Natural and Artificial Selection

Mark Scheme 6

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 6

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 **(** 1 nucleotide ;

2 adenine + ribose / pentose + three phosphates ;

3 loss of phosphate leads to energy release / hydrolysis releases 30.5 kJ ;

4 ADP + Pi ⟷ ATP (reversible reaction) ;

5 small packets of energy ;

6 small / water soluble, so can move around cell ;

7 used by cells as immediate energy donor ;

8 link between energy yielding and energy requiring reactions / AW ;

9 high turnover ;

10 two examples of use ; ; e.g. active transport / muscle contraction / Calvin cycle /

11 protein synthesis [8 max]

(b) 12 Pyruvate, cannot enter mitochondrion / remains in the cytoplasm ;

13 becomes, hydrogen acceptor / reduced ;

14 by reduced NAD ;

15 from glycolysis ;

16 converted to lactate ;

17 lactate dehydrogenase ;

18 allows glycolysis to continue ;

19 no, decarboxylation / CO_2 removed ;

20 single step ;

21 reversible reaction / converted back to pyruvate ;

22 by oxidation ;

23 ref. oxygen debt ;

24 ethanol produced ;

accept ora for marking points 19–23 [7 max]

[Total: 15]

2	**(a)**		AABBCC ;	[1]
	(b)		*if doubling of chromosomes has not occurred*	
		1	chromosomes would not be able to pair ;	
		2	because chromosomes in the two sets are not homologous ;	
		3	during, prophase 1 / meiosis 1;	
		4	(therefore) gametes cannot be produced ;	[3 max]
	(c)	1	unable to, breed / reproduce ;	
		2	to produce fertile offspring ;	
		3	reproductively isolated ;	[2 max]
	(d)	1	species split into two populations by (geographical) barrier ;	
		2	different, selection pressures / (environmental) conditions, (on the two populations) ;	
		3	different features, selected / advantageous ;	
		4	change in, gene pools / allele frequencies ;	
		5	(over time) become unable to interbreed ;	[3 max]
				[Total: 9]

3 **(a)** 1 allopatric speciation ;

2 geographical isolation / spatial separation ;

3 e.g. of barrier ;

4 e.g. of organism ; *must relate to 3*

5 sympatric speciation ;

6 example ;

7 meiosis problems ;

8 polyploidy ;

9 behavioural / temporal / ecological / structural, isolation ;

10 (isolated) populations, prevented from interbreeding / can only breed amongst themselves ;

11 no, gene flow / gene mixing, (between populations) ;

12 different selection pressures operate ;

13 natural selection ;

14 change in allele frequencies ;

15 different gene pool ;

16 over time (differences prevent interbreeding) ;

17 reproductively isolated ; [8 max]

(b) 18 humans **;** *must be linked to, choosing / selecting / mating etc*

19 parents with desirable feature **;**

20 e.g. organism **and** feature **;**

21 bred / crossed **;**

22 select offspring with desirable feature **;**

23 repeat over many generations **;**

24 increase in frequency of desired allele(s) / decrease in frequency of undesired allele(s) **;**

25 background genes **;**

26 loss of hybrid vigour / increase in homozygosity / ref. inbreeding depression **;**

27 AVP **;** e.g. detail of breeding techniques [7 max]

[Total: 15]

Question 4
(a)
Either
If genetic diagram used **Penalise once for incorrect symbols**

orange dominant to black (or converse);

orange scallop

parents	$S^o S^b$	X	$S^o S^b$		;
gametes	S^o	S^b	S^o	S^b	;
genotype	$S^o S^o$	$S^o S^b$	$S^o S^b$	$S^b S^b$	
phenotype	orange		black		;

black scallop

parents	$S^b S^b$	X	$S^b S^b$	;
gametes	(	S^b	S^b)	
genotype		$S^b S^b$		
phenotype		black		;

Or
If text explanation given

orange dominant to black (or converse);
orange are heterozygous;
(because) ref. 3:1 ratio;
link data to ratio;
black are homozygous;
because all offspring are black; **6**

(b)
separate orange scallops produced from first cross / test cross orange with black ;
some will produce only orange offspring ;
these will be homozygous for orange allele/pure breeding ; **2 max**

Total : 8