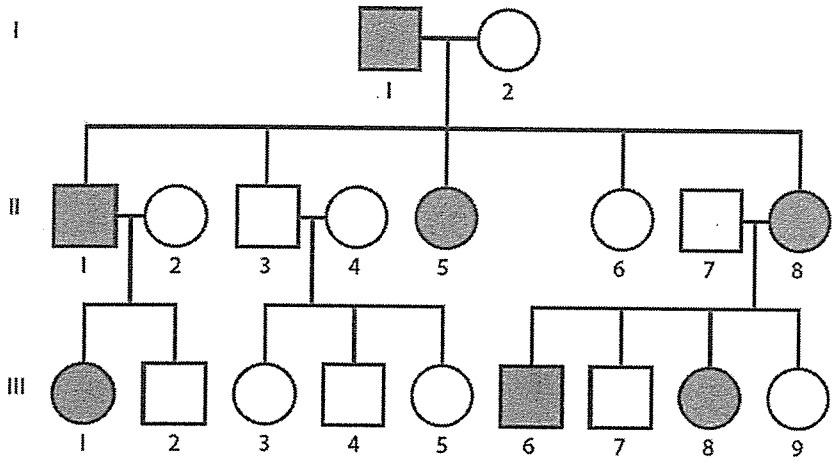
11 HUMAN BIOLOGY PEDIGREE ANALYSIS /51

Name: New key Due date: _____

1. Examine the pedigree and answer the following questions.




a) **State** the type of inheritance that is shown and list two reasons for choosing it. (1 mark)

Dominant autosomal. Must have both

b) **List** TWO reasons for choosing that particular type of inheritance. (2 marks)

Dom: No generations skipped or No parents without the trait who have children with the trait (1) Autosomal: If sex linked Dominant trait father cannot have daughter without the trait. But this is seen with $I_1$ and $II_6$. (1)

c) Using the symbols 'A' and 'a' give the genotypes for: (3 marks)

Individual (I:2): aa

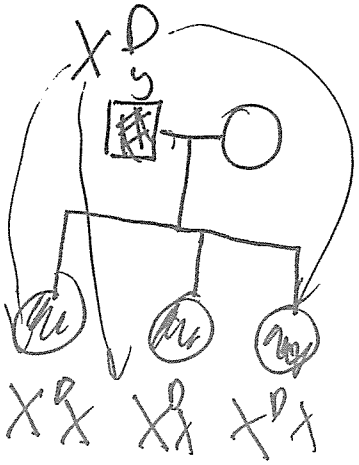
Individual (II:2): aa

Individual (III:5): aa

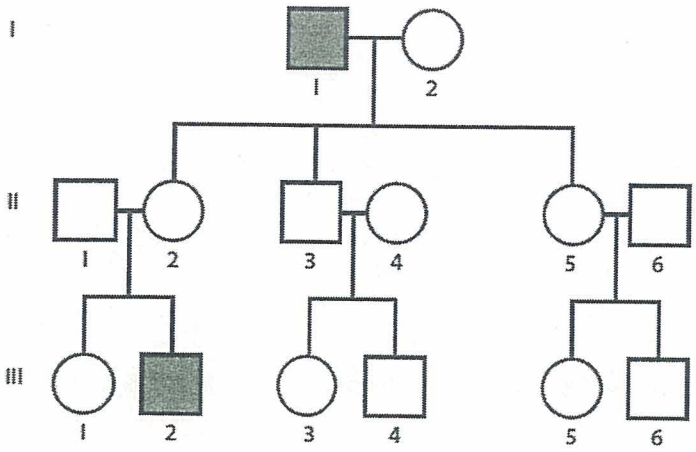
Individual (III:4): aa

Individual (III:6): Aa

Individual (III:9): aa



2. Examine the pedigree and answer the following questions.



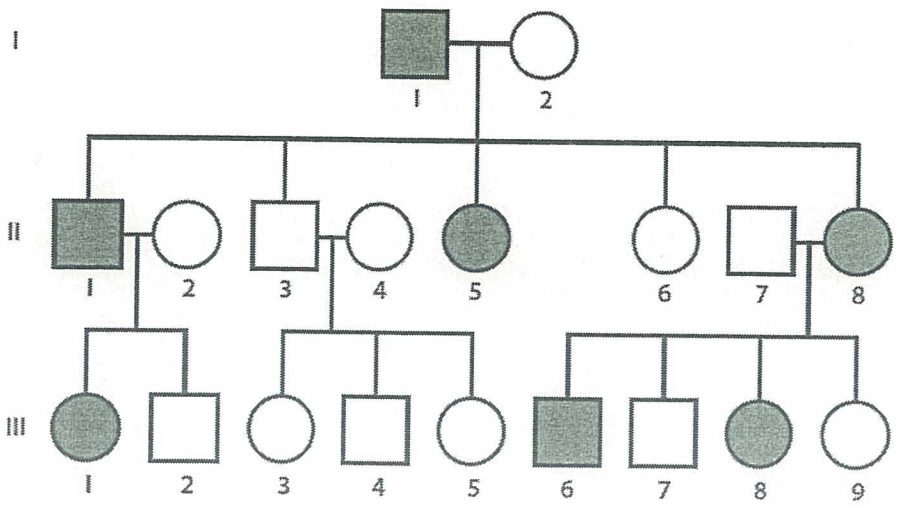

a) **Describe** THREE pieces of evidence (from the pedigree) that demonstrates that the characteristic is an X-linked recessive trait. Recessive = skips a generation or parents (3 marks)
without the trait have children with the trait (1)
Sex linked = suggested by only boys have trait (1)
No definative proof (1)
- no father to son transmission

b) State a possible genotype for individual (III:2). Hint: make a key for the symbols used. (1 mark)

$X^aX^a$ or $X^aY$

3. Examine the pedigree and answer the following questions.

The following pedigree chart begins with a mating between a man with black hair and a woman with blonde hair.



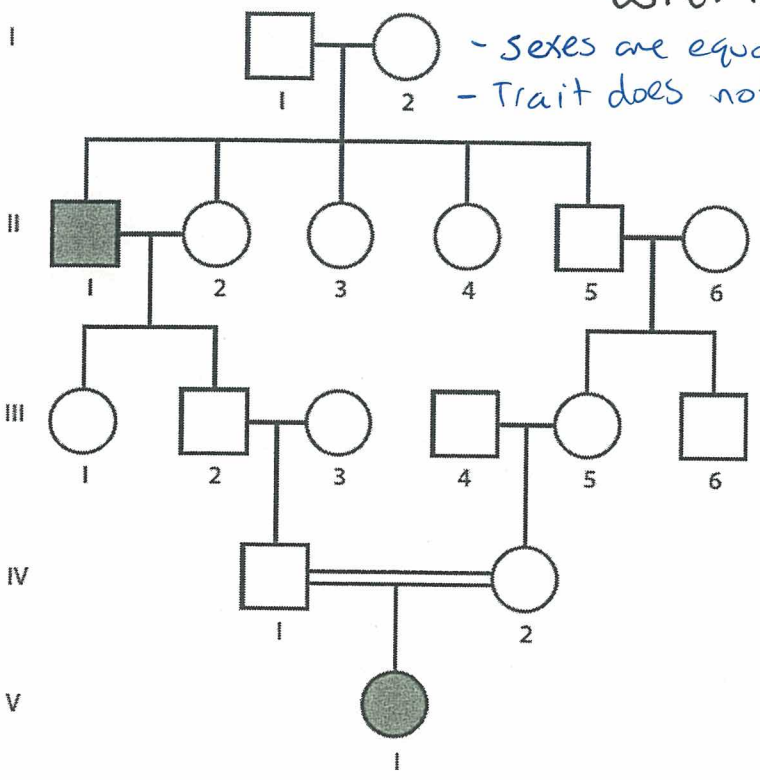
a) **State** the type of inheritance that is shown and list two reasons for choosing it. (1 mark)

Dominant Autosomal or Polygenetic Autosomal

b) **List** TWO reasons for choosing that particular type of inheritance. (2 marks)

From pedigree Dominant as no skipping of generations. (1)
Autosomal because if it where dominant sex linked a father with the trait could not have a daughter without the trait. But this is seen with $I_1$ and $II_6$ (1)

4. Examine the pedigree and answer the following questions.




- sexes are equally affected
- Trait does not skip generations

Or they can answer for Polygenetic inheritance Hair colour in not controlled by one gene. Instead it is controlled by 3 genes, with 2 alleles each.

a) State the relationship between individual (IV:1) and individual (IV:2). (1 mark)

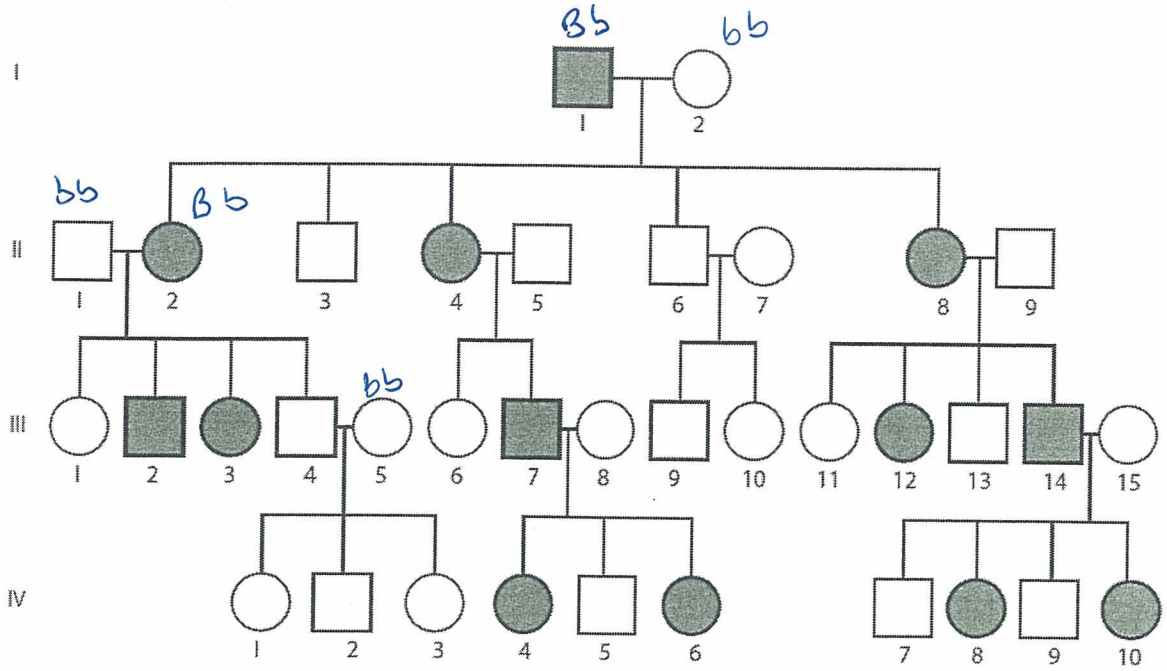
Inbreeding (1)
or Consanguineous

b) Can the genotype for individual (V:1) be explained by her parent's marriage? **Explain** why or why not.

(2 marks)

Yes (1) Inbreeding increases the chance of the trait being expressed (1).

5. Examine the pedigree and answer the following questions.




a) **State** the type of inheritance that is shown and list two reasons for choosing it. (1 mark)

Sex linked Dominant

b) **List** TWO reasons for choosing that particular type of inheritance. (2 marks)

Dominant = No generations skipped (1)
If sex linked dominant a father with the trait must have all daughters with the trait. This is shown in this pedigree

c) Using the symbols 'B' and 'b' give the genotypes for: (3 marks)

Individual (I:2): $X^bX^b$

Individual (II:2): $X^BX^b$

Individual (III:5): $X^bX^b$

Individual (III:3): $X^BX^b$

Individual (III:14): $X^BY$

Individual (IV:5): $X^bY$

no father to son transmission
- All affected have affected parents

6. Read the information then answer the questions.

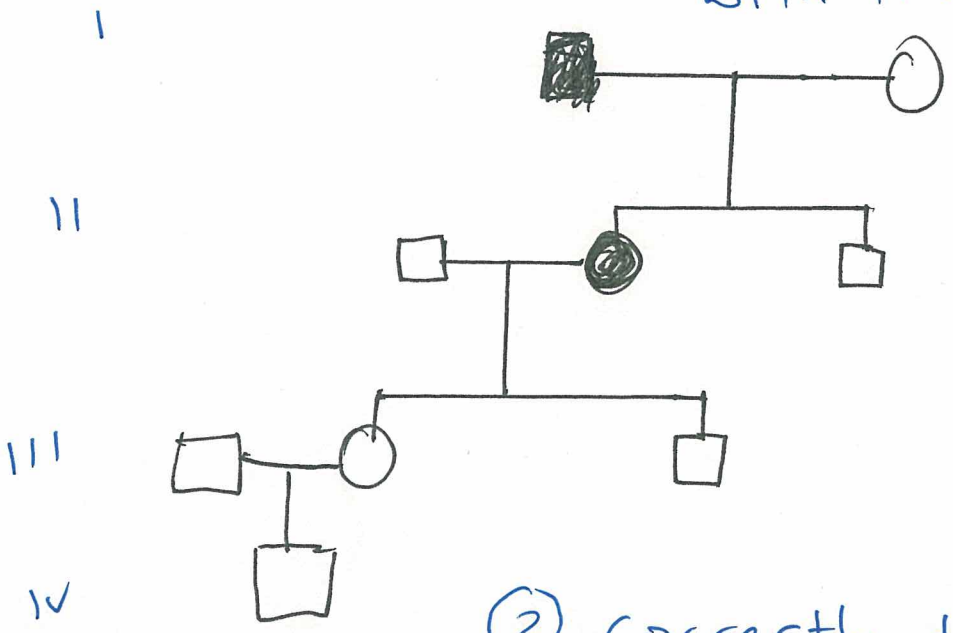
Jennifer is 45 years of age and has just developed the symptoms of Huntington disease. Her father, James, is 70 years old and is hospitalised with the disorder, but her mother, Anne, two years younger than her father, does not have the condition.

Jennifer's husband, John, also 45 years of age, does not have Huntington disease, and there is no history of the condition in his family. Jennifer's older brother, Malcolm, does not have the disease.

Jennifer and John have two children, Andrew (25 years old) and Michelle (21 years old). Michelle is married to Tony, who is the same age as her brother, and she has just given birth to their first child called Darren. There is no history of Huntington disease in Tony's family.

a) **Construct** a pedigree to show all the individuals in the family. Indicate the individuals who have Huntington disease by shading the relevant circles or squares. (5 marks)

(1) shaded individuals with trait




(2) correctly drawn

(1)

label generations

male with trait

Female with trait

(1)

b) State the possible genotypes of the following individuals. (2 marks)

James: Hh

Anne: hh

Jennifer: Hh

John: hh.

c) **Explain** the symbols you are using. (1 mark)

Hh ] - Have Huntington's
HH ]

hh ] - Do not have Huntington's

d) Work out the probability that Michelle has inherited Huntington disease.
(Show full working out using a punnet square) (3 marks)

Parent ♂ ♀
Genotypes hh Hh (1)

Max = 3 marks

| | H | h |
|---|---|---|
| h | Hh | hh |
| h | Hh | hh |

(1)

offspring

| Genotype | Phenotype. |
|---|---|
| Hh 50% | 50% Have Huntington's |
| hh 50% | 50% Do not have Huntington's. |

(1) (1)

Probability of Michelle having Huntington disease: 50% (1)

e) Work out the probability that Darren has inherited Huntington disease.
(Show full working out using a punnet square) (3 marks)

Parent ♂ ♀
Genotypes hh Hh (1)

Max = 3

| | H | h |
|---|---|---|
| h | Hh | hh |
| h | Hh | hh |

(1)

offspring

| Genotype | Phenotype. |
|---|---|
| Hh 50% | Have Huntington's 50% |
| hh 50% | Do not have Huntington's 50% |

(1) (1)

50% chance of Michelle having Huntington's so for Darren 50% of 50% = 25%

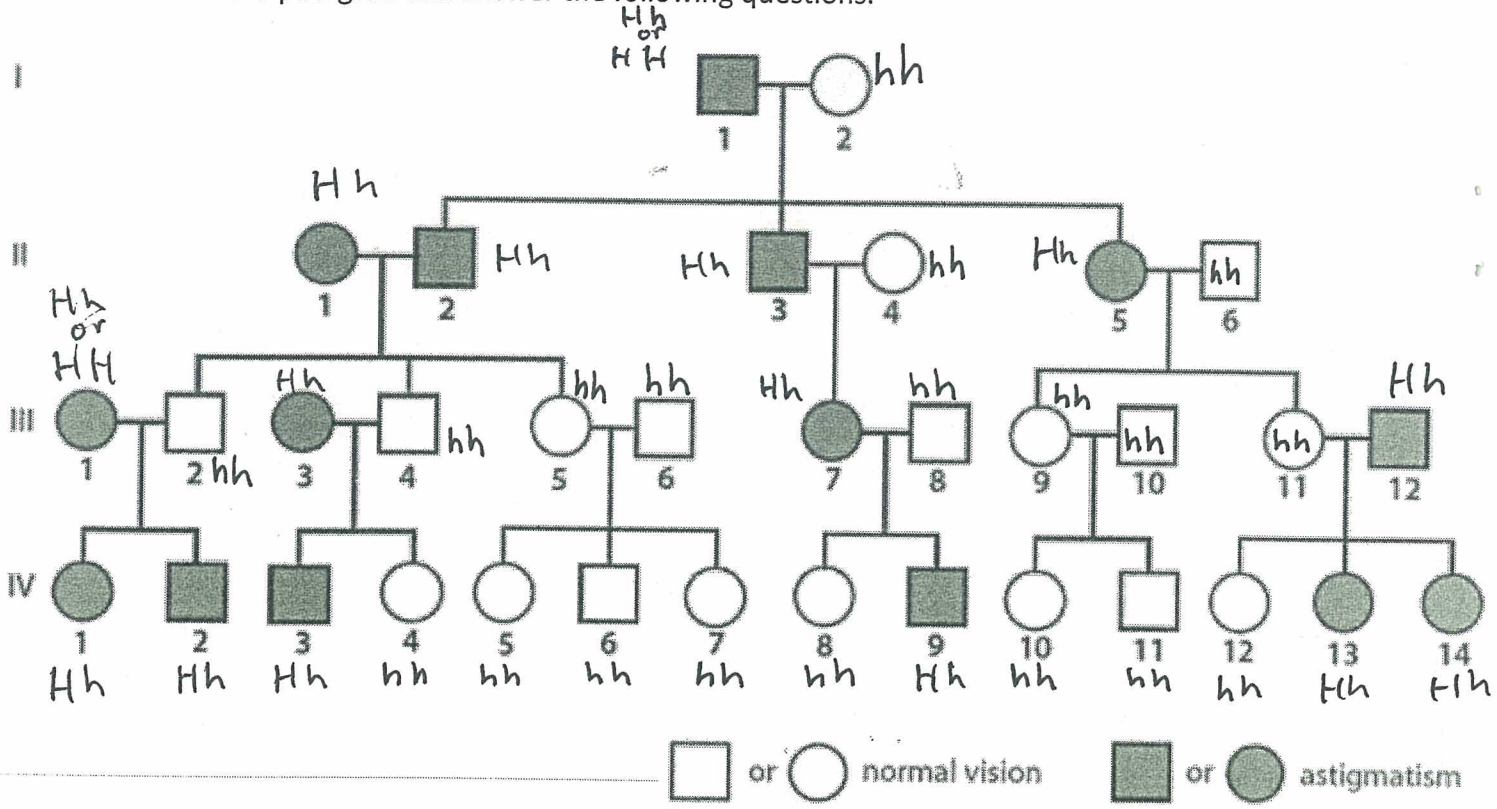
Probability of Darren having Huntington disease: 25%

(1)

f) **State** whether Huntington disease is controlled by a gene on an autosomal chromosome or an X chromosome. (1 mark)

Autosomal (1).

7. Examine the pedigree and answer the following questions.




a) Work out the genotypes for all the individuals. (10 marks)

-1 for each error

b) State the individuals that have genotypes which are uncertain. (1 mark)

I:1 III:1

b) State whether astigmatism in the family illustrated is dominant or recessive. (1 mark)

Dominant

c) **Explain** your answer using evidence. (2 marks)

- No parents without the trait producing offspring with the trait.
- II:1 and II:2 are both astigmatic but have three children with normal vision