Name: Key Date: Period:

# COMPLEX GENETICS TEST REVIEW

## I. Basic Genetics

1. Gregor Mendel is known for 3 main laws/principles. Define each:
   a. **Law of Segregation** offspring inherit one copy of each allele from each parent aka each parent donates one copy of each allele
   b. **Principle of Dominance** dominant $ traits will mask/cover up recessive traits
   c. **Law of Independent Assortment** inheritance of one gene does not impact inheritance of another
2. What is the difference between a genotype and a phenotype?
   genotype → genetic makup ex. BB, XX phenotype - physical apperance ex. blue eyes
3. Gene (E) codes for length of eyelashes. Long eyelashes are dominant to short eyelashes.
   a. What is the genotype for a person with short eyelashes? ee
   b. What is the genotype for a person who is homozygous dominant? EE
   c. What is the phenotype for a person who is Ee? long eyelashes
4. What is the only genotype where the recessive trait will be expressed as the phenotype?
   homozygous recessive ee
5. What is the different between a chromosome, gene and an allele?
   chromosomes are made up of genes.
   Alleles are different versions/forms of a gene

## II. Monohybrid Punnett Squares

6. In a Punnett Square…
   a. What do the letters outside the squares represent? parent gametes/genotypes
   b. What do the letters inside the squares represent? potential offspring genotypes
7. If tall plants (T) are dominant to short pea plants (t). Show the cross of a heterozygous tall plant and a short plant. What is the phenotypic ratio for the offspring?

| | T | t |
|---|---|---|
| t | Tt | tt |
| t | Tt | tt |

1 tall : 1 short

8. A bird's egg shell coloration shows codominance. The egg with be blue (B) if it is homozygous BB. The egg will be white (b) if it is homozygous bb. What is the **phenotypic** ratio if a bird laying white eggs is crossed a bird laying blue eggs?

bb x BB

| | B | B |
|---|---|---|
| b | Bb | Bb |
| b | Bb | Bb |

100% Bb

100% blue + white speckled

9. Carnations can either be red (RR), pink (RW) or white (WW).
   a. What type of inheritance is this? incomplete dominance (red + white = pink)
   b. Show the cross between a red and pink flower.

| | R | R |
|---|---|---|
| R | RR | RR |
| W | RW | RW |

50% red, 50% Pink
1:1 ratio

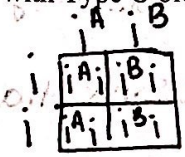
10. Color-blindness is a sex-linked trait found on the X chromosome. If a color-blind man and a woman who is a carrier for color-blindness have a child… **Draw Punnett Square**
    a. What is the probability they will have a color-blind girl? ~~50%~~ 25%
    b. What is the probability they will have a color-blind boy? 25%

| | $X^B$ | $X^b$ |
|---|---|---|
| $X^b$ | $X^BX^b$ | $X^bX^b$ |
| Y | $X^BY$ | $X^bY$ |

11. Hemophilia is a sex-linked recessive trait found on the X chromosome. A woman who does not have hemophilia has a daughter with hemophilia. What are the genotypes of the two parents?

daughter $X^hX^h$ dad - $X^hY$ mom (carrier) $X^HX^h$

12. A woman with Type O blood and a man with AB blood have a child. What are the potential phenotypes of the child?




Type A, B blood

## III. Complex Genetics

13. What is the difference between an autosome and a sex chromosome?

autosome: not a sex chromosome, same regardless of gender

sex chromosome: determines gender (X, Y)

14. Why do females inherit sex-linked traits differently than males?

Females have 2 X chromosomes

Males have 1 X and only need one recessive allele to show trait

15. What is a carrier? Do they show the recessive trait? Can they pass it on to their kids?

Carrier is heterozygous, they do not show the recessive trait but can pass it to their kids.

16. What is the difference between codominance and incomplete dominance?

Codominance: both homozygous traits shown ex) red + blue spots

Incomplete Dominance: heterozygous is a blend ex) purple

17. If a parent has the genotype, AaEE, what are the 4 potential gametes that they can produce?

AE AE aE aE

18. Define multiple alleles and provide an example.

more than 2 versions of the trait

ex) Blood Typing $i^A, i^B, i$

19. Based on the dihybrid cross to the right, list the **phenotypic** ratios. The cross shows two heterozygous long-haired, blue eyed goats. Long hair (H) is dominant to short hair (h). Blue eyes (B) are dominant to red eyes (b).

| | HB | Hb | hB | hb |
|---|---|---|---|---|
| HB | HHBB | HHBb | HhBB | HhBb |
| Hb | HHBb | HHbb | HhBb | Hhbb |
| hB | HhBB | HhBb | hhBB | hhBb |
| hb | HhBb | Hhbb | hhBb | hhbb |

9 long-blue : 3 long-red : 3 short blue : 1 short-red

## IV. Pedigrees:

20. For each major type of inheritance, list KEY ways that you can determine the type of inheritance simply from analyzing a pedigree.

a. **Dominant Trait:** shows in every generation

b. **Recessive Trait:** skips generations

c. **Sex-Linked Trait:** more common in males.