Passage of information from parent to offspring

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Inherited change
Sub Topic	Passage of information from parent to offspring
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : **66 minutes**

Score : **/ 55**

Percentage : **/100**

Grade Boundaries:

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

1 **(a** W^R = allele for warfarin resistance
W^S **=** allele for warfarin susceptibility

parental phenotypes	resistant male		resistant female	
parental genotypes	$W^R W^S$		$W^R W^S$	
gametes	W^R	W^S	W^R	W^S ;
offspring genotypes	$W^R W^R$	$W^R W^S$	$W^R W^S$	$W^S W^S$;
offspring phenotypes	**resistant**	**resistan**	**resistant**	

[3]

(b) not enough Vitamin K found (in the wild) / require too much Vitamin K; [1]

(c) competitive / reversible;

as the concentration of inhibitor increases, the rate of the (inhibited) reaction decreases
or
as dose of warfarin increases, the rate at which blood clots decreases; **ora** [2]

(d) 1. different, codon / triplet;

2. stop codon;

3. different amino acid;

4. different, primary / secondary / tertiary / 3D, structure;

5. shortened, polypeptide / protein;

6. change in function of protein; [3 max]

[Total: 9]

2 **(a** *heterozygous*
two different alleles of a gene / different allele pair for a gene / AW ;

produces gametes with different genotypes ; *max 1*

genotype
alleles present in an organism / particular alleles of a gene / genetic constitution / AW ; [2]

(b) *parental genotypes*
AaDd x AaDd ;

gametes
AD Ad aD ad x AD Ad aD ad ;

two marks for correct Punnett square ;; *deduct one mark for each mistake*

(all 4) phenotypes linked correctly to genotypes ;

(probability of yellow offspring) 3 out of 16 **or** 0.19 **or** 19% ; [6]

[Total: 8]

3 **(a) (i)** 1. hybrid vigour ;
2. increased heterozygosity / decreased homozygosity ;
3. increases gene pool / AW ;
4. harmful recessive alleles less likely to be expressed / reduces inbreeding depression ;
5. increased yield ;
6. other named useful characteristic ; e.g. disease resistance / more nutritious [3 max]

(ii) high cost (of seed) / farmers must buy new seed each year ; [1]

(b) (i) 1. stomata closed ;
2. to reduce transpiration / to avoid too much loss of water ;
3. so carbon dioxide cannot enter the leaf ;
4. so carbon dioxide concentration (in leaf / in chloroplast) becomes very low ; [3 max]

(ii) 1. RuBP / rubisco / Calvin cycle, present in bundle sheath cells ;
2. which are tightly packed ;
3. which are not in contact with air (spaces) ;
4. so are not exposed to oxygen ;
5. CO_2 / malate, delivered to bundle sheath cells ;
6. from mesophyll (cells) ;
7. (so) CO_2 concentration in bundle sheath cells always high ; [4 max]

(c) (i) 1. CO_2 concentration (in bundle sheath cells) is always high ;
2. CO_2 not limiting ;
3. another factor / light intensity / temperature, limiting ;
4. no photorespiration ; [2 max]

(ii) 1. idea of change in temperature ;
2. affects, light independent / light dependent, stage (of photosynthesis) ;
or
3. idea of change in light intensity ;
4. affects light dependent stage (of photosynthesis) ; [2]

[Total: 15]

4 **(a)** *gene mutation*

1. spontaneous / random, change **;**
2. in, base sequence / nucleotide sequence / mRNA code / codon **;**
3. example **;** e.g. addition / insertion / substitution / deletion / inversion

triplet code

4. (sequence of) three (DNA nucleotide) bases **;**
5. complementary to <u>mRNA codon</u> **;**
6. codes for a specific amino acid **;** 4 max

(b)

parental phenotypes	man without HD	woman with HD
parental genotypes	**tt**	
gametes	**all t**	**T or t ;**
offspring genotypes	**Tt**	**tt**
offspring phenotypes	**Huntington's disease**	**normal ;**
probability of first child having D	**50% / 0.50 / 1 in 2 ;**	[3]

[Total: 7]

5 **(a** 1 allele/gene, found on **X** chromosome **;**

2 females have two copies of, allele/gene **;**

3 males have only one copy of, allele/gene **;** [2 max]

(b) *key to symbols*

recessive allele $\mathbf{X^a}$ (= allele for CI)

dominant allele $\mathbf{X^A}$ (= allele for normal iris) ;

cross 1
parental phenotypes male with CI/cleft iris **and** normal female **;**

gametes $\mathbf{X^a}$ **or Y** $\mathbf{^A}$ **;**

offspring genotypes $\mathbf{X^AX^a}$ $\mathbf{X^AY}$ **;**

offspring phenotypes **normal female** **normal male ;**

.....

or

……

cross 2
parental phenotypes male with CI/cleft iris **and** normal female **;**

gametes $\mathbf{X^a}$ **or Y** $\mathbf{X^A}$ **or** $\mathbf{^a}$ **;**

offspring genotypes $\mathbf{X^AX^a}$ $\mathbf{X^AY}$ $\mathbf{X^aX^a}$ $\mathbf{X^aY}$ **;**

offspring phenotypes **normal female** **normal male** **I le** **cleft iris/CI male** [5]

offspring phenotypes must be linked to genotypes

(c) 1 in 4/25%/0.25 **; R** ratios

[Total: 8]

6 **(a)** key **;** *black upper case, chestnut lower case*

gametes **;**

offspring genotypes **and** chestnut identified **;**

25% / 0.25 / ¼ / 1 in 4, (probability) **;** *ignore ratios* [4]

(b)

parental genotype	$aaCC^{CR}$	AaCC
parental phenotype	palomino / cream	black **;**
gametes	**aC** **aC^{CR}**	**AC** **aC ;**
offspring genotypes	**AaCC** **aaCC**	**Aa** **$aaCC^{CR}$;** *any order*
offspring phenotypes	**black** **chestnut**	**black** **palomino / cream ;** *order linked to genotype order*

ecf can be applied to offspring genotypes and phenotypes [4]

[Total: 8]