PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS (PACK 1)

SCORE	PERCENTAGE
/223	%

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Mark Scheme

Q1.

Question Number	Answer	Mark
(a)(i)	The only correct answer is C as they are the microvilli A is not correct as it is not the microvilli B is not correct as it is not the microvilli D is not correct as it is not the microvilli	**1**

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

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to four of the following points: • folded / long to increase surface area / (1) • contains many villi to increase surface area (1) • contains microvilli to increase surface area (1) • contains lacteal to absorb lipid / eq (1) • contains capillaries to absorb glucose / amino acids / minerals /eq (1) • capillaries / blood flow maintain diffusion / concentration gradient / eq (1) • thin wall/ one cell thick for fast diffusion/ short diffusion distance / eq (1)	must have structure and explanation	**4**

Question Number	Answer	additional guidance	Mark
(c)	A description that makes reference to three following points: • oxygen to foetus from mother / eq (1) • digested food / nutrients / amino acids / glucose / fatty acids to foetus from mother / eq (1) • removes waste (products) / urea / carbon dioxide from foetus to mother / eq (1) • provides antibodies for baby / foetus /eq (1) • produces hormones / progesterone / eq (1)	If write blood transferred from mother to foetus penalise once -1 allow minerals named mineral / vitamin / named vitamin	**3**

Q2.

Question Number	Answer	Mark
(a)(i)	The only correct answer is D (protoctists) A is incorrect as the animals do not have chloroplasts B is incorrect as bacteria do not have nuclei C is incorrect as plants are multicellular	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is B (cell membrane and mitochondrion) A is incorrect as animal cells do not have chloroplasts C is incorrect as animal cells do not have chloroplasts D is incorrect as animal cells do not have cell walls	**1**

Question Number	Answer	Additional guidance	Mark
(b)	• one mark for $6CO_2 + 6H_2O$ (on LHS) (1) • one mark for $C_6H_{12}O_6$ (on RHS) (1)	**Accept** $6H_2O + 6CO_2$	**2**

Question Number	Answer	Additional guidance	Mark
(c)(i)	An explanation that makes reference to two of the following. • low / less / no light (1) • photosynthesis is slower than respiration / photosynthesis is less than respiration / respiration is faster than photosynthesis / eq (1) • more oxygen taken in than released / more oxygen used than produced / there is a net movement of oxygen in / eq (1)	**Accept** dark **Accept** no photosynthesis but respiration occurs **Ignore** respiration gets faster **Accept** less oxygen released than taken in	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that makes reference to three of the following. • at 10 (au) respiration (rate) and photosynthesis (rate) are equal / at the compensation point respiration and photosynthesis are equal (1) • rate of photosynthesis increases (as light intensity increases) (1) • photosynthesis rate is greater than respiration rate (1) • levels off / eq, because another factor / temperature / carbon dioxide is limiting (1)	**Accept** converse **Accept** levels off as light is no longer limiting **Accept** at (value between 45 (a.u.) and 55(a.u.) / 40 mm^3) another factor / temperature / carbon dioxide is limiting)	**3**

Question Number	Answer	Additional guidance	Mark
(c)(iii)	**two marks** for 48 (2)	**one mark** for correct reading of 38 (1) OR **one mark** for +10 (1)	**2**

Question Number	Answer	Additional guidance	Mark
(d)	A description that makes reference to three of the following. • move lamp different distances / eq (1) • place same mass / number / volume / concentration *Chlorella* / algae, in (hydrogen-carbonate indicator) (1) • same volume / concentration of indicator / same temperature / leave for same or stated time / same starting colour of indicator / use a control tube (with no *Chlorella*) (1) • (indicator turns) yellow with low light / covered tube / **and** red / purple with high light / uncovered tube (1)	**Accept** other correct methods e.g. cover with cloths / foil / change bulb power / use of variable resistor **Ignore** place in dark and light unqualified **Ignore** amount **Accept** place bung in / seal tubes **Accept** yellow with increase in carbon dioxide / and red / purple with decrease of carbon dioxide **Accept** correct references to photosynthesis and respiration	**3**
			(Total for Question = 14 marks)

Q3.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following points: • few / no chloroplasts / thin layer / thin cells / one cell thick (1) • transparent / lets light through / allows light to reach palisade layer (1) • (waxy cuticle) reduces water loss / evaporation / waterproof layer / barrier to water / eq (1) • protects against infection / eq (1)	**Allow** light to reach layer B / **Allows** cells underneath to photosynthesise	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to two of the following points: **two from:** *(Layer B)* • vertical cells / rectangular / tightly packed / many chloroplasts (1) • large surface area (1) • absorb / capture / harvest / trap light / eq (1) **and two from** *(Layer C)* • air spaces / gaps between cells / loosely packed / eq (1) • for gas exchange (1) • diffusion of CO_2 / diffusion of O_2 (1)	**Allow** for one mark gases diffuse if not mp5 / 6	**4**

Question Number	Answer	Additional Guidance	Mark
(c)	An explanation that makes reference to the following points: • guard cells (1) • open / close stomata (1) • let carbon dioxide in during day / when light (1)	**Allow** oxygen out during day / when light	**2**

Question Number	Answer	Mark
(d)	An explanation that makes reference to four of the following points: • reduce / stop transpiration / water loss (from plant) (1) • so plant does not wilt / go flaccid (1) • (but) allows absorption of carbon dioxide / CO_2 can still get in / can still pass through (1) • photosynthesis can occur / can (still) make glucose / carbohydrates / starch (1) • but less absorption / transport of mineral ions / named mineral ions (1) • less cooling / plant may overheat / eq (1)	**4**
	Total 12 marks	

Q4.

Question Number	Answer	additional guidance	Mark
(a)	• so semen contained sperm / (bull is) (sexually) mature / sperm in semen / gone through puberty / fully developed / eq	**accept converse** ignore cannot produce semen	**1 grad**

Question Number	Answer	additional guidance	Mark
(b)	An explanation that includes two of the following points • collect semen / sperm from **penis** of bull (1) • insert **straw** into / inject semen (into cow) (1) • put (it / semen / sperm) in **vagina / uterus** /womb /cervix(1)	semen injected into uterus scores m2 and mp3	**2 exp**

Question Number	Answer	additional guidance	Mark
(c)(i)	• preserve (sperm)/ keep (sperm) alive / viable / prevent growth of microorganisms / slow down metabolism / eq	allow last longer ignore denatured	**1 grad**

Question Number	Answer	Mark
(c)(ii)	• provide females (produce milk) / will produce cows / eq	**1 grad**

Question Number	Answer	Additional guidance	Mark
(d)	• 500 000 ÷ 2.4 million = 0.2083 • 0.2083 × 100 = **20.83% / 21.0% / 20.8%**	award full marks for correct numerical answer without working allow 1 mark for ÷ 2.4 million	**2 grad**

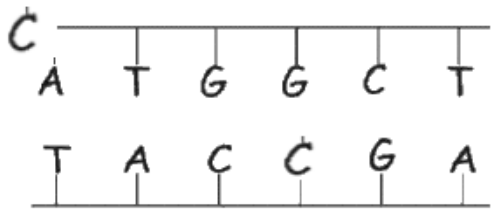
Question Number	Answer	Mark
(e)	A description that makes reference to three of the following points • use semen (from each bull) to fertilise (many / similar) cows (1) • collect / measure milk yields / eq (1) • from each daughter / offspring of these cows / mother of bull (1) • select bull with highest (average) milk yield (across all daughters) (1)	**3 exp**

Question Number	Answer	Mark
(f)	An explanation that makes reference to two of the following points: • (milk that contains) (most) fat (1) • (most) protein (1) • (most) vitamins (1) • (milk that contains) (most) calcium (1)	**2 exp**

Question Number	Answer	additional guidance	Mark
(g)(i)	A description that makes reference to four of the following points: • nucleus from (**body) cell of bull** (1) • insert this nucleus into enucleated egg cell (1) • electric shock (1) • mitosis / cell division (1) • <u>embryo</u> into uterus / womb (1) • surrogate mother (1)	**reject from udder** **reject egg cell from bull**	**4 exp**

Question Number	Answer	Mark
(g)(ii)	An explanation that makes reference to two of the following points • **genetically** identical / no **genetic** variation / same (combination of) alleles (1) • quicker process (1)	**2 exp**
		Total =18 marks

Q5.

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	

Q6.

Question Number	Answer	Mark
(a)	An answer that makes reference to two of the following points: • cytoplasm (1) • ribosomes (1) • cell membrane (1) • DNA (1)	**2**

Question Number	Answer	Mark
(b)(i)	The only correct answer is B bacteria are pathogens *A is not correct because it is not possible to conclude that the bacteria are decomposers* *C is not correct because it is not possible to conclude that the bacteria are microscopic* *D is not correct because it is not possible to conclude that the bacteria are non-living*	**1**

Question Number	Answer	Mark
(b)(ii)	An answer that makes reference to two of the following points: • vaccination / inoculated (1) • (same) antigens / (same) protein (on bacteria) (1) • secondary immune response (1) • memory cells (1) • (make) large numbers antibodies / (make) antibodies produced fast / soon / eq (1)	**4**
		Total = 7 marks

Q7.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following. • less oxygen (transported) (1) • to muscles (1) • less respiration / less ATP production / less energy release / more lactic acid / more anaerobic respiration (1)		**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	UUACCGCCGAGU (2)	one mark for one incorrect pairing or use of T instead of U e.g. UUACC**A**CCGAGU – one mark **TT**ACCGCCGAG**T** – one mark	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	A description that makes reference to four of the following. • <u>transcription</u> occurs in nucleus (1) • production of messenger RNA / mRNA (from DNA) (1) • translation occurs on ribosome / mRNA binds to ribosome / mRNA goes to ribosome (1) • tRNA brings / has amino acids (1) • codon binds to anticodon / codons are complementary to anticodons / (complementary) triplets on tRNA and mRNA bind / eq (1) • polypeptide produced / amino acids joined together /amino acid chain produced / eq (1)	**Ignore** protein produced / synthesised	**4**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to four of the following. *Pros* ***(max 3)*** • patients produce red blood cells / can exercise / are not breathless / have more energy / eq (1) • independent life / transfusions not needed / better quality of life / no need to keep visiting hospitals / eq (1) • no rejection (1) • less risk of infectious disease (from blood) (1) • permanent treatment / long lasting / lasts a lifetime / cure / works for at least 15 months (1) *Cons* ***(max 3)*** • need to spend long time in isolation (for treatment) / eq (1) • side effects (1) • small sample size / only tested on two people / needs further testing / more repeats / eq (1) • could cause mutations in DNA / cause cancers (1) • need to be tested for more than 15 months / for longer / eq (1)	**Accept** converse **Accept** blood transfusions need frequent hospital visits need to be done often **Accept** transfusions have risk of infections **Accept** transfusions need to be done for life **Accept** need 15 months / several months in hospital **Accept** few side effects from transfusions **Accept** might not work for everyone / no mention of age / sex / health state/ eq **Accept** time period is too short to tell	**4**
			(Total mark for question = 12 marks)

Q8.

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

Question Number	Answer	Mark
(b)(i)	<table><tr><th rowspan="2">Species</th><th colspan="2">Field A</th><th colspan="2">Field B</th></tr><tr><th>Number of each plant</th><th>Percentage (%) of each species</th><th>Number of each plant</th><th>Percentage (%) of each species</th></tr><tr><td>daisy</td><td>19</td><td>76</td><td>15</td><td>32</td></tr><tr><td>dandelion</td><td>4</td><td>16</td><td>18</td><td>38</td></tr><tr><td>buttercup</td><td>2</td><td>8</td><td>14</td><td>30</td></tr><tr><td>total</td><td>25</td><td></td><td>47</td><td></td></tr></table> Scores one mark for 4 and 2 (1) Scores one mark for 32(%) (1)	**2**

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

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Q9.

Question Number	Answer	Mark
(a)(i)	An answer that makes reference to the following points: • prevent loss of blood / stops bleeding (1) • prevent entry of pathogens / microbes / bacteria / viruses / fungi / eq / prevent infections (1)	**2 grad**

Question Number	Answer	Mark
(a)(ii)	An answer that makes reference to the following point: • graph showing drop at 37 °C then increase	**1 grad**

Question Number	Answer	Mark
(b)(i)	An explanation that makes reference to the following points: • (have been given) genetic material / gene / allele / DNA / genetically alter (1) • from human / different species (1)	**2 grad**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to six of the following points: • use enucleated egg / empty egg / remove nucleus from egg / eq (1) • nucleus from body cell / diploid nucleus (placed into empty egg) / fuse adult cell with empty egg (1) • use of electricity / shock (1) • cell division / mitosis (1) • embryo (1) • uterus / womb (1) • surrogate mother (1)	**Ignore** DNA	**6 exp**
			Total 11 marks

Q10.

Question Number	Answer	Additional guidance	Mark
(a)	lymphocytes / eq	**Ignore** white blood cells **Reject** phagocytes	**1**

Question Number	Answer	Additional guidance	Mark
(b)(i)	An answer that makes reference to one of the following: • both alleles expressed (1) • both alleles affect the phenotype (1) • both alleles show their characteristics / traits (1)	**Accept** both alleles work together / both alleles work together to form a third phenotype / phenotype depends upon both alleles	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	**The correct answer is D (A, B, AB and O)** A is incorrect as the cross could also produce AB and O B is incorrect as the cross could produce also AB and O C is incorrect as the cross could also produce A, and B		**1**

Question Number	Answer	Additional guidance	Mark
(c)	$4.7(4) \times 10^7$ (2)	**one mark** for 47400000 **or** 47.4 million **or** 47 million **or** other incorrect standard forms using 47(4) **Correct answer gains all marks**	**2**

Question Number	Answer	Additional guidance	Mark
(d)	An explanation that makes reference to the following: • artificial cells are not (bi)concave / red blood cells are (bi)concave (1) • artificial cells have smaller SA(:vol ratio) / red blood cells have larger SA (:vol ratio) (1) • artificial cells absorb / bind / release less oxygen / red blood cells absorb bind more oxygen / release more oxygen / eq (1) • artificial cells do not pass through capillaries easily / eq / red blood cells pass through capillaries more easily / eq (1)	**Accept** artificial cells carry less oxygen / red blood cells carry **more** oxygen **Accept** artificial cells have slower diffusion (of oxygen) / red blood cells have faster diffusion (of oxygen)	**3**

Question Number	Answer	Additional guidance	Mark
(e)	An explanation that makes reference to the following: • no platelets (1)	**Allow** no fibrinogen	**1**

Question Number	Answer	Additional guidance	Mark
(f)	An explanation that makes reference to two of the following: • no / less water uptake / eq (1) • by osmosis / due to osmotic effects (1) • so cells do not burst / eq (1)	**Accept** converse **Accept** equal water movement in and out **Accept** correct ref to water potential	**2**

Question Number	Answer	Additional guidance	Mark
(g)(i)	An explanation that makes reference to two of the following: • stem cells can divide / perform mitosis (1) • stem cells can differentiate / specialise / stem cells can become any cell / other cell types (1)	**Accept** stem cells are undifferentiated / unspecialised	**2**

Question Number	Answer	Additional guidance	Mark
(g)(ii)	An answer that makes reference to two of the following: • (there are) no antigens (present) / eq (1) • so antibodies will not be produced / no rejection / no immune response / eq (1) • any recipient / more people can receive blood group O (1)	**Accept** no surface proteins **Accept** blood group A/ B / AB can receive the blood / O is the universal donor	**2**

Question Number	Answer	Additional guidance	Mark
(h)	An answer that makes reference to two of the following: • urea (1) • digested food / named example (1) • carbon dioxide (1) • hormone / named hormone (1) • mineral / ion / (not sodium / sodium chloride / salt) / vitamins (1) • protein / clotting factors / fibrinogen / antibodies / eq (1)	e.g amino acids / glucose / fatty acids / LDLs **Accept** named minerals / vitamins	**2**

Q11.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following points: • (unspecialised cells) develop into specialised cells / cells with specific functions (1) • to produce tissues / organs / example of tissue or organ (1)	**Allow** examples of specific cell types e.g. muscle cells / bone cells	**2**

Question Number	Answer	Mark
(b) (i)	The only correct answer is D are found in some tissues and organs A is not correct as they can divide B is not correct as do not divide my meiosis C is not correct as cannot become all cell types	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • cells from embryos can make any cell type / many more cell types / adult stem cells can become fewer cell types (1) • ethical issues about the use of embryonic cells / eq (1)	**Allow** converse for adult cells for both MPs **Allow** only stem cells that come from embryos are totipotent / eq **Allow** people object to killing embryos / embryos are potential human lives / eq **Allow** embryo cells can become tumours	**2**
			Total 5 marks

Q12.

Question Number	Answer	Additional guidance	Mark
(a)(i)	**B is the correct answer** A is incorrect as there are no palisade cells present C is incorrect as there are no palisade cells present D is incorrect as there are no palisade cells present		**1**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	**C is the correct answer (low humidity high temperature)** A is incorrect because high humidity would reduce transpiration B is incorrect because high humidity would reduce transpiration D is incorrect because low temperature would reduce transpiration		**1**

Question Number	Answer	Additional guidance	Mark
(b)(i)	(concentration of) carbon dioxide (1)		**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to two of: • temperature (1) • light (1) • mineral ions / pH / soil / eq (1) • water / humidity (1)	**Accept** light intensity / wavelength / colour	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	140 (3)	**Accept** answers between 139 and 140 for 3 marks **one mark** for 70 **AND** **one mark** for area between 0.50 and 0.503 **Correct answer gains all marks**	**3**

Question Number	Answer	Additional guidance	Mark
(b)(iv)	A discussion that makes reference to four of the following: 1. carbon dioxide is needed in photosynthesis / eq (1) 2. fewer stomata may reduce uptake of carbon dioxide / less gas exchange (1) 3. fewer stomata needed if carbon dioxide is high / higher diffusion gradient of carbon dioxide (1) 4. (fewer stomata) reduces water loss / transpiration / evaporation / eq (1) 5. (less transpiration) prevents wilting (1) 6. (less transpiration) reduces mineral transport (to leaves) / reduces mineral absorption / eq (1) 7. less magnesium for chlorophyll / less nitrate for amino acids / eq (1) 8. (less transpiration) reduces cooling / eq (1)	**Accept** high carbon dioxide generates high diffusion gradient **Ignore** nutrients **Accept** named minerals **Accept** other correct minerals and functions less uptake of magnesium to make chlorophyll = 2 marks	**4**

Q13.

Question Number	Answer	Mark
(a)	spinal cord / chord	**1 cler**

Question Number	Answer	Mark
(b)(i)	C 0.5 *A is incorrect because 0.5 is the answer* *B is incorrect because 0.5 is the answer* *D is incorrect because 0.5 is the answer*	**1 comp**

Question Number	Answer	Mark
(b)(ii)	A diagram that makes reference to the following points: • one circle and one square shown (1) • two shapes unshaded (1)	**2 grad**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to three of the following points: • prevents translation / no translation (1) • prevents ribosomes attaching (to mRNA) (1) • prevents / no, codon binding to anticodon (1) • prevents amino acids joining / amino acid chain not made (1) • huntingtin / protein / polypeptide not made (1)	**Allow** tRNA does not bind to mRNA **Allow** less huntingtin / protein made	**3 exp**
			Total 7 marks

Q14.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to three of the following: • (selective) reabsorption (1) • in proximal convoluted tubule (1) • by active transport (1) • using energy / ATP (1)	**Accept** absorbed into blood **Accept** pct / first convoluted tubule	**3**

Question Number	Answer	Additional guidance	Mark
(b)(i)	3.9 (2)	**one mark** for 3.86... **OR** for 1700 ÷ 440 **Correct answer gains all marks**	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following: • water is absorbed (1) • in collecting duct (1) • by osmosis (1) • ADH was present (1)	**Accept** urea is not absorbed **Accept** (water absorbed) in loop of Henlé / distal convoluted tubule	**2**

Question Number	Answer	Additional guidance	Mark
(c)(i)	A description that makes reference to two of the following: • biuret (reagent) / sodium hydroxide + copper sulfate (1) • lilac / purple / pink (1)	**Accept** uristicks / eq (1) colour change to blue or green (1)	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to two of the following • protein is a large molecule (1) • high pressure forces protein / eq (1) • out of glomerulus / out of capillaries / through membranes / into (Bowman's) capsule / into glomerular filtrate (1) • the protein is not (re)absorbed (by nephron) (1)	**Accept** pushes / squeezes	**2**

Q15.

Question Number	Answer	additional guidance	Mark
(a)	• salt concentration / concentration of salt (solution) /sodium chloride concentration / percentage sodium chloride / percentage salt solution / water potential of solution / eq (1)	must have concentration , percentage or water potential not just salt solution	**1**

Question Number	Answer	additional guidance	Mark
(b)	• volume of (diluted) blood / volume of solution / time solution left for / concentration of (diluted) blood sample / concentration of blood plasma / eq	not volume of water ignore amount	**1**

Question Number	Answer	Mark
(c)(i)	An explanation that makes reference to two of the following: • no cells in distilled water / A / cells burst / explode / eq (1) • haemoglobin dissolves / eq (1) • cells in present / cells unchanged in other B / 1% / c? 3% /eq(1)	**2**

Question Number	Answer	Mark
(c)(ii)	An explanation that makes reference to two the following: • water enters red cells in A distilled water / eq (1) • water enters and leaves / no movement in B 1% / eq (1) • water leaves red cells in C 3% / eq (1) • (due to) osmosis (1)	**2**

Question Number	Answer	additional guidance	Mark
(d)	An description that makes reference to the following: • Tube A no red cells (layer) / no bottom layer / red colour throughout tube / more 'plasma' / no platelets / no separation into layers / no layers / no cell layers / eq (1) • Tube B / C normal cell layers / normal (layer) of red cells / eq (1)	allow slightly fewer red cells / smaller layer in C than normal	**2**

Q16.

Question Number	Answer	Mark
(a) (i)	increase in temperature 15 (1)	**1**
(ii)	energy released 20 × 4.2 × 15 1260 (J) (1)	**1**
(iii)	energy released by 1 g 1260 ÷ 0.20 = 6300 (J) (1)	**1**

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to five of the following points: • student value much lower / eq (1) • not all energy released from food (1) • not burnt in oxygen / not completely combusted (1) • energy / heat not all transferred to tube / some energy / heat lost (to atmosphere)/ eq (1) • energy lost / heat to atmosphere when moving food / flame (1) • energy lost as light / eq (1) • flame / affected by draught / eq (1) • water not evenly heated/ not stirred / eq (1) • only repeated 3 times / eq (1) • different / distances from tube / distance not fixed / eq (1) • variation in results / parallax error / eq (1)	allow converse for published value	**5**

Question Number	Answer	Mark
(c)	An answer that makes reference to two of the following points • fix position of food / clamp needle (1) • use stirrer/ stir contents / eq (1) • use heat shield / eq (1) • use lid / eq (1) • insulate tube / eq (1)	**2**

Q17.

Question Number	Answer	additional guidance	Mark
(a)	An answer that makes reference to the following points: • carbohydrate / named carbohydrate (1) • oxygen (1) • higher / greater / more (1) • carbon dioxide (1) • equal / the same / balanced (1)	**allow** carbohydrate / named carbohydrate	**5 grad**

Question Number	Answer	additional guidance	Mark
(b)	A description that makes reference to three of the following points: • (how light intensity is varied)foil / muslin / move lamp / eq (1) • leaf in test tube with bung / use flask with delivery tube/eq (1) • (look for colour change after) same/ stated time (1) • same size / species / type / surface area /eq (1) • same temperature / same <u>volume</u> of indicator (1) • correct colour change so goes yellow with increased CO_2 in dark / goes dark red/ red/ purple with reduced CO_2 in light /eq (1)	allow light and dark	**3 exp**
		Total 8 marks	

Q18.

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**

Q19.

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

Q20.

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)