Voice of the Genome -2

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

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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 -2

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 D – the sperm cell releases enzymes that digest the zona pellucida** A is not correct because the enzymes are released by the sperm and digest the zona pellucida B is not correct because enzymes are released by the sperm C is not correct because the enzymes digest the zona pellucida	**1**

Question Number	Answer	Mark
(ii)	**The only correct answer is A –** one copy of each gene | different alleles of some genes B is not correct because sperm can contain a different allele of a gene C is not correct because sperm will contain one copy of each gene D is not correct because sperm contain one copy of each gene and can have a different allele of some genes	**1**

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to two of the following: • pyruvate (1) • oxygen (1) • reduced NAD / ADP (1)		(2)

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to four of the following: • to stop H^+ diffusing out (of mitochondrion) / into cytoplasm (1) • (therefore) maintaining a high concentration (of H^+) in the intermembrane space (1) • so {hydrogen ions / protons / H^+} can move down {concentration / electrochemical} gradient (1) • (by) chemiosmosis (1) • to synthesise ATP (1)	ALLOW moves out for diffuses out ALLOW enabling/allowing/establishing formaintaining	(4)

Q3.

Question number	Answer	Additional guidance	Mark
	An explanation that makes reference to three of the following: • {chemicals in smoke / carcinogens / radiation} can damage DNA (1) • by changing the {DNA base sequence / chromosome number} (1) • with age there have been a greater number of cell divisions (1) • therefore a greater chance of an error (being introduced) in the base sequence of the DNA (during replication) (1)	IGNORE they cause mutations ALLOW 'they damage DNA' ALLOW causing {epigenetic changes / methylation of DNA / acetylation of histones} ALLOW longer period of exposure (to mutagens) ALLOW (with age) there is a greater chance of change in chromosome number	Expert (3)

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	C (amino acids joined by peptide bonds)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	A description that makes reference to • carboxyl group / COOH (1) • amine group / NH_2 (1) • R group (1)		**(3)**

Q5.

Question Number	Answer	Mark
(i)	**The only correct answer is A - ligaments only** ***B*** *is not correct because the tendons do not join bones to bones in the elbow joint* ***C*** *is not correct because the tendons do not join bones to bones in the elbow joint* ***D*** *is not correct because the ligaments do join bones to bones in the elbow joint*	**(1)**

Question Number	Answer	Mark
(ii)	**The only correct answer is D rows 3 and 4** ***A*** *is not correct because the tendons showing a change is not a change in genotype* ***B*** *is not correct because the tendons also show a physiological adaptation* ***C*** *is not correct because the tendons showing a change is not a change in genotype*	**(1)**

Question Number	Answer	
* (iii)	Answers will be credited according to candidates' deployment of knowledge and understanding of materialin relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the materialwhich is relevant. Additional content included in the response must be scientific and relevant. **Indicative content Valid because:** • {sufficient replicates / 12 individuals} used and a mean calculated • All same gender • Means of both heart rate and blood lactate agree with conclusion • Spread of data (standard deviation / error bars) between cycling and running does not overlap **Not valid because:** • Insufficient / only 12 individuals involved • Insufficient detail relating to the athletes e.g. they maybe athletes that focus on different sports/have done more than one previous triathlon / more experienced • The three disciplines are always done in the same order / different distances covered • Spread of cycling data (standard deviation / error bars) for blood lactate overlaps with swimming • As no time allowed to recover between sports, some of blood lactate shown for cycling could havebeen produced during swimming • Agree or not agree with conclusion	**(6)**

			Additional Guidance
Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainlyjust one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolatedelements of biological knowledge and understanding butwith limited evidence to support the judgement being made.	Considers one area only e.g. comparingmean data or spread of data only Conclusion based on only one set of data or only one sport considered e.g. cycling ismost demanding
Level 2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasionalevidence to support the judgement being made.	Considers both a valid and an invalid aspect e.g. relevance of spread of data forlactate concentrations overlap in some cases or elements of the study Conclusion given that takes both valid andinvalid aspects into account
Level 3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidencefrom the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages tobiological knowledge and understanding with evidence to support the judgement being made.	Considers both a range of valid and invalidaspects A conclusion based on a range of considered evidence

Q6.

Question Number	Answer
	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. 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. Comparisons between phospholipid bilayer and proteins in the cell surface membrane: • judgement about the relative importance of the phospholipid bilayer and the proteins within that bilayer Use of data: • most proteins in the cell are associated with the cell membrane • whilst quantities of phospholipid are the same the proteins have more functions Importance of proteins in the cell surface membrane: • immune response e.g. as antigens and therefore body defence, antibodies, MHC proteins • receptors e.g. receptor proteins on tip of sperm allowing acrosome reaction when encounters zona, for neurotransmitters • regulation e.g. with regards to hormones such insulin • signal / transcription e.g. transcription factors, secondary messengers • transport e.g. active transport, as channel proteins allowing facilitated diffusion, as {voltage-gated / eq} channels for the nerve impulse / resting potential or / and role of Na^+-K^+ pump Importance of phospholipid bilayer in some of: • the role of fluidity and structure of cell the membrane • inhibiting polar substances moving across due to having a hydrophobic component • having both hydrophilic and hydrophobic components which leads to the separation of the aqueous contents of the cell from its aqueous external surroundings • allowing diffusion of gases directly across it • myelin sheath / nerve impulse

Level	Marks	Descriptor	Additional guidance
0		No awardable content	
1	1-3	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. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.	Discussion of one type of membrane protein linked to its role May have lots of irrelevant information
2	4-6	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of **more than one** piece of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.	Discussion of more than one membrane protein linking them to their function Also discussing the role of phospholipids
3	7-9	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of **several** pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Good discussion of role of proteins and phospholipids – reaching a judgement Linking role of proteins and phospholipids Number of specific examples of membrane proteins Very little if any irrelevant information

Q7.

Question Number	Indicative content
*	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. 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. Basic information • All the treatment combinations were effective at treating TB • All treatments had some { relapses / individuals with TB } 3 years after treatment • { Group 1 / Groups 1 and 2 / Rifampicin + Pyrazinamide / Rifampicin + Isoniazid } had the lowest number of patients with TB (3 years later) Evidence for linkages made • Percentage relapse varies depending on second part of treatment • Combinations involving Rifampicin most effective • The antibiotics tested act on different targets in bacteria • Gaps in information - not all combinations tested, other combinations might be more effective • Other time scales may have been more effective Evidence for sustained scientific reasoning • Could be other reasons for infections with TB 3 years later not due to the antibiotic treatment • No information about dormant TB (only percentage of active cases) • Bacterial RNA polymerase possibly the best target for antibiotics • Antibiotics targeting synthesis of cell wall fatty acids least effective in terms of relapses • Idea of combination of antibiotics with different mode of activity most effective

Level	Mark	Descriptor	
Level 0	Marks	No awardable content	
Level 1	1-2	An answer may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The answer will contain basic information with some attempt made to link knowledge and understanding to the given context.	Reference to effectiveness of different combinations of antibiotics.
Level 2	3-4	An answer will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows some linkages and lines of scientific reasoning with some structure.	Reasons for differences in effectiveness considered.
Level 3	5-6	An answer is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Information about action of antibiotics related to effectiveness. Evaluation of study design considered.

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	C (significant and positive)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • greater number of cell divisions means more opportunities for errors in DNA replication (1) • more mutations result in greater chance of cancer (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(iii)	• correct risks identified (1) • correct calculation (1)	0.08 and 0.004 <u>Example of calculation:</u> 0.08 ÷ 0.004 = 20.0 Allow full marks for correct answer with no working	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(iv)	An explanation that makes reference to two of the following: • cigarettes { are an environmental risk factor / contain carcinogens } (1) • that increases the number of mutations in cells (1) • resulting in uncontrolled cell division (1)	Accept description of how mutations arise	**(2)**

Q9.

Question Number	Answer
*	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. 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. <u>Indicative content</u> Adult screening advantages and disadvantages • Identifies risk of developing a particular disease in the future so choices can be made e.g. extra screening for breast cancer or preventative mastectomy/screening and lifestyle changes for some types of CVD • Identification of carriers so choices can be made about family planning – both partners tested, risk can be identified and have prenatal screening • May not want to know if you have a high likelihood of developing a disease, if one person is tested it may give other family members information they would chose not to know, may potentially affect life insurance

	Prenatal screening advantages and disadvantages • Amniocentesis – prepares parents for child with disease/gives choice of abortion • Chorionic villus sampling – as amniocentesis, carried out earlier in pregnancy • Some of the conditions tested for are very unpleasant and may be life limiting • NIPD non-invasive, less traumatic procedure, no increased risk of miscarriage • PGD only implant healthy embryos, do not have to make decision about abortion • Both amniocentesis and CVS carry increased risk of miscarriage, especially CVS (although it can be carried out earlier in the pregnancy) • Can't cure the disease, only choice is to have an abortion-not acceptable to everyone • For conditions such as CF, where there is more than one possible mutation, test is only for most common mutations so there may be false negatives • NIPD currently only available for chromosome disorders such as Down's syndrome • PGD involves IVF, which can be emotionally traumatic and only has about 30% success rate • All pre-natal screening has a risk of false positives with abortion of a healthy fetus. • Procedures involving IVF can be regarded as unethical because many embryos are discarded • Invasive nature of some of the tests

Level	Mark	Descriptor	Additional Guidance
0	Mark	No awardable content	
1	1-2	Limited scientific judgement made with a focus on one side of the argument only. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	Only considered one benefit or one risk without further explanation beyond a brief description. A generalised discussion without focusing on the details of specific types of screening
2	3-4	A scientific judgement is made through the application of relevant evidence to both sides of the argument. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.	Considers at least two types of screening One advantage and one disadvantage of each type of screening discussed.
3	5-6	A scientific judgement is made, which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.	Advantages and disadvantages of blood tests and pre-natal tests discussed fully. Discussion of blood tests to identify adults with genetic disorders. Conclusion or judgement made, e.g. identifying genetic disorders by blood tests in adults is better as the disadvantages have less impact than disadvantages of genetic testing on embryos / fetuses.

Q10.

Question Number	Answer	Additional guidance	Mark
	An answer that makes reference to: • no (in row two) (1) • some (in row five) (1)		(2)

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	A answer that makes reference to the following: • {alternative form / different form / version / variation} of a gene (1)	IGNORE type of gene	1

Question Number	Answer	Additional Guidance	Mark
(ii)	• correct use of Hardy-Weinberg equation (1) • correct calculation of probability of each homozygote (1) • correct answer (1)	Example of calculation $p^2+2pq+q^2= 1$ p^2= either 0.185 or 0.325 q^2= either 0.325 or 0.185 or 2pq = 0.43 x 0.57 x 2 = 0.4902 frequency = 50.98 % / 51% (which is greater than 50%) Correct answer with no working gains full marks	3

Q12.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • thinner blood-gas barrier (1) • because of thinner { alveolar walls / capillary walls / extracellular matrix layer } (1) • therefore a reduced diffusion distance (1) • a faster rate of { diffusion / gas exchange } (1)	ALLOW greater rate	3

Q13.

Question Number	Answer	Additional Guidance	Mark
	• width of X to Y ÷ magnification **(1)** • correct answer with appropriate units **(1)**	Example of calculation 50(mm) ÷ 5 000 000 / 5(cm) ÷ 5 000 000 10 nm / 0.01 μm	**(2)**

Q14.

Question Number	Answer	Additional guidance	Mark
	An explanation that makes reference to three of the following: • less oxygen available for aerobic respiration (1) • deoxygenated blood mixes with oxygenated blood (1) • therefore reducing the concentration of oxygen in the bloodcirculating in the body (1) • because some deoxygenated blood {does not leave right ventricle / is transferred to the left ventricle / does not go to thelungs / goes to the respiring tissues} (1)	ALLOW lack of oxygen leads to (some) anaerobic respiration ALLOW some oxygenated blood {does not leave left ventricle / is transferred to the right ventricle / does not go to the respiring tissues / goes to the lungs}	**(3)**

Q15.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to three of the following: Differences: • only actin has a tertiary structure (1) • collagen has three chains whereas an actin (filament) has one chain (1) Similarities: • both are made up of (a sequence of) amino acids joined together by peptide bonds (1) • both have a secondary structure / both have { more than one polypeptide chain / a quaternary structure } (1)		(3)

Q16.

Question Number	Answer	Mark
	B - lowering the activation energy of a reaction *The only correct answer is* ***B*** ***A*** *is incorrect because enzymes do not increase activation energy* ***C*** *is incorrect because enzymes do not provide energy to reactants* ***D*** *is incorrect because enzymes do not remove energy from reactants*	**(1)**

Q17.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • decreases betalain concentration (in the cells) (1) • due to betalain {diffusing out / moving down a concentration gradient} (1) • (because) the alcohol increases membrane permeability (1) • membrane {lipids/ phospholipids} dissolve in alcohol (1)	IGNORE reference to cell wall	(3) Exp

Q18.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • tranexamic acid has a (very) similar {structure / shape} to lysine • tranexamic acid { binds to the active site on plasmin / acts as a competitive inhibitor } • stopping plasmin binding to { fibrin / lysine }	ALLOW preventing plasmin and fibrin forming enzyme – substrate complex	(3)

Q19.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer the makes reference to the following: • sequence of {bases / nucleotides} in DNA • that codes for the {primary structure / amino acid sequence / polypeptide}	ALLOW that codes for a protein	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to the following: • tRNA molecules {transport amino acids to the ribosome} • tRNA molecule has an anticodon that {binds to / recognises} a codon on the mRNA • each tRNA carries a particular amino acid	ALLOW the amino acid on the tRNA is determined by the anticodon	**(3)**

Question Number	Answer	Additional Guidance	Mark
(iii)	A description that makes reference to three of the following: • {primary structure / sequence of the amino acids} determines the folding (of the polypeptide) • forming a globular structure • hydrophobic (R) groups located in the centre of the protein / hydrophilic (R) groups located on the outside of the protein • water forms hydrogen bonds with { protein / hydrophilic groups}	ALLOW position of R groups ALLOW determines tertiary structure ALLOW polar for hydrophilic / non-polar for hydrophobic ALLOW dipole-dipole / hydrophilic interactions (between water and the protein)	**(3)**

Q20.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to two of the following: • (adding or removing one or two nucleotides) changes the triplet code • introducing a new {start / stop} codon • coding for a shorter sequence of amino acids (1)	ALLOW different codons produced (1) ALLOW one amino acid shorter	**(2)**

Q21.

Question Number	Answer	Additional guidance	Mark
	A description that makes reference to the following: • (a peptide bond is formed by a) condensation reaction (1) • between the {amine group / NH_2} and the {carboxyl group / COOH} of adjacent amino acids (1)	ALLOW 'amino' for 'amine' and 'carboxylic acid' for 'carboxyl'	(2)

Q22.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to the following: • { P / troponin } changes shape (1) • causing { Q / tropomyosin } to move away from the myosin-binding sites (on actin) (1)	ALLOW P binds with calcium ions ALLOW Q is displaced away from myosin binding sites	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • (primary structure) determines interaction between {amino acids / R groups} (1) • (primary structure) determines { folding / tertiary structure } (1) • (therefore) affecting the shape of the active site (1) • (active site is) complementary to ATP (1)	e.g. bonds formed between R groups ALLOW 3D shape ALLOW ATP fits active site	(3)

Q23.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to two of the following: • carrier protein (in cell surface membrane) • (glucose moves from) high to low concentration • glucose binds to (carrier) protein / (carrier) protein changes shape to move glucose (across the membrane) (1)	IGNORE channel protein ALLOW 'down a concentration gradient'	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • polymer of glucose • to provide glucose for respiration • {branched / contains 1,6-glycosidic bonds / has many terminal ends} for rapid hydrolysis • compact to allow large amount (of glucose / energy) to be stored in a small space / insoluble therefore no osmotic effect on cells	ALLOW polysaccharide /made of many glucose monomers DO NOT ALLOW β- glucose IGNORE 'easy to hydrolyse' ALLOW break down instead of hydrolyse	**(3)**

Q24.

Question number	Answer	Additional guidance	Mark
	A description that makes reference to three of the following points: • calcium ions released from sarcoplasmic reticulum (1) • in response to { nerve impulse / action potential / depolarisation } (at neuromuscular junction) (1) • calcium channels open (to allow calcium ions to cross the membrane / enter the sarcoplasm) (1) • calcium ions taken back up into the sarcoplasmic reticulum by active transport (1)	ALLOW Ca^{2+} for calcium ions ALLOW calcium ions moving through channel protein	(3)

Q25.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to the following: • vesicles (containing hormone) (1) • fuse with the cell (surface) membrane (of fat cells) / by exocytosis (1)		**(2)**