Extra Review Practice – Biology Test Genetics - Key

Mendel fill in the blanks:

Mendel was an Austrian monk who studied genetics primarily using _pea____ plants. He started with plants that produced offspring with only one from of a trait; these were called true or _pure_____ breeding plants. Through breeding two pure plants with different phenotypes, like tall and short, he discovered how traits could skip _generations_____ and how __recessive___ alleles could get masked.

One of the things Mendel discovered was the Law of __Segregation_____. This law states that alleles of a gene separate from each other during _meiosis_____ so only one allele for a particular gene is in each ___gamete_____ cell.

Another thing Mendel noticed is that when he crossed peas with two contrasting forms of the trait, for example tall vs. short and round vs. wrinkled, the inheritance of one trait didn't influence the inheritance of the other. So the other law that Mendel discovered was the Law of _Independent Assortment_. This law states that the inheritance of one trait does not have to determine the trait of another, for example his tall pea plants didn't always have to have round seeds also.

Generations	Pea	Recessive	Pure
Segregation	Meiosis	Gamete	Independent Assortment

Monohybrid Crosses and Basics

Fill in the blanks below:

Every person has _46__ chromosomes that contain many genes. _alleles_____ are different versions of a gene and based on which ones you inherit certain traits will be expressed. The _genotype_____ of an organism represents its' genetic composition (the alleles you actually inherit), the __phenotype___ of an organism reflects all the traits that are actually expressed (what you physically see). You have two alleles for each trait, if you have two dominant alleles you are _homozygous dominant_____, if you have two recessive alleles you are __homozygous recessive___, if you have two different alleles you are __heterozygous_____. In simple genetic problems someone who is heterozygous will show the ___dominant_____ trait because it masks the recessive allele. When studying the inheritance of alleles a __monohybrid_____ cross involves one trait or gene, while a _dihybrid___ cross involves studying two genes or traits at the same time.

Homozygous Dominant	Alleles	Phenotype	Heterozygous
Dihybrid	Homozygous Recessive	Genotype	Dominant
Monohybrid	46		

Create monohybrid crosses that study height in pea plants. Tall pea plants (T) are dominant to short (t) pea plants.

1. Set up a cross between **two heterozygous** parents. Show the Punnett square below then answer the following questions:

	T	t
T	TT	Tt
t	Tt	tt

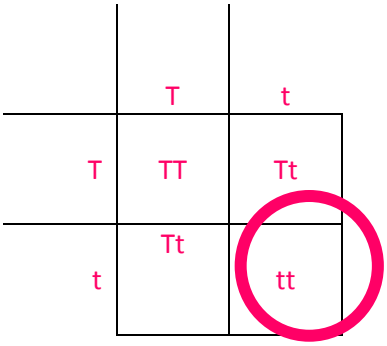
   a. What is the genotypic ratio: 1 TT: 2 Tt: 1 tt
   b. What is the phenotypic ratio: 3 tall: 1 short
   c. What percent chance will the offspring be tall? 75%
   d. What percent chance would the offspring be homozygous dominant? 25%
   e. What percent change would the offspring be heterozygous? 50%

2. Set up a cross between a **heterozygous parent** and a **homozygous recessive** parent. Show the Punnett square below then answer the following questions:

	T	t
t	Tt	tt
t	Tt	tt

   a. What is the genotypic ratio: 2 Tt: 2 tt OR 1:1
   b. What is the phenotypic ratio: 2 Tall: 2 Short OR 1:1
   c. What percent chance will the offspring be tall? 50%
   d. What percent chance would the offspring be homozygous dominant? 0%
   e. How many different phenotypes are possible between these parents? Two, tall and short
   f. How many different genotypes are possible between these parents? Two, Tt and tt

3. If two parents are carriers for a disorder, what does that mean about their genotype? What does it mean about the disorder? What is the likelihood that even though they don't express the disorder their child would?
   If they are carriers they must be heterozygous so if we were using T's… Tt. If they are carriers that means the disorder must be recessive, because if it was dominant then they would just express the disorder… carriers don't express the disorder, just carrier the recessive allele for it so they could potentially pass it on to their offspring. A Punnett square between the parents would look like this…



   So that would mean their child would have a 25% chance of having it.

Dihybrid Crosses and Exceptions to Mendel

1. When creating a dihybrid cross you are actually studying two traits at once, however offspring will only inherit one allele from each parent. If a parent has the following genotype, what are the different combinations of that could be passed on to their offspring: DdGg
   Combinations include: DG, Dg, dG, dg

2. If tall is dominant (T) over short (t) and Yellow (Y) is dominant over green (y), examine the following cross:

   Parental Generation: Male - TtYy x Female – TtYy

	TY	Ty	tY	ty
TY				
Ty	A			
tY			B	
ty				

a. What do the parents look like? They are both tall and yellow
b. What is the phenotypic ratio of the offspring? 9:3:3:1
c. What is the genotype of the box with an "A" in it? TTYy
d. What is the genotype of the box with a "B" in it? ttYY

3. Match the following using the word bank below:
    a. When organisms who are heterozygous show a blended phenotype the trait is - Incomplete Dominant
    b. When organisms who are heterozygous show both forms of a trait – Co-dominant
    c. Controlled by multiple alleles in humans - Blood Type
    d. Color blindness and hemophilia are caused by genes on the X chromosome, so they are – Sex-linked
    e. Sex linked traits are more likely to be found in what gender - Males
    f. Carriers are people who have this genotype - Heterozygous
    g. If someone is a carrier for a disease, the disease must be - Recessive
    h. When more than one gene controls a trait it is - Polygenetic

Co-dominant	Blood type	Sex linked	Polygenetic
Heterozygous	Recessive	Male	Incomplete Dominant

Mutations

1. Mark the following as true or false:
    a. Mutations can be inherited, environmentally caused or happen during replication True
    b. Everyone has lots of hidden recessive mutations that are not always expressed or harmful True
    c. Cells have efficient systems for correcting errors to prevent mutations (think G1 and G2 check points in mitosis) True
    d. Hemophilia, cystic fibrosis and sickle cell anemia are all caused by genes that code for defective proteins True

Pedigrees

1. If a trait shows up equally in males and females on a pedigree that means it is most likely what type of trait? Autosomal

2. If a trait shows up more often in males than in females on a pedigree that means it is most likely what type of trait? Sex-linked

3. If everyone who shows a trait on a pedigree has a parent who also shows it, it is most likely what type of trait? Dominant

4. If a child has a trait on a pedigree but their parents don't or are only half shaded in, it must be what type of trait? Recessive

5. In a pedigree where a circle of square is half shaded on that person is a _ Carrier/heterozygous_____, and if it is fully shaded in that person actually _has____ the disorder or trait.

6. **Don't forget to practice using the pedigree on the review sheet!**

Vocabulary

__Genetics_____	This is the study of heredity, aka the unit we are studying
__Heredity_____	This is the passing of traits from parents to offspring
___Gene_____	This is a segment of DNA that carries the instructions for a specific gene/protein
__Mutation_____	A change in a gene due to damage or being copied incorrectly
__Meiosis_____	This is the process of creating sex cells, it is also when alleles separate to be passed on to offspring