Key Terms Blurt:

Q1.

(b) Describe the structure of proteins.

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(5)

Q3.

(a) In humans, the enzyme maltase breaks down maltose to glucose.
This takes place at normal body temperature.

Explain why maltase:
- only breaks down maltose
- allows this reaction to take place at normal body temperature.

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(Extra space) _____

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(5)

(b) NMO is a disease that leads to damage to nerve cells in the spinal cord.
A person with NMO produces anti-AQP4 antibody that attacks only these nerve cells.

Explain why the anti-AQP4 antibody only damages these cells.

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(4)

(c) Each type of antibody binds specifically to one of the antigen proteins.

Explain why.

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(3)

(d) HIV attaches to a specific protein receptor on helper T cells. A low percentage of people have a mutation of the *CCR5* gene which codes for this protein receptor. This mutation results in a non-functional protein receptor.

Explain how this mutation can result in the production of a non-functional protein receptor.

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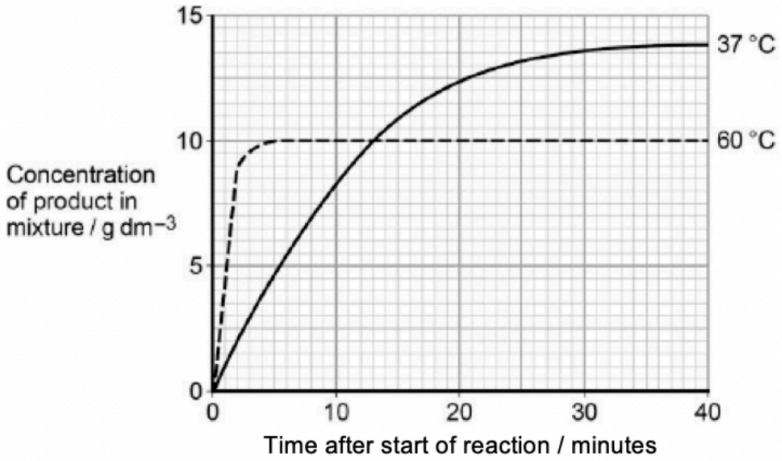
(4)
(Total 16 marks)

Q5.

A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same concentration of substrate.



(a) Give **two** other factors the technician would have controlled.

1. _____

2. _____

(1)

(b) Draw a tangent on each curve to find the initial rates of reaction.
Use these values to calculate the ratio of the initial rates of reaction at 60 °C : 37 °C.

Ratio = _____ :1

(2)

(c) Explain the difference in the initial rate of reaction at 60 °C and 37 °C.

_____

_____

_____

(2)

(d) Explain the difference in the rates of reaction at 60 °C and 37 °C between 20 and 40 minutes.

_____

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_____

(4)
(Total 9 marks)

Q1.

(b)
1. Polymer of amino acids;
2. Joined by peptide bonds;
3. Formed by condensation;
4. Primary structure is order of amino acids;
5. Secondary structure is folding of polypeptide chain due to hydrogen bonding;

Accept alpha helix / pleated sheet

6. Tertiary structure is 3-D folding due to hydrogen bonding and ionic / disulfide bonds;
7. Quaternary structure is two or more polypeptide chains.

5 max
[11]

Q3.

(a)
1. Tertiary structure / 3D shape of enzyme (means);

Accept references to active site

2. Active site complementary to maltose / substrate / maltose fits into active site / active site and substrate fit like a lock and key;

Idea of shapes fitting together

3. Description of induced fit;
4. Enzyme is a catalyst / lowers activation energy / energy required for reaction;

Accept "provides alternative pathway for the reaction at a lower energy level"

5. By forming enzyme-substrate complex;

Accept idea that binding stresses the bonds so more easily broken

Do not award point 5 simply for any reference to E-S complex

5

(b)
1. (Anti-AQP4) antibody has a (specific) tertiary structure;
2. Has binding site / variable region that only binds to / complementary to one antigen;
3. Antigen to this antibody (only) found on these nerve cells;
4. So, antibody (only) binds to / forms antigen-antibody complex with these nerve cells (causing damage);

Reject "active site" (only penalise once if it occurs throughout)

3. / 4. Accept 'receptor' for antigen

4

(c)
1. Each antigen protein has a different tertiary structure;
2. (Each) antibody has a specific antigen / binding / variable region / site;
3. So, (each antibody) forms different antigen-antibody complex

OR

(each antibody) only binds to complementary (protein);

3

(d)
1. Change in DNA base/nucleotide (sequence);

Accept: mutation in DNA base (sequence).

Accept: deletion/substitution/addition of a DNA base/nucleotide.

2. Change in amino acid (sequence)/primary structure;

Reject: different amino acid formed.

Ignore: change in code for amino acid.

3. Alters (position of) hydrogen/ionic/disulfide bonds;
4. Change in tertiary structure (of receptor);

Reject: any reference to active site.

Ignore: 3°.

4
[16]

Q5.

(a) Any **two** of the following:
Concentration of enzyme
Volume of substrate solution
pH.

Allow same concentration of substrate

1

(b) Ratio between 5.18:1 and 5.2:1
Initial rates incorrect but correctly used = 1 mark.

Allow 1 mark if rate at:

60°C = 0.83g dm^{-3} s^{-1} /49.8g dm^{-3} $minute^{-1}$

OR

37°C = 0.16g dm^{-3} s^{-1} /9.6g dm^{-3} $minute^{-1}$

2

(c) At 60 °C:
1. More kinetic energy;
2. More E–S complexes formed.

Allow converse for 37 °C

2

(d) Different times:
1. Higher temperature / 60 °C causes denaturation of all of enzyme;

Accept converse for 37 °C

2. Reaction stops (sooner) because shape of active site changed;

Reject if active site on substrate

Different concentrations of product (at 60 °C)
3. Substrate still available (when enzyme denatured);
4. But not converted to product.

4
[9]