Natural and Artificial Selection

Mark Scheme 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Selection and evolution
Sub Topic	Natural and artificial selection
Booklet	Theory
Paper Type	Mark Scheme 1

Time Allowed : **57 minutes**

Score : **/ 47**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a** 1 lots of pollen grains made
so more chance of pollination **;**

2 pollen grains, light / smooth / aerodynamic,
so easily transported **;**

3 no / small, petals / corolla / perianth,
so stamens / anthers / stigma, outside of flower **;**

4 long filaments
so anthers outside of flower **;**

5 anthers outside of flower / versatile anthers,
so pollen released **;**

6 long style
so stigma outside of flower **;**

7 stigma outside of flower / stigma has large surface area,
so traps pollen **;** [max 5]

(b) 1 not dependent on, external factors / wind **;**

2 other plants (for cross-pollination) may be at a distance **;**

3 maintains (hybrid) gene pool **;**

4 keeps advantageous (hybrid) characteristics in offspring **;** [max 3]

(c) can breed with parent species / not reproductively isolated from parent species **;** [1]

[Total: 9]

2 **(a)** 1 humans (as selective agent) ;

2 shorthorn and Brahman bred together ;

3 offspring with ideal characteristics chosen to mate ;

4 repeated over many generations ;

5 allele frequency for ideal characteristics increases ;

6 directional selection ; [max 3]

(b) *any two from*
docility / AW ;

ref. to milk production ;

high fertility ;

hornlessness ;

ref. to meat production ;

disease resistance ; [max 2]

(c) 1 inbreeding depression / lack of hybrid vigour ;

2 more chance that harmful recessive alleles may be expressed ;

3 decrease in heterozygosity / increase in homozygosity ;

4 less genetic variation ; [max 3]

[Total: 8]

3 **(a** presence of C base in DNA (code) changes amino acid (in myostatin) **;**

myostatin in CC horses, is inactive / not produced **; ora for TT**

in CC horses muscle, differentiation / growth, has not been slowed **; ora for TT** [max 2]

(b) CC genotype does best in short races **;**

data quote **;** e.g. 75% winners at 1.0 km **;**

TT genotype does better in longer races **;**

data quote **;** e.g. about 60% of winners at 2.6 km

CT genotype has some winners at all distances **;**

CT does best at 1.8 km **;** [max 4]

(c) (i) by humans **;**

individuals with desired features chosen to breed / AW / named example **;** [2]

(ii) can choose parents genotypes to breed **;**

CC for racing short distances / TT for racing long distances / CT as all-rounders **;**

ref. need to keep all three genotypes in population **;** [max 2]

[Total:10]

4 reproductive ;
constant / stable / AW ;
variation ;
alleles ;
gene ; [5]

[Total: 5]

5 **(a)** 1 code is three, bases / nucleotides ; **A** triplet code

2 (gene) mutation ; **R** chromosome mutation

3 base, substitution / addition / deletion ;

4 addition / deletion, large effect (on amino acid sequence) ;

5 frame shift ;

6 completely new code after mutation / alters every 3 base sequence which follows ;

7 (substitution) often has no effect / silent mutation ;

8 different triplet but same amino acid / new amino acid in non-functional part of protein ;

9 (substitution) may have big effect (on amino acid sequence) ;

10 could produce 'stop' codon ;

11 sickle cell anaemia / PKU / cystic fibrosis ;

12 reference to transcription or translation in correct context ; **A** description

12a AVP ; e.g. protein produced, is non-functional / not produced / incomplete [7 max]

(b) 13 individuals in population have great reproductive potential / AW ;

14 numbers in population remain roughly constant ;

15 variation in members of population ;

16 environmental factors / named factor (biotic or abiotic) ; *linked to 17 and 18*

17 (cause) many, fail to survive / die / do not reproduce ;

18 those best adapted survive / survival of the fittest ;

19 (reproduce to) pass on alleles ; **R** genes

20 genetic variation leads to change in phenotype ;

21 ref: changes in, gene pool / allele frequency ;

22 over time produces evolutionary change ;

23 new species arise from existing ones / speciation ;

24 directional / stabilising, selection ; [8 max]

[Total: 15]