

M1.(a) C.

Ignore name of organ

1

(b) E.

Ignore name of organ

1

(c) 1. Active site (of enzyme) has (specific) shape / tertiary structure / active site complementary to substrate / maltose;

Reject active site on substrate.

Must have idea of shape

Assume "it" = maltase

Accept (specific) 3D active site

Reject has same shape

2. (Only) maltose can bind / fit;

Accept "substrate" for "maltose"

3. To form enzyme substrate complex.

Accept E-S complex

3

[5]

M2.(a) Accept **three** suitable suggestions:

1. (Lactase / beads) can be reused / not washed away;

1. Accept lactase / beads not wasted

1. Less lactase used is insufficient

2. No need to remove from milk;

2. Accept lactase not present in milk.

3. Allows continuous process;

4. The enzyme is more stable;

5. Avoid end-product inhibition.

Ignore ref to SA

3 max

- (b) 1. (Lactose hydrolysed to) galactose and glucose;
 2. (So) more sugar molecules;
 2. *Idea of **more** sugars essential*
 3. (So) more / different receptors stimulated / sugars produced are sweeter (than lactose).

2 max

[5]

- M3.(a)** 1. Large / dense / heavy cells;
 2. Form pellet / move to bottom of tube (when centrifuged);
 3. Liquid / supernatant can be removed.
 Must refer to whole cells.

3

- (b) Break down cells / cell parts / toxins.
 Idea of 'break down / digestion' needed, not just damage

1

- (c) 1. To stop / reduce them being damaged / destroyed / killed;
 Reject (to stop) bacteria being denatured.
 2. By stomach acid.
 Must be in context of stomach.

2

- (d) 1. More cell damage when both present / A;
 2. Some cell damage when either there on their own / some cell damage in B and C;
 MP1 and MP2 – figures given from the graph are insufficient.
 3. Standard deviation does not overlap for A with B and C so difference is real;
 *MP3 and MP4 **both** aspects needed to gain mark.*
 4. Standard deviations do overlap between B and C so no real difference.

MP3 and MP4 accept reference to significance / chance for 'real difference'

3 max

- (e) 1. Enzyme (a protein) is broken down (so no enzyme activity);
Accept hydrolyse / digested for 'broken down'.
2. No toxin (as a result of protein-digesting enzyme activity);
Must be in the correct context.
3. (So) toxin is protein.
This must be stated, not inferred from use of 'protein-digesting enzyme'.

3

[12]

M4.(Maintaining constant pH to avoid)

1. Named protein / enzyme (in blood) sensitive to / affected by change in pH;
Accept converse for MP2 and MP3.
Named example should be a protein that might be affected (by change in pH) eg haemoglobin, carrier protein in plasma membrane.
Accept 'change in H⁺ concentration' for 'change in pH'.
2. (Resultant) change of charge / shape / tertiary structure;
The change in charge idea relates to the enzyme / protein and not the blood (plasma) or red blood cells.
'Denaturation' alone is insufficient.
3. Described effect on named protein or enzyme.
e.g. less oxygen binds with haemoglobin / less transport across membranes / fewer substrates can fit active site / fewer enzyme-substrate complexes.
Idea of 'less' or 'fewer' required. Ignore suggestion of 'no' or 'none'.

[3]

- M5.(a)** 1. Inhibition;
Accept either competitive or non-competitive inhibition or a description of either.

2. Changes tertiary structure (of enzyme);
3. Changes shape of / blocks active site (of enzyme);
The active site must be in the context of the enzyme / cytochrome oxidase.
4. Enzyme cannot bind to its substrate / no enzyme-substrate complex formed.
Accept 'ES'. Accept 'substrate cannot attach to enzyme'.

3 max

- (b) (Antidote reacts with / binds to cyanide) so cyanide cannot bind to enzyme / cytochrome oxidase
OR
(Antidote reacts with / binds to cyanide) so causing cyanide to be released from the enzyme / cytochrome oxidase.

Key idea is how the antidote affects the cyanide.

1

- (c) (i) 1. **A + C + E** / all liver (trials)
2. **B + D + F** / all kidney (trials)
3. **D + E** / all rat (trials);;
Accept a description of any trial letter.
All 3 groups correct = 2 marks.
Any 2 groups correct = 1 mark.
1 group / no groups correct = 0 mark.

2 max

- (ii) 1. Cyanide reduces oxygen use / rate of respiration in **A** and **B** / in both
OR
as concentration of cyanide increases, the use of oxygen decreases in both;
*Accept use of letters or description of the animal **and** organ*
Reference to 'both', in some way, is required.
2. Greater effect of cyanide (on oxygen use) on sheep kidney / **B** than on sheep liver / **A**;
Comparison required in the statement. The statement should not be inferred from MP3.
3. Appropriate calculations of mean oxygen use from the data
E.g. 1 liver falls by 74% whereas kidney falls by 87%
OR
liver falls to 0.26 / to 26% whereas kidney falls to 0.13 / to 13%
E.g. 2 liver falls by 2.0(au) whereas kidney falls by 12.2(au);

Check correct calculations using the data but a comparison must be shown. Accept other calculations using the data.

3

(iii) 81(%)

Correct answer = 2 marks.

Allow 1 mark for either:

Showing 8.1 divided by 10 or answer of 19(%)

Ignore '+' or '-' in showing the difference.

2

[11]

M6.(a) Concentration of substrate solution / of enzyme solution / pH.

1

(b) 1. 2.5 / 0.04;

1 mark for correct value

2. $\text{g dm}^{-3} \text{ minute}^{-1} / \text{g dm}^{-3} \text{ s}^{-1}$;

1 mark for related unit

2

(c) 1. Initial rate of reaction faster at 37 °C;

2. Because more kinetic energy;

3. So more E-S collisions / more E-S complexes formed;

4. Graph reaches plateau at 37 °C;

5. Because all substrate used up.

Allow converse for correct descriptions and explanations for curve at 25 °C

5

[8]

M7.(a) Deoxyribose.

1

- (b) 1. Thymine 18 (%);
2. Guanine 32 (%). 2
- (c) DNA polymerase. 1
- (d) 1. (**Figure 1** shows) DNA has antiparallel strands / described;
2. (**Figure 1** shows) shape of the nucleotides is different / nucleotides aligned differently;
3. Enzymes have active sites with specific shape;
4. Only substrates with complementary shape / only the 3' end can bind with active site of enzyme / active site of DNA polymerase. 4
- [8]**