Grey Matter -4

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: Grey Matter -4

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	Additional guidance	Mark
	A description that makes reference to two of the following: • period of time during early development (1) • when the nervous system must obtain specific experiences to develop properly (1) • so that synapses are strengthened / unstimulated synapses are removed (1)	ALLOW retina needs to be exposed to light ALLOW when visual columns are organised	(2)

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	• calculation of { largest difference in concentration / largest value at 0 minutes and smallest value at 30 minutes } (1) • calculation of rate of decrease in nicotine concentration per minute (1)	Example of calculation (35.0 + 9.3) / 44.3 and (24.1 – 5.6) / 18.5 25.8 ÷ 30 = 0.86 Correct answer without working gains full marks	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to two of the following: • percentage change greater for {the lower concentration of / 0.1 mg } nicotine (1) • a higher concentration causes a positive (percentage) change whilst the lower concentration leads to a negative (percentage) change (1) • correct calculation of percentage change for both rat groups (1)	2.08% for { 1.0 mg nicotine / group A } and 6.25% for { 0.1mg nicotine / group B }	**(2)**

Question Number	Indicative content
*(iii)	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 relevant. Additional content included in the response must be scientific and relevant. Give examples of relevant biological knowledge and understanding: <u>Validating the statement</u> • Investigation involved rats inhaling nicotine which humans do during smoking • Rats are mammals so can extrapolate to humans <u>Not validating the statement</u> • Nicotine inhaled (for both nicotine concentrations) leads to vasoconstriction and then vasodilation and then returns to original diameter • Blood pressure for 1mg nicotine concentration increases and decreases but drops below original value • Presence of nicotine leads to noradrenaline release which increases heart rate • Blood pressure (for both nicotine concentrations) increases and decreases • No reference to rats inhaling smoke, only nicotine • Rats are not the same as humans • Sample size too small to make a valid statement <u>Comment</u> • whether agree or disagree with statement

			Additional guidance
Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	An answer that refers to just one piece of evidence – either lumen size or blood pressure Simple conclusion drawn from the evidence
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 occasional evidence to support the judgement being made.	An answer that refers to evidence concerning both lumen size and blood pressure Links made between lumen size, vasoconstriction and blood pressure
Level 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.	An answer that refers to data about vasoconstriction and vasodilation and links it to effect of nicotine on the release of noradrenaline and therefore on blood pressure Conclusion made considering validity of data collected from rats and how it can be applied to humans

Q3.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • increasing light intensity decreases the current (1) • because {rhodopsin is broken down / opsin is released} (1) • therefore, more opsin binds to the channel proteins in the outer segment (1) • sodium-gated voltage channels close (1) • {reducing / stopping} the influx of sodium ions / making membrane impermeable to sodium ions (1)	ALLOW opsin binds to the cell surface membrane / sodium-gated voltage channels ALLOW Na^+ channels / (non-specific) cation channels for sodium-gated voltage channels	**(5)**

Q4.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: • as they age Drosophila climb {less high / more slowly} (1) • (the expression of) 0N3R or 0N4R further {reduce theheight climbed / slow down} the Drosophila (1) • 033R has a greater effect than 0N4R (1)	ALLOW tau proteins / both tau proteins reducedheight climbed ALLOW fly in place of climb ALLOW 033R affected the flies the most	Choose an item. (3)

Q5.

Question number	Answer	Additional guidance	Mark
(i)	A description that makes reference to two of the following: • shading (coleoptile tip) reduces / stops bending (1) • light {detecting / sensitive} part of coleoptile is in first 5 mm (1) • no (significant) difference between {(exposure for) 2 or 3 hours / (shading of) 5 mm or 10 mm} (1)	ALLOW as (length of) shading increases degree of bending decreases ALLOW converse ALLOW part of coleoptile that bends is below the part that detects light	Expert (2)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • {5% / 1 in 20} probability (1) • the results (obtained) occurred by chance (1) OR • 95% probability (1) • the results (obtained) did not occur by chance (1)	IGNORE reference to null hypothesis ALLOW less than 5% ALLOW probability of 0.05 DO NOT ALLOW results are {accurate / correct / wrong}	Expert (2)

Q6.

Question number	
*	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. **Indicative content** Information • there are 20 000 different proteins • these proteins carryout different functions • there are a {large number of / 20} different {R groups / amino acids} • most R groups are non-polar, some are polar a few have a charge Linkage to **s**tructure • R groups determine {3D shape / structure} of proteins • {large number of / 20 R groups} • many combinations of amino acids required to give wide variety of protein structures • R groups can form bonds to stabilise 3D structure (e.g. cysteine) • role of R-groups in structure of haemoglobin • role of R-groups in structure of collagen • location of cysteine allows formation of disulfide bonds Linkage to **f**unction • R groups variety of protein shapes are required to allow proteins to carry out wide range of functions • 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 • polar / ionic R groups increase solubility • non-polar R groups will be on outside of insoluble proteins / structural proteins / collagen / proteins inserted into membranes • role of R-groups in function of haemoglobin • role of R-groups in function of collagen Linkage to **l**ocation • polar R groups will be in aqueous environment /non-polar regions in a non-aqueous environment

	• 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 • role of R-groups in location of haemoglobin • role of R-groups in location of collagen

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

		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

Q7.

Question number	Answer	Additional guidance	Mark
	• correct length calculated	3.3 / 3.33	Clerical (1)

Q8.

Question number	Answer	Additional guidance	Mark
	A description that makes reference to five of the following: • light is detected by rod cells (1) • rod cell membrane is hyperpolarised (1) • stopping the release of the inhibitory neurotransmitter glutamate (1) • bipolar neurone is depolarised (1) • impulse transmitted along {ganglion neurone / optic nerve} (1) • (impulse transmitted) to visual cortex of the brain (1)	ALLOW description of role of rhodopsin ALLOW occipital lobe	**(5)**

Q9.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: • (IAA) produced in the tip of the shoot (1) • (IAA) accumulates on the dark side of the shoot (1) • (IAA) stimulates cell elongation (1) • causing the shoot to grow towards the light source (1)	ALLOW a diffusion gradient is established / IAAdiffuses to the opposite side of the shoot ALLOW low concentrations of IAA inhibit cellelongation on the light side ALLOW plant ALLOW bend	Choose an item. (4)

Q10.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: Similarities • both have a cell body containing a nucleus (1) • both have an axon (1) • both have dendrites at one end of neurone and terminal branches at the other end (1) Difference • location of cell body (1)	IGNORE descriptions of function ALLOW motor neurone cell body is at one end of the axon whereas in the sensory neurone the cell body is located along the axon	(4)

Q11.

Question number	Answer	Additional guidance	Mark
(i)	An explanation that makes reference to three of the following: • acetylcholinesterase breaks down acetylcholine (1) • inhibitor prevents break down of acetylcholine (1) • so more (acetylcholine) is available to bind to post-synaptic {membrane / receptors} (1) • therefore compensating for the {reduced production of acetylcholine / loss of acetylcholine producing neurones} (1)	ALLOW blocks acetylcholinesterase ALLOW inhibiting acetylcholinesterase maintains higher concentrations of acetylcholine (in synapse) (1)	Choose an item. (3)

Question number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to the following: • concentration between 25 and 50 µmol dm^{-3} (1) • concentration having greatest inhibitory effect (1) • but having no effect on cell viability (1)	ALLOW any value between 25 and 50 ALLOW suitable description of effect e.g. reduces enzyme activity by {more than 50% / 60% / 2.4 a.u. ALLOW viability remains at 100%	Choose an item. (3)

Q12.

Question Number	Answer	Mark
(i)	**C** - retinal *The only correct answer is **C*** ***A** is incorrect because IAA is auxin* ***B** is incorrect because opsin is the protein part and not the non-protein* ***D** is incorrect because rhodopsin is the pigment*	**(1)**

Question Number	Answer	Mark
(ii)	**A** *The only correct answer is **A*** ***B** is incorrect because it is the hypothalamus* ***C** is incorrect because it is the medulla oblongata* ***D** is incorrect because it is the cerebellum*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • (fMRI) detects { blood flow / oxygen use } in the brain • increased brain activity results in increased { blood flow / demand for oxygen / aerobic respiration } in the area of activity • oxyhaemoglobin absorbs fewer radio waves / fMRI detects areas where less signal absorbed	ALLOW signal reflected by oxyhaemoglobin	**(3)**

Q13.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to two of the following: • transcription (of the DNA containing the mutation) / transcribe to produce { mRNA / RNA } • using { RNA nucleotides / RNA polymerase }	IGNORE translation	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • individuals have different mutations / targets an individual's specific mutation • the RNA molecule used will be specific to { each mutation / individual }	ALLOW mutations at different loci	(2)

Q14.

Question Number	Answer	Additional Guidance	Mark
	1. idea that there was no bias ; 2. idea of contributes to validity ; 3. idea of hot object desensitises ; OR idea of thermoreceptors not harmed /overstimulated / habituated due to high temp ;	**1. ACCEPT** sequence of procedure has no effect/to see if positive then negative gives a different outcome to negative then positive	(2)

Q15.

Question Number	Answer	Additional Guidance	Mark
	1. idea that opsin uncouples from the (rod cell) cell surface membrane ; 2. trans retinal {converts / eq} to cis retinal ; 3. rhodopsin is (re)formed / eq ; 4. from opsin and retinal ; 5. idea that this results in dark adaptation ; 6. permeability of the cell surface membrane to Na^+ increases / eq ; 7. hyperpolarisation of cell decreases / eq ; 8. (more) neurotransmitter is released / eq ;	**NB IGNORE** ***references to bipolar neurone responses*** **IGNORE** reference to retinol **6. ACCEPT** Na^+ {enters /channels unblocked / channels open} **7. ACCEPT** (partial) depolarisation / reduced potential difference **8. ACCEPT** glutamate for neurotransmitter	**(5)**

Q16.

Question Number	Answer	Mark
	The only correct answer is **A** – CT uses X-rays that can cause mutations in the DNA of muscle fibres ***B*** *is incorrect because mutations do not occur in protein* ***C*** *is incorrect because CT does not use magnets* ***D*** *is incorrect because CT does not use magnets and mutations do not occur in protein*	**(1)**