

Inheritance

Mark Scheme 4

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|-------------------|-------------------------|
| Level | IGCSE |
| Subject | Biology |
| Exam Board | CIE |
| Topic | Inheritance |
| Paper Type | (Extended) Theory Paper |
| Booklet | 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] | R – $A^C A^C$ etc A – A^C , A^C MP2 relies on <u>correct</u> MP1 , allow ECF MP3 stands alone (A orange) |
| (b) | | <div>cross</div> <div>genotypes of offspring</div> | | |
| | 2 | offspring x offspring | | |
| | 3 | offspring x crimson-flowered plant | | |
| | 4 | offspring x yellow-flowered plant | | |
| | | | [3] | Allow ECF from Question 4a |
| (c) 1 2 3 4 5 6 7 | | phenotype of $A^C A^Y$ (offspring of cross 1) is different from either parent / homozygote genotype / AW ; the phenotype, was intermediate / mixture of two colours ; both alleles are expressed ; <u>co / incomplete</u> dominance ; offspring of cross 2 gives three phenotypes not two ; offspring of crosses 3 and 4 both give two phenotypes ; if dominance then cross 3 or 4 would give one phenotype only ; | [max 3] | MP2 orange / red must be qualified MP3 R genes |

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|----------|--------------------------------------|---|--------------------|--|
| 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] | R fertilisation MP2, 3 need ref to flowers 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] | R no variation MP2 – A ref to inbreeding / limited gene pool MP7 A ref to disease in context (as a change) R parents resistant, therefore offspring resistant /AW |
| | | | [Total: 15] | |

| Question | E | Answers | Marks | Additional Guidance |
|----------|------|--|-------|--|
| 2 | (a) | 1 fewer red blood cells ; 2 less elastic / less flexible, red blood cells ; 3 less haemoglobin ; 4 haemoglobin / blood, less efficient at transporting oxygen ; 5 less respiration ; 6 less energy / fatigue / exhaustion / less active / feeling faint / breathlessness ; 7 <u>capillaries</u> are blocked ; 8 increased chance of thrombosis ; 9 pain ; 10 death of tissues linked to oxygen supply ; 11 'sickle cell crisis' ; 12 slow / poor, growth ; 13 reduced life span ; 14 AVP ; e.g. susceptible to infections / kidney damage | max 5 | R no oxygen R no respiration |
| | | | | |
| (b) | (i) | $\text{Hb}^A\text{Hb}^S \times \text{H}^A\text{Hb}^S$ $\text{Hb}^A, \text{Hb}^S + \text{H}^A, \text{Hb}^S ;$ $\text{Hb}^A\text{Hb}^A, \text{Hb}^A\text{Hb}^S, \text{Hb}^A\text{Hb}^S, \text{Hb}^S\text{Hb}^S ;$ normal, sickle cell trait, ; | 3+1 | allow ecf following a mistake in the genetic diagram after the parental genotypes, but 'mistake' must be worked correctly do not allow genotypes for parents or children that are single alleles phenotypes must match genotypes, i.e. must be in the same sequence R 1:4 or 4:1 |
| | (ii) | chance is 1 in 4 / 25% / 0.25 / 0,25 ; | | |

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|----------|-----|---|--------------|--|
| 2 | (c) | resistance to / less chance of getting malaria ; | 1 | R immunity to malaria / stops you from getting malaria |
| | (d) | <i>idea that both alleles / Hb^A and Hb^S, are expressed ;</i> 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 | |
| | | | | |
| | | | [Total : 12] | |

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| Question | | Answers | Marks | Additional Guidance |
|----------|-----|--|----------------|--|
| 3 | (a) | <p><i>T. castane</i></p> <p>1 wet / AW ;</p> <p>2 any evidence from the table</p> <p>e.g. hot: (A) 100% – (B) 86% / warm: (C) 86% – (D) 13% / cold: (E) 29% – (F) 0% ;</p> <p>3 in wet conditions, decreasing survival with decreasing temperature ;</p> <p>4 any suitable two points from the table (i.e. (A) 100% – (C) 86% – (E) 29%) ;</p> <p><i>T. confus</i></p> <p>5 dry / AW ;</p> <p>6 any evidence from the table</p> <p>e.g. hot: (A) 0% – (B) 14% / warm: (C) 14% – (D) 87% / cold: (E) 71% – (F) 100% ;</p> <p>7 in wet conditions, increasing survival with decreasing temperature ;</p> <p>8 any suitable two points from the table (i.e. (A) 0% – (C) 14% – (E) 71%) ;</p> | <p>[max 4]</p> | <p>Note: marking points are linked in pairs e.g. MP1 pairs with M</p> <p>Note: at least two data points within species are required as ‘evidence’</p> <p>ignore ref. to temperature for MP1 and MP2</p> <p>ignore 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>Note: marking points 1, 2, 3 are free-standing. MP 4 is linked to MP 3.</p> <p>allow ECF from MP1 to MP2</p> <p>allow ECF from MP2 to MP3</p> <p>allow ECF from MP3 to MP4</p> |
| | (d) | <p>mutation ; mutation, rare event ;</p> <p>(white) <u>allele</u> is recessive / ora ; 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> |
| | | | [Total: 16] | |