

Human Biology

Advanced GCE

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

Mark Scheme for January 2013

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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
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not	answers which are not worthy of credit
reject	answers which are not worthy of credit
ignore	statements which are irrelevant
allow	answers that can be accepted
()	words which are not essential to gain credit
—	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument
ü	correct response
û	incorrect response
bod	benefit of the doubt
nbod	benefit of the doubt not given
ECF	error carried forward
^	information omitted
I	ignore
R	reject

Question			Answer	Marks	Guidance
1	(a)	(i)	<p>1 <i>idea that</i> condom least effective ;</p> <p>2 use of figs with units ;</p> <p>3 <i>idea that</i> diaphragm is less effective qualified ;</p> <p>4 <i>idea that</i> hormone method is (significantly) better ;</p>	2	<p>ACCEPT not very effective</p> <p>2 two figures with units</p> <p>3 look for reference to lowest percentage in any study eg sentence which includes fig comparison</p>
		(ii)	<p>1 (much) lower rate of <u>pregnancy</u> ;</p> <p>2 <i>idea that</i> potentially as good as each other ; ora</p> <p>3 use of figs ;</p> <p>4 may forget to take pill ;</p> <p>5 <i>idea that</i> oral pill could be affected by, vomiting / diarrhoea ;</p>	2	<p>IGNORE ref to antibiotics / other factors that would affect both hormonal treatments equally</p> <p>IGNORE refs to duration</p>
		(iii)	<p>injected hormones results in peaks / troughs ;</p> <p>(as) high concentration result in hormones being (quickly) metabolised ;</p> <p>injections need to be replaced every 12 weeks but implants last 3–4 years ;</p> <p>implants release hormones continuously ;</p>	2	<p>look for idea of fluctuation</p> <p>CREDIT injections temporary but implants long lasting</p>

Question	Answer	Marks	Guidance
	<p>(iv)</p> <p>1 (synthetic) progesterone, put under skin / sub-cutaneous ;</p> <p>2 (named) hormone diffuses into blood stream ;</p> <p>3 inhibits (release of) FSH ;</p> <p>4 (which) stops, follicles maturing ;</p> <p>5 thickens cervical mucus ;</p> <p>6 (results in) barrier to sperm ;</p> <p>7 causes endometrium to be thinner ;</p> <p>8 preventing implantation ;</p>	3	<p>1 CREDIT named product DO NOT CREDIT if progesterone is part of a list with oestrogen</p> <p>2 ACCEPT description of diffusion</p> <p>3 DO NOT CREDIT if part of a list</p> <p>4 ACCEPT idea of preventing ovulation</p> <p>7 ACCEPT lining of womb / uterus</p>
	<p>(b)</p> <p>1 increases risk of STDs or 2 <i>idea that</i> (large dose of) hormone, may be harmful / effect described or 3 short-term side effects named effects ;</p> <p>4 <i>idea that</i> (some believe that) life starts at fertilisation / (all) life is sacred / it is a form of abortion which is wrong or 5 may encourage promiscuity or 6 <i>idea of</i> (obtained by request so) records may be incomplete ;</p>	2	<p>2 eg long term adverse effect on fertility</p> <p>3 eg stomach cramps</p> <p>4 IGNORE 'religious reasons' or 'playing God' <i>they need to convey the views that life can be sacred or that abortion can be wrong</i></p>
	Total	11	

Question		Answer	Marks	Guidance
2	(a) (i)	<p>X adenine ; Y ribose ;</p>	2	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE base IGNORE pentose / (5C) sugar</p>
	(ii)	<p>ATP has three phosphates and NAD has two phosphates ; ATP has one, pentose (sugar) / ribose / Y, and NAD has two pentose (sugar) / ribose / Y ;</p> <p>only NAD has nicotinamide ; only NAD is a dinucleotide / has two bases ;</p>	3	
	(iii)	<p><i>immediate</i> (ATP) hydrolysed / broken down (to release energy)</p> <p>OR</p> <p>energy released in small amounts ;</p> <p><i>continuous</i> synthesised by (named) reactions during, photosynthesis / respiration</p> <p>OR</p> <p><i>idea of</i> (rapid) regeneration / turnover ;</p> <p><i>links metabolic processes</i> soluble so easily moved ;</p>	2 max	<p>CREDIT equation</p> <p>ACCEPT '30.6 kJ released' DO NOT CREDIT 'energy produced'</p> <p><i>idea that</i> as ATP is used it is replaced</p>

Question		Answer	Marks	Guidance
	(b)	<p><i>idea that</i> not all intermediates used</p> <p>or</p> <p>(some) reduced NAD / reduced FAD / pyruvate, used in other reactions ;</p> <p>(some) ATP used to transport (pyruvate into mitochondria)</p> <p>some energy lost as heat / respiration is exothermic ;</p> <p>protons may leak through (mitochondrial) membranes ;</p> <p><i>idea that</i> (cell) may not be at optimum pH ;</p> <p>ref anaerobic respiration / high CO₂ levels lead to low pH ;</p> <p>cell has finite amounts of, NAD / FAD ;</p>	2	<p>ACCEPT red NAD / NADH (+ H⁺) / NADH₂ / red FAD / FADH (+ H⁺) / FADH₂</p> <p>ACCEPT not all protons go through ATP synthase / stalked particles</p> <p>ACCEPT lactic acid increase</p>
	(c) (i)	<p>ester ;</p>	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT covalent</p>
	(ii)	<p>facilitated diffusion ;</p> <p>via, transport / carrier / channel protein ;</p>	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT active transport</p>

Question		Answer	Marks	Guidance
	(iii)	108 ; ;	2	<p>Correct answer = 2 marks</p> <p>If answer is incorrect, AWARD 1 mark for</p> <p>18 carbon atoms = 9 acetyl CoA</p> <p>OR</p> <p>error carried forward (eg correctly calculated 12 x candidate's stated number of acetyl CoA molecules)</p>
	(d)	<p>saturated fatty acids have no double bonds so contain more hydrogen ; ora</p> <p>(during) oxidative phosphorylation / (at the end of) electron transport chain, hydrogen combines with oxygen ;</p>	2	<p>ACCEPT hydrogen and oxygen combine in aerobic respiration</p>
		Total	15	

Question		Answer	Marks	Guidance
3	(a)	<p>1 transcription ;</p> <p>2 gene(s) / described ;</p> <p>3 hydrogen bonds between (complementary DNA) bases break ;</p> <p>4 ref to template strand ;</p> <p>5 free RNA nucleotides (pair up with template) ;</p> <p>6 complementary base pairing / description ;</p> <p>7 phosphodiester bonds / sugar phosphate backbone ;</p> <p>8 messenger RNA / mRNA, detaches ;</p> <p>9 leaves through nuclear pore ;</p> <p>10 ref to named enzyme ;</p>	5	<p>1 IGNORE translation CREDIT 'DNA is transcribed' ACCEPT transcribed or transcription as one term</p> <p>2 ref to start / initiation, codons / stop / termination, codons</p> <p>3 ACCEPT DNA unzips</p> <p>4 DO NOT CREDIT if more than one strand used</p> <p>6 eg C to G / A to U DO NOT CREDIT T in RNA</p> <p>10 DNA helicase (DNA unwinds) / RNA polymerase (promoter, phosphodiester bonds)</p>
		QWC ;	1	3 of the emboldened terms used and spelled correctly
	(b) (i)	Golgi (apparatus/body) ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

Question	Answer	Marks	Guidance
	<p>(ii)</p> <p>1 (haemoglobin has) four haem groups each containing iron / each polypeptide has one haem group containing iron ;</p> <p>2 oxygen (molecule) binds, reversibly / described, to, iron/haem ;</p> <p>3 co-operative binding / described ;</p> <p>4 haemoglobin (almost) fully saturated at high pO_2 ;</p> <p>5 (as) pO_2 falls / at low(er) pO_2, haemoglobin releases oxygen / AW ;</p> <p>6 high pO_2 in lungs and low pO_2 in (respiring) tissues ;</p>	3	<p>CREDIT 'prosthetic group' instead of haem</p> <p>CREDIT idea that binding of oxygen to one haem affects affinity of binding to other groups</p> <p>ACCEPT level / concentration for partial pressure</p> <p>ACCEPT level / concentration for partial pressure regions of high and low pO_2 needed</p>
	Total	10	

Question			Answer	Marks	Guidance
4	(a)		used ; used ; produced ;	3	
4	(b)	(i)	community of different organisms interacting with each other / AW ; community / AW, interacting with their environment / AW ;	2	<i>Look for idea of living things interacting with each other</i> <i>look for idea of living things interacting with environment</i>

Question	Answer	Marks	Guidance
(ii)	<p>Two methods stated from the list below ; increased size of fields / destruction of or hedgerows use of pesticides or use of fertilisers or monoculture of crops or <i>idea of heavy machinery</i> or use of antibiotics <i>Description of effect from the list below,</i> <i>correctly matched to method(s) ; ;</i> loss of, habitats / nesting sites / niches / AW or extinction of species or (pesticides) accumulating in food chain / food web or (fertilisers) run off into river ecosystems or eutrophication / correct description of effects or decrease in biodiversity or loss of soil structure or increased use of fuel adds to greenhouse effect or <i>idea of excessive use of antibiotics leads to</i> <i>resistance in pathogens</i></p>	3	<p>IGNORE refs to pollution unqualified One mark for two correctly stated methods</p> <p>ACCEPT megadairies</p> <p>IGNORE refs to pollution unqualified Two marks for descriptions of effects correctly matched to method</p>
	QWC ;	1	3 of the emboldened terms used and spelt correctly

Question		Answer	Marks	Guidance
	(c) (i)	as carbon dioxide concentration increases the sea level rises ; figures to support ;	2	CREDIT positive correlation DO NOT CREDIT 'as the sea level rises the carbon dioxide concentration increases' value for sea level, with correct units, for two years and value for CO ₂ conc, with correct units, for two stated years
	(ii)	(increased CO ₂) traps heat (energy) / raises (air) temperature ; (polar) ice (caps) melt / glaciers break off into water ;	2	ACCEPT description IGNORE reference to greenhouse unqualified
	(iii)	<i>supports statement</i> (the mean figures) in 2000 is higher than the mean in 1990 ; <i>does not support statement</i> overlapping <u>error</u> bars OR no reference to a (named) statistical test ;	2	DO NOT CREDIT reference to RANGE BARS overlapping as the bars are evenly distributed
		Total	15	

Question		Answer	Marks	Guidance
5	(a)	embryo / cells, contain(s) water ; idea that when water freezes it expands ; (ice crystals) destroy / damage, embryo / organelles / cells ; without vital organelles the cell cannot, metabolise / divide ; <i>idea of problems with, long term storage ;</i> <i>idea of problems with, viability, of embryos ;</i>	2	
	(b)	1-6 days ;	1	ACCEPT any value between 1 and 6 days
	(c)	1 cells (in blastocyst) are undifferentiated ; 2 each cell is <u>totipotent</u> / described ; 3 (remaining cells) divide by <u>mitosis</u> ; 4 ref to <u>stem</u> cells ;	2	ACCEPT unspecialised Look for idea that they can differentiate into <u>all types</u> of tissue
	(d)	thickness of, endometrium / lining of uterus / lining of womb ;	1	ACCEPT correct stage of <u>uterine</u> cycle

Question		Answer	Marks	Guidance
	(e)	<p>1 no corpus luteum present ;</p> <p>2 <i>idea that</i> not enough, oestrogen / progesterone, produced ;</p> <p>3 to maintain, endometrium / lining of uterus / lining of womb ;</p> <p>4 placenta, formed by 8 weeks ;</p> <p>5 (placenta) then produces oestrogen / progesterone ;</p>	3	
		Total	9	

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