PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 4: ECOLOGY AND THE ENVIRONMENT (PACK 1)

SCORE	PERCENTAGE
/205	%

STEMUP

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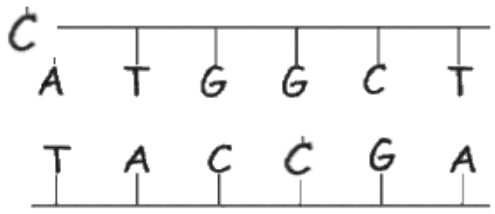
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Mark Scheme

Q1.

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

Question Number	Answer	Mark
(b)(i)	The only correct answer is C 7.5 *A is not correct as is not 2.5* *B is not correct as is not 4.5* *D is not correct as is not 8.5*	**1**

Question Number	Answer	Mark
(b)(ii)	An explanation that makes reference to the following points: • lower / eq (1) • denatured / change in shape of active site / eq (1) • urea does not bind (into active site) / fewer E/S complexes / eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(c)	A description that makes reference to five of the following points: • nitrogen fixing / fixation (1) • (nitrogen fixing / fixation) nitrogen gas to ammonia (1) • nitrifying / nitrification (1) • (nitrifying / nitrification) ammonia to nitrite / nitrite to nitrate / ammonia to nitrate (1) • denitrifying /denitrification (1) • (denitrifying /denitrification) nitrate to nitrogen gas / reduces nitrogen available to plants / eq (1)	**Allow** nitrogen to nitrates / amino acids /eq eg nitrifying bacteria convert nitrate to nitrogen gas scores mp 3 but not mp 4	**5**
	Total = 9 marks		

Q2.

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

Question Number	Answer	Mark
(b)(i)		**2**

Species	Field A		Field B	
	Number of each plant	Percentage (%) of each species	Number of each plant	Percentage (%) of each species
daisy	19	76	15	**32**
dandelion	**4**	16	18	38
buttercup	**2**	8	14	30
total	25		47	

Scores one mark for 4 and 2 (1)
Scores one mark for 32(%) (1)

Question Number	Answer	additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • (although) both / A and B, have 3 different species / same number of species / eq / (1) • B (is more diverse) because it has more even / similar numbers of each species / eq (1)	**Allow** converse	**2**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to the following points: • named mineral / nitrate / magnesium (1) • correct function / amino acids/ protein / chlorophyll / photosynthesis /eq (1)	**Allow** other correct named minerals award mp 2 only if correct mineral given **Ignore** nitrogen e.g. Nitrogen for amino acids is one mark only	**2**
			total = 7 marks

Q3.

Question Number	Answer	additional guidance	Mark
(a)	An explanation that makes reference to four of the following points: • more (decomposition) /faster with warmer temperatures /eq (1) • enzymes (1) • more (decomposition)/ faster with cut material / eq (1) • more surface area (1) • fungi / bacteria (1)	 allow mass remains high in low temp mass remains high in uncut allow converse	**4 exp**

Question Number	Answer	Additional guidance	Mark
(b)	6.0 – 3.6 = 2.4 2.4 ÷ 3 = 0.8 6.0 – 2.0 = 4.0 4.0 ÷ 3 = 1.3(3) 1.3(3) – 0.8 = 0.5(3) or could 4-2.4 = 1.6÷3 = or even 3.6-2 =1.6 ÷3 = **allow 0.5 or 0.53 or 0.533 etc for full marks**	award full marks for correct numerical answer without working allow 1 for 2.4 **and** 4.0 or 1.3 **and** 0.8 and allow 1 for dividing by 3 so can get 2 marks for (2.4 and 4.0) and dividing by 3	**3 exp**

Question Number	Answer	additional guidance	Mark
(c)	An answer that makes reference to two of the following points: • species/ type / of leaves / plant (1) • age of plant / leaves (1) • same (number of) / type of decomposers / eq (1) • insects or organisms that might consume leaf /eq (1)	**ignore volume of leaves**	**2 grad**
			Total = 9 marks

Q4.

Question Number	Answer	Additional guidance	Mark
(a)	**C is the correct answer (UAAGGCUCA)** A is incorrect as T is not present in RNA B is incorrect as T is not present in RNA D is incorrect as the sequence is not complementary		**1**

Question Number	Answer	Additional guidance	Mark
(b)	**C is the correct answer (translation anticodon)** A is incorrect because it is not transcription B is incorrect because it is not transcription D is incorrect because it is not a codon		**1**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to three of the following: • mutation is a <u>rare / random</u> change to DNA / genetic material (1) • change in nucleotides / bases / triplets / eq (of DNA) (1) • change (in sequence of) amino acids (in proteins / polypeptide) (1) • changing enzyme / protein / producing different protein / enzyme / eq (1)	**Accept** codons **Accept** changing active site / changing shape of protein	**3**

Question Number	Answer	Additional guidance	Mark
(d)(i)	An description that makes reference to three of the following: • use of quadrat / gridding of area / eq (1) • random (selection of areas) (1) • count butterflies / eq (1) • repeat / means / eq (1)	**Accept** quadrats for two marks (mp1 and mp4)	**3**

Question Number	Answer	Additional guidance	Mark
(d)(ii)	A discussion that makes reference to five of the following: 1. increase in abnormal butterflies / more abnormal butterflies after 10 months (1) 2. (due to) longer exposure to radioactivity / eq (1) 3. larger increase in number of abnormal / mutated offspring (compared with adult after 10 months) (1) 4. mutations / genes / eq passed on to offspring (1) 5. recessive mutations may be carried by adults / eq (1) 6. if heterozygotes / carriers mate they may produce abnormal offspring / eq (1) 7. other factors could cause the abnormalities / abnormalities may not be due to mutations /not genes / DNA(1) 8. there is no control experiment / no data before the accident / no idea of normal number of abnormalities / eq (1) 9. radioactivity not measured / monitored / radioactivity may change / decay / eq (1) 10. do not know number of butterflies sampled / eq (1)	**Accept** adult / offspring / both **Accept** longer exposures increases number of mutations **Accept** more abnormal offspring than abnormal adults **Accept** adults increase by 15.7 and %, offspring increase by 41.9 % **Accept** no idea of health of butterflies / disease **Accept** no data from area with no radioactivity **Accept** no idea how long radioactivity lasted / changed **Accept** experiment has not been repeated / small sample size	**5**

Q5.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following points: • (damage to) alveoli (1) • reduces / less / small surface area (1) • (less) diffusion / (less) oxygen in / (less) carbon dioxide out (1)	Less surface area of alveoli = two marks	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following points: • bacteria / microorganisms / pathogens are killed / destroyed / removed / eq (1) • no / less chance of infection (with TB) / disease / catching *Mycobacterium* / *Mycobacterium bovis* / catching TB / eq (1)	**Allow** converse **Ignore** get sick / ill	**2**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to two of the following points: • fewer cattle (to be infected) (1) • fewer people in Europe (than in rest of world) (1) • cattle are screened / if infected are killed (1) • cattle are given antibiotics (1) • vaccination (of cattle / people / badgers in Europe) (1) • more pasteurised milk drunk / milk pasteurised (1) • fewer badgers (in Europe to transmit TB) / fewer other animals (in Europe to transmit TB) / badgers culled (in Europe) (1)	**Allow** converse	**2**

Question Number	Answer	Additional guidance	Mark
(d)	• 149 000 – 1290 = 147 710 and 13 400 – 103 = 13 297 (1) • 147 710 ÷ 13 297 = 11.1 : 1 (2)	award full marks for correct numerical answer without working **Allow** 11.11, 11.108 etc **Allow** full marks for 11.1 to 1 one mark for 13297 **and** 147710 or one mark for 1:11.1 or one mark for 11.1 alone	**2**

Question Number	Answer	Mark
(e)	An answer that makes reference to two of the following points: • (find / protect / less competition for) mates / females (1) • (protect) food / less competition for food / resources / obtain more food (1) • protect young (1)	**2**

Question Number	Answer	Additional guidance	Mark
(f)	An explanation that makes reference to three of the following points: • use attenuated / dead / weak / inactive pathogen / bacterium / eq (1) • antigens (1) • memory cells (1) • secondary immune (response) (1) • antibody production fast(er) / soon(er) / more / large amounts (1)	**Ignore** disease / virus no credit for antibody production alone	**3**

Question Number	Answer	Mark
(g)	An answer that makes reference to three of the following points: • vaccinate badgers in one area and not in another / eq (1) • (count) number of cattle with TB / see if there are fewer / more cases of TB (1) • same number / control number of badgers in each area (1) • same field size / area (1) • same number of cattle (1)	**3**

Q6.

Question Number	Answer	Additional guidance	**Mark**
(a)	An answer that makes reference to the following points: • (all) living organisms / community / (different / all) species (1) • and environment / area / habitat / abiotic factors / non-living factors / physical factors (1)	Mp1 Ignore animals and plants	**2**

Question Number	Answer	Additional guidance	**Mark**
(b)	An explanation that makes reference to the following points: • (animals get) glucose / oxygen / energy (1) • (algae get) carbon dioxide / protection / shelter / safety / cannot be eaten (1)	Mp1 Ignore food / nutrients Mp2 Ignore place to live / food	**2**

Question Number	Answer	**Mark**
(c)(i)	An explanation that makes reference to the following points: • (sun)light (1) • photosynthesis (1)	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to two of the following points: • supply food / algae / plankton (1) • supply minerals / ions / named mineral (1) • supply oxygen (1) • supply carbon dioxide (1) • remove waste / faeces / carbon dioxide (1) • distribute gametes (1)	Ignore nutrients / clean water / remove bacteria / cooling	**2**

Question Number	Answer	Additional guidance	Mark
(d)	An answer that makes reference to the following points: • quadrat (1) • repeat (1) • random / random number (1) • count / measure / number of / percentage cover of coral (1) • calculate percentage by dead ÷ total ×100 / dead ÷ living + dead ×100 (1)	Allow quadrants for Mp 1 and 2 quadrats = Mp1 and Mp2 Allow bleached / white as eq to dead	**3**

Question Number	Answer	Additional guidance	Mark
(e)	An answer that makes reference to the following point: there is less food / less coral to eat (1)	Ignore only source of food / only coral available	**1**

Question Number	Answer	Additional guidance	Mark
(f)	An answer that makes reference to three of the following points: • reduce greenhouse gas / greenhouse effect (1) • reduce carbon dioxide / CFCs / methane / N_2O / ozone / HCFCs / HFCs emissions (1) • use less fossil fuel / fewer cars / fewer vehicles / less deforestation / use renewable sources of energy / solar / wind / hydroelectric / farm fewer cattle / cycling more / fewer aerosols / eq (1) • control/reduce predators / starfish / snails (1) • reduce tourism / fishing / diving / restrict access / cordon reef / eq (1) • reintroduce coral / plant more coral / grow coral in lab and place on coral / supply other surfaces for coral to grow (1)	Mp2 Ignore carbon emissions / carbon footprint Ignore pollution	3

Q7.

Question number	Answer	Mark
(a)	An explanation that makes reference to the following two points: • ice caps melt/flooding/rise of sea levels/climate change/ extreme weather (1) • therefore loss of habitat/extinction/effect on food webs/ effect on crop growth (1)	2

Question number	Answer	Mark
(b)	Transfers virus (from sheep to sheep)	1

Question number	Answer	Mark
(c)	An explanation that makes reference to the following points: • evaporation of water (1) • therefore reduces body temperature/heat loss/equivalent (1) • enzymes not denatured (1)	2

Question number	Answer	Mark
(d)	Too cold for midge to move/survive/reproduce/equivalent	1

Question number	Answer	Additional guidance	Mark
(e)	• (100 × 20) ÷ 995 (1) • 2.01% (1)	award full marks for correct numerical answer without working	2

Question number	Answer	Mark
(f)	An explanation that makes reference to two of the following points: • less blood/(oxy) haemoglobin/oxygen (1) • narrowing of blood vessels (1) • vasoconstriction (1)	2

Question number	Answer	Mark
(g)	An explanation that makes reference to three of the following points: • sheep injected with dead/attenuated/harmless virus/antigens (1) • (sheep produces) memory cells (1) • (sheep produces) antibodies (1) • faster/greater/quicker response (1)	3

Question number	Answer	Mark
(h)	An explanation that makes reference to the following points: • midges cannot bite/feed (1) • reduce spread of virus (1)	2

(Total for question = 15 marks)

Q8.

Question Number	Answer		Mark
(a)(i)	methane / nitrous oxides / CFCs / water vapour / eq (1)	**Accept** other correct named greenhouse gases **Reject** carbon monoxide	1

Question Number	Answer	Additional guidance	Mark
(a)(ii)	1.8×10^{13} (3)	**Accept** 18 000 000 000 000 or 18 trillion for **two marks** **Accept** 18×10^{12} for **two marks** **Accept** 18 or (727 + 37 - 746) or 18 with other incorrect standard form for **one mark** *Example of calculation:* • *727 + 37 - 746 = 18* • *x 1 000 000 000 000* • *conversion to standard form*	**3**

Question Number	Answer	Additional guidance	Mark
(a)(iii)	An answer that makes reference to two of the following. • ice (caps) melt / glaciers melt / eq (1) • flooding / sea level rises / eq (1) • loss of habitat / desertification / droughts (1) • extinctions / disrupted food chains / migration of species / damaged ecosystems / decreased plant yields / decreased productivity / eq (1) • destruction of coral reefs / coral bleaching / eq (1) • spread of disease / pests / pathogens / eq (1) • extreme weather / climate change / changes in weather patterns / eq (1)	**Accept** two correct answers within one answer space	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to four of the following. • plants take in / absorb, carbon dioxide (1) • for photosynthesis (1) • carbon (dioxide) is converted into / stored as suberin / locked up in suberin / eq (1) • suberin does not decay for long periods / suberin decomposes slowly / suberin remains for long period of time / eq (1) • perennial plants remain for long periods of time / do not die off / grow for many years / don't die each year / don't have to be replanted / eq (1) • slower / less carbon dioxide is released from decomposition / decay / (respiration of) decomposers (1)	**Ignore** carbon **Accept** roots decompose slowly / eq **Ignore** carbon	**4**

Question Number	Answer	Additional guidance	Mark
(c)	The only correct answer is D A is incorrect as the amylase digests starch B is incorrect as ligase sticks DNA C is incorrect as lipase digests fats		**1**

Question Number	Answer	Additional guidance	Mark
(d)	An answer that makes reference to two of the following. • prevent water loss (1) • (due to) osmosis (1) • when water moves from a higher water potential to a lower water potential / eq prevents plant cells becoming flaccid / wilting / stay turgid (1)	**Ignore** water gain **Ignore** waterproof **Allow** water moves from dilute solution to more concentrated solution **Accept** movement from high concentration <u>of water</u> to low concentration <u>of water</u>	**2**

Question Number	Answer	Additional guidance	Mark
(e)	An answer that makes reference to three of the following. • produce large numbers / large scale / eq (1) • fast (process) / quick(er) / eq (1) • all crops produce suberin / all plants are (genetically) identical / all clones / eq / (1) • less risk of cross pollinating (with wild plants) / pollinating wild plants / spreading (trans)gene into wild / eq (1) • can be done at, any time of year / all year / eq (1)	**Ignore** faster growth of plants **Accept** no variation / guarantees characteristics/ all have the gene	**3**
		(Total for Question = 16 marks)	

Q9.

Question Number	Answer	Mark
(a)(i)	The only correct answer is B microscopic plankton *A is not correct because crustaceans are not producers* *C is not correct because sea birds are not producers* *D is not correct because turtles are not producers*	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is C human *A is not correct because crustaceans are not a tertiary consumer* *B is not correct because fin whales are not a tertiary consumer* *D is not correct because whale sharks are not a tertiary consumer*	**1**

Question Number	Answer		Mark
(b)	An explanation that makes reference to five of the following points: • (less) food taken in / eaten / taken in (to stomach) / starve (1) • food cannot be digested / less digestion (1) • fewer amino acids / less glucose / fatty acids / glycerol (1) • less gas exchange / less air <u>taken</u> in / can't breathe / <u>air</u> cannot flow through trachea / bronchi / suffocate (1) • less oxygen (in blood) / less oxygen (to lungs) (1) • less carbon dioxide removed / eq (1) • less (aerobic) respiration / more anaerobic respiration (1) • less energy / ATP / more lactic acid (1)	**Allow** less energy idea from less food / glucose / eq **ONCE**	**5**

Question Number	Answer	Additional Guidance	Mark
(c)	An answer that makes reference to the following points: • plastic concentrate (along food chain) / plastic increases in bodies (along food chain) / more plastic in higher trophic levels / plastic works along food chain / plastic builds up / eq (1) • humans at end of food chain / humans eat plastic when eating fish / eq / humans gain plastic from the fish (1) • less catch of fish / less food for humans (if fish populations decrease) (1)	**Allow** toxin for plastic **Allow** plastic not excreted / not removed from bodies / stay in the bodies	**2**

Question Number	Answer	Additional guidance	Mark
(d)	• 2000 – 200 = 1800 • 1800 × 365 = 657 000 or 660 000 • = 6.57 × 10^5 or 6.6 x 10^5 (3)	Award full marks for correct numerical answer without working **Allow one mark** for 1800 **Allow two marks** for 657 000 / 660 000 **Allow two marks** for any 6.57 / 6.6 with wrong power	**3**

Question Number	Answer	Additional guidance	Mark
(e)	An explanation that makes reference to the following points: • reduced biodiversity / eq (1) • fewer species / lower populations (1) • fewer food sources / eq / fewer niches (1)	**Allow** some species become extinct/ die out **Allow** food chain disruption idea	**2**

Question Number	Answer	Additional guidance	Mark
(f)	An answer that makes reference to two of the following points: • less microplastic produced (1) • fewer animals harmed / suffocated / killed / damaged / not eaten by animals (1) • broken down / digested / decomposed (1) • by microorganisms / bacteria / fungi (1)	**Allow** less bioaccumulation / less toxin passed along food chains / eq **Ignore** (bio)degrade	**2**
			Total = 16 marks

Q10.

Question Number	Answer	Mark
(a)	**A** denitrification / denitrifying (bacteria)(1) **B** nitrification / nitrifying (bacteria) (1) **C** nitrogen fixation / nitrogen fixing (bacteria) (1)	**3**

Question Number	Answer	additional guidance	Mark
(b)(i)	120 + 58 + 5 + 70 = 253 253 x 10^{12} 2.53 x 10^{14} (2)	full marks for correct answer allow 1 for 2.53 or 253 253 × 10^{12} scores 1	**2**

Question Number	Answer	additional guidance	Mark
(b)(ii)	40 + 100 + 60 + 5 = 205 40 / 205 x 100 20% or 19.5 or 19.51 or 19.512 etc (2)	full marks for correct answer allow 1 for 205	**2**

Question Number	Answer	Mark
(b)(iii)	An explanation that makes reference to two of the following: • (biomass) contains proteins / amino acids / DNA / RNA / nucleic acids / eq (1) • N containing <u>compounds</u> (1) • produce nitrous oxides / oxides of nitrogen when burned / eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to two of the following: • (nitrous oxide is a) greenhouse gas (1) • trap heat in atmosphere / absorbs IR radiation / prevents IR radiation escaping / eq (1) • increases / causes global warming (1)	 not just heats up earth / atmosphere not just increases temp	**2**

Q11.

Question Number	Answer	additional guidance	Mark
(a)(i)	producer to primary consumer = 132/ 703 x 100 = 19%	**allow 18.8 / 18.78 / 18.777 18.7767 / eq**	1

Question Number	Answer	Mark
(a)(ii)	primary consumer to secondary consumer = 1% of 1 = 0.01	**1**

Question Number	Answer	additional guidance	Mark
(a)(iii)	• more energy transferred / less energy lost / less heat loss / less movement in aquatic / more of producer eaten /eq (1)	**allow converse** not all crop eaten	**1**

Question Number	Answer	Additional Guidance	Mark
(b)	An explanation that makes reference to **two** the following points • less biomass in producers than consumers / consumers have more biomass / eq (1) • but producers have more energy /eq (1) • producers have low mass at any one point in time / are continually being consumed / replaced / high reproduction rate (1) • consumers feed in other areas/ eq (1)	ignore number	**2**

Question Number	Answer	Mark
(c)	An answer that makes reference to two of the following points • sampling using quadrats (1) • burn plants to release energy (1) • use of calorimeter / how heat energy released is measured when burning / heat volume of water and note temperature change/ eq (1)	**2**
	Total 7 marks	

Q12.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following: • (select and) mate fish that grow quickly / have desired characteristics / eq (1) • (select and) mate offspring that grow quickly / repeat breeding over several generations / eq (1) • (so that) genes / alleles for fast growth are passed on / eq (1)	**Accept** fish that do not waste food for grow quickly **Ignore** large fish **Accept** repeat with offspring	**2**

Question Number	Answer	Additional guidance	Mark
(b)	A description that makes reference to two of the following: • nitrifying bacteria / nitrification (1) • (ammonium) to nitrite / nitrite to nitrate (1)		**2**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to five of the following: 1. waste food / faeces eaten / removed (by lobsters and crabs) / eq (1) 2. less decomposition / fewer decomposers / fewer bacteria (1) 3. less disease / infection (due to fewer bacteria) (1) 4. less (bacterial/ decomposers) respiration (1) 5. more oxygen in the water / less removal of oxygen / seaweed releases oxygen (1) 6. nitrate / minerals / nutrients / carbon dioxide removed by seaweed (1) 7. less algae growth / algal bloom / eutrophication / eq (1) 8. more products to sell (1) 9. no need to buy food for lobsters / crabs / no need to buy minerals for seaweed (1)	**Accept** converse for mps **Accept** (more) fish / animal respiration / eq **Accept** other correct named minerals **Accept** fish provide carbon dioxide for seaweed **Accept** can sell crabs / lobsters / seaweed	**5**

Q13.

Question Number	Answer	Mark
(a)	An answer that makes reference to five of the following points: • oxygen decreases / eq (1) • bacteria increase as present in sewage (1) • bacteria feed on nutrients / sewage (1) • mayfly numbers drop (1) • bacteria use oxygen for respiration / mayfly larvae need oxygen for respiration / eq (1) • tubifex numbers increase as use nutrients from / feed on sewage / eq (1) • tubifex can survive in low oxygen / eq (1) • then bacteria decrease / eq (1) • (so) oxygen increases (1) • mayfly increase / tubifex decrease / eq (1)	**5**

Question Number	Answer	Additional guidance	Mark
(b)(i)	An explanation that makes reference to **two** of the following points • variation shown by organisms in an ecosystem (1) • number of / how many (different) species (1) • number / abundance / how many of **each** species / eq (1)	allow richness allow evenness	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to the following points • mayfly (only) found in oxygen rich / unpolluted water /no / few mayfly in polluted / eq (1) • tubifex (can be) found oxygen deprived / polluted water / no /few tubifex in unpolluted / eq (1)	In polluted water mayfly low /in unpolluted mayfly high (1) In polluted water tubifex high/ in unpolluted tubifex low (1)	**2**

Q14.

Question Number	Answer	Additional guidance	Mark
(a)	A description that makes reference to two of the following points: • use random number tables / computer / eq (1) • to generate coordinates in field / place tape measures along edge of field / eq (1)	**Allow** grid area / split area into squares (1)	**2**

Question Number	Answer	Mark
(b)(i)	**3** (1)	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	12 (1)	**ECF** from 6(b)(i)	**1**

Question Number	Answer	Additional guidance	Mark
(c)	A description that makes reference to two of the following points: • more plants / named plants in field A / more plants per quadrat / more of each species (1) • more species in field A (1) • higher (bio)diversity in field A / eq (1) • more species evenness in field A (1) / even distributions	**Allow** converse for all mark points **Allow** A has 39 plants, B has only 16 **Allow** A has 4 species, B has only 2 **Allow** only dandelions (and 1 violet) in B / all species present in A	**2**

Question Number	Answer	Additional guidance	Mark
(d)	A description that makes reference to three of the following points: **EITHER METHOD 1** • measure water content of soil / field / eq (1) • take repeated samples (1) • along a transect / at random locations (1) • count buttercups / compare number of buttercups to water content of soil (1) **OR METHOD 2** • plant buttercups in one field / pots with poor drainage and one with good drainage / eq (1) • repeat (1) • control temperature / minerals / light / rainfall / water added / eq (1) • count number of buttercups (1)	Mark either of the two methods **Allow** calculate mean water content **Allow** plant in high soil water and low soil water	**3**
			Total marks 9 marks

Q15.

Question number	Answer	Mark
(a)	One mark for each of the following: **A** nitrogen fixation (1) **B** decomposition (1) **C** nitrification (1)	3

Question number	Answer	Mark
(b)(i)	A description that makes reference to two of the following points: • nitrate values and BOD decrease (1) • BOD decreases at a faster rate (1) • nitrate rises in some years/fluctuates (1)	2

Question number	Answer	Mark
(b)(ii)	An explanation that makes reference to four of the following points: • lower nitrate levels means less plant growth/equivalent (1) • less eutrophication (1) • less plant death (1) • less decomposition/fewer decomposers/fewer bacteria/equivalent (1) • less respiration (1) • named other factor that could affect BOD (1)	4

(Total for question = 9 marks)

Q16.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to one of the following. • sterilised / unsterilised / eq (1) • presence of bacteria / absence of bacteria / eq (1) • heated / unheated soil / eq (1) • soil sample / soil used (1)		**1**

Question Number	Answer	Additional guidance	Mark
(b)(i)	An answer that makes reference to two of the following. • remove / dissolve / wash away nitrate present / get rid of nitrates / eq (1) • (so any) nitrate made must have been from the ammonium salt / are due to ammonium salts / eq (1) • so a fair comparison is made / so the test is valid / so the test is fair (1)	**Accept** make sure no nitrate present **Accept** to see if the nitrates come from the ammonia **Ignore** accurate / reliable	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to four of the following. • nitrates present in unsterilised soil (1) • nitrates produced /made from ammonium / ammonia (1) • nitrifying bacteria / nitrification (1) • ammonium is converted into nitrite / nitrite is converted into nitrate (1) • nitrates not present in sterilised soil because there are no bacteria / bacteria were dead / killed / removed (1) • not repeated / no measure of quantity of nitrates / qualitative not quantitative (1)	Ammonium to nitrite to nitrate = **2 marks** (mp2 and mp4)	**4**
			(Total for Question = 7 marks)

Q17.

Question Number	Answer	Mark
(a)(i)	The only correct answer is A B is not correct as B is not Nitrogen fixation C is not correct as C is not Nitrogen fixation D is not correct as D is not Nitrogen fixation	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is D A is not correct as A is not decomposition B is not correct as B is not decomposition C is not correct as C is not decomposition	**1**

Question Number	Answer	Mark
(a)(iii)	The only correct answer is C A is not correct as A is not nitrification B is not correct as B is not nitrification D is not correct as D is not nitrification	**1**

Question Number	Answer	additional guidance	Mark
(a)(iv)	• (nitrifying) bacteria / fungi allow correctly named genus / species (1)	ign denitrifying / nitrogen fixing bacteria / microorganisms	**1**

Question Number	Answer	Mark
(b)(i)	An explanation that makes reference to two of the following points • compare / (look at growth in) test solution / without **nitrate** / eq (1) • compare with (growth of) control / shows normal growth /eq(1) • if control had no minerals / other minerals absent would not show normal growth (1)	**2**

Question Number	Answer	Mark
(b)(ii)	• remove nitrates / all minerals /eq (1)	**1**

Question Number	Answer	Mark
(b)(iii)	An explanation that makes reference to two of the following points • block out light (from roots) /eq (1) • prevent photosynthesis (1) • prevent algal growth (1)	**2**

Question Number	Answer	Mark
(b)(iv)	An explanation that makes reference to two of the following points • measure height / length / leaf area / mass of plants (1) • using ruler / balance / scales / eq (1) • of both solutions / seedlings complete with minus nitrates (1)	**2**
	Total 11 marks	

Q18.

Question Number	Answer	Mark
(a)	C ultrafiltration *A is incorrect because digestion is not a process in the kidneys* *B is incorrect because mutation is not a process in the kidneys* *D is incorrect because vaccination is not a process in the kidneys*	**1 comp**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to three of the following points: • stay out of water / wear waterproof clothes / eq (1) • treat drinking water / boil water (before drinking) / do not drink water / drink bottled water / eq (1) • sanitation / no faeces in water / no urine in water /eq (1) • remove snails /eq (1) • vaccination (1)	**Allow** do not go in infected rivers or lakes / cover skin when in water / avoid contact with affected water / only wash in clean water **Allow** filter water / do not drink river water / lake water **Allow** use sewage treatment system / use toilet with septic tank **Allow** don't touch snails	**3 exp**

Question Number	Answer	Mark
(c)	An answer that makes reference to two of the following points: • red blood cells / rbc (1) • white blood cells / wbc (1) • lymphocytes (1) • phagocytes / macrophages (1)	**2 grad**

Question Number	Answer	Mark
(d)	D 4 800 *A is incorrect because it is the wrong value* *B is incorrect because it is the wrong value* *C is incorrect because it is the wrong value*	**1 comp**

Question Number	Answer	Additional guidance	Mark
(e)	• $8 \times 10^{-4} = 0.0008$ • x 240 million = 192 000 ÷ 100 = 1920 (2)	**Allow** 1 mark for: 19200000 / 1920000 / 192000 / 19200 / 192 / 19.2 / 1.92 / 0.192 / 0.0192 Award full marks for correct numerical answer without working	**2 grad**

Question Number	Answer	Mark
(f)	A a circle of DNA *B is incorrect because it is not RNA* *C is incorrect because it is not a protein* *D is incorrect because it is not RNA*	**1 comp**

Question Number	Answer	Mark
(g)	An explanation that makes reference to three of the following points: • antigen (1) • memory cells / lymphocytes (1) • (secondary) immune response (1) • more antibodies / antibodies made sooner / faster / faster immune response / eq (1)	**3 exp**

Question Number	Answer		Mark
(h)(i)	• (a treatment with) no plasmid / no protein / only water / saline / eq (1)	**Allow** placebo vaccine / a placebo / plasmid with no gene / plasmid with no DNA / different DNA	**1 exp**

Question Number	Answer	Additional Guidance	Mark
(h)(ii)	An answer that makes reference to three of the following points:		**3 exp**
	• reduced numbers / eq (1)	**Allow** reduces numbers of worms / worms decrease / lower number of worms after vaccine **Allow** more worms in control group	
	• by 19 or by 47% / about 50%		
	• schistosomes / worms, still present in body (1)	**Allow** does not completely get rid of them	
	• no idea of group size / needs to be repeated (1)	**Allow** more testing / more people tested	
	• no idea of age / sex / health (1)		
			Total = 17 marks