

Higher

GCSE

Biology B Twenty First Century Science

J257/02: Depth in Biology (Foundation Tier)

General Certificate of Secondary Education

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 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 available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of 2 standardization responses.

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 50% 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, email or via the RM Assessor messaging system.

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 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 email.

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.

10. 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 **5(a)(i)** and **7(c)**.

11. Annotations available in RM Assessor

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
	Ignore

12. 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.

The breakdown of Assessment Objectives for GCSE (9-1) in Biology B:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

Question			Answer	Marks	AO element	Guidance
1	(a)		sensory neuron ✓	1	2.1	
	(b)		effector ✓	1	1.1	
	(c)		motor neuron ✓	1	2.1	
	(d)		brain stem – heart rate and breathing rate cerebellum – conscious movement cerebral cortex – intelligence and memory ✓✓	2	1.1	two or three correct lines = 2 marks one correct line = 1 mark DO NOT ALLOW any box with more than one line joined to it DO NOT ALLOW branching lines

Question			Answer	Marks	AO element	Guidance
2	(a)		digestive ✓ osmosis ✓ kidney ✓ urea ✓ water ✓	5	1.1	
	(b)	(i)	<p>General uses of both sugars and fatty acids: to make cells / organelles / hormones / tissues ✓ for (cellular/aerobic/anaerobic) respiration / to make ATP ✓</p> <p>Uses of sugars: to make carbohydrate(s) ✓ to make nucleotides / DNA / amino acids ✓</p> <p>MAX TWO uses of fatty acids: combined with glycerol ✓ to make lipids ✓ to make (cell) membranes ✓ to make fat/adipose tissue for storage/insulation ✓</p>	3	1.1	<p>DO NOT ALLOW unspecific idea that they are “nutrients” or that they are needed for a balanced diet / “to keep healthy” / “for energy” / “for growth/repair” / “to keep warm” without further explanation</p> <p>ALLOW named carbohydrate e.g. glucose / glycogen DO NOT ALLOW ref. to controlling/raising blood sugar level</p> <p>ALLOW to make fatty sheath / to insulate neurons</p>

Question			Answer	Marks	AO element	Guidance
2	(b)	(ii)	protein(s) ✓ genome contains the instructions / determines the order in which the amino acids are joined together ✓	2	1.1	ALLOW enzymes/correct named human protein ALLOW genome “codes for” protein
		(iii)	nucleus ✓	1	1.1	DO NOT ALLOW chromosomes / genes / DNA / alleles
		(iv)	four AND double ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
3	(a)		correct x-axis label for each bar AND correct y-axis label ✓ one bar correctly plotted at 92% ✓ the other bar correctly plotted at 8% ✓	3	2.2	ALLOW bars with no gap between them
	(b)		First check the answer in table If answer = 20 (%) award 2 marks $(40 \div 200) \times 100$ ✓ $= 20 (\%)$ ✓	2	2.2	ALLOW answer written outside the table
	(c)		(yes because) in tray 1 most/92% of the seedlings grew straight up / towards the lamp ✓ (yes because) in tray 2 most/75% of the seedlings grew curved towards the window ✓ idea that lamp/window are sources of (bright) light ✓ idea that tray 2 results support the prediction less strongly than tray 1 OR idea that (on the whole / in general) the results support the prediction even though not all seedlings grew towards the light ✓	4	3.2a x 2 3.1b x 2	

Question			Answer	Marks	AO element	Guidance
3	(d)	(i)	Any two from: the time of day (without reference to a specific time or part of the day) ✓ night time / sunset ✓ weather / clouds ✓ shadows (cast by things outside) / idea of something blocking light coming through the window ✓ changing day length (in spring/autumn) ✓ switching light(s) on/off in the room / power cut ✓	2	3.1b	
		(ii)	Any two from: use lamp / artificial light source / same bright light as for Tray 1 ✓ placed to the side of the tray / instead of the window ✓ ref. to controlling length of exposure to light ✓	2	3.3b	
	(e)		phototropism ✓	1	2.1	More than 1 box ticked = 0 marks
	(f)		auxin(s) ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	<p>Any two from:</p> <p>Leo has high blood pressure ✓</p> <p>idea that his (systolic) blood pressure is near/just over the lower boundary of the high category ✓</p> <p>he should lower his (systolic) blood pressure ✓</p>	2	3.2b	ALLOW although his diastolic blood pressure is in the ideal range
		(ii)	<p>70 ✓</p> <p>(to)</p> <p>120 ✓</p>	2	3.1a	<p>ALLOW either order</p> <p>ALLOW 119</p>
	(b)	(i)	<p>(positive) <u>correlation</u> ✓</p> <p>number of deaths (generally) increases as the amount of fat eaten increases ✓</p>	2	3.1a	

Question			Answer	Marks	AO element	Guidance
4	(b)	(ii)	<p>Any three from:</p> <p>high-fat diet increases the risk of CVD / coronary heart disease (CHD) ✓</p> <p>causes fatty deposits/build-up in (coronary) arteries ✓</p> <p>can block/restrict blood flow through arteries / cause blood clots ✓</p> <p>can cause a heart attack / lack of oxygen/food/nutrients getting to the heart (muscle) / chest pains/angina ✓</p> <p>can cause increase in fat around the heart ✓</p> <p>high-fat diet causes obesity / causes you to be overweight / raises BMI (which increases risk of CVD) ✓</p> <p>high-fat diet increases blood pressure (which increases risk of CVD) ✓</p> <p>high-fat diet increases cholesterol (which increases risk of CVD) ✓</p>	3	2.1	ALLOW can “clog” arteries

Question			Answer	Marks	AO element	Guidance
4	(b)	(iii)	Any three from: people of different/all sexes/genders ✓ people of different/all ages ✓ people of different ethnicities ✓ people with different health/medical histories ✓ people with different body mass / BMI / height ✓ people with different lifestyles / named example ✓ people with different occupations / jobs ✓ people from different areas / regions / socioeconomic backgrounds ✓ people who consume different amounts of sugar / salt / alcohol ✓ idea that each group/category should be present in the sample in (roughly) the same proportion as in the population ✓	3	2.1	DO NOT ALLOW “size” e.g. smokers/non-smokers, amounts of exercise DO NOT ALLOW “fat” as this is given earlier in the question DO NOT ALLOW “diet” unqualified
		(iv)	First check the answer on answer line If answer = 2 360 400 award 2 marks $(60\,000\,000 \div 100\,000) \times 3934$ ✓ $= 2\,360\,400$ ✓	2	2.2	

	(c)	(i)	Any two from: eat less fat / eat low-fat foods ✓ walk/cycle to work / get more exercise ✓ one valid suggestion not directly prompted by the doctor's notes ✓	2	3.2a	DO NOT ALLOW "diet" or "eat a healthy diet" without reference to fat e.g. eat less salt / stop smoking / lose weight/reduce BMI
		(ii)	(medicine tested on) human cells / animals ✓ (medicine tested for) safety ✓	2	2.1	ALLOW side-effects DO NOT ALLOW effectiveness
		(iii)	side-effects OR allergic/adverse reaction ✓	1	2.1	ALLOW overdose ALLOW it may not work IGNORE could die

		(iv)	<p>Any two from:</p> <p>lifestyle changes have low(er) risk of death / complications ✓</p> <p>lifestyle changes are less expensive (for the NHS) ✓</p> <p>lifestyle changes are less painful / not invasive / no risk of (postoperative) infection / no risk of long-term consequences of surgery ✓</p> <p>lifestyle changes can start immediately / no waiting list ✓</p> <p>idea that lifestyle changes can't repair existing damage ✓</p> <p>idea that surgery might not help if he continues his unhealthy lifestyle ✓</p> <p>idea that it takes longer to see effects/benefits of lifestyle changes OR idea that Leo will have to continue with the new lifestyle (for a long time) to maintain the benefits of it ✓</p> <p>surgery has a recovery time / need to take time off work ✓</p>	2	2.1	<p>ALLOW reverse argument throughout</p> <p>DO NOT ALLOW "more/less effective" unqualified</p>
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Question			Answer	Marks	AO element	Guidance
5	(a)	(i)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Detailed explanation that longer beaks meant these swordbill hummingbirds were more likely to reproduce and pass on their characteristics/alleles. AND Correctly uses examples of technical terms, e.g. competition / variation / adaptation / adapted / advantage / mutation/allele/variant. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Explains that longer beak meant swordbill hummingbirds were more likely to <u>reproduce</u> because they got more nectar/food. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Basic explanation includes the idea that longer beak meant swordbill hummingbirds got more nectar/food AND therefore were more likely to survive. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	2.1	<p>AO2.1 Applying understanding of natural selection to explain why the swordbill has become the most common species of hummingbird in the region</p> <p>For example:</p> <ul style="list-style-type: none"> • competition/competing between (species of) hummingbirds for (limited) food/nectar in the region • (genetic) variation between hummingbirds meant they had different features • swordbills / hummingbirds with a longer beak were better able/adapted to reach nectar at the bottom of the passionflower tube • this gave the swordbill hummingbirds an advantage • swordbill hummingbirds were more likely to get (enough) food/nectar to survive • therefore, swordbill hummingbirds were more likely to reproduce • so swordbill hummingbirds were more likely to pass their characteristics / alleles / variants / mutations / genes / DNA to the next generation • therefore, swordbill hummingbirds became more common over a number of generations

Question			Answer	Marks	AO element	Guidance
5	(a)	(ii)	<p>Any two from:</p> <p>a (new) disease/pathogen could kill swordbills ✓</p> <p>(new/increase in) predator(s) could kill/eat swordbills ✓</p> <p>a new competitor could reduce the amount of food/habitat for swordbills ✓</p> <p>decrease in number of passionflowers / less food/nectar for swordbills ✓</p> <p>climate change / global warming could mean the swordbills are less able/well adapted to survive ✓</p> <p>pollution could kill/harm swordbills ✓</p> <p>hunting of the swordbills by humans ✓</p> <p>natural disaster / example (e.g. forest fire) ✓</p> <p>loss of habitat / building/urbanisation ✓</p>	2	2.1	<p>ALLOW “invasive” species</p> <p>DO NOT ALLOW “new species” unqualified</p> <p>DO NOT ALLOW ref. to chopping down trees or loss of “home”, as this is stated in the question</p>
		(iii)	<p>Any three from:</p> <p>transfer of pollen/gametes / pollination/fertilisation is needed for reproduction ✓</p> <p>passionflower reproduction/pollination dependent upon / needs swordbill hummingbird ✓</p> <p>if swordbill numbers decrease the passionflower might not be able to reproduce / passionflower numbers will decrease ✓</p> <p>idea of ‘vicious circle’ effect (less passionflower pollination/reproduction = less food for swordbills = even less pollination, and so on) ✓</p>	3	3.2a	<p>DO NOT ALLOW ref. to “extinction” as this is in the question – must qualify by saying numbers would decrease</p>

Question			Answer	Marks	AO element	Guidance
5	(b)		<p>Any two <u>pairs</u> from:</p> <p>parents and offspring have similar features ✓ some traits/features/characteristics are inherited ✓</p> <p>fossils / bones / skulls ✓ that had some features in common with living organisms, and some differences / that show changes in (the features of) species over time ✓</p> <p>idea that different populations of the same/similar species (living in different places/conditions) ✓ have different adaptations / are adapted (differently) to their environment / can become separate species ✓</p> <p>different species have similar bones/body structures ✓ (which suggests) they evolved from the same/common ancestor ✓</p> <p>selective breeding / artificial selection / selection by humans ✓ produced new varieties of plants / new breeds of animals / changed the characteristics of animals/plants ✓</p>	4	1.1	ALLOW points communicated through examples (e.g. Galápagos tortoises)
	(c)		<p>It can help to explain modern examples of evolution, such as bacteria becoming resistance to antibiotics</p> <p>AND</p> <p>Most scientists accept that it is the best explanation for evolution ✓</p>	1	1.1	

Question			Answer	Marks	AO element	Guidance
5	(d)		<p>idea that there was a change in the (sequence of bases in the) bacteria's DNA/genome/genes ✓</p> <p>(due to) a mutation ✓</p> <p>idea that this caused a change in an existing enzyme OR idea that this changed/provided the instructions for making the enzyme ✓</p>	3	2.1	ALLOW genetic variation

Question			Answer	Marks	AO element	Guidance
6	(a)		Tissue A – Xylem AND Tissue C – Phloem ✓	1	1.1	DO NOT ALLOW any box with more than one line joined to it DO NOT ALLOW branching lines
	(b)	(i)	C before B ✓ B before E ✓ E before D ✓	3	1.2	The correct sequence is: C (A) B E D
		(ii)	Any two from: (use focus controls to) move objective lens(es) upwards/away from slide (to avoid smashing slide) ✓ view from the side when moving lens towards the slide ✓ use a lamp / indirect light / do not use direct sunlight ✓ do not look down the microscope without a slide on the stage / do not look directly into the lamp ✓ place the microscope on a flat/even/non-slip surface / away from edge of bench / carry the microscope with two hands ✓ wear gloves / safety glasses / PPE when handling stain/stained material ✓ idea of clipping slide securely onto stage ✓ handle glass (slide/cover slip) gently / dispose of broken glass properly ✓	2	3.3a	IGNORE simple statements 'wear safety glasses' etc. Answer must relate to using the stain
	(c)	(i)	stain ✓	1	2.2	ALLOW dye / named stain (e.g. H&E)
		(ii)	multiply the magnifications of the two lenses ✓	1	1.2	ALLOW 10 x 40 ALLOW x400

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	10^1 ✓	1	1.2	
		(ii)	3 ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
7	(a)		photosynthesis AND (cellular) respiration ✓	1	1.1	both required, in correct order for 1 mark DO NOT ALLOW anaerobic respiration
	(b)		to provide <u>ATP</u> / <u>energy</u> (for other life processes / active transport / chemical reactions) ✓	1	1.1	ALLOW releases energy DO NOT ALLOW energy made / created or produced ALLOW named chemical reactions e.g. photosynthesis, translocation

	(c)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Detailed explanation considers the effects of both light and temperature.</p> <p>OR Detailed explanation links (the glucose made by) photosynthesis to cellular respiration and how this would affect the amount of ATP/energy available for growth.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Explanation links light to photosynthesis.</p> <p>AND Explanation links photosynthesis to the production of food/materials for growth OR ref. to faster rate / more photosynthesis.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Simple explanation recognises the role of light</p> <p>AND indicates more/less light received (by a tree).</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	2.1	<p>ALLOW reverse argument for the other tree throughout</p> <p>AO2.1 Applying understanding of factors that affect photosynthesis to explain why tree A has grown bigger than tree B</p> <p>For example:</p> <ul style="list-style-type: none"> • Tree A receives more light • More light / higher light intensity increases the rate/amount of photosynthesis • More sunlight means tree A will be warmer • Higher temperature increases the rate/amount of photosynthesis • More photosynthesis means more starch/glucose/sugar/carbohydrate/food will be made • Making more glucose/sugar/carbohydrate means tree A can make more materials for growth <p>ALLOW credit at Level 3 for alternative ideas that explain why tree B has grown less, e.g. disease / damage / less fertile soil</p> <p>ALLOW credit at Level 3 for the idea that carbon dioxide concentration likely to be the same for both trees so would not have affected growth of one more than the other</p> <p>AO2.1 Applying understanding of respiration to explain why tree A has grown bigger</p> <p>For example:</p> <ul style="list-style-type: none"> • More photosynthesis in tree A means more glucose for respiration <p>More respiration means more ATP/energy for life processes that enable growth, e.g.</p>
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						synthesising new materials, active transport (e.g. of nutrients)
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