



EXAM PAPERS PRACTICE

## Voice of the Genome -1

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: Voice of the Genome -1

Type: Mark Scheme

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful



## Mark Scheme

Q1.

Question Number	Answer	Mark
(i)	The only correct answer is –A <i>amino acids</i>  B is incorrect because nitrates are not found in cellulose  C is incorrect because nitrates are not found in starch  D is incorrect because nitrates are not found in sucrose	Computer (1)

Question Number	Answer	Mark
(ii)	The only correct answer is –C <i>nucleic acids</i>  A is incorrect because phosphate is not found in cellulose  B is incorrect because phosphate is not found in chlorophyll  D is incorrect because phosphate is not found in sucrose	Computer (1)

Question Number	Answer	Mark
(iii)	The only correct answer is – C <i>chlorophyll</i>  A is incorrect because magnesium is not found in amino acids  B is incorrect because magnesium is not found in cellulose  D is incorrect because magnesium is not found in starch	Computer (1)



Q2.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to three of the following</p> <ul style="list-style-type: none"><li>• (because) { one triplet is affected / a different triplet code is produced } (1)</li><li>• (the mutation) could change one of the amino acids (1)</li><li>• this would {change the bonds formed between the R groups / cause a change in the tertiary structure}(1)</li><li>• the haemoglobin would no longer be able to bind to oxygen (1)</li></ul>	<p>ALLOW produce a stop codon</p> <p>IGNORE reference to secondary or quaternary structure</p>	<p>( 3 )</p>

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"><li>• partially permeable membrane is a barrier to some solutes but not water (1)</li><li>• enables a concentration gradient of { solutes / water } (1)</li></ul>		<p>(2)</p>



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Q4.

Question Number	Answer	Mark		
(i)	<p><b>The only correct answer is B -</b></p> <table border="1"><tr><td>against a solute concentration gradient</td><td>through a partially permeable membrane</td></tr></table> <p>A is not correct because in osmosis water moves against a solute concentration gradient - through a partially permeable membrane</p> <p>C is not correct because in osmosis water moves against a solute concentration gradient - through a partially permeable membrane</p> <p>D is not correct because in osmosis water moves against a solute concentration gradient - through a partially permeable membrane</p>	against a solute concentration gradient	through a partially permeable membrane	<b>1</b>
against a solute concentration gradient	through a partially permeable membrane			

Question Number	Answer	Mark
(ii)	<p><b>The only correct answer is A – Active transport</b></p> <p>B is not correct because exocytosis is an export process</p> <p>C is not correct because osmosis describes the movement of water (solvent) molecules</p> <p>D is not correct because passive diffusion take place down a concentration gradient</p>	<b>1</b>

Question Number	Answer	Mark
(iii)	<p><b>The only correct answer is D – Protein</b></p> <p>A is not correct because carrier molecules or channel used for facilitated diffusion are proteins</p> <p>B is not correct because carrier molecules or channel used for facilitated diffusion are proteins</p> <p>C is not correct because carrier molecules or channel used for facilitated diffusion are proteins</p>	<b>1</b>



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Q5.

Question Number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none"><li>• using carbon (14) dating</li></ul>	ALLOW the deeper the layer in the peat, the older it is	graduate (1)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation that makes reference to three of the following</p> <ul style="list-style-type: none"><li>• conditions are anaerobic (1)</li><li>• therefore less (aerobic) respiration by decomposers (1)</li><li>• acidic conditions {inhibit /denature} enzymes (1)</li><li>• therefore (enzymes) cannot {digest / break down} organic material (1)</li></ul>	<p>ALLOW (waterlogging) reduces the oxygen content</p> <p>ALLOW microorganisms / named decomposers ALLOW decomposers respiring anaerobically</p> <p>ALLOW description of denaturing eg change in shape of active site</p> <p>ALLOW break down plants / animals /peat</p>	Expert (3)



Q6.

**Biology A (Salters-Nuffield) Advanced Paper 3 (9BN0/03)**

Question Number	Acceptable Answer	Additional Guidance	Mark
<b>(a)</b>	Tonoplast		<b>(1)</b>

Question Number	Acceptable Answer	Additional Guidance	Mark
<b>(b)</b>	<ul style="list-style-type: none"><li>• selection of correct points from the graph (1)</li><li>• calculation of percentage (1)</li><li>• difference in percentage (1)</li></ul>	0.17 AU , 0.23 AU , 0.26 AU <u>Example of calculation:</u> 35.3% ÷ 13.0% = 22.3% Allow full marks for correct answer with no working	<b>(3)</b>

Question Number	Acceptable Answer	Additional Guidance	Mark
<b>(c)(i)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• interferes with { tertiary / 3-D } shape of the channel proteins (1)</li><li>• therefore causes channel proteins to</li></ul>		<b>(2)</b>



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Question Number	Acceptable Answer	Additional Guidance	Mark
<b>(c)(ii)</b>	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"><li>• solutions with a range of pH values (1)</li><li>• pieces of beetroot of same surface area (1)</li><li>• control of other named relevant variables (1)</li><li>• measurement of absorbance of solution using colorimeter (1)</li><li>• repeats at each pH value to calculate mean (1)</li></ul>	<p>e.g. temperature / volume of solution / time left in solution /</p>	<b>(4)</b>

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Q7.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to four of the following</p> <ul style="list-style-type: none"><li>• a mutation will lead to a change in the sequence of bases (in the DNA) (1)</li><li>• (therefore a mutation) may lead to {a different amino acid /change in the sequence of amino acids} (1)</li><li>• so different R groups would change the tertiary structure of the enzyme (1)</li><li>• therefore the (shape of the) active site is changed (1)</li><li>• therefore substrate does not fit active site of enzyme / substrate-enzyme complexes cannot form (1)</li></ul>	<p>ALLOW change to triplet code (of DNA)</p> <p>ALLOW reference to STOP codon being produced</p>	<p>Expert (4)</p>





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Q8.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to four of the following: <ul style="list-style-type: none"><li>• DNA unzips and one strand acts as a template (1)</li><li>• ribonucleotides pair up with complementary bases (1)</li><li>• RNA polymerase joins ribonucleotides together to form pre-mRNA (1)</li><li>• the mRNA has fewer bases than pre-mRNA / gene (1)</li><li>• as a result of removal of introns / mRNA made up of exons only (1)</li></ul>		<b>(4)</b>

Q9.

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(a)(i)</b>	49 182 000 × 0.05 (1) 2 459 100 (1)	Correct answer gains full marks	<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(a)(ii)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• can dilate bronchioles /airways (1)</li><li>• therefore allowing more oxygen into lungs /alveoli (1)</li></ul>		<b>(2)</b>



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Question Number	Acceptable Answer	Additional guidance	Mark
<b>(a)(iii)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• sympathetic neurotransmitters are released at the SAN (1)</li><li>• therefore if beta-2 agonists are present the SAN will increase its rate of stimulation (1)</li><li>• so impulses will spread faster and more often over the atria (1)</li><li>• therefore the heart muscle will contract more often which increases the heart rate (1)</li></ul>		<b>(4)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(b)</b>	An explanation that makes reference to four of the following: <ul style="list-style-type: none"><li>• HGH binds to receptor in cell surface membrane (1)</li><li>• activation of messenger molecule in cytoplasm (1)</li><li>• reference to protein kinase cascade (1)</li><li>• transcription factor produced (1)</li><li>• gene for IGF-1 switched on (1)</li></ul>		<b>(4)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(c)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• occur naturally / would have some present in body (1)</li><li>• therefore difficult to detect additional HGH (1)</li></ul>		<b>(2)</b>



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Question Number	Acceptable Answer	Additional guidance	Mark
<b>(d)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• no need for blood transfusion (1)</li></ul> plus any one from: <ul style="list-style-type: none"><li>• therefore no risk of rejection / agglutination/ delay in {tissue/blood} typing (1)</li><li>• they supply the oxygen requirements for the body (1)</li></ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(e)</b>	An explanation that makes reference to four of the following: <ul style="list-style-type: none"><li>• reference to {sodium ion channels / voltage gated sodium ion channels} (1)</li><li>• binding blocks movement of sodium ions into neurone (1)</li><li>• membrane is not depolarised (1)</li><li>• action potential is not generated (1)</li><li>• no impulses conducted to brain (1)</li></ul>	Accept more sophisticated answers that refer to the effect on calcium ion movement	<b>(4)</b>



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Question Number	Acceptable Answer	Additional guidance	Mark
<b>(f)</b>	An explanation that makes reference to two of the following: <ul style="list-style-type: none"><li>• (they) increase the removal of {water/salts} from blood (1)</li><li>• (removal of water) lowers blood volume and therefore pressure (1)</li><li>• (removal of salt) lowers uptake of water into blood (by osmosis from tissue fluid) and therefore blood pressure (1)</li></ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(g)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• normal ratio is 1:1 (1)</li><li>• taking testosterone and epitestosterone in equal measures maintains this ratio (1)</li><li>• therefore it is not possible to detect cheats (1)</li></ul>		<b>(3)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(h)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>• drug E has been retained in the gas phase longer (1)</li><li>• because it has {greater solubility / smaller mass} (1)</li></ul>	Accept more sophisticated answers related to charge	<b>(2)</b>



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Question Number	Acceptable Answer	Additional guidance	Mark
<b>(i)</b>	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"><li>• longitudinal monitoring / to be followed over time (1)</li><li>• therefore can identify individual differences in naturally occurring drug concentrations (1)</li><li>• therefore can see pattern or link to competition / injury / look for changes (1)</li></ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>(j)</b>	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"><li>• the absolutist's view would be that they should never be used (1)</li></ul> <p>plus any one from:</p> <ul style="list-style-type: none"><li>• because of the damage to the body by the side effects (1)</li><li>• athletes should compete using their innate {anatomical / physiological} abilities / fair competition should be promoted (1)</li></ul> <p>and</p> <ul style="list-style-type: none"><li>• the rationalist's view would be that their use is acceptable if there is a justifiable outcome (1)</li></ul> <p>Plus any one from:</p> <ul style="list-style-type: none"><li>• because it is a personal choice (1)</li><li>• because it could help to overcome the inequalities in {training / medical support} (1)</li></ul>		<b>(4)</b>



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Q10.

Question Number	Answer	Mark
(i)	<p><b>The only correct answer is D - 5</b></p> <p><i>A is not correct because oxygen has to travel across both sides of a cell in the alveolus wall plus both sides of the capillary wall cell as well as across the cell surface membrane of a red blood cell. This summates to 5, not 2.</i></p> <p><i>B is not correct because oxygen has to travel across both sides of a cell in the alveolus wall plus both sides of the capillary wall cell as well as across the cell surface membrane of a red blood cell. This summates to 5, not 3.</i></p> <p><i>C is not correct because oxygen has to travel across both sides of a cell in the alveolus wall plus both sides of the capillary wall cell as well as across the cell surface membrane of a red blood cell. This summates to 5, not 4.</i></p>	(1)

Question Number	Answer	Mark
(ii)	<p><b>The only correct answer is B (diffusion)</b></p> <p><i>A is not correct because oxygen does not enter a red blood cell by active transport</i></p> <p><i>C is not correct because oxygen does not enter a red blood cell through facilitated diffusion</i></p> <p><i>D is not correct because oxygen does not enter a red blood cell through osmosis</i></p>	(1)



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Q11.

Question Number	Answer	Additional guidance	Mark
(i)	<p>An explanation that makes reference to three of the following</p> <ul style="list-style-type: none"><li>• ribosome shape is altered (1)</li><li>• mRNA is prevented from binding (to the ribosome) / causing change in tRNA binding (1)</li><li>• therefore translation cannot occur (1)</li><li>• { protein / polypeptide } is not synthesised (1)</li></ul>	<p>ALLOW translation is affected / reduced / altered</p> <p>ALLOW faulty protein produced</p>	(3)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An answer that makes reference to two of the following</p> <ul style="list-style-type: none"><li>• bacteria have not been exposed to new antibiotics before / bacteria do not have mechanisms to make them resistant to the new antibiotics (1)</li><li>• bacteria have developed resistance (to other antibiotics) by { evolving / natural selection } (1)</li><li>• therefore there has been {no advantage to possessing a mutation to bypass the new antibiotic / no mutation present to give resistance } (1)</li></ul>		(2)



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Question Number	Answer	Mark
(iii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>Indicative content</p> <ul style="list-style-type: none"><li>• prepare agar plates with bacterial cultures / bacterial lawn / seeded with bacteria –use bacteria that are resistant to other antibiotics</li><li>• prepare solutions of new antibiotic and penicillin</li><li>• place onto paper discs / into wells in the agar / prepare mast rings</li><li>• control time and temperature of incubation</li><li>• same concentration and volume of both antibiotics</li><li>• measure the area of inhibition</li><li>• repeat for effective antibiotics</li><li>• description of serial dilution of each antibiotic</li><li>• range of dilutions on each plate-one antibiotic per plate</li><li>• statistical test to determine which is the most effective</li><li>• repeat with different strains of resistant bacteria</li></ul>	(6)





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Level	Marks		Additional Guidance
0	0	No awardable content	
1	1-2	<p>An explanation of how the investigation should be modified may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>	<p>Preparation of agar plates Method of adding antibiotic</p> <p>Use of new antibiotic and penicillin Measure zone of inhibition</p>
2	3-4	<p>An explanation of how the investigation should be modified will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p>	<p>Incubated for stated time 24-72 hours Incubated at stated temperature 25-37°C Method of culturing bacteria on agar plates/preparing a lawn</p> <p>Repeats to calculate the mean Larger zone of inhibition-more effective antibiotic</p>
3	5-6	<p>An explanation of how the investigation should be modified is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.</p>	<p>Strain of bacteria known to be resistant to penicillin/other antibiotics Same volume/concentration of both antibiotics</p> <p>Several strains of resistant bacteria tested with new antibiotic Preparation of serial dilutions for both antibiotics Range of concentrations give minimum effective dose Named statistical test eg T-test</p>



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Q12.

Question Number	Answer	Additional guidance	Mark
(i)	<p>A description that makes reference to three of the following</p> <ul style="list-style-type: none"><li>• the proteins are folded in the rough endoplasmic reticulum (RER) (1)</li><li>• the proteins are {packaged into/transported in} vesicles (1)</li><li>• the protein is modified in the Golgi apparatus (1)</li><li>• exocytosis (1)</li></ul>	<p>ALLOW processed/ description of modification ALLOW description of exocytosis</p>	(3)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation that makes reference to the following</p> <ul style="list-style-type: none"><li>• (if the protein is not folded correctly) the {tertiary structure / 3D shape} would be different(1)</li><li>• therefore the active site of the enzyme would not { fit / bind with } the substrate / it would not be able to form an enzyme substrate complex (1)</li><li>• therefore it would not be able to catalyse the reaction (1)</li></ul>	<p>ALLOW not complementary</p>	(3)



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Q13.

Question Number	Answer	Additional Guidance	Mark
(i)	<ul style="list-style-type: none"><li>• correct values taken from the graph (1)</li><li>• correct answer with units (1)</li></ul>	<p><u>Example of calculation</u></p> <p><math>55 - 45 (= 10)</math></p> <p><math>= 2 \text{ au min}^{-1}</math></p> <p>ALLOW an answer between 1.6 au and 2 au per minute</p> <p>or</p> <p>0.0267 to 0.0333 au per second</p> <p>Correct answer with units, with no working gains full marks</p> <p>Correct answer with no units, gains one mark only</p>	<b>2</b>

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"><li>• DNA contents doubles twice / two stages of DNA synthesis (1)</li><li>• therefore two divisions (1)</li></ul>	<p>ALLOW two increases in uptake of bases</p> <p>ALLOW twice</p>	<b>2</b>



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Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"><li>• because thymine is found only in DNA (1)</li><li>• other radioactive bases taken up by all nucleic acids (1)</li><li>• only DNA would be measured (1)</li></ul>	<p>ALLOW RNA does not contain thymine</p> <p>ALLOW other bases taken up by RNA</p> <p>ALLOW no need to separate DNA from RNA</p>	<b>2</b>

Q14.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"><li>• selection of two temperatures that are not above the optimum temperature (1)</li><li>• named variable kept constant (1)</li><li>• record the distance travelled by the coloured liquid in a set time (1)</li><li>• description of how to calculate rates (1)</li><li>• data collected during the initial rate of reaction / before a factor (other than temperature) becomes limiting (1)</li></ul>	<p>ALLOW: below a temperature that causes enzyme denaturing or not above optimum temp</p> <p>ALLOW any two temperatures between 10 and 40°C</p> <p>e.g. pH of solution, {sucrose/glucose} concentration, yeast {concentration / volume}</p> <p>ALLOW time taken for coloured liquid to travel a set distance</p> <p>e.g. by dividing distance travelled by time</p>	<b>(4)</b>



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Q15.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none"><li>chloride ions leave cells (through the CFTR channel protein) (1)</li><li>sodium ions leave the cells (following the chloride ions) (1)</li><li>increasing the solute concentration in the mucus (1)</li><li>water moves out of the cells by osmosis (into the mucus) (1)</li></ul>	<p>NOT active transport of chloride ions ALLOW chloride ions move into the mucus</p> <p>ALLOW NaCl, Na<sup>+</sup> or Cl<sup>-</sup> instead of solute</p> <p>ALLOW description of osmosis</p>	3

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"><li>(triplet code) is shown by three bases coding for an amino acid (1)</li><li>non-overlapping code e.g. ATT codes for amino acid I and then AAA code for amino acid K (1)</li><li>degenerate code as both ATT and ATC code for amino acid I (1)</li></ul>		3



Q16.

Question Number	Indicative content	
	<p>Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>Candidates are expected to offer a range of appropriate examples to support a comment on the roles of phosphorylation in Biology.</p> <ul style="list-style-type: none"><li>• Description of phosphorylation as an addition of phosphate.</li><li>• Examples of phosphorylation in respiration to include glycolysis, oxidative phosphorylation, substrate level phosphorylation.</li><li>• Examples of phosphorylation in photosynthesis to include RuBP, GP, NADP, non-cyclic photophosphorylation.</li><li>• Role of phosphorylation of ADP to store energy.</li><li>• Phosphorylation of lipids to make phospholipids and their roles in membranes.</li><li>• Addition of phosphates to help form the DNA backbone / involved in phosphodiester bonds.</li><li>• Appreciation of the consequences of phosphorylation such as activation of molecule for further reactions.</li></ul>	
Level	Mark	Descriptor
	0	No rewardable material
1	1-3	Demonstrates isolated elements of biological knowledge and understanding. Provides little or no references to a range of



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Level	Mark	Descriptor
		<p>scientific idea, processes, techniques and procedures.</p> <p>Scientific arguments may be attempted, but fails to link biological concepts and/or ideas in order to support decision/conclusion. Limited attempt to address the question.</p>
2	4-6	<p>Demonstrates adequate biological knowledge and understanding with selection of some biological facts/concepts to support an argument or decision/conclusion being made.</p> <p>Scientific reasoning occasionally supported through the linkage of a range of scientific ideas, processes, techniques and procedures.</p> <p>Scientific argument is partially developed. Attempts to synthesise and integrate relevant knowledge with linkages to biological concepts and/or ideas, leading to a notional scientific argument or decision/conclusion.</p>
3	7-9	<p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to support an argument or decision/conclusion being made.</p> <p>Scientific reasoning supported throughout by sustained linkage of a range of scientific ideas, processes, techniques and procedures.</p> <p>Scientific argument is well developed and logical. Demonstrating throughout the skills of synthesising and integrating relevant knowledge with consistent linkages to biological concepts and/or ideas, leading to nuanced and balanced scientific argument or decision/conclusion based on evidence.</p>



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Q17.

Question Number	Answer	Additional Guidance	Mark
	<ul style="list-style-type: none"><li>hydrolysis</li></ul>		<b>(1)</b>

Q18.

Question Number	Answer	Additional guidance	Mark
	<p>An answer the makes reference to two of the following:</p> <ul style="list-style-type: none"><li>{biological / protein} catalyst (1)</li><li>lowers the activation energy (for a reaction) (1)</li><li>increasing the rate of reaction (1)</li></ul>		<b>(2)</b>

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Q19.

Question Number	Acceptable Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"><li>• three { polypeptide / collagen } chains tightly coiled around each other (1)</li><li>• due to every third amino acid { being glycine / having a small R group } (1)</li><li>• chains are held together by { hydrogen bonding / covalent cross links } (1)</li><li>• flexible without stretching (due to triple helix) (1)</li><li>• chains of collagen associate together to form fibrils (1)</li><li>• (fibrils) have a high tensile strength (and function to support tissues) (1)</li></ul>		<b>(4)</b>



Q20.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none"><li>• primary structure described as a repeating amino acid sequence (1)</li><li>• three polypeptide chains (1)</li><li>• chains coiled around each other (1)</li><li>• cross-linking between the chains (1)</li></ul>	<p>ALLOW {proline / glycine / hydroxyproline} rich polypeptide chains</p> <p>IGNORE alpha helix</p> <p>ALLOW {covalent / hydrogen / disulphide} bonding between chains</p>	3

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An answer that makes reference to one of the following:</p> <ul style="list-style-type: none"><li>• to provide {strength / flexibility} (1)</li><li>• holds walls of capillaries and alveoli close together (1)</li></ul>	<p>ALLOW to support alveoli</p> <p>IGNORE to support capillaries</p>	1



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Q21.

Question Number	Answer	Additional guidance	Mark
	<p>A description that makes reference to three of the following</p> <ul style="list-style-type: none"><li>• cell membrane is (mainly) phospholipids and protein (1)</li><li>• phospholipids form a bilayer (1)</li><li>• proteins float in the phospholipids / change position / fluidmosaic model (1)</li><li>• proteins may span the bilayer or be located in only onelayer (1)</li></ul>	<p>ALLOW proteins embedded in the phospholipid bilayer</p> <p>ALLOW proteins may be intrinsic /extrinsic IGNORE function of proteins such as carrier/ channel</p>	<p><b>(3)</b></p>

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Q22.

Question number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"><li>• seeds treated with sodium chloride and with sodium chloride and gibberellin (1)</li><li>• description of how an abiotic factor can be controlled (1)</li><li>• extract amylase from the seeds (1)</li><li>• description of assay (1)</li><li>• description of how quantitative results will be obtained to enable comparison (1)</li></ul>	<p>ALLOW with sodium chloride and different concentrations of gibberellin</p> <p>e.g. use a water bath to control the temperature</p> <p>ALLOW method of standardising quantity of amylase e.g. same volume of {amylase extract / seed extract} / same {mass / number / type / size} of seed</p> <p>e.g. iodine starch test or Benedict's test to measure reducing sugars</p> <p>e.g. length of time to remove starch or use of a colorimeter</p> <p>ALLOW a description of how gibberellin might affect the result e.g. 'if gibberellin increases amylase activity time for iodine solution to go colourless will be shorter'</p>	<b>(4)</b>



Q23.

Question number	
*	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><b>Indicative content</b></p> <p>Information</p> <ul style="list-style-type: none"><li>• there are 20 000 different proteins</li><li>• these proteins carry out different functions</li><li>• there are a {large number of / 20} different {R groups / amino acids}</li><li>• most R groups are non-polar, some are polar a few have a charge</li></ul> <p>Linkage to <b>structure</b></p> <ul style="list-style-type: none"><li>• R groups determine {3D shape / structure} of proteins</li><li>• {large number of / 20 R groups}</li><li>• many combinations of amino acids required to give wide variety of protein structures</li><li>• R groups can form bonds to stabilise 3D structure (e.g. cysteine)</li><li>• role of R-groups in structure of haemoglobin</li><li>• role of R-groups in structure of collagen</li><li>• location of cysteine allows formation of disulfide bonds</li></ul> <p>Linkage to <b>function</b></p> <ul style="list-style-type: none"><li>• R groups variety of protein shapes are required to allow proteins to carry out wide range of functions</li><li>• examples of functions that require specific structure e.g. antibodies specific to an antigen / enzymes specific for a substrate / receptors e.g. neurotransmitters and (acetylcholine) and ion-gated channels</li><li>• polar / ionic R groups increase solubility</li><li>• non-polar R groups will be on outside of insoluble proteins / structural proteins / collagen / proteins inserted into membranes</li><li>• role of R-groups in function of haemoglobin</li><li>• role of R-groups in function of collagen</li></ul> <p>Linkage to <b>location</b></p> <ul style="list-style-type: none"><li>• polar R groups will be in aqueous environment / non-polar regions in a non-aqueous environment</li></ul>



## EXAM PAPERS PRACTICE

- |  |   |
|--|---|
|  | <ul style="list-style-type: none"><li>• polar /ionic R groups soluble in {plasma/ tissue fluid / cytoplasm} / line the inside of ion channels / found on the outside of soluble proteins such as hormones / transport proteins / immunoglobulins / cytokines</li><li>• role of R-groups in location of haemoglobin</li><li>• role of R-groups in location of collagen</li></ul> |
|--|---|



EXAM PAPERS PRACTICE



## EXAM PAPERS PRACTICE

Level	Marks		
0	0	No awardable content	
1	1-3	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.	Selection of some information from the table – little or no linkage  Linkage to one aspect – 2 marks Two linkages for same aspect – 3 marks
2	4-6	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.	Linkage between R groups and two aspects from structure, function and location  One comment on each - 4 marks An additional comment - 5 marks An additional 2 comments – 6 marks
3	7-9	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures.	Linkage between R groups and all three aspects (structure, function and location)  One comment on each - 7 marks



## EXAM PAPERS PRACTICE

		The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	An additional comment - 8 marks An additional 2 comments - 9 marks
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Q24.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"><li>the parents were {heterozygous / had a dominant and a recessive allele} as the offspring had both yellow and nonyellow coats (1)</li><li>(because the parents had yellow coats) the recessive allele was for non-yellow coat (1)</li></ul>	ALLOW parents were carriers	(2) Exp





EXAM PAPERS PRACTICE

Question Number	Answer	Additional Guidance	Mark				
(ii)	<table border="1"><tr><td>offspring with a yellow coat</td><td>offspring with a non-yellow coat</td></tr><tr><td>1199.25</td><td>399.75</td></tr></table> <p>1 mark for each predicted number</p>	offspring with a yellow coat	offspring with a non-yellow coat	1199.25	399.75	<p>ALLOW 1199 for 1199.25</p> <p>ALLOW 400 for 399.75</p>	(2) Clerical
offspring with a yellow coat	offspring with a non-yellow coat						
1199.25	399.75						

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following :		(3) Exp
	<ul style="list-style-type: none"><li>ratio is 2 : 1 rather than 3 : 1 (1)</li><li>random fertilisation (1)</li><li>due to no homozygous dominant individuals surviving / homozygous dominant is lethal (1)</li></ul>	ALLOW description of random fertilisation	



## EXAM PAPERS PRACTICE

Q25.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that includes: <ul style="list-style-type: none"><li>a line that shows a positive correlation with lung, liver and colon points below the line and breast, bladder and pancreas above the line</li></ul>		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: <ul style="list-style-type: none"><li>there is a correlation between age and level of DNA methylation (1)</li><li>as there is only a 5% likelihood of these results being produced by chance (1)</li></ul>	ALLOW converse, e.g. 95% probability that DNA methylation increases with age ALLOW as the calculated value is greater than the critical value at $p=0.05$	(2)



## EXAM PAPERS PRACTICE

Question Number	Indicative content
*(iii)	<p>Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is relevant. Additional content included in the response must be scientific and relevant.</p> <p>Give examples of relevant biological knowledge and understanding:</p> <ul style="list-style-type: none"><li>• mutation is a change in the { base sequence in DNA / gene } / different amino acid sequence / primary structure of the enzyme succinate dehydrogenase</li><li>• succinate dehydrogenase { less / non- } functional</li><li>• succinate therefore accumulates</li><li>• accumulation of succinate inhibits TET</li><li>• therefore methyl groups not removed / increased methylation of DNA</li><li>• affects transcription of a gene / therefore alters amount of product formed</li><li>• greater methylation is of DNA is associated with increased risk of cancer</li></ul>



## EXAM PAPERS PRACTICE

			<b>Additional Guidance</b>
<b>Level 0</b>	Marks	No awardable content	
<b>Level 1</b>	1-2	<p>An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>	<p>Only one point of basic information referred to: e.g. mutation results in more succinate, or high succinate and inhibition of TET, or less TET and more methylation of DNA</p>
<b>Level 2</b>	3-4	<p>An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p>	<p>Link between high levels of succinate and inhibition of TET</p>
<b>Level 3</b>	5-6	<p>An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.</p>	<p>Links made to include all of these points: mutation leads to higher levels of succinate, which inhibits TET, therefore increasing DNA methylation, which increases risk of cancer</p> <p>Logical explanation of the reasons why a mutation in the enzyme succinate dehydrogenase can increase risk of developing cancer</p>