OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

WS1.3 ANALYSIS AND EVALUATION

SCORE	PERCENTAGE
/159	%

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Question			Answer/Indicative content	Marks	Guidance
1			B ✓	1 (AO2.2)	
			Total	1	
2	a	i	electric heater ✓	1 (AO2.2)	ALLOW electric incubator / <u>electric</u> (water) bath
		ii	wear goggles / tie (long) hair back / secure loose clothing ✓	1 (AO1.2)	ALLOW wear gloves / use gauze under flask / use heatproof mat IGNORE face mask / do not touch hot equipment
		iii	Any two from: difficult to keep constant/regulate temperature ✓ uneven heating of flask creating hot/cold spots ✓ human error in reading thermometer ✓	2 (AO2.2)	ALLOW water may overheat ALLOW may become hot and denature enzyme ALLOW flask may have slightly raised temperature ALLOW temperature in water bath may not reflect temperature in the flask
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 32 award 2 marks 34 + 29 + 33 = 96 ✓ 96 ÷ 3 = 32 ✓	2 (AO2.2)	ALLOW answer in the space under the table but answer on answer line in table takes preference ALLOW ECF for mean calculation
		ii	temperature ✓	1 (AO2.1)	
		iii	identifies variability in each point plot / gives an estimate of level of uncertainty ✓	1 (AO1.2)	ALLOW can plot range/error bars ALLOW large error bars variability is high/ORA ALLOW high variability then reliability is low/ORA ALLOW idea of the spread of data at each point and possibly identify/eliminate outlier/anomaly ALLOW ranges overlap the data at those 2 points isn't significantly different

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Question			Answer/Indicative content	Marks	Guidance
		iv	**Any two from:** as temperature increases enzyme activity increases ✓ optimum enzyme activity between 25^0C and 35^0C enzyme activity ✓ but somewhere between 30^0C and 35^0C enzyme activity starts to decrease ✓ idea decrease in rate (after 35^0C) due to denaturing ✓	2 (AO3.1a)	**ALLOW** idea that as temperature increases/gets higher so does rate of (enzyme) reaction / gas release / ORA **ALLOW** higher temperature the faster the enzyme activity **ALLOW** enzyme starts to denature above 30^0C/between 30^0C and 35^0C
			Total	10	

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Question			Answer/Indicative content	Marks	Guidance
3	a		distance of lamp/light source ✓	1 (AO2.2)	ALLOW light intensity IGNORE the lamp with no mention of distance or intensity
	b	i	Any two from: bubbles are different sizes / has different volume of gas ✓ some bubbles may also be missed/miscounted ✓ so volume at each point may not be representative of rate ✓	2 (AO2.2)	ALLOW amount of oxygen varies / bubbles burst IGNORE the pondweed could be different sizes
		ii	Any two from: measure volume (of gas released) ✓ names a suitable apparatus for measuring for volume ✓ use a heat sink ✓	2 (AO2 x 3.3a)	IGNORE measure amount ALLOW e.g. measuring cylinder / gas syringe / Audus apparatus /graduated pipette
	c	i	axes correctly labelled, including units ✓ all points correctly plotted ✓ ✓ suitable line of best fit drawn ✓	4 (AO4 x 2.2)	ALLOW +/- half a square all points correctly plotted 0 to 1 correct point plotted = 0 mark 2 to 4 correct points plotted = 1 mark All 5 correct points plotted = 2 marks ALLOW line of best fit based on plotted points IGNORE dot to dot line

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Question			Answer/Indicative content	Marks	Guidance
		ii	further lamp is from the plant photosynthesis reduced / ORA ✓ example of a decrease from data e.g. at 10cm 30 bubbles given off and at 40cm only 2 bubbles ✓ OR photosynthesis stops in very low light ✓ by 50 cm there are no bubbles ✓ OR idea that rate of photosynthesis decrease is a non-linear relationship ✓ e.g. nearly double the number of bubbles at 10cm compared to 20cm but not double elsewhere ✓	2 (AO3.2b)	IGNORE type of gas mentioned in bubbles ALLOW description of decrease in bubbles e.g. further lamp the less bubbles ALLOW there is a negative correlation
			Total	11	
4		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3 : 1 award 2 marks 24 : 8 or 3 ✓ 3 : 1 ✓	2 (AO2.2)	ALLOW answer in the table but answer on answer line takes preference
		ii	higher SA:V ratio faster rate of diffusion / ORA ✓	1 (AO3.2b)	ALLOW positive correlation ALLOW reference to less time instead of faster rate IGNORE they are directly proportional
		iii	reduces (total) SA of alveoli/air sacs / reduces SA : Vol ratio of alveoli/air sacs ✓ so diffusion (of oxygen) reduced ✓	2 (AO2 x 3.1a)	ALLOW harder for oxygen to diffuse IGNORE oxygen cannot diffuse into the blood in emphysema
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
5		i	The higher the BMI then the higher the mass of urea (in urine) / ORA ✓	1 (AO2.1)	**ALLOW** positive correlation **IGNORE** they are directly proportional **IGNORE** linear relationship
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.0016 (g/cm^3) award 2 marks** 1.6 ÷ 1000 ✓ = 0.0016 (g/cm^3) ✓	2 (AO2.2)	 **ALLOW** 1.6 x 10^{-3}
		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 22.2/second graph ✓ idea that first graph/22.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓	2 (AO2 x 3.2b)	**ALLOW** larger mass of urea per BMI gained **ALLOW** line is steeper/higher gradient in Fig22.2 **IGNORE** higher BMI for greater mass of urea **ALLOW** second graph does not follow the line of best fit so closely
			Total	**5**	
6			C ✓	1 (AO2.2)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
7	a	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 250 award 2 marks 25 x 30 / 3 **OR** 750 / 3 ✓ = 250 ✓	2 (AO2 x 2.2)	
		ii	Idea of less visible ORA ✓ otherwise they are more likely to be eaten ORA ✓	2 (AO2 x 2.2)	**ALLOW** spot not visible to predators = 2 marks **ALLOW** small spot is less likely to be toxic / poisonous If no other mark scored, credit less likely to be washed off
	b	i	(further from the factory) there is less sulfur dioxide and so thicker cuticle/leaves ORA✓ insects find it harder to feed on the thicker leaves/cuticle ORA✓ the numbers are lower with thicker leaves/cuticle ORA✓	2 (AO2 x 3.1b)	**IGNORE** any reference to section A If no other mark scored, credit thicker leaves/cuticle further from the factory ORA
		ii	very high concentrations of sulfur dioxide kill the insects✓	1 (AO3.2b)	
			Total	7	
8		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10 000(per mm^3) award 2 marks 1000 ÷ 0.1 **OR** 1000 x 10 ✓ = 10 000 (per mm^3) ✓	2 (AO2 x 2.2)	
		ii	no (no mark) (because 10 000) is in the normal range / levels / range without Fanconi anaemia✓	1 (AO3.2a)	**ALLOW** ECF from (i) **ALLOW** 10 000 is between 6000 and 16000
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
9	a		to allow a valid comparison of the results✓	1 (AO3.1b)	
	b	i	correct plots ✓✓ smooth curved line between points ✓	3 (AO3 x 2.2)	**ALLOW** +/- half a square All correct = 2 marks 3 or 4 plots correct = 1 mark **DO NOT ALLOW** sketchy line / line thicker than half a square
		ii	increases up to 10 days/70^{o}C ✓ then decreases ✓	2 (AO3.1a)	**ALLOW** increases up to 9-11 days **ALLOW** increases by 44^{o}C
		iii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 39 (^{o}C) award 2 marks** 70-31 ✓ = 39 (^{o}C)✓	2 (AO2.2) (AO1.2)	
		iv	normal compost is made by aerobic respiration✓ aerobic respiration releases more energy than anaerobic respiration✓	2 (AO2 x 2.1)	2 correct ticks = 2 marks 1 correct ticks = 1 mark 3 ticks two correct = 1 mark 3 ticks one correct = 0 marks 4 or more ticks = 0 marks
	c	i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 8 (kg) award 3 marks** 1500-1200 **OR** 300 ✓ 300/40 **OR** 7.5 ✓ = 8 (kg) ✓	3 (AO3 x 2.2)	**ALLOW** one mark for clear evidence of rounding incorrect answer correctly to the nearest whole number
		ii	less carbon dioxide is produced ✓	1 (AO3.1b)	**ALLOW** less contribution to global warming / greenhouse effect / climate change
			Total	**14**	

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Question			Answer/Indicative content	Marks	Guidance
10	a		man woman **D** | **d** **d** | Dd | dd **d** | Dd | dd ✓ 50% / 0.5 / ½ ✓	2 (AO1 x 2.2) (AO1 x 3.1a)	**ALLOW** 1 in 2 or 1:1 **ALLOW** ecf for probability

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Question			Answer/Indicative content	Marks	Guidance
	b		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Provides a detailed explanation linking cholesterol to heart disease. AND Provides a detailed analysis to explain if this link is supported by the graph. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* Level 2 (3–4 marks) Provides a detailed explanation linking cholesterol to heart disease. OR Provides a detailed analysis to explain if this link is supported by the graph. OR Provides a basic explanation linking cholesterol to heart disease. AND Provides a basic analysis of the information to explain if this link is supported by the graph. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* Level 1 (1–2 marks) Provides a basic explanation linking cholesterol to heart disease. OR Provides a basic analysis of the information to explain if this link is supported by the graph. OR Demonstrates knowledge of the importance of the blood supply to the heart muscle. *There is an attempt at a logical structure with a line of reasoning. The information is*	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1b)	AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle. • coronary artery carries blood to heart/muscle • blood takes oxygen/glucose to the heart/muscle • heart/muscle carries out aerobic respiration/needs energy • energy is needed for the heart/muscle to contract AO2.1 Apply knowledge and understanding of the requirements of the heart muscle • cholesterol build up (partially) blocks the blood flow in the artery • this reduces blood/oxygen/glucose carried to the heart/muscle • heart/muscle carries out less aerobic respiration/less energy released • heart/muscle can't contract as forcefully AO3.1b Analyse information and ideas to interpret the results on the study Support the link: • men with heart disease had (on average) a higher blood cholesterol level. • Men without heart disease had (on average) a lower blood cholesterol level. • build-up of cholesterol can lead to heart disease Doesn't support the link: • considerable overlap between the two groups • men can still have heart disease with low blood cholesterol levels • Men without heart disease can still have high blood cholesterol levels

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Question			Answer/Indicative content	Marks	Guidance
			in the most part relevant. 0 marks *No response or no response worthy of credit*		
			Total	8	
11		i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
			Total	2	

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Question			Answer/Indicative content	Marks	Guidance
12		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3 : 1 award 2 marks 24 : 8 or 3 ✓ 3 : 1 ✓	2 (AO2.2)	**ALLOW** answer in the table but answer on answer line takes preference
		ii	higher SA:V ratio faster rate of diffusion / ORA ✓	1 (AO3.2b)	**ALLOW** positive correlation **ALLOW** reference to less time instead of faster rate **IGNORE** they are directly proportional
		iii	reduces (total) SA of alveoli/air sacs / reduces SA : Vol ratio of alveoli/air sacs ✓ so diffusion (of oxygen) reduced ✓	2 (AO2 x 3.1a)	**ALLOW** harder for oxygen to diffuse **IGNORE** oxygen cannot diffuse into the blood in emphysema
			Total	5	
13		i	The higher the BMI then the higher the mass of urea (in urine) / ORA ✓	1 (AO2.1)	**ALLOW** positive correlation **IGNORE** they are directly proportional **IGNORE** linear relationship
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.0016 (g/cm^3) award 2 marks 1.6 ÷ 1000 ✓ = 0.0016 (g/cm^3) ✓	2 (AO2.2)	**ALLOW** 1.6×10^{-3}
		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 17.2/second graph ✓ idea that first graph/17.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓	2 (AO2 x 3.2b)	**ALLOW** larger mass of urea per BMI gained **ALLOW** line is steeper/higher gradient in Fig17.2 **IGNORE** higher BMI for greater mass of urea **ALLOW** second graph does not follow the line of best fit so closely
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
14	a		more accurate/precise measurement (of volume/amount of gas) ✓	1 (AO3.3b)	ALLOW gas could dissolve in water / less gas can escape IGNORE gives exact measurement of gas release
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.3 (cm^3 / min) award 3 marks $\frac{25+23+22}{3} = 23.3333333$ ✓ $\frac{23.3^{\cdot}}{10} = 2.3333333$ ✓ = 2.3 (cm^3 / min) ✓	3 (AO1 x 1.2) (AO2 x 2.2)	ALLOW one mark for clear evidence of rounding incorrect answer correctly to one dp.
		ii	increased movement of molecules / increased kinetic energy ✓ therefore, more chance of substrate colliding with enzymes/active sites ✓ more chance of substrate entering active site ✓	3 (AO2 x2.1)	increased KE of enzymes and substrates leads to more collisions = 2 marks ALLOW more enzyme-substrate complexes forming
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
15	a	i	water evaporates (on surface of spongy mesophyll) ✓ water (vapour) passes/diffuses through the stomata/pores ✓	2 (AO1.1)	Need evaporate or a description of the process
		ii	measure distance gas bubble moves ✓ over certain time / specified time ✓ vary distance of lamp from potometer ✓	3 (AO1.2)	ALLOW measure position of bubble before and after time taken for bubble to move a certain distance = 2 marks
		iii	absorbs heat/thermal energy (from lamp) / keeps (plants at) constant temperature ✓ heat/temperature would affect transpiration ✓	2 (AO2.2)	IGNORE references to photosynthesis
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 57 (mm^3) award 3 marks π x 0.5^2 x 72 ✓ = 56.52 ✓ = 57 (mm^3) ✓	3 (AO3 x 2.2)	ALLOW one mark for an answer of 226.08 and 2 marks for an answer of 230 (1.0 has been used as r) ALLOW one mark for clear evidence of incorrect answer correctly rounded to two sig figs.
		ii	42 (mm) / Trial 1 at 40cm ✓ reading taken too quickly after moving the lamp / error in measurement (distance bubble moved/time) / heat sink not in the way/radiating heat / change in room temp/air movements / potometer/light not at correct distance ✓	2 (AO2 x 2.2)	
		iii	Idea that they should remove/ignore the anomalous result (before processing) ✓	1 (AO1.2)	ALLOW repeat that reading
		iv	the mean is 73 mm ✓ the range of values is 71 to 75 / range is 4 mm / 2mm is half the range ✓	2 (AO2 x 1.2)	ALLOW adding or subtracting 2 from 73 covers all the readings this is the mean ± half the range = 2 marks
			Total	15	

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Question			Answer/Indicative content	Marks	Guidance
16	a	i	**Any two from:** contains (plant) hormones ✓ causes excessive/rapid cell elongation/growth ✓ only affects broadleaved plants ✓	2 (AO2 x 1.1)	**ALLOW** auxins **IGNORE** just plants grow faster **ALLOW** effects some plants/weeds and not others/the crop
		ii	**B** because B causes highest percentage death of horsenettle ✓ A/C do not kill other broadleaved plants/weeds / A/C not suitable as field contains other weeds / A/C only kills horsenettle ✓ D does not kill roots / much less effective at killing horsenettle ✓ Spring treatment because buds just growing and flowering yet to happen ✓	4 (AO3.1b)	**No mark for B on its own.** **NEED a choice of B or D to score any marks** **Mark first choice** Need reference to both buds and flowering **ALLOW D** for three marks if B is not chosen first: because D kills more species of weeds ✓ D much cheaper than B ✓ spring treatment because buds just growing and flowering yet to happen ✓
	b		peak CO_2 level is close to the peak of ripening chemical level / CO_2 levels increasing as production of chemical increases ✓ process is respiration ✓	2 (AO2 x 3.2b)	**DO NOT ALLOW** there is a spike/peak in CO_2 as the chemical increases **ALLOW** fermentation
			Total	**8**	

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Question			Answer/Indicative content	Marks	Guidance
17	a	i	Yes (no marks) cooler than black/grey skin **OR** Yes (no marks) lighter skin is cooler **OR** No (no marks) zebra skin was similar temperature to the other barrels **OR** No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours **OR** idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	**ALLOW** use painted towels to cover barrels **ALLOW** for same type of skin e.g. hair-free skin
	b	i	**Any two from:** zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2x3.1a)	**ALLOW** insect bites for insects **IGNORE** length of stripe **ALLOW** width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	**ALLOW** width tolerance between 7-9cm and least number of insects (on tape)

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Question			Answer/Indicative content	Marks	Guidance
		iii	**Any three from:** stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	**ALLOW** some more striped than others **ALLOW** offspring produced / breed together **IGNORE** selective breeding **ALLOW** pass on advantageous gene **IGNORE** trait is passed on / genes are passed on **IGNORE** over time
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
18	a		normal bin has holes to allow in air / oxygen ✓ (making normal compost) so aerobic respiration occurs ✓	2 (AO2.1) (AO1.1)	**ALLOW** converse arguments for bokashi bin **ALLOW** aerobic bacteria carry out respiration **IGNORE** bacteria work aerobically
	b		used the same pile of dead plant material for both composters / used same plant type / used equal mass in both composters ✓	1 (AO2.2)	**ALLOW** used the same time interval for both composters **ALLOW** used the same water/moisture content for both composters **ALLOW** idea of same external conditions e.g. put both in same place / external temperature kept the same / kept in the same environment **IGNORE** references to fair testing
	c	i	Axes – both correctly labelled, including units✓ Axes - even scales occupying more than half of the grid ✓ Plotting - all points correctly plotted ✓ Line - lines labelled or a key ✓ Line - points with curve of best-fit lines ✓	5 (AO5 x 2.2)	Must have time on x-axis and temperature on y-axis **ALLOW** +/- half a square at least 8 points correctly plotted **IGNORE** extrapolated lines
		ii	temperature increased as compost decomposed / bacteria released heat by respiration ✓ temperature starts to drop as decomposition slows down/complete / bacterial respiration slows ✓	2 (AO2 x 2.1)	**ALLOW** rise in temperature due to energy released by respiration ✓ **ALLOW** bacterial activity slows (if respiration already mentioned) **ALLOW** temperature starts to drop as enzymes in respiration denature at high temperatures
		iii	idea that decomposition in bokashi (method) bin much slower ✓ anaerobic respiration releases less heat/energy than aerobic respiration ✓	2 (AO2 x 2.1)	Enter text here.

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Question			Answer/Indicative content	Marks	Guidance
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 27 (%) award 3 marks 400 / 1500 x 100 ✓ 26.6 (%) ✓ = 27 (%) ✓	3 (AO2.2) (AO2.2) (AO1.2)	If answer = 26.6 (%) award 2 marks ALLOW ECF for correct rounding
		ii	 idea that the gas given off is carbon dioxide ✓ less greenhouse gas produced / less likely to result in global warming / less contribution to greenhouse effect ✓	2 (AO2.2) (AO3.1b)	ALLOW for 2 marks less carbon dioxide produced which is a greenhouse gas ALLOW correct formula ALLOW explanations of the greenhouse effect IGNORE references to environmental damage/not environmentally friendly/pollution/not good for the environment
			Total	17	

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Question			Answer/Indicative content	Marks	Guidance
19	a		**Any two from:** anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2 (AO2 x 1.1)	**DO NOT ALLOW** incorrectly matched symptom to blood cell type **ALLOW** less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC **ALLOW** (recurring) nosebleeds / bruise easily due to lack of platelets
	b	i	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ **OR** weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2 (AO2 x 2.1)	**IGNORE** fighting(off) pathogens
		ii	Area = 10 × 10 = 100(mm^2) Volume = 100 × 0.001 = 0.1 (mm^3) ✓	1 (AO2.2)	
		iii	No (no mark) 1000 ÷ 0.1 OR 1000 x 10 ✓ number of white blood cells/mm^3 is 10 x 10^3 / 1.0 x 10^4 / 10000 ✓ within the range of 6.0 – 16.0 x 10^3 ✓	3 (AO2 x 2.2) (AO3.2b)	**ALLOW** ECF from (ii) **ALLOW** number of white blood cells /mm^3 = 10 000 **ALLOW** within the normal white blood cell range/ 6000 – 16000

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Question			Answer/Indicative content	Marks	Guidance
	c		(Fanconi anaemia) (no mark) (3 x 10^6 is a) low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ OR cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓	3 (AO3x3.2 b)	if incorrect disorder then no marks IGNORE low numbers of all cells
			Total	11	

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Question			Answer/Indicative content	Marks	Guidance
20	a		smallest → largest: nucleotide; allele; chromosome; genome	1 (AO1.1)	
	b		66000000 ÷ 500 = 132 000 ✓	1 (AO2.2)	**ALLOW** 0.132 million or 132 thousand
	c		man: D, d woman: d, d Dd, dd Dd, dd ✓ 0.5 / 50(%)✓	2 (AO2.2) (AO3.1a)	**ALLOW** appropriate use of other lower/upper case letters **ALLOW** ECF **ALLOW** 1 in 2 / ½ / 1:1 ✓ **DO NOT ALLOW** 1:2

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Question			Answer/Indicative content	Marks	Guidance
	d		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **AND** Analyses the information to explain the link between a lack of LDL protein and heart disease. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **OR** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Analyses the information to explain the link between a lack of LDL protein and heart disease. **OR** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **AND** Analyses the information to explain the link between a lack of LDL protein and heart	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)	**AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle.** • blood in the coronary artery supplies heart muscle • oxygen / glucose is supplied to the muscle • this is needed for the muscle to contract/for respiration **AO2.1 Apply knowledge and understanding of the requirements of the heart muscle** • without oxygen / glucose the heart muscle cannot respire • energy from respiration is needed for the muscle to contract **AO3.1a Analyse information and ideas to interpret the effects of lack of LDL receptor protein.** • without LDL receptor protein there will be more cholesterol in the blood / cholesterol levels will be too high to be removed/broken down • increased build up of cholesterol in the coronary artery will increase the risk of heart disease / decrease blood flow to the heart muscle

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Question			Answer/Indicative content	Marks	Guidance
			disease. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Demonstrates a knowledge of the importance of the blood supply to the heart. **OR** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **OR** Analyses the information to explain the link between a lack of LDL protein and heart disease. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit*		
	e		low dose of the drug does not seem to have any effect ✓ because the effect is very similar to the placebo ✓ high dose of the drug lowers blood cholesterol level most and would be the best way to administer the drug ✓	3 (AO3 x 3.1b)	
			Total	**13**	

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Question			Answer/Indicative content	Marks	Guidance
21			**Any three from:** biological control ✓ nematodes will eat cutworms ✓ less cutworms ✓ less stevia eaten ✓ increase the yield ✓	3 (AO3 x 2.1)	 **ALLOW** predators of the cutworms added **ALLOW** more crop
			Total	3	

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