Questions

Q1.

(a) Draw one straight line from each digestive enzyme to its substrate.

(b) (i) Complete the sentence by putting a cross (X) in the box next to your answer. Pepsin is an enzyme that digests protein into

A amino acids  
B fatty acids  
C glucose  
D glycerol

(ii) An experiment was carried out to investigate the effect of pH on the activity of pepsin and another enzyme called trypsin. The graph shows the results of the experiment.

Complete the sentence by putting a cross (X) in the box next to your answer. The graph shows that
A pepsin only works at a pH of 3
B pepsin has an optimum pH of 3
C trypsin only works at a pH of 3
D trypsin has an optimum pH of 3

(iii) Using the graph, describe two ways in which the activity of pepsin is different to the activity of trypsin.

(iv) Explain why the activity of trypsin is different at pH 11 compared to pH 9.

(Total for Question is 8 marks)
Q2.

Enzymes and digestion

(a) (i) The diagram shows an enzyme and four substrates.
   Draw one straight line from the enzyme to its correct substrate.

(ii) The diagram models one way enzymes are thought to work with their substrates.
   Complete the sentence by putting a cross (X) in the box next to your answer.
   This model represents the hypothesis known as
   A base pairing
   B DNA replication
   C lock and key
   D protein synthesis

(b) Some babies have difficulty absorbing nutrients from their food.
   Protease enzymes can be added to baby food during its manufacture.
   (i) Explain why protease enzymes are added to baby food.
(ii) A baby food is manufactured at 35 °C. Higher temperatures affect the protease enzymes in baby food. Explain how enzymes are affected by temperatures above 40 °C.

*(c) Describe the action of carbohydralse and lipase enzymes in different parts of the digestive system.

(Total for question = 12 marks)
Q3.

State **two** factors, other than temperature, that affect enzyme activity.

............................................................................................................................
............................................................................................................................

(2)

Q4.

The lock and key hypothesis explains the complementary shape of enzymes and substrates.

Protein is digested by the enzyme pepsin.

The diagram shows a model of a protein.

![protein](image)

Draw the complementary shape of pepsin on the diagram.

(1)

(Total for question = 1 mark)

**Mark Scheme**

Q1.

<table>
<thead>
<tr>
<th></th>
<th>Answer</th>
<th>Acceptable answers</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>enzyme</td>
<td>molecule that the enzyme digests</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>amylase</td>
<td>DNA</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>lipase</td>
<td>protein</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>starch</td>
<td>(1)</td>
</tr>
<tr>
<td>(b)(i)</td>
<td>A amino acids</td>
<td>(1)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(b)(ii)</td>
<td>B pepsin has an optimum pH of 3</td>
<td>(1)</td>
<td></td>
</tr>
</tbody>
</table>
| (b)(iii) | A description including two from the following points  
- pepsin has a lower activity  
- pepsin works at a lower pH  
- pepsin works within a narrower pH range  
- the optimum pH of pepsin is lower | ORA Accept: pepsin works in acidic conditions |
| (b)(iv) | A explanation linking the following points  
- it is less active/activity only 6 arbitrary units (1)  
- (starting to) denature (1)  
- active site is changing shape (1)  
- cannot bind to its substrate as well at this pH (1) | Accept: reference to pH9 being the optimum/pH11 is not the optimum |
### Q2.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>(a)(i)</td>
<td><img src="image" alt="Diagram" /></td>
<td>Reject if more than one line drawn from enzyme</td>
<td>(1)</td>
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</table>

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<tbody>
<tr>
<td>(a)(ii)</td>
<td>Lock and key</td>
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</table>
| (b)(i)          | A explanation including **two** of the following:  
|                 | - (baby food) contains proteins (1);  
|                 | - (protease) breaks down/digests proteins (1);  
|                 | - into amino acids (1);  
|                 | - amino acids can then be absorbed (1);  
<p>|                 | - reference to growth (1); | Accept large/ insoluble molecules, Accept small/ soluble molecules | (2)  |</p>
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| (b)(ii)         | An explanation including **two** of the following:  
  - less/no activity/not at optimum(1);  
  - enzyme/active site changes shape(1);  
  - cannot bind to substrate(1);  
  - denatures(1);                   | Accept destroyed | (2)  |

<table>
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<th>Indicative Content</th>
<th>Mark</th>
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</table>
| QWC             | *(c)* A description that links some of the following points  
  - carbohydrate breaks down carbohydrates  
  - to maltose/glucose/sugar  
  - carbohydrate in small intestine/ mouth  
  - reference to amylase  
  - lipase breaks down fats  
  - to fatty acids/glycerol  
  - in the (small) intestine | (6)  |

<table>
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<tr>
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<tr>
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<tr>
<td>1</td>
<td>1 - 2</td>
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</table>
|       | a limited description that gives one correct link between an enzyme and its substrate OR product OR location e.g. carbohydrases in the mouth  
  - the answer communicates ideas using simple language and uses limited scientific terminology  
  - spelling, punctuation and grammar are used with limited accuracy |      |
| 2     | 3 - 4                  |      |
|       | a simple description that gives one correct link between one enzyme, its substrate, product and its location e.g. carbohydrases break down carbohydrates to glucose in the small intestine OR two enzymes with their substrates and either the products OR location  
  - the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately  
  - spelling, punctuation and grammar are used with some accuracy |      |
| 3     | 5 - 6                  |      |
|       | a detailed description that links BOTH enzymes with their substrates AND their products AND their location.  
  - the answer communicates ideas clearly and coherently using a range of scientific terminology accurately  
  - spelling, punctuation and grammar are used with few errors |      |
### Q3.

<table>
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<tbody>
<tr>
<td></td>
<td>• substrate concentration (1)</td>
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<td></td>
<td>• pH (1)</td>
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<td>(2)</td>
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### Q4.

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<tr>
<td></td>
<td>Any drawing that shows that the enzyme has a complementary shape to any part of the substrate e.g.</td>
<td></td>
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<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
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<td>(1)</td>
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