PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

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

SCORE	PERCENTAGE
/290	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Mark
(a)(i)	The only correct answer is D nucleoid A is not correct as it is the flagellum B is not correct as it is the cell membrane C is not correct as it is the cell wall	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is B cell membrane A is not correct as it is a flagellum D is not correct as it is the nucleoid E is not correct as it is a plasmid	**1**

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to three of the following points: • bacterium has no chloroplasts (1) • bacterium has no nucleus (1) • bacterium has no (large) vacuole (1) • bacterium has plasmids (1) • bacterium has flagella (1) • bacterium has no mitochondria (1)	allow converse for plant cell ignore chlorophyll no credit for reference to structure A etc	**3**
			Total = 5 marks

Q2.

Question Number	Answer	Additional guidance	Mark
(a)(i)	X: stigma (1) Y: anther (1)		**2**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to three of the following: • insect (pollination) / bee / eq (1) • (because it has) large petals / eq (1) • (and) Y / anthers / stamen, within the flower / not hanging out / eq (1) • (and) X / stigma within the flower / not feathery / not hanging out / eq (1)	**Ignore** colours / scents / bright / nectar(y) **Allow** the structures given in part (i) are within the petals if they are correct	**3**

Question Number	Answer	Additional guidance	Mark
(b)(i)	*ungerminated seeds*: starch (1) *germinating seeds*: starch and, glucose / sugar / maltose (1)	**Reject** if additional incorrect substances listed e.g. protein, fats **Reject** if additional incorrect substances listed e.g. protein, fats	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to three of the following: *In ungerminated seeds:* • starch is for (energy) storage (1) • as it is insoluble / does not affect osmosis / eq (1) *In germinating seeds:* • (water activates) enzymes / amylase / carbohydrase (1) • digests / converts / breaks down starch into maltose / glucose / sugar (1) • (glucose is used in) respiration / for energy (1)	**Allow** converse throughout **Allow** starch is a store **Allow** starch not broken down into glucose in ungerminated seeds **Allow** less / no respiration in ungerminated seed	**3**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to two of the following: • allows oxygen in (1) • for germination / respiration / eq (1) • allows carbon dioxide to escape / eq (1)	**Ignore** oxygen and carbon dioxide **Reject** if carbon dioxide <u>for</u> respiration **Ignore** light / references to photosynthesis	**2**

Q3.

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

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

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

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

Q4.

Question Number	Answer	Mark
(a)(i)	An explanation that makes reference to three of the following points: • oxygen (1) • glucose (1) • respiration (1) • energy / ATP (1)	**3 exp**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to two of the following points: • antibodies (from mother) (1) • (bind to) antigens (1) • to kill bacteria / pathogen / virus eq (1)	**Allow** destroy / bind to pathogens / clump pathogens / mark / label pathogen	**2 grad**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to two of the following points: • fetus is female / a girl (1) • cells contain 46 chromosomes / 23 pairs / has a diploid number / has two sets of chromosomes / normal number of chromosomes / eq (1) • chromosomes have different lengths / sizes / shapes (1)	**Allow** does not have Down's syndrome /	**2 exp**

Question Number	Answer	Mark
(c)(i)	An answer that makes reference to four of the following points: • calcium for bone / teeth growth / bone / teeth development / prevent rickets (1) • protein to grow / for enzymes / antibodies / eq (1) • iron for haemoglobin / red blood cells / prevent anaemia (1) • vitamin D for bone growth / bone development / calcium absorption / strong bones (1) • more energy as baby is heavy / mother becomes heavy / more energy for fetal development / to carry baby / eq (1)	**4 exp**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	• 9 = 50% more (1) • 100% = 9 × 2 = 18 (1) • 18 + 9 = 27 (1)	**Allow** one mark for 0.5 / 50% / ½ / times 2 **Allow** 18 for two marks Award full marks for correct numerical answer without working	**3 exp**
			Total 14

Q5.

Question Number	Answer	Mark
(a)	The only correct answer is C Y A is not correct as W is not adrenal gland B is not correct as X is not adrenal gland D is not correct as Z is not adrenal gland	**1**

Question Number	Answer	Mark
(b)	• several / different tissues carrying out a / one / particular, function / purpose / eq (1)	**1**

Question Number	Answer	Mark
(c)	An answer that makes reference to five of the following points: • (more) light into eye / retina (1) • to see danger / be more aware of surroundings / eq (1) • more blood to lungs (1) • more blood to (leg) muscles / blood diverted to (leg) muscles (1) • more oxygen (to muscles) (1) • more glucose (to muscles / in blood) (1) • more respiration / less anaerobic respiration / less lactic acid produced (1) • more ATP / energy (1) • run faster / escape / contract muscles more / eq (1)	**5**
		Total 7 marks

Q6.

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

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

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

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

Q7.

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

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

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

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

Q8.

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

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

Q9.

Question Number	Answer	Mark
(a)	D $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ *A is not the correct equation for aerobic respiration* *B is not the correct equation for aerobic respiration* *C is not the correct equation for aerobic respiration*	**1 comp**

Question Number	Answer	additional guidance	Mark
(b)(i)	An explanation that makes reference to two of the following points: • moves left / towards locust (1) • carbon dioxide produced by insect absorbed by KOH / filter paper (1) • oxygen (used by insect) (1) • in respiration (1)	 ignore air ignore breathing /inhaling/eq	**2 Expert**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An answer that makes reference to six of the following points: • size / mass /(of locusts)/eq (1) • (more cells) (more) respiration (1) or • movement / size of flask /eq (1) • more room for movement means more respiration (1) or • volume / concentration of KOH / size of filter paper (1) • affects carbon dioxide absorption /eq (1) or	 mark 3 variables to maximise score ignore amount but allow stated volume	**6 exp**

	• temperature (1) • affects enzymes / increase kinetic energy / particle movement /eq (1) or • time / duration (1) • more time to respire / more oxygen absorbed (1)	ignore time of day / light / oxygen / humidity etc	

Question Number	Answer	Mark
(c)(i)	• 5.3 or 5.27 or 5.267 or 5.26 recurring	**1 grad**

Question Number	Answer	Mark
(c)(ii)	An answer that makes reference to the following points: • not reliable / reliability can be increased /eq (1) • not enough repeats / only three results / needs to be repeated (1) • one result is <u>anomalous</u> / male 3 result is <u>anomalous</u> (1) • more variation within sex than between sexes / eq (1)	**3 exp** ignore not repeated
		Total 13 marks

Q10.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to the following points: • glucose • carbon dioxide • water all 3 correct scores 2 marks 2 or 1 correct scores 1 mark	Allow correct formulae	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to three of the following points: • mouse is smaller / less body mass (1) • larger surface area to volume ratio (1) • heat loss / eq (1) • maintain body temperature (1) • (more) respiration / higher metabolic rate (1)	Allow converse for human	**3 exp**

Question Number	Answer	Mark
(c)(i)	The only correct answer is C pulmonary vein A is not correct as X it is not the aorta B is not correct as X is not the pulmonary artery D is not correct as X is not the vena cava	**1**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that makes reference to one of the following points: • human heart has 4 chambers / frog heart has 3 chambers (1) • frog heart has one ventricle / human heart has two ventricles (1) • no septum / no division between ventricles / human has septum (1) • frog artery splits into two / frog only has one artery leaving the heart (1) • frog heart has no semi lunar valves (1)		**1**

Question Number	Answer	Mark
(c)(iii)	An answer that makes reference to five of the following points: • one ventricle (1) • oxygenated and deoxygenated blood mixes / blood from body mixes with blood from lung / eq (1) • less deoxygenated blood goes to lungs / some oxygenated blood to lungs / eq (1) • less efficient gas exchange in lungs / eq (1) • no semi-lunar valves (1) • backflow of blood into ventricle (1) • less oxygenated blood to body / some deoxygenated blood to body / less oxygen (to body) / eq (1) • less respiration / more anaerobic respiration (1) • lactic acid accumulation / less ATP made / less energy released (1)	**5**
	Total 12 marks	

Q11.

Question Number	Answer	Mark
(a)(i)	An explanation that makes reference to the following: • peristalsis (1) • (waves of) muscular contractions (1)	**2**

Question Number	Answer	Mark
(a)(ii)	C liver A is incorrect because bile is not made in the stomach B is incorrect because bile is not made in the pancreas D is incorrect because bile is not made in the gall bladder	**1**

Question Number	Answer	Mark
(a)(iii)	An explanation that makes reference to three of the following: • bile neutralises stomach acid / food / chyme / eq (1) • to set the optimum pH for enzymes (1) • bile emulsifies fats / breaks up fats into smaller droplets / eq (1) • to increase the surface area (for digestion) (1)	**3**

Question Number	Answer	Additional guidance	Mark
(b)(i)	0.11 (2)	One mark for 2.2 or 8 - 5.8 One mark for dividing by 20 **Award full marks for correct answer**	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following: • (without inhibitor) pH falls faster / falls more / becomes more acidic (without inhibitor) / bigger change in pH / eq (1) • because fats are broken down into fatty acids (and glycerol) (1) • inhibitor causes less acid to be produced (1)	**Accept** converse **Accept** converse	**2**

Question Number	Answer	Additional guidance	Mark
(b) (iii)	A discussion that makes reference to five of the following: 1. lower blood lipid / fat when taking inhibitor / eq (1) 2. (because) less fat is absorbed (when taking inhibitor) (1) 3. fat needs to be broken down into fatty acids (to be absorbed) (1) 4. less fat would be stored / deposited around the body (1) 5. one person who did not take inhibitor did not have increase in lipid / fat in blood / eq (1) 6. two / more / some suffered side effects when taking the drug / eq (1) 7. side effects may be due to the olive oil / may not be caused by the drug (1) 8. sample size is only very small / eq (1) 9. there is no information about diet / other food / activity / eq (1) 10. no information on age / sex / health / diabetes / eq (1) 11. no information on change of mass of people / experiment does not actually assess obesity / / eq (1) 12. starting levels of blood lipid were equal (so were controlled) (1)	**Accept** drug causes side effects / abdominal pains **Accept** one person had side effects without drug **Accept** other factors may affect obesity	**5**

Q12.

Question Number	Answer	additional guidance	Mark
(a)	• only expressed / seen in phenotype of homozygous / requires two / both (copies) to be expressed in phenotype / only seen / expressed / shown if no dominant allele present / not expressed if dominant allele present / eq (1)	allow only expressed if aa / cc etc	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	• Parents Aa and Aa (1) • gametes A and a (1) • offspring genotypes AA Aa aa (1) • offspring phenotypes or ratio 3 no symptoms to 1 alkaptonuria / eq (1) eg parents AN and AN gametes A and N offspring AA AN AN NN	allow other symbols allow different letters eg A and N if cross works NOT X and Y gametes circled or in Punnet or separated allow ecf for max 2 marks for correct gametes and offspring ie mp 2 and 3 allow full marks for Punnet square	**4**

Question Number	Answer	Mark
(b)(ii)	0.375/ 37.5% / 3/8 / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(c)(i)	did not receive the drug / no treatment / eq (1)	current best treatment / placebo	**1**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that that makes reference to five of the following points: yes • control group so valid study /eq (1) • showed improvement /reduced symptoms / activity / life / eq (1) • quicker to stand up/eq (1) • improved distance walked/ eq (1) No because • small group size / should be tested on more people / repeat study / eq (1) • not all finished study/ eq (1) • adverse / side effects / eq (1) • one died in drug group /eq (1) • no information on age / mass / sex / other health conditions / activity / exercise / eq (1)	allow converse for control	**5**

Question Number	Answer	additional guidance	Mark
(d)	An answer that that makes reference to two of the following points: • patients may not know what foods contain these / what proteins contain these/ eq (1) • present in many / most foods / most proteins /eq (1) • proteins required for growth / repair / eq (1)	allow contain these proteins allow provide essential amino acids	**2**

Q13.

Question Number	Answer	additional guidance	Mark
(a)(i)	• agouti (1) • all offspring are agouti / no offspring are black / as allele always expressed / shown / visible in all phenotype / expressed in heterozygous / black allele not expressed / /eq (1)	allow ignore passed on as black allele also passed on otherwise, all the black parents would need to be heterozygous and even then only 0.5 probability that each is black / eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(a)(ii)	An answer that makes reference to two the following: • parent genotypes Aa and Aa (1) • parent gametes (1) A or a A or a • offspring genotypes AA Aa aa (1) • offspring phenotypes labelled or ratio 3 : 1 (1)	allow from Punnett square allow other letters allow A and b eg Ab x Ab A or b A or b AA Ab bb ignore X and Y ECF max 2 for mp 2 gametes and mp 3 genotypes of offspring	**4**

Question Number	Answer	additional guidance	Mark
(a)(iii)	• probability of agouti / probability of male • multiplied ⅜ or 0.375 or 37.5% (2)	allow full marks for correct answer no working 1 mark for 0.5 or ½ or 50% or 0.75 or ¾ or 75%	**2**

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

Question Number	Answer	additional guidance	Mark
(b)(ii)	An explanation that makes reference to three of the following: • more <u>adrenaline</u> produced / affects amount of <u>adrenaline</u> produced / eq (1) • affects heart rate / fear response / fight or flight idea /eq (1) • neurotransmitter levels affects <u>synapses</u> / eq (1) • quicker reflex / reaction time / quicker response / more responsive / eq (1)	allow converse for smaller adrenal and less neurotransmitter	**3**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to three of the following: • iris does not block / blocks less light / eq (1) • so pupil change / dilate / constrict has little / no effect / (iris) cannot regulate / control amount of light entering eye / eq (1) • <u>too much</u> light / <u>more light</u> enters eye / falls on retina / eq (1) • poor vision / damages retina / (goes) blind / eq (1)	not just iris lets light through	**3**
			total 15 marks

Q14.

Question Number	Answer	additional guidance	Mark
(a)	• (the allele coding for) grey	allow grey mouse allow grey male mouse	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	An answer that makes reference to the following points: • parent genotypes aa x Aa (1) • correct gametes for parents a and a or A (1) • offspring genotypes aa and Aa (1) • phenotypes white (aa) and grey (Aa) (1)	allow G and W allow full marks from Punnet square gametes must be clearly shown separated or in circles or in Punnet square allow ecf for wrong parent genotypes gametes and offspring mark for 2 max	**4**

Question Number	Answer	additional guidance	Mark
(b)(ii)	an answer that makes reference to one of the following: • fertilisation is random / combination of gametes is random / eq (1) • due / by chance / to chance / eq (1)	it is a probability doesn't happen every time	**1**

Question Number	Answer	additional guidance	Mark
(b)(iii)	• probability of male 0.5 / eq • probability of white 0.5/eq so combined = 0.5 x 0.5 0.25 / 25% / ¼ (2)	allow 1 mark for 0.5 /eq full marks for correct answer no working	**2**

Question Number	Answer	additional guidance	Mark
(c)	A description that makes reference to three of the following points: • white blood cells (1) • phagocytes (1) • (phagocytes) ingesting / engulfing / pathogens / eq (1) • lymphocytes (1) • (lymphocytes) releasing antibodies (1)	phagocytes release antibodies scores mp 2 but not mp5 white blood cells produce antibodies scores mp1 and mp 5	**3**

Q15.

Question number	Answer	Mark
(a)(i)	A graph showing: • y-axis scale half grid and linear (1) • bars drawn with lines (1) • x-axis labelled age and y-axis labelled mean maximum, and x-axis units as years and y-axis units as dm^3 (1) • bars plotted correctly (1) • key males/females (1)	**5**

Question number	Answer	Mark
(a)(ii)	Subtraction 5.2 − 2.1 = 3.1 (1)	**1**

Question number	Answer	Mark
(a)(iii)	An explanation that makes reference to three of the following points: • mean maximum lung volume for males is greater than females for 16 and 25 (1) • males grow more than females (1) • greater difference from puberty/equivalent (1) • males continue to grow from 16 to 25 (1)	**3**

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

Question number	Answer	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • different body mass/size (1) • taking more exercise/equivalent (1) • smoking (1) • asthma/lung disease/equivalent (1) • genetics/inheritance (1)	2

(Total for question = 12 marks)

Q16.

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

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

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

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

Q17.

Question Number	Answer	Mark
(a)	**Example of process** / **Name of process** plants with a short growing season survive drought — **natural selection** growth of algae in rivers polluted by fertiliser — eutrophication (1) pollen transferred from one plant to another by an insect — insect pollination (1) absorption of nitrate ions from soil using ATP — active transport (1)	3

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

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

Q18.

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

Question Number	Answer	additional guidance	Mark
(b)(i)	A description that makes reference to **three** of the following points: • measure out one m² / use quadrat / eq (1) • place randomly / eq (1) • cut / harvest grass / remove plants / eq (1) • repeat / use quadrat**s** /eq (1) • measure mass/ weight after one year / eq (1)	allow crops not repeat several times a year allow find difference between start and end of year idea	**3**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to 5 of the following points: • S y axis scale linear and half the grid (1) • axis labelled (mean) net primary productivity (1) • Units in g per m²/ eq (1) • P bars plotted correctly within one (1) • K key / each bar labelled with ecosystem type (1)	line graph scores 4 max **if scale non-linear no S or P**	**5**

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

Q19.

Question number	Answer	Mark
(a)(i)	An explanation that makes reference to the following five points: • training improves performance by increasing the number of capillaries (1) • better supply of oxygen/aerobic (1) • better supply of glucose (1) • respiration/energy/ATP (1) • muscle contraction (1) • better removal of lactic acid/carbon dioxide (1) • can run for longer/equivalent (1)	**5**

Question number	Answer	Mark
(a)(ii)	An answer that makes reference to two of the following points: • use more people (1) • extend training period (1) • compare different ages/genders (1)	2

Question number	Answer	Additional guidance	Mark
(b)(i)	Multiplication • 0.008 (1) Division • 25 ÷ 0.008 = 3125 = 3100 (1)	award full marks for correct numerical answer without working accept 3125 the final answer should reflect the precision of the least precise data (in this case two sig figs)	2

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • wall contains muscle/elastic tissue (1) • blood is under high pressure from the left ventricle (1) • aorta needs to expand (1) • need to transport more blood (1)	allow converse	2

(Total for question = 11 marks)

Q20.

Question Number	Answer	Mark
(a)(i)		**5**

statement	letter
contains the least carbon dioxide	A
contains the most glucose after a meal	G
contains the least oxygen	J
contains the least urea	F
contains blood at the highest pressure	B

Question Number	Answer	additional guidance	Mark
(a)(ii)	An answer that makes reference to two of the following points: A / pV has • thin(ner) wall (1) • <u>less</u> muscle (1) • <u>less</u> elastic tissue (1) • wide(r) / big(er) / lumen (1)	allow converse for J allow thin allow wide ignore ref to valves	**2**

Question Number	Answer	Mark
(b)	An answer that makes reference to five of the following points: • more (capillaries to transport) oxygen / glucose (1) • more (aerobic) respiration / less <u>anaerobic</u> respiration (1) • more ATP/ more energy (1) • (more) muscle contraction (1) • less lactic acid (1) • effective for long distance events / ineffective for power events / type of performance not specified /only leg muscle sampled / eq(1) • other factor(s) / age / lung (capacity) / heart (rate) named other factors affect performance (1) • need to test more than one person / not repeated / eq (1)	**5**
		Total 12 marks

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Q21.

Question Number	Answer	Mark
(a)	An explanation that makes reference to four of the following points: • glucose (transported) from intestine / ileum / liver / glucose (transported) to body cells / to liver (1) • amino acids (transported) from ileum / liver / amino acids (transported) to body cells / liver (1) • fatty acids / vitamins / minerals / eq (transported) from intestine / fatty acids / vitamins / minerals / eq (transported) to cells (1) • hormones (transported) from (endocrine) glands / hormones (transported) to organs / tissues (1) • urea (transported) from liver / urea (transported) to kidney (1) • carbon dioxide (transported) from cells / carbon dioxide (transported) to lungs (1) • antibodies (transported) to site of infection / eq (1) • fibrinogen / clotting proteins (transported) to wound / eq (1)	**4**

Question Number	Answer	Additional guidance	Mark
(b)(i)	• measurement of diagram = 58 mm / 5.8 cm • divide diagram measurement in mm by 0.013 • answer 4462 (2)	Award full marks for correct numerical answer without working Accept answers between 4307 to 4616 Award one mark for 56 mm up to 60 mm or 5.6 cm up to 6.0 cm or award one mark for a division by 0.013	**2**

Question Number	Answer	Mark
(b)(ii)	• nucleus (1)	**1**

Question Number	Answer	Mark
(b)(iii)	An answer that makes reference to • engulf / ingest / eq bacteria / pathogen / microbe / eq (1) • digest / break down (1) • enzymes (1)	**2**

Question Number	Answer	Mark
(c)	An answer that makes reference to Biuret / add NaOH and CuSO4 / albustix /eq (1)	**1**
		Total 10 marks

Q22.

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

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

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

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

Q23.

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

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

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

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

Q24.

Question Number	Answer	Mark
(a)(i)	The only correct answer is B M is the cell wall. A is not the answer as M is not the cell membrane C is not the answer as M is not the nucleus D is not the answer as M is not the vacuole	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is **C** N is the cytoplasm. A is not the answer as N is not the cell membrane B is not the answer as N is not the cell wall D is not the answer as N is not the vacuole	**1**

Question Number	Answer	Mark
(b)(i)	• sodium chloride (solution) / salt solution / bathing solution / eq (1)	**1**

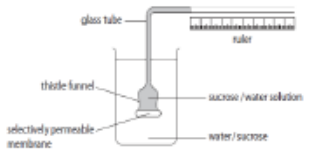
Question Number	Answer	additional guidance	Mark
(b)(ii)	An explanation that makes reference to four of the following in distilled water • water enters cell / eq(1) • by osmosis (1) • from dilute solution to more concentrated solution / from high(er) water potential to low(er) water potential / water / outside has a higher water potential / eq (1) • cytoplasm pushed against cell membrane/ cell wall / eq (1) • cell is turgid / (1)	allow converse for cell in salt solution water exits allow as salt soln / outside has lower water potential allow **high conc of water** to **low conc of water** .cytoplasm /cell membrane shrinks away . cell plasmolysed / flaccid	**4**

Question Number	Answer	additional guidance	Mark
(c)	A description that makes reference to four of the following		**4**
	• (immerse) onion epidermis /rhubarb epidermis / named suitable plant tissues / leaf epidermis / eq (1)	allow 'layer of onion' 'onion skin cells' 'rhubarb stem' *Cladophora* / / toadflax /eq not just leaf	
	• same volume of solutions / stated volume of solutions /eq (1)		
	• <u>at least two</u> different concentrations of salt solution / eq (1)	not just water and salt solution	
	• leave cells for stated time / same time / eq (1)	if describe potato discs expt can score mp 2 3 4 so 3 max	
	• (observe / draw / photograph under) <u>microscope</u> / eq (1)		
			total 11 marks

Q25.

Question number	Answer	Mark
(a)(i)	D	**1**

Question number	Answer	Mark
(a)(ii)	A	**1**

Question number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to the following four points: • beaker containing water/sucrose/thistle funnel containing sucrose/water (1) • selectively permeable membrane separating sucrose from water (1) • ruler by tube of thistle funnel (1) • level of liquid shown in the tube (1)		**4**

Question number	Answer	Additional guidance	Mark
(c)	Identification • 42 (1) Division • 42 ÷ 60 = 0.70 (1)	award full marks for correct numerical answer without working	**2**

(Total for question = 8 marks)

Q26.

Question Number	Answer	Mark
(a)	• nucleus	**1** **cler**

Question Number	Answer	Additional guidance	Mark
(b)	convert length into µm 60 mm = 60 000 µm (1) division 60 000 ÷ 6 = ×10 000 (1)	award full marks for correct numerical answer without working 1 mark for 60 000 or dividing by 6	**2** **exp**

Question Number	Answer	Mark
(c)(i)	A 0.33 *B is not correct as 3 is not the mean* *C is not correct as 10 000 is not the mean* *D is not correct as 75 000 000 is not the mean*	**1 comp**

Question Number	Answer	additional guidance	Mark
(c)(ii)	An answer that makes reference to the following: • sperm smaller / sperm is small cell / eq (1) • fewer (total) mitochondria (per cell) (1) • more mitochondria per volume / per μm^3 (1) • uses <u>energy</u> to swim / move / get to /eq (1) • fertilise egg (1)	**allow converse for egg** larger more fewer does not move egg is fertilised	**3 exp**
			Total 7 marks

Q27.

Question number	Answer	Additional guidance	Mark
(a)(i)	A description that makes reference to the following two points: • release of energy (1) • within cells (1)	reject production of energy	**2**

Question number	Answer	Additional guidance	Mark
(a)(ii)	A description that makes reference to the following points: • keeping named characteristic, e.g. temperature (1) • constant within narrow range (1)	allow blood glucose/carbon dioxide/blood pressure/water content/equivalent	2

Question number	Answer	Mark
(b)	C	1

Question number	Answer	Mark
(c)	C	1

Q28.

Question number	Answer	Additional guidance	Mark
(a)(i)	A description that makes reference to the following two points: • release of energy (1) • within cells (1)	reject production of energy	2

Question number	Answer	Additional guidance	Mark
(a)(ii)	A description that makes reference to the following points: • keeping named characteristic, e.g. temperature (1) • constant within narrow range (1)	allow blood glucose/carbon dioxide/blood pressure/water content/equivalent	2

Question number	Answer	Mark
(b)	C	1

Question number	Answer	Mark
(c)	C	1