Enzymes

Mark Scheme 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 2

Time Allowed: **66 minutes**

Score: **/55**

Percentage: **/100**

	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 / **AW** ;	[max 1]	**ORA**
(b)	*idea that* protease , 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 ºC
(d)	**1** (bacteria grown in) fermenters ; **2** (bacteria provided with) substrate / food (substances) / glucose / minerals / whey / waste substances / nutrients / culture medium / AW ; **3** oxygen / aerobic conditions ; **A** air bubbled through **4** (bacteria) grow / reproduce / increase in number ; **5** enzymes, secreted / released / AW ; **6** enzymes separated from, bacteria / mixture ; **A** ref to filtration **7** AVP ; e.g. conditions – 26 °C / pH 5–6	[max 3]	**A** 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)**	**K** – plumule **;** **L** – radicle **;** **M** – cotyledon **;** **N** – testa **;**	[4]
	(b)	hypha(e) **;**	[1]
	(c)	**MP1** substrate, 'fits' into enzyme **;** **MP2** active site (of enzyme)**;** **MP3** shape is complementary **;** **MP4** substrate is key, enzyme is lock **;** **MP5** substrate / starch / nutrient, converted (into products) / AW **;** **MP6** (2) products (molecules) lea **;** **MP7** 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]
			[Total: 15]

Question		Expected Answers	Marks	Additional Guidance
3	**(a)**	*substance that* speeds up a chemical reaction **;** not changed during the reaction **;**	[2]	
	(b)	**(i)** *ideas that* temperature is not a variable being investigated **;** temperature is a factor that affects enzyme action **;** 30 ^{o}C, optimum temperature / enzymes work best **;**	[max 2]	**A** temperature is a control variable
		(ii) as control(s) **;** *tube 5* to show that urea does not breakdown without enzymes **;** *tube 6* 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]	**A** 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) *lymphocytes secrete* 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 ***ora*** ; **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 ; *idea of* 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 *idea* **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]		