Mark scheme

Monohybrid crosses (genetic diagrams)

Biology 0610 · Questions from Paper 3 and Paper 4

Total marks

71

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
4	5	5	7	8	9	8	7	9	9	**71**

Question 1 [4]

1	<table><tr><th>number</th><th>genotype</th></tr><tr><td>1</td><td>**bb ;**</td></tr><tr><td>2</td><td>**Bb ;**</td></tr><tr><td>4</td><td>**Bb ;**</td></tr><tr><td>14</td><td>**bb ;**</td></tr></table>	4	

Question 2 [5]

2(a)(i)	**V**;	**1**	
2(a)(ii)	**W**;	**1**	
2(a)(iii)	**U**;	**1**	
2(a)(iv)	**X**;	**1**	
2(b)	1:1;	**1**	**A** 50% / 0.5
		Total: 5	

Question 3 [5]

3(a)(i)	(male) black (fur) (female) white (fur) ;	**1**	
3(a)(ii)	**bb ;**	**1**	
3(a)(iii)	**Bb ;**	**1**	
3(b)(i)	**BB** and **Bb ;**	**1**	
9)b)(ii)	3 (black) : 1 (white) ;	**1**	

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Question 4 [7]

4(a)(i)	has two identical alleles (for a particular gene);	1	
4(a)(ii)	(one of the parent plants is white but) all of the offspring have red flowers ;	1	
4(b)	*parental genotypes: (red flower)* **Rr** ; (white flower) **rr** ; *parental gametes:* **R**, **r** and **r**, (**r**) ; *offspring genotypes:* **Rr** and **rr** ; *offspring phenotypes:* red and white ;	5	

Question 5 [8]

5(a)(i)	gg ; yellow ; yellow ;	3	
5(a)(ii)	top row both offspring Gg, bottom row both offspring gg ; 1:1 ;	2	
5(b)(i)	2 ;	1	
5(b)(ii)	**R** / **S** ;	1	
5(b)(iii)	0% circled ;	1	

Question 6 [9]

6(a)	alternative form / different versions ; of a gene ;	2	
6(b)	*individual 1*: **gg** / homozygous recessive ; it is yellow / it is **not** green ; *individual 2:* **Gg** / heterozygous ; there are yellow offspring ;	4	**A** if **G** was present, it would be green **A** individuals **4** and **6** could not be produced (if **GG**) / both pod colours can only be produced if **Gg**
6(c)	both parental gametes are **G** and **g** ; offspring are **GG Gg Gg gg** ; 3 (green pod :) 1 (yellow pod) ;	3	**ecf** for incorrect previous step

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Question 7 [8]

7 **(a)**	the allele that is expressed (if it is present) / AW; always seen in the phenotype; masks (effect of) recessive allele;	**max 1**	**I** 'powerful' defines the phenotype defines characteristic(s)
(b) (i)	*Parent genotype*: Ff , Ff; *Parent phenotype*: (with) flecks × (with) flecks; *Gametes*: F , f, F , f; Working shown to derive genotype; *Offspring genotype*: FF , Ff , ff; linked to correct phenotype	**5**	**ECF** on incorrect key usage **ECF** from each line **A** Punnett square / criss-cross lines
(ii)	ff × ff; parents may be implied as first part of the question asks for parental genotype both parents must have a recessive <u>allele</u> / (if ff × ff) no dominant or F <u>allele</u>, in either parent / (if ff × ff) both parents must be homozygous, recessive / without flecks no parent must be homozygous dominant / presence of (even) one dominant allele in parents could result in flecks;	**2**	**A** Ff × Ff and Ff × ff **ECF** on incorrect key usage from **(i)** **A** gene for allele
		[Total: 8]	

Question 8 [7]

8(a)	*any two from:* parent 2, is homozygous recessive / has two alleles (for red-green colour blindness) **;** only parent 2 can provide the X chromosome for male children **;** males only have one X chromosome and they only need one recessive allele (to be red-green colour blind) **;** red-green colour blindness is a sex-linked characteristic **;**	**2**	
8(b)	*parental genotypes:* parent 3 X^bY **and** parent 4 X^BX^b **;** *gametes:* X^b , **Y/0/-** **and** X^B, X^b **;** *probability:* 0.5 / 50% **;**	**5**	

offspring genotypes	X^BX^b,	X^BY	X^bX^b	X^bY	;
offspring phenotypes	normal (colour vision) female	normal (colour vision) male	colour-blind female	colour-blind male	;

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Question 9 [9]

9 (a)	*gene* a length of DNA that codes for a protein ; *gene mutation* a change in base sequence of DNA ;	[2]	**R** chromosome / molecule of / genome
(b) (i)	1 **Bb** ; 2 **bb** ; 3 **Bb** ;	[3]	

(ii)	(Bb x bb) **B** , **b** + **b** , (**b**) ; *offspring genotypes* **Bb** and **bb** ; **A** heterozygous and homozygous recessive *offspring phenotypes* normal / carrier and acatalasia ;	[3]	<table><tr><td colspan="2"></td><td colspan="2">male gametes</td></tr><tr><td colspan="2"></td><td>**B**</td><td>**b**</td></tr><tr><td rowspan="2">female gametes</td><td>**b**</td><td>**Bb**</td><td>**bb**</td></tr><tr><td>(**b**)</td><td>(**Bb**)</td><td>(**bb**)</td></tr></table>
(iii)	test (cross) ;	[1]	
		[Total: 9]	

Question 10 [9]

10(a)	discontinuous ;	**1**	
10(b)	*chicken 2* – F^BF^B and F^BF^W ; *chicken 7* – F^WF^W and F^BF^W and F^BF^B ;	**2**	
10(c)	*phenotypes: (**5**)*(male) black and white (feathers) × *(**6**)*(female) black (feathers) ; *parental genotypes:* F^BF^W × F^BF^B ; *gametes:* F^B , F^W F^B , F^B ; *offspring genotypes:* F^BF^W, (F^BF^W) and F^BF^B, (F^BF^B) ; *offspring phenotype percentage:* 50(%) black and white and 50(%) black ;	**5**	ecf from previous step
10(d)	(ABO) blood group / AVP ;	**1**	

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