

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(i)</b>	met, val, lys met - val - lys MET VAL LYS	Accept mix of upper and lower case  Accept: metvallys / metvalys  Not necessary to separate the words out.	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(ii)</b>	translation	Accept spellings such as transation, transalation  reject: transcription	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(iii)</b>	<b>D</b> ribosome		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)</b>	An explanation including <b>two</b> of the following points: <ul style="list-style-type: none"> <li>• ref to specific shape (1)</li> <li>• to bind to substrate / form enzyme substrate complex (1)</li> <li>• for reaction to take place / catalysed(1)</li> <li>• joining together {substrates / molecules} / break down {substrates / molecules} (1)</li> <li>• ref to lock and key mechanism / hypothesis (1)</li> </ul>		<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)</b>	<p>A description including <b>three</b> of the following points:</p> <ul style="list-style-type: none"> <li>• a mutation is a change in a gene (sequence) / base pairs (1)</li> <li>• (change in DNA) causes a change in amino acid(s) /order of amino acids (1)</li> <li>• change in shape of {active site / protein / enzyme} (1)</li> <li>• prevent / reduce binding to substrate (1)</li> <li>• enzyme can no longer function / reduced function (1)</li> <li>• enzyme could be more effective (1)</li> </ul>	<p>accept change enzyme function / stops the function of the enzyme</p> <p>ignore: refs to denaturation</p>	<b>(3)</b>

Question number	Answer	Mark
2(a)(i)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): <ul style="list-style-type: none"> <li>fatty acids are formed when the lipids are broken down by lipase (1)</li> <li>and fatty acids are acidic (so the pH decreases) (1)</li> </ul>	(2)

Question number	Answer	Mark
2(a)(ii)	An answer that combines up to a maximum of <b>two</b> points to provide a logical description: <ul style="list-style-type: none"> <li>as the temperature increases from 20 °C to 37 °C the rate of lipase activity increases (from 0.2 to 0.8) (1)</li> <li>the rate of lipase activity is optimal at 37 °C (1)</li> <li>above 37 °C the rate of lipase activity decreases (from 0.8 to 0.1) (1)</li> </ul>	(2)

Question number	Answer	Mark
2(a)(iii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): <ul style="list-style-type: none"> <li>an increase in temperature above 40 °C causes changes in the shape of the active site of the enzyme (1)</li> <li>therefore the enzyme becomes denatured and no longer functions (1)</li> </ul>	(2)

Question number	Answer	Additional guidance	Mark
2(b)(i)	<ul style="list-style-type: none"> <li>mean= <math>588/5 = 117.6</math> (1)</li> <li>rate = <math>1 \div 117.6</math> (1)</li> <li>0.0085 (1)</li> </ul>	award full marks for correct numerical answer without working  accept $1000/t$ accept $10/t$	(3)

Question number	Answer	Mark
2(b)(ii)	Any one variable from: <ul style="list-style-type: none"> <li>concentration of the enzyme</li> <li>volume of enzyme solution</li> <li>volume of starch solution</li> <li>pH of the solutions</li> </ul>	(1)

Question number	Answer	Mark
2(c)	<p>An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark):</p> <ul style="list-style-type: none"><li>• the active site of an enzyme has a specific shape because of the order of the amino acids (1)</li><li>• the substrate must have a shape which is complementary to the active site (1)</li></ul>	<p>(2)</p>

Question Number	Answer	Acceptable answers	Mark
<b>3(a)</b>	mRNA mRNA		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)</b>	<p>A description linking two of the following:</p> <ul style="list-style-type: none"> <li>leaves the nucleus / moves to the cytoplasm</li> <li>through the nuclear membrane</li> <li>attaches to ribosome</li> </ul>	Accept through a nuclear pore	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(c)</b>	<p>A explanation linking three of the following:</p> <ul style="list-style-type: none"> <li>(enzyme and substrate have) complementary shapes</li> <li>substrate fits into enzyme / enzyme substrate complex formed</li> <li>reference to <u>active site</u></li> <li>enzymes break (chemical) bonds / form chemical bonds / (causes) reaction to occur / make products</li> <li>Idea of products leaving enzyme (so that enzyme can be used again)</li> </ul>	<p>this may be awarded if clearly shown in an unlabelled diagram</p> <p>reject if active site is part of substrate</p>	<b>(3)</b>

Question Number	Indicative Content	Mark
<b>QWC</b> *3( )	<p>A description to include some of the following points</p> <p>Temperature</p> <ul style="list-style-type: none"> <li>• (temperature) too low – not enough energy to make reactions occur (fast enough)</li> <li>• reference to optimum temperature</li> <li>• optimum for most (humans) - 37°C</li> <li>• over 37°C changes enzyme shape / changes active site shape of enzyme</li> <li>• therefore rate of reaction decreases / stops</li> <li>• enzymes denatured (if temperature too high)</li> </ul> <p>pH</p> <ul style="list-style-type: none"> <li>• optimum pH – around 7.3 / 6 to 8 for most enzymes</li> <li>• specific optimum quoted eg pepsin – pH 2 to 3</li> <li>• pH either side of optimum – changes the shape of the enzyme / shape of the active site</li> <li>• therefore rate of reaction decreases / stops</li> <li>• enzymes denatured (if pH too high / too low)</li> </ul> <p>substrate / enzyme concentration</p> <ul style="list-style-type: none"> <li>• higher concentrations faster reactions</li> <li>• due to more collisions</li> <li>• until maximum rate reached / all enzymes being used</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	No rewardable content
<b>1</b>	<b>1 – 2</b>	<ul style="list-style-type: none"> <li>• a limited description of how temperature OR pH OR substrate concentration affects the rate of enzyme action</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>
<b>2</b>	<b>3 – 4</b>	<ul style="list-style-type: none"> <li>• a simple description of two or more factors OR a detailed description of one factor</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>
<b>3</b>	<b>5 – 6</b>	<ul style="list-style-type: none"> <li>• a detailed description of at least two factors</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>

**(Total for question 3 = 12 marks)**