

# Inheritance

## Mark Scheme 4

<b>Level</b>	IGCSE
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Inheritance
<b>Paper Type</b>	(Extended) Theory Paper
<b>Booklet</b>	Mark Scheme 4

**Time Allowed:** 52 minutes

**Score:** /43

**Percentage:** /100

Question	E	Answers	Marks	Additional Guidance												
1 (a) 1 2 3		$A^C A^Y$ ; $A^C A^Y$ ; orange-red ;	[3]	<b>R</b> – $A^C A^C$ etc <b>A</b> – $A^C$ , $A^C$ <b>MP2</b> relies on <u>correct</u> <b>MP1</b> , allow ECF <b>MP3</b> stands alone ( <b>A</b> orange)												
(b)		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 30%;">cross</th> <th style="width: 40%;">genotypes of offspring</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>offspring x offspring</td> <td><math>A^C A^C</math> , <math>A^Y A^Y</math> , <math>A^C A^Y</math> ;</td> </tr> <tr> <td>3</td> <td>offspring x crimson-flowered plant</td> <td><math>A^C A^C</math> , <math>A^C A^Y</math> ;</td> </tr> <tr> <td>4</td> <td>offspring x yellow-flowered plant</td> <td><math>A^Y A^Y</math> , <math>A^C A^Y</math> ;</td> </tr> </tbody> </table>		cross	genotypes of offspring	2	offspring x offspring	$A^C A^C$ , $A^Y A^Y$ , $A^C A^Y$ ;	3	offspring x crimson-flowered plant	$A^C A^C$ , $A^C A^Y$ ;	4	offspring x yellow-flowered plant	$A^Y A^Y$ , $A^C A^Y$ ;	[3]	Allow ECF from Question 4a
	cross	genotypes of offspring														
2	offspring x offspring	$A^C A^C$ , $A^Y A^Y$ , $A^C A^Y$ ;														
3	offspring x crimson-flowered plant	$A^C A^C$ , $A^C A^Y$ ;														
4	offspring x yellow-flowered plant	$A^Y A^Y$ , $A^C A^Y$ ;														
(c) 1 2 3 4  5 6 7		1 phenotype of $A^C A^Y$ (offspring of cross 1) is different from either parent / homozygote genotype / AW ; 2 the phenotype, was intermediate / mixture of two colours ; 3 both alleles are expressed ; 4 <u>co / incomplete</u> dominance ;  5 offspring of cross 2 gives three phenotypes not two ; 6 offspring of crosses 3 and 4 both give two phenotypes ; 7 if dominance then cross 3 or 4 would give one phenotype only ;	[max 3]	<b>MP2</b> orange / red must be qualified <b>MP3</b> R genes												

Question	E	Answers	Marks	Additional Guidance
1 (d)	1 2 3	transfer of pollen from, <u>anthers</u> / <u>stamen</u> , to <u>stigma</u> ; self = within same flower (or flower on same plant); cross = between flowers on different plants (of same species) ;	[2]	<b>R</b> fertilisation <b>MP2, 3</b> need ref to <b>flowers</b> at some point
(e)	1 2 3 4 5 6 7 8	limited / little, variation ; offspring become homozygous (over time) / AW ; variation is due to mutation ; low chance that mutations will be expressed / AW ; offspring will be well adapted to conditions, locally / near parent ; if environment does not change ; limited / no, opportunity for evolution, if environment changes / example of change / will not be able to adapt to change in the environment ; AVP ; e.g. some variation due to meiosis / reduced variation leads to intraspecific competition locally	[max 4]	<b>R</b> no variation <b>MP2 – A</b> ref to inbreeding / limited gene pool  <b>MP7 A</b> ref to disease in context (as a change) <b>R</b> parents resistant, therefore offspring resistant /AW
			<b>[Total: 15]</b>	

Question	E	Answers	Marks	Additional Guidance
2	(a)	<ol style="list-style-type: none"> <li>1 fewer red blood cells ;</li> <li>2 less elastic / less flexible, red blood cells ;</li> <li>3 less haemoglobin ;</li> <li>4 haemoglobin / blood, less efficient at transporting oxygen ;</li> <li>5 less respiration ;</li> <li>6 less energy / fatigue / exhaustion / less active / feeling faint / breathlessness ;</li> <li>7 <u>capillaries</u> are blocked ;</li> <li>8 increased chance of thrombosis ;</li> <li>9 pain ;</li> <li>10 death of tissues linked to oxygen supply ;</li> <li>11 'sickle cell crisis' ;</li> <li>12 slow / poor, growth ;</li> <li>13 reduced life span ;</li> <li>14 AVP ; e.g. susceptible to infections / kidney damage</li> </ol>	max 5	<p><b>R</b> no oxygen</p> <p><b>R</b> no respiration</p>
(b)	(i)	$\text{Hb}^{\text{A}}\text{Hb}^{\text{S}} \times \text{H}^{\text{A}}\text{Hb}^{\text{S}}$ $\text{Hb}^{\text{A}} , \text{Hb}^{\text{S}} + \text{H}^{\text{A}} , \text{Hb}^{\text{S}} ;$ $\text{Hb}^{\text{A}}\text{Hb}^{\text{A}} , \text{Hb}^{\text{A}}\text{Hb}^{\text{S}} , \text{Hb}^{\text{A}}\text{Hb}^{\text{S}} , \text{Hb}^{\text{S}}\text{Hb}^{\text{S}} ;$ <p>normal, sickle cell trait, ;</p>	3+1	<p><i>allow <b>ecf</b> following a mistake in the genetic diagram after the parental genotypes, but 'mistake' must be worked correctly</i></p> <p><i>do not allow genotypes for parents or children that are single alleles</i></p> <p><i>phenotypes must match genotypes, i.e. must be in the same sequence</i></p>
	(ii)	chance is 1 in 4 / 25% / 0.25 / 0,25 ;		<b>R</b> 1:4 or 4:1

Question	E Answers	Marks	Additional Guidance
2	(c) resistance to / less chance of getting malaria ;	1	R immunity to malaria / stops you from getting malaria
	(d) <i>idea that</i> both alleles / Hb <sup>A</sup> and Hb <sup>S</sup> , are expressed ; both alleles make two different forms of haemoglobin ; if dominant / recessive, then only one form of haemoglobin in heterozygous people ; three phenotypes (not two) / sickle cell trait is a different phenotype from normal and sickle cell anemia ;	max 2	
		<b>[Total : 12]</b>	

Question	E Answers	Marks	Additional Guidance
3 (a)	<p><i>T. castane</i></p> <p><b>1</b> wet / AW ;</p> <p><b>2</b> any evidence from the table</p> <p>e.g. hot: (A) 100% – (B) warm: (C) 86% – (D) 13% / cold: (E) 29% – (F) 0% ;</p> <p><b>3</b> in <b>wet</b> conditions, <b>decreasing</b> survival with decreasing temperature ;</p> <p><b>4</b> any suitable two points from the table (i.e. (A) 100% – (C) 86% – (E) 29%) ;</p> <p><i>T. confus</i></p> <p><b>5</b> dry / AW ;</p> <p><b>6</b> any evidence from the table</p> <p>e.g. hot: (A) 0% – (B) warm: (C) 14% – (D) 87% / cold: (E) 71% – (F) 100% ;</p> <p><b>7</b> in <b>wet</b> conditions, <b>increasing</b> survival with decreasing temperature ;</p> <p><b>8</b> any suitable two points from the table (i.e. (A) 0% – (C) 14% – (E) 71%) ;</p>	[max 4]	<p><b>Note: marking points are linked in pairs e.g. MP1 pairs with M</b></p> <p><b>Note: at least two data points within species are required as ‘evidence’</b></p> <p><b>ignore</b> ref. to temperature for MP1 and MP2</p> <p><b>ignore</b> ref to temperature for MP5 and MP6</p>

Question		Answers	Marks	Additional Guidance
3	(b)	competition ; example of competition (food / space) ; one species better adapted / AW ;	[2]	R 'survive better' unqualified A survival of the fittest in context of adaptation
	(c)	<p>1 red-brown      black , Aa      x      aa ;</p> <p>2 A , a + a / a,a ;</p> <p>3 Aa , aa</p> <p>4 red-brown, black ;  1:1 / AW ;</p>	[4]	<p><b>Note:</b> marking points 1, 2, 3 are free-standing. MP 4 is linked to MP 3.</p> <p><b>allow ECF from MP1 to MP2</b></p> <p><b>allow ECF from MP2 to MP3</b></p> <p><b>allow ECF from MP3 to MP4</b></p>
	(d)	<p>mutation ; mutation, rare event ;</p> <p>(white) <u>allele</u> is recessive / <b>ora</b> ; only expressed in homozygote recessive ;</p> <p>selection ; disadvantage / AW ;</p>	[max 2]	<p>R gene A correct ref to parents – both must be heterozygous / homozygous / one of each</p> <p>A reason for being so</p>
	(e)	<p>decomposition ; bacteria / fungi, release enzymes / digest ; breakdown protein (in faeces) → amino acids ; deamination ; amino acids → ammonia ; breakdown urea → ammonia (+ carbon dioxide) ; (undigested) carbohydrate (in faeces) respired ;</p>	[max 4]	<p>A bacteria / fungi are decomposers A feed saprophytically</p>
			<b>[Total: 16]</b>	