OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B5.1 INHERITANCE

SCORE	PERCENTAGE
/154	%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			Total	**1**	
2			A	1	
			Total	**1**	
3	a		Nn / heterozygous (1)	1	
			0.5 (1)	1	**allow** 50% / ½ / 1 in 2 / 50:50
	b	i	Tim's and Meena's genotypes Nn (1)	1	
		i	correct genotypes of offspring (NN, Nn, Nn, nn)	1	
		ii	baby may be nn (1)	1	
		ii	one in four chance of baby being affected (1)	1	
		ii	pancreas produces insulin (1)	1	
		ii	insulin controls blood glucose level (1)	1	
			Total	**8**	
4			all genetically identical / all have the same genes (1)	1	all clones (1)
			Total	**1**	
5			C	1	
			Total	**1**	
6			A	1	
			Total	**1**	
7			A	1	
			Total	**1**	
8			A	1	
			Total	**1**	
9	a		change in base sequence of DNA (1)	1	
			change in order of amino acids (1)	1	
			protein shape changes (1)	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			reference to shape not being suited to function e.g. change in enzymes active site shape (1)	1	
	b		heterozygous (1)	1	
			does not have Wolfram's syndrome (1)	1	
	c	i	Tim's and Lucy's genotypes Nn (1)	1	**allow** correctly completed punnet square
		i	correct genotypes of offspring (NN, Nn, Nn, nn) (1)	1	
		ii	baby may be nn (1)	1	
		ii	one in four chance of baby being affected (1)	1	
		ii	pancreas produces insulin (1)	1	
		ii	insulin controls blood glucose level (1)	1	
			Total	12	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
10	a		50% /½/1 in 2 (1) Gemma must be / heterozygous / (only) got one dominant allele and Leroy is / homozygous recessive / has no dominant allele (1)	2	**allow** 50/50 **allow** letters such as Hh and hh in a punnet square but must indicate which genotype belongs to who Look for correct labelling on diagram **Examiner's Comments** There were a lot of Punnett squares drawn in response to this question, the majority correct. Although many did work out the correct ratio, a number of candidates tried to work out the probability based on the ratio of brothers and sisters affected, rather than the genotypes of Gemma and Leroy.
	b	i	Gemma's phenotype but not her genotype (1) **last box**	1	**Examiner's Comments** A good discriminator question.
		ii	**any two from:** (antigens trigger) white blood cells release antibodies / antitoxins (1) antibodies / antitoxins lock on to antigens (and destroy them) (1) white blood cells engulf antigens (1)	2	**allow** attach on to antigens **allow** phagocytosis / digest antigen **ignore** eaten **ignore** antibodies engulf antigens **ignore** pathogens **Examiner's Comments** The best responses clearly described the roles of white blood cells in antibody production and phagocytosis. With a few candidates there was some confusion between antigens, antibodies and even antibiotics, for example ‘antibodies engulfing antigens’ or ‘antigens producing antibodies’. Other candidates incorrectly referred to pathogens.
			Total	**5**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
11		i	**any two from:** in the nucleus (1) on/in the chromosomes (1) in the DNA (1)	2	**allow** mitochondria (1)
		ii	it is a non-infectious (disease) (1) not caused by a pathogen / is caused by a gene (1)	2	**allow** non-contagious / can not be caught **allow** it is inherited **ignore** it's genetic (in question) **Examiner's Comments** In part (i) three quarters of candidates gained at least 1 mark, with a third of these gaining 2, for correctly referring to the nucleus, chromosomes or DNA. In part (ii) a quarter of the candidates gained both marks for explaining that hyperhidrosis is a non-infectious disease because it is caused by a gene not a pathogen. Although a mark was given for saying that the condition is caused by a gene, there was no credit for simply saying that it is a 'genetic disorder', as this term had already been given in the question. Candidates should be made aware of this principle of marking. Credit was given for saying that the condition is inherited, but candidates should be aware that it 'can be passed to relatives' is not the same as 'can be inherited'.
			Total	**4**	
12			mutation (1) recessive (1)	2	
			Total	**2**	
13			all clones (1) so are genetically identical / have the same genes (1)	2	
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
14	a		DNA is not a protein (1)	1	**ignore** just DNA
	b		**any two from:** egg cells do not supply all the chromosomes / genes (1) BUT (sperm and) eggs (each) supply half of the genetic material / genes / chromosomes (2) egg cells are larger because they do not need to swim / contain food reserves (1)	2	
	c		the substrate is like a key (not the enzyme) (1) the substrate fits into the enzyme's active site (not the other way round) (1)	2	**allow:** the enzyme is like a lock (not a key) (1) **allow:** the enzyme has an active site not the substrate (1) **allow**: 'enzyme and the substrate are the wrong way round' (2)
			Total	**5**	
15			mutation (1) recessive (1) heterozygous / carriers (1)	3	**ignore** different
			Total	**3**	
16			A ✓	**1 (AO1.1)**	
			Total	**1**	
17			B ✓	**1 (AO1.1)**	
			Total	**1**	
18			C ✓	**1 (AO1.1)**	
			Total	**1**	
19			C ✓	**1 (AO1.1)**	
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
20	a		<table><tr><th>Continuous</th><th>Discontinuous</th></tr><tr><td>height</td><td>sex blood group eye colour</td></tr></table> ✓✓	2 (AO1.1)	All four correct = 2 marks Three correct = 1 mark Two or less correct = 0 marks <u>Examiner's Comments</u> There was some confusion in the answers, mixing up continuous and discontinuous variation. Lower ability candidates did not gain marks here.
	b		sperm cell 23 ✓ zygote 46 ✓ body cell 46 ✓	3 (AO1.1)	<u>Examiner's Comments</u> The majority of candidates achieved full marks here for correctly identifying the number chromosomes in each of the cell types.
			Total	5	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

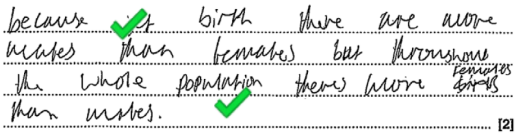
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
21	a		male sex chromosomes are XY ✓ female sex chromosomes are XX ✓	2 (AO 2 × 1.1)	<u>Examiner's Comments</u> The majority of candidates did not recall that males have XY and females have XX sex chromosomes. This question was a good differentiator. Most common errors were linking gametes or chromosome number of gametes to male and female respectively. This is shown in Exemplar 3, which achieved 0 marks. Exemplar 3 Male 23 Female 23 [2]
	b	i	51.2 (%) ✓	1 (AO 2.2)	ALLOW 51 / 51.22 or correct rounding <u>Examiner's Comments</u> This question differentiated well, with the higher ability candidates more likely to correctly calculate the percentage.
		ii	210 (%) ✓	1 (AO 2.2)	ALLOW 209 <u>Examiner's Comments</u> This answer was correctly calculated by half of the candidates.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		iii	in the **whole population**, there are more females / less males✓ however more males are born (than females) ORA ✓	2 (AO 2 × 3.1a)	IGNORE less males alive IGNORE there are less males over the whole population than at birth If no other mark scored, credit ratio of males has decreased from birth <u>Examiner's Comments</u> The most common mark scored was that in the whole population there are more females (than males). Of those candidates that didn't score, the vast majority did not compare males against females and stated the number for males at birth compared to the whole population. Exemplar 4 scored full marks. Exemplar 4  because at birth there are more males than females but throughout the whole population there is more females than males. [2]
			Total	6	

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
22	a		mutation: change in a gene / DNA / deletion of a base / addition of a base / change in order of bases ✓ gene: a section/length of DNA ✓ OR codes for a protein ✓	2 (AO 2 × 1.1)	AW nucleotide for base ALLOW codes for the order/sequence of amino acids IGNORE codes for a characteristic Examiner's Comments There were some good answers here demonstrating their knowledge and understanding of the meaning of the terms mutation and gene. Mutation was the most common credited answer.
	b	i	(the allele) is recessive ✓	1 (AO 2.1)	ALLOW neither dominant Examiner's Comments Candidates need to apply their knowledge and understanding of genetics to achieve this mark. It differentiated well with the higher ability candidates' understanding that the allele is recessive. The majority of candidates referred to the number of eyes, and that they need two to become stronger / dominant, which did not gain credit.
		ii	The retina is damaged/doesn't function ✓	1 (AO 1.1)	ALLOW retina detects light / focuses the image / contains light receptors Examiner's Comments This was a well differentiated question. The majority of lower ability candidates did not gain the mark as common answers were too generalised such as 'it affects the eyes'.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		<table><tr><td></td><td>*R*</td><td>*r*</td></tr><tr><td>*R*</td><td>*RR*</td><td>*Rr*</td></tr><tr><td>*r*</td><td>*Rr*</td><td>*rr*</td></tr></table> ✓✓ *probability = 0.25 / ¼ / 25% / 1 in 4 / 1:3* ✓	3 (AO 2 × 1.2) (AO 3.2b)	All genotypes correct = 2 marks Three genotypes correct =1 mark One / two genotypes correct =0 marks Examiner's Comments The majority of candidates achieved 2 or 3 marks correctly identifying the genotypes in the offspring. Some candidates couldn't work out the probability…
			Total	7	
23			C ✓	1 (AO2.1)	
			Total	1	
24			D ✓	1 (AO1.1)	
			Total	1	
25			D ✓	1 (AO1.1)	
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
26			C ✓	1 (AO1.2)	Examiner's Comments This question assessed candidates' understanding of how the phenotype and genotype are affected under different conditions. Many candidates' responses were that it was only the genotype that would be affected by the treatment rather than the correct response being only the phenotype.  This may indicate a misconception in candidates thinking that anything that happens within the body has to do with the genotype. Key:  Misconception
			Total	1	

STEMUP.CO.UK

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>27</td><td>a</td><td></td><td>Gene:
a length of DNA that codes for a protein ✓

Allele:
an alternative form/version of a gene ✓</td><td>2
(AO 2 × 1.1)</td><td>IGNORE section of DNA that codes for a specific characteristic

ALLOW a particular copy of a gene

<u>Examiner's Comments</u>
This question tested recall knowledge AO1.1 of the definitions of two genetic terms. The most common error was to only describe the gene as a section of DNA coding for a characteristic rather than coding for a protein. Candidates had a better knowledge of what an allele was.</td></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><td></td><td>R</td><td>r</td></tr><tr><td>R</td><td>RR</td><td>Rr</td></tr><tr><td>r</td><td>Rr</td><td>rr</td></tr></table>
correct gametes ✓

correct genotypes of offspring ✓

probability = 0.25 / ¼ / 25% / 1 in 4 / 1:3</td><td>4

(AO 2.2)

(AO 2.2)

(AO 3.2b)</td><td>ALLOW other forms of diagrams other than Punnett square

<u>Examiner's Comments</u>
This question assessed AO2.2 with the application of practical techniques in completing a genetic cross. This was particularly well done by most candidates, except some candidates did not choose the symbols recommended in the question and this caused them confusion in interpretation. The question also included an AO3 mark for interpreting and drawing a conclusion from the Punnett square. The most common error was to give 75% as the response. Some candidates also made an error by describing the ratio as 1 in 3 when they should have written 1 in 4 or 1:3. These errors could be minimised by improving examination technique, where candidates are made aware of common errors in interpreting genetic diagrams.</td></tr>
</table>

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	rod cells are do not work / damaged ✓	3 (AO 2.1)	**ALLOW** rods cells broken down / cones are not broken down **IGNORE**rod cells broken down (as in stem of question)
			rod cells can work in dim light ✓	(AO 2.1)	**ALLOW** converse for cones
			but cannot detect colour ✓	(AO 1.1)	**ALLOW** converse for cones **ALLOW** rods only see in black and white Examiner's Comments This question covered AO1.1 and AO2.1. Candidates often did not identify that rod cells were damaged. They frequently just put rod cells break down, missing out it was 'only' the rod cells, and hence were just repeating what was in the stem of the question. Good responses also discussed cones cells so got the reverse argument.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
28	a		sperm/male gametes contain either an X or Y chromosome **and** eggs/female gametes contain an X chromosome ✓ indication that XX is female **and** XY is male ✓	2 (AO 2 × 1.1)	**ALLOW** correct Punnett square but unlabelled for gamete mark **ALLOW** correct Punnett square that indicates XY is male **and** XX is female for 2 marks Examiner's Comments Most candidates scored well on this AO1 question. Candidates who didn't gain marks either mixed up the genders, saying females were XY, or occasionally they used incorrect nomenclature **m** and **f**, and some had **YY** as a possible genotype.
	b		**First check answer on answer line** **If answer = 357512 award 2 marks** $\frac{105}{205}$ x 698000 ✓ = 357512 ✓	2 (AO 2 × 2.2)	**ALLOW** answer given to several dps Examiner's Comments This question assessed candidates' mathematical skills in AO2.2. In the main, many candidates got maximum marks. Common incorrect responses were due to rounding errors, including rounding before multiplying. Lower ability candidates simply halved 689000. Some candidates made rounding errors but only wrote the final answer and had not shown any working. They were not able to gain the mark for correct working out even though they had most likely done this. Improved examination technique and practice would overcome this. Examination technique needs candidates to focus on candidates showing their working out on calculations.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		males do not live as long/ORA ✓	1 (AO3.1b)	ALLOW they (females) live longer Examiner's Comments In this AO3 question many candidates tried to explain why it was likely that males die, but few referred to them dying earlier than females, or that females live longer. Higher ability candidates correctly referred to the longer life expectancy of females.
			Total	5	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

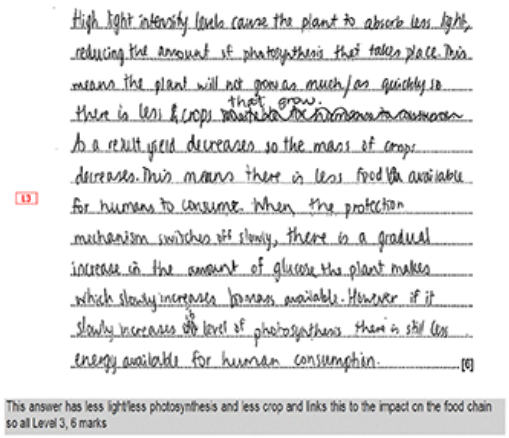
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
29			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)** Detailed explanation including conclusions about how the mechanism affects photosynthesis and links this to less biomass available to humans in the food chain. *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)** Explanation of how the mechanism affects photosynthesis or affects the biomass available to humans. *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 some knowledge of how the mechanism affects photosynthesis or affects the biomass available to humans. *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.*	6 (AO 3. × 1.1) (AO 2. × 2.1) (AO 1. × 3.2b)	**AO1.1 Demonstrate knowledge of photosynthesis and biomass.** • Photosynthesis requires light energy • Mechanism reduces photosynthesis • Trapped by the leaves and used to produce food molecules • Photosynthesis required for plant growth • Plant biomass is a food source for animals including humans **AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass** • More light energy converted to heat, then less energy for photosynthesis • Less photosynthesis then plants can make less food / plants can grow less • Less plant biomass leads to less available food **AO3.2b Draw conclusions linking photosynthesis to biomass in food chains** • In low light intensities, light availability is the limiting factor • Less plant growth/crops therefore less food for cattle/less food for humans / in the food chain <u>Examiner's Comments</u> This Level of Response question assessed all three main assessment objectives. It was common to be limited to a low level mark due to repeating the stem of question regarding less biomass all through their response instead of linking the protection mechanism's impact to less light, less photosynthesis so less glucose/food made and consequently less food for cattle and humans. Candidates that did not appreciate that a reduction in light resulted in a reduction in photosynthesis, which also limited their answer to a low level.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					There was little evidence of candidates planning their response. Taking time to consider how to answer a LoR, might encourage them to make notes and think through key areas. A common low level answer was to refer to the loss of energy due to the energy needed to switch on the mechanism. It was noted how many candidates did not link biomass to growth or production of food. However, those candidates that realised that the key to the answer was essentially linked to factors influencing photosynthesis, produced excellent responses. Exemplar 5  High light intensity levels cause the plant to absorb less light, reducing the amount of photosynthesis that takes place. This means the plant will not grow as much/as quickly so there is less crops that grow. As a result yield decreases so the mass of crops decreases. This means there is less food available for humans to consume. When the protection mechanism switches off slowly, there is a gradual increase in the amount of glucose the plant makes which slowly increases biomass available. However if it slowly increases the level of photosynthesis there is still less energy available for human consumption. [6] This answer has less light/less photosynthesis and less crop and links this to the impact on the food chain so all Level 3, 6 marks This candidate has been credited Level 3 maximum 6 marks. They have structured their answer in a concise manner but included all the relevant marking points. The candidate describes the protection mechanism's impact in reducing light andphotosynthesis. The candiates states that thedecrease in mass of crops and food made means there is consequently less food for the humans to consume. They continue to give a reason why there will still be less energy available even when the plants resume photosynthesis due to the mechanism switching off slowly.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
30			C	1 (AO 1.1)	Examiner's Comments This question proved to be the most challenging question in section A. Many candidates did not recognise the correct combination of gametes which will produce a male baby which is C - A sperm with one Y chromosome and an egg with one X chromosome. All incorrect responses demonstrated equal weighting.
			Total	1	
31			C	1 (AO 2.2)	Examiner's Comments This question assessed the candidate?s application of their knowledge and understanding of genotypes. All incorrect responses demonstrated equal weighting, confusing homozygous and heterozygous along with dominant and recessive genotypes.
			Total	1	
32			D	1 (AO 1.1)	Examiner's Comments This question assessed knowledge and understanding of discontinuous variation. Roughly half of candidates achieved this mark. Those who didn?t opted for a named example of continuous variation instead.
			Total	1	
33			B	1 (AO 2.1)	Examiner's Comments This question assessed the candidate?s application of their knowledge and understanding of gamete chromosome numbers. The main incorrect response was D, and candidates doubled the body cell diploid number provided instead of halving it to provide the haploid chromosome number.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
34			D	1 (AO 1.1)	
			Total	**1**	
35			D	1 (AO 1.1)	Examiner's Comments Recalling their knowledge in this AO1.1 question was answered well by higher ability candidates, less so by others. Lower ability candidates were frequently distracted by A.
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

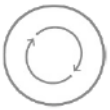
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
36		i	control ✓ can act as a comparison / to check the drug works ✓ idea of identifying / eliminates any psychological effect ✓	3 (AO 1.1)	ALLOW placebo contains no active drug / dummy injection ALLOW see the effects of the drug ALLOW to test if receiving something from a doctor or the drug itself is having the effect / some people believe they are feeling better when they are not ALLOW to eliminate placebo effect ALLOW tricks body into thinking it is taking a medicine Examiner's Comments This AO1.1 question tested knowledge of using a placebo group in drug development. Although it was described in a range of ways, most candidates realised the reason for a placebo group was to make sure that any improvement was not merely psychological. Fewer candidates stated that a placebo was a control, i.e. contains no active drug. Some candidates' responses focused on double blind tests and side effects. Very few candidates referred to the data in the table.
		ii	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 51.6 (%) award 3 marks 9.1-4.4 = 4.7 ✓ (4.7?9.1) x 100 ✓ = 51.6 (%) ✓	3 (AO 2 x 2.2) (AO 1 x 1.2)	51.648 / 51.65 /51.7 = two marks ALLOW ECF on the rounding IGNORE sign Examiner's Comments The AO2.2 part of this question resulted in candidates making a common error in not deriving 4.7, but the function and answer to their function were usually correct. Very few candidates scored zero, but a few worked out the correct answer then didn't round it correctly, so did not get the AO1.2 marking point.
			Total	6	

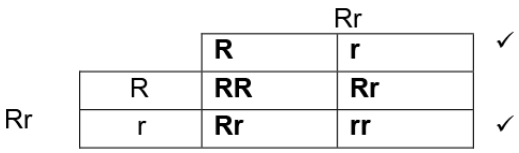
© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
37			an allele is a form/version of a gene ✓ dominant means that it always expresses itself when present ✓	2 (AO 1.1)	**ALLOW** only needs one allele present to be expressed/shown in the phenotype **ALLOW** allele which is expressed instead of another <u>Examiner's Comments</u> This AO1.1 question proved to be very challenging, even for some higher ability candidates. Many candidates did not define the term allele at all, limiting their maximum mark to 1.  AfL Candidates should be encouraged to learn definitions. Many candidates didn't seem to really understand the term dominant, in a biological context, using words like stronger, override or overpower.
			Total	2	

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
38	a		clots the blood ✓ prevents bleeding / allows wounds to heal / forms a scab ✓	2 (AO 1.1)	IGNORE clump blood ALLOW prevents pathogens getting into the body <u>Examiner's Comments</u> There was some confusion in the responses describing the role of platelets whereby candidates thought platelets had a role in the specific immune response. Only higher ability candidates gained a mark here.
	b		 ✓ ✓ ratio 3 : 1 ✓	3 (AO 2.1) (AO 3.2b)	correct gametes = one mark correct genotypes of offspring = 1 mark ALLOW ECF for ratio ALLOW 3 in 4 <u>Examiner's Comments</u> The majority of candidates achieved two or three marks correctly identifying the gametes and genotypes. Most went onto correctly identifying the ratio if they achieved the gametes mark. Very few candidates achieved the error carried forward mark.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

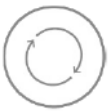
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		**Any three from:** variation with some rats resistant and some who are not ✓ (resistant rats) more likely to survive/less likely to be killed ORA ✓ (resistant rats more likely) reproduce ORA ✓ pass on the allele / gene for resistance ORA ✓	3 (AO 2.1)	**IGNORE** selective breeding **ALLOW** mutation for resistance **ALLOW** offspring produced / breed together **ALLOW** pass on advantageous gene **IGNORE** trait is passed on / genes are passed on Examiner's Comments Candidates had to apply their knowledge of natural selection to explain why the percentage of resistant rats was increasing. There were a range of marks given for this question. Most none scoring responses were too vague and not using key terms. Most candidates did not appreciate that there was variation for resistance within the population.
	d		**Any two from:** (stops/less) respiration ✓ (no/less) energy/ATP ✓ key process interrupted e.g. cell metabolism/protein synthesis/chemical reactions/active transport ✓	3 (AO 2.1)	Examiner's Comments This question was one of the most challenging application of knowledge and understanding questions. The most common awarded mark was appreciation that energy release would be affected. A lot of responses were very general and would say the rat can't breathe or can't get any oxygen.
			Total	11	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
39	a		platelets are needed for blood clotting ✓ the rat would keep bleeding/bleed to death ✓	2 (AO 2.1)	Examiner's Comments Many candidates were able to score both marks on this AO2.1 question although some did not mention platelets. A significant number of candidates, however, linked the poison to clotting incorrectly, saying blood would clot too much or in the wrong place. In that type of response, there were references to heart attacks and strokes. Some candidates referred to wounds clotting.
	b		parents are Rr and Rr ✓ offspring are RR, Rr, Rr, rr ✓ rr identified as being non-resistant ✓	3 (AO 2.2)	**ALLOW** all marks from a Punnett square **ALLOW** ECF on offspring Examiner's Comments Many candidates scored on this AO2.2 question. The most frequent way candidates did not get maximum marks was by omitting to identify the correct offspring genotype. Candidates needed to annotate rr. A significant number of candidates only identified the non-resistant rate, not noticing that homozygous dominant rats were also present in that ratio; and therefore only stating 25% were homozygous. Candidates should be encouraged to routinely include the phenotypic ratio.  **AfL** Some candidates made errors on the Punnett square diagram. The main error was to cross R with r and derive RR. Candidates should be encouraged to check their answers for this type of error.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		Rr/heterozygous rats more likely to survive than RR/homozygous rats as they need less vit K / ORA ✓ therefore, when two Rr rats mate rr rats will be born ✓	2 (AO 2.2)	ALLOW rats that need less vit K are more likely to survive <u>Examiner's Comments</u> Where candidates successfully answered this AO2.2 question, it was from developing ideas from the previous question and linking the vitamin K survival rate in the heterozygous rat to when two Rr rats mate rr rats will be born. Many responses to this question showed confusion. Candidates referred to a variety of incorrect explanations such as non-resistant alleles becoming dominant and rats finding enough vitamin K to become non-resistant but immune to warfarin. Other incorrect responses included non-resistant rats surviving because they don't need much vitamin K and rats in some areas not getting access to warfarin.
			Total	**7**	
40			C ✓	1 (AO1.1)	
			Total	**1**	
41			C ✓	1 (AO2.1)	
			Total	**1**	
42			A ✓	1 (AO1.1)	
			Total	**1**	
43			A ✓	1 (AO2.1)	
			Total	**1**	
44			B ✓	1 (AO2.1)	ALLOW 19
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
45	a		smallest: nucleotide / allele / chromosome :largest ✓	1 (AO1.1)	
	b		66000000 ÷ 500 = 132 000✓	1 (AO2.2)	**ALLOW** 0.132 million or 132 thousand or 1.32×10^5
	c		man: D, d; woman: d, d; Dd, dd, 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
			Total	**4**	
46			B ✓	1 (AO1.1)	
			Total	**1**	
47			C ✓	1 (AO2.1)	
			Total	**1**	
48			D ✓	1 (AO1.1)	
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
49	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

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

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	
50	a		smallest: nucleotide allele chromosome largest: 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
	d		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 839 award 2 marks 2517/3 ✓ = 839 ✓	2 (AO2 x 1.2)	 ALLOW 840 or 2521/3 ✓
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK