Name: _____   Period: _____   Date: _____

BIOLOGY SPRING BENCHMARK 2 STUDY GUIDE

Part A. Ecology

1. The study of biology can be studied at different levels. Each level is a system made up of smaller parts. What is the order of organization of living things starting from the largest level?
   a. BIOSPHERE
   b. Biome
   c. Ecosystem
   d. Community
   e. Population
   f. Individual (Organism)

   *At this lowest level, what characteristics must the individual possess to be considered living?

   Composed of Cells, Maintains Homeostasis, Reproduces, Universal Genetic Code, Responds to Stimuli, Grow and Develop, Evolve and Adapt, Obtain and Uses Energy

   **Which level is the smallest to contain both biotic and abiotic factors? Ecosystem

   ***Which level studies living and nonliving interactions in a particular climate? Biome

2. What is the ultimate source of energy for all living things? Sun
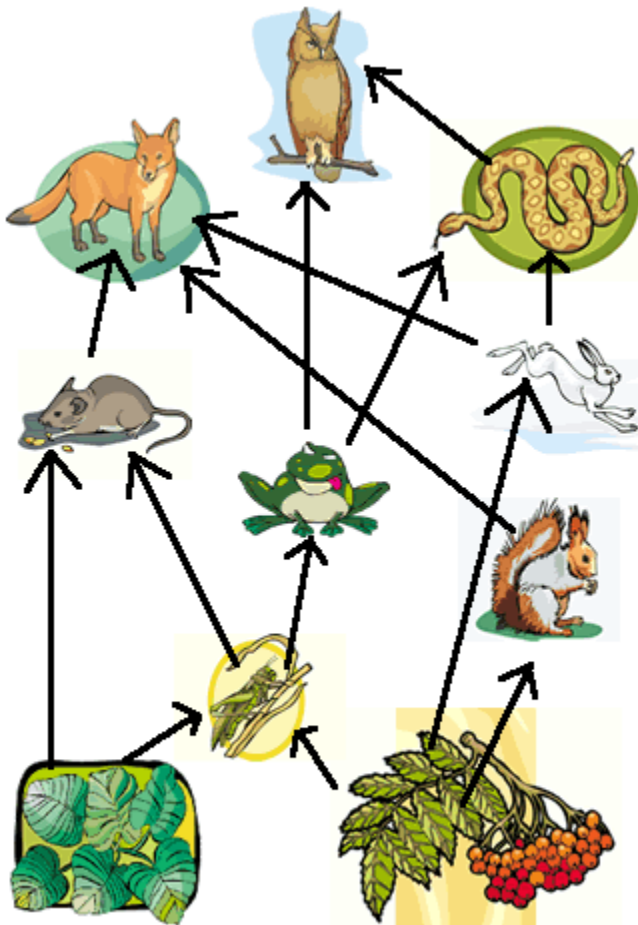
3. Is this a food chain or web? How do you know?

   Food Web, it shows multiple feeding relationships

4. Identify one food chain:

   Berries → Squirrel → Fox

5. What percent of energy is passed from one trophic level to the next?

   10% Transfer, the rest is used by the organism and eliminated as heat energy
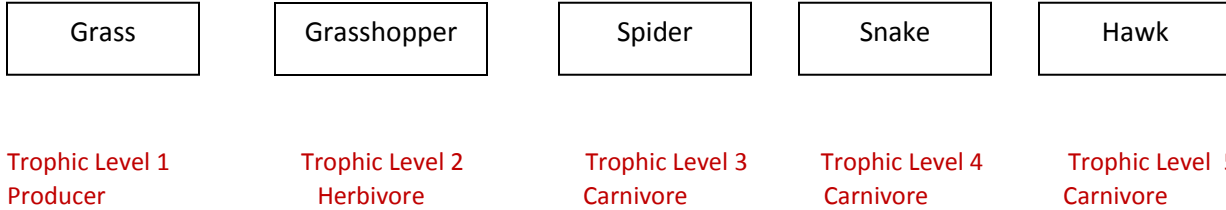
6. Use the picture to identify:

   a. Herbivore: __Squirrel, Grasshopper, and Rabbit_

   b. Carnivore: _Frog, Snake, Owl, Fox__

   c. Omnivore: __Mouse___

   d. Producer: __Leaves and Berries___

7. Given this food chain, grass => grasshopper => spider => snake => hawk. Identify all trophic levels and then identify the producer and different types of consumers.

| Grass | Grasshopper | Spider | Snake | Hawk |

Trophic Level 1   Trophic Level 2   Trophic Level 3   Trophic Level 4   Trophic Level 5
Producer   Herbivore   Carnivore   Carnivore   Carnivore

8. Which level of a biomass pyramid contains the highest amount of biomass?
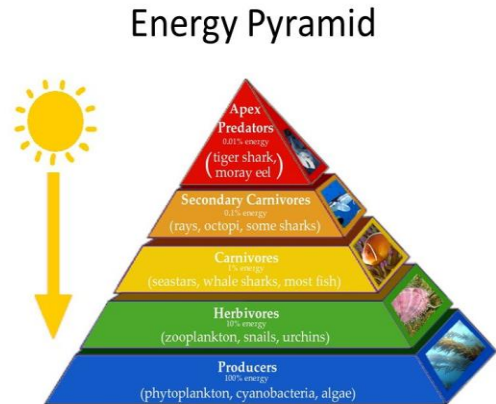
The bottom (Trophic Level 1)

9. Which level of a numbers pyramid contains the smallest numbers?

The top (Trophic Level 5)

10. If the producer of this energy pyramid contains 2250 kcals of energy, how much energy is available on the 3rd trophic level?

22.5 kcals

Energy Pyramid

Apex
Predators
0.01% energy
(tiger shark,
moray eel)
Secondary Carnivores
0.1% energy
(rays, octopi, some sharks)
Carnivores
1% energy
(seastars, whale sharks, most fish)
Herbivores
10% energy
(zooplankton, snails, urchins)
Producers
100% energy
(phytoplankton, cyanobacteria, algae)

11. Match the following words:

__5___ a. Autotroph   1. The maximum number of individuals an environment can support.

__11__ b. Heterotroph   2. Individuals of the same species living in the same area at the same time

__8___ c. Food chain   3. The organism's job in the ecosystem.

__7___ d. Food Web   4. The first species to inhabit an area.

__4___ e. Pioneer species   5. An organism that can make its own food, like plants.

__9___ f. Climax community   6. Factors that limit or decrease a population size.

__10__ g. Habitat   7. ALL the feeding relationships or energy pathways in an ecosystem.

__3___ h. Niche   8. ONE possible pathway of energy flow in an ecosystem.

__2___ i. Population   9. The stable, final community that an ecosystem grows into.

__12__ j. Community   10. The environment in which an organism lives.

__6___ k. Limiting factor   11. An organism that cannot make its own food but feeds on others.

__1___ l. Carrying capacity   12. Several populations living in the same area.

12. What does it mean if two organisms have a symbiotic relationship?

_____At least one of the organisms depends on the other for their survival_____

13. Give an example of the following:

Mutualism	+/+ Both organisms benefit (Flower and Honeybee)
Parasitism	+/- One Benefits and the other is harmed (Flea on a Dog)

Commensalism	+/0 One benefits the other is neither harmed or helped (Barnacle and the Whale)

14. What are the two types of population growth?   Graph each of them below.

_____Exponential (J curve) _____ &   ___Logistic (S curve) – Has Carrying Capacity_____
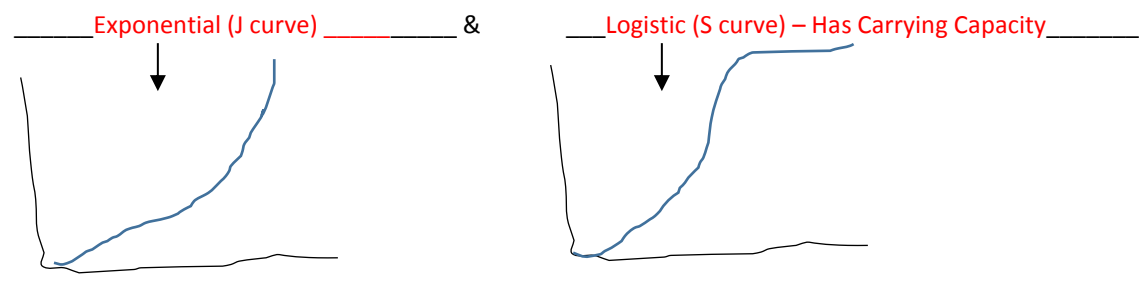
15. Which of the following statements is an example of population density?

There are 12 deer.   OR   There are 12 deer per square kilometer.

16.   Population of Deer in Georgia
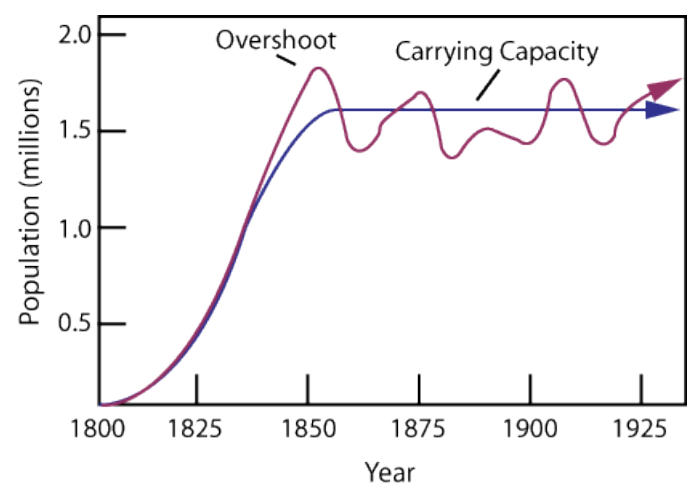
a. Over what time frame were the deer in Georgia growing exponentially? 1800-1850

b. In approximately what year did the growth change from exponential to logistic growth? 1850

c. Why did this change in growth happen? Limiting Factors in the environment caused the population to reach a carrying capacity

d. What is the carrying capacity for this curve?

1.6 million

17. What is a limiting factor? _____Anything that causes the population growth to slow down or decline_____

18. Define the following and give an example.

	Definition	Example
Density-Independent limiting factors	Limits a population no matter the size of the population, impacts all populations the same	Seasonal changes, severe weather changes, natural disasters (fire, flood, earthquake, etc.)
Density-Dependent limiting factors	Limits a population because of its size, because it is too crowded.	Food, parasitism, space, mates, disease

19. Define the following and give an example.

	Definition	Example
Abiotic	Non-living factors in an ecosystem	Rocks, Soil, Water, Air, Sun
Biotic	Living Factors in an ecosystem	Plants, Animals, Protist, Fungi, and Bacteria

20. Tell whether each of the following characteristics are primary succession (P) or secondary succession (S) or both.

__P___ a. Begins with bare rock 　　　　　　　　　　　__P___ e. Begins after volcanic eruption

__S___ b. Begins with soil 　　　　　　　　　　　　　　__S___ f. Begins after a clear-cutting, fire, flood.

__P___ c. Pioneer species are lichen 　　　　　　　__P and S___ g. Results in a climax community.

__S___ d. Pioneer species are grasses/weeds

Part B. Evolution
1. Read the scenario below and write how each of the tenets of natural selection apply to the scenario:
　　Deer Mice are found in the sandy soils in Nebraska.   Deer mice are widespread across North America, but they usually have dark coat, so that they can blend into dark soils and stay hidden from owls.   However, the soil turned to a more sandy environment. Over a period of many years the deer mice with dark coats became obvious to predators and were eaten. The lighter coated mice blended in with their environment and now most mice have lighter coats.

a) Variation in the Gene Pool: ___Deer mice can be have dark coats or light coats____
b) Organisms over-reproduce: ___Mice are rodents that tend to have many offspring at once._____
c) Struggle for Existence: _____Those that cannot camouflage will be eaten by owls _____
d) Survival of the Fittest: _____The deer mice with the light coat are the best fit for the new sandy environment._____
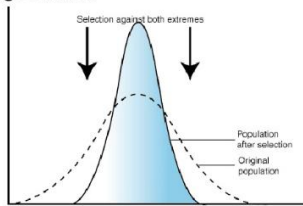
2. . Identify the following scenarios as directional selection, disruptive selection, or stabilizing selection.
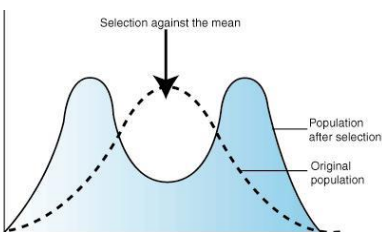
• One extreme trait is favoured
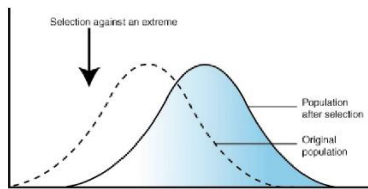
a) 　　　　　　　　　　　　　　　　_____directional – only one extreme is favored_____

• Most Common
• Average survives

b) 　　　　　　　　　　　___Stabilizing – environment has not changed and the average is still favored____

c) 　　　　　　　　　　　___disruptive selection – favors both extremes, may lead to speciation____

d) Prior to the industrial revolution in England the peppered moth had light coloration and lived on trees covered with light colored lichen. This provided camouflage against predatory birds. There were a few dark individuals in the population, but they were usually eaten by birds. However, once the industrial revolution began the light-colored lichens covering the trees were killed by sulfur dioxide emissions from the new factories. Without the light background of the trees, the light moths were more visible to birds and now the dark moths had a camouflage advantage. In 1848, the dark moths comprised 1% of the population and by 1959 they represented ~90% of the population. __directional selection____

e) A population of mice lives in a desert habitat with both sand and black volcanic rocks. The mice with black fur are able to hide from predators amongst the black rocks, and the mice with lighter fur are able to hide from predators in the sand. The mice with intermediate fur, however, stand out in all areas of the habitat, and thereby suffer greater predation. Natural selection would favor both light and dark colored mice, but select against mice of intermediate color. ___disruptive selection_____

f) A large population of southern yellow tailed hornbills is living in the Kalahari Desert. There are small amounts of rainfall and the summer temperature is very high. Yellow-billed hornbills are monogamous and will live in breeding pairs or small family groups. When they begin their courtship the male will feed the female for up to a month by bringing her small bits of food in his mouth. Females are attracted to males with richly pigmented feathers and less likely to choose a male with dull colored feathers. However, if the males have richer pigment they have trouble regulating their body temperature in warmer temperatures and often don't survive to adulthood. As the effects of climate change increase what type of pattern of natural selection could we expect to see in the southern yellowtail hornbill population with respect to amount of pigment in males? _____stabilizing selection_____

3. Highlight ways genetic drift and the founder effect are demonstrated in the following information about this population?

Around 1814, a small group of British colonists founded a settlement on *Tristan da Cunha*, a group of small islands in the Atlantic Ocean, midway between Africa and South America. One of the early colonists apparently carried a rare, recessive allele for *retinitis pigmentosa*, a progressive form of blindness that afflicts homozygous individuals. As late as 1961, the majority of the genes in the gene pool on Tristan were still derived from 15 original ancestors; as a consequence of the inbreeding, of 232 people tested in 1961, four were suffering from retinitis pigmentosa. This represents a prevalence of 1 in 58, compared with a worldwide prevalence of around 1 in 4,000.

Founder Effect – Small Group of British colonist founded a new settlement

Genetic Drift - As late as 1961, the majority of the genes in the gene pool on Tristan were still derived from 15 original ancestors; as a consequence of the inbreeding, of 232 people tested in 1961, four were suffering from retinitis pigmentosa. This represents a prevalence of 1 in 58, compared with a worldwide prevalence of around 1 in 4,000.

4. How do the numbers of variations after genetic drift has occurred compare to the numbers of variations in an original population? ___Less variation after genetic drift has occured_____

5. Is the new population that formed due to natural selection or random events? _____random_____

6. Classify each of the following types of reproductive isolation as geographical, behavioral, or temporal.

a) The blue-footed booby shares its habitat with several other similar species but never mates with them because the male blue-footed booby has an elaborate courtship dance that the female blue-footed booby will watch for. Only after this special dance is completed will the female mate with the male. ___behavioral isolation_____

b) The northern spotted owl and the western spotted owl are two closely related species that both live along the western coast of the United States. The two are prevented from reproducing from one another, however, due to the barrier of mountain ranges. __geographic isolation_____

c) Closely related American toads and Fowler's toads do not interbreed, despite living in the same area, because American toads mate in early summer and Fowler's toads mate in late summer. __temporal_____

d) It is difficult to distinguish between the eastern meadowlark bird and the western meadowlark based on their appearance. However, each has a distinct mating call that each type of species will only recognize. ___behavioral_____

e) Two closely related firefly species have a special pattern of light pulses to signal to the females of their species. The females will only choose males with their specific light pattern, preventing the two species from mating with each other. _____behavioral_____

7. Each of the above types of reproductive isolation will lead to __speciation___.

8. Solve the following Hardy-Weinberg problem. (HONORS ONLY)

A population of rabbits may be brown (the dominant phenotype) or white (the recessive phenotype). Brown rabbits have the genotype BB or Bb. White rabbits have the genotype bb. The frequency of the BB genotype is .35.

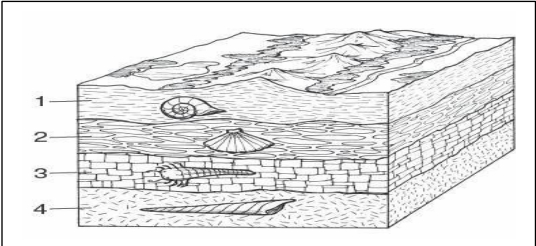What is the frequency of heterozygous rabbits? 2 (.59)(.41) = .48

What is the frequency of the B allele? .59

What is the frequency of the b allele? .41

9. Identify the following types of evolution.
    a. The type of evolution that occurs when two closely related organisms become more and more dissimilar is called _____divergent_____ evolution. Homologous Structures
    b. The type of evolution that occurs when two unrelated organisms develop similar structures and appearances is called _____convergent___ evolution. Analogous Structures
    c. The type of evolution that occurs when two or more species in close interaction change in response to each other changing over time is called __coevolution (Bees and Flowers)____.
    d. _____adaptive radiation_____ is a type of divergent evolution where one species evolves into many diverse life forms.

    e. Identify the following examples as either divergent evolution, convergent evolution or coevolution. If it is divergent evolution, specify whether or not it is also an example of adaptive radiation.

        i. Grizzly bears and polar bears are very similar, genetically speaking. They share a common ancestor, but have evolved different characteristics as adaptations in their different habitats. _____divergent_____
        ii. Giraffes have evolved a long neck through the process of natural selection. Those that had the longest necks survived better to pass on their traits. However, trees have also grown taller along with the neck of the giraffe. Trees that were tallest were less affected by giraffes, and survive better to pass on their traits. _____coevolution_____
        iii. On the Galapagos Islands, Darwin studied the beaks of finches found on each island. Although fossil evidence suggests there was a single ancestral species of finch, the modern-day finches consist of a wide variety of species, each with a distinct beak shape adapted for the food present on each island. __divergent (adaptive radiation) _____

        iv. Dolphins, whales, and sharks all have similar body shapes and characteristics, adapted for life in an aquatic environment. However, dolphins and whales are mammals, and sharks are fish. _____convergent_____

        v. Type of evolution associated with the formation of homologous structures. __divergent__

        vi. Type of evolution associated with the formation of analogous structures. __convergent____

10. Identify each of Darwin's evidences for evolution.

a.

_____Fossils (Demonstrates Change Over Time,

Identify Changes Since Common Ancestor___

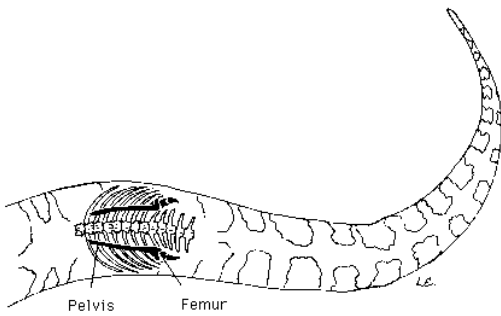Fish   Reptile   Bird   Human
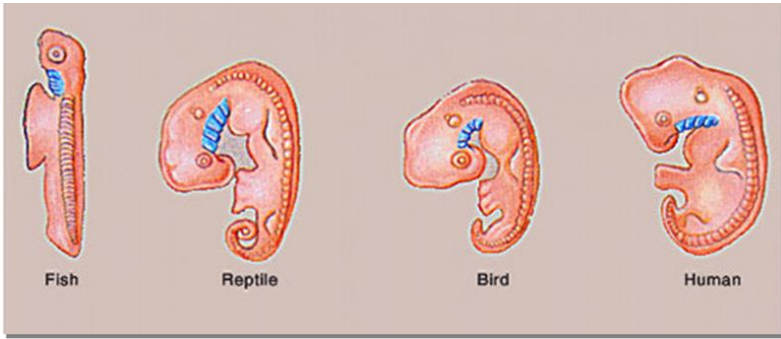
b. ___Embryology (Similar in early stages demonstrates

common ancestor____

Species	Sequence of Amino Acids in the Same Part of the Hemoglobin Molecules
Human	Lys–Glu–His–Iso
Horse	Arg–Lys–His–Lys
Gorilla	Lys–Glu–His–Lys
Chimpanzee	Lys–Glu–His–Iso
Zebra	Arg–Lys–His–Arg

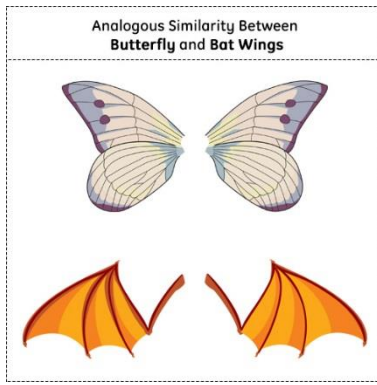c. ___Biochemical Evidence (Most Reliable Form of Evidence)_____

Pelvis   Femur

d. _____Vestigial Structure ex) Appendix_____

e. ___Homologous Structure – Same Structures Modified to Serve Different

Functions____

Analogous Similarity Between
Butterfly and **Bat Wings**

f. ___Analogous Structures (No Common Ancestor, Only Changes to Become More Similar Due to Environmental Pressures)_____

Part C. Genetics and DNA/RNA

1. What would the expected phenotypic ratio be in a cross between a man of blood type O and a woman of blood type AB? Remember, type A and B blood types are codominant and type O is recessive. OMIT

2. What would the expected phenotypic ratio be in a cross between a man who was heterozygous A and a woman who was heterozygous B? Remember, type A and B blood types are codominant and type O is recessive. OMIT

3. In a legal case, a woman of blood group AB claimed that a baby of Blood group O was her baby. Knowing what you know about the inheritance of blood types, what would you say? Remember, type A and B blood types are codominant and type O is recessive.

OMIT

4. Hemophilia in humans is a sex-linked recessive disorder. What will be the results of mating between a normal (non-carrier) female and a hemophiliac male? OMIT

5. A human female "carrier" who is heterozygous for the recessive, sex-linked trait causing colorblindness marries a normal vision male. What percentage of their male offspring will be colorblind? OMIT

6. In a flowering plant, tall (T) is dominant to short (t), and blue flowers (B) is dominant to white flowers (b). Cross a heterozygous tall, white flowered plant with a short, heterozygous blue flowered plant. Give the resulting phenotypes. OMIT

7. Match Mendel's Laws with their correct definition. You will use the terms more than once. OMIT MENDEL'S LAWS

Mark (**D**) for Law of Dominance, (**S**) for Law of Segregation, and (**IA**) for Law of Independent Assortment.

_____ a. Some alleles will mask the expression of other alleles.

_____ b. Alleles will separate during gamete formation of meiosis.

_____ c. When alleles separate during gamete formation, they do so without influencing other alleles.

_____ d. A homozygous tall pea plant crossed with a short pea plant produces all tall pea plant offspring.

_____ e. A genotype of TtBb can produce alleles that are TB, Tb, tB, or tb into egg or sperm.

_____ f. A genotype of Tt will split up so that either T or t allele will go into the egg or sperm.

8. What process is shown in the diagram below? _____Replication (DNA)_____

Chromosome

Adenine
Thymine
Cytosine
Guanine

A
B
C
D
E
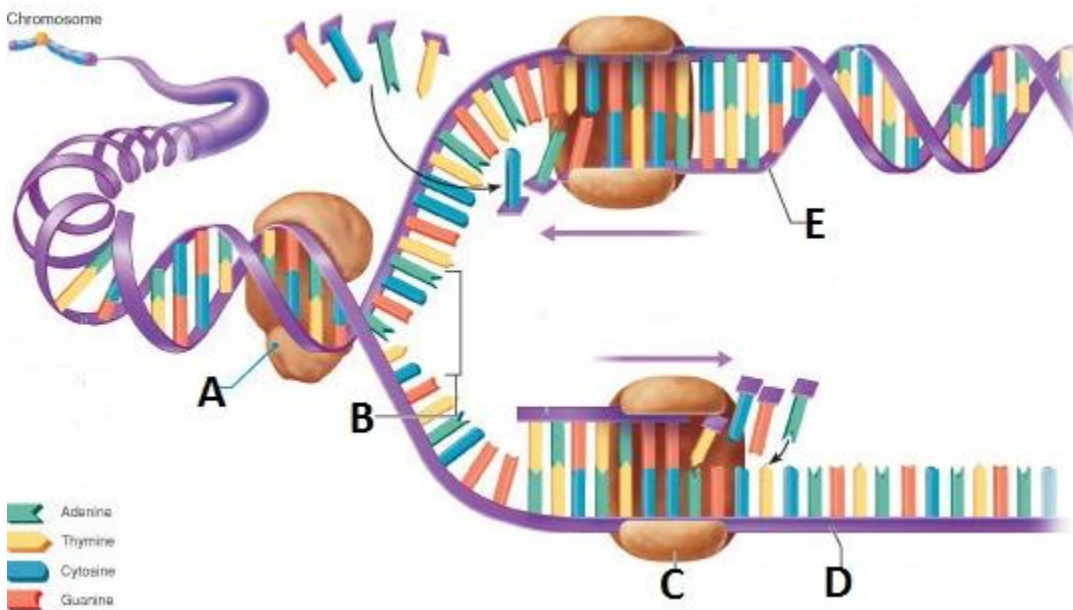
9. Use the following terms to label A-E.

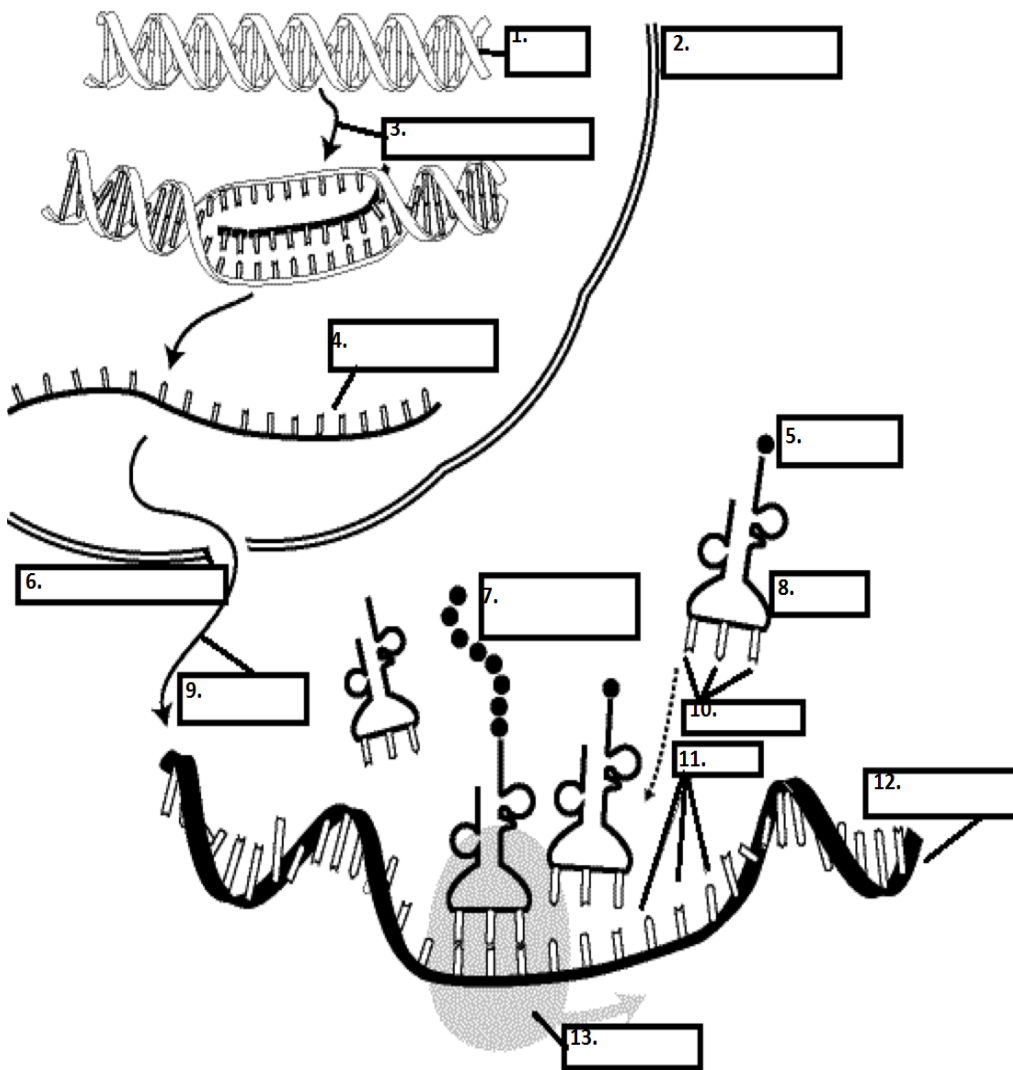Original DNA Strand, DNA Polymerase, Helicase, New DNA Strand, DNA nucleotides.

A= ___Helicase_____

B = __DNA Nucleotides__

C = __DNA Polymerase_____

D = _Original DNA Strand__

E = __New DNA Strand___

10. What process is shown in the diagram below? _____Protein Synthesis_____

11. Use the following terms to label 1-13.

Ribosome, mRNA (use twice), DNA, Nucleus, Transcription, Translation, tRNA, Codon, Anticodon, Polypeptide Chain/Protein, Transport to Cytoplasm, Amino Acid.

1. __DNA___

2. __Nucleus____

3. __Transcription____

4. __mRNA____

5. __amino acid_____

6. __Cytoplasm____

7. __Polypeptide Chain_____

8. __tRNA____

9. __Translation_____

10. _Anticodon____

11. _Codon_____

12. _mRNA____

13. _ribosome____

12. Mutations that involve one DNA base or a very small number of bases are called __gene__ mutations.

13. Mutations that involve an entire chromosome or pieces of a chromosome or a large portion of DNA are called ___chromosomal____ mutations.

14. Find and identify the type of gene mutation shown below. Use the codon chart from your notes to identify the amino acids.

Original DNA sequence:	TAC	ACC	TTG	GCG	ACG	ACT
mRNA transcript:	AUG	UGG	AAC	CGC	UGC	UGA
amino acids:	Meth	Trypt	Aspar	Arg	Cyst	

| Mutated DNA sequence:	TAC	ACC	TTA	GCG	ACG	ACT	
mRNA transcript: *(Circle any changes)*	AUG	UGG	AAU	CGC	UGC	UGA	
amino acids:	Meth	Trypt	Aspara	Arg	Cyst		
Type of mutation (Circle one.)	Point ⇨	Substitution			Frameshift ⇨	Insertion	or	Deletion
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change (silent)	1 amino acid changed	Premature stop signal	No stop signal	1 amino acid added/ deleted	All the amino acids changed after the point of mutation	

15. Identify the types of chromosome mutations below. Write the name of the mutations in the box to the right. Apply this to identifying the chromosome disorder and answer the questions about the following karyotype.
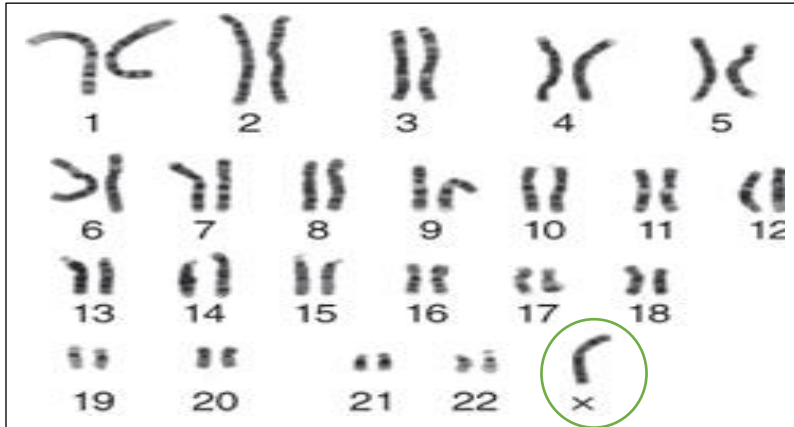
1.

2.

3.

4.
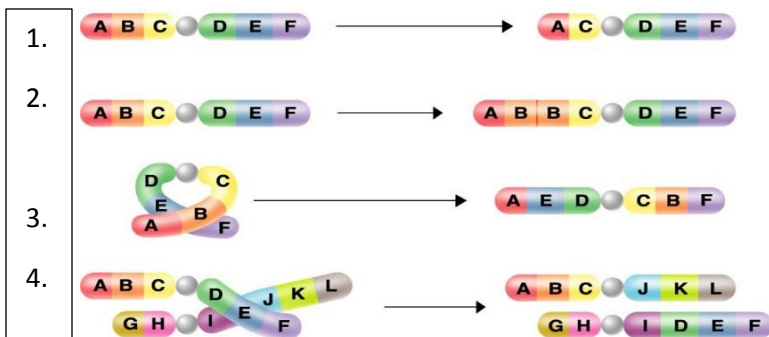
1. Deletion

2. Duplication

3. Inversion

4. Translocation

16.
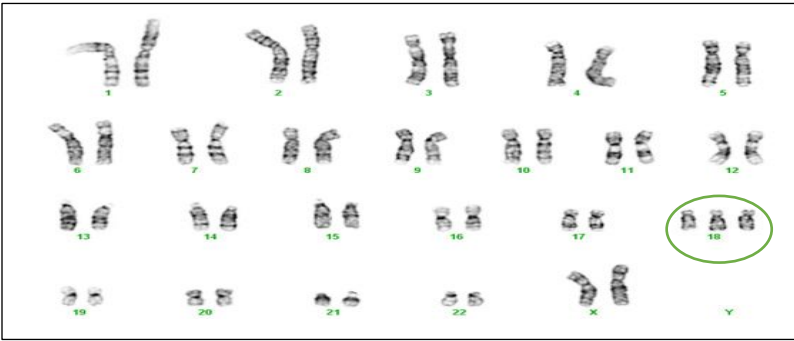
a. Is this individual male or female?

b. How many autosomes? 45

c. How many sex chromosomes? 2

d. Circle the abnormality.

e. What would this disorder be called?
Trisomy 18

f. Which of the above chromosome mutations would this represent?
Nondisjunction

17.

a. Is this individual male or female?

b. How many autosomes?44

c. How many sex chromosomes?1

d. Circle the abnormality.

e. What would this disorder be called?
Turner's Syndrome

f. Which of the above chromosome mutations would this represent?
Nondisjunction

18. Match the following terms for biotechnology with the correct definition.

__e___ 1. Gene   a. DNA that has been formed artificially by combining genetic material of differing organisms

__i___ 2. Gel Electrophoresis   b. continually breeding individuals with similar characteristics to maintain desired traits

__f___ 3. Transgenic   c. organic products should not contain these organisms, which have been genetically altered

__c___ 4. GMOs   d. method of breeding that allows only individuals with desired traits to reproduce

__j___ 5. Mutation   e. segment of DNA that codes for a particular trait

__a___ 6. Recombinant DNA   f. an organism that has foreign DNA that has been introduced to it

__d___ 7. Artificial Selection   g. a member of a population of genetically identical cells produced from a single cell

__h___ 8. Plasmid   h. small, circular chromosome of bacteria

__b___ 9. Inbreeding   i. a laboratory method that separates DNA fragments based on their size

__g___ 10. Clone   j. a change in DNA

19. Use the gel electrophoresis example below to identify the correct suspect of the crime. Circle the perpetrator of the crime.

DNA samples from:

| crime scene | suspect #1 | suspect #2 | suspect #3 |