

Genetics Benchmark Study Guide

✓ 1. What is a trait? A distinguishing characteristic that can be inherited.

✓ 2. When is a recessive allele expressed in the phenotype?

Have to have two recessive alleles (homozygous recessive)
(rr)

✓ 3. Briefly describe Mendel's experiments with pea plants. What happened when he crossed a purebred white flowered plant with a purebred purple flowered plant?

What did his dihybrid crosses lead him to conclude?

$pp \times PP$ all 100% offspring had purple flowers!
P must be dominant!

Law of independent assortment. All traits are inherited independently.

✓ 4. Where do you find heterozygous alleles? Homozygous alleles?

Hybrids

(Tt)

Purebred

(TT & tt)

Homologous

chromosomes

✓ 5. What does genotype mean? What does each letter represent?

The letters (always two) | Allele combination | Each letter represents
ONE allele

6. What do we call traits that are affected by the interactions of many genes?

polygenic trait

✗ ~~Albinism is caused by the presence of an epistatic gene. What is an epistatic gene? How does this affect the pigmentation of skin, hair, and eye color?~~

✓ 8. What is heredity? The study of genetics (how traits are passed from one generation to the next)

✓ 9. Who is the "Father of Genetics"?

Gregor Mendel

✓ 10. How can you calculate probability?

$$\frac{\# \text{ of one possible outcome}}{\text{total \# of outcomes}} \times 100$$

11. What are multiple allelic traits? What is a common example of this in humans?

More than two alleles determine a trait. Blood types
A, B, + O

12. What is incomplete dominance? Codominance?

When the dominant allele is not completely dominant.

In heterozygotes, the dominant allele does not completely mask the recessive allele. Rr = pink, not red.

More than one dominant allele. In heterozygous individuals BOTH dominant phenotypes are seen. BW = Spotted;

13. If a mother and father are heterozygous for eye color, with X being brown and x being blue, what are the chances of their offspring having blue eyes? Brown eyes?
Draw a Punnett square to support your answer.

$$\begin{array}{c|cc} & X & \bar{x} \\ \hline X & XX & X\bar{x} \\ \hline \bar{x} & X\bar{x} & \bar{x}\bar{x} \end{array}$$

$X\bar{x} \times X\bar{x}$

Blue eyes: $\frac{1}{4} = 25\%$

Brown eyes: $\frac{3}{4} = 75\%$

14. In a dihybrid cross, what is the phenotypic ratio when two heterozygotes are crossed?

9 : 3 : 3 : 1

15. What are linked genes? Genes that are close together on a chromosome and are likely to be inherited together.

16. What does meiosis produce? 4 genetically different haploid gametes (sperm; egg)

17. What is the law of segregation?

Each parent has two alleles for every trait, but can only pass down one during reproduction.

(Due to Meiosis)

18. What does Mendel's second law, the law of independent assortment, explain?

Each trait is inherited independently of all others - Dihybrid Cross.

19. What is crossing over? What does this process increase?

During Prophase I, when homologs pair up, they can exchange segments of DNA. Genetic variations!

20. What are frameshift mutations?

The length of the original strand changes: deletion or insertion
(DNA)

21. What are point mutations?

The length stays the same: substitution
inversion - switch places

22. Are mutations that occur in somatic cells passed onto to offspring?

NO! Germ cells' DNA can.

23. What are transgenic organisms? Organisms that have at least one gene from another organism.

24. What is genetic engineering? Any type of alteration of the DNA in an organism. (Artificial - not natural)

25. What makes genetic engineering possible? All organisms are based on the same genetic code (A, T, C, G)

26. What is a karyotype? A pictograph of ONE individual's chromosomes (stained) Used to diagnose chromosomal or mutation disorders.

27. What is gene therapy? Used as a treatment (not cure) for some genetic disorders. The defective gene is temporarily replaced with the "normal" gene. (Breathing tx's)

28. What is recombinant DNA? Give an example.

A gene that is wanted is snipped out of an organism using enzymes. The gene is then placed in a bacterial DNA plasmid. The bacteria makes the protein. Insulin.

29. How can genetic engineering benefit agriculture? Medicine?

Pesticide resistance | antibiotics / gene therapy

30. How are DNA and RNA different? List all 3 ways.

DNA	RNA
S = deoxyribose	S = ribose
NB = thymine	NB = uracil
double helix	single strand

31. What is the monomer of nucleic acids? What three parts make up this monomer?

nucleotides

Phosphate, 5-C sugar, Nitrogen base



32. What is the function of mRNA? What does it look like?

It copies the building instructions for building a protein and delivers this info. to a ribosome. Single stranded (has U's)

33. What do Chargaff's Rules state? The amount of Adenine = the amount of thymine. The amount of cytosine = the amount of Guanine.

34. What did Watson and Crick reveal about the structure of DNA? (based on the work of Rosalind Franklin and others!!!!) Double helix

35. What is the function of tRNA? What does it look like?

Carries amino acids to the ribosome.

Kind of like a lowercase "t". (has U's in it.)

36. What is transcription? Where does it occur?

The making of mRNA from a DNA gene.

Nucleus.

37. What is translation? Where does it occur?

The building of a protein / polypeptide chain using the instructions carried by mRNA.

Ribosome.

38. What do we call a nucleotide triplet that codes for a particular amino acid on mRNA?

codon

39. What are the base pairing rules? If you are given the DNA strand ATCGCC, what is the complementary strand?

A - T
C - G

TAGCGG

40. What is DNA replication? Where does it take place? Why is it called semiconservative?

Making copies of DNA; nucleus;
Each new double helix consist of an old strand and a new strand.

41. There are 20 men in purple shoes is an example of an observation. The variable manipulated by the experimenter is called the independent variable. The variable measured in the experiment is called the dependent variable.

42. Distinguish between exocytosis and endocytosis.

exocytosis - large molecules being moved out of a cell.
endocytosis - large molecules being moved into a cell.

43. What organelle manufactures proteins?

Ribosomes

44. Cells that require a lot of energy would need a lot of which organelle?

Mitochondria

45. A specialized protein that reduces activation energy is called an enzyme.

46. Organelles that transport, package, and sort proteins are known as the

Golgi body / apparatus

47. Why is water a polar molecule? The electrons are not shared equally, so one end of the molecule has a slight (+) charge, while the other has a slight (-) charge.

48. Distinguish between active and passive transport.

Active	Passive
Requires ATP	Does NOT require ATP (energy)
low \rightarrow high	high \rightarrow lower
Ion Pump, <u>cytosis</u>	<u>diffusion</u> / <u>osmosis</u>

49. Distinguish between osmosis and diffusion.

Osmosis refers to the movement of H₂O ONLY!

Diffusion = the movement of a molecule from a high concentration to a lower concentration.

50. What happens when a cell is put in isotonic, hypertonic, and hypotonic solutions?

Isotonic = No change; H₂O will move in and out to maintain homeostasis

hypertonic = Shrivels/shrinks; H₂O is being sucked out of the cell.

hypotonic = Swells (like a hippo); H₂O moves into the cell.

