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**AP Biology Exam Review: Classical Genetics (Unit 9)**

**Helpful Videos and Animations:**

1. [Bozeman Biology: Mendelian Genetics](https://www.youtube.com/watch?v=NWqgZUnJdAY&feature=BFa&list=PLFCE4D99C4124A27A)
2. [Bozeman Biology: Chromosomal Genetics](https://www.youtube.com/watch?v=rIe7mPXkYhs&list=PL7A750281106CD067&index=52&feature=plpp_video)
3. [Bozeman Biology: A Beginner's Guide To Punnett Squares](https://www.youtube.com/watch?v=Y1PCwxUDTl8&feature=BFa&list=PL7A750281106CD067)
4. [Bozeman Biology: Probability in Genetics - Multiplication and Addition Rules](https://www.youtube.com/watch?v=y4Ne9DXk_Jc&feature=BFa&list=PL7A750281106CD067)
5. [Bozeman Biology: Linked Genes](https://www.youtube.com/watch?v=-_UcDhzjOio&feature=BFa&list=PL7A750281106CD067)
6. [Bozeman Biology: The Genetics of Blood Types](https://www.youtube.com/watch?v=KXTF7WehgM8&feature=BFa&list=PL7A750281106CD067)
7. [Andrew Douch: Pedigree Analysis 1](http://www.youtube.com/watch?v=HbIHjsn5cHo)
8. [Andrew Douch: Pedigree Analysis 2](http://www.youtube.com/watch?v=ej2hFc8u_zQ&feature=channel&list=UL)

**Unit Vocabulary**

-DNA (deoxyribonucleic acid)

-Inherited Trait

-Chromosomes

-Homologous Chromosomes

-Gene

-Allele (dominant vs. recessive)

-Genotype (homozygous dominant vs. homozygous recessive vs. heterozygous)

-Phenotype

-Fertilization

-Zygote

-Punnett Square

-Purebred (another term for homozygous)

-Hybrid (another term for heterozygous)

-Gregor Mendel

-Pea Plant Generations: P, F1, F2

-Multiplication Rule of Probabilities

-Addition Rule of Probabilities

-Incomplete Dominance / Blending Inheritance

-Codominance

-Sex-Linked Traits (X-linked traits vs. Y-linked traits)

-X-Linked Recessive Traits

-X-Linked Dominant Traits

-Monohybrid Cross

-Dihybrid Cross

-Multiple Alleles (the pattern of inheritance seen in blood type genetics)

-Pleiotropy

-Polygenic Inheritance

-Multifactorial Traits (controlled by DNA AND the environment)

-Non-nuclear Inheritance (controlled by DNA NOT found in the nucleus, ex: mitochondrial DNA)

-Pedigree

-Autosomal Recessive Trait

-Carrier

-Autosomal Dominant Trait

-Mendel’s Law of Dominance

-Mendel’s Law of Segregation

-Mendel’s Law of Independent Assortment

-Nondisjunction

-Aneuploidy (ex: trisomy or monosomy)

-Polyploidy

-Linked Genes

-Unlinked Genes

-Recombination Frequencies

-Linkage Maps

-Map Units

-Gene Loci (singular = locus)

**Topic Outline: (Thank you to Megan Chirby and Amy Litz!)**

***Unit 9, Part 1 Notes: The Basics of Mendelian Genetics***

1. Mendel’s experiments
* Pea plants with distinct dominant vs. recessive traits
* Know what happens in the P 🡪 F1 🡪 F2 generations
1. Basic Genetics Vocabulary
* Gene vs. allele
* Homozygous vs. heterozygous
* Genotype vs. Phenotype
* Monohybrid Cross vs. Dihybrid Cross
* Testcross
1. Setting up / analyzing genetic crosses with Punnett squares
* Know how to set up monohybrid and dihybrid crosses given information regarding parent genotypes and phenotypes and analyze offspring genotype / phenotype ratios
* Understand the rules of probability in Punnett Square analysis:
1. Rule of Multiplication: when calculating the probability that two or more independent events will occur together in a specific combination, multiply the probabilities of each of the two events

For example, the probability of a coin landing face up two times in two flips is ½ X ½ = ¼

In genetics, if you cross two organisms with the genotypes AABbCc and AaBbCc, the probability of an offspring having the genotype AaBbcc is ½ X ½ X ¼ = 1/16

1. Rule of Addition: when calculating the probability that any of two or more mutually exclusive events will occur, you need to add together their individual probabilities. For example, if you are tossing a die, what is the probability that it will land on either the side with four spots or the side with five spots? (1/6 + 1/6 = 1/3)
2. Non-Mendelian Patterns of Inheritance
* Explain how sex-linkage is different from autosomal patterns of inheritance and be able to set up a sex-linked Punnett square
* Codominance and Incomplete Dominance (be able to complete Punnett squares for these two patterns of inheritance)

***Unit 9, Part 2 Notes: Human Genetics***

1. Non-Mendelian Patterns of Inheritance (continued)
* Multiple Alleles (blood type Punnett squares! Use the alleles i, IA, and IB)
* Pleiotropy
* Polygenic Inheritance
* Nonnuclear inheritance (traits determined by DNA in mitochondria or chloroplasts, not DNA in the nucleus)
* Traits influenced by the environment (ex: human height)
1. Analyzing a pedigree of a human inherited condition
* Be able to describe the methods of fetal testing for inherited genetic conditions (amniocentesis and chorionic villi sampling)
* Be able to determine the type of inheritance shown in a pedigree (autosomal dominant, autosomal recessive, sex-linked dominant, and sex-linked recessive) Here are a couple hints:
1. If there are significantly more males with a condition than females, the trait is sex-linked (be able to explain why sex-linked recessive conditions are found more often in males)
2. With an autosomal trait, if a child has a trait but the parents don’t, the trait is recessive (both parents are carriers)

***Unit 9, Part 3 Notes: Chromosomal Genetics***

1. Mendel’s Laws
* Law of Dominance
* Law of Segregation (and explain how disorders caused by nondisjunction – ex. Trisomy 21 / Down Syndrome – are related to this law ; be able to define aneuploidy, monosomy, and trisomy)
* Law of Independent Assortment
1. Linked Genes (found on the same chromosome and inherited together during cell division)
* Crossing over between homologous chromosomes during Prophase I of meiosis may separate linked genes onto different chromosomes. The frequency of recombination of linked genes due to crossing over increases if two genes are farther apart on the chromosome
* We can create a linkage map shown the location of genes on a chromosome. The distance between genes is measured in map units. 1 map unit = 1% recombination frequency 🡪 those genes are close together!

**Practice Long Response Questions**

In fruit flies, the phenotype for eye color is determined by a certain locus. ***E*** indicates the

dominant allele and ***e*** indicates the recessive allele. The cross between a male wild-type fruit fly

and a female white-eyed fruit fly produced the following offspring.



a. **Determine** the genotypes of the original parents (P generation) and **explain** your reasoning. You may use Punnett squares to enhance your description, but the results from the Punnett squares must be discussed in your answer.

b. Use a Chi-squared test on the F2 generation data to analyze your prediction of the parental genotypes. **Show** all your work and **explain** the importance of your final answer.

c. The brown-eyed female in the F1 generation resulted from a mutational change. **Explain** what a mutation is, and **discuss** two types of mutations that might have produced thebrown-eyed female in the F1 generation.

**Practice Calculations Questions**

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