PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 4: ECOLOGY AND THE ENVIRONMENT (PACK 2)

SCORE	PERCENTAGE
/198	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	additional guidance	Mark
(a)(i)	• correct order of names (1) • correct shape (1)	(bottom) starting with producer / primary consumer/ secondary consumer / tertiary consumer ignoring shape pyramid shape ignoring order allow triangle pyramid	**2**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	an answer that makes reference to three of the following • quadrat / use grid /eq (1) • random sample (1) • count (all) plants / producers / eq (1) • repeat / divide total sum of plants by area (1)	 ignore organisms allow quadrat**s** as ref to repeat mp 4	**3**

Question Number	Answer	Additional guidance	Mark
(b)(i)	calculation 2.40 ÷ 10.60 x 100 = 22.6% / 23 % (1)	 allow 22.64 /22.642/22.6415 22.64151 etc	**1**

Question Number	Answer	additional guidance	Mark
(b) (ii)	An answer that makes reference to four of the following: • fewer organisms at top of pyramid / eq (1) • less biomass/ dry mass at top of pyramid/ eq (1) • energy / biomass lost (at each transfer) / less energy / biomass transferred / not all energy/ biomass transferred/ eq (1) • most energy lost from producer to primary consumer / less energy/ less biomass transferred from producer to primary consumer /eq (1) • allow any **<u>two</u>** causes of energy loss (2) • movement / heat loss / respiration / metabolism • not all material digested / cellulose not digested / energy lost in faeces / energy present in faeces • not all organism eaten /eq • some energy excreted / in urine / eq • some organisms die / decomposed / eq	 allow converse **allow two from**	**4**
			total 10 marks

Q2.

Question Number	Answer	additional guidance	Mark
(a)	An answer that makes reference to three of the following points: • thin / one cell thick / eq (1) • large surface area (1) • blood (supply) / capillaries (1)	Ignore permeable	**3**

Question Number	Answer	Mark
(b)	An answer that makes reference to five of the following points: Argument for – (fish will live because) • window / light for photosynthesis (1) • photosynthesis / bubbles / aerator add oxygen to the water (1) • for respiration (1) (once in for OR against) • changing water removes waste / removes algae / less decomposition by bacteria / less chance of infection / disease (1) • food for energy / growth (1) Argument against – (fish may die because) • window / light causes algal growth / eq (1) • oxygen concentration falls (at night / after four days) (1) • large bubbles less diffusion (of oxygen / carbon dioxide) (1) • less carbon dioxide removal (1) • excess / waste food decomposed by bacteria (1) **Plus opinion** • not the best way to keep fish in an aquarium (1)	**6**
		Total 9 marks

Q3.

Question number	Answer	Mark
(a)	An explanation that makes reference to the following two points: • attaches to haemoglobin (1) • therefore less oxygen transport (1)	2

Question number	Answer	Mark
(b)	A	1

Question number	Answer	Mark
(c)	An answer that makes reference to the following six points: • plus and minus sulphur dioxide (1) • same species of seed/equivalent (1) • more than one seed per treatment/equivalent (1) • number of seeds germinated/calculate percentage germination (1) • air tight container used (1) • same time period (1) • same water/same temperature/equivalent (1)	6

(Total for question = 9 marks)

Q4.

Question Number	Answer	Additional guidance	Mark
(a)(i)	A (beavers) is the only correct answer A is incorrect as coyote are secondary consumers B is incorrect as grass is a producer C is incorrect as wolf is a secondary and tertiary consumer		1

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer which makes reference to: • community and environment / biotic and abiotic parts / <u>all</u> organisms and the environment / <u>all</u> living things and non-living things / the environment and community / eq	**Ignore** area **Allow** habitat	**1**

Question Number	Answer	Additional guidance	Mark
(b)	An answer which makes reference to four of the following: • fewer elk / coyote were consumed / more elk (present) / more coyote (present) (1) • more consumption of plants / producers (by elk) / fewer producers / less grass / eq (1) • less food for mice (1) • more beavers <u>eaten</u> / more mice <u>eaten</u> (by coyotes) / eq (1) • <u>old</u> trees not removed (1) • younger trees are shaded / less photosynthesis / less energy fixed / enters ecosystem / eq (1) • less food for hawk / fewer mice for hawk / eq (1) • soil erosion (due to loss of plants) (1) • fewer shelters / habitats / nesting places (for organisms) (1)	**Allow** fewer elk / coyote hunted (by wolves) **Allow** fewer trees / fewer smaller plants / loss of plants **Ignore** no / fewer beavers	**4**

Question Number	Answer	Additional guidance	Mark
(c)(i)	• 180 – 50 = 130 • (130 ÷ 50) x 100 **260 (%) (2)**	**two marks** for 260 (%) **one mark for** 180 – 50 **or** 130	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to two of the following: • food begins to run out / eq (1) • disease (spread) (1) • hunting (1) • new competitors / (high) competition / new predators (1) • loss of habitat (1) • migration (1)	**Allow** coyote / elk numbers fall / eq **Allow** more bears / cougars	**2**

Question Number	Answer	Additional guidance	Mark
(c)(iii)	An description that makes reference to three of the following: • grid area / quadrat (1) • random (placement) / eq (1) • calculate / measure / count plants / eq (1) • repeat / calculate mean (1) • scale up for whole area (1)	**Ignore** quadrant quadrats = 2 mark	**3**

Q5.

Question Number	Answer	Mark
(a)(i)	C cytoplasm *A is not correct as cellulose is not found in the bacterium* *B is not correct as chitin is not found in the bacterium* *D is not correct as a nucleus is not found in the bacterium*	**1 comp**

Question Number	Answer	Mark
(a)(ii)	C 7 *A is not correct because 1 is not neutral pH* *B is not correct because 2 is not neutral pH* *D is not correct because 12 is not neutral pH*	**1 comp**

Question Number	Answer	additional guidance	Mark
(a)(iii)	An explanation that makes reference the following points: • mutation (1) • variation (1) • survive (1) • reproduce / breed / offspring (1) • pass on allele / gene (1)		**4 exp**

Question Number	Answer	Mark
(b)	An answer that makes reference the following points: • probiotic / cranberry / both / treatments (better than control) reduce (bacteria) /eq(1) • more reduction if taken together / eq (1) • cranberry (alone) reduces more than probiotic (alone) / eq(1)	**2 grad**
		Total 8 marks

Q6.

Question Number	Answer	Mark
(a)		**3**

Example of process	Name of process
plants with a short growing season survive drought	**natural selection**
growth of algae in rivers polluted by fertiliser	eutrophication (1)
pollen transferred from one plant to another by an insect	insect pollination (1)
absorption of nitrate ions from soil using ATP	active transport (1)

Question Number	Answer	additional guidance	Mark
(b)(i)	An explanation that makes reference to four of the following points: • (more) grass flourishes / grows well / survives / not killed by zinc / eq (near mine) (1) • less competition (1) • mutation (1) • reproduce (1) • pass allele / gene / DNA on to offspring (1)	other species killed by zinc near mine	**4**

Question Number	Answer	additional guidance	Mark
(b)(ii)	A description that makes reference to four of the following points: • use tape measure (1) • quadrat (1) • repeat / several (1) • count plants / estimate percentage cover described (1)	allow belt transect for mp1 allow for quadrats how many	**4**
			Total 11 marks

Q7.

Question Number	Answer	Mark
(a)	• respiration (1)	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	A description that makes reference to **three** of the following points: • measure out one m^2 / use quadrat / eq (1) • place randomly / eq (1) • cut / harvest grass / remove plants / eq (1) • repeat / use quadrat**s** /eq (1) • measure mass/ weight after one year / eq (1)	allow crops not repeat several times a year allow find difference between start and end of year idea	**3**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to 5 of the following points: • S y axis scale linear and half the grid (1) • axis labelled (mean) net primary productivity (1) • Units in g per m^2/ eq (1) • P bars plotted correctly within one (1) • K key / each bar labelled with ecosystem type (1)	line graph scores 4 max **if scale non-linear no S or P**	**5**

Question Number	Answer	additional guidance	Mark
(b)(iii)	An answer that makes reference to **five** of the following points: • **tropical rainforest** high(est) productivity / growth / eq (1) • high temperature / sunlight / rainfall / water/ eq (1) • **desert** low(est) growth / eq (1) • too little water / rain / dry eq (1) • too hot / extremes of temperature / enzymes denature / eq (1) • for photosynthesis (1) • **deciduous temperate forest** high / second highest / eq (1) • not as warm / less intense sunlight / less leaves in autumn / more diverse / range of plants eq(1) • **cultivated farmland higher than /** similar to **(temperate) grassland** / eq (1) • contain similar plants / grasses / cereals / no trees / eq (1) • cultivated is given water / minerals/ fertiliser / grown in polythene tunnels / eq (1)		**5**
		Total 14 marks	

Q8.

Question Number	Answer	Additional guidance	Mark
(a)	4.6 (2)	one mark for 4.625 / 4.63 **Award full marks for correct answer**	**2**

Question Number	Answer	Additional guidance	Mark
(b)	A discussion that makes reference to five of the following: *Agreement:* 1. (anaerobic digesters) release less CO_2 / methane (1) 2. release less CO (1) 3. (because less CO_2 / less methane) there is less greenhouse effect / global warming / eq (1) 4. so less ice caps melting / habitat loss / climate change / other effects / flooding / coral reef damage / eq (1) 5. (because less carbon monoxide) less damage to haemoglobin / carboxyhaemoglobin / eq (1) 6. so less effect on oxygen transport / eq (1) *Disagreement:* 7. (however) anaerobic digesters release more sulfur dioxide (1) 8. (causing) acid rain (1) 9. which causes deforestation / kills fish in lakes / eq (1)	**Accept** less ocean acidification / extreme weather / desertification **Accept** other correct biological consequences of acid rain	**5**

Q9.

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

Q10.

Question Number	Answer	Additional guidance	**Mark**
(a)	A description that makes reference to three of the following points: • binds with haemoglobin / forms carboxyhaemoglobin (1) • (less) oxygen (1) • (less) respiration (1) • fatal / death / less growth / suffocation (1)	Less oxyhaemoglobin = 2	**3**

Question Number	Answer	**Mark**
(b)	An explanation that makes reference to six of the following points: • pathogenic bacteria / cause disease (1) • urea / urine / nitrogenous waste / nitrate / phosphate (1) • decomposition / decomposed / decomposers (ONCE) (1) • eutrophication / plant growth / algae growth (1) • (plants) block light / prevents photosynthesis (1) • respiration (ONCE) (1) • (less) oxygen (1) • death of organisms (ONCE) / reduce biodiversity / eq (1)	**6**

Q11.

Question Number	Answer	additional guidance	Mark
(a)	P is the ileum / small intestine (1) Q is the <u>oesophagus</u> (1)	allow intestine reject large intestine	**2**

Question Number	Answer	additional guidance	Mark
(b)	An explanation that makes reference to two of the following points: • <u>cellulose</u> (1) • (produces / release) glucose / energy (1) • respiration (1)	allow produce <u>cellulase</u> no credit for microorganisms being digested for glucose	**2**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to two of the following points: • fewer cows means less methane (into atmosphere) (1) • greenhouse gas (1) • (less) heat trapped / (less) radiation reflected (1) • (less) global warming (1) • farmers may choose to keep same number / more cows (1) • some cows kept for beef / eq (1) • other sources of greenhouse gas / cars / fossil fuels / eq	allow converse ignore climate change	**4**
			Total 8 marks

Q12.

Question Number	Answer	Mark
(a)	Carbon / C (1)	**1**

Question Number	Answer	Mark
(b)(i)	The only correct answer is **A** W is combustion **B** is not the answer as W is not decomposition **C** is not the answer as W is not feeding **D** is not the answer as W is not respiration	**1**

Question Number	Answer	Mark
(b)(ii)	The only correct answer is **D** X is respiration **A** is not the answer as X is not combustion **B** is not the answer as X is not decomposition **C** is not the answer as X is not feeding	**1**

Question Number	Answer	Mark
(c)	bacteria / fungi / allow correct genus and species names (1)	**1**

Question Number	Answer	additional guidance	Mark
(d)	A description that makes reference to six of the following points: • C different pH of organic material / add acid /alkali / add buffers/ eq (1) • O same organic material / plant / age / species / type / mass / volume of organic material(1) • R repeat (at each different pH) (1) • M1 measure change / loss in mass of organic material / initial mass – final mass /volume of carbon dioxide released / change in hydrogen-carbonate indicator / change in limewater /eq (1) • M2 after stated time period (1) • S1 same temperature / oxygen / eq (1) • S2 same water / same mineral ions / same humidity / same volume of each acid /alkali/ buffer / same bacteria / fungi / decomposer added / eq (1)	same state of decay or allow time taken M2 for same mass M1 to decompose 1 hour + allow same number of bacteria /decomposers / eq	**6**

Q13.

Question Number	Answer	additional guidance	Mark
(a)	A description that makes reference to three of the following points: • crush / grind nut /eq (1) • ethanol / Sudan III (1) • add water (1) • white / emulsion / red (layer) (1)	if add oil -1 to score	**3**

Question Number	Answer	Additional guidance	Mark
(b)(i)	An explanation that makes reference to two of the following points: • peristalsis (1) • move food along intestine / prevent constipation / helps bowel movement / eq (1) • undigested material / indigestible / cellulose (1)	**ignore** ref to prevent cancer **ignore** helps digestion	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference the following points: • (nut A) has <u>more</u> iron/protein (1) • (more) haemoglobin (1)	iron for haemoglobin scores 1	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	• $16.7 \times 10^{-2} = 0.167$ • $\times 28 = 4.68$ allow 4.676 allow 4.7	award full marks for correct numerical answer without working should be 3 sig figs allow one mark for 0.167 **or** one mark for x 28 one mark for any version 4676 or 47 or 468	**2**

Question Number	Answer	Mark
(c)	An explanation that makes reference to five of the following points: • more foxes (to eat squirrels) / increased predation (1) • foxes eat nuts (so less food) (1) • fewer trees (1) • other species enter woods and feed on nuts /eq (1) • <u>other</u> predators entered woodland (1) • disease / infection (1) • migration / eq (1) • time of year when numbers counted (1) • cold weather / lower temperature (1) • fox increase <u>is more than</u> tree decrease (1) • human impact / hunting (by humans) / eq (1)	**5**

Q14.

Question Number	Answer	Mark
(a)	small fish	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	A description that makes reference to three of the following points: • photosynthesis (1) • chloroplasts / chlorophyll (1) • absorbs / traps light /eq (energy) (1) • starch / glucose / carbohydrate (1)	allow formula or from equation	**3**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following points: • respiration / heat loss (by plant) (1) • cannot digest / egested / not absorbed /eq (1) • uneaten / die / decomposition (1) • excretion (1)		**2**

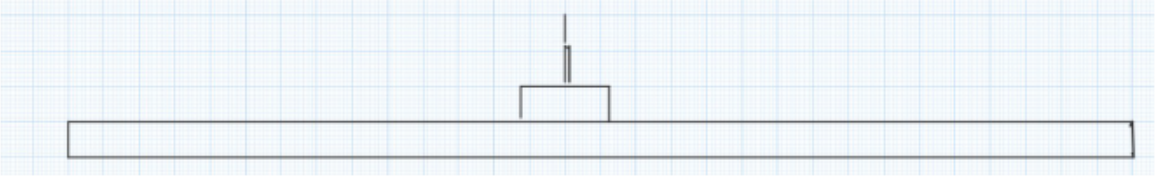
Question Number	Answer	Mark
(c)	An answer that makes reference to the following points: • increase surface area (1) • enzymes (1)	**2**
	Total 8 marks	

Q15.

Question Number	Answer	Mark
(a)(i)	• oak / (oak) leaves / oak tree / eq (1)	**1**

Question Number	Answer	Mark
(a)(ii)	• sparrowhawk(s) / hawk(s) (1)	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	An answer that makes includes: • pyramid shape / wider at bottom (1) • order of oak caterpillar blue tits sparrowhawk (1) • **Relative** width (oak to caterpillar approx 10 to 1 caterpillar to blue tit thin **and** very thin at top) (1)	ignore names ignore shape	**3**



Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to five of the following points: yes because • fewer insects (1) • fewer tits and thus fewer sparrowhawks (1) • build-up / bioaccumulation/ greatest effect in sparrowhawks (50%) / less effect in caterpillars (33%) eq (1) • no decrease in oak leaves / change in caterpillars not due to less food / eq (1) • fewer caterpillars not due to having more predators (fewer bluetits) /eq (1) no because • not repeated / only one sample / not reliable / eq (1) • no information on time of year / season / temperature/eq (1) • no direct measurement of chemical in organisms / environment /eq (1) • no information on other sources of food /food chains / other consumers / eq(1) • no reference to species of oak / caterpillar / eq (1) • may be fewer moths / caterpillars in the area poorly camouflaged /disease / eq (1)		**5**
			Total 10 marks

Q16.

Question Number	Answer	additional guidance	Mark
(a)(i)	• algae (1) • bladder wrack (1)	minus 1 mark for each extra incorrect organism	**2**

Question Number	Answer	additional guidance	Mark
(a)(ii)	An answer that makes reference to two of the following: • (common) seal (1) • crab (1) • lobster (1) • (herring) gull (1)	minus 1 mark for each extra incorrect organism	**2**

Question Number	Answer	Additional Guidance	Mark
(a)(iii)	bladder wrack → winkle → crab → gull (2)	Allow 1 mark for order without arrows or arrows in wrong direction no credit for pyramids	**2**

Question Number	Answer	Additional Guidance	Mark
(b)(i)	• order correct (1) • shape correct (1)	Require names for order Allow 1 mark for order of names but wrong shape (of pyramid) Allow 1 mark for correct pyramid shape without names no credit for food chain	**2**

Question Number	Answer	Mark
(b)(ii)	An explanation that makes reference to three of the following points: • energy lost (between each stage / level) / eq (1) • as heat / used in respiration / movement (1) • excreted / urine / eq (1) • not eaten / not digested / egested / faeces / eq (1) • decompose / die (1)	**3**
	Total = 11 marks	

Q17.

Question Number	Answer	Additional guidance	Mark
(a)	(number of plants) (2) number of primary consumers: 2 or two number of carnivores: 2 or two number of food chains: 6 or six	Mark each row independently.	**3 cler**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to two of the following points: • coloured / bright / large petals (1) • enclosed anthers / short filaments (1) • enclosed stigma / short style (1) • sticky stigma / sticky pollen / rough surface on pollen (1) • scent / eq / (1)		**2 grad**

Question Number	Answer	Additional guidance	Mark
(c)(i)	• select correct slope 1.3-0.7 (1) • calculation 0.6 (1)	Award full marks for correct numerical answer without working Award one mark for correct slope values 1.3 and 0.7 if final answer incorrect	**2 grad**

Question Number	Answer	Mark
(c)(ii)	An answer that makes reference to one of the following points: • taken / fed on / drunk by insects (1) • evaporation (1)	**1 grad**

Question Number	Answer	Additional guidance	Mark
(d)	An answer that makes reference to two of the following points: • prevent ants eating/removing/destroying pollen (1) • prevent ants / (other) insects from eating flower / named floral part e.g. petal (1) • prevent ants eating other insects / pollinators (1) • more nectar left (for attracting pollinators/other insects) (1) • more chance of being pollinated / can still be pollinated / more pollinators come (1)	For mp1,2,3 ignore 'harm' 'damage' unqualified	**2 exp**
			Total 10 marks

Q18.

Question Number	Answer	additional guidance	Mark
(a)	• oak → caterpillar → mouse → tick (1)	no credit for other chains without correct arrows pyramids	**1 grad**

Question Number	Answer	Mark
(b)	An explanation that makes reference to two the following points: • less food (for mice) / eq (1) • mice can (now only) feed on tree (1) • mice population declines / fewer mice / it declines / eq (1)	**2**

Question Number	Answer	Mark
(c)	An explanation that makes reference to three of the following points: • energy loss / used up (at each trophic level) / not all energy transferred /less energy reaches top / eq (1) • respiration / heat loss / movement (1) • cannot digest / egested / not absorbed /eq (1) • uneaten / die / decomposition (1) • excretion / eq (1)	**3**

Q19.

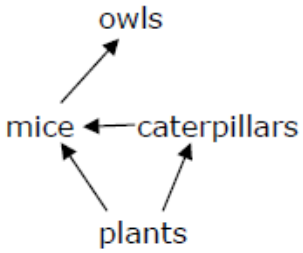
Question Number	Answer	Mark
(a)(i)	A - 2 *B is incorrect as there are not 3 secondary consumers* *C is incorrect as there are not 4 secondary consumers* *D is incorrect as there are not 5 secondary consumers*	**1**

Question Number	Answer	Mark
(a)(ii)	Acacia / plant → (desert) rat → fennec / fox → monitor / lizard → hawk (1)	**1**

Question Number	Answer	Additional guidance	Mark
(a)(iii)	An explanation that makes reference to three of the following: • (energy is lost due to) indigestible parts / faeces / not absorbed / eq (1) • (energy is lost due to) excretion / metabolic waste / urine / eq (1) • (energy is lost due to) organisms / parts of organisms that are not consumed /eq (1) • (energy is released) in respiration / by heat loss / in active transport / due to metabolism (1) • (energy is lost due to) movement (1)	**Accept** some organisms / food not eaten Accept loss to death / decay	**3**

Question Number	Answer	Mark
(b)	An explanation that makes reference to four of the following: • mutation / genetic variation (1) • (the fox has / ears have) large surface area to lose heat / keep body cool (1) • (which) enables survival (1) • breeding occurs / (fox) produces offspring (1) • passes on alleles / genes (for ear shape) (to next generation) (1)	**4**

Q20.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to the following points: • arrows in correct direction (1) • food web includes four organisms (in correct places) (1)  	**Allow** MP1 if only one food chain plants →caterpillars →mice→owls = one mark No marks if more than one web drawn and one is incorrect	**2 grad**

Question Number	Answer	Mark
(b)	• primary consumer / 1° consumer	**1 cler**

Question Number	Answer	Additional guidance	Mark
(c)(i)	• $3 \times 10^3 = 3000$ per km^2 (1) • $\times 5 = 15\,000$ (1)	**Allow** x 5 for **one** mark **Allow** 3000 for one mark **Allow** $1.5x\ 10^4$ / 15×10^3 Award full marks for correct numerical answer without working	**2 grad**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to three of the following points: • more food / plants / caterpillars / other sources of food available (1) • warmer weather (1) • fewer other predators / owls ate other species (1) • less disease / infection (1) • higher birth rate than death rate (1)	**Ignore** fewer owls	**3 exp**

Question Number	Answer	Mark
(c)(iii)	An answer that makes reference to two of the following points: • feed on other prey (1) • insufficient food / energy to maintain more owls (1) • have no predators (1) • birth rate = death rate / birth rate and death rate are similar (1) • owls produce few offspring (so population will not rapidly increase) (1)	**2 exp**

Question Number	Answer	Mark
(c)(iv)	An answer that makes reference to three of the following points: • use a trap / use filming / use a sample area / use a quadrat (1) • random sampling (1) • repeat (1) • count number of mice / faeces (in quadrat) (1) • calculate average (1) • multiply up to total area (1)	**3 exp**
		Total 12 marks