Name: \_\_\_KEY\_\_\_\_\_Date: \_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_

# HONORS BIOLOGY FINAL STUDY GUIDE

# Genetics

1. Who discovered the principles of inheritance? \_Gregor Mendel

2. What are the sex chromosomes for a male? \_\_XY\_, a female? \_XX\_\_

3. Who determines the sex of a child? \_\_Father \_

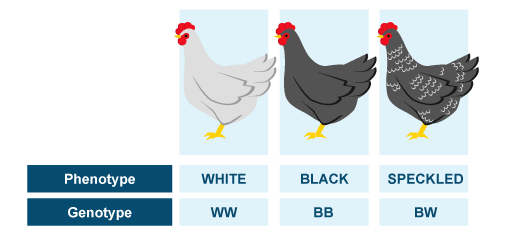
4. Define *phenotype* – the physical expression of genetic traits (Ex. Purple flowers)

5. Define *genotype –* the genetic combination of alleles that indicate a specific characteristic of a trait (Ex. AA, Aa, aa)

6. Define *multiple alleles –* 3 or more alleles available for a specific trait (Ex. Blood type: IA, IB, i)

7. Define *polygenic traits* – many alleles/genes are involved in the expression of ONE phenotypic trait (Ex. Skin color).

8. Define *codominance –* both alleles are dominant. In a heterozygous genotype both alleles will be expressed together, but separately (Ex. Roan horses, or erminette chickens)



**BLACK & WHITE STRIPES**

**BLACK**

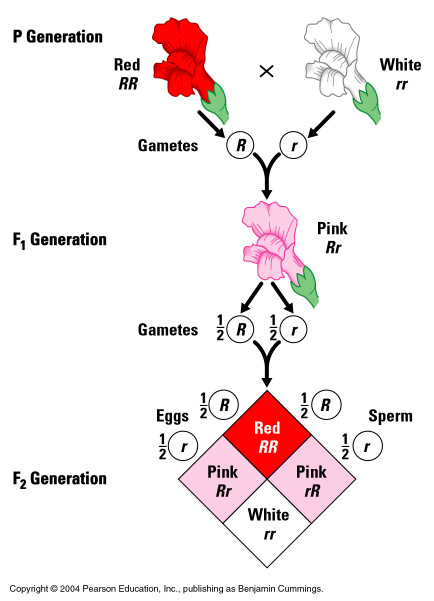
**WHITE**

**FWFB**

**FBFB**

**FWFW**

9. Define *incomplete dominance –* neither alleles are dominant. In a heterozygous genotype, alleles will be expressed blended together, creating a new phenotype (Ex. Snapdragons).



10. A person with type B blood would have the genotype \_\_IBIB or IBi\_\_\_\_\_.

11. What is replication? \_\_the process of unwinding and splitting the DNA molecule apart to create a identical copy or replica. Occurs during the S Phase of the Cell Cycle\_\_\_\_

12. What is translation? The process of creating amino acids and linking the amino acids together to form a polypeptide at the ribosomal RNA from the instructions of mRNA. Transfer RNA is used to link the amino acids together.

13. What is transcription? The process of rewriting or transcribing the DNA molecule into a more compact, Messenger RNA (mRNA) molecule. This process must occur in order the protein synthesis to occur at the ribosomes. DNA is too large to exit the nucleus through the nuclear membrane so mRNA is used as a messenger to transport the instruction from nucleus to the ribosomes.

14. Who discovered the structure of DNA? Watson & Crick

15. What are the 3 differences between RNA and DNA?

|  |  |  |
| --- | --- | --- |
|  | **RNA** | **DNA** |
| Structure | Single Helix | Double Helix |
| Sugar | Ribose | Deoxyribose |
| Nitrogenous-base | Uracil | Thymine |

16. What is the ultimate expression of our genes? \_ultimate expression of genes is the synthesis of a specific amino acid sequence and the creation of specific proteins (1 gene = 1 polypeptide)\_\_

17. If 15% of a strand of DNA is cytosine, how much is adenine? 35%

18. If 10% of a strand of DNA is thymine, how much is guanine? 40% of Guanine

Work:

Amount of Adenine = Amount of Thymine

Amount of Guanine = Amount of Cytosine

# of Adenine + # of Thymine + # of Guanine + # of Cytosine = 100%

Thymine = 10% …then… Adenine = 10%

10% + 10% + # of Guanine + # of Cytosine = 100%

Amount of Guanine and Cytosine = 80%

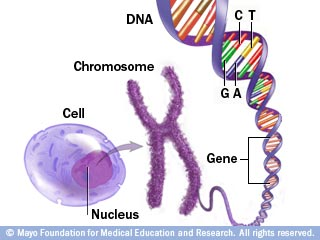
Therefore, Guanine = 40%

19. Define *codon –* 3 nucleotides coding for a specific amino acid

20. Define *anticodon* – 3 nucleotides on the transfer RNA (tRNA) that are complementary to a codon on the mRNA strand.

21. What is the overall structure of DNA? Double helix

22. What is the relationship between DNA, genes, and chromosomes?



23. Describe the different types of point mutations.

1. Silent – no change in AA
2. Missense – different AA
3. Nonsense – premature stop

# 24. What is an autosome?

Chromosomes that do not impact the sex of an organism (Ex. Humans have 46 chromosomes total: 2 are sex chromosomes and 44 are autosomes).

25. What is the function of:

DNA Ligase – repairs and links fragments of DNA (Okazaki Fragments) together.

DNA polymerase – unzips DNA’s double helix, replicate DNA’s nucleotide sequence, and proofreads newly replicated DNA.

DNA Helicase – unwinds DNA’s double helix

RNA polymerase – creates a messenger RNA (mRNA) strand from a DNA molecule

26. What are the three types of RNA discussed in class and what are their functions?

1. Messenger RNA (mRNA) - the form of RNA in which genetic information transcribed from DNA as a sequence of bases is transferred to a ribosome.
2. Ribosomal RNA (rRNA) - is the **RNA** component of the ribosome, and is essential for protein synthesis in all living organisms.
3. Transfer RNA (tRNA) - RNA consisting of folded molecules that connects and transport amino acids from the cytoplasm of a cell to a ribosome.

# Problems and Labels

27. Tall plants are dominant over short. If a heterozygous tall plant is crossed with a short plant, what would the genotypic and phenotypic ratio be?

t

T

Tt x tt

ttt

Tt

t

Genotypic Ratio: 0 TT : 2 Tt : 2 tt

Phenotype Ratio: 2 tall : 2 short

tt

Tt

t

28. Purple flowers are dominant over white flowers. The two parent plants are purple, but the offspring is white. What are the genotypes of the parent plants?

Parents MUST be heterozygous (Ff) because in order to produce recessive offspring the parents must be carriers for the recessive trait.

f

F

|  |  |
| --- | --- |
| F  FF | Ff |
| f  Ff | ff |

29. What blood types could a child be with a father with Type B blood and a mother with type O? *Children could only be Type B or Type O*

IB i

IB  IB

i

i

|  |  |
| --- | --- |
| IBi | ii |
| IBi | ii |

|  |  |
| --- | --- |
| IBi | IBi |
| IBi | IBi |

i

i

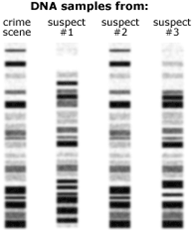
30. Fill out the chart below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| cDNA | C G G | T A T | T C A | T G A | G C A |
| DNA | G C C | A T A | A G T | A C T | C G T |
| mRNA Codon | C G G | U A U | U C A | U G A | G C A |
| Anti-codon | G C C | A U A | A G U | A C U | C G U |
| Amino Acid | Arg | Tyr | Ser | Ter | Ala |

**Biotechnology**

31. What is gel electrophoresis and what is it used for?

Gel electrophoresis is a technique used to separate mixtures like DNA and proteins. This process is used to create a DNA fingerprint and is used to solve crimes and determine paternity.



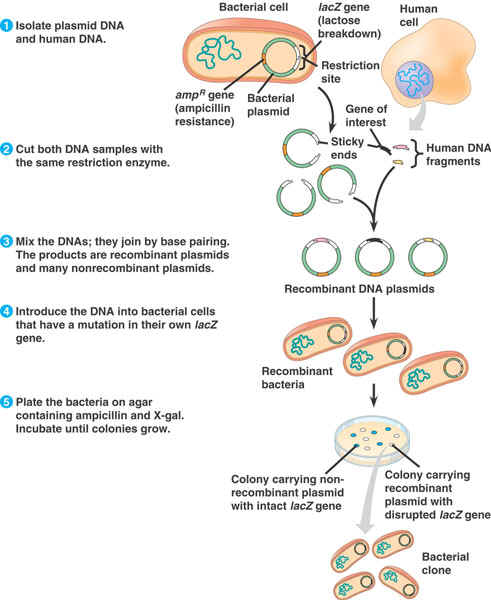
32. What is a DNA Microarray and what is it used for?

**DNA microarray** is an orderly arrangement of thousands of identified sequenced genes printed

33. What two characteristics of DNA allows for the separation of DNA fragments?

The separation is based on how positively or how negatively charged a molecule is and its size

34. What steps are used to clone a gene?



35. What is polymerase chain reaction (PCR) and what is it used for?

**Polymerase chain reaction**, or PCR, is a laboratory technique used to make multiple copies of a segment of DNA. PCR is very precise and can be used to amplify, or copy, a specific DNA target from a mixture of DNA molecules. Is necessary for gel electrophloresis to occur

36. Define *genetically modified organism –* A **genetically modified organism** (GMO) is an **organism** whose genetic material has been altered using genetic engineering techniques.

37. Define *Selective breeding.*

**Selective breeding** (also called artificial selection) is the process by which humans breed other animals and plants for particular traits. Typically, strains that are selectively bred are domesticated, and the **breeding** is normally done by a professional breeder.

38. What types of impact has genetic engineering had on society?

* Agriculture improvements
* Environmental clean-up (GMOs used in oil spills)
* Development of medical advancements.

**Natural Selection**

39. What are the main points of the theory of natural selection?

Three Major Observations

1. More offspring are produced than can survive

2. Inherited traits are varied in population

3. Individuals of a population vary in their traits and those traits are passed to their offspring

40. Describe an organism that would be considered “fit.”

* Fitness – contribution an individual makes to the gene pool of the next generation relative to the contribution of other individuals

*A fit organism would be an organism that possesses traits that allow the organism to be successful and produces a large amount of offspring.*

41. What is a *homologous structure?*

Homologous Structures – similarity in structure that result from common ancestry

- “Decent with Modification” – process of modifying the function of homologous structures in population

42. Describe *reproductive isolation*.

**Reproductive Isolation -** physical or behavioral differences or geographical barriers, that prevent potentially interbreeding populations from cross-fertilization.

43. What is the difference between an observation and an inference?

Observation – a statement describing something someone saw, heard, smelled, tasted, or touched.

Ex) The footsteps are 6 inches apart

Inference – making a conclusion based on observations or evidence

Ex). The animal who created the footsteps were running away from a predator.

44. What are the sources of genetic variation?

1. Mutations
2. Sexual Recombination (Meiosis)

45. Define *gene flow –*

*Gene Flow – transfer or flow of alleles from a population by the movement of individuals or gametes*

46. Define *founder effect –*

*Founder Effect – colonization of a new habitat by a small number of individuals causing all future populations to possess similar characteristics/traits of the founding members*

47. Define *bottleneck effect –*

*Bottleneck Effect – genetic drift resulting from an event that drastically decreased population size*

48. What is a *vestigial structure?*

A **structure** in an organism that has lost all or most of its original function in the course of evolution, such as the pelvic bones in whales.

49. What is some evidence for evolution?

**-** fossil record

- homologous structures

- vestigial structures

- molecular biology

- biogeography

- embryology

**Ecology**

Trees (berries) 🡪 mouse 🡪 snake 🡪 hawk

50. What is the source of energy for this food chain? Sun

51. Which of these organisms are producers? Trees (berries)

52. In this food chain, what is the primary consumer? Mouse

53. Which is a third order carnivore? Hawk

54. At what level do decomposers play a role? Decomposers arrive AFTER the last consumer to break down consumers remains and release the nutrients back into the environment.

#### Examine the food web below and answer the questions that follow

Hint: Prey Predator

Coyotes

Spiders Pocket gophers

Rabbits

Insect-eating birds Snakes Grasses/shrubs

Frogs Hawks/owls

Insects Lice

Seed-eating birds

Bacteria

55. Give a few examples of herbivores?

* Insects
* Rabbits
* Seed-eating birds
* Bacteria
* Pocket Gophers

56. Give me some examples of a first order consumer?

* Insects
* Rabbits
* Seed-eating birds
* Bacteria
* Pocket Gophers

57. Give me some examples of producers?

* Grass/shrubs

58. Give me some examples of third order consumers?

- Insect-eating birds

- Lice

59. Define *population* – individuals of a same species living in the same location interacting with one another.

60. Define *community –* diverse group of populations living together and interacting with one another.

61. Define *habitat –* the home/environment and all of the abiotic factors

62. Define *succession –*

* Primary succession – a community arises in a virtually lifeless area with no soil
* Secondary succession – disturbance has destroyed an existing community, but left the soil intact

63. Define *commensalism –* one organism lives on/in another organism. One benefits while the other is NOT harmed and does NOT benefit.

Ex) eyelash mites on human eyes

64. Define *parasitism –* one organism lives on/in another organism. One benefits while the other is harmed in the process

Ex) tapeworm and humans

65. Define *predation –* one organisms eats/preys on another

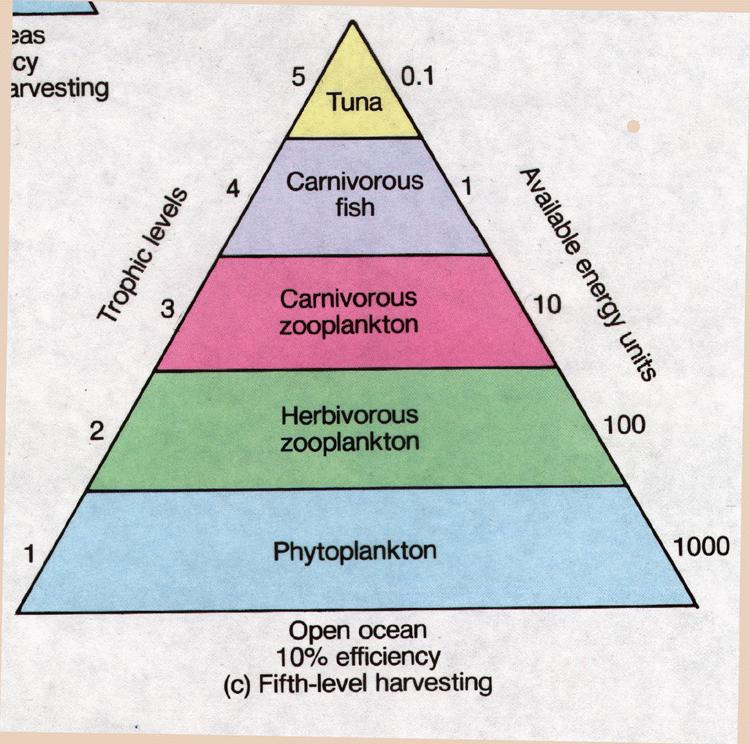
Ex) coyotes eat rabbits

66. Define *mutualism –* one organism lives on/in another organism. Both organisms benefits.

Ex) clownfish and a sea anenome

67. What happens to the energy level as you move up the food chain?

The amount of available energy decreases.



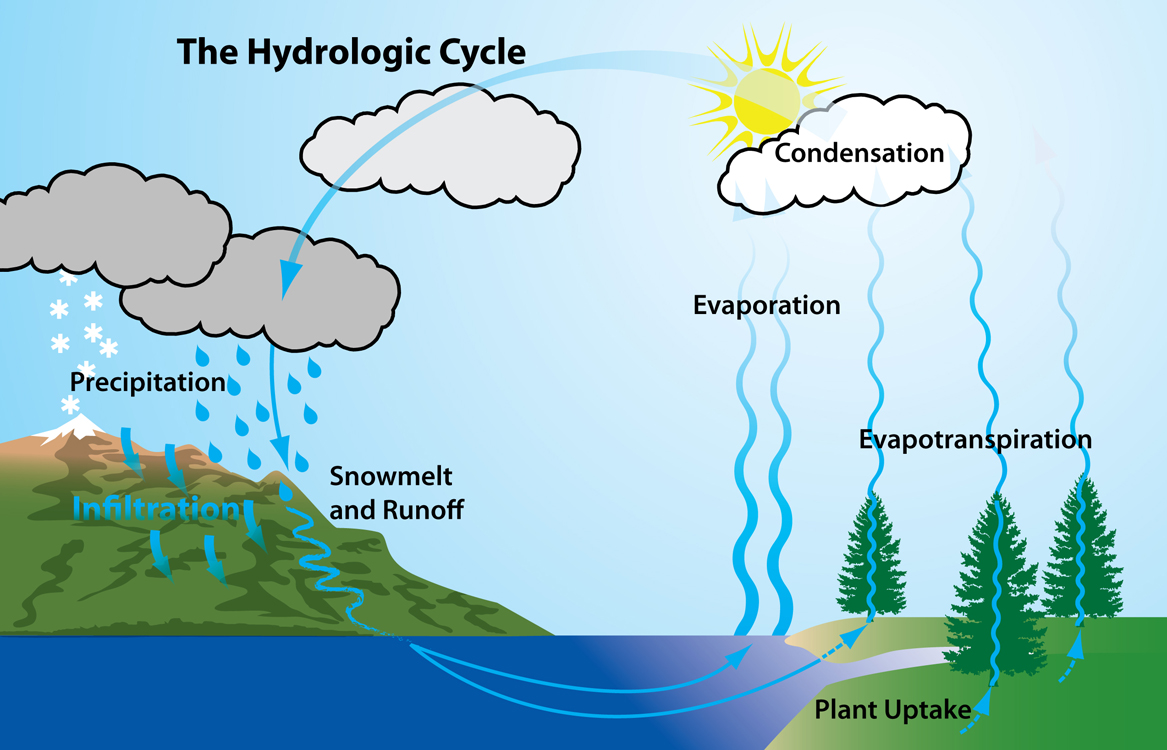
68. Define *trophic level –* the energy flow in an ecosystems and the feeding relationships among the various species making up the community

69. Define *competition –*

* *Interspecific competition – 2 species compete for a limited resource*
* *Competitive exclusion principle – 2 species cannot coexist in a community if their niches are identical*

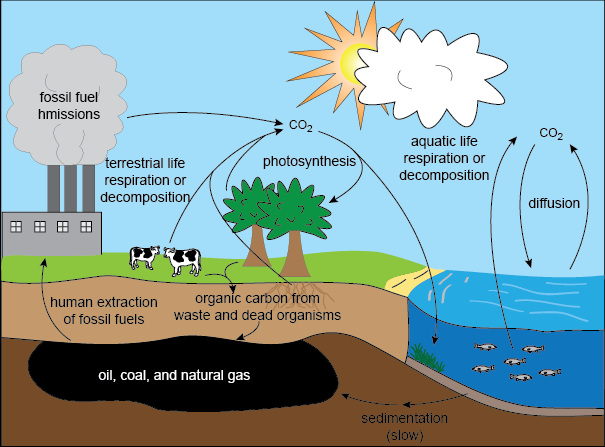
70. Summarize the water cycle.

**Water Cycle**



**Transpiration**

71. Summarize the carbon cycle.



72. What are some examples of limiting factors?

*FACTORS THAT LIMIT POPULATION GROWTH*

* Density-dependent factors – limiting factors whose effects depend on the population density

*Ex)*

*Food*

*Space*

* Density-independent factors – limiting factors whose occurrence is not affected by population density

*Ex)*

*Natural Disasters*

*Disease*

73. What is the difference between density-dependent and density-independent factors?

(SEE ABOVE)

74. Define *carrying capacity –* number of individuals in a population that the environment can sustain with no net increase or decrease

75. Why are food chains limited to 4 or 5 organisms?

There is no available energy or a limited amount of available energy beyond the 5th organism in a food chain. Look at the picture below, any organism eating the tuna in the food chain below would receive 0.01 energy which is not enough to make it worth eating the tuna.

