

1. A [1]
2. B [1]
3. B [1]
4. C [1]
5. (a) 200 μ M (*units required*)
1
- (b) $(77-51)/77 \times 100 = 35\%$ (*Units required. Allow answers in the range of 32–37%.*) 1
- (c) highest rate of photosynthesis at pH 7;
decrease (in rate of photosynthesis) between pH 7 and pH 7.5;
little change (in rate of photosynthesis) at higher pH values;
rate of photosynthesis falls again (slightly) at pH 9; 2 max
- (d) uses hydrogen carbonate ions;
uses stored carbon dioxide / carbon dioxide from respiration; 1 max

- (e) *pH*
optimum pH may be less than 7;
reducing the pH below 7 may lead to a higher rate (of photosynthesis);
(but) enzyme activity can be affected by low pH;

or

Temperature

optimum temperature may not be 15°C;
enzyme activity is affected by temperature;
temperatures above (or below) 15°C may lead to a higher rate
(of photosynthesis);

or

Light intensity

light intensity may not be optimal/may be limiting;
too low light intensity produces less ATP/NADPH + H⁺;
higher light intensities may result in a higher rate (of photosynthesis);
as light intensity/temperature increases rate of photosynthesis
may not increase as another factor becomes limiting;

2 max

[1] for named limiting factor and [1] for effect on photosynthesis.

[7]

6. D

[1]

7. (a) *Award [1] for each structure clearly drawn and clearly labelled.*

overall circular or cylindrical shape;
smooth outer membrane and inner folded membrane shown close
together;
cristae, shown as thin folds of the inner membrane orientated
towards the inside of the mitochondrion;
matrix;
ribosomes/circular DNA;
intermembrane space;

3 max

- (b) large inner surface area of cristae for respiratory complexes/
electron transport chains;
matrix contains/encloses DNA and ribosomes for protein
(enzyme) synthesis / Krebs cycle enzymes;
(double) membrane(s) isolates metabolic processes from
the rest of the cytoplasm;
small IM space between inner and outer membranes for
accumulation of protons; 2 max
Answers must clearly link a structure to a function for a mark.

[5]

8. (a) 90 (minutes)
1
- (b) as temperature increases activity increases/positive correlation 1
- (c) avoid predators / less competition for food 1
- (d) as temperature increases metabolic rate decreases/negative correlation
(*accept converse*) 1
- (e) metabolic rate of group mice is always less than single mice;
(*accept converse*)
both follow similar pattern of increases/decreases/fluctuations at
same time of day;
fluctuations greater in group mice;
both most active/higher metabolic rate during evening/21:00;
(*accept any reference to times between 18:00 and 00:00*) 2 max
- (f) single mice need to produce more heat/have greater heat loss
because of greater surface exposed to air / group mice huddle
together to reduce the surface exposed to air 1
Allow any other reasonable answer.
- (g) oxygen is required for (aerobic) respiration;
respiration produces ATP/releases energy/heat in the mice;
metabolic rate is a measure of total energy released/consumed in
the body / oxygen consumption is proportional to energy released/
consumed in body/proportional to metabolic rate; 2 max

- (h) metabolic activity high when mice more active supports the hypothesis;
activity is normally correlated with energy consumption;
but another factor may be causing both to increase at the same time /
correlation does not always establish cause and effect;
grouping/environmental temperature also affect metabolic rate;

2 max

[11]