1. A  [1]

2. B  [1]


4. C  [1]

5. (a)  200 μM (units required)  1

(b)  \( \frac{77-51}{77} \times 100 = 35\% \) (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

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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;

Answers must clearly link a structure to a function for a mark.

8. (a) 90 (minutes)

(b) as temperature increases activity increases/positive correlation

(c) avoid predators/less competition for food

(d) as temperature increases metabolic rate decreases/negative correlation (accept converse)

(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
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