PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 5: USE OF BIOLOGICAL RESOURCES (PACK 2)

SCORE	PERCENTAGE
/189	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Mark
(a)	A oesophagus / gullet (1) B stomach (1) C small intestine / ileum / duodenum / jejunum (1) D large intestine / colon / eq (1)	**4**

Question Number	Answer	additional guidance	Mark
(b)	An explanation that makes reference to three of the following: • (plants contain) cellulose (1) • digested by cellulase / enzyme (1) • into glucose (1) • energy released / respiration / eq (1)	 allow broken down by cellulase converse for no cellulase energy not released / energy lost in feaces / eq	**3**

Question Number	Answer	Mark
(c)(i)	• humans do not digest cellulose / do not eat only plant material / omnivores / eat fewer / less plants / vegetables / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(c)(ii)	An answer that makes reference to two the following: • removes useful bacteria / fewer / no useful bacteria / eq (1) • reduces competition / eq (1) • pathogenic bacteria increase / survive / multiply / grow / more harmful bacteria / eq (1)	 not just appendix contains useful bacteria as this is in stem allow toxic / bad / eq to harmful bacteria	**2**

Q2.

Question Number	Answer	Mark
(a)	The only correct answer is C it is specific A it lasts a short time is not correct B it leads to bioaccumulation is not correct D it is quicker is not correct	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	An answer that includes the following • sucrose / sugars (1) • amino acids / eq (1)	ignore water reject starch / glucose allow named amino acid	**2**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An explanation answer that makes reference to four of the following: • less respiration / eq (1) • less ATP / less energy (1) • less active transport/ less minerals <u>absorbed</u> / eq (1) • less / remove / eat carbohydrate / sucrose / sugars / less amino acids / eq (1) • less growth (of leaves / tubers /bulbs /grain/ fruit) (1) • less starch <u>stored</u> / less proteins (synthesis) (1) • less photosynthesis (1) • less <u>nectar</u> (1) • less (insects for) pollination (1) • spread disease / infection / eq (1)	not glucose stored or carried in phloem	**4**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that that makes reference to five the following points: yes • hoverflies eat / consume more aphids / eq (1) • at each/ all temperature(s) / eq (1) • therefore fewer hoverflies need to be used (1) • greatest / most difference (×3) at 12 °C /eq / least at 18 °C (×1.9) (1) • (both) flies consume more at higher temperatures /eq (1) but not conclusive because • only one larvae used /should use more larvae / not repeated / eq (1) • (less valid) not natural habitat / not a field study / done in laboratory setting / eq (1) • only 2 species hoverfly and silverfly compared / eq (1)	allow % difference	**5**

Q3.

Question Number	Answer	Additional guidance	**Mark**
(a)	An explanation that makes reference to the following points: • (boiled to) remove oxygen / kill any other organisms / bacteria /eq(1) • (cooled so) enzymes not denatured / destroyed / yeast not killed (1)	Ignore germs Ignore (to ensure it is) anaerobic Reject enzymes killed	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following points: • measuring cylinder / syringe / eq (1) • (therefore) measure <u>volume</u> / <u>cm^3</u> (1)	Ignore amount	**2**

Question Number	Answer	Mark
(c)(i)	He only correct answer is A removal of oil to allow oxygen diffusion B is not correct as remove liquid oil to allow carbon dioxide diffusion would not affect aerobic respiration C is not correct as add more liquid oil to prevent oxygen diffusion would reduce aerobic respiration D is not correct as add more liquid oil to prevent carbon dioxide diffusion would not affect aerobic respiration	**1**

Question Number	Answer	Mark
(c)(ii)	An answer that makes reference to the following points: • *y-axis* labelled number / amount / number of bubbles / bubbles produced / rate of respiration **and** *x-axis* labelling anaerobic and aerobic (bars) (1) • two bars drawn **and** bar for aerobic respiration is higher (1)	**2**
		Total 7

Q4.

Question number	Answer	Additional guidance	Mark
(a)(i)	An explanation that makes reference to the following: • to exclude oxygen (1) • ensure respiration is anaerobic (1)	ignore reference to air	**2**

Question number	Answer	Additional guidance	Mark
(b)(i)	• Addition of readings 10 + 12 + 11 + 14 = 47 (1) • Division by 4 47 ÷ 4 = 12 (11.75) (1) round to 12 for correct sig figs	award full marks for correct numerical answer without working	2

Question number	Answer	Additional guidance	Mark
(b)(ii)	• Subtraction of means 14 – 6 =8 (1) • Division by original rate x 100 8 ÷ 6 = 1.33 × 100 = 133% (1)	award full marks for correct numerical answer without working	2

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to three of the following points: • increased temperature causes vibrations/ breaks bonds (1) • causes change in shape of active site (1) • enzyme denatures (1) • substrate can no longer fit in/bind with enzyme (1)	reject reference to enzyme being killed	3

Q5.

Question number	Answer	Additional guidance	Mark
(a)(i)	An explanation that makes reference to the following: • to exclude oxygen (1) • ensure respiration is anaerobic (1)	ignore reference to air	2

Question number	Answer	Additional guidance	Mark
(b)(i)	• Addition of readings 10 + 12 + 11 + 14 = 47 (1) • Division by 4 47 ÷ 4 = 12 (11.75) (1) round to 12 for correct sig figs	award full marks for correct numerical answer without working	2

Question number	Answer	Additional guidance	Mark
(b)(ii)	• Subtraction of means 14 – 6 =8 (1) • Division by original rate x 100 8 ÷ 6 = 1.33 × 100 = 133% (1)	award full marks for correct numerical answer without working	2

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to three of the following points: • increased temperature causes vibrations/ breaks bonds (1) • causes change in shape of active site (1) • enzyme denatures (1) • substrate can no longer fit in/bind with enzyme (1)	reject reference to enzyme being killed	3

Q6.

Question Number	Answer	Mark
(a)	An explanation that makes reference to four of the following points: • nitrates (for growth) (1) • for amino acids (1) • for protein (1) • magnesium for chlorophyll / chloroplasts (1) • so more photosynthesis (1) • more glucose (1) • phosphates used for ATP / DNA / eq (1) • potassium for control of water movement / eq (1)	**4 exp**

Question Number	Answer	Mark
(b)	An answer that makes reference to four of the following points: • fertiliser leaches into river / washed into river / eq (1) • fertiliser would cause algal / plant growth / algal bloom / eutrophication (1) • dead algae are decomposed / broken down by bacteria / decomposers (1) • (bacterial) respiration would reduce oxygen (1) • means were calculated / readings repeated so experiment is reliable / valid (1) • measurements taken at same time of year / in April (so are valid) (1) • direction of river is past farm (1) • reduced oxygen could be due to other factors / sources of fertiliser from other fields (1)	**4 exp**

Question Number	Answer	Mark
(c)	• manure / faeces / dung / compost / seaweed / bone / blood / animal wastes / eq (1)	**1 grad**
		Total 10 marks

Q7.

Question Number	Answer	Mark
(a)	chemical / solution / eq that kills / destroys / eq pests / animals / plants / insects / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(b)	1319.5 /1320 /1300 km^2 (1) Barley (1)	Multiply total area by % sprayed 91 % of 1450	**2**

Question Number	Answer	additional guidance	Mark
(c)	An answer that makes reference to two of • in winter cold / low temperature / less food eq (1) • fewer insects / pests (1) • less insecticide / pesticide needed (1)	allow converse for spring spring warmer / more food more insects more insecticide /pesticide	**2**

Question Number	Answer		Mark
(d)	An answer that makes reference to four of • around 70% / even pattern of herbicide / fungicide and insecticide in fruit crops (1) • high(er)use of herbicide in cereals / low(er) use of herbicide in fruit(1) • as smaller plants / growing plants need to compete with weeds (1) • high(er) use of insecticide in fruit crops / low(er) use of insecticide in cereals (1) • more variation in fungicide use in cereals (1) • high use of fungicide on (rotting) fruit (1) • as fruit more prone to saprophytic decay/ high sugar content / eq	Allow converse mp 3 allow converse mp 7	**4**

(e)	An answer that makes reference to • use biological control (1) • using a predator (species) (such as Encarsia) to target / eat / consume (specific) pest / insect / eq (eg whitefly) (1)	use nets (1) exclude insects from plants / eq (1) allow introduce consumer of insect / Allow example ladybird for aphids for mp 2	**2**
			Total 11 marks

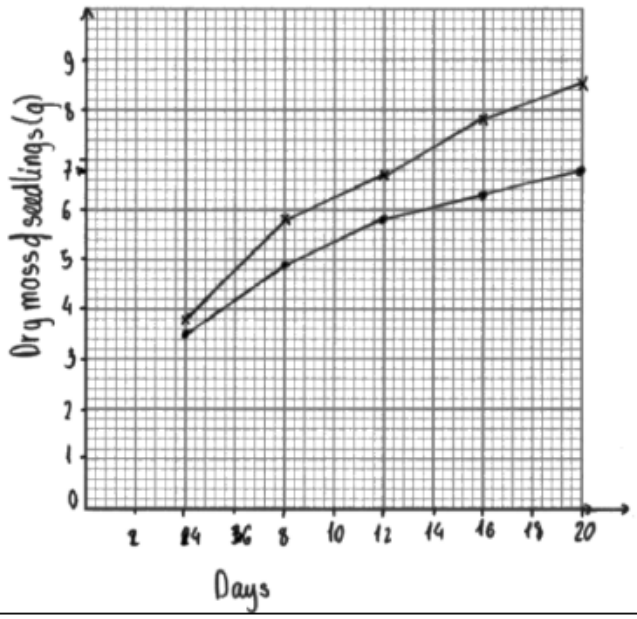
Q8.

Question Number	Answer	Additional guidance	Mark
(a)(i)	An answer that makes reference to two of the following: • light (intensity) / lamp / eq (1) • water <u>volume</u> / watering <u>frequency</u> (1) • mass /weight, of compost (1)	**Ignore** amount **Ignore** fertiliser	**2**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that makes reference to two of the following: • water (content) would vary / water increases the mass / adds mass / makes seeds heavier / some seeds would absorb more water than others (1) • so comparison is valid / fair comparison (1) • water is not <u>biomass</u> / dry mass is the true <u>biomass</u> / (dry mass is) organic molecules (1)	**Allow** water changes mass **Ignore** accuracy / reliable **Ignore** fair test alone **Allow** converse for all MPs	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	S – <u>linear</u> scale that takes up at least half of grid **and** right way round (1) L – ruled, straight lines that join points with no extrapolation (1) A – axes fully labelled with units (1) P – all points correct (1) K – key for each line / each line labelled (1)	**Allow** S, L, A if only one line Bar chart loses L Axes labels are mass (g) and day	**5**

Day	Dry mass of seedlings in g	
	Without fertiliser	With fertiliser
4	3.5	3.8
8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5



Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to four of the following: • magnesium ions (increase) chlorophyll / chloroplasts (1) • (so more) photosynthesis (1) • (which produces) carbohydrates / glucose / starch / cellulose / eq (1) • nitrate ions for amino acids (1) • (nitrate / amino acid) for protein (synthesis for growth) (1)	If no other marks, award **one mark** for making chlorophyll <u>and</u> amino acids / protein with no ref to minerals **Allow** for enzymes	**4**

Q9.

Question Number	Answer	Mark
(a)(i)	An explanation that makes reference to two of the following: • <u>oxygen</u> is required (1) • for respiration (1)	**2**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to two of the following: • to kill pathogens / other microorganisms / sterilises the fermenter / eq (1) • to prevent contamination (of the product) / competition (1) • steam condenses to water so does not affect product / taste/ flavour / eq (1)	**Accept** remove bacteria / eq Prevent bacterial contamination = 2 marks	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	A graph that includes: • S scales linear and at least half page and axes the correct way around (1) • A both axes labelled with units (1) • L straight lines joining points (1) • P points correctly plotted (1) • K key / labelled GM and non-GM (1)	Lose line mark for bar chart Units: time in days and mass in kg **Ignore** extrapolation to zero Plots +/- half square	**5**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following: • GM fungus grows faster up to 20 days / before day 30 / eq (1) • (but) over 30 days, the non-GM fungus produces a higher final yield / GM fungus starts to level off after 20 days / non-GM fungus produces more over longer time (1) • GM fungus is better if product is required in a shorter time / non-GM fungus is better is product is required after longer time period (1)	**Accept** converse for all MPs **Accept** GM produces more mass over first 20 days / produces more product in short time **Accept** at 30 days GM fungus produces less yield than non-GM / grows slower / non-GM has higher yield over last new days	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to five of the following: *Yes because:* 1. there is less fat in mycoprotein (1) 2. there is less cholesterol in mycoprotein (1) 3. less risk of heart disease / obesity / eq (1) 4. there is more fibre in mycoprotein so less risk of constipation / moves through gut / gut / eq (1) 5. mycoprotein has more calcium for bones / teeth / eq (1) *No because:* 6. mycoprotein has less protein (1) 7. for growth / muscle growth / eq (1) 8. mycoprotein has less iron so may be a risk of anaemia / less haemoglobin / fewer red blood cells / eq (1)	**Accept** other protein functions	**5**

Q10.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following points: • plasmid / virus / bacteriophage / phage / gene gun / eq (1) • transfer (recombinant) / DNA / gene / into organism) eq (1)	allow carry DNA /gene introduce / insert DNA / gene	**2**

Question Number	Answer	additional guidance	Mark
(b)(i)	Magnesium / Mg Iron / Fe Nitrate / NO_3	Mg^{2+} Fe^{2+} / Fe^{3+} NO_3^-	**1**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An answer that makes reference to six of the following points: • C use pulling / method A and weedicide / method B /eq (1) • O uses same species of crop / same crop / plant (1) • R repeat investigation / uses more than one field (1) • M1 measure crop mass / weigh /eq (1) • M2 use quadrats / use sampling / per m^2 / per unit area / per tray / eq (1) • S1 after **stated** time period / one growing season / eq • S2 (control) temperature / light / carbon dioxide / soil / water / fertiliser / minerals /eq (1)	not amount not yield allow idea of in same region / climate for S2	**6**
			Total 9 marks

Q11.

Question Number	Answer	Mark
(a)	A description that makes reference to three of the following points: • (same) restriction enzyme to cut / remove / open /eq (1) • plasmid / vector <u>and</u> target gene / gene for making poison / eq (1) • ligase enzyme to join / stick / insert /eq (1) • complementary shapes / sticky ends /eq (1)	**3 exp**

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to six of the following points: Good decision to use GM: • GM plants are specific / kill specific insects / pesticides kill other insects / plants / pesticide kills non-specific insects (1) • GM plants reduce need for pesticide (1) • pesticide needs reapplication / do not last long (1) • insects can become resistant to pesticide (1) • pesticides can enter food chains / bioaccumulation (1) • pesticides can lead to health problems / affect human health /eq (1) eg: organophosphates and nervous system Poor decision to use GM: • pesticides are quick to kill (1)	ignore harmful unqualified pollution allow poisons humans	**6 exp**

	• GM plants could result in cross pollination of other species (1) • GM pollen may kill insect pollinators (1) • insects may develop resistance to poison produced by GM crops (1) • customers may not buy GM crops (1) • patents mean farmers become dependent on companies for their seed (1)		
			Total 9 marks

Q12.

Question Number	Answer	Mark
(a)	**C** plasmid *A is incorrect because it is not the cell wall* *B is incorrect because it is not the nucleoid* *D is incorrect because it is not RNA*	**1 comp**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to three of the following points: • insulin / glucagon (1) • steam / hot water (1) • competition / contamination / eq (1) • mix / stir / agitate / distribute / eq (1) • oxygen / O_2 (1) • temperature (1)	**Allow** disinfectant / bleach / sterilising fluid / alcohol / ethanol **Allow** infection	**6 grad**
			Total 7 marks

Q13.

Question Number	Answer	Mark
(a)	bacteria that contain added genes / additional DNA / added genetic information / genes from another species / DNA from another species / foreign genes / foreign DNA / genetic information from another species / eq (1)	**1**

Question Number	Answer	Mark
(b)	A description that makes reference to **four** of the following points: • restriction enzyme used (1) • to cut human DNA / gene (that codes) for insulin / to cut plasmid (1) • produces sticky ends /eq (1) • ligase used to (1) • insert gene / join DNA into bacterial plasmid / eq (1) • plasmid inserted into bacterium / eq (1)	**4**
		Total 5 marks

Q14.

Question Number	Answer	Mark
(a)(i)	An explanation that makes reference to the following points • (transfer of a) gene / allele / DNA (1) • from a different species / eq (1)	**2**

Question Number	Answer	Mark
(a)(ii)	An answer that makes reference to the following points • restriction enzyme / endonuclease cuts DNA / gene / allele (1) • ligase joins DNA / gene / allele / plasmid (1)	**2**

Question Number	Answer	Mark
(b)	An answer that makes reference to four of the following points **Points in favour of GM crops:** • less insecticide / pesticide used (1) • less bioaccumulation of pesticides / less evolution of resistance to pesticides / no pesticide remaining in soil / eq (1) • pest resistant crops do not affect non-target species / pollinators (1) • weedkiller kills weeds but not (GM) crops / easier to remove weeds / eq (1) • less spread of viruses to other species / crops / eq (1) **Points against GM:** • gene transfer to other species / (cross) pollinate with other species / eq (1) • outcompete native species / affect food chains / eq (1) • reduction in insect populations (1) • requires herbicide use / more use of herbicides (1)	**4**
	Total = 8 marks	

Q15.

Question Number	Answer	additional guidance	Mark
(a)	An explanation that makes reference to the following points: • restriction / endonuclease to cut DNA / gene/ plasmid (1) • ligase to join DNA / gene / plasmid (1)	allow named restriction endonuclease	**2**

Question Number	Answer	Mark
(b)	An answer that makes reference to six of the following points: • C with and without GM (1) • O same species / type / plant / age /eq (1) • R repeat (1) • M1 number / count/ yield /mass / height / eq (1) • M2 after same stated time / eq (1) • S1 same temperature / light / CO_2 / humidity / eq (1) • S2 same water / mineral / fertiliser /soil / pH / eq (1)	**6**
		Total 8 marks

Q16.

Question Number	Answer	Mark
(a) (i)	An explanation that makes reference to two the following points: • as temperature increases so does (rate of) photosynthesis (1) • increased (kinetic) energy (of molecules) / molecules move faster / more collisions (1) • optimum temperature for enzymes (1) • more glucose / starch / sugar / carbohydrate / eq produced (1)	**2**

Question Number	Answer	Mark
(a)(ii)	An explanation that makes reference to two the following points: • it releases CO_2 (1) • CO_2 a reactant / used in / needed in / for photosynthesis / eq (1) • as CO_2 is limiting factor (1)	**2**

Question Number	Answer	Additional guidance	Mark
(b) (i)	An explanation that makes reference to the following points: • nitrate • for amino acids / proteins (1) • magnesium • for chlorophyll for chloroplasts (1)	Allow other minerals and their function **ignore** nitrogen eg phosphate for ATP / DNA can only gain function if mineral is correct	**2**

Question Number	Answer	Mark
(b) (ii)	An answer that makes reference to five of the following points: • increased soil concentration reduces water potential of soil (1) • prevents water uptake / absorption by osmosis / causes water loss (1) • so plant wilts / eq (1) • damaging effect of leaching / escaping / washing into rivers lakes / eq (1) • causes eutrophication (1) • leads to algal bloom/ plant growth in river / lake / eq (1) • loss of aquatic life / fish / water plants die /eq; • (may prefer to) use natural fertiliser / manure (1) • can produce organic earn more money (1) • other factors limit growth / there is excess fertiliser / not all fertiliser is used (1)	**5**

Q17.

Question Number	Answer	Mark
(a)	The only correct answer is A it is digested into amino acids *B is not correct as its surface area is not increased by bile* *C is not correct as its pH is not raised by hydrochloric acid* *D is not correct as it is not absorbed by villi*	**1**

Question Number	Answer	Additional guidance	Mark
(b)	<table><tr><th>Component</th><th>Function</th></tr><tr><td>lipid</td><td>store of energy</td></tr><tr><td>vitamin D</td><td>bone / teeth / calcium absorption / prevent rickets (1)</td></tr><tr><td>iron</td><td>haemoglobin / red blood cells (1)</td></tr><tr><td>fibre</td><td>peristalsis / move food / prevent constipation (1)</td></tr></table>	Ignore egestion Helps digestion and prevents constipation = 1	**3**

Question Number	Answer	Additional guidance	Mark
(c)(i)	20% of 1250 = 250 250 ÷ 50 = 5 (2)	Award full marks for correct numerical answer without working Allow one mark for 250 in working	**2**

Question Number	Answer	Mark
(c)(ii)	An answer that makes reference to six of the following points: • GM salmon grow more / heavier / longer / larger / more mass / grow faster / eq (1) • (more) protein provided (1) • only need protein in correct amount / only need sufficient protein / only need 50g / too much protein / excess protein / eq (1) • balanced diet also needs vitamins / carbohydrate / lipid / minerals / fibre / no idea of other **named** component in salmon (1) • one salmon used / not repeated / should use several fish (1) • (data) not reliable / result may be anomalous (1) • no information on food supply to salmon / temperature / oxygen / pollution (1) • protein need depends on age / sex / activity / eq (1)	**6** **Mp1 Allow converse**

Question Number	Answer	Additional guidance	Mark
(d)	An answer that makes reference to the following points: • gene / allele (1) • restriction / endonuclease (1) • ligase (1)	Allow restrictive	**3**

Q18.

Question Number	Answer	additional guidance	Mark
(a)	A description that makes reference to two the following: • biuret (1) • deepest / darker / intensity purple contains most protein (1) • reference to same volume of milk / biuret (1)	allow other quantitative methods such as solidify the milk protein by denaturing (1) mass of the protein (1)	**2 exp**

Question Number	Answer	additional guidance	Mark
(b)	An explanation that makes reference to two of the following points: • prevent infection / disease (1) • (by destroying / due to) virus / bacteria / pathogen (1) • provides immunity / eq (1)	ignore illness	**2 exp**

Question Number	Answer	additional guidance	Mark
(c)	An answer that includes two of • use as a source of / for energy / respiration (1) • use as store of energy (1) • insulation / myelin sheath / protection fat around organs/ eq(1)	ignore for warmth	**2 grad**

Question Number	Answer	Mark
(d)(i)	lactose	**1 cler**

Question Number	Answer	Mark
(d)(ii)	*Lactobacillus / Streptococcus* Allow species names	**1 cler**

Question Number	Answer	Mark
(d)(iii)	An explanation that makes reference to two of the following points • sterilise milk / pasteurise (1) • kill bacteria / pathogen / microorganisms (1) • prevent competition (for carbohydrate / sugar) (1)	**2 exp**
		Total 10 marks

Q19.

Question Number	Answer	additional guidance	Mark
	An answer that makes reference to four of the following points • C change amount of starch (1) • O use same species / strain / genotype / mass / volume / measure of yeast (1) • R repeat each flour type more than once / eq (1) • M1 measure height / volume of dough / bread / use ruler (1) • M2 after stated time / same time (1) • S1 use same measure of flour / volume / mass of flour / volume/ mass of water / eq (1) • S2 same temperature / knead for stated / same time / eq (1)	ign amount ign amount allow cook at same temp	**6**

Q20.

Question number	Answer	Mark
(a)	A description that makes reference to the following three points: • *Lactobacillus* (1) • lactose (1) • lactate/lactic acid (1)	3

Question number	Answer	Mark
(b)	An answer that makes reference to the following points: • fruit provides vitamin C to prevent scurvy (1) • roughage/fibre to help peristalsis (1)	2

(Total for question = 5 marks)