PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS (PACK 3)

SCORE	PERCENTAGE
/249	%

STEMUP

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Mark Scheme

Q1.

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

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

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

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

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

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

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

Q2.

Question Number	Answer	Mark
(a)	A the left ventricle is thick to pump blood to the body *B is not correct because the left ventricle wall is not thin* *C is not correct because the right ventricle pumps to the lungs* *D is not correct because the right ventricle wall is not thick*	**1**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to three of the following points: • ventricle (wall) is thinner / ventricle (wall) has less muscle (1) • coronary artery is blocked / coronary artery has less blood passing through / eq (1) • less oxygen / glucose (1) • less (aerobic) respiration / anaerobic respiration occurs / not enough energy / less ATP (1) • cell / muscle / tissue death (1)	**Ignore** heart dies	**3**

Question Number	Answer	Additional guidance	Mark
(c)(i)	An explanation that makes reference to three of the following points: • (stem cells can) differentiate / can become muscle cells / can make any cell types / stem cells are undifferentiated / unspecialised cells / eq (1) • stem cells divide / (carry out) mitosis / cell division (1)	**Allow** stems cells are pluripotent / totipotent / multipotent	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that makes reference to two of the following points: • cells have same DNA / genes / alleles / eq (1) • same antigens / tissue type / blood group (1) • less risk of rejection / not rejected (1) • no immune response / by immune system / no need to take immunosuppressants (1) • no risk of infection / disease spread (1)	No immune rejection = two marks	**2**

Q3.

Question Number	Answer	Additional guidance	Mark
(a)	• Less able to contract / pump / beat / eq (1)	**Allow** heart has to work harder to push blood	**1**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that refers to three of the following points • pump / push blood into ventricles (1) • receive deoxygenated blood / blood from body / blood from vena cava (1) • receive oxygenated blood / blood from lungs / blood from pulmonary vein (1)	**Ignore** blood passes from atria ventricles without idea of actively being moved **Allow** one mark for receive blood if no MP2 or MP3	**3**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that refers to two of the following points • low(er) pressure (1) • low(er) oxygen / less oxygenated / deoxygenated (1) • high(er) carbon dioxide (1)	**Allow** converse for all mark points	**2**

Question Number	Answer	Additional guidance	Mark
(d)	An explanation that refers to three of the following points **LUNG FUNCTION** • oxygenates blood (1) • removes carbon dioxide (1) **HEART FUNCTION** • transport / pump, blood around body (1) • (enable tissues / cells to) respire (1) • allows surgeon to operate on heart / connect new heart (1)	**Allow** aerates blood **Allow** transport glucose / nutrients, around body / to cells	**3**

Question Number	Answer	Additional guidance	Mark
(e)	An explanation that refers to two of the following points • prevents rejection (1) • because antigens / eq, are recognised / are different (1) • stops action of immune system / reduces immune response / reduces lymphocyte action / stops antibody production /prevents white blood cells activity / eq (1)	**Ignore** attack stops immune system rejecting heart = 2 marks **Ignore** suppress **Allow** reduced phagocytosis	**2**

Question Number	Answer	Additional guidance	Mark
(f)	An explanation that refers to two of the following points • less oxygen in blood / less efficient gas exchange (1) • narrows arteries / damages artery walls / increased risk of fat in artery walls / atheroma / increased risk of heart disease / eq (1) • carbon monoxide binds with haemoglobin / red blood cells (1) • (increased risk of) blood clotting / strokes (1) • (increases risk of) higher blood pressure (1)		**2**

Question Number	Answer	Additional guidance	Mark
(g)	• contains **all** required nutrients /food groups in the correct proportion / amounts (1)	**Allow** all the food groups in correct amounts / eq **Allow** has carbohydrates, protein, fats, vitamins minerals, fibre and (water) in right amounts **Ignore** balance must contain **all** or complete list (except water) and correct proportion	**1**

Question Number	Answer	Additional guidance	Mark
(h)	150 (2)	75 x 200 /100 75/100 x 200 0.75 x 200 **Allow** 2 marks for 150 **one mark** for use of 75 and 200	**2**

Question Number	Answer	Additional guidance	Mark
(i)	• puts more pressure on heart / (increased risk of) heart attack / causes heart rate to increase / makes heart beat harder / increases blood pressure / eq (1)	**Allow to** not strain the heart / too stressful on heart	**1**

Question Number	Answer	Additional guidance	Mark
(j)	• immune system is weaker / less able to produce antibodies / less immune response / eq	**Allow** because they are taking immunosuppressants	**1**
			Total 18 marks

Q4.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to one of the following points: • balanced diet / eq (1) • less lipid / fat / oil / eq (1) • less foods that contain cholesterol eg eat fewer eggs that contain cholesterol /eq (1)	oily / fatty not just eat less cholesterol/ eat fewer eggs	**1**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that includes : • maintains water level/ water of body / body fluids / plasma / blood / cells / eq (1) • maintains **salt and water levels / salt and water balance / concentration / water potential** in body / body fluids / blood/ plasma cells / eq (2)	controls water / water levels in body = 1 mark controls water and dissolved materials / solutes in body = 2 marks	**2**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to two of the following points: • (body produces) urea / salt / toxins / water / metabolic waste / eq • need to be excreted / removed / prevent build up / prevent poisoning / become toxic eq (1) • kidneys cannot recover / no cure / incurable / (until) transplant /eq (1)	Not urine cannot excrete / remove Remove excrete urea = 2 remove toxins = 2	**2**

Question Number	Answer	Additional guidance	Mark
(d)(i)	An explanation that makes reference to the following points: • (only) lets / allows some molecules / substances / water pass through (stops others) eq (1) • does not let large ones / charged ones / pass through / eq (1)	allow converse	**2**

Question Number	Answer	Additional guidance	Mark
(d)(ii)	An explanation that makes reference to two of the following points: • so that substances do not leave blood / so they can return to blood / eq (1) • by diffusion / down concentration gradient / eq (1) • as cells require water for water balance / ions for water balance / water for metabolic reactions / eq (1) • glucose for respiration / energy / allow named mineral ion for correct function / (1)	kidney normally reabsorbs these	**2**

Question Number	Answer	Mark
(e)	An explanation that makes reference to two of the following points: • lower concentration of / no urea / salts / waste products in dialysis fluid (1) • by <u>diffusion</u> / (from blood / into solution) (1)	**2**

Question Number	Answer	additional guidance	Mark
(f)(i)	9 ÷ 24 = 0.375 or 63÷168 0.375 × 100 = 38 % 37.5 or 38 % (2)	9÷24 or 63÷168 For one mark	**2**

Question Number	Answer	Mark
(f)(ii)	• you can walk around / can be done at home / when travelling / does not require machine/ eq (1)	**1**

Question Number	Answer	Additional guidance	Mark
(g)	A description that makes reference to three of the following points: • proteins **/** large molecules can't leave glomerulus / can't go into Bowman's capsule / eq (1) • reabsorption of glucose / amino acids / glucose absorbed (back) into blood eq (1) • by proximal convoluted tubule / eq (1) • water reabsorbed from collecting duct / eq (1)	must refer to large molecules / proteins **and** glomerulus or Bowman's capsule Allow from PCT and Loop of Henle	**3**

Q5.

Question Number	Answer	Mark
(a)		**6**

Hormone	Organ that releases hormone	Location of target cells	Effect on target cells and tissues
FSH	**pituitary (1)**	**ovaries (1)**	growth of follicle
LH	pituitary	ovaries	**ovulation / release of egg (1)**
progesterone	ovary	uterus	**thickens / maintains lining /eq (1)**
testosterone (1)	testes	**skin / armpit / groin /scrotum / / penis / eq (1)**	growth of body hair
		Ignore testes/testicles	

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to three of the following points • hormone produced in endocrine cells / glands / eq (1) • carried in blood stream / plasma /eq (1) • all around body / affects many target cells / eq (1) • long term effect / response / eq (1)	allow converse for neurotransmitter produced in presynaptic cell / neurone into synapse one cell / local affect short term effect/ response ignore faster / slower	**3**

Q6.

Question Number	Answer	Additional guidance	Mark
(a)	A: ureter (1) B: bladder (1)	**Allow** phonetic spellings that cannot be mistaken for urethra, e.g. ureta **Reject** urethra **Reject** gall bladder	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	An answer that makes reference to the following. • protein is large (1) • (so) does not pass out of glomerulus / capillary / through basement membrane / does not pass into (Bowman's) capsule (1)		**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following. • glucose is reabsorbed / absorbed into the blood / selectively reabsorbed (1) • at the proximal convoluted tubule / pct / eq (1) • by active transport / uptake (1)	**Ignore** absorbed unqualified	**2**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to four of the following. • hypothalamus detects / osmoreceptors detect high (salt) concentration of blood / low water of blood (1) • pituitary releases ADH / eq (1) • collecting duct (1) • increased permeability (1) • more water (re)absorbed / enters blood / eq (1)	**Accept** pituitary produces ADH	**4**
			(Total for Question = 10 marks)

Q7.

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to the following points: • draws water up (to leaves) / enables water to be taken up (by roots) (1) • cooling (1) • (transport) minerals / named mineral (1) • prevent wilting / eq (1) • (water for) photosynthesis (1)	**Allow** maintain turgidity	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	• reading from graph multiplied = 21. 5 x 10^{-4} = 0.00215 • multiply by 250 Answer: 0.5375 or 0.538 or 0.537 or 0.54 scores two (2)	award full marks for correct numerical answer without working one mark for x 250 one mark for 0.00215 one mark for 5400 or 5375 or 5380 or 5370	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to the following points: • wind moves water (away from plant surface) / blows water away (1) • creates / maintains / increases (concentration) gradient (1) • (more) (water moves out of plant by) diffusion / evaporation (1)	**Allow** converse for still air for all marking points Maintains diffusion gradient = two marks	**3**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: • (same) light (intensity) (1) • as it affects stomata opening / eq (1) OR • (same) temperature (1) • as it affects diffusion / speed of molecules / (kinetic) energy / evaporation (1) OR • humidity (1) • reduces / affects concentration / diffusion gradient (1) OR • (same) species / age / size / mass / leaf area of plant (1) • as this affects number of stomata / thickness of leaves / eq (1) OR • same CO_2 concentration (1) • as it affects stomata opening (1)	Mark in pairs **Ignore** transpiration	**4**

Q8.

Question Number	Answer	**Mark**
(a)(i)	The only correct answer is C thread-like hyphae *A is incorrect because fungi lack chloroplasts* *B is incorrect because fungi do not store starch* *D is incorrect because fungi walls are made of chitin*	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is D maltose *A is incorrect because amino acids are products of protease digestion* *B is incorrect because fatty acids are products of lipase digestion* *C is incorrect because glycerol is a product of lipase digestion*	**1**

Question Number	Answer	Mark
(a)(iii)	A description that makes reference to five of the following points: • transcription / transcripts / transcribes (1) • mRNA/messenger RNA **and** leaves nucleus / mRNA/messenger RNA **and** enters cytoplasm (1) • ribosomes (1) • tRNA/transfer RNA (brings) attached amino acids (1) • codons / anticodons / complementary bases (1) • translation / translated / translates / amino acid chain / polypeptide chain (1)	**5**

Question Number	Answer	Mark
(b)(i)	70.475 to 70.5	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	(70.5 – 50 =) 20.5	Allow (answer from 3(b)(i) – 50) eg: 70.4 – 50 = 20.4	**1**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to four of the following points: • same surface area / mass / thickness / area / size (1) • remove soil from square (before weighing) (1) • control <u>temperature</u> / oxygen / moisture / water (1) • (soil) same mass / same amount / same volume / same type / same soil / decomposers / bacteria / fungi (1) • repeat / use more squares / obtain average / remove anomalies (1) • increase range of pH / use different pHs / more pHs (1)	Ignore more time Mp3 Ignore light / carbon dioxide Mp4 Ignore sterile soil	**4**

Q9.

Question Number	Answer	Additional guidance	Mark
(a)	A description that makes reference to the following points: • use warm/hot ethanol/alcohol / use ethanol in water bath (1) • use iodine (1) • blue black / blue / black (1)	Add Benedict's and blue black = 1	**3**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to four of the following points: • (position) palisade at top / (just) beneath upper epidermis OR spongy in middle/near(er) lower surface (1) • (structure) palisade closely packed / long / rectangular / elongated / column / packed together / dense / fixed together / no air spaces / no gaps OR spongy have air spaces / gaps / rounded (1) • (chloroplasts) palisade have more/many chloroplasts / chlorophyll OR spongy have fewer chloroplasts / less chlorophyll (1) • (palisade cells) absorb (sun)light (1) • spongy allow diffusion / gas exchange / gases to move / movement of water vapour / movement of carbon dioxide / movement of oxygen / transpiration (1)	Mp1 Ignore palisade closer to surface Mp3 palisade have more and spongy have none = 0	**4**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to three of the following points: • mass is lost from lower surface / mass is lost when upper surface covered / OR little/least mass lost from upper surface / little/least mass lost when lower surface is covered (1) • stomata in lower surface / few/no stomata on upper surface (1) • disagrees with conclusion (1)	Mp1 Ignore change in mass	**3**

Q10.

Question Number	Answer	Additional guidance	Mark
	A description that makes reference to six of the following points: • weigh each crisp / use same mass of crisp (1) • stated volume / mass of water in tube / beaker / calorimeter (1) • ignite / light crisp (1) • heat water using burning crisp / place burning crisp under tube / eq (1) • burn until it has completely burnt / no longer relights / eq (1) • measure temperature of water before and after burning / measure change in temperature (1) • energy content (per g) = 4.2 × mass of water × temp rise ÷ (mass of crisp) (1) • repeat (to obtain reliable data) (1) • insulate / move crisp under tube quickly (1)	**Allow** shc for 4.2 mass of crisps / mass of water / temperature rise, may be awarded here	**6**
			Total 6 marks

Q11.

Question number	Answer	Additional guidance	Mark
(a)	One mark for each of the following : • osmoregulation (1) • excretion (1)	any order	**2**

Question number	Answer	Mark
(b)(i)	0.17/(0.200 – 0.030)	**1**

Question number	Answer	Mark
(b)(ii)	An explanation that makes reference to four of the following points: • protein stays in plasma/not in filtrate or in urine (1) • protein molecules too large to pass out of glomerulus/into Bowman's capsule (1) • glucose in plasma and filtrate/none in urine (1) • small enough to pass out of glomerulus/into Bowman's capsule (1) • all glucose reabsorbed by active transport in proximal convoluted tubule (1)	4

Question number	Answer	Mark
(b)(iii)	A description that makes reference to four of the following points: • Benedict's/equivalent (1) • heat (1) • red in high concentration of glucose (1) • orange/yellow-green in low concentration of glucose (1) • control volume of sample/time heated/temperature/ volume of Benedict's/equivalent (1)	4

Question number	Answer	Mark
(c)	An explanation that makes reference to three of the following points: • less volume (1) • more concentrated (1) • as more water lost in sweat (1) • more ADH released (1)	3

(Total for question = 14 marks)

Q12.

Question Number	Answer	Mark
(a)	The only correct answer is A B is not correct as B is not the Bowman's capsule C is not correct as C is not the Bowman's capsule D is not correct as D is not the Bowman's capsule	1

Question Number	Answer	Additional guidance	Mark
(b)(i)	An explanation that makes reference to three of the following points: • (selective) (re)absorption (1) • into blood / from / out of filtrate (1) • proximal convoluted tubule / B (1) • active transport (1)	**Allow** PCT / first coiled tubule	**3**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	• **99 / 99.2 / 99.17 / 99.16 (recurring) (2)**	**180 000 - 1500 = 178 500** **178 500 ÷ 180 000 × 100 = 99.2** **One mark** for 178 500 / (180000-1500 ÷ 180000) / 0.99 / 99.1 / 99.16 award full marks for correct numerical answer without working	**2**

Question Number	Answer	Mark
(b)(iii)	the only correct answer is C protein A is not correct as is fat not used to produce urea B is not correct as is glucose not used to produce urea D is not correct as is water not used to produce urea	**1**

Question Number	Answer	Mark
(c)	An explanation that makes reference to four of the following points: • less urine / decreases urine production / urine more concentrated (1) • collecting duct (1) • more permeable (1) • water (absorbed) into blood / water reabsorbed (1) • by osmosis (1)	**4**
		Total 11 marks

Q13.

Question Number	Answer	Mark
(a)	An answer that makes reference to two of the following points: • so that sperm can swim / can reach egg / otherwise they cannot swim / otherwise they cannot reach egg / eq (1) • can fertilise egg / fertilisation can occur / (if abnormal) will not fertilise egg (1) • so (initial) fertility is not reduced / or (if abnormal) fertility of these men will (already) be reduced (1)	**2**

Question Number	Answer	Mark
(b)(i)	An explanation that makes reference to two of the following points: • thickens / maintains, uterine wall / lining / endometrium / maintains pregnancy / eq (1) • inhibits FSH production / prevents more eggs maturing / eq (1) • inhibits LH production / prevents ovulation / eq (1)	**2**

Question Number	Answer	Mark
(b)(ii)	• male sex hormone / increase male hormone level (1) • because progestin reduces testosterone / eq (1)	**1**

Question Number	Answer	Mark
(b)(iii)	• testes / testicles (1)	**1**

Question Number	Answer	Mark
(c)(i)	• reduce sperm production / eq (1)	**1**

Question Number	Answer	Mark
(c)(ii)	• to measure if sperm count fell / below 1 million per cm^3 / fertility dropped / eq (1)	**1**

Question Number	Answer	Mark
(c)(iii)	• prevent fertilisation / eq, as sperm production may be above 1 million per cm^3 / still high / eq (1)	**1**

Question Number	Answer	Mark
(d)	• to ensure sperm production stays below 1 million per cm^3 / stays low / eq (1) • to see if, the treatment / progestin works / lowers sperm production (1)	**1**

Question Number	Answer	Additional guidance	Mark
(e)	• 98.4 x 320/100 = 314.88 • = 320 - 315 • 5 (2) 100 - 98.4 = 1.6 % 1.6 × 320 / 100 = 5.12 = 5 (2)	**Allow** 1 mark for 315 or 1.6 in working **Allow** 5.1 or 5.12 award full marks for correct answer no working	**2**

Question Number	Answer	Mark
(f)	An answer that includes any 4 of the following points *(For / positive about method)* • reduces pregnancy / 98.4 % work / (very) effective / eq (1) • 75% / most men / partners / couples, happy to continue (1) • do not need to be remember to take / eq (1) • does not require surgery / reversible (1) • no need for women to take hormones (1) *(Against / negative about method)* • side effects / acne / mood disorders / skin infections / skin irritation / eq (1) • does not protect against STI / named disease / eq (1) • suppression phase takes a long time / 26 weeks / eq (1) • may not be reversible / reduce long term male fertility / may take time to reverse / eq (1)	**4**
	total =16 marks	

Q14.

Question Number	Answer	Mark
(a)	in glass / in test tube / in (Petri) dish (1)	**1**

Question Number	Answer	Mark
(b)(i)	An explanation that makes reference to two of the following points: • increases up to **pH** 6 and decreases above **pH** 6 (1) • enzymes (1) • optimum pH is 6 / (enzymes) denature at high / low pH / eq (1)	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	A description that makes reference to five of the following points: • use forceps / scalpel / knife / eq to remove explants / pieces from plant (1) • wash in bleach / hypochlorite / ethanol / alcohol / sterile wipes / eq (1) • (grow on) agar (1) • nutrients / minerals / carbohydrates / amino acids / named mineral / eq / growth factors / hormones (1) • add acid / alkali / buffer (1) • use several / multiple explants / repeat (1) • control temperature / carbon dioxide / light (1) • sterile agar / sterile tubes (1) • same age plant / same plant / same size of explants / eq (1) • count number of shoots after same / stated time (1)	**Ignore** sterilised alone **Allow** rooting powder **Allow** sterile cotton wool / **Allow** disinfected / ensure sterile conditions / sterilise equipment **Allow** roots	**6**

Question Number	Answer	Mark
(c)	An answer that makes reference to two of the following points: • lots produced (1) • genetically identical / no variation / all same type / identical / same characteristics / guaranteed plant / they are clones (1) • can grow GM plants / eq (1) • faster / quicker (1) • any time of year (1) • can be used for plants that are hard to germinate / grow from seed (1)	**2**
	Total 11 marks	

Q15.

Question Number	Answer	additional guidance	Mark
(a)	An explanation that makes reference to two of the following: • (two) different parent plants / cross with another plant / eq (1) • (produce different) gametes (1) • parent plants /gametes have different genotypes / alleles / genes / genetic material / DNA / eq(1) • (gametes) fuse / combine / fertilisation (1)	allow other flower	**2**

Question Number	Answer	additional guidance	Mark
(b)(i)	An explanation that makes reference to the following: • less competition for light / get enough / sufficient / more light / eq (1) • less competition for water / get enough / sufficient water / more water eq (1) • less competition for minerals / named mineral / get enough / sufficient minerals/ more minerals /eq (1)	allow one mark for less competition unqualified ignore space / CO_2	**3**

Question Number	Answer	Mark
(b)(ii)	• can grow in suitable / same conditions / habitat as parent (which successfully grew there) / has plant to <u>cross-pollinate</u> with / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to three of the following: • warmth / optimum temperature for enzyme action / increased temperature for chemical reactions / eq (1) • water to mobilise enzymes / for chemical reactions / eq (1) • oxygen for respiration / eq (1) • light to stimulate growth / break dormancy / eq (1)	must have factor and reason not light for photosynthesis	**3**

Question Number	Answer	additional guidance	Mark
(d)	An explanation that makes reference to two the following: • (bright colours to) attract animals / humans / easily seen / eq (1) • to eat the fruits / consume / eq (1) • as they contain glucose / sugars / eq (1)	ignore attract insects	**2**

Question Number	Answer	additional guidance	Mark
(e)	An answer that makes reference to : • from fruit eaten and egested by/ passed through humans / from faeces / seeds not digested /eq (1)	no credit for more nitrates / minerals	**1**

Question Number	Answer	additional guidance	Mark
(f)	An answer that makes reference to : • heat / warmth / high temperature (for evaporation) / dries out (tissue)/ eq (1)	not just evaporation of water	**1**

Question Number	Answer	Mark
(g)	A description that makes reference to three of the following: • use watch / clock / measure record to time fall (1) • from same height (1) • repeat / calculate mean time (1) • use same mass seeds / same seeds / same species / eq (1) • with and without fluff / different amounts of fluff/ eq (1)	**3**

Q16.

Question Number	Answer	additional guidance	Mark
(a)(i)	An answer that makes reference to the following points: • extension / pointed / elongated / eq (1) • increased surface area / increased surface area to volume ratio (1)	**Allow** from labelled diagram	**2**

Question Number	Answer	additional guidance	Mark
(a)(ii)	An answer that makes reference to one of the following points: • involve (movement of) water (only) (1) • must pass through cell membrane (1)	 **Allow** converse **Allow** converse	**1**

Question Number	Answer	additional guidance	Mark
(b)(i)	An explanation that makes reference to three of the following points: • more water taken up in light (1) • more water lost in light (1) • evaporation from leaves creates a transpiration stream / transpiration pull / sets up water potential gradient / eq (1) • stomata open in light (1) • (more water is taken up than lost because) water used to fill cells / growth / turgor/ photosynthesis (1)	 **Allow** converse **Allow** converse **Allow** converse Ignore refs to temp	**3**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following points: • humidity / moisture (1) • temperature (1) • wind / air flow / eq (1) • time (1)	 Ignore CO_2	**2**

Question Number	Answer	Mark
(c)(i)	potometer / bubble potometer / volume potometer (1)	**1**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to three of the following points: • measure distance bubble moves (1) • calibrate (scale) / calculate volume by multiplying distance by (cross sectional) area / eq (1) • use reservoir to reset / eq (1) • repeats (to calculate mean) (1) • ref to measuring / stated time (1)	• measure volume lost from beaker (1) • use scale on beaker / note volume before and after time period (1)	**3**
			Total = 12 marks

Q17.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to the following points: $6CO_2 + 6H_20 \longrightarrow C_6H_{12}O_6 + 6O_2$ (2)	**Allow** 1 mark for unbalanced but correct formula No marks for word equation	**2 grad**

Question Number	Answer	Additional guidance	Mark
(b)(i)	• 84 + 80 ÷ 2 • 82 (2)	**Allow** 1 mark for 70 or 70.3 or 70.33 etc **Allow** one mark for 164 or 80 + 84 Award full marks for correct answer	**2 grad**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to four of the following points: • no filter has highest rate of photosynthesis / bubbling / oxygen (1) • (because) all light colours / wavelengths are present / has more light energy / most amount of light that can be absorbed / eq (1) • green has low(est) rate of photosynthesis, **because** green light is not absorbed / eq (1) • blue / red has a medium rate of photosynthesis **because** light is, absorbed / not reflected / eq (1) • chlorophyll / chloroplast absorbs red / blue light / does not absorb green light / eq (1)	**Allow** no bubbling / 8 bubbles / no oxygen production **because** green light is reflected / passes through **Allow** causes photosynthesis / produces bubbles **because** light is, absorbed / not reflected / eq	**4 exp**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to two of the following points: • temperature (1) • carbon dioxide (1) • light <u>intensity</u> (1)	 **Allow** volume / amount / concentration of hydrogen carbonate **Allow** brightness of lamp/ thickness of filter / eq	**2 grad**

Question Number	Answer	Additional guidance	Mark
(c)(i)	An explanation that makes reference to two the following points: • bubbles are different volumes / sizes (1) • O_2 may dissolve in water (1) • bubbles may be CO_2 not oxygen / may not be due to photosynthesis /other gases may be present (1) • easy to miscount / miss bubbles (1) • bubbles get trapped / stuck (1)	**Allow** bubbles may be due to respiration **Ignore** 'make error' unqualified	**2 exp**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to two the following points: • use measuring cylinder / (gas) syringe / burette / graduated test tube (1) • (to measure) volume (1) OR • use hydrogen carbonate <u>indicator</u> (1) • change colour (of hydrogen carbonate indicator) (1)		**2 exp**
			Total 14 marks

Q18.

Question Number	Answer	Additional guidance	Mark
(a)(i)	A description that makes reference to two of the following points: • elongated / pointed / projections / extensions /eq (1) • increase surface area (1) • thin wall for short diffusion path / eq (1) • concentrated cell sap for osmosis / eq (1)	**Allow** low water potential to increase gradient for osmosis / increase water potential gradient /eq	**2 grad**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to four of the following points: •water enters (root) by osmosis (1) • from dilute solution to more concentrated solution / eq (1) •(water) enters / moves up xylem (1) •water pulled up to leaf due to transpiration / pulled along transpiration stream / eq (1) • (water vapour) exits through stomata (1)	**Allow** from higher water potential to lower water potential **Allow** from high concentration of water to low concentration of water **Allow** water pulled due to evaporation from leaf / eq	**4 exp**

Question Number	Answer	Additional guidance	Mark
(b)	A description that makes reference to four of the following points: • use (bubble) / (weight) <u>potometer</u> (1) • cut shoot underwater / dry leaves / place mineral oil on surface of water / eq (1) • measure distance moved by bubble (in cm) / mass lost / change in volume of water (1) • (in set) time (1) • repeat / calculate mean rate (1)	**Allow** polythene bag around soil (if shoot placed in soil) **Allow** stated time **Allow** time mark ref and mass mark for two marks if given as units e.g. cm per min g per min	**4** **exp**
			Total 10 marks

Q19.

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

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

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

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

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

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

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

Q20.

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

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

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

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

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