



# Enzymes

## Mark Scheme 1

<b>Level</b>	IGCSE
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Enzymes
<b>Paper Type</b>	(Extended) Theory Paper
<b>Booklet</b>	Mark Scheme 1

**Time Allowed:** 63 minutes

**Score:** /52

**Percentage:** /100

1 (a)	<p>full marks may be possible from a fully annotated genetic diagram</p> <p>females are XX, males are XY ;</p> <p>female gametes are X, male gametes are X or Y ;</p> <p>ref to random fusion of gametes / shown in a Punnett square or alternative ;</p> <p>1:1/50:50/ described, shown / stated ;</p>	[4]	
(b)	<p>ref to, identify / separate, sperm with X (chromosome) ;</p> <p>semen / sperm, inserted / injected, into, uterus / oviduct ;</p> <p>at / around time of, ovulation / AW ;</p>	max [2]	
(c)	<p>1 formula milk is, similar / closer in composition, to human milk ;</p> <p>2 any nutrient with similar quantities in formula and human milk ;</p> <p>3 <i>idea that</i> human milk meets requirements of human babies ;</p> <p><i>comparisons with cow's milk</i></p> <p>4 formula supplies less protein which is harder to digest ;</p> <p>5 formula supplies more iron, for haemoglobin formation / to prevent anaemia ;</p> <p>6 formula supplies more vitamin D for, absorption of calcium / formation of bone / for strong bones / prevention of rickets ;</p> <p>7 formula supplies more vitamin A, for immune system / retina / rods / vision in dim light / prevention of night blindness ;</p> <p>8 use of comparative figures <u>with correct units</u> ;</p>	max [4]	
(d)	<p>biological / made by cells ;</p> <p>catalyst / speeds up the rate of a reaction ;</p> <p>made of protein ;</p>	max [2]	

1 (e)	<p><b>tubes 1 and 3 – the effect of pH</b></p> <p>1 lysozyme is active in, 1/pH 4.0/acid ;</p> <p>2 <u>cell walls</u>, broken down/digested/destroyed in tube 1 ;</p> <p>3 no (bacterial) growth in tube 1 ;</p> <p><b>tubes 1 and 4 – the effect of type of bacteria</b></p> <p>4 lysozyme, destroys/AW, bacteria, <b>A</b>/in tube 1 ;</p> <p>5 lysozyme does not, destroy/AW, bacteria, <b>B</b>/in tube 4 ;</p> <p>6 ref to specificity to bacteria <b>A</b>/bacteria <b>B</b> is resistant ;</p> <p>7 <b>ignore</b> bacteria are immune <i>idea that</i> nothing in (cell wall of) bacteria <b>B</b> for lysozyme to digest ;</p> <p><b>tubes 1 and 2 – the effect of boiling</b></p> <p>8 lysozyme denatured (by boiling) ;</p> <p>9 lysozyme not, active ;</p> <p>10 <i>idea that</i> tube 2 is a control to show that lysozyme is responsible for no growth in tube 1 ;</p>	max [6]	
(f)	<p>1 gives (passive) <u>immunity</u> ;</p> <p>2 defends against, infection/illness/disease/pathogens/AW ;</p> <p>3 ref to diseases that the mother has had ;</p> <p>4 any one function of antibodies ;</p>	max [2]	

2 (a)	<u>lock and key</u> mechanism; substrate fits into enzyme; (shape of) substrate is complementary to, enzyme/active site; ref to active site; substrate breaks/product(s) forms/product(s) leaves enzyme; enzyme, free for next reaction/not used up/remains unchanged; AVP;	max 3	e.g. lowers activation ener
(b)	(cellulose) <u>cell wall</u> ;	1	
(c) (i)	protease activity, similar/AW, on both sites; all enzyme activity is, greater/better/faster, in site <b>A</b> ; cellulase activity on site <b>A</b> greater than protease activity on site <b>A</b> ; cellulase activity, higher on site <b>A</b> , than site <b>B</b> /ORA; cellulase and protease activity on site <b>B</b> similar; use of data with units to support any of these marking points;	max 3	do not award data quote unqualified
(ii)	pH/water content, no effect on protease activity; cellulase more active, at higher pH/less acidic environment; cellulase more active, at lower soil moisture; ref to <u>optimum</u> pH of, protease/cellulase/enzymes; low pH may denature cellulase; idea of different leaf composition; size of leaves/surface area/species of leaf; different stage of decomposition;	max 3	

2 (d)	1 ref to, decomposers / bacteria / fungi; 2 proteins are broken down to amino acids; 3 by proteases; 4 amino acids converted to, ammonia / ammonium (ions); 5 deamination; 6 ammonia / ammonium ions, converted to nitrite ions; 7 nitrites converted to nitrate ions; 8 nitrification / oxidation / nitrifying bacteria; 9 nitrate ions absorbed by plants;	max 3	protease is linked to <b>MP2</b>  ammonia to nitrate = 1 <b>A</b> nitrites <b>A</b> nitrates ammonia to nitrite and then to nitrate = 2 <b>A</b> nitrates
(e) (i)	<u>nitrogen fixation</u> ;	1	
(ii)	root nodules (on legumes); free living bacteria; <u>nitrogen-fixing bacteria</u> ; nitrogen, converted to, ammonium / ammonia / amino acids;	max 2	1 lightning  1 nitrate(s) 1 nitrification / nitrifying bacteria
		[Total: 17]	

3 (a) (i)	<p>1 without enzymes reactions, occur too slowly / not at all ;  <b>A</b> enzymes speed up reactions</p> <p>2 reduce, activation energy / energy needed for a reaction ;</p> <p>3 reactions take place at lower temperatures ;</p> <p>4 enzymes are catalysts ;</p>	[max 3]	<b>MP1 A</b> some aspect of metabolism as an alternative to reactions, e.g. digestion
(ii)	<p>lipase – pancreas ;</p> <p>protease – stomach / pancreas ;</p> <p>amylase – salivary gland / pancreas ;</p>	[3]	organs have to be different if the answer for lipase is incorrect <b>A</b> pancreas for either protease or amylase but not both
(b) (i)	<p>control ; <b>R</b> control(led) variable to show differences in, colour / pH / fat, due to, enzyme / lipase ;</p> <p>to use for comparing, colours / pH ;</p>	[max 2]	<b>A</b> to show what happens without, enzyme / lipase, and bile salts
(ii)	<p>acid pH / below pH 5 / lowers the pH / becomes acidic ;</p> <p>fat has been, digested / broken down ;</p> <p>fatty acids (and glycerol) ;</p>	[3]	<b>R</b> ref to lipase / bile salts being acidic

3	(iii)	1	ref to specific, pH / colour in, <b>B / C</b> ; i.e. <b>B</b> is blue / 8-10 / alkaline i.e. <b>C</b> is yellow / 4-5 / slightly acid  <b>ignore</b> bile salts / lipase is alkaline in <b>B</b>	[max 4]			
		2	<b>B</b>		test-tube	contents	colour of pH indicator after 5 minutes at 40 °C
		3	no, (chemical) digestion / breakdown (of fat) ;		<b>A</b>	milk, alkaline solution, lipase and bile salts	orange
		4	no fatty acids ;		<b>B</b>	milk, alkaline solution, bile salts and water	blue
		5	no lipase ;		<b>C</b>	milk, alkaline solution, lipase and water	yellow
		6	<b>C</b>		<b>D</b>	milk, alkaline solution and water	blue
		7	some, (chemical) digestion / breakdown (of fat) ;				
		8	fat not <u>emulsified</u> ;				
		9	so slower reaction (than A) ;				
		10	fewer fatty acids produced ;				
		11	<i>award for <b>B / C</b></i> bile salts <u>emulsify</u> fats ; ref to increasing surface area of fat (globules / AW) ; bile salts are not enzymes ;				