21. Biotechnology and genetic modification

21.2 Biotechnology

Paper 3 and 4

Marking Scheme

Q1.

(a)	*any three from:* 1 with pectinase (overall) more (fruit) juice produced / without pectinase less juice produced ; 2 with pectinase yellow plum has a more juice than blackcurrants / with pectinase blackcurrants have less juice than plums ; 3 without pectinase blackcurrants have more juice than plums / without pectinase plums have less juice than blackcurrants ; 4 greatest increase in juice with pectinase in plums (than blackcurrants) / smallest increase in juice with pectinase in blackcurrants (than plums) ; 5 comparative / manipulative, data quote ;	**3**	
(b)	*any two from:* (named) vitamins ; (named) mineral / ions ; water ; fibre ; (named) carbohydrate ; proteins ;	**2**	

Q2.

(c)	enzyme / biological catalyst ;	**1**	
(d)(i)	optimum temperature (for enzyme) / AW ;	**1**	**A** highest rate of reaction
(d)(ii)	to break down starch / make the juice sweeter / make the juice clearer / increase the sugar content ;	**1**	
(d)(iii)	*any one from:* to kill pathogens / (named) microorganisms / *ref. to* pasteurisation ; AVP ;	**1**	
(e)	biofuels ; bread-making ;	**2**	**R** each additional circle

Q3.

(a)(i)	any value between 5.81 and 7.39 (cm^3) inclusive ;	**1**	
(a)(ii)	22.7 / 23 (%) ;;	**2**	MP1 selection of correct values from table, i.e. 5.4 and 4.4 MP2 correct calculation to any number of decimal places

Q4.

(e)	genetic ; rapid ; complex ;	**3**	

Q5.

(a)	fungus / fungi ;	1	**A** *Penicillium*
(b)	**X**: lag (phase) **Y**: log (phase) / exponential (phase) **Z**: stationary (phase)	3	
(c)(i)	organisms need oxygen ; for (aerobic) respiration ;	2	
(c)(ii)	*any three from:* respiration, produces heat ; *ref. to* enzymes (in organisms) ; (enzymes are) denatured by excess heat ; to keep (the fermenter) at the optimum (temperature) ; for maximum yield of product ; ora AVP ;	3	e.g. so that the microorganisms are not killed
(c)(iii)	*any two from:* *ref. to* mixing / stirring ; ensure even / uniform, distribution of, oxygen / air / nutrients / fungi ; ensure even / uniform, temperature / pH, (in all parts of the fermenter) ;	2	
(c)(iv)	*any two from:* insulin ; mycoprotein ; AVP ;	2	

Q6.

(c)(i)	1 *y*-axis = number / population, of (living) bacteria per (1.0) mm^3 **and** 2 *x*-axis = time / hours / days ;	1	
(c)(ii)	**P** – lag **Q** – exponential / log **R** – stationary **S** – death / decline ;;	2	four correct = 2 marks two or three correct = 1 mark one correct = 0
(c)(iii)	*any three from:* limiting factor(s) / factors that limit ; not enough space / overpopulation ; competition ; fewer / no, (named) nutrient(s) / food ; not enough oxygen ; change in pH / increase in acidity ; increase in temperature ; build-up of, (named) toxic / waste, substances ;	3	

Q7.

(d)(i)	kills (named) microorganisms / pathogens ; prevents contamination (by bacteria / microorganisms) ; steam does not contaminant, product / medicines (with chemicals) ; steam reaches all the crevices of fermenter ;	**2**	
(d)(ii)	pH ; temperature ; oxygen ; carbon dioxide ; (named) nutrients ; waste ; turbidity ; AVP ; (gas) pressure / rate of stirring / amount of (named) product	**3**	
(d)(iii)	penicillin ; AVP ;	**1**	