PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



MARK SCHEME

TOPIC 9: ECOSYSTEMS AND MATERIAL CYCLES (PAPER 2)

SCORE	PERCENTAGE
/105	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Mark
(i)	2108 (g)	**(1)** AO2 1

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: • population of earthworms will decrease (1) • because more earthworms will be eaten by hedgehogs (1)	 accept earthworms will die out accept hedgehogs have only one food source accept population of earthworms will increase as more {food/cabbages} available (2 marks)	**(2)** AO2 1

Question number	Answer	Additional guidance	Mark
(iii)	A description including: • use of quadrat / belt transect (1) • count the number of slugs in the sampled area (1) • multiplication factor to make the estimate (1)	 accept description of quadrat 1m x 1m / $1m^2$ accept calculate the mean numbers of slugs from all the samples	**(3)** AO3 3a

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	substitution (12 x 18 ÷10) = 21.6 (1)	award full marks for correct answer with no working	**(3)** **AO2**
	whole organism (1) = 21 / 22	e.c.f. from incorrect substitution **using data from the table**	
	(50 – 21 / 22) = 28 / 29	e.c.f. from incorrect whole organism award two marks for 28.4 or 27.9 or 22 or 21 without working	

Question Number	Answer	Mark
(ii)	Any **two** from: • sample at the (same) time of day (1) • sample for the (same) length of time (1) • use the (same) equipment / techniques (1) • (same) time period between first and second sample (1) • (same) marking process (1) • do not harm organisms when sampling (1)	**(2)** **AO2**

Q3.

Question number	Answer	Additional guidance	Mark
	carbon absorbed 120.1 + 92.8 or 212.9 (1) OR carbon released 119.6 + 90 + 6.4 or 216.0 (1) Evaluation 3.1 (gigatonnes)	award full marks for correct answer with no workings	**(2)** AO2 1

Q4.

Question Number	Answer	Additional guidance	Mark
	A description including **three** from:		**(3)**
	• place a quadrat along a {rope / tape} measure (1)	reject quadrant accept good descriptions of quadrats – e.g. ½ metre wire square	**AO3 3a**
	• tape measure to measure along the transect (1)		
	• measure light intensity at different distances (from the wood) (1)	accept use a light meter/lux meter	
	• measure the stinging nettles {along the transect / at different light intensities} (1)		
	• way of measuring growth of stinging nettles (in the quadrats) (1)	accept named examples – e.g. {height / mass/ dry mass / number of leaves / number of plants}	

Q5.

Question number	Answer	Additional Guidance	Mark
	A description including: • decomposers break down waste matter (into ammonia) (1) • nitrifying bacteria convert ammonia / nitrifying bacteria make {nitrites / nitrates} (1) • nitrogen fixing bacteria convert nitrogen into nitrates (1) • denitrifying bacteria {convert nitrates / release nitrogen} (1)	accept dead organisms for waste matter accept nitrification for nitrifying bacteria accept ammonia/nitrogen compounds for nitrates accept denitrification releases nitrogen	**(4)** AO1 1

Q6.

Question number	Answer	Additional guidance	Marks
	An answer that combines the following points of application of knowledge and understanding to provide a logical description: • a description of the use of a quadrat either by random sampling or using a belt transect (1) • a sample size 10–100 and count the number of clover plants in each quadrat (1) • multiplication factor dependent on the number of quadrats sampled (1)	to gain maximum marks steps must be in a logical sequence	(3)

Q7.

Question number	Answer	Additional guidance	Mark
	An explanation linking three from: • {squirrels / earthworms / cabbages} release carbon dioxide (1) • from respiration (1) • cabbages take in carbon dioxide (1) • (cabbages) for photosynthesis (1) • when organisms die decomposers release carbon dioxide (1) • {squirrels/earthworms} eat {cabbages / plants} which contain **carbon** (1) • egestion releases **carbon** (into the soil) (1)	accept CO_2 reject CO^2 accept **decomposers** respire accept squirrels eat earthworms which contain carbon accept named methods of egestion	**(3)** AO2 1

Q8.

Question number	Answer	Mark
	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks): • clover/leguminous plants could be used in crop rotation (1) • where at intervals (2–3 years) a field is planted with clover/leguminous plants and left fallow (1) • the clover/leguminous plants will have colonies of nitrogen fixing bacteria which will produce nitrates (1) • the nitrates will increase the fertility of the soil and negate the need for artificial fertilisers (1)	**(4)**

Q9.

Question Number	Answer	Additional Guidance	Mark
	An explanation linking **two** from: • leaching / run off / fertilisers / dead organic matter (1) • (causes) a build up of nitrates / nitrates in the water (1)	accept {sewage / mineral ions} accept phosphates ignore nutrients	**(2)** **AO1**

Q10.

Question number	Indicative content	Mark
*	**AO1 6 marks** **Reforestation** • reforestation is planting of trees • trees take up water from the soil • prevents erosion and reduces flooding • trees can be used for renewable resources • provides habitats • increases the rate of photosynthesis • removes carbon dioxide and releases oxygen • reduces greenhouse gases / global warming • provides a source of medicines / food for consumers **Animal conservation** • increase numbers of endangered species / prevent extinction • through controlled breeding programmes /reduction in poaching /maintaining habitats • generating income to fund conservation projects through zoos / animal parks / ecotourism • improves the number of animals / range of species • maintains the food web • maintains genetic diversity • allows re-introduction of animals into the wild	(6)

Level	Mark	Descriptor
	0	• no rewardable material.
Level 1	1-2	• demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • presents an explanation with some structure and coherence.
Level 2	3-4	• demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed. • presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	• demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • presents an explanation that has a well-developed structure which is clear, coherent and logical.

Additional Guidance

Level 1	1-2	• A brief explanation of either the benefits of reforestation OR animal conservation projects. • The response refers to changes in atmospheric gases OR photosynthesis OR **HOW** animal conservation improves biodiversity
Level 2	3-4	• A brief explanation of the benefits of reforestation AND animal conservation projects • The response refers to changes a **named** atmospheric gas **OR** photosynthesis **OR HOW** animal conservation improves biodiversity
Level 3	5-6	• A detailed explanation on the benefits of reforestation and animal conservation projects • The response refers to changes in both **named** atmospheric gases **AND HOW** animal conservation improves biodiversity including why endangered species are preserved or the impact on food webs

Level	Marks	Possible responses
Level 1	1 2	• Animal conservation protects endangered species / reforestation provides habitats for animals • Reforestation is planting trees which take in carbon dioxide / reforestation provides habitats for animals and reduces greenhouse gases
Level 2	3 4	• Animal conservation protects endangered species and reforestation provides habitats for animals / Animal conservation protects endangered species from hunting. Reforestation is the planting of trees which provides habitats for animals. • Animal conservation protects endangered species so the numbers increase and reforestation is the planting of trees. The trees take in carbon dioxide and provide habitats for animals
Level 3	5 6	• Animal conservation protects endangered species so the numbers increase by protecting them from hunting and maintaining habitats. Reforestation is the planting of trees. The trees take in carbon dioxide and provide habitats and food source for animals. • Animal conservation protects endangered species so the numbers increase by protecting them from hunting and maintaining habitats. Reforestation is the planting of trees. The trees release oxygen and take in carbon dioxide. They also provide habitats and food source for animals.

Q11.

Question Number	Answer	Additional guidance	Mark
(i)	An explanation linking: • as light intensity decreases the number of (small) plants (per m^2) decreases (1) • because the (small) plants will not be able to photosynthesise enough (1)	accept reverse argument	**(2)** **AO3 1ab**

Question Number	Answer	Additional guidance	Mark
(ii)	Any **one** from: • same time of day (1) • same meter (1) • same position(s) in area / measure the same size area (1) • same person makes the readings (1) • meter held vertically each time (1)	accept other valid variables that should be controlled	**(1)** **AO3 1ab**

Q12.

Question number	Answer		Mark
(i)	An explanation linking: • largest amount of growth seen with the highest concentration of nitrates / the higher the concentration of nitrates the more growth /ORA (1) • nitrates are needed to make proteins (1)	accept faster growth for more growth accept nitrates stimulate growth accept amino acids	(2) AO 3 2a AO 3 2b

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that links the following: • by the roots/ root hair cells (1) AND • by diffusion (1) • from a high concentration to a low concentration / down the concentration gradient (1) OR • by active transport (1) • from a low concentration to a high concentration / against the concentration gradient / using energy (1)	 reject osmosis reject osmosis	(3) AO 2 1

Q13.

Question number	Answer	Additional guidance	Mark
	An explanation linking three of the following: • to increase nitrate/ammonia levels in the soil (1) • because nitrogen fixing bacteria live in {colonies/root nodules} on the roots of pea and bean plants • (nitrogen-fixing bacteria) produce {nitrates/ nitrogen compounds / ammonia} (1) • from nitrogen {atmospheric/gas} (1)	 ignore live in the roots	(3) AO 1 1

Q14.

Question number	Answer	Mark
	An explanation including three of the following: • because {conditions / named conditions} are suitable for {growth / photosynthesis} /conditions similar to native conditions /it is adapted to the conditions (1) • it outcompeted the natural plants (1) • therefore, it {grows / reproduces} (1) • as no natural herbivores {eat it / restrict it} (1)	**(3)** **AO2.1**

Q15.

Question number	Answer	Mark
(i)	B	**(1)**

Question number	Answer		Mark
(ii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the bacteria convert the ammonia into nitrites then nitrates maintaining the pH (1) • (this prevents an increase in pH) which would cause enzymes to denature and kill the fish (1)		**(2)**

Question number	Answer	Mark
(iii)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the aquatic plant will take up nitrates by active transport (1) • against the concentration gradient/from where there is a low concentration to where there is a high concentration of nitrates (1)	(2)

Q16.

Question Number	Answer	Additional Guidance	Mark
(i)	X – decomposers Y – nitrifying (bacteria)	accept fungi / decomposing bacteria accept named nitrifying bacteria reject denitrifying bacteria / nitrogen-fixing bacteria	(2) AO1 1

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking **three** from: • leguminous crops planted (1) • that have nitrogen-fixing bacteria (1) • in root (nodules) (1) • which fix nitrogen (gas) (1)	 accept named leguminous crops accept use nitrogen from the air / use atmospheric nitrogen / make ammonia ignore produce nitrates	(3) AO1

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation linking: • nitrates are needed to make {protein / amino acids} (1) • which are needed for growth (1)	accept for DNA / genetic material	**(2)** **AO1**

Q17.

Question Number	Answer	Mark
(i)	**D mutualism** **The only correct answer is D** ***A*** *is not correct because it is not parasitism* ***B*** *is not correct because it is not indigenous* ***C*** *is not correct because it is not biodiversity*	**(1)** **AO1**

Question Number	Answer	Additional Guidance	Mark
(ii)	7500 (µm)	accept 7.5×10^{3} reject $7.5 \times \mathbf{10^{-3}}$	**(1)** **AO1 1**

Q18.

Question Number	Answer	Acceptable answers	Mark
(i)	3 (÷ 20) (X100) (1) 15 (%)	**Accept 3** ÷ 13 Full marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	Any two of the following: can photosynthesise more (1) higher light intensity / more light (1) more water / rain (1) warmer (1) more mineral ions / nutrients(1)	accept: reverse argument for woodland Accept: more competition from trees (for water / mineral ions) (1) bigger leaves (1) less flowers eaten (1) different genes (1)	**(2)**

Q19.

Question number	**Answer**		**Mark**
(i)	• set up the apparatus as shown in figure 13 (1) • replace the nitrate solution with (distilled) water / do not add nitrate pellet (1)	accept set up with a seedling on the cotton wool ignore just idea of controlling the volume of solution	**(2)** AO 2 2

Question number	Answer	Mark
(ii)	B oxidising **1. The only correct answer is B** ***A*** *is not correct because this is not the symbol for flammable* ***C*** *is not correct because the symbol for corrosive is a hand with acid* ***D*** *is not correct because the symbol for explosive has an explosion on it*	**(1)** AO 1 1

Question number	Answer	Additional guidance	Mark
(iii)	measure the (change in) mass (1)	accept idea of looking at the number/size of leaves accept the width of the seedling	**(1)** AO 3 3b

Q20.

	Answer	Acceptable answers	Mark
	An explanation to include three of the following points bacteria use nitrogen / nitrogen fixing bacteria (1) make ammonia / ammonium / nitrogen compounds /nitrates for use by plants (1) bacteria protected (within the root nodule) (1) bacteria obtain chemical substances / glucose / sugar from the plant (1) this is called a mutualism / symbiosis(1)	**Ignore food/nutrients** **reject parasitism**	**(3)**

Q21.

Question Number	Answer	Additional guidance	Mark
	Any **one** from: bacteria / fungi / decomposers / prokaryotes	 accept microorganisms accept named decomposing organisms e.g. worms	**(1)** **AO1 1**

Q22.

	Answer	Acceptable answers	Mark
(a)	**C** ☒ nitrification		**(1)**
a(ii)	an explanation to include the following points • used to make protein (1) • for growth (1)	**Ignore references to use as food (plants do not feed)** accept amino acids/ chlorophyll /DNA ignore references to photosynthesis / respiration	**(2)**
a(iii)	A description linking **four** of the following points (nitrates) leach/flow into water (1) algae and small plants grow **rapidly**/algal bloom (1) **underwater** plants cannot photosynthesise (1) (lack of photosynthesis / sunlight) causes plants to die (1) decomposers / (decomposing) bacteria break down the dead material / plants (1) these bacteria use up oxygen during respiration(1)	 accept fertilisers for nitrates	**(4)**
b	An explanation to include three of the following points bacteria use nitrogen / nitrogen fixing		**(3)**

	bacteria (1) make ammonia / ammonium / nitrogen compounds /nitrates for use by plants (1) bacteria protected (within the root nodule) (1) bacteria obtain chemical substances / glucose / sugar from the plant (1) this is called a mutualism / symbiosis(1)	**Ignore food/nutrients** **reject parasitism**	

Total for question = 10 marks

Q23.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** leaf palisade cell		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	An explanation linking two of the following: • by osmosis • from an area of high **water** concentration to an area of low **water** concentration • through (partially permeable) membrane	Ignore references to diffusion reject active transport accept water moves down a concentration gradient	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	• all four bars plotted correctly (+/- 1/2 small square) (1) • X axis correctly labelled for plotted bars , eg North A, North B, South A, South B (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	**D** a quadrat		**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(iii)	A suggestion including two of the following: • Species B **is able to** grow on both (North and South) sides (1) • (there are more) on the south side because of a specific difference in a named abiotic factor eg lighter /darker on South side , temperature, pH, water level, (1) • there are fewer on the north side because they are out competed by species A / idea of eaten more on North side (1)	Ignore species B is found / grows on both sides Ignore carbon dioxide concentration Accept less pollution / less sulphur dioxide on South side	**(2)**

Q24.

	Answer	Acceptable answers	Mark
	An explanation linking three of the following: • plants use /nitrogen taken in as nitrates (1) • fertilisers / compost (1) • nitrogen fixation / nitrogen fixing bacteria / lightning (1) • nitrification /nitrifying bacteria (1) • absorption through the roots (1) • by active transport (1)	Accept nitrates in the correct context	**(3)**

Q25.

Question Number	Answer	Acceptable answers	Mark
a(i)	(49 + 64 + 58) / 3 or 171 / 3 (1) = 57	Correct bald answer award 2 marks ecf applies if incorrect total is calculated but divided correctly by 3 for 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
a(ii)	An explanation to linking four of the following points: nitrates leaked/leached into river (between the two sites) (1) causing eutrophication (1) algae block light to underwater plants / underwater plants cannot photosynthesise (1) (dead plants / algae) broken down by microorganisms (1) microorganisms respire (1) causing oxygen depletion / less oxygen available for the fish (1)	 accept fertiliser for nitrates allow bacteria/decomposers	**(4)**

Question Number		Indicative Content	Mark
QWC	* **(b)**	A description to include some of the following points • indicator species used • number of indicator used as an assessment of pollution level Water pollution – polluted • bloodworms / sludgeworms /other named species • their presence signify high water pollution • they can survive in low oxygenated waters Water pollution – clean • freshwater shrimp / stonefly (larvae) / other named species • their presence signify low water pollution • they can only survive in areas of high oxygen (thus low pollution) Air pollution • blackspot fungus found on roses • blackspot fungus grows on roses in unpolluted areas because it is killed by the presence of sulfur dioxide that would be found in polluted air. • lichen – certain types of lichen can survive in polluted areas – so depending on the type of lichen found will be used to assess the pollution level of air	**(6)** **Exp**

Level	0	No rewardable content
1	1 – 2	• a limited description of the use of indicator species no names of species needed • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 – 4	• a simple description of the assessment of air or water pollution and the name/s of the species used with some idea of the level of pollution they respond to • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 – 6	• a detailed description of the assessment of both air and water pollution and the names of indicator species with clear indication of polluted water and/or unpolluted water organisms as well as the response of lichen or blackspot fungus to sulphur dioxide • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q26.

Question number	Answer	Mark
(i)	all the oxygen had been used up / no oxygen left	(1) AO2 2

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: • the **plant** produced oxygen (1) • through photosynthesis (1)	ignore plant removes carbon dioxide	(2) AO2 1

Question number	Answer	Additional guidance	Mark
(iii)	Any two from: • light intensity (1) • temperature (1) • size of bell jar / same volume of air (1) • {size/type} of candle /length of the wick (1) • **level** of liquid/water in the container (1)	accept same volume of gas in bell jar	**(2)** AO2 2

Q27.

Question number	Answer	Mark
(i)	(belt) transect	**(1)**

Question number	Answer	Mark
(ii)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (2 marks): • number of poppy plants decreases (closer to the woodland) (1) and • trees block light (1) • light is needed for photosynthesis (1) or • competition (with other species/trees) (1) • for resources/named resource (1)	**(3)**

Question number	Answer	Mark
(iii)	An answer that combines the following points to provide a plan: • **randomly** place the quadrat several times (1) • record the number of poppy plants in each quadrat (1) • method for scaling up the area sampled to the total area of the field (1)	(3)

Q28.

	Answer	Acceptable answers	Mark
(i)	**C** ☒ nitrification		(1)
(ii)	an explanation to include the following points • used to make protein (1) • for growth (1)	**Ignore references to use as food (plants do not feed)** accept amino acids/ chlorophyll /DNA ignore references to photosynthesis / respiration	(2)
(iii)	A description linking **four** of the following points (nitrates) leach/flow into water (1) algae and small plants grow **rapidly**/algal bloom (1) **underwater** plants cannot photosynthesise (1) (lack of photosynthesis / sunlight) causes plants to die (1) decomposers / (decomposing) bacteria break down the dead material / plants (1) these bacteria use up oxygen during respiration(1)	accept fertilisers for nitrates	(4)

Q29.

	Answer	Acceptable answers	Mark
	An explanation including **three** of the following: • (chemosynthetic) bacteria live in (the gut of) the tube worms (1) • the bacteria convert sulphurous / hydrogen sulphide compounds (1) • into food for the tube worms (1) • the tube worms provide place for the bacteria to live / provides oxygen for bacteria (1) • this is a mutualistic relationship (1)	**Accept sulphur** Accept bacteria make food for worms **Accept protection** Accept mutualism / mutual benefit / mutual relationship	**(3)**

Q30.

Question number	Answer	Additional Guidance	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • woodland provides a different type of habitat (1) • allows different {animal/plant} species to live in the park (1)	accept the idea that human intervention is controlled accept specific example e.g. nesting site for birds	**(2)**

Q31.

	Answer	Acceptable answers	Mark
(a)(i)	**C** ☒ parasite		**(1)**
(a)(ii)	A suggestion linking **two of the following:** • suckers on the head /adaptation of the head (1) • attaches to the intestine (1) OR • a very long thin shape / large surface area (1) • for absorption (1) OR • surface / skin (1) • resistant to enzymes (1)	Accept hooks, teeth for suckers Reject large intestine Accept long flexible shape Ignore references to resistance to stomach acid Ignore references to larvae, eggs and reproduction	**(2)**
(a)(iii)	A suggestion including two of the following: • cooking meat thoroughly (1) • do not eat meat /become a vegetarian / vegan(1) • destroy/don't eat the cysts in the meat(1) • prevent animals from eating tapeworm eggs (1) • worm the animal (1)	Accept food/pork for meat	**(2)**
(b)	An explanation including **three**of the following: • (chemosynthetic) bacteria live in (the gut of) the tube worms (1) • the bacteria convert sulphurous / hydrogen sulphide compounds (1) • into food for the tube worms (1) • the tube worms provide place for the bacteria to live / provides oxygen for bacteria (1)	**Accept sulphur** Accept bacteria make food for worms **Accept protection** Accept mutualism / mutual benefit / mutual relationship	**(3)**

	• this is a mutualistic relationship (1)		