

	Answers	Marks	Guidance for Examiners
1 (a) (i)	amylase ;	[1]	
(ii)	pH is a factor that influences / affects enzyme activity / AW; to give the optimum pH ; extreme pH could denature enzyme / <b>AW</b> ;	[max 1]	<b>ORA</b>
(b)	<i>idea that protease</i> , would break down, enzymes / enzyme 2 ;	[1]	
(c)	stable at high temperatures / does not denature at 60 °C / optimum temperature near 60 °C ;	[1]	I bears / tolerates hot temperatures I heat resistant I ref to denatures > 60 °C
(d)	<ol style="list-style-type: none"> <li>1 (bacteria grown in) fermenters ;</li> <li>2 (bacteria provided with) substrate / food (substances) / glucose / minerals / whey / waste substances / nutrients / culture medium / AW ;</li> <li>3 oxygen / aerobic conditions ; <b>A</b> air bubbled through</li> <li>4 (bacteria) grow / reproduce / increase in number ;</li> <li>5 enzymes, secreted / released / AW ;</li> <li>6 enzymes separated from, bacteria / mixture ; <b>A</b> ref to filtration</li> <li>7 AVP ; e.g. conditions – 26 °C / pH 5–6</li> </ol>	[max 3]	<b>A</b> extracted by crushing bacteria
(e)	extracts more juice / speeds up juice extraction ; pectin converted to sugars ; so juice is sweeter ; cell wall material is removed from juice / pectin digested to soluble product(s) ; so the juice is clearer ; AVP; humans don't produce pectinase i.e. humans can digest the juice.	[max 3]	I easier.....
		[Total:10]	

2 (a)	<b>K</b> – plumule ; <b>L</b> – radicle ; <b>M</b> – cotyledon ; <b>N</b> – testa ;	[4]
(b)	hypha(e) ;	[1]
(c)	<b>MP1</b> substrate, ‘fits’ into enzyme ; <b>MP2</b> active site (of enzyme); <b>MP3</b> shape is complementary ; <b>MP4</b> substrate is key, enzyme is lock ; <b>MP5</b> substrate / starch / nutrient, converted (into products) / AW ; <b>MP6</b> (2) products (molecules) lea ; <b>MP7</b> enzyme / amylase, can work again on another substrate ;	[max 4]
(d)	very little activity until day 5 ; increase to day 11 / peak at day 11 ; decrease to day 15 ; data quote with day <u>and</u> activity ;	[max 3]
(e)	ref to different shapes of the lines ; (therefore) there is enzyme activity in both pH ; enzyme activity influenced by / specific to, pH ; data quote ; e.g. quote of activity at pH 8 <u>and</u> pH 5 on a specified day ; suggesting one enzyme prefers acid conditions, but by day 15 less enzyme, produced / available ;	[max 3]
		<b>[Total: 15]</b>

Question	Expected Answers	Marks	Additional Guidance
3	(a) <i>substance that</i> speeds up a chemical reaction ; not changed during the reaction ;	[2]	
	(b) (i) <i>ideas that</i>  temperature is not a variable being investigated ; temperature is a factor that affects enzyme action ; 30 °C, optimum temperature / enzymes work best ;	[max 2]	<b>A</b> temperature is a control variable
	(ii) as control(s) ; <i>tube 5</i> to show that urea does not breakdown without enzymes ;  <i>tube 6</i> to show that beans are not source of pH change ;	[max 2]	
	(iii) soya and jack beans have urease ; mung and broad beans have no urease ; mung and broad beans may have low concentration of urease ; jack beans have more urease than soya beans ;	[max 3]	<b>A</b> more active

3	(c)	converted to, nitrite (ions) / nitrate (ions) ; by nitrifying bacteria ; absorbed by plants ; vapourises ; donates hydrogen ions ; (hydrogen ions from ammonium ions) reacts with lime in neutralised (in this context only) ;	[max 2]	
	(d)	(i) (gastric juice contains) hydrochloric acid ; low pH ; kills bacteria / stops them dividing ; AVP ;	[max 2]	
		(ii) urease produces ammonia ; neutralises, stomach acid / hydrochloric acid ;	[2]	
		(iii) <i>lymphocytes secrete</i> antibodies ; phagocytes engulf bacteria ;	[2]	
			[Total: 17]	

Question	E	Answers	Marks	Additional Guidance
4	(a)	amylase ; prote(in)ase ; lipase ;	[3]	R carbohydrase R trypsin / pepsin / peptidase R 'protase', A 'proteas'
	(b)	1 prevents spread of (named) disease / AW <i>ora</i> ; 2 avoids pollution / removes harmful substances ; 3 makes, water / sewage / effluent, safe / AW ; 4 avoids smells ; 5 recycling of water ; 6 AVP ; e.g. ref. to eutrophication	[max 1]	A removes harmful microbes / bacteria R 'germs' A examples  no need to specify for whom or what it is safe, but R 'safer' unqualified, treat 'marine organisms' as 'aquatic'
	(c)	1 mixes microorganisms with sewage ; 2 good contact between microorganisms and solids ; 3 more collisions ; 4 (aerobic) respiration ; R if anaerobic respiration 5 microorganisms produce carbon dioxide ; 6 gain / release / transfer, energy ; 7 (for) growth ; 8 (for) reproduction ; 9 to make enzymes ; A ref. to digestion	[max 4]	A microbes / bacteria
	(d)	to start the breakdown of the sewage quickly ; continuous process ; do not have to, breed / buy, the microorganisms ; <i>idea of</i> without waiting for the lag phase ;	[max 3]	A 'the right organisms to digest the sewage'  A ref. to cost / less wastage of microbes A keeps the population of microbes constant <i>idea</i> R 'to save time' unqualified R 'to use over and over again'
	(e)	destroys / kills, bacteria / microorganisms ;  prevents spread of, disease / pathogens ; makes water suitable for drinking ;	[max 2]	R disinfection R 'removes bacteria'
			[Total: 13]	