1 **(a)** ref. to biological ;
catalyst AW ;
ref. to protein nature AW ; **[max. 2]**

(b) **(i)** ref. to stains may be protein / fat / not removable with detergent only AW ;
ref. to presence of lipase ;
breaks down fat (stain) + to form fatty acids and glycerol ;
ref. to presence of protease ;
breaks down protein (stain) + to form amino acids ;
ref. to products being soluble AW ; **[max. 3]**

(ii) high temperature denatures enzymes ;
so enzymes will not work AW ;
low temperature + enzymes work slowly AW ;
appropriate explanation e.g. ref to kinetic energy of molecules ;
ref, to constant temperature maintains optimum conditions AW ; **[max. 3]**

(iii) TEMPERATURE **AND** EXPLANATION NEEDED FOR THE MARK
around 37^{o}C + ref. to optimum temperature for enzyme action ;
Ⓐ refs. to higher temperatures (up to 70^{o}C with suitable explanation e.g. modified to withstand high temperatures) **[1]**

(c) ref. to fermenter ;
ref. to source of enzyme e.g. yeast / fungus / bacteria ;
ref. to feedstock / starch solution ;
ref. to suitable conditions – air bubbled ;
ref. to suitable conditions – stirring ;
ref. to intracellular enzymes + microbes filtered ;
then crushed and extracted ;
ref. to extracellular enzymes + extracted from filtered feedstock ; **[max. 4]**

[max. 13]

2 **(a)**	*method of pollination*: wind ; *explanation to max 2:* Feathery / AW, stigma ; long, filament ; large, anthers / stamens ; anthers / stamens, hang outside flower ; anthers loosely attached (to filament) ; light pollen ; no petals ;	[1] + max [3]	**A** 'only bracts'

Question	Answer	Marks	Additional Guidance
2 **(b)**	cross (pollination) ;	[1]	
(c)	pollen tube ; delivers male gamete / pollen nucleus / male nucleus to ovule ; AW	[2]	**A** female gamete / egg / female nucleus / ovum.
(d)	*idea that* tip of pollen tube opens / AW ; gametes / sex cells / ova and pollen nuclei, fuse / join / combine ; formation of zygote ; diploid ;	max [2]	**A** male nucleus for pollen nucleus **ignore** pollen unqualified **ignore** meet / mix
(e) (i)	ovule ;	[1]	
(ii)	ovary (wall) ;	[1]	
(iii)	colonise new areas ; reduce (intraspecific) competition ; reduce inbreeding ; **ora**	max [1]	
(f)	stored food / food reserves (in seed) broken down ; named enzyme plus substrate ; product plus use ; enzymes required in process of respiration ;	max [2]	
		[Total:13]	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>3 (a)</td><td>A – (waxy) cuticle;
B – palisade mesophyll / palisade layer / palisade cell;
C – (lower) epidermis / epidermal layer;
D – stoma / stomata / guard cell(s);
E – air / gas, space;</td><td>5</td><td>I outer layer / AW
R mesophyll / palisade unqualified

R (spongy) mesophyll</td></tr>
<tr><td>(b)</td><td>
<table>
<tr><th>function</th><th>letter from Fig. 1.2</th></tr>
<tr><td>controls movement of substances into and out of the cell</td><td>G</td></tr>
<tr><td>creates a pressure to maintain the shape of the cell</td><td>K</td></tr>
<tr><td>produces sugars using light as a source of energy</td><td>L</td></tr>
<tr><td>withstands the internal pressure of the cell</td><td>J</td></tr>
<tr><td>controls all the activities of the cell</td><td>F</td></tr>
</table>
</td><td>5</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance for Examiners
3 (c) (i)	volume of, oxygen / gas, increases (with time); levels off / reaches a plateau / AW; increases rapidly at start and then slows down; use of data;	max 3	**I** 'reaction stops' e.g. levels off at 6.2 cm^3 of oxygen at 90 seconds data quotes must have units
(ii)	substrate / hydrogen peroxide / reactant / AW, fits into enzyme; active site; shape is, complementary / AW; any reference to lock and key; product(s) / oxygen and water, formed and leaves the enzyme; AVP;	max 3	**A** answers in the context of catalase **I** 'speeds up the reaction' **R** if shape is the same **A** product and enzyme separate e.g. enzyme can work again / enzyme not used up / enzyme is not changed during reaction / lowers activation energy
		[Total: 16]	

4	**(a)**	**(i)**	amylase **A** carbohydrase		[1]	**lg** odd spelling
		(ii)	**1** **2** **3** **4** **5**	starch is not soluble / large /complex fungus does not, secrete / produce, amylase for absorption (of glucose) / AW ref to, respiration / growth, (of fungus) as nutrient, for fungus / fermentation / AW	[max 2]	Mpt 2 **A** ecf from (i) / carbohydrase / enzyme to digest starch
	(b)	**1** **2** **3** **4** **5**	other fungi / bacteria / virus / other microorganisms compete for nutrients reduce productivity / yield / quality contaminate the product / produce toxic *or* harmful product / ORA stop the process (early) and sterilise fermenter		[max 2]	**R** contaminate unqualified

4	**(c)**		energy is lost, between / within, trophic levels / along food chain		**Ig** ref to healthy diet
		2	animals are, at second trophic level / primary consumers OR plants are, autotrophs / producers / first trophic level		
		3	(energy lost) in animal respiration / heat / (named) metabolic process / movement		ref to 100→10→1
		4	ref to (more) material that is inedible / not digestible (in longer food chains)		
		5	ref to 10% energy transfer / ORA		
		6	less pollution (from farm animal waste)	[max 3]	Mpt 6 **A** plants use CO_2
	(d)	**1**	cheaper		**Note:** Use list rule
		2	requires less energy as less is lost along food chain		
		3	mycoprotein can be made anywhere / less land (in fermenters)		
		4	less (animal) waste		
		5	better for animal welfare / more ethical		
		6	lower in fat **/** lowers risk of heart disease		
		7	suitable for, vegetarians / vegans		**R** longer shelf life, help food shortages, more protein, more nutrients, easier to digest
		8	AVP e.g. quicker, contains fibre, disease free	[max 3]	
	(e)	**1**	mycoprotein / fungus production requires supply of corn (starch)		
		2	this comes from crop plants		
		3	(fungus) still need to be grown		
		4	(manufacture) requires energy		
		5	rate of food supply cannot keep up due to overpopulation		
		6	AVP e.g. does not contain all nec nutrients, may be consumer resistance to eating mycoprotein foods / needs flavourings / unbalanced diet	[max 3]	**R** required machinery
			[Total: 14]		