PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 3: REPRODUCTION AND INHERITANCE (PACK 3)

SCORE	PERCENTAGE
/216	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Mark
(a)(i)	The only correct answer is **A** P is the anther **B** is not the answer as it is the filament **C** is not the answer as it is the stigma **D** is not the answer as it is the style	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is **B** Q is the petal **A** is not the answer as it is the leaf **C** is not the answer as it is the stem **D** is not the answer as it is the style	**1**

Question Number	Answer	Mark
(a)(iii)	The only correct answer is **D** structure S the stigma **A** is not the answer as they do not germinate on P anther **B** is not the answer as they do not germinate on Q petal **C** is not the answer as they do not germinate on R stem	**1**

Question Number	Answer	Mark
(b)	An answer that makes reference to the following: • P / anthers exposed / hanging out / outside / eq (1) • S / stigma feathery / exposed / hanging out / longer /outside / eq (1) • Q / petals smaller/ absent / green / not coloured / not scented / eq (1)	**3** allow hairy

Question Number	Answer	Additional guidance	Mark
(c)(i)	runners / eq	**allow** corms / bulbs / rhizomes/ tubers	**1**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	cuttings/ eq	**allow** grafting / layering / micropropagation / tissue culture	**1**

Question Number	Answer	Additional guidance	Mark
(c)(iii)	An answer that makes reference to two the following: • no / (less) genetic variation /a clone / eq (1) • maintain phenotype / colour / flavour / desired characteristic / same characteristics / eq (1) • faster / eq (1) • seeds not viable / produce rare plants / eq (1)	allow converse for sexual not just get a copy off ign more plants	**2**

Q2.

Question Number	Answer	Mark
(a)(i)	A description that makes reference to three of the following: • W or stigma / feathery / large surface area / W stigma outside flower / exposed (to catch pollen)/eq (1) • X or anther outside flower/ exposed (to disperse pollen) / eq (1) • Y or filament long / hinged / not rigid / can move (to disperse pollen)/eq (1)	**3**

Question Number	Answer	additional guidance	Mark
(a)(ii)	An answer that refers to two of the following	allow converse for insect pollinated	**2**
	• smaller / dull / green flowers /petals / no petals / eq (1)	larger/ coloured /eq	
	• no nectar/ nectary (1)	nectar/nectary	
	• no scent / eq (1)	scent	
	• smaller / lighter / smooth pollen grains / more pollen produced (1)	larger / sticky / have hooks pollen grains/ less pollen produced	

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to five the following: • link between pollen number and symptoms /eq (1) • Person A allergic to tree pollen (only) / eq (1) • Person B allergic to (mainly) grass pollen / eq (1) • Person B some / mild allergy to tree and weed / eq (1) • Person C allergic to all pollen / tree and grass and weed/eq (1) • Person D no pollen allergy / eq (1) • Person E allergic to (mainly) grass and weed / eq (1) • Person E some / mild allergy to tree / eq (1) • no species level data / eq (1) • only one year / eq (1)	allow hay fever/ allergic response/ for allergy	**5**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to two of the following • response to antigens / pathogen / allergen / bacteria / virus /eq (1) • by white blood cells/ phagocytes / lymphocytes /eq (1) • antibodies produced / phagocytosis / engulf / eq (1)	if put phagocytes produce antibodies scores mp 2 only or lymphocytes engulf scores mp 2 only	**2**
			total 12 marks

Q3.

Question Number	Answer	Mark
(a)(i)	An explanation that makes reference to the following points: • male (1) • as has X and Y / different sized length of chromosomes / heterogametic / has a Y chromosome / female would be XX / eq (1)	**2**

Question Number	Answer	Mark
(a)(ii)	An explanation that makes reference to two of the following points: • (Diagram 1 is) diploid (1) • because diploid has two of each chromosome / has 23 pairs / has 46 chromosomes / has 2 sets of chromosomes / eq (1) • haploid only has one of each pair / would have 23 chromosomes / has one set of chromosomes / would have half the number of chromosomes / eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(b)(i)	An answer that makes reference to two of the following points: • diagram 2 / Klinefelter has an extra chromosome / has 47 (1) • X chromosome / sex chromosomes are different / eq (1)	Allow converse for karyotype 1 has extra X chromosome scores 2 marks has three sex chromosomes scores two marks	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to the following points: • mutation (1) • failure of chromosomes to separate (1) • during meiosis / gamete formation (1)	Allow nondisjunction	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	49 % of 66 million = 32 340 000 men 1/660 x 32 340 000 = 49 000 (2)	Award full marks for correct numerical answer without working one mark for 32 340 000	**2**

Question Number	Answer	Mark
(b)(iv)	An answer that makes reference to one of the following points: • mutation more likely (1) • gametes are older / eq (1)	**1**
	Total = 11 marks	

Q4.

Question Number	Answer	Mark
(a)		**3**

number of organisms	8
number of producers	1 / one
number of primary consumers	2 / two
number of food chains	10 / ten

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following points: • respiration / movement / heat loss (1) • egested / undigested / faeces / not absorbed / not assimilated (1) • excreted / urine / urea (1) • uneaten (1) • death / <u>decomposition</u> (1)	Mp1 Ignore exercise / metabolism Mp3 excreted from the digestive system = 0	**4**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to four of the following points: • <u>variation</u> / <u>variety</u> / <u>varied</u> (1) • mutation (1) • longer beak means more worms/food / longer beak can reach deeper for worms/food (1) • <u>survival</u> and reproduction / breeding / offspring (1) • pass on gene / allele / DNA (1)	Allow converse for Mps 3, 4 and 5 mutation passed on = 1	**4**

Q5.

Question Number	Answer	Additional guidance	Mark
(a)(i)	fertilisation / fertilise / fuse with egg / join with egg / combine with egg	Ignore meet with egg	**1**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that makes reference to two of the following points: • nucleus (1) • chromosomes (1) • haploid number (1) • DNA (1) • acrosome (1)	Ignore genes / alleles	**2**

Question Number	Answer	Mark
(a)(iii)	An explanation that makes reference to the following points: • (aerobic) respiration / energy / ATP (1) • movement / swimming (of sperm / of tail) (1)	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	• select 24.8% from table and convert to 0.248 • calculate 24.8% of 58 million 14 384 000 / 14 400 000 / 1.4×10^7 1.44×10^7 14.384×10^6 / 1.4384×10^7 / eq (2)	Award full marks for correct numerical answer without working One mark for 0.248×58 million / $24.8 \div 100 \times 58$ million	**2**

Question Number	Answer	Mark
(b)(ii)	An explanation that makes reference to five of the following points: <u>Arguments for:</u> • nicotine reduces normal/undamaged cells / nicotine increases damaged cells (1) • less (chance of) fertilisation / eq (1) • rats are similar to humans / rats are mammals / eq (1) <u>Arguments against:</u> • there are normal/undamaged sperm cells in nicotine samples / there are damaged cells with no nicotine (1) • investigation on rats (not humans) / eq (1) • rats were not smoking / small range(of concentrations) / no idea of nicotine concentration in cigarettes / eq (1) • not repeated / no idea of number of rats / not reliable (1)	**5**

Q6.

Question Number	Answer	Mark
(a)	C uterus / womb / uterine wall / uterine lining / uterus lining /endometrium (1) D vagina (1)	**2**

Question Number	Answer	Mark
(b)	A description that makes reference two the following points: • site of fertilisation / fusion (1) • egg travels / egg from ovary / transports egg /eq (1) • sperm travels (from vagina/ uterus /cervix/ to egg) / transports sperm / eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(c)	An explanation that makes reference to two of the following points: • produces oestrogen / eq (1) • at puberty (1) • example of named secondary sexual characteristic /eq(1) • second example of named secondary sexual characteristic /eq (1)	examples pubic hair/ breasts develop/ body hair / hips widen / menstruation starts	**2**

Q7.

Question Number	Answer	**Mark**
(a)	The only correct answer is D starch *A is not correct as glucose is not the large insoluble molecule* *B is not correct as lipid is not the large insoluble molecule* *C is not correct as protein is not the large insoluble molecule*	**1**

Question Number	Answer	**Mark**
(b)(i)	An answer that makes reference to two of the following points: • reset (the coloured water) / eq (1) • repeat readings / reliable results / more results (1) • allow oxygen in / (aerobic) respiration / prevent anaerobic respiration (1)	**2**

Question Number	Answer	**Mark**
(b)(ii)	The only correct answer is A absorbs carbon dioxide *B is not correct as it does not absorb oxygen* *C is not correct as it does not release carbon dioxide* *D is not correct as it does not release oxygen*	**1**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	• multiply by length • determine volume • correct answer 0.0047(13) / $4.7(13) \times 10^{-3}$ (3)	Award full marks for correct numerical answer without working 3.142 x 0.05 x 0.05 = 0.007855 × 0.6 = 0.0047(13) / $4.7(13) \times 10^{-3}$ Allow one mark for × 6.0 / × 0.6 in working Allow two marks for 4.7 / 47 / 0.47 in working Allow three marks for 4.7 $\underline{mm^3}$	**3**

Question Number	Answer	Additional guidance	Mark
(c)(i)	• oxygen absorbed at 22 and 12 • calculation of percentage increase 100 (2)	Award full marks for correct numerical answer without working rate at 22 = 1.6 ÷ 20 = 0.08 and rate at 12 = 0.8 ÷ 20 = 0.04 percentage increase = (0.08 - 0.04) ÷ 0.04 × 100 = 100(%) Or 1.6 – 0.8 ÷ 0.8 × 100 = 100(%) One mark for 0.08 **and** 0.04 or 1.6 **and** 0.8 in working	**2**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to two of the following points: • (more) respiration (1) • enzymes (1) • (more)(kinetic) energy / collisions / enzyme substrate complexes / move faster / eq (1)	Allow converse	**2**

Q8.

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

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to 4 of the following points. • receptors in skin surface detect stimulus / are stimulated /(1) • impulse (1) (once) • sensory neurone to relay neurone / CNS / eq (1) • via diffusion of neurotransmitters / eq (1) (once) • synapse (1) (once) • motor neurone to muscle / effector (1) • effector/ muscle contracts eq (1)	allow action potential ignore message / signal eq	**4**

Question Number	Answer	Mark
(c)(i)	An explanation that makes reference to the following points. • less sweat released /eq (1) • less (sweat) evaporates / less cooling / less heat loss /eq (1)	**2**

Question Number	Answer	additional guidance	Mark
(c)(ii)	An explanation that makes reference to 3 of the following points. • B / blood vessels (to surface) constrict / vasoconstriction / eq (1) • less blood flows (to skin surface) / eq (1) • less heat loss / heat conserved /eq (1) • less convection / radiation (1)	allow converse ignore capillaries constrict more blood away from surface / eq	**3**

Question Number	Answer	Mark
(d)	An explanation that makes reference to 4 of the following points. • variation in amount of body hair / eq (1) • caused by mutation (1) • less hair increased heat loss / can lose heat in sun / warm / hot climate / chase animals / started to wear clothes / eq (1) • survive and reproduce (1) • pass on alleles / genes to offspring (1)	**4**
		Total = 14 marks

Q9.

Question Number	Answer	Mark
(a)(i)	Radicle/ root / plumule / shoot has grown / seed split/ sprouts /eq (1)	**1**

Number		guidance	
(a)(ii)	An answer that includes two of the following • Temperature (1) • Volume of solution (1) • Humidity (1) • Oxygen (1) • Light (1) • pH (1) • Carbon dioxide (1)	ignore amount of water ignore wind allow soil / compost /growth medium	**2**

Question Number	Answer	additional guidance	Mark
(b)(i)	An answer that includes two of the following S linear and half of each axis (1) L straight and passing through all points (1) A x axis correct way round (Na Cl or salt conc / eq) (1) U axes labelled with Na Cl / salt concentration **in mmol** and **percentage** / **% germination** (1) P points correctly plotted within one square (1)	if non linear scale can still get P bar chart loses L	**5**

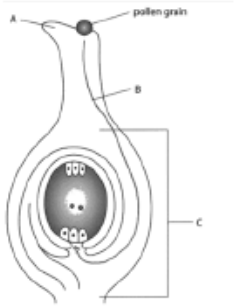
Question Number	Answer	additional guidance	Mark
(b)(ii)	An explanation that makes reference to four of the following points • (increasing (salt)concentration) decreases germination (1) • (as concentration of solution increases) (lower) water potential / concentration / osmotic gradient /eq (1) • less water absorbed / water exits /eq (1) • by osmosis (1) • to activate enzymes / digest starch / eq (1)	allow water potential / concentration gradient described /reversed eg more water molecules inside / eq	**4**

Question Number	Answer	Additional guidance	Mark
(c)(i)	An answer that makes reference to the following points • roots grow towards gravity (1) • positively gravitropic / geotropic (1)	Allow converse for stems allow gravitrophic	**2**

Question Number	Answer	Additional guidance	**Mark**
(c)(ii)	An answer that makes reference to the following points • roots grow away from light (1) • negatively phototropic (1)	Allow converse for stems	**2**
			16 marks

Q10.

Question Number	Answer	Mark
(a)(i)	• A stigma (1) • B style (1) • C ovary (1)	**3**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that makes reference to the following points: • tube going down style (1) • tube entering the micropyle (1)	 **Reject** arrows pointing upwards	**2**

Question Number	Answer	additional guidance	Mark
(a)(iii)	A description that makes reference to two of the following points: • ovule becomes seed (1) • ovule wall becomes seed coat / testa (1) • ovary becomes fruit (1)	**Ignore** ovum	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	• 476 - 432 • 44 ÷ 432 × 100 = • allow 10.2 / 10.19 /10.185/ 10.1852/ 10.18519	award full marks for correct numerical answer without working **Allow** one mark for 44	**2**

Question Number	Answer	additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following points: • in warm (and wet) conditions there are more fungi / bacteria/ microbes / eq (1) • so seeds are diseased or contents digested / consumed / seeds killed (by fungi /bacteria /microbes / eq) / eq (1) • enzymes are activated **in storage** (1) • seeds have (already) started to germinate in storage (1)	**Allow** converse for wet and cold	**2**

Question Number	Answer	additional guidance	Mark
(b)(iii)	A description that makes reference to one the following: • (seed / testa) split / eq(1) • radicle / root (is seen) (1) • plumule / shoot (is seen)/ eq (1) • sprouts (1)		**1**

Q11.

Question Number	Answer	Mark
(a)(i)	Sickle shaped red blood cells stick to each other / caught / trapped /eq walls of blood vessels / eq (1)	**1**

Question Number	Answer	Mark
(a)(ii)	An explanation that makes reference to three of the following points • cold temperatures reduce blood flow / cause more sickling (1) • less oxygen (at high altitude) (1) • less respiration / (more) anaerobic respiration (1) • more lactic acid (1) • (less) energy / ATP (1)	**3**

Question Number	Answer	Mark
(b)(i)	only expressed when homozygous / two copies / no dominant allele present / not expressed in heterozygote /eq (1)	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	0.75 x 0.5 ¾ X ½ 0.375 or 3/8 or 37.5% (2)	Allow 1 mark for ¾ or 0.75 or 75% or one mark for ½ or 0.5 or 50%	**2**

Question Number	Answer	Mark
(c)	The only correct answer is D A is not correct as bacterium does not cause malaria B is not correct as fungus does not cause malaria C is not correct as plant does not cause malaria	**1**

Question Number	Answer	Mark
(d)	The only correct answer is B A is not correct as chlorophyll not found in red blood cells C is not correct as iron is not a pigment D C is not correct as magnesium not found in red blood cells	**1**

Question Number	Answer	Additional guidance	Mark
(e)	An answer that includes two of the following points • red cells smaller (1) • red cells have no nucleus (1) • red cells are biconcave /eq (1)	Allow converse for wbc allow (mature) RBC's lack mitochondria ign haemoglobin	**2**
			Total 11 marks

Q12.

Question Number	Answer	Additional guidance	Mark
(a)(i)	• nucleus (present) (1)	**Allow** converse	**1**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to two of the following: • (shape gives) lower surface area (to volume ratio) (1) • less space / nucleus takes up space (in cell) (1) • (less space for) haemoglobin (1) • less diffusion / less oxygen absorbed / less oxygen taken up / eq (1)	**Allow** converse for human cells **Allow** less volume (for oxygen) **Ignore** gas exchange	**2**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to four of the following: • mutation (1) • variation (in haemoglobin / how much oxygen is absorbed) (1) • llamas survive / compete better / eq (1) • reproduce / create offspring / eq (1) • pass on allele / gene / eq (1)	Pass on allele to offspring / next generation = **two marks** **Ignore** pass on characteristic	**4**

Question Number	Answer	Additional guidance	Mark
(c)	A description that makes reference to three of the following: • engulf / eq (1) • microbes / pathogens / bacteria / viruses / eq (1) • digest / break down (1) • using enzymes (1)	**Allow** ingest Digestive enzymes is **2 marks**	**3**

Q13.

Question Number	Answer	Mark
(a)(i)	The only correct answer is D oak tree A blackbird is not correct as it is not the producer B centipede is not correct as it is not the producer C earthworm is not correct as it is not the producer	**1**

Question Number	Answer	Mark
(a)(ii)	The only correct answer is A blackbird is a secondary and tertiary consumer B earthworm is not a secondary and tertiary consumer C ground beetle is not a secondary and tertiary consumer D sparrowhawk is not a secondary and tertiary consumer	**1**

Question Number	Answer		Mark
(b)(i)	An explanation that makes reference to the following: • some light / colours / wavelengths reflected (1) • light falls on flowers / not on leaves / some does not fall on chloroplasts / chlorophyll / eq (1)	ignore shade allow not enough chloroplasts	**2**

Question Number	Answer	additional guidance	Mark
(b)(ii)	• producer to primary consumer 1.4 / 87 x 100 = 1.61 % (1) allow 1.6% • primary to secondary consumer 1.6 / 14 x 100 = 11.4 % (1) allow 11% 11.43% or ENERGY LOST producer to primary 98.4% (1) ENERGY LOST primary to secondary 88.6% (1) so student is incorrect primary to secondary consumer most efficient	must calculate % to score allow 1 mark for each correct calculation allow calc of energy lost	**2**

Question Number	Answer	Mark
(c)(i)	• involuntary / automatic / does not involve the brain / spontaneous / without thinking / unconscious / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(c)(ii)	• protects from predators / only exposes hard shell /eq (1)	ignore danger / harm /injury	**1**

Question Number	Answer	additional guidance	Mark
(c)(iii)	An answer that makes reference to four of the following: • (gene) mutation/ mutated gene / eq (1) • variation (1) • woodlice that roll up survive / not eaten /eq (1) • reproduce / eq (1) • pass on alleles/ genes (for rolling behaviour) (1)	 allow converse allow converse not just pass on mutation /behaviour	**4**

Q14.

Question number	**Answer**	**Additional guidance**	**Mark**
(a)	An explanation that makes reference to two of the following points: • dominant allele always expressed (1) • dominant expressed in heterozygote (and homozygote)/recessive allele not expressed in heterozygote (1) • recessive allele only expressed in phenotype of homozygote/equivalent (1)	 allow seen/visible	**2**

Question number	**Answer**	**Additional guidance**	**Mark**
(b)	A genetic diagram including: • parents Nn and Nn (1) • gametes N or n (1) • genotypes of offspring NN Nn Nn nn and phenotypes correctly assigned (1)	 allow max 3 for transfer error allow all marks from Punnett square	**3**

Question number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: • Nn not affected/killed by malaria/survive (1) • reproduce (1) • so number of Nn individuals increase (1) • so number of nn individuals increases/frequency of (n) allele increases (1)	allow converse for NN	4

Q15.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that makes reference to two of the following points: • dominant allele always expressed (1) • dominant expressed in heterozygote (and homozygote)/recessive allele not expressed in heterozygote (1) • recessive allele only expressed in phenotype of homozygote/equivalent (1)	allow seen/visible	2

Question number	Answer	Additional guidance	Mark
(b)	A genetic diagram including: • parents Nn and Nn (1) • gametes N or n (1) • genotypes of offspring NN Nn Nn nn and phenotypes correctly assigned (1)	allow max 3 for transfer error allow all marks from Punnett square	3

Question number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: • Nn not affected/killed by malaria/survive (1) • reproduce (1) • so number of Nn individuals increase (1) • so number of nn individuals increases/frequency of (n) allele increases (1)	allow converse for NN	4

Q16.

Question Number	Answer	Mark
(a)	The only correct answer is B anther to stigma A is not correct as it is not **anther to petal** C is not correct as it is not filament to ovary D is not correct as it is not stigma to the style	**1**

Question Number	Answer	Mark
(b)(i)	• enclose stamens and stigma in bag / cut off anthers and pollinate by hand / eq (1)	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following: • parents genotypes Rr and Rr (1) • gametes R or r (1) • Offspring genotypes 1 RR 2 Rr and 1 rr • phenotype of offspring / ratio 3 round : 1 wrinkled.	allow TE for **2 max** gametes and offspring genotypes / phenotypes	**4**

Question Number	Answer	additional guidance	Mark
(c)	An answer that includes three of the following: • gametes / haploid cells / requires two cells (1) • fertilisation/ fusion (1) • genetic variation (1) • slower (1)	allow converse for asexual one parent cell / no gametes /eq no fertilisation no genetic variation faster	**3**
			Total 9 marks

Q17.

Question Number	Answer	Mark
(a)	the only correct answer is A anther B is not correct as ovary does not contain pollen grains C is not correct as petal does not contain pollen grains D is not correct as sepal does not contain pollen grains	**1**

Question Number	Answer	Mark
(b)(i)	An answer that makes reference to two of the following points: • supplies glucose / sucrose / sugar / carbohydrate / nutrients (1) • respiration / energy / ATP (1) • supplies amino acids (1) • make protein (1) • supplies water (1) • cell elongation / eq (1)	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	• 120 – 60 = 60 minutes • 4.7 – 1.4 = 3.3 in one hour • 3.3 ÷ 60 = 0.055 (3)	Award full marks for correct numerical answer without working Award 1 mark for 1.4 and 4.7 or 3.3 Award one mark for ÷ 60	**3**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: C plus and minus pesticide / range of concentrations of pesticides (1) O same / variety / age / mass / size, of apple tree type (1) R use many trees / orchard / repeats / eq (1) M1 number of apples / mass of apples (1) M2 same time / stated period of time (1) S1 same soil / fertiliser / compost / water / eq (1) S2 light/ temp/ CO_2/ bees / eq (1)	 Allow same species Ignore yield	**6**
			Total 12 marks

Q18.

Question number	Answer	Mark
(a)(i)	Circle around dendrites/cell body and dendrites	**1**

Question number	Answer	Additional guidance	Mark
(a)(ii)	Multiplication • 1.20 × 102 = 120 (1) Multiplication • 1.3 ÷ 120 = 0.0108/1.08 × 10^{-2} (1)	award full marks for correct numerical answer without working	2

Question number	Answer	Mark
(a)(iii)	Mitochondria	1

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that makes reference to the following points: • chromosome (1) • plasmid (1)	allow nucleoid	2

Question number	Answer	Mark
(b)(ii)	Stage Q	1

Question number	Answer	Mark
(b)(iii)	Stage R	1

(Total for question = 8 marks)

Q19.

Question Number	Answer	Additional guidance	Mark
(a)(i)	An answer that makes reference two the following points: • (male parent) Bb / heterozygous (1) • (female parent) Bb / heterozygous (1) • (because one of the) offspring is bb / homozygous recessive (1)	Both parents Bb =2	2

Question Number	Answer	Mark
(a)(ii)	• 4 / four	**1**

Question Number	Answer	Additional guidance	Mark
(b)	• 0.125 / 1/8 / 12.5% / 1 out of 8 (1)	Reject 1:8	**1**

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following points: • (natural) selection (1) • white giraffes easily seen / not camouflaged / hunted eq (1) • die / killed / don't survive (1) • fewer reproduce / don't reproduce / no offspring (1) • allele for white not passed on (1)	Allow converse for brown for mp 2-5	**4**
			Total 8

Q20.

Question Number	Answer	Mark
(a)(i)	D testis *A is incorrect as meiosis does not occur in kidney* *B is incorrect as meiosis does not occur in penis* *C is incorrect as meiosis does not occur in skin*	**1 comp**

Question Number	Answer	Mark
(a)(ii)	C root tip *A is incorrect as mitosis is not observed in anther* *B is incorrect as mitosis is not observed in cotyledon* *D is incorrect as mitosis is not observed in xylem*	**1 comp**

Question Number	Answer	Mark
(b)		**6 Grad** 1 mark for each row

Feature	Meiosis	Mitosis
number of chromosomes in each original cell	46	**46**
number of daughter cells produced from each original cell	**4**	2
number of chromosomes in each daughter cell	**23**	**46**
ploidy level of daughter cells produced	**haploid**	diploid
genetic differences in daughter cells	present	**absent /none/identical /eq**
type of cell produced	**gamete / sperm / egg / sex cell**	body cell

Question Number	Answer	Mark
(c) (i)	A description that makes reference to the following • random mating (1) • random fertilisation / gametes received/ eq (1) • environment (1) • mutation (1)	**3 exp**

Question Number	Answer	Mark
(c) (ii)	An explanation to the following points • little / no <u>genetic</u> variation / have same genotype / alleles (1) • no genotype environment interaction / respond to drugs in same way /eq (1)	**2 exp**
		Total 13 marks