

Heredity II Study Guide KEY

Name: _____ Period: ____ **Practicing Punnett Squares**

Show the results of the following crosses using Punnett squares and the information accompany the figure.

1. Heterozygous short-hair x heterozygous short-hair

Genotypic ratio: 1:2:1

Phenotypic ratio: 3:1

2. Heterozygous tabby x stripeless

Genotypic ratio: 0:1:1

Phenotypic ratio: 1:1

3. Colorpoint x homozygous normal

Genotypic ratio: 0:1:0

Phenotypic ratio: 1:0

4. Homozygous short, homozygous colorpoint x homozygous long, homozygous normal

Phenotypic ratio: 1:0:0:0

5. Heterozygous short, heterozygous normal x heterozygous short, heterozygous normal

Phenotypic ratio: 9:3:3:1

6. Heterozygous tabby, heterozygous normal x stripeless colorpoint

Phenotypic ratio: 1:1:1:1

7. Long-hair, heterozygous normal x longhair, heterozygous normal

Phenotypic ratio: 0:3:0:1

MATCHING TERMS: *In the space provided, write the term that best fits the description.*

Trait 1. Characteristic that is inherited.

Genome 2. **All** of an organism's genetic material.

Dominant 3. Allele that is expressed when two different alleles are present in an organism's genotype.

Recessive 4. Allele that is not expressed unless two copies are present in an organism's genotype.

Allele 5. Any of the alternative forms of a gene that occurs at a specific place on a chromosome.

Heterozygous 6. Characteristic of having two **different** alleles that appear at the same locus of sister chromatids.

Homozygous 7. Characteristic of having two of the **same** alleles at the same locus of sister chromatids.

Genotype 8. Collection of all an organism's genetic information that codes for traits (genetic make-up).

Phenotype 9. Collection of all an organism's physical characteristics (physical characteristics)

Test cross 10. Cross between an organism with an unknown genotype and an organism with a recessive phenotype.

Monohybrid cross 11. Cross, or mating, between organisms that involves only one pair of contrasting traits.

Dihybrid cross 12. Cross, or mating, between organisms that involves two pairs of contrasting traits.

Crossing over 13. Exchange of chromosome segments between homologous chromosomes during meiosis I.

Sex-linked gene 14. Gene that is located on a sex chromosome.

Codominance 15. Heterozygous genotype that equally expresses the traits from both alleles.

Incomplete dominance 16. Heterozygous phenotype that is a blend of the two homozygous phenotypes.

Probability 17. Likelihood that a particular event will happen.

Cross 18. Mating of two organisms.

Law of independent assortment 19. stating that (1) organisms inherit two copies of genes, one from each parent, and (2) organisms donate only one copy of each gene to their gametes.

Law of segregation 20., stating that allele pairs separate from one another during gamete formation.

Punnett square 21. Model for predicting all possible genotypes resulting from a cross, or mating.

Gene 22. Specific region of DNA that codes for a particular protein.

Genetics 23. Study of the heredity patterns and variation of organisms.

Polygenic 24. Trait that is produced by two or more genes.

Purebred 25. Type of organism whose ancestors are genetically uniform.

Diploid 26. Contains 2 copies of the chromosomes.

Haploid 27. Contains 1 copy of the chromosomes.

Homologous 28. Describes corresponding chromosomes that carry alleles from the same traits.

Sister chromatids 29. These separate during Meiosis II.

Meiosis 30. Process that produces 4 unique, haploid cells from 1 diploid cell in 2 cell divisions.

Polar bodies 31. Small cell resulting from meiosis in female animals, which usually does not participate in reproduction.

Mitosis 32. Process involved in growth/repair in multicellular organisms and reproduction in single-celled organisms where 1 diploid cell divides to form 2 identical, diploid cells.

Pollen 33. Male gamete in higher plants.

Tetrad 34. Configuration of homologous chromosomes pairs as seen in Metaphase I.

Meiosis:

1. If an organism reproduces asexually, will its cells undergo mitosis or meiosis?

Mitosis

2. Fill out the blanks in the Mitosis vs. Meiosis Comparison Chart Below:

Mitosis	Meiosis
One nuclear division	Two nuclear divisions
Results in 2 new genetically identical cells	Results in 4 new genetically different cells
Produces diploid cells	Produces haploid cells
Produces somatic cells (in multicellular organisms)	Produces gametes
In multicellular organisms mitosis is used for growth and development	In multicellular organisms meiosis is used for reproduction

3. What is crossing-over and at what phase during meiosis does crossing over occur?

Crossing-over occurs when homologous chromosomes pair up beside each other and swap pieces of their chromosomes. This occurs in prophase of meiosis I.

4. What is a tetrad (this is in your written notes, not the book)?

A four-part structure that forms during the prophase of meiosis I and consists of two homologous chromosomes, each composed of two sister chromatids.

5. Do chromosomes line up as tetrads during meiosis I or meiosis II?

Meiosis I

6. Are the cells that are formed after the first cell division of meiosis I haploid or diploid?

Diploid

7. What is the difference between metaphase I and metaphase II of meiosis?

In metaphase I of meiosis homologous chromosomes (one from each parent) line up at the cell equator. In metaphase II of meiosis duplicated chromosomes line up at the cell equator.

8. What is the difference between anaphase I and anaphase II of meiosis?

Anaphase I- Homologous chromosomes are pulled apart to opposite sides of the cell. Anaphase II- Sister chromatids are pulled apart to opposite sides of the cell.

9. Be able to identify pictures of meiosis and mitosis and know what each phase is in each type of cell division.

Mendel, Punnett Squares, Etc.:

1. Mendel is known as the **father** of genetics.
2. What organism did Mendel experiment with?

Self-pollinating pea plants

3. What is the scientific study of heredity?

Genetics

4. If an organism is heterozygous for being hairy, what would its genotype be?

Hh

5. If you cross a parent with a genotype of Tt with a parent that has a genotype of tt, what is the probability of their offspring being homozygous recessive?

50%

6. What does the F1 generation refer to in a genetic cross?

F1 refers to the first filial generation or the offspring made by the cross of the parent generation.

7. A dominant allele is one that **masks** the affect of a recessive allele.

8. What are the units of inheritance?

Genes located on chromosomes are the units of inheritance.

9. Alleles for recessive traits are represented by a **lower case** letter.

10. What is probability?

The chance or likelihood that an event will occur.

11. If there is $\frac{3}{4}$ chance that a cross between two individuals will yield offspring that are heterozygous, what is the percentage of heterozygous offspring that can be produced? ($\frac{3}{4} = \mathbf{75\%}$)

12. What is Mendel's Law of Independent Assortment?

Alleles for different traits are distributed to sex cells (offspring) independently of one another.

13. What is the principal of dominance?

It states that some unit characters (alleles for a trait) can mask the expression of others.

14. When one allele for a gene is not completely dominant over another for that gene it is called **incomplete dominance.**

15. What is the law of segregation?

Organisms inherit two copies of each gene, one from each parent and organisms donate only one copy of each gene in their gametes. Therefore, the two copies of each gene segregate, or separate, during gamete formation (meiosis).

16. Are X-linked, recessive traits more likely to be passed on to women or men? Why?

Men because they only receive one X chromosome and therefore only need one X with the recessive allele. Women would need to get both X chromosomes with the recessive allele in order to have the disorder.

17. Define and give an example of codominance.

Codominance occurs when both alleles for a trait are inherited equally. Neither allele masks the effect of the other so they are both displayed in the offspring. Example: When a red flower is crossed with a white flower, their heterozygous offspring will be red and white spotted. Blood type in humans is another example of codominance.

18. Hemophilia and colorblindness are known as **sex-linked** traits. Why?

Because the genes for these disorders are carried on the sex chromosomes (X or Y).

19. Give an example of incomplete dominance:

In certain species of flowers, when a red flower is crossed with a white flower the heterozygous offspring will be pink (a mixture of the two colors).

20. Frank and Elizabeth are phenotypically normal, but their son, Ralph, is colorblind. Colorblindness is a sex-linked, recessive disorder. What percent of Frank and Elizabeth's children will be normal (not colorblind)?

75% will be normal

21. Mendel discovered that the phenotypes of F₂ offspring followed the ratio of 9:3:3:1 when a monohybrid or dihybrid cross for 2 linked or 2 unlinked traits was performed. (Circle the correct choices)

22. Are sex cells haploid or diploid? **Haploid**

23. Why did Mendel cut the male reproductive parts off of the flowers on the pea plants he was experimenting with?

He cut the male reproductive parts off because he wanted to be sure that the plant was only being pollinated by the type of plant he wanted it to be crossed with.

24. What are homologous chromosomes and when do they line up in meiosis?

Homologous chromosomes are two separate chromosomes (one from the mom and one from the dad) that carry genes that code for the same trait. They line up at the equator in metaphase I of meiosis.

25. What does it mean to be a carrier for a genetic disorder?

Carriers do not have the disorder, but they do have one allele for it and can therefore pass the disorder on to their offspring.

26. What types of organisms can reproduce asexually?

Single-celled organisms like bacteria reproduce asexually. Also sponges, sea stars, sea anemones, planarian worms, and other invertebrates can reproduce asexually.

27. What are the advantages of sexual reproduction?

Advantages to sexual reproduction are that the organisms can make genetically diverse offspring that will have a better chance of surviving in a changing environment because they can adapt to the environment. The DISADVANTAGE of sexual reproduction is that two individuals are necessary. A mate it sometimes hard to find in the animal world, especially if the environment has changed where food, water, or shelter is scarce.