

Genetics Unit Review and Problem Set

Part 1: Background

1. What is a trait? Give an example
2. What is a genotype? Give an example.
3. What is a phenotype? Give an example.
4. What is an allele? Give an example.
5. What are gametes? What is the process that makes gametes?

Part 2: Mendel's Genetics

1. What is the law of dominance?
2. What is a dominant allele? Give an example.
3. What is a recessive allele? Give an example.
4. What is the law of segregation?

Part 3: Modern Genetics

1. Define: multiple alleles
2. Set up a cross for a person heterozygous for type A blood and a person with type AB blood. Do a Punnett square for this cross.
3. Define autosomes and sex chromosomes.
4. What is a carrier?
5. What does sex-linked mean? Name two sex linked traits.
6. Set up a cross between a colorblind man and a carrier female. What is the probability that they will have a colorblind son?

Part 4: Meiosis

1. How many divisions are there in meiosis? How many cells do you end up with?
2. What is haploid? What is diploid? Are the cells made from meiosis haploid or diploid? Explain.
3. What is crossing over? How does this increase genetic diversity?
4. What is nondisjunction? What are three disorders caused by nondisjunction?

Part 5: Pedigrees

1. What is a pedigree?
2. What is the symbol for a man who shows the trait being traced? What is the symbol for a female carrier?
3. How can you determine from looking at a pedigree whether an allele is dominant or recessive?
4. How can you determine from looking at a pedigree whether a trait is sex-linked?

Reviewing Codominance, Multiple Alleles, and Sex-linked Traits

1. In cattle, the alleles for red coat (R) and white coat (Q) behave as the co-dominants. Both red **and** white hairs are produced in the heterozygote producing a coat pattern that is called "roan."

- Give the phenotypic and genotypic ratios to be expected among the offspring from a cross of two roan animals.
- What are the expected genotypic and phenotypic ratios from a cross of a roan animal and a white one?

2. The Case of the Suspected Father

Blood typing is often used as evidence in paternity cases in courts, but it cannot be used to convict a man, only exonerate him (show that he is not the father!). In a series of disputed paternity cases, the mother and child each had the blood types listed in the table below. For each, indicate the blood types which, if found, would exonerate (free) an accused man.

Mother's Phenotype	Possible Genotypes for Mother	Child's Phenotype	Possible Genotypes for Child	Man exonerated if he has these phenotype(s)
A		O		
B		AB		
O		A		
AB		A		
O		O		
B		B		
A		B		

3. In humans type A blood is caused by the antigen A in the red cells resulting from gene A. Type B is caused by a gene B for antigen B. Type O blood results from the absence of either gene while the presence of both genes causes both antigens to be formed resulting in type AB blood. If a person of blood group AB marries one belonging to blood group O what will be the blood groups of their children?

4. If one parent has Type A blood and the other has type B, but all four blood types are represented among the offspring, what are the genotypes of the parents?

5. If both parents are type A but $\frac{3}{4}$ of their children are type A and $\frac{1}{4}$ of the children are type O, what are the parent's genotypes?

6. What are the likely genotypes of the parents if one has type AB blood and the other type B, but their children are $\frac{1}{4}$ A, $\frac{1}{4}$ AB and $\frac{1}{2}$ type B?

7. In a case of disputed paternity, the mother belongs to group B, the child to O, one possible father to A and the other to AB. Which one is the true father of the child?

8. What are the possible blood types of children in the following families?

(a) Type A mother, Type A father

Biology jsd '15

(b) Type A mother, Type AB father

(c) Type AB mother, Type AB father

(d) Type A mother, Type B father

9. A type A woman has a baby who has a blood type of O. She claims that one of two men is the father. Man #1 has blood type B. Man #2 has blood type AB. **Is it possible to rule out one man as the possible father? Why?**

Is it possible to prove that one of these men is the father? Why?

10. 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?

11. 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)

12. 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?

13. 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**.