

GCE

Human Biology

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

Advanced GCE

Mark Scheme for June 2017

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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.

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Question		Answer	Marks	Guidance												
1	(a) (i)	A (band) ;	1	DO NOT ACCEPT 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 IGNORE crosses DO NOT ACCEPT hybrids cross-ticks ✗
Feature of muscle cell	Biceps muscle	Triceps muscle														
H zone is visible in the sarcomere		✓														
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	(b) (i)	ATP / adenosine triphosphate ;	1	Mark the first answer only. If additional incorrect answer given = 0 marks												
	(ii)	condensation OR (substrate linked / substrate level) phosphorylation ;	1	DO NOT ACCEPT oxidative phosphorylation												
	(iii)	RNA / Ribonucleic Acid ;	1	DO NOT ACCEPT DNA / Deoxyribonucleic acid IGNORE type of RNA												
	(c)	glycogen ;	1													
Total			8													

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>;</p> <p>OR</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. IGNORE references to monounsaturated fatty acids</p> <p>ACCEPT ORA low levels decrease risk</p> <p>IGNORE reverse argument</p> <p>1. ACCEPT '16:0 <u>and</u> 18:0' instead of 'saturated fat' 2. ACCEPT '18:2 <u>and</u> 18:3' instead of 'polyunsaturated fat'</p> <p>ACCEPT correct data quotes or 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	ACCEPT 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 OR Resistance <u>allele(s)</u> passed on (to next generation) ;	2	1. DO NOT ACCEPT insecticide causes mutation 3. ACCEPT insects / individuals
	(c)	(ii)	<i>Idea of increase availability of <u>nitrate</u> ;</i>	1	IGNORE no need for fertilisers DO NOT ACCEPT nitrogen
Total				13	

Question			Answer	Marks	Guidance
3	(a)	(i)	A;	1	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
		(ii)	E ;	1	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
		(iii)	D and E ;	1	Mark the first two answers 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)		Sperm, stored in / cannot leave D ; (macrophages) engulf sperm cells ;	2	ACCEPT epididymis ACCEPT accumulated IGNORE E
	(c)		<i>Vein</i> Transports <u>blood</u> from testis (back to the heart) ;	1	DO NOT ACCEPT in context of other blood vessel (artery, capillary, venule) ACCEPT E IGNORE any other named structure

	(d)	(i)	Secondary / 2°, oocyte ;	1	DO NOT ACCEPT primary oocyte IGNORE 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 = 0 marks</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 IGNORE crosses.</p>
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		(iv)	FSH / follicle stimulating hormone ; LH / luteinising hormone ;	2	<ul style="list-style-type: none"> IGNORE the numbered prompt lines and mark the first 2 distinct hormones, whether they are on the same line or on separate lines. 																		
Total				12																			

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	ACCEPT from glycolysis OR from anaerobic respiration IGNORE phosphorylation DO NOT ACCEPT oxidative phosphorylation

Question		Answer	Mark	Guidance
4	(b)	arteries have thick walls so no gas exchange occurs ;	1	ACCEPT Oxygen cannot, diffuse out/ leave ACCEPT Oxygen cannot dissociate from oxyhaemoglobin
	(c) (i)	8.4 <u>kPa</u> ;	1	ACCEPT 8.2-8.6 <u>kPa</u>
	(ii)	<i>Idea that curve drops steeply to the left of the ICU point ;</i>	1	ACCEPT a description such as 'percentage saturation of haemoglobin drops steeply to the left of this point'
	(d) (i)	(P50) increases ;	1	DO NOT ACCEPT '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"> 1. carbon dioxide and water form carbonic acid, catalysed by / using, carbonic anhydrase ; 2. carbonic acid, dissociates / breaks down, to form, hydrogen carbonate (ions) / HCO_3^- , and , hydrogen ions / H^+ ; 3. hydrogen ions / H^+, bind to haemoglobin to form haemoglobinic acid ; 4. (Haemoglobin) affinity for oxygen decreases ; <p>QWC ;</p>	<p>2</p> <p>ACCEPT Hb for haemoglobin throughout</p> <p>1. ACCEPT $\text{CO}_2 + \text{H}_2\text{O}$ form H_2CO_3 using carbonic anhydrase</p> <p>2. ACCEPT splits</p> <p>3. ACCEPT hydrogen ions protonate Haemoglobin ACCEPT picked up</p> <p>1</p> <p>Any three of the following terms: catalysed OR catalyst / carbonic anhydrase / carbonic acid / dissociate / hydrogen carbonate / hydrogen ion</p>	
Total			10	

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

Question			Answer	Marks	Guidance
6	(a)	(i)	1. (pyruvate decarboxylated) acetyl coenzyme A formed ; 2. (CO ₂ and) reduced NAD produced ; 3. (by) dehydrogenase ;	2	2. ACCEPT reduced NADH / NADH+H / NADH ₂ DO NOT ACCEPT in context of glycolysis
	(a)	(ii)	citrate ;	1	ACCEPT isocitrate, alpha-ketoglutarate
	(b)	(i)	soda lime / potassium hydroxide / sodium hydroxide / calcium hydroxide ;	1	
		(ii)	temperature / mass of seeds ;	1	ACCEPT volume of seeds IGNORE references to pH IGNORE amount / number, of seeds IGNORE 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	ACCEPT an explanation using the formula for RQ IGNORE '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	ACCEPT higher proportion of C-H bonds IGNORE H ₂ / H ions / H ⁺ ACCEPT reduced NADH / NADH+H / NADH ₂
		(ii)	ATP ;	1	Mark the first answer only. If additional incorrect answer given = 0 marks
Total				10	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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