Photosynthesis 5

Name: _____

Class: _____

Date: _____

Time: **36 minutes**

Marks: **36 marks**

Comments:

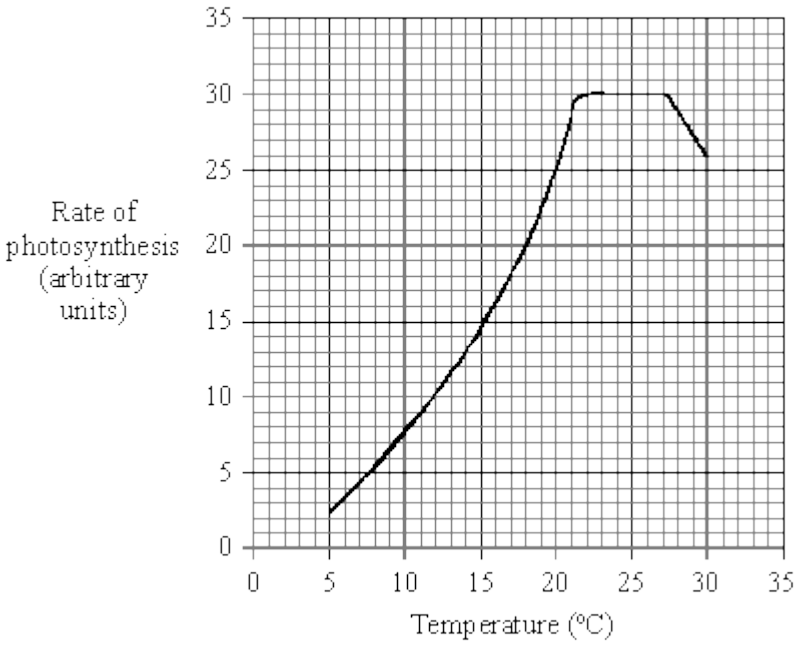
1. Green plants make food in their leaves.

(a) From where do the leaves get the energy that they need to make food?

_____

(1)

(b) The graph shows the effect of temperature on the rate of photosynthesis.



(i) Between which temperatures is the rate of photosynthesis fastest?

_____ and _____ °C

(1)

(ii) Suggest why the rate of photosynthesis stays the same between these two temperatures.

_____

_____

_____

_____

(2)

(iii) A greenhouse owner wants to grow lettuces as quickly and cheaply as possible in winter.

At what temperature should he keep his greenhouse in order to grow the lettuces as quickly and cheaply as possible?

_____ °C

Explain your answer.

_____

_____

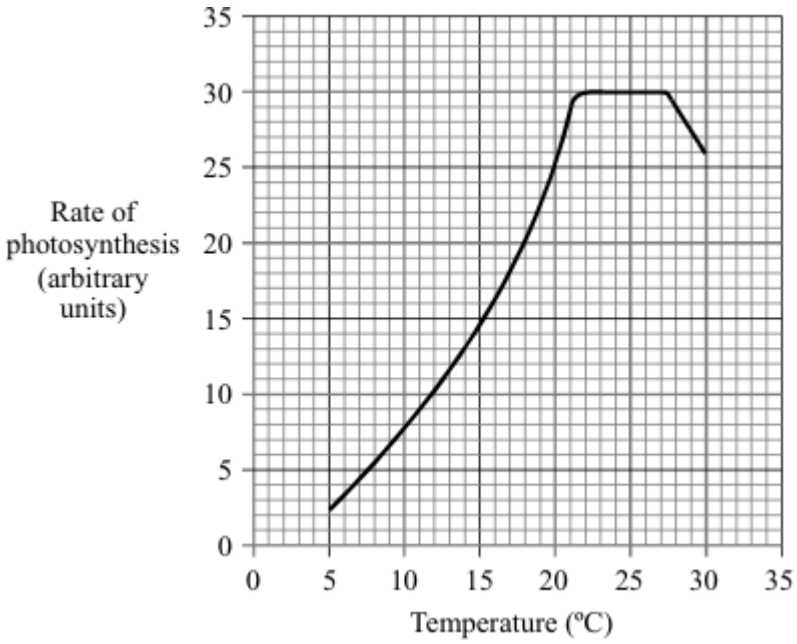
_____

_____

(3)

(Total 7 marks)

2. The graph shows the effect of temperature on photosynthesis.



(a) Between which temperatures is the rate of photosynthesis fastest?

_____ and _____ °C

(1)

(b) Suggest why the rate of photosynthesis stays the same between these two temperatures.

_____

_____

_____

_____

(2)

(c) A greenhouse owner wants to grow lettuces as quickly and cheaply as possible in winter.

At what temperature should he keep his greenhouse in order to grow the lettuces as quickly and cheaply as possible?

_____ °C

Explain your answer.

_____

_____

_____

_____

(3)

(Total 6 marks)

3. Low light intensity is one factor that limits the yield of a crop.

In Britain, many tomato growers use artificial lights to increase the yield of tomato crops.

The table shows the amount of natural daylight and artificial lamplight received by a tomato crop grown in a greenhouse.

Month	Natural daylight received by tomato plant		Artificial lamplight given to tomato plant		Total light energy received by plant per day in J/cm^2	Percentage increase in growth resulting from artificial light
	Day length in hours	Light energy received by plant per day in J/cm^2	Hours of light given per day	Light energy received by plant per day in J/cm^2		
January	8.1	239	18	492	731	206
February	9.9	492	18	492	984	100
March	11.9	848	12	328	1176	39
April	13.9	1401	2	55	1456	4
May	15.5	1786	0	0	1786	0
June	16.6	1960	0	0	1960	0
July	16.2	1849	0	0	1849	0
August	14.7	1561	0	0	1561	0
September	12.8	1064	2	55	1119	5
October	10.6	614	11	301	915	49
November	8.8	288	18	492	780	171
December	7.6	183	18	492	675	269

(a) Describe the pattern for the amount of light energy received from natural daylight by a tomato plant during the day.

_____

_____

_____

_____

_____

_____

(3)

(b) A tomato plant needs 600 J of light energy per cm^2 each day to grow and produce tomatoes.

Use this information and data from the table to suggest an explanation for the pattern of the artificial light given to the tomato plants.

_____

_____

_____

_____

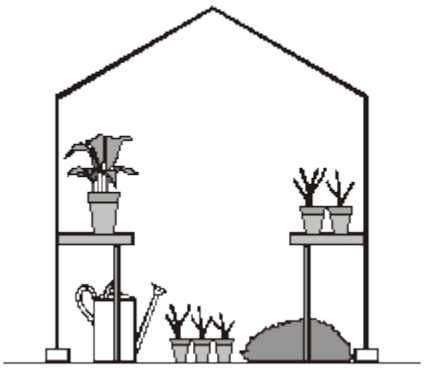
_____

_____

(2)

(Total 5 marks)

4. The diagram shows some plants growing in a greenhouse on a hot summer's day.



Which **one** of the following factors is most likely to limit the rate of photosynthesis at this time?

- carbon dioxide concentration
- light intensity
- temperature

Factor _____

Explain the reason for your answer.

_____

_____

_____

_____

_____

_____

(Total 4 marks)

5. (a) Balance the following equation for photosynthesis.

_____ CO_2 + _____ H_2O → $C_6H_{12}O_6$ + _____ O_2

(1)

(b) Give **two** conditions necessary for photosynthesis apart from a suitable temperature range and the availability of water and carbon dioxide.

1. _____

2. _____

(2)

(a) Plants have leaves which contain guard cells and palisade cells. Explain how **each** of these kinds of cell assists photosynthesis.

Guard cells _____

_____

_____

_____

(2)

Palisade cells _____

_____

_____

_____

(2)

(d) Glucose is a product of photosynthesis. Give **three** uses which green plants make of glucose.

1. _____

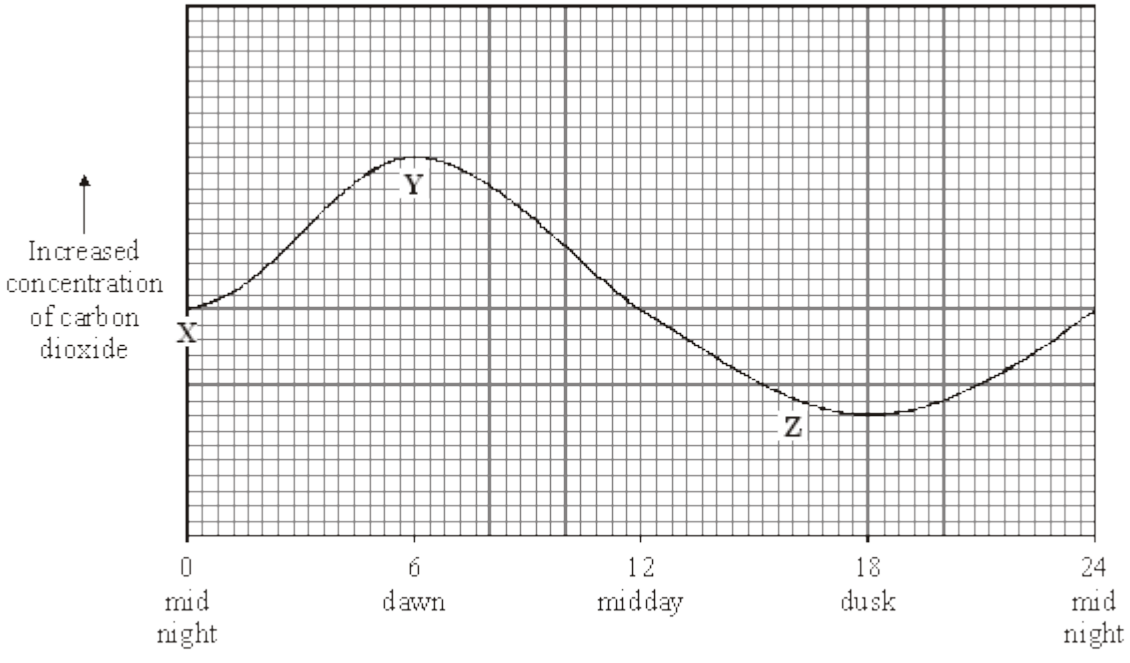
2. _____

3. _____

(3)

(Total 10 marks)

6. The graph shows the concentration of carbon dioxide in the air in a greenhouse full of tomato plants, measured over a period of 24 hours.



(a) Explain why the concentration of carbon dioxide in the air in the greenhouse increased between **X** and **Y**.

_____

_____

_____

_____

(2)

(b) Explain why the concentration of carbon dioxide in the air in the greenhouse decreased between **Y** and **Z**.

_____

_____

_____

_____

(2)

(Total 4 marks)

Mark schemes

1.

(a) Sun / sunlight / light

for 1 mark

1

(b) (i) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark

1

(ii) ideas of limiting factor / shortage of
e.g. light / carbon dioxide / water /chlorophyll

each for 1 mark
(allow 1 for 'maximum' rate of enzyme activity if no reference to limiting factors)
(ignore reference to dematuring)

2

(iii) 21.5 – 22° C

(allow first figure from answer to (i) so that no 'double-penalty' *but not below 20)*

maximum rate of photosynthesis
(can relate to any number on 'flat')

most economical heating (must relate to left end of 'flat'
each for 1 mark

3

[7]

2.

(a) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark

1

(b) *ideas of*
limiting factor / shortage of
e.g. light / carbon dioxide / water / chlorophyll

each for 1 mark
(allow 1 for 'maximum / optimum rate of enzyme activity if no reference to limiting factors) (ignore denaturation)

2

(c) 21.5 – 22° C

*(allow **first** figure from answer to (i) so that no 'double-penalty but only if this first answer is 20 or greater)*

maximum rate of photosynthesis / highest / fastest

but related to flat part of curve

most economical heating / cheapest related to heating

must relate to the temperature the candidate has given

each for 1 mark

3

[6]

3. (a) low in winter / named months /when the days are short

accept increases in spring / Dec – June

1

high in summer / named month(s) / (when days are long

decreases in autumn / June – December

1

reasonable quantitative statement

accept any reasonable calculated / translated quantitative statement

higher in summer than in winter for 2 marks
comparative statements may be worth 2 marks
but
8/11 times higher in summer than in winter for 3 marks

1

(b) no artificial light given in summer / light only given in winter

since natural light greatly exceeds minimum / 600 J (required to produce tomatoes)

accept day length if linked to light energy

OR

light only given in winter

as natural light less than the minimum needed (to grow them) or 600 J

OR

for 2 marks:
percentage increase in growth from artificial] light only significant in winter

2

[5]

4. carbon dioxide concentration

1

since atmospheric concentration very low / value give e.g. 0.03%

allow carbon dioxide used up

1

temperature high

allow if light chosen as a factor

1

light intensity high

allow If temperature chosen as a factor

1

[4]

5. (a) 6 6 6

all required

accept a '6n 6 n n 6n' version of the balanced equation provided it is correct in every detail

1

(b) any **two** of

- (presence of) chlorophyll **or** (amount of) chloroplasts

  accept green leaves (or other green parts)

- (sufficient) light (intensity)

- (light) of **a** suitable wavelength

  any light other than green light

  do not credit Sun's energy or sunshine or Sun

2

(c) **guard cells**

any **two** of

* control by osmosis
* the movement of gases

*accept movement of carbon dioxide **or** oxygen **or** water vapour*

beware movement of CO_2 out

accept a diagram or description

* through the stoma

2

palisade cells

any **two** of

* near the upper surface
* contain (a great) many **or** more chloroplasts
* (so) contain the most chlorophyll

2

(d) any three of

* for respiration
* conversion to (insoluble) starch

or to food store **or** to (other)carbohydrates
* (conversion to) sucrose **or** to food store **or** to (other) carbohydrates

or polysaccharides

*do not credit just to grow **or** live*

***or** survive*

accept conversion to food store

***or** to (other) carbohydrates once only*

* (conversion to) lipids **or** fats **or** oils
* (conversion to) amino acids **or** (plant) proteins **or** auxins **or** (plant) hormones **or** enzymes

3

[10]

6. (a) respiration

reject start respiring / respire only at night

1

no photosynthesis because no light

1

(b) photosynthesis rate greater than respiration rate

1

reject no respiration / photosynthesis only

photosynthesis since light

1

[4]