	1	<b>ACCEPT</b> volume of seeds <b>IGNORE</b> references to pH <b>IGNORE</b> amount / number, of seeds <b>IGNORE</b> time - as this was already controlled
	(c)		meniscus moves to the right ;  <i>Explanation</i> <i>Idea that less carbon dioxide produced than oxygen</i> consumed ;	2	<b>ACCEPT</b> an explanation using the formula for RQ <b>IGNORE</b> 'fats need more oxygen to produce the same amount of carbon dioxide'
	(d)	(i)	fats contain higher proportion of hydrogen / H ;  more, reduced NAD ;  more ATP (from oxidative phosphorylation) ;	2	<b>ACCEPT</b> higher proportion of C-H bonds <b>IGNORE</b> H <sub>2</sub> / H ions / H <sup>+</sup>  <b>ACCEPT</b> reduced NADH / NADH+H / NADH <sub>2</sub>
		(ii)	ATP ;	1	<b>Mark the first answer only.</b> If additional incorrect answer given = 0 marks
<b>Total</b>				<b>10</b>	

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