GCE

Biology A

H420/03: Unified biology

A Level

Mark Scheme for June 2023

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 5 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:
   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response questions on this paper are **4(a)** and **6.**

10. **Annotations**

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given

Annotation	Meaning
I	Ignore
BP	Blank page

11. **Subject Specific Marking Instructions**

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Marks	AO Element	Guidance
1	(a)	(i)	(A =) smooth muscle ✓ (B =) cartilage ✓	2	2.3	**ALLOW** 'involuntary muscle' **IGNORE** elastic fibres / elastin
1	(a)	(ii)	goblet (cells) **and** secrete mucus (to trap microorganisms) ✓ ciliated epithelial (cells) **and** (beat to) move mucus / AW ✓	2	2.3	**ALLOW** produces, mucus / mucin **DO NOT ALLOW** excrete mucus **ALLOW** ciliated epithelium e.g. 'to, waft mucus / push mucus (upwards / towards throat) / remove mucus' **IGNORE** 'waft / move, dust/ microbes / particles'
1	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 46:1 award three marks** (radius =) 0.065 (mm) ✓ (volume = (4/3) x 3.14 x 0.065^3 =) 0.00115 (mm^3)✓ 0.053/0.00115 = 46:1 ✓	3	2.2	**ALLOW 46.1:1 for 3 marks** **If answer given to more than 3 sig figs =2 max** **ALLOW ECF for mp2 and 3 if incorrect radius used** **ALLOW** 0.065 or 0.13/2 seen anywhere in working **ALLOW** $1.15x10^{-3}$ (mm^3) **ALLOW ECF for mp3 if incorrect volume used** (volume =) (4/3) x 3.14 x 0.065^3 = 0.00115 (mm^3) =2 marks (mp1 and 2) **If correct answer not given as ratio e.g. 46 or 46.1 alone = 2 marks**

Question			Answer	Marks	AO Element	Guidance
1	(b)	(ii)	more, gas exchange / diffusion / AW ✓	1	1.1	e.g. 'fast(er) / increased , rate of diffusion / gas exchange' e.g. 'greater uptake of oxygen' **IGNORE** 'more efficient gas exchange' / 'maximises area for gas exchange' **IGNORE** 'absorption of oxygen'
1	(c)		involuntary **AND** does not use, the cerebrum / somatic nervous system **or** coordinated by the medulla (oblongata) /AW **or** does not use , decision-making /AW ✓ reflex / fast (response) **AND** involves, (only) three (named) neurones / few neurones **or** coordinated by , brainstem / medulla (oblongata) ✓	2	3.1 3.2	**ALLOW** autonomic **IGNORE** automatic / unconscious e.g. 'involves the medulla (oblongata)' e.g. 'does not require conscious thought / happens without thinking about it' **IGNORE** 'involves minimal number of neurones' **ALLOW** '(only) involves, two / few, synapses' **ALLOW** 'passes through , brainstem / medulla' **IGNORE** 'spinal / cranial' 'it is involuntary and fast because it involves the medulla (oblongata)' = 2 marks

Question			Answer	Mark	AO Element	Guidance
2	(a)	(i)	stain(s) / dye(s) ✓ (exposure to) UV light ✓	1	2.7	**ALLOW** any named stain
2	(a)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.3 award two marks** 2.4/8 ✓ = 0.3 ✓	2	2.8	**ALLOW** 0.29 – 0.31 for 2 marks 2.5/8 = 0.31 2.3/8 = 0.29 Answers given to more than 2 sig figs = max 1
2	(b)		D is, pyrimidine (base) / thymine, and, pentose sugar / deoxyribose ✓ (*B_9 deficiency causes*) fewer, nucleotides / pyrimidines / bases (available) ✓ DNA synthesis / DNA replication / S phase , slows / stops / incomplete ✓ (due to) less complementary base pairing with, purines / adenine (on template strand) ✓ does not pass G2 checkpoint / AW ✓	2 max	2.5	**ALLOW** D is thymidine **IGNORE** cytosine **ALLOW** 'less D available' **DO NOT ALLOW** 'no D available' **IGNORE** guanine e.g. 'due to G2 checkpoint identifying the error'
2	(c)	(i)	label E anywhere in the mitochondrial matrix ✓ label F on inner mitochondrial membrane ✓	2	1.1 2.1	**CON** a second label E in the cytoplasm **ALLOW** a line to the inner membrane or any part of the letter F touching the membrane

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO Element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(c)</td><td>(ii)</td><td>
<table>
<tr><th>Feature</th><th>FAD</th><th>NAD</th></tr>
<tr><td>Is a prosthetic group</td><td>✓</td><td>×</td></tr>
<tr><td>Is reduced in the link reaction</td><td>×</td><td>✓</td></tr>
<tr><td>Oxidises molecules in the electron transport chain</td><td>×</td><td>×</td></tr>
</table>
✓ ✓</td><td>2</td><td>1.1</td><td>2 rows correct = 1 mark
3 rows correct = 2 marks

DO NOT ALLOW hybrid ticks
ALLOW ‘yes’ or ‘no’ in place of ‘✓’ or ‘×’
ALLOW if only ‘✓’ or ‘×’ used in table

ALLOW ‘×’ for FAD is a prosthetic group</td></tr>
<tr><td>2</td><td>(c)</td><td>(iii)</td><td>active, transport / uptake (of pyruvate or another named molecule) ✓

synthesis of (named) enzymes (involved in respiration) ✓</td><td>1 max</td><td>2.5</td><td>ALLOW pumping / acts as a pump
IGNORE ref. to role of ATP in glycolysis
DO NOT ALLOW ref to active transport of H^+ ions</td></tr>
</table>

Question			Answer	Mark	AO Element	Guidance
2	(d)	(i)	assists enzymes / AW ✓ without being permanently bound to enzymes / AW ✓ example of mechanism ✓	2 max	1.1	e.g. 'activates enzymes' / 'helps enzyme (carry out its function)' e.g. 'temporarily attached to enzyme' e.g. 'reduces activation energy required for reaction' / 'involved with binding of substrate to active site' / 'allows substrate to bind more easily' / 'allows more ESCs to form' / 'binds to active site of enzyme' / 'changes structure of binding site' / 'helps transport reactant into active site'
2	(d)	(ii)	acts as inhibitor / reduces enzyme activity / enzyme activity is (always) lower in the presence of vitamin C / reduces amount of cAMP produced ✓ *idea of* (possibly) non-competitive because increasing ATP concentration does not allow enzyme activity to reach level without vitamin C ✓ *idea of* cannot decide whether it is competitive or non-competitive because enzyme activity has not plateaued (at the ATP concentrations shown) ✓	2 max	3.1	**ALLOW** 'without vitamin C enzyme activity is (always) higher ' **ALLOW** 'non-competitive because V_{max} not reached' **Note** : if state 'it is a non-competitive inhibitor because increasing ATP concentration does not allow enzyme activity to reach level without vitamin C' = mp1 and 2

Question			Answer	Mark	AO Element	Guidance
3	(a)	(i)	rate of NPQ ✓ rate of CO_2 fixation ✓	1 max	3.4	
3	(a)	(ii)	greater rate (of carbon fixation in GM plants) because , less light energy is converted to heat energy / lower NPQ rate / more energy remains as light ✓ (so) more electrons enter electron transport chain / AW ✓ more, ATP / NADPH / reduced NADP , generated for / supplied to , Calvin cycle (from light-dependent stage) ✓	2 max	2.1 3.1	**ora** for unmodified plants **ALLOW** ref to figures for comparison of rates **ALLOW** 'light-independent stage' for Calvin cycle or a description of the Calvin cycle
3	(a)	(iii)	*idea that* company could charge high prices (to farmers / countries) ✓ *idea that* GM crop not available to everyone ✓	1 max	1.1	e.g. 'poorer farmers cannot afford GM seed'

Question			Answer	Mark	AO Element	Guidance
3	(b)		sequence genomes (of different varieties) ✓ (*use bioinformatics and computational biology to*) develop / use, (appropriate) software ✓ use , algorithms / statistical tests / (mathematical) models ✓ store , data / information (from different DNA sequences) ✓ analyse / identify, differences / similarities, in DNA (sequences) / alleles ✓	**3 max**	1.2 2.5 2.7	**ALLOW** 'develop theoretical models' **ALLOW** 'use a database' / 'storing genomes (on a database)' **ALLOW** 'comparison of, differences / similarities, in their genes '

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO Element</th><th>Guidance</th></tr>
<tr><td>3</td><td>(c)</td><td></td><td>(parental genotypes) AaBb and aaBb ✓

(gametes) AB Ab aB ab and aB ab ✓

purple & smooth : purple & wrinkled : yellow & smooth : yellow & wrinkled ✓

(ratio =) 3:1:3:1 ✓</td><td>4</td><td>2.6
2.5</td><td>If incorrect symbols used throughout = max 3
ALLOW ECF for mp2-4 if incorrect genotypes used

ALLOW mp2 if gamete line is incomplete (e.g. only one parental genotype given - AB, Ab, aB, ab) but Punnett square is correct for both sets of gametes
If AA /aa / BB / bb / Aa / Bb given as gametes no further mp’s awarded as incorrect biology

<table><tr><td></td><td>AB</td><td>Ab</td><td>aB</td><td>ab</td></tr><tr><td>aB</td><td>AaBB purple & smooth</td><td>AaBb purple & smooth</td><td>aaBB yellow & smooth</td><td>aaBb yellow & smooth</td></tr><tr><td>ab</td><td>AaBb purple & smooth</td><td>Aabb purple & wrinkled</td><td>aaBb yellow & smooth</td><td>aabb yellow & wrinkled</td></tr></table>
ALLOW mp2 and mp3 from a Punnett square

all four phenotypes should be listed (in any order)

ALLOW ratio of 6:2:6:2

ALLOW phenotypes and ratio in a different order for mp3 and mp4, providing they correctly correspond.</td></tr>
</table>

4	(a)		***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.***			
			Level 3 (5-6 marks) Detailed evaluation of the negatives and positives in the data from both graphs. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** Evaluation of both negatives and positives of one graph **and** either the negatives or the positives of the other graph. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** Discussion of negatives or positives of either graph. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	**6**	3.3 3.4	**Indicative scientific points may include (but are not limited to):** *Positives (indicators of success)* • The majority of species identified as threatened are protected under CITES (4.1) • Approximately 20% of threatened species cannot be traded (4.1) • The number of species being assessed by the IUCN is increasing every year, which means more species can be added to the protected list (4.2) • The number of species being assessed is rising faster than the number of species identified as threatened (4.2) *Negatives (indicators of lack of success)* • A large number (more than a quarter) of species identified as threatened are not protected under CITES (4.1) • A large number (more than three quarters) of the species identified as threatened can still be traded (4.1) • trade is only one aspect of protecting threatened species (4.1) • The number of species assessed is a small fraction of the total number of species that exist, which means most threatened species have not been assessed or protected (4.2) • The number of threatened species has increased more rapidly in recent years (from 2018) (suggesting conservation has not been successful) (4.2) • No data on the number of species that have become extinct (4.2) • the IUCN and CITES alone cannot prevent extinctions (4.1 /4.2)

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO Element</th><th>Guidance</th></tr>
<tr><td>4</td><td>(b)</td><td>(i)</td><td>(genetic) bottleneck ✓</td><td>1</td><td>1.1</td><td>ALLOW population bottleneck</td></tr>
<tr><td>4</td><td>(b)</td><td>(ii)</td><td>
<table>
<tr><th>Kakapo trait</th><th>Type of adaptation</th></tr>
<tr><td>Active at night to avoid predators</td><td>behaviour(al)</td></tr>
<tr><td>Green feathers that camouflage with its surroundings</td><td>anatomical</td></tr>
<tr><td>Slow digestion to extract nutrients from a high-fibre, low-protein diet</td><td>physiological</td></tr>
<tr><td>Strong beak and claws to climb trees</td><td>anatomical</td></tr>
</table>
✓ ✓
</td><td>2</td><td>2.1</td><td>2 correct = 1 mark
4 correct = 2 marks

ALLOW ‘anatomy’ for ‘anatomical’

ALLOW ‘physiology’ for ‘physiological’

ALLOW ‘anatomy’ for ‘anatomical’</td></tr>
</table>

Question			Answer	Mark	AO Element	Guidance
4	(b)	(iii)	*evidence for sympatric speciation* species live(d) in the same (geographical) area / AW ✓ ecological / behavioural / temporal , isolation ✓ (because) they occupy different , niches / AW ✓ *idea that* (some) kaka flew to North Island after speciation ✓ *evidence for allopatric speciation* geographical isolation as mountain range emerged / AW ✓ *idea that* (some) proto-kaka flew to the North Island and evolved into kaka / AW ✓ *idea that* (some) kaka later returned (to South Island) ✓	4 max	3.1 3.2	**ALLOW** ref to same location **IGNORE** ref to same / similar, environment / habitat **ALLOW** divergence / separation for isolation **IGNORE** reproductive / mechanical , isolation e.g. 'differences in diet' / 'time of activity' e.g. 'Alps creates physical barrier between populations'
4	(b)	(iv)	species richness is the number of (different) species (in an area or community or ecosystem) ✓ species evenness is the (relative) abundance (of individuals) in each species (in an area or community or ecosystem) ✓	2	1.1	**IGNORE** amount of different species (in an area or community or ecosystem) **ALLOW** 'species evenness is (a comparison of) the number (of individuals) in each species (in an area or community or ecosystem)'

Question			Answer	Mark	AO Element	Guidance
5	(a)	(i)	CO_2 is produced earlier with maltose /AW ✓ CO_2 production is higher with maltose / AW ✓ difference between maltose and glucose increases (over time) / AW ✓ both show slow increase at start followed by a steeper increase later on / AW ✓	2 max	2.8	**ora** for glucose **ALLOW** quoted data for mp1 e.g. 'starts rising after 0 minutes for maltose but after 20 minutes for glucose' **IGNORE** 'quicker / faster' as implies rate **ALLOW** quoted data for mp 2 e.g. 'a total of, 84 / 85 , cm^3 of CO_2 is produced by glucose compared to 100 cm^3 by maltose'

Question			Answer	Mark	AO Element	Guidance
5	(a)	(ii)	*agree* (final) volumes of CO_2 produced are low / AW ✓ volumes of CO_2 produced is same , up to 20 minutes / at 90 minutes ✓ the data have the same order of magnitude ✓ *disagree* sucrose , increases earlier / plateaus / stops producing CO_2 ✓ final sucrose volume is (approximately) half that of fructose / AW ✓	**2 max**	3.2	e.g. 'neither rise above 18 - 20 cm^3' **ora** fructose , increases later / continues to rise **ora** final fructose volume is (approximately) double that of sucrose **ALLOW** quoted data from graph e.g. 'sucrose produces 8-10 cm^3 of CO_2 whilst fructose produced 18-19 cm^3 (after, 140 /150, minutes)' e.g. 'fructose produces 15-17 cm^3 of CO_2 whilst sucrose produced 8-10 cm^3 (after 125 minutes)'

Question			Answer	Mark	AO Element	Guidance
5	(b)	(i)	use (named) equipment with high(er) resolution / AW ✓ use volumetric flask, instead of measuring cylinder / to measure the water ✓ use graduated pipette, instead of dropping pipette / to measure the glucose solution ✓ use one dilution instead of two ✓ produce one 0.01 mol dm^{-3} solution for all the populations instead of separate solutions ✓	2 max	3.4	**MARK AS PROSE** e.g. 'use, measuring cylinder / pipette, with high(er) resolution' e.g. 'use equipment with, smaller gaps between divisions / smaller intervals' **IGNORE** 'more, intervals / divisions' **IGNORE** precise / accurate **ALLOW** use, burette / syringe, instead of measuring cylinder / to measure the water **ALLOW** use, micropipette / volumetric pipette / pipette filler / syringe, instead of dropping pipette / to measure the glucose solution 'instead of a pipette, use a syringe which has a higher resolution' = mp1 and 3 **ALLOW** 'use fewer dilutions'
5	(b)	(ii)	sterilised / boiled / distilled ✓ sealed / vacuum / airtight / closed / described ✓ standard deviation(s) ✓	3	3.3	e.g. 'put bung in (flask)'

6*			***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.***			
			Level 3 (5-6 marks) A detailed description of the general roles of homeobox genes **and** valid suggestions for the roles in the development of the brain. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** A description of the general role of homeobox genes **and** a valid suggestion for a role in the development of the brain. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** An outline of the general role of homeobox genes **or** a valid suggestion for a role in the development of the brain. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	**6**	**1.2** **2.5**	**Indicative scientific points may include (but are not limited to):** *General roles* • determine overall body plan • switch different genes on and off in different cells and tissues • (and therefore) determine cell identity • expressed in a set order during development • regulate patterning and positioning of (named) structures • determine polarity • regulate levels of apoptosis and mitosis *Roles in brain development* • determine the head and tail regions / anterior and posterior regions and therefore where the brain and spinal cord will develop • expressed in a set order to determine (named) regions of the brain • and neural organisation in the brain • switch genes on or off in the brain • to form specialised, neurones / nerve cells • regulate mitosis and apoptosis of neurones to adjust neural organisation

Question			Answer	Mark	AO Element	Guidance
7	(a)		*idea that* that Archaea and Eukarya are (most closely) related due to similarities in, histones / (DNA) polymerase ✓ *idea that* Archaea and Bacteria are (most closely) related due to, similarities in ribosomes / absence of mitochondria ✓ no evidence that Bacteria and Eukarya are (most closely) related ✓ *idea that* helicase comparison provides no useful evidence ✓ *idea that* phylogeny / evolutionary relationships should be determined by genome analysis ✓	**3 max**	3.1 3.2	e.g. 'Archaea and Bacteria have similar organelles and are related' **ALLOW** ' Bacteria and Eukarya are least related because they only have helicase in common' **IGNORE** 'all contain the same helicase' unqualified
7	(b)		(DNA polymerase) (catalyses) formation of phosphodiester bonds (between nucleotides / in DNA strand) ✓ (helicase) unwinds / separates / unzips, (DNA) double helix / (DNA) strands ✓	**2**	1.1	**ALLOW** proofreading of new DNA strand **ALLOW** adds nucleotides to new DNA strand **ALLOW** construction of new sugar phosphate backbone (between nucleotides / in DNA strand) **ALLOW** breaks the H bonds between, base pairs / (DNA) strands / nucleotides

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