

5 Use of biological resources

5.1 describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops

5.2 understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses

5.3 understand how the use of fertiliser can increase crop yield

5.4 understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants

(b)	(sun)light; water / rain / moisture / eq; carbon dioxide / CO ₂ ; minerals / ions / nutrients / salts / named mineral / eq; temperature / warmth;	ignore sun alone ignore humidity ignore weather / climate / pollution / global warming / drought / flooding / beetles / insects / pests	2
(c)	kills/destroys/reduce number of/remove beetles/consumers/pests; less rice eaten / eq;	because the beetles feed on the rice = 0 stop beetles eating rice = 1	2
(d)	idea of increasing number of toads/other organism/ predator; eats <u>beetles</u> / eq; OR capture / hunt mongoose / eq; increase toad population / less toads eaten / eq;	reduce the amount of beetles eating rice = 1 introduce predator to control pest = 1	2
(c)	<u>biological</u> ;		1
(d)	1. no sperm / less reproduction / less breeding / eq; 2. fewer eggs/females fertilised / fewer larvae; 3. s rile male compete for resources / mates;		2

5.5 understand the role of yeast in the production of food including bread



4(a)	Food product	Genus of organism used	Group organism belongs to	Substrate used	Type of respiration	Chemical product	Ignore alcohol as food product Ignore milk as substrate used	5
	beer / wine / bread / eq;	<i>Saccharomyces</i>	fungus	glucose	anaerobic	ethanol		
	yoghurt	<i>Lactobacillus</i> / <i>Streptococcus</i> ;	bacteria	lactose ;	aerobic	lactic acid / lactate ;		

5.6 practical: investigate the role of anaerobic respiration by yeast in different conditions

6 (a)	keep out oxygen; <u>anaerobic</u> / prevent <u>aerobic</u> idea / eq;	respiration alone gets no credit	2
(b) (i)	<p>rate of carbon dioxide production in bubbles per minute</p> <p>starts low and rises; peak / level / rise less steep; down;</p>	inverted = 0	3
(ii)	carbon dioxide / CO ₂ (production);		1
(iii)	temperature;		1
(c)	<p>volume of glucose; concentration / mass of glucose;</p> <p>mass / volume / number / of yeast; species / type of yeast; pH of <u>solution</u>;</p>	<p>allow amount / quantity</p> <p>ignore volume of water in bath ignore room temperature ignore ref to oxygen ignore ref to oil</p>	2
(d)	repeat / eq;		1
(e)	volume of gas / measuring cylinder / syringe / eq;		1



5.7 understand the role of bacteria (<i>Lactobacillus</i>) in the production of yoghurt			
3	(a)	1 / stage 1 / pasteurise; 2 / stage 2 / sterilise;	Ignore order 2
	(b)	1. prevent killing / prevent enzyme <u>denaturation</u> ; 2. bacteria / <i>Lactobacillus</i> / <i>Streptococcus</i> ;	Avoid denaturing bacteria = 1 Kill enzyme = 0 Ignore reference to suitable temperature for enzymes 2
	(c)	1. less production / product contaminated / spoil taste / eq; 2. (other) bacteria present / bacteria not killed / bacteria would compete / bacteria use lactose / eq;	Contaminated with other bacteria = 2 Allow microorganisms / microbes / fungi 2
	(d)	1. less production / take longer / less lactic acid / affect the taste / eq; 2. because bacteria stop growing / bacteria stop reproducing; 3. less enzyme activity / below <u>optimum</u> / less (kinetic) energy / eq;	3. Ignore denature Max 2
	(e)	1. contains vitamin C; 2. prevent scurvy;	Allow vitamin C if in list with other vitamins Allow vitamin A Max 1



5.8 understand the use of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of microorganisms

1 (a)	(i)	1. distribute food / nutrients / eq; 2. distribute oxygen; 3. even out temperature / distribute heat;	2. ignore air 3. ignore maintain temperature constant	2
	(ii)	1. optimum / best / suitable for enzymes; 2. prevent denaturation / prevent change to active site;	2. ignore death of microbes	2
	(iii)	insulin / antibiotics / enzymes / hormones / yeast / amino acids / clotting factors / gibberellin / eq;	reject ethanol / beer / biogas / yoghurt / medicine / drugs	1
	(b)	1. stop air supply / stop oxygen supply; 2. open pressure release valve / have exit pipe (for biogas) / eq;	1. ignore reduce air supply / remove air filter	2
	(c)	1. oxygen ; 2. aerobic respiration / eq; 3. x / eq;		max 2
	(d)	1. sterilise / aseptic / kills microorganisms / eq; 2. cools to) water / condenses; 3. prevent competition from unwanted organisms / produce different product / eq; 4. prevent chemical contamination of product;		2 max



<p>5.9B understand the methods used to farm large numbers of fish to provide a source of protein, including maintaining water quality, controlling intraspecific and interspecific predation, controlling disease, removing waste products, controlling the quality and frequency of feeding, and selective breeding</p>			
3	<p>control intraspecific predation / control overcrowding / separate sizes / separate ages / eq;</p> <p>control interspecific predation / killing predators;</p> <p>control disease / infection; antibiotics / remove dead fish; biological control of pests / eq;</p> <p>control oxygen; remove waste products;</p> <p>frequent feeding / feed small amounts; (high) <u>protein</u> diet;</p> <p>selective breeding / eq; hormones;</p>	ignore clean water	max 6
5 (a)	<ol style="list-style-type: none"> 1. individual fish) can control size / age / mass / species / growth / faster production / grow faster / control health / control disease / control protein content / control feeding / control quality of fish; 2. can selectively breed / genetically modify; 3. reduce overfishing / does not reduce wild stocks / sustainable / less risk to food chains / less chance of catching other species / less chance of catching rare fish / prevent extinction; 4. high yield / large numbers of fish / guaranteed harvest / regular supply / available all year; 5. safer / less risk for fishermen / eq; 	ignore cheaper	<p>4. ignore less time consuming / easier to catch</p> <p>Max 2</p>



<p>(b) (i)</p>	<p>fewer pathogens / bacteria / algae / less eutrophication / less fertiliser / less sewage / less human waste / less faeces / less chance of disease / less chance of infection / eq;</p>	<p>ignore cleaner / less minerals / less waste / less pollutants / less contamination</p>	<p>1</p>
<p>(ii)</p>	<p>1. humans do not want to eat antibiotics; 2. passes along food chain / bioaccumulation; 3. less chance of (bacteria) resistance;</p>	<p>ignore safer to eat / cost / rivers / environment</p>	<p>Max 2</p>
<p>5 (c) (i)</p>	<p>37.9 / 38 / 38.0 %;;</p>	<p>allow if in table allow one mark for 1.1 as numerator / 2.9 as denominator in working / 37.93;</p>	<p>2</p>
<p>(ii)</p>	<p>C traditional and new type of farm; O (waste from) same species / same fish / same number / mass / age / size / same size of fish farm / eq; R repeat experiment; M1 (what is measured): mass of algae / mass of pondweed / oxygen level / CO₂ level / nitrate level / phosphate level / mineral level / turbidity / biodiversity / number of species / number of fish / number of organisms / eq; M2 same time of day / same time of year / each month / same length of sampling time / eq; S1 same mass of food (in farm / tank) / same type of food / same diet / same antibiotics; S2 same distance from farms / same depth in water / same light / temperature;</p>	<p>allow amount</p>	<p>Max 6</p>



3 (a)	different diet / different species / eq;	Ignore nitrogen Eg. eat different food / eat more food / different amounts of protein / different amounts of nitrogenous food / different amounts of nitrogen compounds in food / one is carnivorous Eg. type of fish / breed of fish / strains of fish / genes in fish / metabolism of fish	1
(b)	28.9 / 28.92;	Allow one for 0.4 / 0.0723 / 2.5 in working Allow 28.9 / 28.92 in working for 2 marks if 29 on answer line	2
1	C different temperatures / eq; O same species / size/ age/gender/eq; R repeat / eq; M1 mass / length / number / eq; M2 time period <u>stated</u> ;(one day minimum) S1 and S2 same food type / same food mass / same oxygen / tank size / fish density stated / eq;;		6
5.10 understand how selective breeding can develop plants with desired characteristics			
7	humans / people / farmers / scientists / breeders / eq; characteristics / features / named feature / traits / qualities / eq; offspring / eq; repeated / continued / done / carried on / ongoing / eq;	ignore genes / genetics ignore successful	4
(ii)	short stem / eq; wheat / eq;	2	



5.11 understand how selective breeding can develop animals with desired characteristics			
3 (a) (i)	humans / farmers (select organisms) / eq; desired features / characteristics / named feature / eq; mate / breed / reproduce / cross / AI / eq; repeat / several generations / select offspring / eq;	4	
6 (a)	1. source of food / source of nutrients / eq; 2. smell eq;		1 max
(b)	1. Cheviot and East Friesian (chosen); 2.(parent sheep with) bare legs <u>and</u> (parent sheep with) bare backsides; 3. cross breed / mate / eq; 4. <u>lect/choose/use</u> offspring with bare legs <u>and</u> bare back side; 5. repeat / many generations / eq;		4 max
(c)	1. farmer / humans you (choose parents) / eq; 2. steril process / eq; 3. does not affect survival / no survival of fittest / no competition / adaptations may not improve survival / eq;	Allow converse	2
(d)	1. kills/harms other organisms / not specific / eq; 2. affect <u>food chain</u> / bioaccumulation / eq; 3. resistance;	Ignore pollution / harm to sheep or crops or meat or wool or humans Ignore immune Ignore cost / reapplication	2 max
1 (a)	1. select high milk yield cow/mother/cattle/ones/ male on basis of mother's or daughters milk yield / eq; 2. breed / reproduce / mate / eq; 3. use offspring with high milk yield; 4. repeat process / many generations / eq;	Allow two cows with high milk yield	3



5.12 understand how restriction enzymes are used to cut DNA at specific sites and ligase enzymes are used to join pieces of DNA together			
(ii)	restriction / endonuclease; ligase;		2
2	(a) (i)	restriction (enzyme) / endonuclease;	ignore other words such as DNA or enzyme 1
	(ii)	ligase;	1
5.13 understand how plasmids and viruses can act as vectors, which take up pieces of DNA, and then insert this recombinant DNA into other cells			
(a)	(i)	plasmid;	1
	(iii)	plasmid / virus / gene gun / eq;	1
3		restriction (enzyme); human DNA / gene / allele; ligase; use <u>same</u> restriction enzyme; plasmid; recombinant (DNA/plasmid); vector; insulin / factor VIII / named protein;	reject lipase Max 5
5.14 understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter			
(c)	(i)	1. <u>human</u> gene / <u>human</u> DNA / <u>human</u> allele; 2. restriction / endonuclease; 3. <u>plasmid</u> ; 4. <u>vector</u> ; 5. <u>same</u> restriction enzyme; 6. recombinant; 7. ligase;	gene for insulin = 0 human gene for insulin = 1 5
	(ii)	D - transgenic;	1
(d)	(i)	1. oxygen / aerobic ; 2. respiration;	2
	(ii)	1. less/no insulin / less production; 2. fewer bacteria / kill bacteria / eq; 3. enzymes; 4. (not) optimum pH; 5. denatured / changed active site / destroyed;	4
5.15 understand how genetically modified plants can be used to improve food production			



1	<p>C ± GM / GM field and normal field / eq;</p> <p>O same species / size / mass / length / eq;</p> <p>R many plants / several fields / eq;</p> <p>M1 mass / length / surface area of leaves / count fruit / count flowers / eq;</p> <p>M2 <u>stated</u> time period;</p> <p>S1 and S2 same temp. / light intensity / carbon dioxide / water / mineral ions / soil / exposure to pests / eq;;</p>	<p>M1 ignore yield</p> <p>M2 one day plus</p>	6
5.16 understand that the term transgenic means the transfer of genetic material from one species to a different species			
5(a)	<p>1. contains gene / allele / DNA;</p> <p>2. from different <u>species</u>;</p>	<p>Mp 2 ignore organism</p> <p>Mp 2 allow if both organisms are named and are clearly different species</p>	2
(b)	<p>insulin production / gene therapy / herbicide resistance / golden rice / organ transplants / human organs / named drug production / anti-freeze gene into strawberries / bioluminescence / goats and spider silk / eq;</p>	<p>Allow any transgenic example</p> <p>Allow hormone production</p>	1
5.17B describe the process of micropropagation (tissue culture) in which explants are grown <i>in vitro</i>			
5	<p>1. identical;</p> <p>2. explant;</p> <p>3. sterile;</p> <p>4. microorganisms / fungi / bacteria / microbes / viruses / pathogens;</p> <p>5. growth / nutrient / culture;</p> <p>6. carbohydrate / sugar / sucrose / glucose / starch;</p> <p>7. chlorophyll / chloroplast;</p> <p>8. <u>nitrate</u>;</p> <p>9. large(r) / great / high / many / more / mass / big / eq;</p> <p>10. any / different;</p>	<p>2. ignore cutting</p> <p>3. ignore clean</p> <p>4. ignore disease / infection</p> <p>5. ignore agar / jelly</p>	10



5 (a)	adenine / thymine / guanine / cytosine;	ignore A, T, G and C	1
(b)	1 (kill) bacteria / (kill) pathogens / fungi / microbes / viruses / eq; 2 prevent disease / prevent infection / prevent spread of disease / prevent spread of infection; 3 affect growth (of explant) / (less) competition (for minerals);	allow remove bacteria / get rid of bacteria / eq	max 2
(c)	protein / enzymes / named protein;	ignore other molecules - DNA	1
(d)	organism / bacterium / virus / fungus that causes disease / infection;	ignore harm / illness	1
(e)	1 identical / clones / all same / no variation / eq; 2 large quantities / more / high yield / eq; 3 fast / faster / eq; 4 free from disease / free from pathogens / eq; 5 all year production / prevent extinction / eq;	ignore quality and characteristics being controlled ignore cost / cheaper ignore conservation	max 2
(f)	never runs out / renewable / can be replaced / can be grown again / unlimited supply / eq;	ignore never dies out ignore reproduced ignore reused	1



1(a)	1. explants; 2. small pieces of tissue / small pieces of plant / eq; 3. agar / jelly; 4. contains nutrients / amino acids / glucose; 5. plant hormones / named hormone / eq; 6. minerals / named mineral; 7. sterile; 8. control light; 9. control humidity;		Max 5								
5.18B understand how micropropagation can be used to produce commercial quantities of genetically identical plants with desirable characteristics											
(b)	1. quick / eq; 2. many produced; 3. any time of year; 4. no <u>genetic</u> variation / <u>genetically</u> identical / produce clones;	Allow converse	Max 2								
5.19B describe the stages in the production of cloned mammals involving the introduction of a diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep											
7 (a)	<table border="1" data-bbox="225 1025 730 1205"> <thead> <tr> <th>event</th> <th>stage</th> </tr> </thead> <tbody> <tr> <td>Cell division produces an embryo</td> <td>6;</td> </tr> <tr> <td>An embryo is put into a surrogate mother</td> <td>7;</td> </tr> <tr> <td>An egg cell is collected from a female sheep</td> <td>3;</td> </tr> </tbody> </table>	event	stage	Cell division produces an embryo	6;	An embryo is put into a surrogate mother	7;	An egg cell is collected from a female sheep	3;		3
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(b)	C (R);		1								
(c)	D (P and R);		1								
(c) (i)	genetically / gene / allele / DNA; identical / same / eq;	ignore similar	2								
(ii)	lots / no shortage / no delay / better supply / always available / eq; no rejection / match / accepted by body / eq; no problems with relatives / eq;	allow ref to blood type	2								



2	<p>1. e (cell) nucleus removed / enucleated / eq;</p> <p>2. b y cell nucleus inserted / adult cell nucleus inserted / eq;</p> <p>3. e ctricity / electric shock;</p> <p>4. ll division / mitosis;</p> <p>5. e _ryo;</p> <p>6. uterus / womb ;</p> <p>7. s _rogate (mother);</p>	Ignore fetus	5
3	<p>cell;</p> <p>egg / ovum / sex;</p> <p>mitosis;</p> <p>embryo;</p> <p>uterus / womb;</p> <p>surrogate;</p>	<p>allow (udder) cell</p> <p>look carefully at spelling and reject meiosis</p>	6
5.20B understand how cloned transgenic animals can be used to produce human proteins			
(c) (i)	<p>genetically / gene / allele / DNA; identical / same / eq;</p>	ignore similar	2
(ii)	<p>lots / no shortage / no delay / better supply / always available / eq;</p> <p>no rejection / match / accepted by body / eq;</p> <p>no problems with relatives / eq;</p>	allow ref to blood type	2



2	(a)	DNA / part of a chromosome / eq; codes for protein / makes protein / determines characteristic / determines named characteristic / eq;		2
	(b)	(release/ produce) lots of eggs / more eggs / ovulate more / eq;	need idea of larger quantity	1
	(c)	uterus / womb;		1
	(d)	smoking / (having) cigarette / (having) tobacco;		1
	(e)	50 (%);		1
	(f) (i)	protein/blood clotting factor digested/destroyed (by acid) / eq;	allow broken down ignore need to separate from milk ignore sugar	1
	(ii)	glucose; (more) respiration / energy / ATP; milk / meat production / growth / eq;		2
	(g)	<u>transplant</u> / <u>transplantation</u> ; (more) hearts available / less shortage / less waiting time / no need for donors / few donors / lowers demand / eq; less immune response / less rejection / human proteins / human DNA / human genes / tissue type / better match / compatible / eq; less deaths / live longer / eq;	ignore work for longer / reduce heart attacks	3