Question Number	Answer	Acceptable answers	Mark
1(a)(i)	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.	**(1)**

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

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	**D** ribosome		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation including **two** of the following points: • ref to specific shape (1) • to bind to substrate / form enzyme substrate complex (1) • for reaction to take place / catalysed(1) • joining together {substrates / molecules} / break down {substrates / molecules} (1) • ref to lock and key mechanism / hypothesis (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	A description including **three** of the following points: • a mutation is a change in a gene (sequence) / base pairs (1) • (change in DNA) causes a change in amino acid(s) /order of amino acids (1) • change in shape of {active site / protein / enzyme} (1) • prevent / reduce binding to substrate (1) • enzyme can no longer function / reduced function (1) • enzyme could be more effective (1)	accept change enzyme function / stops the function of the enzyme ignore: refs to denaturation	**(3)**

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): • fatty acids are formed when the lipids are broken down by lipase (1) • and fatty acids are acidic (so the pH decreases) (1)	**(2)**

Question number	Answer	Mark
2(a)(ii)	An answer that combines up to a maximum of **two** points to provide a logical description: • as the temperature increases from 20 °C to 37 °C the rate of lipase activity increases (from 0.2 to 0.8) (1) • the rate of lipase activity is optimal at 37 °C (1) • above 37 °C the rate of lipase activity decreases (from 0.8 to 0.1) (1)	**(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): • an increase in temperature above 40 °C causes changes in the shape of the active site of the enzyme (1) • therefore the enzyme becomes denatured and no longer functions (1)	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)(i)	• mean= 588/5 = 117.6 (1) • rate = 1 ÷ 117.6 (1) • 0.0085 (1)	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: • concentration of the enzyme • volume of enzyme solution • volume of starch solution • pH of the solutions	**(1)**

Question number	Answer	Mark
2(c)	An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark): • the active site of an enzyme has a specific shape because of the order of the amino acids (1) • the substrate must have a shape which is complementary to the active site (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	mRNA mRNA		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description linking two of the following: • leaves the nucleus / moves to the cytoplasm • through the nuclear membrane • attaches to ribosome	Accept through a nuclear pore	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	A explanation linking three of the following: • (enzyme and substrate have) complementary shapes • substrate fits into enzyme / enzyme substrate complex formed • reference to <u>active site</u> • enzymes break (chemical) bonds / form chemical bonds / (causes) reaction to occur / make products • Idea of products leaving enzyme (so that enzyme can be used again)	this may be awarded if clearly shown in an unlabelled diagram reject if active site is part of substrate	**(3)**

Question Number		Indicative Content	Mark
QWC	***3( )**	A description to include some of the following points Temperature • (temperature) too low – not enough energy to make reactions occur (fast enough) • reference to optimum temperature • optimum for most (humans) - 37^{o}C • over 37^{o}C changes enzyme shape / changes active site shape of enzyme • therefore rate of reaction decreases / stops • enzymes denatured (if temperature too high) pH • optimum pH – around 7.3 / 6 to 8 for most enzymes • specific optimum quoted eg pepsin – pH 2 to 3 • pH either side of optimum – changes the shape of the enzyme / shape of the active site • therefore rate of reaction decreases / stops • enzymes denatured (if pH too high / too low) substrate / enzyme concentration • higher concentrations faster reactions • due to more collisions • until maximum rate reached / all enzymes being used	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited description of how temperature OR pH OR substrate concentration affects the rate of enzyme action • 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 of two or more factors OR a detailed description of one factor • 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 of at least two factors • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 3 = 12 marks)