

TRIAL TEST 14: TYPES OF INHERITANCE



Time allowed: 60 minutes
Total marks: 80

Section 1 – Multiple Choice
Section 2 – Short Answer
Section 3 – Short Answer

10 marks
50 marks
20 marks

SECTION 1 – MULTIPLE CHOICE (10 MARKS)

- The best description of a person in terms of his/her observable features is called his/her:
 - profile
 - genotype
 - phenotype
 - genome.
 - A person who has two identical genes for a particular trait, for this trait, is called as:
 - hybrid
 - homozygote
 - heterozygote
 - hemizygote.
 - A couple have a family of four daughters. Which of the following statements about the sex chromosomes of the family are true?
 - All the sex chromosomes of the parents are X
 - All the sex chromosomes of the husband are X
 - All the sex chromosomes of the wife are X
 - All the sex chromosomes of the daughters are X
 - Half the sex chromosomes of the husband are Y and half are X
 - Half the sex chromosomes of the wife are X and half are Y.
 - 1, 2 and 3
 - 2, 3 and 4
 - 3, 4 and 5
 - 4, 5 and 6.
- Use the following information to answer questions 4 and 5.
- Tongue rolling is inherited as a dominant autosomal trait. Non-tongue rolling is recessive.*
- If two people, one of whom is a heterozygote for tongue rolling and the other who is a non-tongue roller have children, what is the probability that their first child will be a non-tongue roller?
 - 0.25
 - 0.50
 - 0.75
 - 0
 - What is the probability of a couple, one of whom is a homozygote for tongue rolling, the other who is a non-tongue roller, having a child who is a non-tongue roller?
 - 0.25
 - 0.50
 - 0.75
 - 0.00

6.

Colour blindness is an X-linked recessive condition. What is the probability that a man who is colour blind who is married to a woman who is a carrier, have a child who is colour blind?

- 0.25
- 0.50
- 0.75
- 1.00

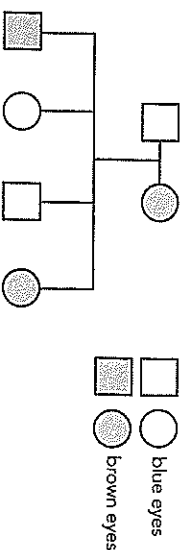
7.

A good example of co-dominance occurs in the ABO blood grouping system. This occurs between the following alleles:

- I^A and I^B
- I^A and i
- I^B and i
- I^A , I^B and i .

8.

Study the information below the pedigree to answer the next question.

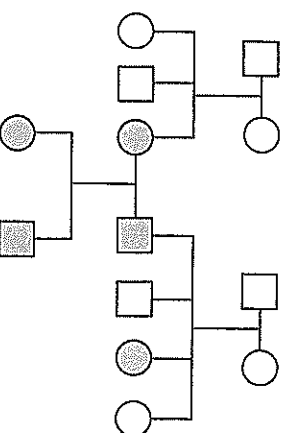


Given the brown allele is dominant and the ratio of brown-eyed to blue-eyed offspring matches the theoretical ratio determined by Mendelian inheritance in this family pedigree, which of the following is true?

- the mother is homozygous and the father heterozygous for eye colour
- the father is homozygous and the mother is heterozygous for eye colour
- the father and mother are both homozygous for eye colour
- the father and mother are both heterozygous for eye colour.

9.

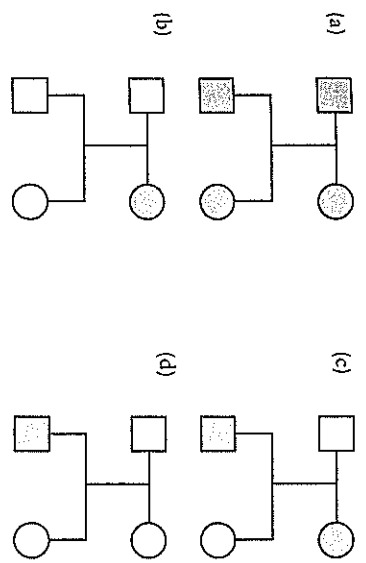
In the pedigree below, individuals who have a genetic disease are shaded.



From this pedigree it appears that the grandparents:

- each carries a gene for the disease
- at least one of each grandparent couple carries a gene for the disease
- are all homozygous
- only one couple is homozygous.

10. Some people can taste a substance called phenyl thiocarbamide (PTC), others cannot. Non-tasters are shaded in the pedigrees shown. Which proves that the non-tasting gene is recessive?



SECTION 2 – SHORT ANSWER (50 MARKS)

Answer each question in the space provided.

1. Assume that the gene for brown eyes is dominant, B and the gene for blue is recessive, b. A brown-eyed woman whose mother had blue eyes marries a man with brown eyes. They produce four children all of whom are brown-eyed.

(i) What is the genotype of the mother? [1 mark]

(ii) What are the possible genotypes of her husband? Explain. [1 mark]

(iii) If their fifth child is blue-eyed, what is the husband's genotype? Explain your answer. [2 marks]

[3 marks]

(iv) Use a Punnet square to show the possible genotypes of their children.

	Man	
♀		
♀		
♀		
♀		

[2 marks]

2. Sickle-cell anaemia is a genetic disease in which the homozygote ss causes the red blood cells to become sickle shaped and lose their oxygen carrying capacity. In the heterozygote Ss, both types of red blood cells are formed, i.e. both normal and sickling. The person is said to have sickle-cell trait (not anaemia). People who have Ss are quite healthy but they can suffer a shortage of oxygen at high altitudes or under extreme physical exertion. A person who is a homozygote SS is normal.

(i) What is this disease's mode of inheritance?

[2 marks]

(ii) If a couple who both have the sickle-cell trait have children, what is the probability that their first child will have sickle cell trait?

[3 marks]

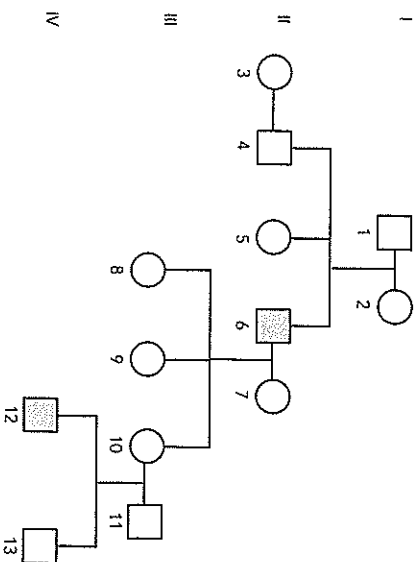
	Man	
♀		
♀		
♀		
♀		

(iii) If a person who has sickle-cell trait marries a normal homozygote, what is the probability that any of their children will have sickle-cell anaemia?

[3 marks]

	Man	
♀		
♀		
♀		
♀		

5. The pedigree below shows the incidence of haemophilia (shaded individuals), which is a rare blood disease.



- (i) What is the "mode of inheritance" of haemophilia? _____ [2 marks]
- (ii) What is the chance of 10 and 11's next child having haemophilia? _____ [1 mark]
- (iii) What is the chance of 10 and 11 having a daughter who is a haemophiliac? _____ [1 mark]
- (iv) The chance that 3 and 4's next son being a haemophilic is low. Why? _____ [1 mark]
- (v) Write the genotypes of the following in the blank spaces: [1 mark]
- 1 _____ 2 _____ 4 _____ 6 _____
- 10 _____ 11 _____ 12 _____ 13 _____ [4 marks]
- (vi) Fifty years ago very few haemophiliacs reached maturity. As a result, haemophilia was unheard of in females. Explain why females rarely inherited the disease. _____ [2 marks]

3.

Red-green colour blindness is an X-linked recessive condition. Alison has normal vision as do her parents, Dick and Dora, but Alison's brother Bob has colour blindness.

What are the genotypes of Alison, her parents Dick and Dora and her brother Bob. Use X^a and X^b to represent the alleles.

- (i) Alison _____
- (ii) Dick _____
- (iii) Dora _____
- (iv) Bob _____ [4 marks]
- (v) How could you be sure of Alison's genotype? _____ [2 marks]

4.

- (i) Use the ABO system of blood grouping to explain what is meant by multiple alleles. _____ [2 marks]

- (ii) What are the possible genotypes for this trait in the population? _____ [3 marks]

- (iii) What evidence is there to suggest that other traits may be controlled by multiple alleles? _____ [3 marks]

[2 marks]

SECTION 3 – EXTENDED ANSWER (20 MARKS)

- (i) What is DNA profiling?
-
-
- (ii) Why is it used?
-
-
- [2 marks]

[2 marks]

- (iii) Explain why it works.

[2 marks]

- (iv) Explain how it works.

[3 marks]

[2 marks]

- (i) How do genetic counsellors use pedigrees and genetic testing to provide advice to couples who are planning to have children? [10 marks]

[10 marks]

- (ii) Why is it not uncommon for a couple to have four boys and no girls? However, in state primary schools, it is highly unlikely that all the children will be boys; such co-educational schools probably have about equal numbers of boys and girls.

[5 marks]

- (iii) If a man is colour blind and his wife is a 'carrier' for colour blindness, what is the probability that if they have four children all four are colour blind boys?

[5 marks]