Edexcel

A-Level
BIOLOGY

Biological Molecules

Enzymes 2

Time allowed
59 minutes

MARK SCHEME

Score	Percentage
/49	%

Question Number	Answer	Mark
1(a)	1. reference to enzyme increasing the rate of reaction (higher than the rate if no enzyme present) ; 2. idea that the rate of reaction with the enzyme present is non-linear ; 3. Idea that increase in (initial) rate of reaction is same with or without enzyme present above (substrate concentration) of {10 / 12} ; 4. credit correct manipulation of figures (in relation to the effect of the enzyme) ;	**(2)**

Question Number	Answer	Mark
1(b)(i)	ester ;	**(1)**

Question Number	Answer	Mark
1(b)(ii)	Any **two** from: 1. fatty acid (s) / carboxylic acid(s) 2. glycerol / propan1,2,3 triol 3. monoglyceride 4. diglyceride ;;	**(2)**

Question Number	Answer	Mark
1(b)(iii)	(pH) would {fall / drop / get lower / decrease / eq} ;	**(1)**

Question Number	Answer	Mark
*1(c QWC	**Take into account quality of written communication when awarding the following points.** 1. reference to use of a range of substrate (triglyceride) concentrations ; 2. idea of mixing (enzyme and substrate) ; 3. identification of a suitable dependent variable e.g. pH 4. description of how to measure the dependent variable e.g. use of pH indicator ; 5. reference to measuring time ; 6. description of how to calculate (initial) rate of reaction ; 7. idea of repeating experiment without the enzyme ; 8. idea of control of enzyme (lipase) concentration ; 9. reference to one other named controlled variable (e.g. temperature, type of triglyceride, volume of solutions) ; 10. reference to {replicates / repeats} (using the same triglyceride concentration) ;	**(5)**

Question Number	Answer	Mark
2 (a)(i)	1. different tissues have different activities of catalase / eq ; 2. Z has highest (activity) / eq ; 3. Y has the lowest (activity) / X and Y have very similar levels / eq ; 4. credit correct manipulation of figures e.g. Z has 12 more than Y / Z has 11 more than X ;	**(3)**

Question Number	Answer	Mark
2(a)(ii)	1. idea activity in mussel E is not higher than M in all tissues ; 2. mussel E has lower (activity) in tissue X / eq OR (activity) is the same in tissue Y / eq OR mussel E has higher (activity) in tissue Z / eq ; 3. mussel E has more (overall activity)/ eq ; 4. credit correct comparative manipulation of figures ; 5. Idea that both mussels have tissues with same order of activity e.g. Y X Z ;	**(2)**

Question Number	Answer	Mark
2(b)	1. reference to measuring volume of oxygen ; 2. suitable reference to time e.g. oxygen produced in unit time, time taken to produce same volume of oxygen ; 3. idea of measuring the initial rate of reaction ; 4. reference to controlled variable in relation to the mussel e.g. age, part of mussel, mass, surface area ; 5. reference to a controlled variable in relation to the experiment e.g. volume of hydrogen peroxide, temperature, concentration, pH ; 6. suitable reference to repeats ;	**(4)**

Question Number	Answer	Mark
3(a)	1. reference to {enzymes / biological catalysts} reducing activation energy / eq ; **Biological catalyst** 2. produ d by {organisms /cells}; 3. spe s up (rate of) {reactions / processes} / eq ; **Activation energy** 4. energy needed for a reaction to occur / eq ; 5. By causing bonds to {break / weaken / form} / by increasing the number of collisions / eq ;	**max (4)**

Question Number	Answer	Mark
3(b)	1. idea that there should be enough substrate molecules to saturate the enzyme ; 2. (to ensure that) substrate is not a limiting factor/ eq ; 3. {fastest / highest} rate / decreases after initial rate / eq ; 4. as reaction proceeds substrate concentration decreases / eq ; 5. as substrate gets used up {by enzyme / in reaction / eq } ; 6. substrate concentration should be constant (in each test) / eq ;	**max (2)**

Question Number	Answer	Mark
3(c)	**Any two pairs** pH ; buffer ; temperature ; water bath ; not room temperature time of reaction ; stopwatch ; volume of {enzyme / substrate} ; not amount measuring cylinder / pipette ; type of enzyme ; same batch of enzyme ;	(4)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	1. a resource that can be { renewed / replaced } / not finite / will not run out ; 2. idea that it is available to future generations ;	1. IG RE regrown or replanted as this is not in the context of plants	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. idea that (starch comes from plants and) more plants can be grown (to replace those used) ; 2. idea of crude oil { not being renewable / finite /eq } ; 3. idea that using packaging pellets made from starch will allow crude oil supplies to last for longer ;	1. IGNORE renewable DO NOT ACCEPT starch can be regrown 2. ACCE will run out	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	(pH) 9.0 or 9 **AND** 30 (°C) ;	IGNORE units	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. idea of { increased breakdown / larger decrease in mass } at pH 7.5 { when temperature increased / at 40 °C } ; 2. idea of { increased breakdown / larger decrease in mass } at pH 9.0 { when temperature decreased / at 30 °C } ; 3. at { pH 7.5 there is 2% / pH 9.0 there is 23% } difference (between 30°- 40 °C) ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	1. are of plastic sheet ; 2. ickness of plastic sheet ; 3. concentration of { enzyme / solution } ; 4. zyme type ; 5. volume of { enzyme / solution } ;	1. IG RE size 5. N amount	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iv)	1. idea that pH 11 is outside the range of data collected 2. idea of insufficient data (to support prediction) / cannot extrapolate from two values of pH / no indication of a trend ;	1. IG RE pH 11 not tested	**(1)**

Number			
5(a)	1. idea of more than one gene for a single { characteristic / trait } ; 2. on more than one locus ; 3. idea of continuous variation ; 4. idea of genes interacting with each other ;	IGNORE phenotype	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	a Himalayan rabbit shaved (in the same place) and no ice pack (taped to bald patch);	**ACCEPT** shaved with no ice or another object taped to its back instead of an icepack	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. fur grew black when exposed to cold temperatures / eq ; 2. fur remains white when not exposed to cold temperatures / eq ; 3. idea that the gene is { expressed / activated } at low temperatures ;	2. ACCE fur is white in warm areas	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(c)	1. fur is (only) black where { the temperature is lower than 25 °C / ice pack is placed } ; 2. because the enzyme is active / eq ;	1. ACCE darker fur	**(2)**