

OCR BIOLOGY AS. PAPER 2 MARK SCHEME

Mark Scheme

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	A = plasma / cell surface, membrane ; B = DNA / chromosome / chromatin / genetic material ;	2	DO NOT CREDIT membrane, cell membrane DO NOT CREDIT chromosomes (do not accept plural) CREDIT loop of / circle of, DNA DO NOT CREDIT plasmid, RNA ACCEPT nucleoid
1	(a)	(ii)	production of ATP ; <u>aerobic</u> respiration ;	max 1	ACCEPT named stages of aerobic respiration e.g. Krebs cycle, oxidative phosphorylation, ETC, chemiosmosis, link reaction, substrate level phosphorylation DO NOT CREDIT glycolysis, ATP <i>for</i> respiration DO NOT CREDIT <i>produce</i> energy (in form of ATP) IGNORE provide / release energy unqualified
1	(a)	(iii)	protein synthesis / translation ; photosynthesis / described ;	2	ACCEPT production / creation, of proteins / polypeptides, assembly of proteins from amino acids IGNORE autotrophic nutrition DO NOT CREDIT absorption of light unqualified

Question		Expected Answers	Marks	Additional Guidance
2	(a) (i)	<p>1 at low temperatures, all stain is in cells OR no stain in surrounding solution ;</p> <p>2 (taken up / held) against, diffusion / concentration, gradient ;</p> <p>3 at high temperature stain not held in cells ;</p> <p>4 at high temperature enzymes denatured so no ATP for active transport (of stain) ;</p> <p>5 use of correct comparative figs to illustrate a point ;</p> <p>AVP ; ;</p>	max 2	<p><i>MP 1 awarded for observation that the stain was no longer in the surrounding solution and not for the % of cells containing the stain.</i></p> <p>ACCEPT the stain is not evenly distributed between cells and solution ACCEPT stain doesn't move out of cells</p> <p>ACCEPT <i>up</i> the diffusion gradient</p> <p>ACCEPT solution now contains stain ACCEPT 0% = none / no cells (stained)</p> <p><i>MP 1 and 3 - must be stated rather than inferred from quoted figs</i></p> <p>IGNORE 'enzymes denatured' alone CREDIT active transport / carrier, proteins denatured ACCEPT mitochondria stopped working so no ATP produced</p> <p>e.g. 97% at 30°C but 0% at 80°C IGNORE figs without units</p>

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2	(a)	(ii)	cells, dead / not respiring ; no, (metabolic) energy / ATP, to take up stain ; AVP ;	max1	DO NOT CREDIT 'burst' as these cannot be seen ACCEPT inhibitor present / membrane impermeable ACCEPT no functioning mitochondria
2	(b)	(i)	(membrane) structure disrupted ; (phospho)lipid bilayer, melts / more fluid ; (membrane) proteins / carrier molecules, denatured / unable to function ; (membrane) becomes more permeable ;	max 1	<i>Mark first suggestion and if correct award mark – if further answers contradict first answer do not award mark.</i> ACCEPT damaged, destroyed, break down IGNORE <i>membrane</i> , denatured / more fluid IGNORE lipid <i>molecules</i> melt ACCEPT lose shape for denatured ACCEPT leaky IGNORE refs to bonds breaking

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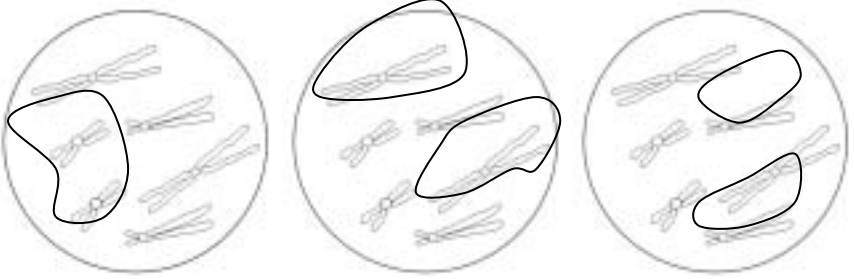
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2	(b)	(ii)	membrane <u>permeable</u> (to stain) ; methylene blue, leaked out of cells / released to solution ; by diffusion / down concentration gradient ;	max 2	IGNORE leaky ACCEPT stain / blue / pigment, moved out IGNORE lost <i>colour</i> / <i>colour</i> moved out (it is in stem of question) ACCEPT by active transport (assuming thermostable enzymes) blue / stain, diffuses out = 2 marks
2	(c)		<p><i>accuracy</i></p> take readings at intermediate temperatures (between 50 °C – 70 °C) ; <p><i>reliability</i></p> take more, readings at each temperature / repetitions ;	2	<p><i>Mark first suggestion only</i></p> DO NOT CREDIT wider temperature range OR more temperatures unqualified OR more regular intervals ACCEPT take readings every 5 degrees / °C ACCEPT ref. to haemocytometer ACCEPT colorimeter used to measure colour intensity of blue solution DO NOT CREDIT ref to use of calorimeter ACCEPT repeat experiment (ideally 3 readings for each temperature) , increase the number of cells observed ACCEPT replica / replicate for repeat

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2	(d)	<p>nucleus divides / mitosis ;</p> <p><i>idea of :</i></p> <p>cell, swells on one side / bulges ;</p> <p>nucleus / cytoplasm / organelles, move into, bud / bulge ;</p> <p>pinches off / cell wall forms, (so bud becomes a separate cell) ;</p>	max 2	<p>ACCEPT asexual reproduction / cloning IGNORE cell splits, ref to genetically identical cells</p> <p>IGNORE <i>bud</i> forms on side</p> <p>IGNORE replicated DNA enters bud</p> <p>ACCEPT cytokinesis IGNORE two cells are formed / bud separates unqualified</p>

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3	(a)	(i)	<p><i>plant cell / Y, has:</i> a wall ; chloroplasts ; vacuole ;</p>	max 2	<p>Credit reverse argument</p> <p>ACCEPT thylakoid, discs / membranes OR granum(a) IGNORE chlorophyll</p>
3	(a)	(ii)	<p>A1 a vacuole ; E1 to take up water / to become turgid ;</p> <p>A2 cell wall thicker on one side ; E2 causes, cell to bend / open stoma(ta) ;</p> <p>A3 mitochondria ; E3 generates ATP (for active transport) ;</p>	max 2	<p><i>Mark adaptation (A) as stand-alone</i> <i>Ensure explanation (E) stated is appropriately linked to adaptation</i></p> <p>DO NOT CREDIT curved cell wall / thick cell wall unqualified ACCEPT close stoma(ta) if adaptation correct</p> <p>IGNORE ref to chloroplasts</p>
3	(b)	(i)	two homologous chromosomes circled ;	1	<p>ACCEPT one circle around both chromosomes or two circles The two chromosomes must be of same length</p> 

Question			Expected Answer				Mark	Additional Guidance																														
4	(a)	(i)	<table border="1"> <thead> <tr> <th>reagent</th> <th>observation</th> <th>molecule</th> <th>present or absent</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>ethanol and water</td> <td>white emulsion</td> <td>lipid</td> <td>present</td> <td></td> <td></td> </tr> <tr> <td>Benedict's solution</td> <td>brick-red precipitate</td> <td>reducing sugar / lactose / glucose / galactose / monosaccharides</td> <td>present</td> <td>;</td> <td></td> </tr> <tr> <td>biuret I and II</td> <td>lilac colour</td> <td>protein / named milk protein</td> <td>present</td> <td>;</td> <td></td> </tr> <tr> <td>iodine solution</td> <td>yellow / brown</td> <td>starch / amylose</td> <td>absent</td> <td>;</td> <td></td> </tr> </tbody> </table>				reagent	observation	molecule	present or absent			ethanol and water	white emulsion	lipid	present			Benedict's solution	brick-red precipitate	reducing sugar / lactose / glucose / galactose / monosaccharides	present	;		biuret I and II	lilac colour	protein / named milk protein	present	;		iodine solution	yellow / brown	starch / amylose	absent	;		3	<p>One mark per correct row. IGNORE 'yes', 'no' and ticks and crosses DO NOT CREDIT if anything incorrect is written in any box in the molecule column. e.g. 'starch or cellulose' = 0 mark</p> <p>ACCEPT maltose DO NOT CREDIT sucrose</p> <p>ACCEPT casein / lactoglobulin / lactalbumin / polypeptide</p> <p>IGNORE amylopectin</p>
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4	(a)	(ii)	milk is already, cloudy / an emulsion / white / AW ;				1	ACCEPT idea of difficulty in detecting change because of the appearance of milk																														
4	(a)	(iii)	<p>(one) glycerol / glyceride ; 3 fatty acids ;</p> <p>ester bond (between glycerol and fatty acid) ;</p>				3	<p>ACCEPT marking points from clearly labelled diagram but DO NOT CREDIT if contradicted in text. IGNORE individual atoms on diagram and look for correct position of labels MAX 2 if phosphate group included (as could be confused with phospholipid)</p> <p>ACCEPT on diagram if 3 shown and at least one labelled ACCEPT triglycerides are esters</p>																														

Question	Expected Answer	Mark	Additional Guidance
4 (b)	<p>1 (thermal) insulation ; 2 energy, store / source / release ;</p> <p>3 protection ; 4 membranes / phospholipid bilayer / control entry and exit into cells ; 5 (steroid) hormones / named steroid hormone ; 6 buoyancy ; 7 waterproofing ; 8 source of water (from respiration) ; 9 (electrical insulation) in myelin / around neurones / around axons / around dendrons ; 10 aid, absorption / storage / production, of, fat soluble / A / D / E / K, vitamins ;</p>	3	<p>MARK THE FIRST RESPONSE ON EACH NUMBERED LINE</p> <p>1 ALLOW 'warmth' 2 CREDIT answers that refer to the idea of lipid as a respiratory substrate but DO NOT CREDIT 'for respiration' unqualified IGNORE 'fat contains energy' without further qualification DO NOT CREDIT refs to producing energy or to quick energy release ACCEPT 'provides energy'</p> <p>4 CREDIT ref to cholesterol in membranes</p> <p>9 CREDIT nerve fibres / saltatory conduction IGNORE nerves</p>
4 (c) (i)	<p>saturated ; (fatty acids have) no / fewer, double bonds ; solid at room temperature ;</p>	1 max	<p>Assume answers refer to animal fats unless otherwise stated ACCEPT reverse argument IGNORE ref to fats and oils (as stated in question)</p> <p>ACCEPT 'fatty acids are not kinked' ACCEPT reasonable temperature quoted</p>

Question	Expected Answer	Mark	Additional Guidance
4 (c) (ii)	<p>1 (death rate for) men greater (at any concentration) / AW ;</p> <p>2 (death rates) rise with increasing cholesterol / AW ;</p> <p>3 death rate for men, initially / AW, falls ;</p> <p>4 steep(er) / AW, rise (in, males / both) at higher cholesterol levels ;</p> <p>5 comparative figures with unit for (blood) cholesterol to support any of the above points ;</p>	3 max	<p>1 ACCEPT ora</p> <p>2 ACCEPT 'positive correlation' (between death and cholesterol)</p> <p>3 ACCEPT 4.8 or below as 'initially'.</p> <p>4 Answers must refer to latter part of graph only (5.7 or above). ACCEPT difference (between sexes) greater at high concentration</p> <p>5 There are 3 ways of getting this mark:</p> <ul style="list-style-type: none"> • values for both sexes at single concentration • two values for single sex at two concentrations • subtraction / calculation, that shows comparison <p>IGNORE terms like 'about'</p> <p>See table for acceptable examples of x and y values – if intermediate cholesterol values are used, refer to the graph for the data</p>

blood cholesterol (mmol dm ⁻³)	deaths per 10 000	
	women	men
3.6	13.2 - 14.1	31.2 - 32.1
4.3	15.0 - 15.9	26.0 - 26.9
4.8	14.0 - 14.9	24.0 - 24.9
5.2	15.1 - 16.0	24.6 - 25.5
5.7	17.4 - 18.3	25.8 - 26.7
6.2	17.8 - 18.7	33.2 - 34.1
6.7	23.5 - 24.3	31.3 - 32.2
7.3	22.0 - 22.9	44.1 - 45.0
8.2	31.7 - 32.6	59.5 - 60.4

Must include (blood) cholesterol units

Any figure within a particular range is acceptable

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4	(c)	(iii)	<p>1 coronary heart disease / CHD / cardio-vascular diseases / heart attack / cardiac arrest / myocardial infarction / MI / angina ;</p> <p>2 <u>atherosclerosis</u> / atheroma ;</p> <p>3 stroke ;</p> <p>4 <u>Type 2</u> diabetes ;</p>	2	<p>Mark first two in list</p> <p>1 DO NOT CREDIT heart disease alone or ‘conary’ ACCEPT hypertension / high blood pressure</p> <p>2 DO NOT CREDIT arteriosclerosis</p>

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Question			Expected Answer	Mark	Additional Guidance
5	(a)	(i)	<p>1 (m)RNA is single stranded / DNA is double stranded ;</p> <p>2 (m)RNA is non helical / DNA is helical ;</p>	1	<p>Mark the first response but do not award the mark if a further answer is incorrect or contradictory DO NOT CREDIT refs to length as given in stem</p> <p>1 ACCEPT DNA is a double helix (as stranded is implied) for this mp DO NOT CREDIT DNA is a double <i>molecule</i></p> <p>2 ACCEPT (mRNA) not twisted / not coiled / not spiral / straight / ora</p>
5	(a)	(ii)	<p>1 RNA contains ribose and DNA contains deoxyribose ;</p> <p>2 RNA contains, uracil / U, and DNA contains, thymine / T ;</p> <p>3 3 / more than 1, forms of RNA ;</p> <p>4 RNA is, single <u>stranded</u> / non helical, and DNA is, double <u>stranded</u> / helical ; <i>if not already awarded as answer in (i)</i></p>	1	<p>Mark the first response to (a)(ii) – but do not award the mark if a further answer is incorrect or contradictory</p> <p>2 DO NOT CREDIT thymine</p> <p>3 ACCEPT ‘one form of DNA’</p>
5	(a)	(iii)	<u>gene</u> ;	1	IGNORE allele / operon
5	(a)	(iv)	too big to / does not, fit through <u>pore</u> (in nuclear envelope) ;	1	ACCEPT ‘too long to fit ... pore’
5	(a)	(v)	<p><i>idea that</i> only copies one, gene / section / part / AW, (of DNA) ;</p> <p><i>idea that</i> DNA comprises many, genes / alleles ;</p>	2	<p>e.g. mRNA only codes for 1 protein</p> <p>DO NOT CREDIT ‘1 DNA molecule contains <u>all</u> the genes’ ‘mRNA only codes for 1 protein but DNA codes for many proteins’ = 2 marks</p>

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5 (b) (i)	<ol style="list-style-type: none"> 1 <u>non</u>-competitive (inhibitor) ; 2 (α-amanitin / inhibitor / toxin) fits into, allosteric site / a place other than active site ; 3 <u>active site</u> changes, shape / configuration / conformation / structure ; 4 substrate no longer, fits / complementary to, <u>active site</u> ; 	2 max	<ol style="list-style-type: none"> 3 ACCEPT 'distortion of active site' 4 Mark to be awarded in context of active site (although need not be repeated if stated in mp 3) IGNORE ESC
5 (b) (ii)	<ol style="list-style-type: none"> 1 inhibits production of mRNA / mRNA not produced ; 2 prevents protein synthesis / AW ; 3 e.g. of, specific named protein / (vital) process, that may be affected ; 	2 max	<ol style="list-style-type: none"> 1 CREDIT prevents transcription 2 CREDIT translation 3 e.g. respiration / photosynthesis (as question refers to 'an organism') / haemoglobin / cytochrome C oxidase
5 (c) (i)	sequence / order, of amino acids ;	1	IGNORE number / organisation
	(c) (ii) A = ionic ; B = hydrogen ; C = <u>disulfide</u> (bond / bridge) ;	3	ALLOW phonetic spelling DO NOT CREDIT <u>disulfate</u>
5 (d)	<ol style="list-style-type: none"> 1 increased <u>kinetic</u> energy ; 2 (any part of protein molecule) vibrates ; 3 hydrophilic / hydrophobic / hydrogen / ionic, bonds / interactions, break ; 4 change in, <u>3D</u> shape / conformation (of protein) ; 5 <u>denatures</u> ; 	3 max	<ol style="list-style-type: none"> 1 must contain the idea of <u>more</u> than normal 3 IGNORE Van der Waals DO NOT CREDIT if disulfide / covalent / peptide bonds are included 4 IGNORE tertiary / structure (as in question) IGNORE refs to, active site / enzymes