Year 10 Life and Living Revision of Genetics Problems

1. What is another term for homozygous? _____ Give an example of a homozygous genotype _____

2. Explain the meaning of a recessive allele by providing a specific example from one of the problems you have done so far. _____

_____

3. What is an allele? Use the gene for tongue rolling as your example. _____

_____

4. Characteristics that you can see...like a person being left handed, short sighted or having curly hair are known as _____.

5. Two brown rabbits had a litter of 12 little rabbits. Six of these were white and six were brown. Explain how coat colour is inherited in rabbits.

6. For question 5 above, were the outcomes expected? Explain.

7. Use two alternative words that can be used to describe the genotype of each of the white rabbits in the questions above. _____or _____

8. Sickle Cell Anaemia is an inherited condition where red blood cells that are produced are deformed and therefore unable to carry oxygen that is required for cell respiration. If a person is born homozygous for sickle cell anaemia then all of their red blood cells are affected and they will die in infancy. If a person is heterozygous for sickle cell anaemia then about half of their red blood cells are deformed and the other half are capable of transporting oxygen. These people are anaemic but will live. If a woman who is heterozygous for sickle cell anaemia has children with a normal man, then what will be the possible phenotypes of the children and in what ratios (%) would these be expected?

9. Haemophilia is a sex linked condition that is caused by the inheritance of a recessive allele. Use a punnet square and appropriate key to show why sons tend to inherit this blood clotting condition from two parents with normal phenotypes.

Revision of Genetics Terminology

1. Describe the structure of a chromosome. _____

_____

_____

_____

_____

2. In a diploid cell homologous chromosomes will be found. Explain. _____

_____

_____

3. Define autosome. _____

4. Why does a human sperm have only 23 chromosomes? _____

_____

5. How are males different to females with regard to their chromosomes? _____

_____

MØNOHYBRID CROSSES

1. Two hybrid organisms are mated. Both have the genes T and t. T stands for tallness and dominates t, which stands for short. Work out the phenotype and genotype of the offspring using a punnet square.

2. In guinea pigs, rough coat (R) is dominant to smooth coat (r) Suppose you were given a pure-breeding female guinea pig with rough fur and a male with smooth coat:
Show the genotype and phenotype of the offspring

3. Agouti colour in mice (A) is dominant to albino (a).Two agouti mice mate to give 5 agouti offspring and one albino. What are the possible genotypes of the 2 parents?

4. Some dogs bark when they follow scent and others are silent. Barking (B) is dominant to silence (b). If a breeder wants to be sure his dog is a homozygous barker what bitch should he mate with his dog to determine this?

5. In dogs droopy ears (d) is recessive to erect ears (D). A droopy eared dog is mated to a dog with erect ears whose sire was droopy eared. How many erect eared offspring would you expect if they had 10 offspring?

6. If black coat colour is dominant to white coat colour in Rats, what will be the genotype and phenotype of a cross between a pure breeding black rat and a pure breeding white rat?

7. Fixed ear lobes are recessive in humans, and free ear lobes are dominant. Two heterozygotes have 4 children.
(i) Draw up the cross to show the probable genotypes and phenotypes for these children.
(ii) What are the chances of the oldest child having fixed ear lobes?
(iii) What are the chances of the offspring being heterozygotes?

8. Red flower is dominant to white flower colour in garden peas. A red flowered plant was crossed with a white flowered plant and the offspring were in the ratio 98 red flowered to 101 white flowered. What was the genotype of the parents?

9. Astigmatism is an eye defect caused by the irregular shape of the cornea or lens. Light rays do not focus at a point on the retina and the image becomes blurred. The defect may be corrected with glasses.
The Gene for astigmatism will dominate a gene for normal vision.
If a man with astigmatism, whose mother had normal vision, marries a woman with normal vision, what is the probability that they will have a child with astigmatism?

10. Double-jointedness is dominant to normal condition of joints in humans.
If a man who is heterozygous for the trait marries a woman who is homozygous recessive for the trait, what are the probable genotypic and phenotypic ratios for this trait in their children?

11. In humans, normal pigmentation is due to a dominant gene (A) and albinism is due to a recessive allele (a).
(i) an albino man man marries a normally pigmented woman. they have nine children all normally pigmented. What are the genotypes of the parents and offspring (progeny)?
(ii) A normally pigmented man whose father was an albino marries an albino woman. They have three children ; two normal and one albino. List the genotypes of all the individuals mentioned in this family.

MONOHYBRID CROSS PROBLEMS

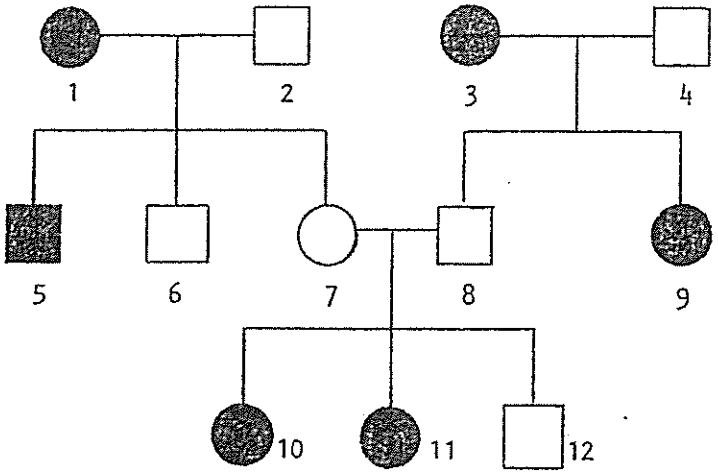
NOTE: Problems should be set out in full.

1. Double-jointedness is dominant to normal condition of joints in humans.

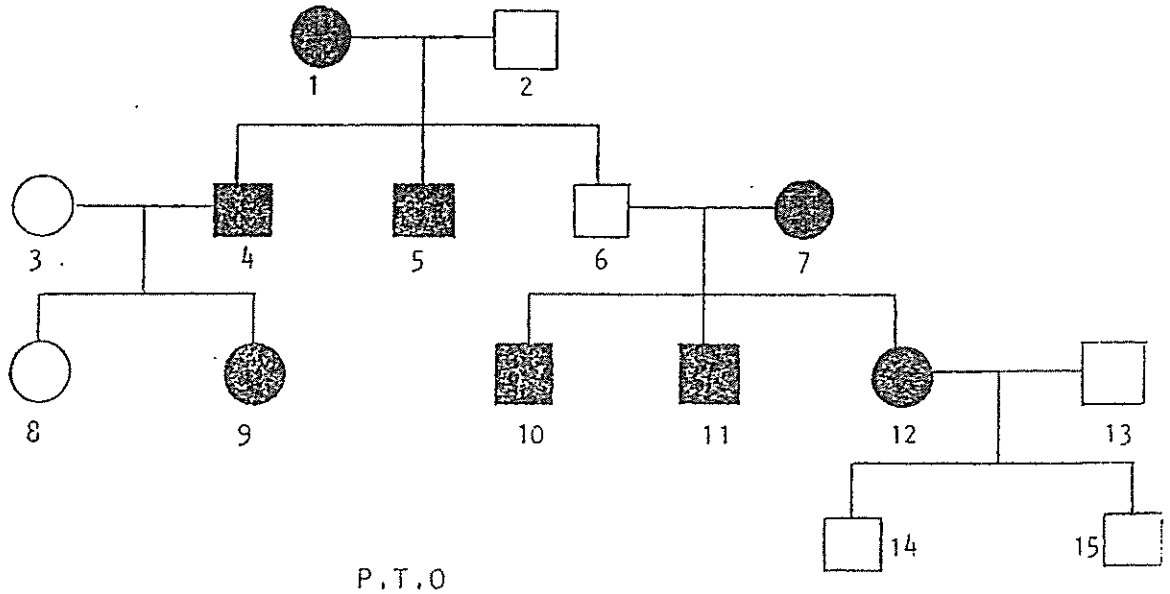
   If a man who is heterozygous for the trait marries a woman who is homozygous recessive for the trait, what is the probable genotypic and phenotypic ratio for this trait in their children?

2. Study the following human pedigrees. Each pedigree relates to a different character; the individuals that show the character are shown in *black*. For each member of a pedigree, state its possible genotype(s) and for each pedigree state, where possible, if the character is dominant or recessive.

   (i) SHORT EYELASHES:-



   (ii) PROMINENT NOSE:-



P.T.O

Genetics Problem - Sex Linkage

1. A couple really wants to have at least one child of each sex. Their first three children are girls, so they feel certain that their next child will definitely be a boy. But...what are the chances of this offspring (or of any offspring) being a boy?

2. Hemophilia or "bleeder's disease" is a **recessive, sex-linked condition.** It is possible for women to be hemophiliacs, but it is more common among men.
   a) For a woman to be a hemophiliac, what must her dad's phenotype and genotype have been?
   b) There are two possibilities for her mother's genotype & phenotype - give both.
   c) Of the 2 possibilities in part b, which one is most likely for the mother? Why?

3. At least one type of colorblindness is a **sex-linked, recessive condition.** A colorblind man marries a woman with a long family history of normal color vision. What would you predict for the vision of their children? (Genotype and phenotype ratios)

4. A husband and his wife both have normal vision, but their baby girl is colorblind. Because he knows that colorblindness is a **sex-linked, recessive trait,** the husband is FURIOUS and immediately sues his wife for divorce on grounds of infidelity. YOU, as a world-famous GENETICS COUNSELOR, have been served a subpoena to testify in court as an expert witness! Could the baby have been theirs, or must she have been unfaithful to him?

5. A colorblind man wonders if he "got" his colorblindness allele from his mother or his father. Can knowledge of genetics provide an answer to his question? Remember, colorblindness is a **sex-linked, recessive condition.**

6. One type of baldness is a ***sex-influenced trait.*** The gene for baldness (B = has hair, b = bald) is NOT on a sex chromosome, but the person's sex does influence the expression of this trait. All BB individuals have hair, and all bb individuals go bald, but (due to hormonal differences) Bb women have hair while Bb men go bald. A bald man and a seemingly normal woman have a son who keeps his hair as he ages, and a daughter who loses hers. **What are the genotypes of the man, his wife, their son, and their daughter?**

7. In cats, the allele B leads to black fur and b leads to yellow fur. However, Bb is tortoise-shell color (in other words, B and b are **codominant**). **The gene for color is on the X chromosome.** A tortoise-shell female is crossed with a black male.
   (a) What kinds of kittens would be expected?
   (b) Would you expect to find any tortoise-shell males.

8. In chickens, there is a sex-linked feather pattern called "barred." In birds, females are XY and males are XX. Barred is dominant to nonbarred. A barred hen (female) is crossed to a nonbarred rooster (male).
   (a) What will be the genotypes and phenotypes of the F_1?
   (b) If the F_1 are allowed to interbreed, what will be the genotypes and phenotypes of the F_2?

9. What kinds of offspring, and in what proportions, will be produced when a non-barred hen is crossed to a heterozygous barred rooster?

10. In Drosophila, yellow body is sex-linked and recessive to brown body. If a yellow male is crossed to a true-breeding brown-bodied female, what color will the bodies of their progeny be?

Revision – Natural Selection and Evolution

1. Define Mutation and explain how mutations can occur.

2. List the 5 points of Darwin's Theory of Evolution by completing each statement.
   a. All organisms produce _____ offspring than can possibly _____.

   b. In every species there is _____.

   c. Nature (_____ factors) selects which individuals _____.

   d. The survivors _____and pass on their survival _____.

   e. Each generation is _____ because there has been selection of who survived to _____. As these changes accumulate, the species _____.

3. Define Natural Selection

4. List 3 "environmental factors" which might contribute to natural selection.

5. "Survival of the fittest" doesn't just mean to survive. What does it mean?

6. When a species evolves, does any individual change during its life time? When do differences appear?

7. Why is variation important in a population?

8. What might happen to a species with no variations at all?

9. Where do new variations originally come from?

10. How does sexual reproduction contribute to variation?

11. List 3 environmental changes that might result in extinction of a species.

12. What may cause a “mass extinction”?

13. Explain how one species, which is living in 2 or more isolated groups, might evolve to become several different species.

14. Name and describe three pieces of evidence that support the theory of evolution