

Passage of information from parent to offspring

Question Paper 1

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	Question Paper 1

Time Allowed : 56 minutes

Score : / 46

Percentage : /100

Grade Boundaries:

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

1 In mice, the intensity of pigmentation of the fur is controlled by multiple alleles of a single gene.

The alleles are listed below in order of dominance, with **C** as the most dominant.

- **C** = full colour
- **C^{ch}** = chinchilla
- **C^h** = himalayan
- **C^p** = platinum
- **C^a** = albino

(a) Explain how multiple alleles arise.

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(b) Eye colour in mice is controlled by two alleles of a single gene, **B/b**:

- allele **B** codes for black eyes
- allele **b** codes for red eyes.

A mouse with full colour fur and black eyes was crossed with a mouse with himalayan fur and black eyes. One of the offspring was albino with red eyes.

Using the symbols above, draw a genetic diagram to show the genotypes and phenotypes of the offspring of this cross.

- 2 Occasionally during meiosis, homologous chromosomes fail to separate at anaphase. This is known as non-disjunction. Turner's syndrome is the most common chromosome mutation in human females. It can occur due to non-disjunction in meiosis during gametogenesis. Some resulting gametes will be missing an X chromosome.

Some forms of Turner's syndrome occur when one of the pair of X chromosomes is not missing but has become damaged. The damaged X chromosome may have been broken and re-formed so that part of its structure is lost.

Fig. 7.1 is a diagram of a normal X chromosome and two forms of 'damaged' X chromosomes, X_1 and X_2 .

- In X_1 , a section of the 'p' arm of the chromosome is missing. This deletion leads to reduced height of the female and abnormalities such as narrowing of the aorta.
- In X_2 , a section of the 'q' arm of the chromosome is missing. This deletion leads to little or no development of the ovaries.

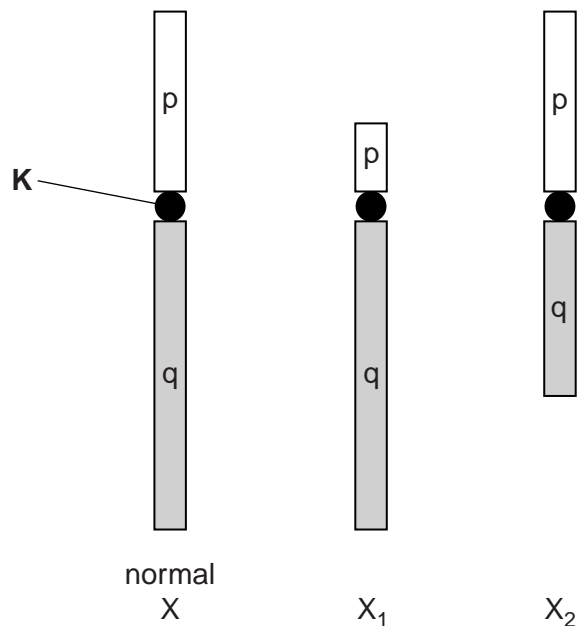


Fig. 7.1

(a) Name structure K.

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(b) Fig. 4.2 shows the number of offspring sired plotted against the body length of the adult male lizards.

Fig. 4.3 shows the number of offspring sired plotted against the fastest running speed (sprint speed) of the adult male lizards.

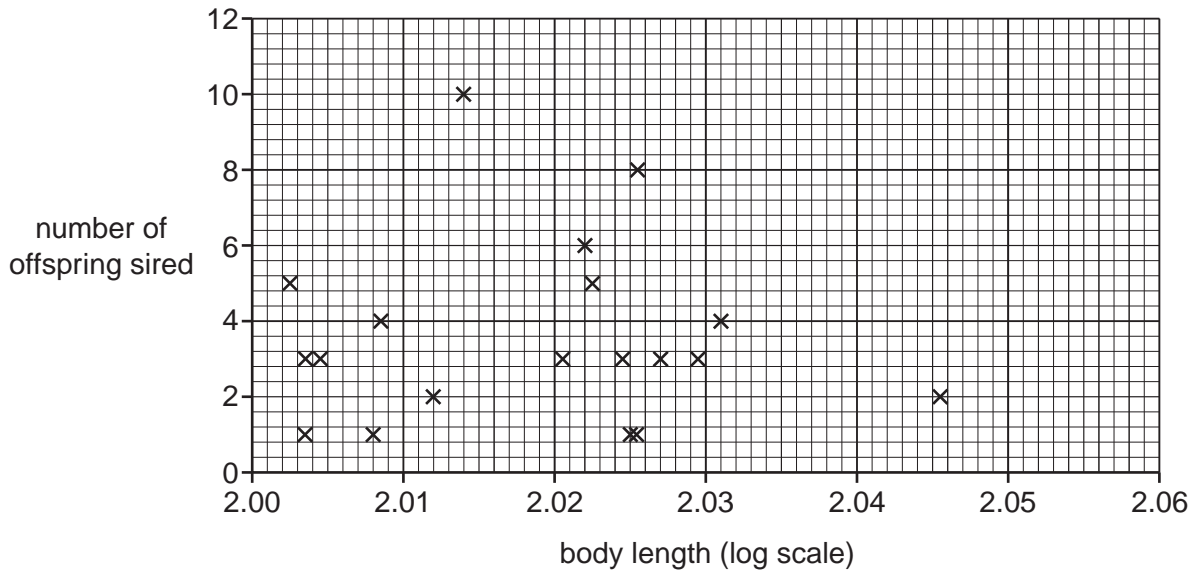


Fig. 4.2

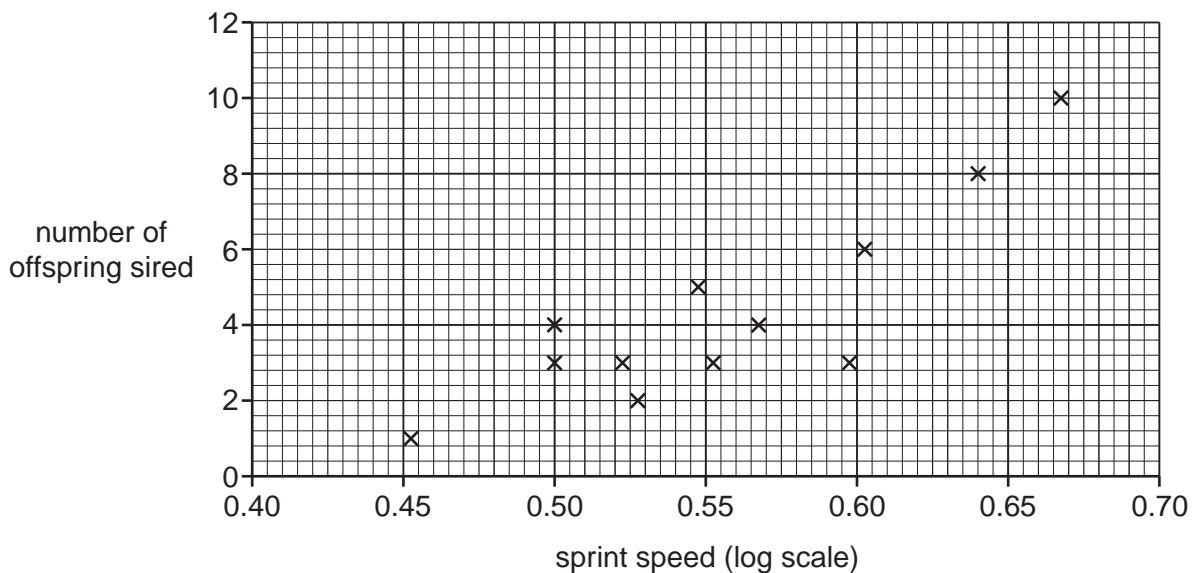


Fig. 4.3

4 Neurofibromatosis (NF) is a genetically inherited condition in humans where tumours grow in the nervous tissue. One symptom, which can develop around the age of 20 years, is loss of sight due to tumours on the optic nerve.

(a) If one parent has NF, there is at least a 50% chance that his or her children will develop the condition, even if the other parent is unaffected.

Complete the genetic diagram below to show how NF may be transmitted from parent to child.

key to symbols

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*parental
phenotypes*

parent with NF

unaffected parent

*parental
genotypes*

gametes

*offspring
genotypes*

*offspring
phenotypes*

[3]

(b) Suggest how a person may develop NF when there is no family history of the condition.

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(c) Suggest how a tumour on the optic nerve could prevent the transmission of nerve impulses to the brain.

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[Total: 8]

- 5 Coat colour in cats is determined by a sex-linked gene with two alleles coding for black and orange.

When black cats are mated with orange cats:

- the female offspring are always tortoiseshell (black and orange patches)
- the male offspring are always the same colour as their mother.

- (a) Explain what is meant by a *sex-linked gene*.

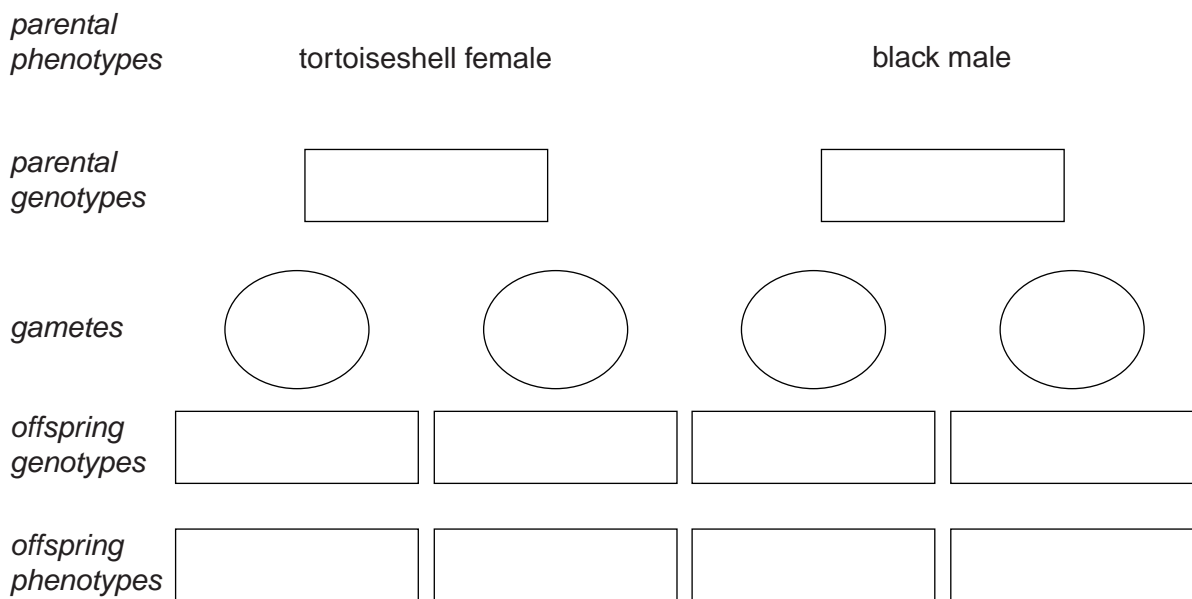
sex-linked

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gene

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- (b) Using the symbols **B** for the allele for black coat and **O** for the allele for orange coat, complete the genetic diagram below.



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- (c) Explain why a male cat cannot have a tortoiseshell coat.

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[Total: 8]