OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B1.4 PHOTOSYNTHESIS

SCORE	PERCENTAGE
/164	%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

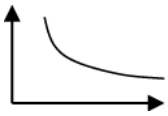
What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Question			Answer/Indicative content	Marks	Guidance
1		i	contains genes / genetic material / DNA (1)	1	
		i	controls cell (functions) (1)	1	**allow** protein synthesis
		ii	(onion cells) do not photosynthesize (1)	1	
		ii	(because) they are underground / in the dark (1)	1	
			Total	**4**	
2			do more repeats / more distances / greater range of distances (1)	1	**allow** specific values if they match the marking points
			longer than 10 seconds (1)	1	**ignore** simply do more measurements
			Total	**2**	
3			B	1	
			Total	**1**	
4	a		bubbles may be different sizes (1)	1	
			may miscount / difficult to count (1)	1	
	b		oxygen (1)	1	
	c		respiration (is also occurring) (1)	1	
			some oxygen is used up (in respiration) / AW (1)	1	**allow** idea that oxygen given out is the net production
	d	i	 as the light intensity decreases (1)	2	
			there are fewer bubbles in 10 seconds (inverse proportional relationship) (1)		
		ii	**any two from** as the distance increases, the light intensity decreases (1)	2	
			as the light intensity decreases, there is less light / energy for photosynthesis (1)		
			the line curves because the light will not decrease to zero / AW (1)		

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

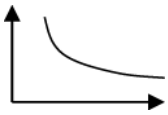
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			Total	9	
5			algae gain protection (1) fungi gain sugars (1)	1 1	**allow** idea about prevention of drying out / absorbing water / minerals
			Total	2	
6			A	1	
			Total	1	
7			B	1	
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
8	a	i	bubbles may be different sizes (1)	1	
		i	may miscount / difficult to count (1)	1	
		ii	would measure total volume (1)	1	
	b	i	 line decreasing = (1) but curved line decreasing = (2)	2	
		ii	**any two from** as the distance increases, the light intensity decreases (1) as the light intensity decreases, there is less light / energy for photosynthesis (1) the line curves because the light will not decrease to zero / AW (1)	2	
	c	i	light energy (1)	1	
		i	splits water (1)	1	
		i	in chloroplasts (1)	1	
		ii	respiration (is also occurring) (1)	1	
		ii	some oxygen is used up (in respiration) / AW (1)	1	**allow** idea that oxygen given out is the net production
			Total	**12**	
9			algae gain protection (1)	1	**allow** idea about prevention of drying out / absorbing water / minerals
			fungi gain sugars (1)	1	
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
10	a		from carbon dioxide (from the air / through leaves) (1)	1	**allow** from glucose **allow** correct formula **ignore** from food **ignore** photosynthesis / respiration / breathing **Examiner's Comments** Half the candidates knew that plants get the element carbon from carbon dioxide.
	b		from water (from the soil / through roots) (1)	1	**allow** from glucose **allow** correct formula **ignore** from food **ignore** photosynthesis / respiration / breathing **Examiner's Comments** Two thirds of candidates knew that plants get the element hydrogen from water.
	c		from carbon dioxide (from the air / through leaves) (1)	1	**not** from water **allow** from glucose **allow** correct formula **ignore** from food **ignore** photosynthesis / respiration / breathing **Examiner's Comments** This question was targeted at A* and accordingly very few candidates correctly stated that plants get the element oxygen from carbon dioxide. The majority thought it came from water, not realising that the oxygen in water is what is released from the plant as oxygen gas.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
11	a		$C_6H_{12}O_6$ and $6O_2$ (1)	1	any order must use subscripts Examiner's Comments The majority of candidates correctly completed the symbol equation for photosynthesis.
	b		idea that not enough mass / materials / substances / nutrients lost from soil to supply the mass / material / substances / nutrients gained by the tree (1) correct calculation: soil lost 1kg but tree gained 78kg (1)	2	allow the tree gained (much) more mass than the soil lost allow total weight changed from 102kg ? 179kg allow soil would have been 22kg (if scientists were correct) allow the tree gained 77kg from somewhere else (not soil) = 2 marks allow tree gains 78kg but soil only lost 1kg = 2 bod Examiner's Comments To gain both marks candidates had to both explain that the tree took on more mass than the soil lost, and support this with an appropriate calculation using the figures provided.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
12	a		water (1) oxygen (1)	2	**allow** formulae if correct: H_2O (1) O_2 (1) **Examiner's Comments** This question was generally well answered with the most common errors being water and oxygen the wrong way round or energy instead of oxygen.
	b		through stomata (1) by diffusion (1)	2	**allow** pores **ignore** holes in leaves **Examiner's Comments** Many candidates appreciated the importance of stomata (sometimes referred to as pores). Reference to diffusion was less frequently seen.
	c		more chlorophyll / more chloroplasts (1) to absorb more light / to absorb as much light as possible / because less light (to absorb) / more shading (1)	2	**allow** less access to sun(light) **ignore** cannot reach sunlight / sunlight cannot reach the plant **not** any reference to availability of gases or water **Examiner's Comments** Most candidates identified the reduction in light as being important but only the best answers linked this to chlorophyll content of the leaves.
			Total	6	
13			glucose **and** oxygen (1)	1	**any order** **allow** sugar **Examiner's Comments** The majority of candidates correctly identified glucose but many lost the mark by including energy rather than oxygen in their answer.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
14		i	idea that not enough mass / materials / substances / nutrients lost from soil to supply the mass / material / substances / nutrients gained by the tree (1) correct **calculation:** soil lost 1kg but tree gained 78kg (1)	2	**allow** the tree gained (much) more mass than the soil lost **allow** total mass changed from 102kg ? 179kg (1) **allow** soil would have been 22kg (if scientists were correct)(1) **allow** the tree gained 77kg from somewhere else (not soil) = 2 marks **allow** tree gained 78kg but soil **only** lost 1kg = (2) (BOD) **Examiner's Comments** Many candidates realised the soil only lost 1kg of mass and the tree gained 78kg. However a number of candidates failed to use the data to answer the question, simply stating the mass must have come from somewhere else.
		ii	**any three from:** enters through root (hairs) (1) by osmosis (1) transported up the stem (1) passes through xylem (1) lost from the leaves by evaporation (1) by the process of transpiration (1)	3	**allow** correct description of osmosis (1) **ignore** diffusion / active transport **for extra marking point allow** **allow** a (small amount) used in photosynthesis (1) **Examiner's Comments** The majority of candidates gained one mark, normally for the idea that the roots take in water and a second for the water moving up the stem or xylem. Few candidates mentioned that water is lost by evaporation from the leaves.
			Total	**5**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
15	a		[Level 3] **Explanation** of why rate of photosynthesis is reduced **AND** **Explanation** of how and why transpiration is affected. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] **Description** of reduced photosynthesis **AND** **Description** of effects on transpiration. **OR** **Explanation** of why rate of photosynthesis is reduced **OR explanation** of how and why transpiration is affected. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] **Description** of reduced photosynthesis **OR** **Description** of effects on transpiration. **OR** **attempts one explanation** without stating if they are increased or decreased Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A Indicative scientific points on explanations may include: Explanations of reduced photosynthesis • photosynthesis reduced because of fewer collisions • photosynthesis reduced because reduced enzyme activity • photosynthesis reduced because high winds cause stomata to close so less carbon dioxide taken in Explanation of effects on transpiration. • transpiration increased because of increased diffusion (gradient) or increased evaporation • transpiration increased because of decreased humidity • transpiration may be reduced by low temperatures reducing evaporation or diffusion • transpiration decreased as dry soils means there is less water and the guard cells become flaccid Indicative scientific points on descriptions may include: Description of reduced photosynthesis • lower temperatures or high winds decrease the rate of photosynthesis • high winds close stomata **ignore** effect of dry soil or sunlight on photosynthesis Description of effects on transpiration. • high winds increase rate of transpiration • high winds cause stomata to close so less transpiration • dry soils may reduce transpiration • low temperatures can reduce transpiration

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					allow absolute ideas e.g. no photosynthesis when cold Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This question discriminated the different levels well, the less able candidates would mention that transpiration and photosynthesis were affected by the different conditions but not actually say that the rates increased or decreased. Only the more able candidates used the correct terminology linked to evaporation from the leaves or enzyme activity. A large proportion of the candidates described the processes of photosynthesis and transpiration without actually linking them to the conditions.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b	i	**any two from:** idea that graph shows an increase in recent times (1) idea that there was a decrease until recently (1) idea that there have been great fluctuations (1) there have been wider rings at other times (in the past) / e.g. 3800 years ago (1) idea that results might not be representative of all trees (1)	2	**ignore** yes / no **allow** increases starting in any correct year (between 2000 years ago to present) **allow** trees are wider in present day (1) **allow** shows an overall increase (1) **allow** decreases (from 4000) to any correct year (between 2000 years ago to 500) (1) **allow** the pattern is random (1) **allow** it has gone up and down (1) **BUT** **allow** it has gone up and down but there is an increase in recent years (2) **allow** only shows bristlecone pine trees (1) **allow** only shows some bristlecone pine trees (1) **allow** only measured in California (1) **ignore** it is warmer in California **Examiner's Comments** Most candidates showed that they understood that the statement could not be completely supported by the data.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**any two from**: there is not enough evidence (to support theory) (1) other factors could have caused wider rings (1) only provides information about tree rings in one location (1)	2	**ignore** yes / no **allow** idea that correlation does not mean causation (1) **ignore no** evidence **ignore** not enough proof **allow** named factors such as rainfall or light (intensity) (1) **ignore** other things could have caused the wider rings **ignore** idea that graph supports global warming recently as rings are getting wider **Examiner's Comments** Only the most able candidates realised that although the tree rings were increasing in size there was no actual evidence to link the change to global warming. The candidates that got one mark tended to state that there were other factors such as water or mineral availability that might have caused the change.
			Total	10	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
16	a		[Level 3] Answer includes **two** adverse environmental condition with at least **one** fully explained. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Answer includes **two** adverse environmental conditions coupled with at least **one** explanation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer includes **two** adverse environmental conditions. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to C Explanations at level 3 may include: • lower temperatures decrease the rate of photosynthesis • less water uptake or more water loss may reduce photosynthesis as water is required Explanations at level 2 may include: • lack of water in the soil results in lack of water uptake / gets less water • windy so more water lost by transpiration / via stomata / less braches so less photosynthesis Indicative scientific points about the adverse environmental conditions may include: • low temperatures / too cold • lack of water (in soil) (**not** just dry) • windy so more water loss / damage to branches Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments Most candidates commented on the adverse conditions, lack of water or cold temperatures. A smaller number could go further and link the wind to larger water loss or the lack of water and cold temperatures to a reduction in photosynthesis.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b	i	any two from: idea that graph shows an increase in recent times (1) idea that there was a decrease until recently (1) idea that there have been great fluctuations (1) there have been wider rings at other times (in the past) / e.g. 3800 years ago (1) idea that results might not be representative of all trees (1)	2	**ignore** yes / no **allow** increases starting in any correct year (between 2000 years ago to present) **allow** trees are wider in present day (1) **allow** shows an overall increase (1) **allow** decreases (from 4000) to any correct year (between 2000 years ago to 500) (1) **allow** the pattern is random (1) **allow** it has gone up and down (1) BUT **allow** it has gone up and down but there is an increase in recent years (2) **allow** only shows bristlecone pine trees (1) **allow** only shows some bristlecone pine trees (1) **allow** only measured in California (1) **ignore** it is warmer in California Examiner's Comments Well answered by many, with references to the increase in recent years, the fluctuations and the decrease until recent years.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**any two from:** there is not enough evidence (to support theory) (1) other factors could have caused wider rings (1) only provides information about tree rings in one location (1)	2	**ignore** yes / no **allow** idea that correlation does not mean causation (1) **ignore no** evidence **ignore** not enough proof **allow** named factors such as rainfall or light (intensity) (1) **ignore** other things could have caused the wider rings **ignore** idea that graph supports global warming recently as rings are getting wider **Examiner's Comments** Although the word proves was emboldened few candidates appreciated the difference between proof and a correlation. Answers often repeated those given to the previous question.
			Total	10	
17			gets enough / more light (1) light needed for photosynthesis (1) for more growth / bigger crop (1)	2	**ignore** simply ‘gets light’ **ignore** to grow **allow** won't grow as much in the shade **Examiner's Comments** Answers to this question highlighted the need to make comparative comments with candidates failing to score marks by simply stating that plants in the shade get no light and so do not grow.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
18	a	i	<table><tr><td></td><td>?</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> (1)	1	more than 1 tick = 0 **ignore** crosses ?Examiner's Comments?? Both parts to this quest were well answered.
		ii	<table><tr><td></td><td>?</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> (1)	1	more than 1 tick = 0 **ignore** crosses ?Examiner's Comments?? Both parts to this quest were well answered.
	b	i	as the temperature increases, the rate of photosynthesis increases and decreases (1) **but** as the temperature increases, the rate of photosynthesis increases, **levels off**, and then decreases (2) **plus** correct uses of data, e.g.: rises to max rate of 20 (arbitrary units) / rises to max rate at 30 (°C) / decreases after 40 (°C) / rate is zero at 55 (°C) / constant / optimum 28?40 (°C)	3	(it) increases and goes down = 0 (it) increases, levels off, then decreases (1) **allow** answer in range 28?30 (°C) **allow** answer in range 28?40 (°C) ?Examiner's Comments?? Many candidates were quoting figures in their answers from the graph which was rewarded but there were a number of candidates who tried to explain the changes rather than describe them.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	answer in range 28?30 (°C) (1) idea that max rate of photosynthesis and heating any more would be wasteful (1)	2	**allow** value less than 28 (°C) if explains that reduced rate of photosynthesis / yield is balanced by reduced heating costs ?Examiner's Comments?? This was a challenging question and few candidates at this level appreciated that a temperature of about 30 degrees would be the best balance between cost and increased rate.
		iii	cost of heaters / cost of heating / payback time for heaters (1) idea of pollution / environmental damage / carbon footprint (1)	2	**ignore** simply 'cost' **allow** idea that gas / oil heaters also release carbon dioxide for photosynthesis (1) **allow** idea that transpiration might increase / may need more water (1) ?Examiner's Comments?? A small number of answers indicated that increased temperature might mean more watering is needed but most candidates listed other possible limiting factors.
			Total	9	
19			**any two from** contain chlorophyll / chloroplasts (1) to absorb light (1) for photosynthesis / to make sugar (1)	2	?Examiner's Comments?? Many candidates simply assumed that the traps were green for camouflage reasons.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
20		i	sun(light) / light (1)	1	**not** green plants
		ii	**any two from:** can be a herbivore and a carnivore / is an omnivore / feeds on both plants and animals / feeds on both green plant and caterpillar (1) when it feeds on green plants it is a primary consumer (1) when it feeds on caterpillar it is a secondary consumer (1)	2	
		iii	numbers increase (1) less are eaten (1)	2	 **allow** its predator has gone
			Total	**5**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
21		i	as the temperature increases, the rate of photosynthesis increases and decreases (1) **but** as the temperature increases, the rate of photosynthesis increases, **levels off**, and then decreases (2) **plus** correct uses of data, e.g.: rises to max rate of 20 (arbitrary units) / rises to max rate at 30 (°C) / decreases after 40 (°C) / rate is zero at 55 (°C) / constant / optimum 28 – 40 (°C)	3	(it) increases and goes down = 0 (it) increases, levels off, then decreases (1) **allow** answer in range 28–30 (°C) **allow** answer in range 28–40 (°C) ?Examiner's Comments?? Many candidates gained three marks for fully describing the graph. Candidates who didn't gain full marks usually omitted to include the section of the graph where the rate of photosynthesis was constant. Some described the rate falling but not rising initially, and others didn't make the variables explicit. Most correctly included data in their description.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	(as the temperature increases, the rate of photosynthesis) increases because particles / enzymes have more (kinetic) energy / collide more (frequently) / ORA (1) levels off because of some other limiting factor / not enough CO_2 / not enough light / temperature is not a limiting factor (1) decreases because enzymes denature (1)	3	**ignore** optimum temperature **allow** at start, temperature is the limiting factor (1) Examiner's Comments Most candidates attempted to describe the shape of the graph in more detail than in part (i) but only a minority did as the question asked, and explained the shape of the graph. Those who did, usually gained one mark for explaining the fall in rate being due to enzymes denaturing, although some did also explain the rise in rate being due to particles having more energy. Very few used the idea of limiting factors to explain the constant part of the graph; of those that did, many incorrectly thought that temperature was the limiting factor at this point.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		iii	answer in range 28–30 (°C) (1) idea that max rate of photosynthesis and heating any more would be wasteful (1)	2	if give temperature above 30 (°C) then no marks at all **allow** value less than 28 (°C) if explains that reduced rate of photosynthesis / yield is balanced by reduced heating costs = 2 answer below 28 (°C) with no justification = 0 ?Examiner's Comments?? Less than half the candidates correctly chose a temperature in the range of 28-30°C, although those who did, usually went on to correctly explain why. A common error was to choose a temperature around 35 °C, the reason being given that it was in the middle of the range of temperatures giving the maximum rate of photosynthesis.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
22	a		photosynthesis (1)	1	
	b		(oxygen levels) rises during the day as / **more** (Sun) light / **more** photosynthesis (1) (oxygen levels) decreases over night as **no** or **less** //(Sun) light / **no or less** photosynthesis (1)	2	**allow** (oxygen levels) rises early evening / more (Sun) light / **more** photosynthesis (1) **allow** (oxygen levels) decreases early morning as no or less /(Sun) light / **no or less** photosynthesis (1) **allow** (oxygen levels) decreases as it gets darker (1) **ignore** rate of photosynthesis is highest in early evening **ignore** references to water and carbon dioxide **ignore** references to respiration if both changes are explained but with no direct link to time then = 1 e.g. (oxygen levels) rises **as more** photosynthesis then decreases as **no** photosynthesis (1)
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
23	a		photosynthesis (1)	1	**allow** phonetic spelling
	b		(oxygen levels) rises during the day as **more** (Sun) light / **more** photosynthesis (1) (oxygen levels) decreases over night as **no** or **less** /(Sun) light / **no or less** photosynthesis (1)	2	**allow** more oxygen in early evening as **more** (Sun) light / **more** photosynthesis (during the day) (1) **allow** less oxygen in early morning as **no** or **less** (Sun) light / **no** or **less** photosynthesis (during the night) (1) **allow** (oxygen levels) decreases as it gets darker (1) **ignore** rate of photosynthesis is highest in early evening **ignore** references to water and carbon dioxide **ignore** references to respiration if both changes are explained but with no direct link to time then = 1 e.g. (oxygen levels) rises **as more** photosynthesis then decreases as **no** photosynthesis (1)
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
24			B ✓	1 (AO 2.2)	<u>Examiner's Comments</u> This question tested AO2.2, with candidates' awareness of the role of chlorophyll in photosynthesis and practical skills of interpreting results from a starch test are needed to successfully answer the question. Candidates frequently made the choice between B and C and occasionally D was seen. Higher ability candidates were able to select the correct response, clearly distinguishing between the area that contains chlorophyll being the area that can photosynthesise in a variegated leaf.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
25	a	i	$6H_2O$ ✓ $6O_2$✓	2 (AO 2 x 1.1)	must be on correct side of equation **ALLOW** unbalanced/incorrectly balanced H_2O O_2 for one mark Examiner's Comments This question assesses AO1.1 recall of knowledge. However, many candidates seemed to lack any recall and tried to separate out combinations from the formulae given in the question, in many cases these were unrecognisable formulae. Only a few higher ability candidates scored both marks. Common mistakes were to get the correct balanced formula but, unfortunately, put them on the wrong side of the equation. Numbers within molecules were sometimes written as a superscript rather than subscript, or even the same size as the letter.
		ii	endothermic✓	1 (AO 1.1)	Examiner's Comments Here, many candidates were able to identify this as an endothermic reaction in this AO1.1 question. Only a few incorrectly opted for exothermic but a significant number mistakenly interpreted the question as what would provide the energy and gave respiration as their response.
	b	i	30(^{0}C)✓	1 (AO 2.2)	Examiner's Comments Nearly all candidates gained marks here, showing good application of scientific techniques AO2.2. Occasionally candidates put 3.9 as their answer, showing they had misinterpreted the graph.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	record at narrower temperature intervals✓ narrower intervals around the 30^0C value✓	2 (AO 2 x 3.3b)	ALLOW any temperature increment less than 5^0C ALLOWnarrower intervals around the optimum ALLOW narrower interval range between 25–35^0C but must include 30^0C Examiner's Comments This question assesses AO3 to analyse information to improve experimental procedures. Many candidates identified the need for narrower temperature intervals, often stating the actual interval they would use, but very few targeted these to around the optimum temperature.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
26		i	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)** Provides a detailed explanation drawing conclusions why GM plants would make more biomass available to humans. Links photosynthesis to agricultural food chains and function of insecticides. *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)** Provides an explanation why GM plants would make more biomass available to humans. Links photosynthesis **or** function of insecticides to agricultural food chains. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Provides a basic explanation why GM plants would make more biomass available to humans. This could include ideas about photosynthesis **or** function of insecticide **or** agricultural food chains. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.	6 (AO 3 × 1.1) (AO 2 × 2.1) (AO 1 × 3.2b)	**AO1.1 Demonstrates knowledge of insecticides and photosynthesis.** • Insecticides will kill insect pests • Less leaves will be eaten/pests eat less leaves • Leaves are the site of photosynthesis • Less pests of the GM plant **AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass** • **More** photosynthesis • **More** light absorption for photosynthesis • **More** chlorophyll / chloroplasts for photosynthesis • **More** food/glucose/biomass made by photosynthesis **AO3.2b Draw conclusions linking photosynthesis to food chains** • More plant growth/food/biomass for cattle • More biomass passes through the agricultural food chain • Cattle receive more energy for growth • Then cattle will grow more, therefore more food for humans <u>Examiner's Comments</u> In this Level of Response question, examiners were looking for a detailed conclusion linking photosynthesis to food chains. This should link both photosynthesis and function of pesticides to agricultural food chains. This differentiated well over the whole ability range of the candidates. Exemplar 7 shows a Level 3 answer which gained 6 marks. Exemplar 7

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					L3 Genetically modified plants that make insecticide are resistant to insects and repell them. This prevents biomass being lost this way and results in more biomass being available for cattle consumption which means more food for them which means more cattle are reared resulting in more food being available for humans in the form of meat or dairy. If less leaves are eaten by insects then there are more leaves available for photosynthesis as there is more surface area. A greater rate in photosynthesis means that the plants will grow stronger and faster which is more efficient for the farmers which means more food for the cattle at a lower cost
		ii	**any two from:** concern that they may be harmful to humans if eaten ✓ plants may escape into the wild ✓ useful /pollinating insects might be harmed ✓ disrupt food chains ✓ ethically wrong ✓	2 (AO 2 × 2.1)	**ALLOW** harmful effects not discovered to humans **IGNORE** dangerous **ALLOW** resistance / resistance gene could get into other plants **IGNORE** harmful to insects/pests **ALLOW** harm the environment /reduce biodiversity **ALLOW** morally / religiously wrong **IGNORE** playing God / not natural / disrupt nature **IGNORE** may not taste good **IGNORE** reduced gene pool / genetic variation / susceptible to the same disease <u>Examiner's Comments</u> The most common credited mark was that it was ethically wrong. A lot of responses focused on it not being natural, which was a non-credit worthy answer.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

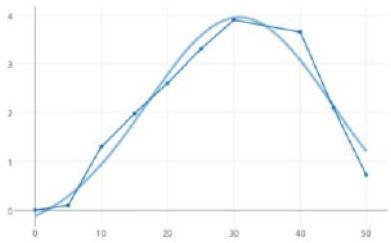
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
27				4	ORA for all marking points
			idea of **less** plants/percentage of plants/% cover in shade/closer to the tree ✓	(AO 1.2)	ALLOW shows negative correlation
			less light (in shade/closer to the tree)✓	(AO 2.1)	IGNORE less sun IGNORE in shade **no** photosynthesis / **no** light
			less photosynthesis (in shade/closer to the tree)✓	(AO 3.1b)	ALLOW **less** light for photosynthesis (closer to the tree) 2 marks ALLOW photosynthesis **less** effective (closer to the tree)
			less food/raw materials produced **for growth** (in shade/closer to the tree)✓	(AO 3.2b)	Examiner's Comments A number of candidates achieved 1 mark on this question for the idea of less plants/% cover closer to the tree/shade or the reverse argument. Most candidates didn't link this to less light for photosynthesis. Less food for growth was the least credited marking point.
			Total	4	
28			C ✓	1 (AO 2.2)	Examiner's Comments This question proved to be the most challenging question in section A. Many candidates did not apply the inverse square law and chose the answer D rather than C.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

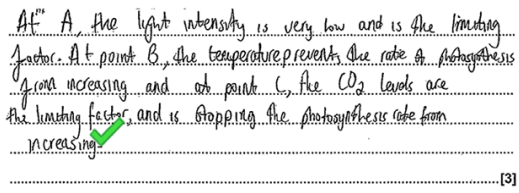
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
29	a		energy/heat is taken from surroundings/into the reaction ✓	1 (AO 1.1)	ALLOW energy absorbed is more than the energy released Examiner's Comments Very few candidates confused endothermic with exothermic in this question.
	b		suitable smooth line of best fit is drawn ✓	1 (AO 2.2)	 dot to dot line = 0 Examiner's Comments The construction of a smooth curve seemed very challenging for candidates. Many candidates attempted to draw a straight line for part of the curve. Others just joined the points. Double lines were often seen.

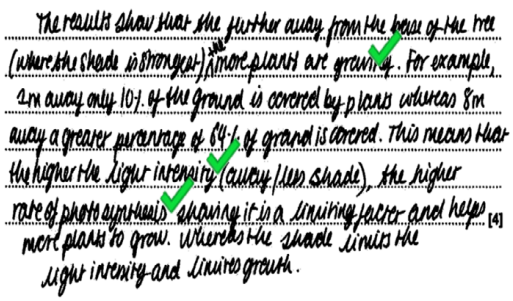
© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		at point A light is limiting as increasing light intensity increases the rate / as it has sufficient temperature and carbon dioxide ✓ at point B temperature is limiting as increasing temperature increases rate / as it has sufficient light and carbon dioxide ✓ at point C carbon dioxide is limiting as increasing carbon dioxide increases rate / it has sufficient temperature and light ✓	3 (AO 3×2.1)	if no other mark scored allow one mark for correct identification of the three limiting factors with no explanations <u>Examiner's Comments</u> This question challenged many of the candidates and was a good discriminator for high ability candidates. Whilst some candidates could identify the limiting factors at the three points, few backed this up with explanations using evidence from the graph. An example of a candidate lacking full explanations and therefore only scoring 1 mark is shown in exemplar 8. Exemplar 8  At A, the light intensity is very low and is the limiting factor. At point B, the temperature prevents the rate of photosynthesis from increasing and at point C, the CO_2 levels are the limiting factor, and is stopping the photosynthesis rate from increasing ✓ [3]
			Total	5	

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
30				4	ORA for all marking points
			idea of **less** plants/percentage of plants/% cover in shade/closer to the tree ✓	(AO 1.2)	ALLOW shows negative correlation
			less light (in shade/closer to the tree) ✓	(AO 2.1)	IGNORE less sun IGNORE in shade **no** photosynthesis / **no** light
			less photosynthesis (in shade/closer to the tree) ✓	(AO 3.1b)	ALLOW **less** light for photosynthesis (closer to the tree) 2 marks ALLOW photosynthesis **less** effective (closer to the tree)
			less food/raw materials produced **for growth** (in shade/closer to the tree ✓	(AO 3.2b)	<u>Examiner's Comments</u> This question assessed four different assessment objectives. Candidates had to identify the trend from the graph and apply their knowledge and understanding to give a reason for the trend. They also had to interpret reasons for the trend and draw conclusions about how the shade was affecting the plants. Most candidates identified the trend. Higher ability candidates linked this to less light closer to the tree so reduced rate of photosynthesis. However, only the highest ability candidates concluded that this would result in less glucose/food production. Most candidates just referred to reduced growth, which on its own did not score a mark. Exemplar 2  The results show that the further away from the base of the tree (where the shade is stronger) the more plants are growing. For example, 2m away only 10% of the ground is covered by plants whereas 8m away a greater percentage of 64% of ground is covered. This means that the higher the light intensity (away from shade), the higher rate of photosynthesis showing it is a limiting factor and helps more plants to grow. Whereas the shade limits the light intensity and limits growth. [4] This candidate has been credited with 3 marks. A mark is gained for identifying the trend as a reverse argument. They have gained a second mark for recognising that

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					this is due to a higher light intensity further from the tree. A third mark was gained for linking the increase light intensity to an increased rate of photosynthesis. The candidate has not gained the final conclusion mark as they have only referenced the plant growth and not the food/raw materials produced to enable thegrowth to occur.
			Total	4	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

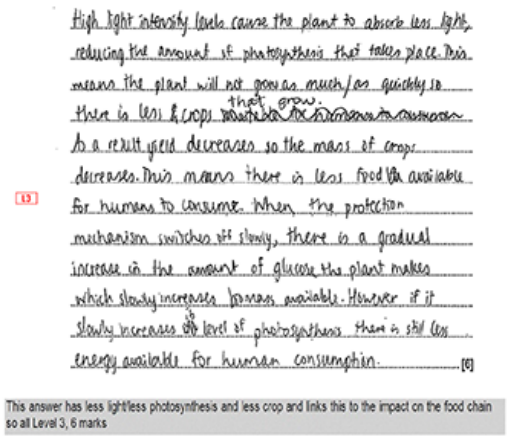
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
31			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 explanation including conclusions about how the mechanism affects photosynthesis and links this to less biomass available to humans in the food chain. *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)** Explanation of how the mechanism affects photosynthesis or affects the biomass available to humans. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Demonstrates some knowledge of how the mechanism affects photosynthesis or affects the biomass available to humans. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	6 (AO 3. × 1.1) (AO 2. × 2.1) (AO 1. × 3.2b)	**AO1.1 Demonstrate knowledge of photosynthesis and biomass.** • Photosynthesis requires light energy • Mechanism reduces photosynthesis • Trapped by the leaves and used to produce food molecules • Photosynthesis required for plant growth • Plant biomass is a food source for animals including humans **AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass** • More light energy converted to heat, then less energy for photosynthesis • Less photosynthesis then plants can make less food / plants can grow less • Less plant biomass leads to less available food **AO3.2b Draw conclusions linking photosynthesis to biomass in food chains** • In low light intensities, light availability is the limiting factor • Less plant growth/crops therefore less food for cattle/less food for humans / in the food chain <u>Examiner's Comments</u> This Level of Response question assessed all three main assessment objectives. It was common to be limited to a low level mark due to repeating the stem of question regarding less biomass all through their response instead of linking the protection mechanism's impact to less light, less photosynthesis so less glucose/food made and consequently less food for cattle and humans. Candidates that did not appreciate that a reduction in light resulted in a reduction in photosynthesis, which also limited their answer to a low level.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					There was little evidence of candidates planning their response. Taking time to consider how to answer a LoR, might encourage them to make notes and think through key areas. A common low level answer was to refer to the loss of energy due to the energy needed to switch on the mechanism. It was noted how many candidates did not link biomass to growth or production of food. However, those candidates that realised that the key to the answer was essentially linked to factors influencing photosynthesis, produced excellent responses. Exemplar 5  High light intensity levels cause the plant to absorb less light, reducing the amount of photosynthesis that takes place. This means the plant will not grow as much/as quickly so there is less crops that grow. As a result yield decreases so the mass of crops decreases. This means there is less food available for humans to consume. When the protection mechanism switches off slowly, there is a gradual increase in the amount of glucose the plant makes which slowly increases biomass available. However if it slowly increases the level of photosynthesis there is still less energy available for human consumption. [6] This answer has less light/less photosynthesis and less crop and links this to the impact on the food chain so all Level 3, 6 marks This candidate has been credited Level 3 maximum 6 marks. They have structured their answer in a concise manner but included all the relevant marking points. The candidate describes the protection mechanism's impact in reducing light andphotosynthesis. The candiates states that thedecrease in mass of crops and food made means there is consequently less food for the humans to consume. They continue to give a reason why there will still be less energy available even when the plants resume photosynthesis due to the mechanism switching off slowly.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
32		i	(no) microorganisms (in the soil) ✓ no decay (takes place) ✓	2 (AO 1.1) (AO 2.1)	AW microbes, decomposers, saprophytes, detritivores, bacteria, fungi AW decomposition, rotting, break down ALLOW not enough nitrifying bacteria to replace nitrates / no nitrates released by nitrifying bacteria = 2 IGNORE no organisms to recycle the minerals <u>Examiner's Comments</u> Very few candidates were able to apply their knowledge of microbes and decay to this question, and found it challenging to answer. Many candidates misinterpreted the question and talked about lack of oxygen for life or that Mars is too dry for life. This is demonstrated with Exemplar 4 which was given 0 marks. Exemplar 4 The conditions are different. It is really hot on mars so the soil would dry out. [2]

Question			Answer/Indicative content	Marks	Guidance
		ii	plants release oxygen by photosynthesis ✓ organisms in the soil / microbes / animals release carbon dioxide by respiration ✓	2 (AO 2.2)	ALLOW correct word (or symbol) equations for photosynthesis linked to plants and respiration linked to organisms in the soil / microbes / animals AW microbes, decomposers, saprophytes IGNORE breathe out carbon dioxide IGNORE plants will respire and give out carbon dioxide ALLOW 1 mark for plants release oxygen/photosynthesise and microbes give out carbon dioxide/respire if no other marks are awarded. Examiner's Comments Candidates had to apply their knowledge and understanding of gases given off by plants in photosynthesis and organisms in carrying out respiration to explain why air would no longer needed to be added after a while. Most non-scoring responses were too vague and just stated gases as in the stem of the question.
			Total	4	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
33		i	(no) microorganisms (in the soil) ✓ no decay (takes place) ✓	2 (AO 1.1) (AO 2.1)	AW microbes, decomposers, saprophytes, detritivores, bacteria, fungi AW decomposition, rotting, break down ALLOW not enough nitrifying bacteria to replace nitrates / no nitrates released by nitrifying bacteria = 2 IGNORE no organisms to recycle the minerals <u>Examiner's Comments</u> Lower ability candidates didn't realise they needed to identify decomposer or a named type of decomposer and instead repeated the term living organisms from the question, thereby missing the AO1.1 aspect of the question. Higher ability candidates were able to name decomposers or types of decomposers. A significant number did not write about the AO2.1 aspect of the question about decomposition, using terms such as replenish or recycle minerals. Some candidates wrote about the minerals being used up but didn't go on to say why they would not be replaced.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	plants release oxygen by photosynthesis ✓ organisms in the soil / microbes / animals release carbon dioxide by respiration ✓	2 (AO 2.2)	ALLOW correct word (or symbol) equations for photosynthesis linked to plants and respiration linked to organisms in the soil / microbes / animals AW microbes, decomposers, saprophytes IGNORE breathe out carbon dioxide IGNORE plants will respire and give out carbon dioxide ALLOW 1 mark for plants release oxygen/photosynthesise and microbes give out carbon dioxide/respire if no other marks are awarded. Examiner's Comments In this AO2.1 question, many candidates referred to plants only, indicating the importance of careful reading of the question that asked about organisms other than plants. Another frequent response from candidates that did not score was reference to 'breathing' out carbon dioxide and not specifically to respiration.
			Total	4	
34			B	1 (AO 2.1)	
			Total	1	
35			A	1 (AO 1.1)	
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
36	a		distance of lamp/light source ✓	1 (AO2.2)	ALLOW light intensity IGNORE the lamp with no mention of distance or intensity
	b	i	Any two from: bubbles are different sizes / has different volume of gas ✓ some bubbles may also be missed/miscounted ✓ so volume at each point may not be representative of rate ✓	2 (AO2.2)	ALLOW amount of oxygen varies / bubbles burst IGNORE the pondweed could be different sizes
		ii	Any two from: measure volume (of gas released) ✓ names a suitable apparatus for measuring for volume ✓ use a heat sink ✓	2 (AO2 x 3.3a)	IGNORE measure amount ALLOW e.g. measuring cylinder / gas syringe / Audus apparatus /graduated pipette
	c	i	axes correctly labelled, including units ✓ all points correctly plotted ✓ ✓ suitable line of best fit drawn ✓	4 (AO4 x 2.2)	ALLOW +/- half a square all points correctly plotted 0 to 1 correct point plotted = 0 mark 2 to 4 correct points plotted = 1 mark All 5 correct points plotted = 2 marks ALLOW line of best fit based on plotted points IGNORE dot to dot line

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	further lamp is from the plant photosynthesis reduced / ORA ✓ example of a decrease from data e.g. at 10cm 30 bubbles given off and at 40cm only 2 bubbles ✓ OR photosynthesis stops in very low light ✓ by 50 cm there are no bubbles ✓ OR idea that rate of photosynthesis decrease is a non-linear relationship ✓ e.g. nearly double the number of bubbles at 10cm compared to 20cm but not double elsewhere ✓	2 (AO3.2b)	IGNORE type of gas mentioned in bubbles ALLOW description of decrease in bubbles e.g. further lamp the less bubbles ALLOW there is a negative correlation
			Total	**11**	
37		i	Three/3 ✓	1 (AO2.2)	
		ii	(sun)light / the sun ✓	1 (AO1.1)	
		iii	Award one mark for: (an organism) that lives on/in on a (host) organism ✓ Idea parasite benefits at the expense to its <u>host</u> ✓ Award two marks for: An organism that feeds on a living organism / An organism that causes harm to a living organism ✓✓	2 (AO2 x 1.1)	IGNORE an organism that feeds on another organism unless qualified
			Total	**4**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK