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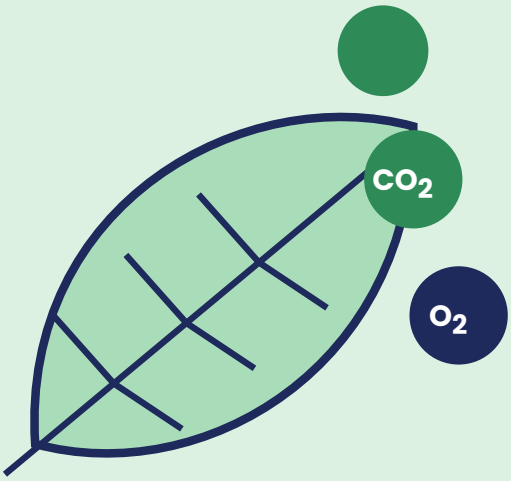
Year 10–11 • GCSE & IGCSE Biology



Photosynthesis

Mark Scheme – Teacher Copy

Answers, marking points and guidance for the Photosynthesis worksheet.

Equation | Glucose | Leaf | Gas exchange | Limiting | Practical

KEY IDEAS IN THIS WORKSHEET

YEAR 10–11

Name: _____ Class: _____

Date set: _____ Date due: _____

What's inside

Section A	Photosynthesis and the uses of glucose	**18 marks**
Section B	Leaf structure and gas exchange	**12 marks**
Section C	Limiting factors	**11 marks**
Section D	Practical skills	**16 marks**

Marking notes

- (1) = one mark for each marking point.
- / separates alternative answers.
- Allow error carried forward in calculations.
- Accept any correct, clearly expressed alternative.

Total marks

57

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Photosynthesis Worksheet – Mark Scheme

Total: 57 marks. (1) = one mark. Accept any scientifically correct alternative wording.

Section A – Photosynthesis and the uses of glucose

Q	Answer	Mark	Guidance
1	the process by which plants make glucose / carbohydrates (1); from carbon dioxide and water using light energy absorbed by chlorophyll (1)	2	
2(a)	carbon dioxide + water → glucose + oxygen (1); light and chlorophyll shown above the arrow (1)	2	
2(b)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$	2	1 mark for correct formulae, 1 mark for balancing
2(c)	energy is transferred from the surroundings (light) / energy is taken in	1	
2(d)	chloroplast (1); chlorophyll (1)	2	
3	respiration: releases energy for the cell; starch: insoluble store of energy that does not affect water movement (osmosis); cellulose: builds cell walls for strength; amino acids: to make proteins for growth and enzymes; fats and oils: energy store (e.g. in seeds)	5	1 mark each
4	magnesium is needed to make chlorophyll (1); without chlorophyll the leaves look yellow and photosynthesis is reduced (1); nitrate is needed to make amino acids (1); which are used to make proteins for growth (1)	4	
	Section A total	**18**	

Section B – Leaf structure and gas exchange

Q	Answer	Mark	Guidance
5	waxy cuticle: waterproof, reduces water loss; upper epidermis: thin and transparent so light passes through; palisade mesophyll: many chloroplasts, near the top to absorb light; spongy mesophyll: air spaces let gases diffuse; stomata and guard cells: let CO_2 in and O_2 out, guard cells open and close them; xylem: carries water and mineral ions to the leaf; phloem: carries sucrose away from the leaf	7	1 mark each
6	diffuses into the leaf through the stomata (1); through the air spaces in the spongy mesophyll (1); down a concentration gradient as CO_2 is used up in photosynthesis, then into the cell (1)	3	
7	large surface area absorbs more light (1); thin so gases have a short diffusion distance / light reaches all cells (1)	2	
	Section B total	**12**	

Section C – Limiting factors

Q	Answer	Mark	Guidance
8	a factor that is in short supply and stops the rate of photosynthesis increasing (1); any two of: light intensity, carbon dioxide concentration, temperature, amount of chlorophyll (2)	3	
9(a)	light intensity	1	
9(b)	light is no longer limiting (1); carbon dioxide concentration is limiting / in short supply (1)	2	
9(c)	temperature (or amount of chlorophyll)	1	
9(d)	distance is 3 times larger, so intensity is $1 \div 3^2$ (1); = 9 times smaller (1)	2	Higher tier / Extended
9(e)	benefit: higher rate of photosynthesis so higher crop yield (1); cost: heating and CO_2 are expensive, so costs must be less than the extra profit (1)	2	
	Section C total	**11**	

Section D – Practical skills

Q	Answer	Mark	Guidance
10(a)	20; 11; 6; 3 bubbles per minute	3	all four correct 3; three correct 2; two correct 1
10(b)	as the lamp distance increases / light intensity decreases (1); the rate of photosynthesis decreases (1)	2	
10(c)	independent: distance of the lamp (1); dependent: number of bubbles per minute (1); control, any two: temperature, same pondweed, CO_2 concentration, time, same lamp (2)	4	
10(d)	it absorbs heat so the temperature stays constant	1	
10(e)	collect and measure the volume of gas (gas syringe) / repeat and calculate a mean	1	
11	boil the leaf in water to kill it and stop reactions (1); heat in ethanol in a hot water bath to remove chlorophyll (1); rinse in water (1); add iodine solution (1); blue-black shows starch is present (1)	5	safety (turn off flames because ethanol is flammable / wear eye protection) is expected but not marked; 5 marks maximum
	Section D total	**16**	

Worksheet total: 57