Passage of information from parent to offspring

Mark Scheme 4

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 4

Time Allowed : **64 minutes**

Score : **/ 53**

Percentage : **/100**

Grade Boundaries:

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

1 (a X^RY and X^rX^r ;

X^R Y X^r **(X^r)** ; *allow ecf from incorrect parental genotypes*

X^RX^r and X^rY ; [3]

(b) (i)

phenotype of fly	**O**	**E**	**O–E**	**$(O–E)^2$**	**$\frac{(O–E)^2}{E}$**
red-eyed female	54	50	(+)4	16	0.32 ;
white-eyed male	46	50	(-)4	16	0.32 ;

0.64 ;
allow ecf [3]

(ii) probability is greater than 0.05 ; **A** chi squared smaller than 3.84

no significant difference ;

due to chance ; [max 2]

[Total: 8]

2 **(a** *allele*
different / alternative, form of a gene ; **A** variety of a gene

one of two or more alternative nucleotide sequences at a single gene locus ; [1 max]

dominant
(allele) that (always) expresses itself in the phenotype when present /
(allele) which influences the phenotype even in the presence of an alternative allele ; [2]

(b) parental genotypes ;
gametes ;
offspring genotypes (in Punnett square) ;;
offspring phenotypes linked to genotypes ;
ratio 9:3:3:1 linked to phenotypes ; [6]

[Total: 8]

3 **(a (i)** *accept answers in a genetic diagram where genotypes are linked to phenotypes*
1 agouti allele / C^a, dominant to black allele / C^b ; **ora**
2 black parents homozygous recessive ;
3 agouti parents heterozygous **or** homozygous ; [2 max]

(ii) *accept answers in a genetic diagram where genotypes are linked to phenotypes*
1 yellow allele / C^y, dominant to, black allele / C^b ;
2 ref. to modified 3:1 ;
3 (homozygous) genotype C^y C^y , lethal / does not survive ; [2 max]

(iii) *accept answers in a genetic diagram where genotypes are linked to phenotypes*
1 yellow allele / C^y, dominant to **all** others ;
2 agouti / C^a **or** black and tan / C^{bt}, allele, dominant to black allele ;
A black allele recessive to all other alleles
3 yellow mice all heterozygous (must be stated) ; [2 max]

(b) 1 cross (black and tan mouse) with, black mouse / homozygous recessive mouse / C^b C^b ;
2 if **all** offspring black and tan then parent, C^{bt} C^{bt} / homozygous ;
3 if some offspring are black (and some are black and tan) then parent, $C^{bt}C^*$ / heterozygous ; [2 max]

[Total: 8]

4 **(a)** *dominant*
(allele) that always expresses itself (in the phenotype) when present
or
(allele) which influences the phenotype even in the presence of an alternative allele **;**

gene
length of DNA / sequence of nucleotides, coding for a (specific) polypeptide **;** **A** protein [2]

(b)

parental phenotypes	man without TSC	woman with TSC	
parental genotypes	**tt**	**Tt**	
gametes	**all t**	**T or t**	**;**
offspring genotypes	**Tt**	**tt**	
offspring phenotypes	**TSC**	**normal**	**;**
probability of child having TSC	**50% / 0.50 / 1in 2 ;**		

[3]

(c) 1. spontaneous / random / chance **;**
2. mutation of, gene / allele **;**
3. AVP **;** e.g. named mutagen / detail of mutation [2 max]

[Total: 7]

5 **(a** variation / different form, of a gene **;** [1]

(b) *marks for reasons only*
Hb^A Hb^A
low – susceptible to / die from, malaria **;**

Hb^A Hb^S
high – no (full blown) SCA / have SC trait **;**
not, susceptible to / likely to die from, malaria **;**

Hb^S Hb^S
low – susceptible to / die from, SCA **;** [4]

(c) 1 *USA* malaria not selection pressure **;**

2 Hb^S no advantage **;**

3 due to outbreeding **;**

4 genetic testing can lead to termination of pregnancy **or** testing / counselling, leads to not having children **;** [2 max]

[Total: 7]

6 **(a)** 1 chiasma / crossing over ;

2 between non-sister chromatids ;

3 of, homologous chromosomes / bivalent ;

4 in <u>prophase 1</u> ;

5 exchange of genetic material / AW ; ***R*** *genes unqualified*

6 linkage groups broken ;

7 new combination of alleles ;

8 <u>independent assortment</u> (of homologous chromosomes) ;
R *random assortment*

9 at equator ;

10 (during) <u>metaphase 1</u> ;

11 possible mutation ;

12 random mating ;

13 random fusion / fertilisation of gametes ; [7 max]

(b) 14 phenotypic variation results from interaction of genotype and environment / VP = VG + VE ;

15 environment may modify expression of gene(s) ; *must be stated*

16 e.g. for size / mass / height ;

17 because, food / nutrient / ion, missing or in short supply ; **A** malnutrition

18 named, food / nutrient / ion, (missing or in short supply) ;

19 environment may, trigger / switch on, gene ; *must be stated*

20 ref. low temperature and change in animal colour ;

21 ref. high temperature and, curled wing in *Drosophila* / gender in crocodiles ;

22 ref. <u>UV</u> light and melanin production ;

23 ref. wavelength of light and, flowering / germination / fruit colour ;

24 other named trigger plus example ;

25 environment effect usually greater on polygenes / ora ;

26 environment may induce mutation affecting phenotype ; [8 max]

[Total: 15]