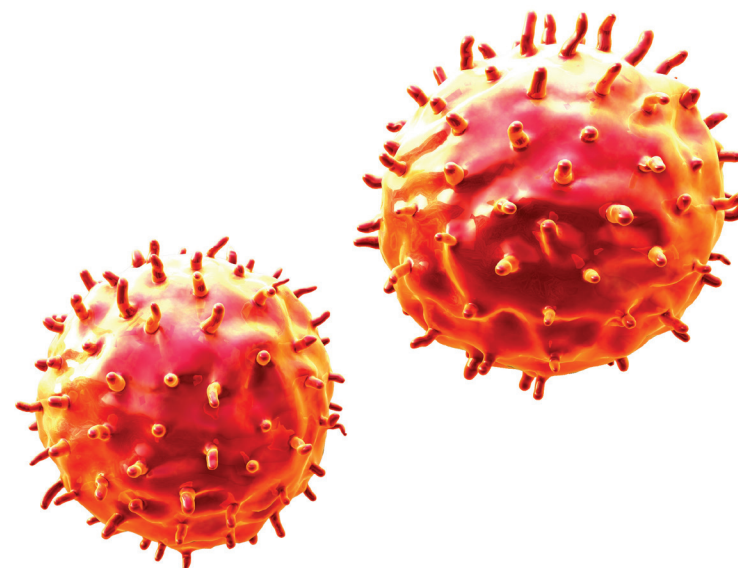


Interactive Example Candidate Responses

Paper 4 (May / June 2016), Question 6

Cambridge IGCSE™
Biology 0610



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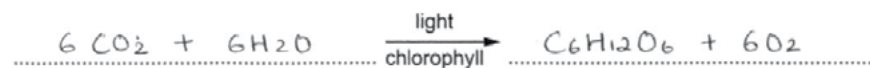
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6 (a) State the balanced chemical equation for photosynthesis.



[2]

A student investigated the effect of different wavelengths of light on the rate of photosynthesis of the water plant, *Cabomba*.

The student used the apparatus shown in Fig. 6.1.

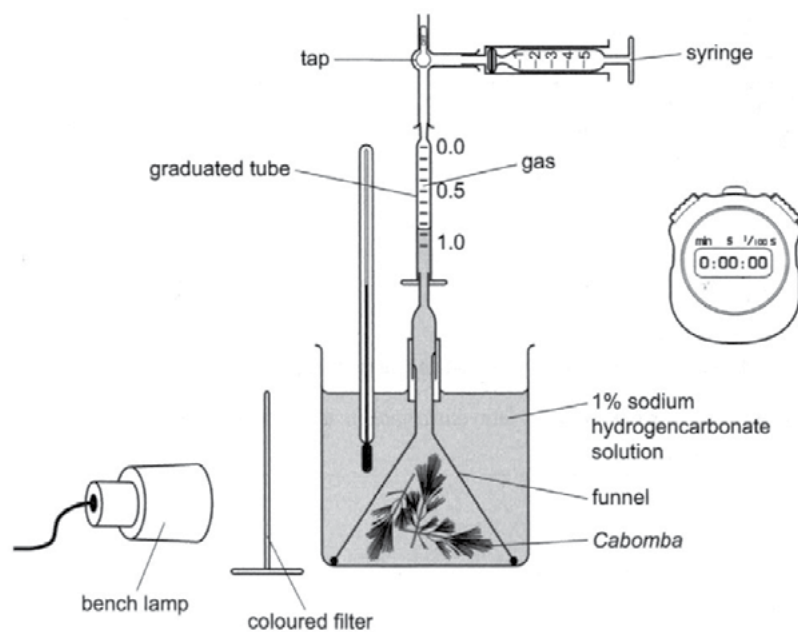


Fig. 6.1

Select
page

Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

6(d)(ii)

6(e)

Q6	Mark scheme	
(a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$; one mark for the correct chemical formulae one mark for balancing the equation correctly R word equation	2 marks
(b)	as <u>wavelength</u> increases, rate (of photosynthesis) decreases and increases ; units must be used once in the answer A volume of gas for rate high rates in, blue and violet and red/400–475 nm and 675 nm ; low(est) rate in, green and yellow/550–600 nm ; <i>either</i> maximum rate = 0.9cm^3 , at 675 nm/red or minimum rate = 0.2cm^3 , at 550 nm/green ;	3 marks
(c)	divide the volumes by, five (minutes)/time ;	1 mark

- (b) The student collected the gas produced by the plant for five minutes. The results are shown in Table 6.1.

Table 6.1

colour of filter	wavelength of light / nm	volume of gas collected / cm ³
violet	400	0.80
blue	475	0.80
green	550	0.20
yellow	600	0.40
red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

As wavelength increases from 400 to 550,
rate of photosynthesis decreases, but as
wavelength is increased further, it increases.
Greatest rate with wavelength 675 nm and
volume of gas collected was 0.90 cm³ in 5 minutes.
At 400 nm, it was 0.8 cm³ in 5 minutes and
at 550 nm, it was 0.2 cm³ in 5 minutes. [3]

- (c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

Divide volume of gas collected by 5.
to obtain rate in cm³ min⁻¹ [1]

Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

6(d)(ii)

6(e)

Q6 Mark scheme

(a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$; one mark for the correct chemical formulae one mark for balancing the equation correctly R word equation 2 marks
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(c)	divide the volumes by, five (minutes)/time ; 1 mark

(d) State why the student:

(i) kept the lamp at the same distance during the investigation,

To keep light intensity constant as it is
a controlled variable.

[1]

(ii) used sodium hydrogencarbonate solution.

To provide carbon dioxide to the
plant for photosynthesis.

[1]

(e) State **three** uses in a plant of the carbohydrate produced in photosynthesis.

1. to release energy by respiration.
2. converted to starch for storage
3. converted to cellulose to make cell walls for
new cells.

[3]

[Total: 11]

Your
Mark

6(a)

6(b)

6(c)

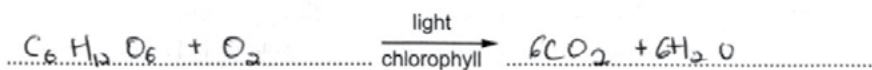
6(d)(i)

6(d)(ii)

6(e)

Q6	Mark scheme
(d)(i)	to keep the light intensity the same ; R temperature I 'fair test' A 'control light intensity'/'light intensity is a control(led) variable' 1 mark
(d)(ii)	to provide carbon dioxide/so carbon dioxide is not a limiting factor/so the only limiting factor is wavelength ; 1 mark
(e)	for, respiration/energy ; I protein synthesis/growth/active transport R produces energy converted to sucrose ; used to make, nectar/fruits ; used to make, cellulose/lignin ; used in cell walls ; used to make, starch/oils/fats ; I 'makes food', but A 'stores food' for 1 mark storage ; used to make, amino acids ; used to make, chlorophyll ; 3 marks

- 6 (a) State the balanced chemical equation for photosynthesis.



[2]

A student investigated the effect of different wavelengths of light on the rate of photosynthesis of the water plant, *Cabomba*.

The student used the apparatus shown in Fig. 6.1.

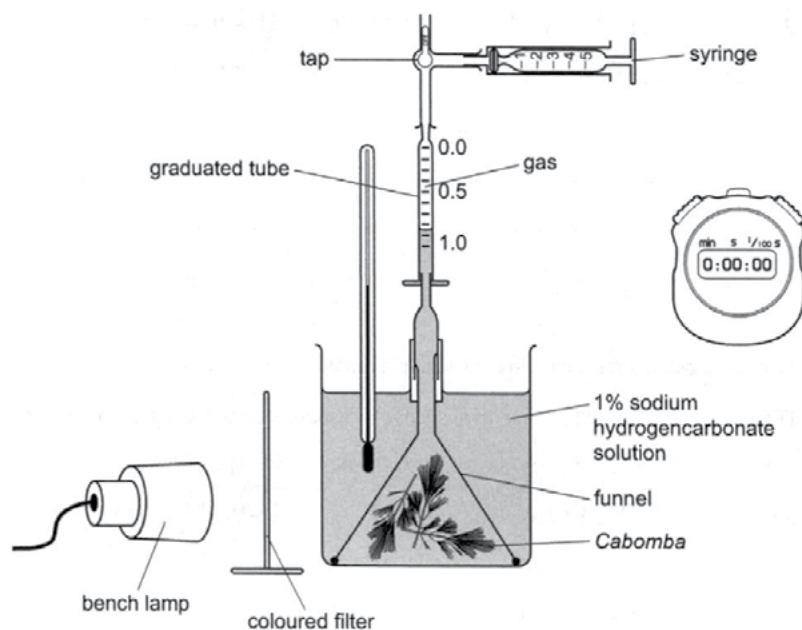


Fig. 6.1

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Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

6(d)(ii)

6(e)

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(c)	divide the volumes by, five (minutes)/time ; 1 mark

- (b) The student collected the gas produced by the plant for five minutes. The results are shown in Table 6.1.

Table 6.1

colour of filter	wavelength of light / nm	volume of gas collected / cm ³
violet	400	0.80
blue	475	0.80
green	550	0.20
yellow	600	0.40
red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

Generally, as wavelength of light increases, volume of gas collected increases. At first the volume of gas collected was 0.80 cm³ at a wavelength of 400 nm. But at 675 nm, the volume increased to 0.90 cm³

[3]

- (c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

By finding the average or
By dividing the wavelength over the time

[1]

Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

6(d)(ii)

6(e)

Q6 Mark scheme

(a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$; one mark for the correct chemical formulae one mark for balancing the equation correctly R word equation 2 marks
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(c)	divide the volumes by, five (minutes)/time ; 1 mark

(d) State why the student:

- (i) kept the lamp at the same distance during the investigation,

Controlled variable for a fair test

[1]

- (ii) used sodium hydrogencarbonate solution.

As a supply of carbon dioxide

[1]

- (e) State three uses in a plant of the carbohydrate produced in photosynthesis.

1. To make starch for growth.
2. For energy
3. To help in respiration.

[3]

[Total: 11]

Select
page

Your
Mark

6(a)

6(b)

6(c)

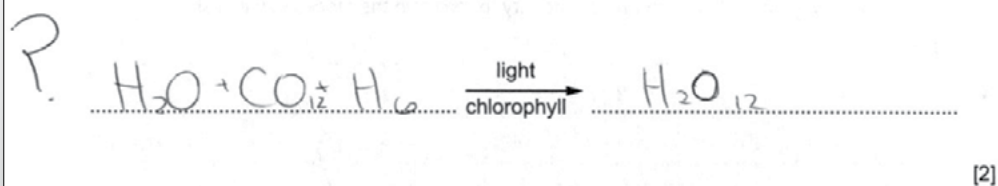
6(d)(i)

6(d)(ii)

6(e)

Q6	Mark scheme
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(d)(ii)	to provide carbon dioxide/so carbon dioxide is not a limiting factor/so the only limiting factor is wavelength ; 1 mark
(e)	for, respiration/energy ; I protein synthesis/growth/active transport R produces energy converted to sucrose ; used to make, nectar/fruits ; used to make, cellulose/lignin ; used in cell walls ; used to make, starch/oils/fats ; I 'makes food', but A 'stores food' for 1 mark storage ; used to make, amino acids ; used to make, chlorophyll ; 3 marks

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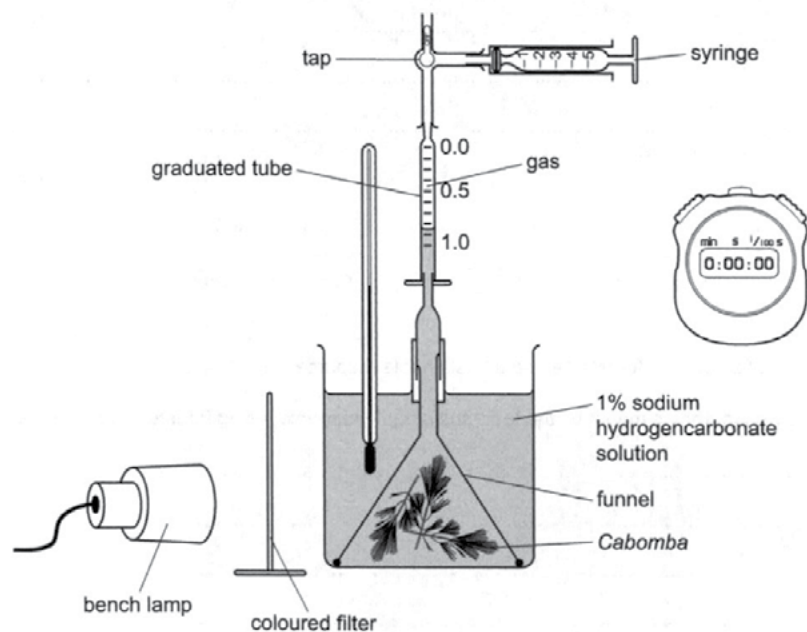


Fig. 6.1

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Your Mark

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6(b)

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red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

The effect of wavelength of light on the rate of photosynthesis as shown in the table is that

.....

 [3]

- (c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

By seeing and figuring out how the results relate to rates of photosynthesis. [1]

Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

6(d)(ii)

6(e)

Q6 Mark scheme

(a)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$; one mark for the correct chemical formulae one mark for balancing the equation correctly R word equation 2 marks
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(c)	divide the volumes by, five (minutes)/time ; 1 mark

(d) State why the student:

(i) kept the lamp at the same distance during the investigation,

So that ~~the~~ results would be accurate and that variable would remain controlled. [1]

(ii) used sodium hydrogencarbonate solution.

Because this solution gives the most accurate results and it's better to use for this experiment. [1]

(e) State three uses in a plant of the carbohydrate produced in photosynthesis.

1. Used to make sugars
2. Used to make the plant produce food
3. Used to help the plant grow.

[3]

[Total: 11]

Your
Mark

6(a)

6(b)

6(c)

6(d)(i)

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