

**GR12 BIOLOGY**  
**UNIT A – UNDERSTANDING GENETICS**  
**REVIEW QUESTIONS**

1. Calico is a coat colour found in cats, which is caused by a sex-linked, co-dominant allele

B= black, R= orange, BR= calico

The following genotypes are possible:

- Female cats can be black  $X^B X^B$ , orange  $X^R X^R$ , or calico  $X^B X^R$
- Male cats can be black  $X^B Y$  or orange  $X^R Y$

Show each of the crosses below and include the phenotypic ratios of the offspring.

a. A black male crossed with an orange female.


b. An orange male crossed with a calico female.


c. A black male crossed with a black female.


d. An orange male crossed with an orange female


e. A black male crossed with a calico female.


2. In fruit flies, eye colour is a sex-linked trait. Red is dominant to white.

a. What are the sexes and eye colours of flies with the following genotypes:

- (1)  $X^R X^r$  : \_\_\_\_\_ (2)  $X^R Y$  : \_\_\_\_\_  
 (3)  $X^r X^r$  : \_\_\_\_\_ (4)  $X^R X^R$  : \_\_\_\_\_  
 (5)  $X^r Y$  : \_\_\_\_\_

b. What are the genotypes of these flies.

- (1) White eyed, male: \_\_\_\_\_  
 (2) red eyed female (heterozygous): \_\_\_\_\_  
 (3) White eyed, female: \_\_\_\_\_  
 (4) red eyed, male: \_\_\_\_\_

c. Show the cross of a white eyed female  $X^r X^r$  with a red eyed male  $X^R Y$ .


- d. Show a cross between a pure red-eyed female and a white eyed male.


What are the genotypes of the parents?

\_\_\_\_\_ x \_\_\_\_\_

How many are:

White eyed and male: \_\_\_\_\_%

White eyed and female: \_\_\_\_\_%

Red eyed and male: \_\_\_\_\_%

Red eyed and female: \_\_\_\_\_%

- e. Show the cross of a heterozygous red eyed female and a red eyed male.


What are the genotypes of the parents?

\_\_\_\_\_ x \_\_\_\_\_

How many are:

White eyed and male: \_\_\_\_\_%

White eyed and female: \_\_\_\_\_%

Red eyed and male: \_\_\_\_\_%

Red eyed and female: \_\_\_\_\_%

3. In humans, haemophilia is a sex-linked trait. Females can be normal, have the disease, or be carriers for the trait. Males will either have the disease or not, but they won't ever be carriers.

$X^H X^H$ : normal female

$X^H X^h$ : female who is a carrier

$X^h X^h$ : female with haemophilia

$X^H Y$ : normal male

$X^h Y$ : male with haemophilia

- a. Show the cross of a man who has haemophilia with a woman who is a carrier.


What is the probability that their children will have the disease? \_\_\_\_\_

- b. A woman who is a carrier marries a normal man. Show the cross:


What is the probability that their children will have the disease? \_\_\_\_\_

What sex will a child in the family with haemophilia be? \_\_\_\_\_

- c. A woman who has haemophilia marries a normal man. Draw a punnett square to answer.

How many of their children will have haemophilia, and what is their sex?

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**PROBABILITY – BINOMIAL** (Advanced questions)

4. You and your spouse have no children. You stand to inherit a sizeable fortune from your crazy Uncle Irving if you can produce three daughters in your family of three children.
- What is the probability of doing just that?
  - If you could convince Uncle Irving that simply having three children all of the same sex would do, then what would be the probability of your receiving the inheritance?
  - In quest of the family stipulated in b. above, you produce a boy as your first child. Now what is the probability of inheriting the fortune?
  - Why are the answers to b. and c. the same?
  - Finally, you have convinced Uncle Irving that you will agree to try for at least three girls out of four children. How likely are you to become wealthy given those conditions?

These are advanced questions for the binomial probability distribution. We will do these separately

**PEA PLANT CROSSES – MONO HYBRID, DI-HYBRID, AND POLY-HYBRID CROSSES**

5. In peas, seeds may be round (R) or wrinkled (r). What proportion of the offspring in the following crosses would be expected to be wrinkled?

a.  $RR \times rr$

b.  $Rr \times Rr$

c.  $Rr \times rr$

7. In peas, seeds may be yellow (Y) or green (y). What proportion of the offspring in the following crosses would be expected to be yellow?

a.  $YY \times Yy$

b.  $Yy \times Yy$

c.  $yy \times yy$

8. This one is way crazy! [Advanced] What proportion of the plants from the following crosses would be tall with yellow, wrinkled seeds?

a.  $TtYYRr \times ttYYrr$

b.  $TTYyRr \times TtYyRr$

c.  $ttYyrr \times ttyyRr$

d.  $TtYyRr \times TtYyRr$

9. From the crosses  $TTYyRr \times TtYyrr$ , what proportion of the offspring would be expected to be:

- a. tall plants with round, yellow seeds
- b. tall plants with round, green seeds
- c. dwarf plants with round, green seeds
- d. tall plants with yellow, wrinkled seeds
- e. tall plants with green, wrinkled seeds

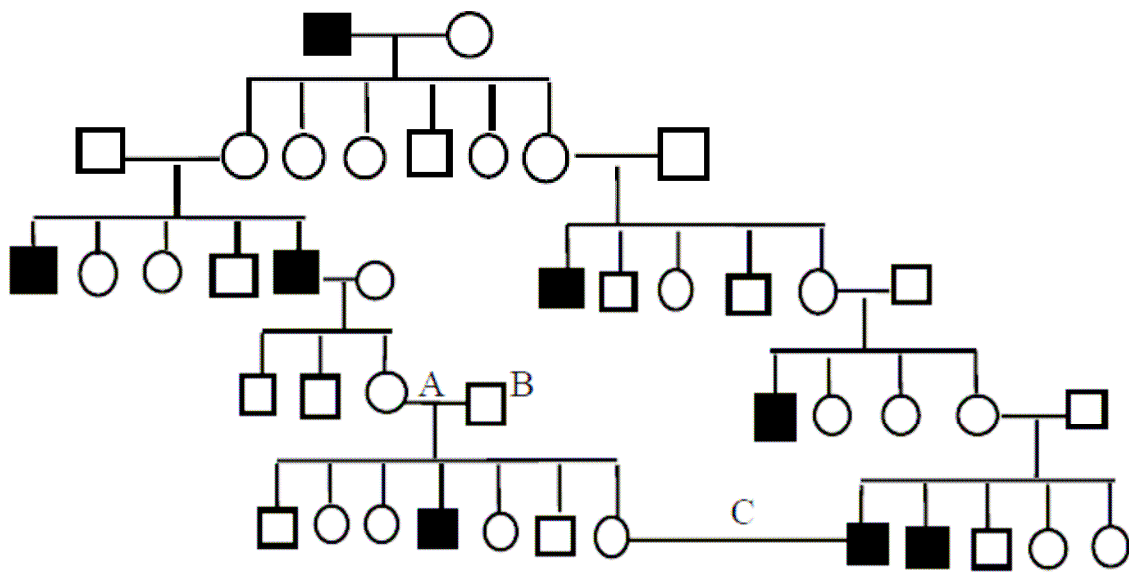
**SEX - LINKED AND PEDIGREE (DI-HYBRID CROSSES) [Advanced]**

10. In humans, dark hair (**B**) is dominant over blondness (**b**), and colour blindness (**c**) is a sex-linked recessive trait. A woman has a blond brother, a blond mother, and a dark-haired father. Her brother and her parents have normal vision. She bears the following three children by her blond, normal-visioned husband:

- (1) a dark-haired son with normal vision
- (2) a dark-haired daughter with normal vision, and
- (3) a dark-haired colour-blind son

- a. Make a pedigree of the entire family showing the probable genotypes of all individuals.
- b. What is the probability that her next (fourth) child will be a colour-blind boy?
- c. If her fourth child is a boy, what is the probability that he will have dark hair?
- d. What is the chance that her next four children will all be girls?

11. Research has shown that a particular eye defect is represented in a family pedigree as follows:



On the basis of this data, which of the following mechanisms of inheritance are POSSIBLE? autosomal dominant, autosomal recessive, sex-linked dominant, sex-linked recessive, Y-linked. (we likely did not study 'Y' – linked traits!)

- What is the most PROBABLE mechanism of inheritance?
- What is the genotype of female A?
- What is the genotype of male B?
- What is the probability that a child from marriage C will show this eye defect?