

1 (a)	<p><i>full marks may be possible from a fully annotated genetic diagram</i></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 ; <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]	

<p>1 (e)</p>	<p>tubes 1 and 3 – the effect of pH</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>tubes 1 and 4 – the effect of type of bacteria</p> <p>4 lysozyme, destroys /AW, bacteria, A/in tube 1 ;</p> <p>5 lysozyme does not, destroy /AW, bacteria, B/in tube 4 ;</p> <p>6 ref to specificity to bacteria A/bacteria B is resistant ;</p> <p>ignore bacteria are immune</p> <p>7 <i>idea that</i> nothing in (cell wall of) bacteria B for lysozyme to digest ;</p> <p>tubes 1 and 2 – the effect of boiling</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>	<p>max [6]</p>	
<p>(f)</p>	<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>	<p>max [2]</p>	

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 A ; cellulase activity on site A greater than protease activity on site A ; cellulase activity, higher on site A , than site B /ORA; cellulase and protease activity on site 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)	<p>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;</p>	max 3	<p>protease is linked to MP2</p> <p>ammonia to nitrate = 1 A nitrites A nitrates ammonia to nitrite and then to nitrate = 2 A nitrates</p>
(e) (i)	<u>nitrogen fixation</u> ;	1	
(ii)	<p>root nodules (on legumes); free living bacteria; <u>nitrogen-fixing bacteria</u>; nitrogen, converted to, ammonium/ammonia/amino acids;</p>	max 2	<p>1 lightning</p> <p>1 nitrate(s) 1 nitrification/nitrifying bacteria</p>
		[Total: 17]	

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

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