BIOLOGY NOTEBOOK MP 3-4

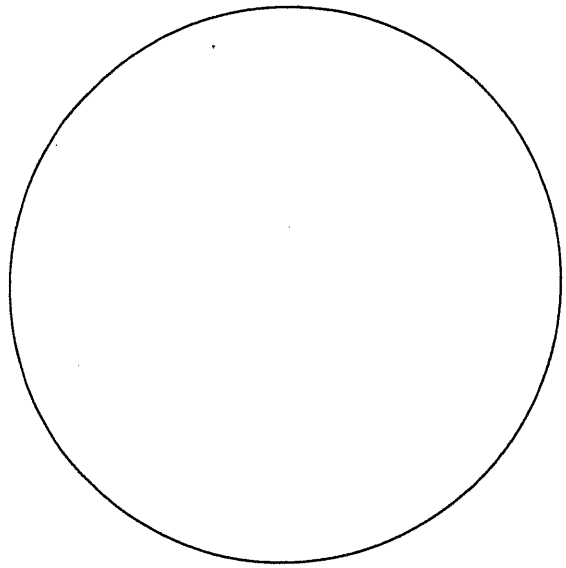
NAME_____

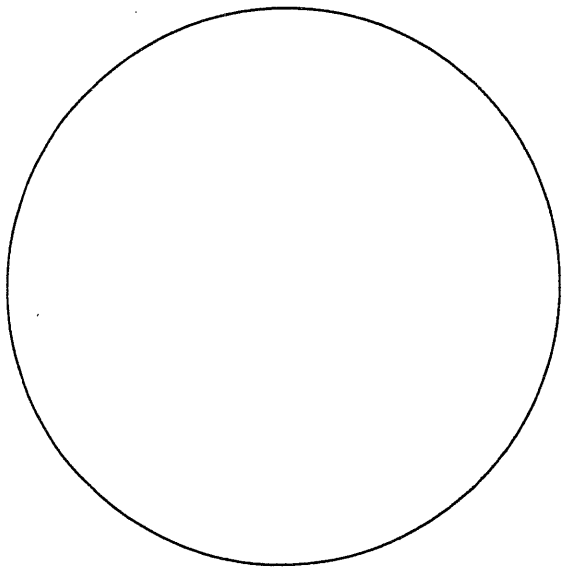
SCI#_____

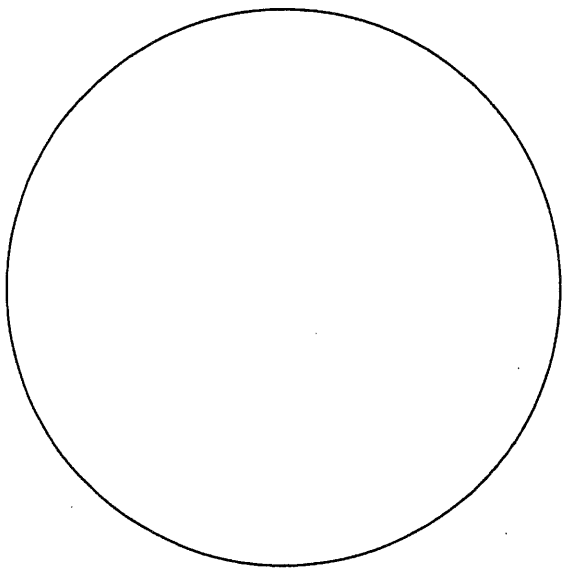
TESTING # _____

HOLT USERNAME_____

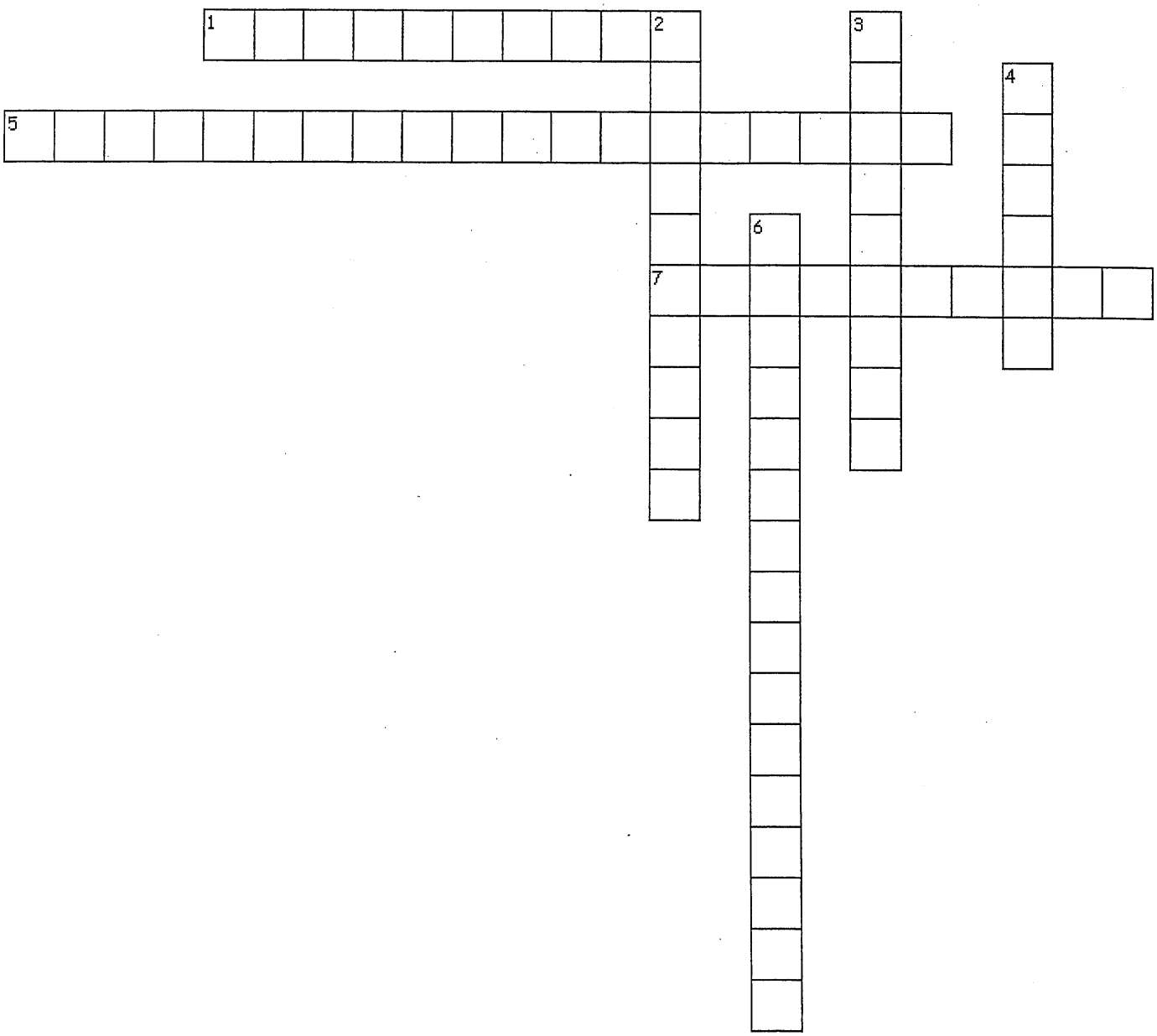
HOLT PASSWORD_____







Ch 16 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard for each term with the word on one side and the definition on the back



Across

1. describes a character that is shared by a group of species because it is inherited from a common ancestor
5. the human practice of breeding animals or plants that have certain desired traits
7. a trait that improves an organism's ability to survive and reproduce; the process of becoming adapted

Down

2. the formation of new species as a result of evolution
3. the process of change by which new species develop from preexisting species over time
4. the trace or remains of an organism that lived long ago; most commonly preserved in sedimentary rock
6. the process by which individuals that are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do

evolution	
artificial selection	
natural selection	
adaptation	
fossil	
homologous	
speciation	

Chapter 16 Evolutionary Theory

I. DARWIN'S IDEAS FROM EXPERIENCE-Darwin's experiences provided him with evidence of evolution at work. In Darwin's time, most people did not think that living things had changed over time. In fact, many doubted that Earth itself had ever changed. But Darwin saw evidence of gradual change.

Individuals and Ideas that Influenced Darwin		
Individual(s) and field	**Major ideas**	**Importance to Darwin's theory**
Jean Baptiste Lamarck (natural history)	• proposed that organisms change over time as they adapt to changing environments • thought (incorrectly) that changes due to use or disuse of a trait would be passed on to offspring	suggested that inheritance plays a role in evolution
Thomas Malthus (economics)	• noted that the human population was growing faster than the food supply • predicted that limited resources would cause deaths from disease, war, or famine	Darwin proposed that all populations, not just human populations, are limited by their environments.
Georges Cuvier (geology)	argued that fossils in rock layers showed: • differences in species over time • that species from the past differed from those of the present	showed that species change over time
James Hutton and Charles Lyell (geology)	thought that geologic processes, such as those that form rocks and fossils, work gradually and constantly	showed that Earth's history was long enough for species to have evolved gradually

II. The Voyage of the _____

A. Darwin's first evidence was gathered during a global voyage on a ship called the Beagle.

B. Darwin also visited the Galápagos Islands in the Pacific Ocean.

C. he collected several different species of birds called _____. – Each of the finches is very similar, but differences can be seen in the size and shape of the bill (or beak).

D. Darwin noticed that many of the islands' plants and animals were similar, but not identical, to the plants and animals he saw in South America.

E. Later, Darwin proposed that the Galápagos species had descended from species that came from South America.

F. Then, the descendant finches were modified over time as different groups survived by eating different types of food.

G. Darwin called such change _____. This idea was a key part of his theory.

III. BREEDING AND SELECTION-Darwin took interest in the practice of breeding, especially the breeding of exotic pigeons.

A. Eventually, Darwin gained a new insight: breeders take advantage of natural variation in traits within a species.

B. If a trait can be inherited, breeders can produce more individuals that have the trait.

C. Breeders simply select individuals that have desirable traits to be the parents of each new generation.

D. Darwin called this process _____ because the selection is done by humans and not by natural causes.

IV. LAMARCKIAN INHERITANCE -In 1809, the French scientist Jean Baptiste _____ proposed an explanation for how organisms may change over generations.

A. He proposed that organisms change over time as they adapt to changing environments.

B. However, Lamarck had an incorrect idea about inheritance. He proposed that changes due to use or disuse of a character would be passed on to offspring. He believed that offspring inherited these kinds of changes.

V. POPULATION GROWTH-Another key influence on Darwin's thinking about evolution was an essay by _____. In 1798, this English economist observed that human populations were increasing faster than the food supply.

A. Malthus pointed out that food supplies were increasing linearly. More food was being produced each year, but the amount by which the food increased was the same each year.

B. In contrast, the number of people was increasing exponentially. More people were added each year than were added the year before.

C. Malthus noted that the number of humans could not keep increasing in this way, because many people would probably die from disease, war, or famine. – Darwin simply applied Malthus's idea to all populations.

D. A _____ is all of the individuals of the same species that live in a specific place.

E. Darwin saw that all kinds of organisms tend to produce _____ offspring than can survive. So, all populations must be limited by their environments.

VI. EVOLUTION BY NATURAL SELECTION- Darwin's theory predicts that over time, the number of individuals that carry advantageous traits will increase in a population.

A. Every living thing has the potential to produce _____ offspring, but not all of those offspring are likely to survive and reproduce.

B. Darwin formed a key idea: Individuals that have traits that better suit their environment are more likely to _____

C. Furthermore, individuals that have certain traits tend to produce _____ offspring than others do.

D. These differences are part of _____.

E. Darwin proposed that natural selection is a cause of evolution.

F. In this context, evolution is a change in the _____ characteristics of a population from one generation to the next.

VII. STEPS IN DARWIN'S THEORY- Darwin's explanation is often called the _____. – This theory can be summarized in the following four logical steps— _____. Each species becomes adapted to its environment as a result of living in it over time. An adaptation is an inherited trait that is present in a population because the trait helps individuals survive and reproduce in a given environment. Darwin's theory explains evolution as a gradual process of adaptation. Note that Darwin's theory refers to populations and species—_____—as the units that evolve.

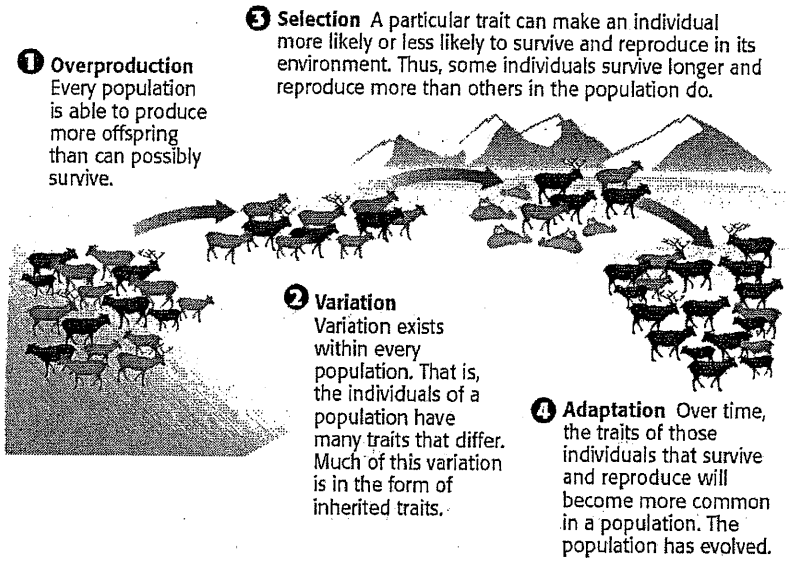
A. Step 1 Overproduction: Every population is capable of producing more offspring than can possibly survive.

B. Step 2 Variation: Variation exists within every population. Much of this variation is in the form of inherited traits.

C. Step 3 Selection: In a given environment, having a particular trait can make individuals more or less likely to survive and have successful offspring. So, some individuals leave more offspring than others do.

D. Step 4 Adaptation: Over time, those traits that improve survival and reproduction will become more common.

The Theory of Evolution by Natural Selection



VIII. DARWIN'S THEORY UPDATED- Discoveries since Darwin's time, especially in genetics, have been added to his theory to explain the evolution of species. Modern biologists have tentative answers to the following questions:

A. Can an individual evolve?

Darwin correctly inferred that individuals do not evolve. They may respond to outside forces, but individuals do not pass on their responses as heritable traits. Rather, populations evolve when natural selection acts (indirectly) on genes.

B. Is evolution the survival of the fittest?

Natural selection can act only on the heritable variation that exists in a population. Chance variations do not always provide the best adaptation for a given time and place. So, evolution does not always produce the "fittest" forms, just those that "fit" well enough to leave offspring.

C. Is evolution predictable?

Evolution sometimes results in larger or more-complex forms of life, but this result cannot be predicted. Many forms of life are simple yet successful. Mostly, scientists cannot predict the exact path that evolution will take.

IX. STUDYING EVOLUTION AT ALL SCALES-Because it affects every aspect of biology, scientists can study evolution at many scales. Generally, these scales range from _____ to _____, with speciation in between.

A. Informally, microevolution refers to evolution as a change in the genes of populations, whereas macroevolution refers to the appearance of new species over time.

B. The link between microevolution and macroevolution is _____. Speciation, the _____, can be seen as a process of genetic change or as a pattern of change in the form of organisms.

X. _____- To study microevolution, we look at the processes by which inherited traits change over time in a population. Five major processes can affect the kinds of genes that will exist in a population from generation to generation—natural selection, migration, mate choice, mutation, and genetic drift.

A. Natural selection can cause an increase or decrease in certain _____ in a population.

B. _____ is the movement of individuals into, out of, or between populations. Migration can change the numbers and types of alleles in a population.

C. If parents are paired up randomly in a population, a random assortment of traits will be passed on to the next generation. However, if parents are limited or _____ in their choice of mates, a limited set of traits will be passed on.

D. Mutation can change the numbers and types of alleles from one generation to the next. However, such changes are rare.

E. The random effects of everyday life can cause differences in the survival and reproduction of individuals .Because of these differences, some _____ may become more or less common in a population, especially in a small population.

Processes of Microevolution	
Process	**Description**
Natural selection	Individuals with a particular trait are more likely to survive and reproduce than those without the trait.
Migration	Individuals with different alleles may move into or out of a population.
Mate choice	Parents that are limited or selective in their choice of mates pass a limited set of traits to the next generation.
Mutation	Mutations are the source of completely new alleles.
Genetic drift	Random effects of everyday life can cause differences in survival and reproduction of individuals.

XI. _____- To study macroevolution, we look at the patterns in which new species evolve. We may study the direction, diversity, or speed of change. Patterns of change are seen when relationships between living and fossil species are modeled.

1. _____Organisms are part of one other's environment, so they can affect one another's evolution. Species that live in close contact often have clear adaptations to one another's existence.

2. _____Over time, species may split into two or more lines of descendants, or lineages. As this splitting repeats, one species can give rise to many new species. The process tends to speed up when a new species enters an environment that contains few other species.

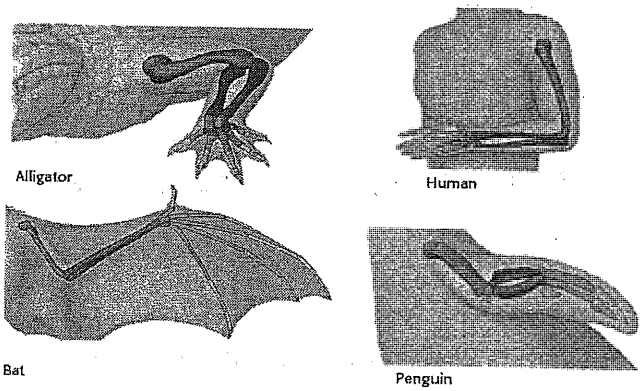
3. _____If all members of a lineage die off or simply fail to reproduce, the lineage is said to be extinct. The fossil record shows that many lineages have

arisen and radiated, but only a few of their descendants survived and evolved into the species present today.

4. _____In Darwin's day, the idea of slow, gradual change was new to geology as well as biology. Darwin had argued that large-scale changes, such as the formation of new species, must require many small changes to build up gradually over a long period of time. This model is called gradualism.

5. _____Some biologists argue that species do not always evolve gradually. Species may remain stable for long periods until environmental changes create new pressures. Then, many new species may "suddenly" appear. This model is called punctuated equilibrium.

Patterns of Macroevolution	
Pattern	**Description**
Convergent evolution	Species living in similar environments may evolve similar adaptations.
Coevolution	Two or more species that live in close contact may affect how each species evolves.
Adaptive radiation	A species may give rise to many new species after it enters an environment that contains few other species.
Extinction	All members of a lineage die off or fail to reproduce.
Gradualism	The formation of some new species requires many small changes to build up gradually over time.
Punctuated equilibrium	Many species remain stable, or unchanged, for a long time. If environmental changes create new pressures, many new species evolve rapidly.



Although they look very different from one another on the outside, the forelimbs of these four vertebrates have very similar groups of bones. This suggests that all vertebrates descended from a common ancestor.

HOMEWORK DATE DUE

CH 16 SEC 1

1. What were Darwin's two major contributions to modern evolutionary theory?

2. How did Darwin explain the similarities among finches in the Galápagos Islands and in South America?

3. What is *descent with modification?*

4. How does artificial selection provide evidence that species can change over time?

5. What idea did Lamarck and Darwin share?

6. What evidence from fossils and rock layers influenced Darwin's ideas?

7. What idea of Malthus did Darwin extend to all populations?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE

CH 16 SEC 2

1. What does Darwin's theory of evolution by natural selection predict?

2. What are the four steps of Darwin's theory of evolution?

3. Complete the table below to summarize how evidence supports

Source of evidence	What the evidence indicates
Fossil record	
Anatomy	
Biogeography	
Developmental biology	Species with embryos that show similar patterns of development probably share a common ancestor.
Biochemistry	

4. What are three major strengths of Darwin's theory of evolution by natural selection?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE

CH 16 SEC 3

1. Name one field of study that has contributed discoveries that support Darwin's theory of evolution.

2. How does microevolution differ from macroevolution?

3. How does migration cause a change in the genes in a population?

4. How does genetic drift differ from natural selection?

5. According to the punctuated equilibrium model of speciation, what causes many new species to evolve rapidly?

6. How do you think adaptive radiation and extinction are related?

7. A scientist observes that a particular species of butterfly has a very long tongue. The butterfly feeds on a flower that has nectar at the bottom of a long tube. What pattern of macroevolution best explains the traits that the scientist observed? Explain your answer

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

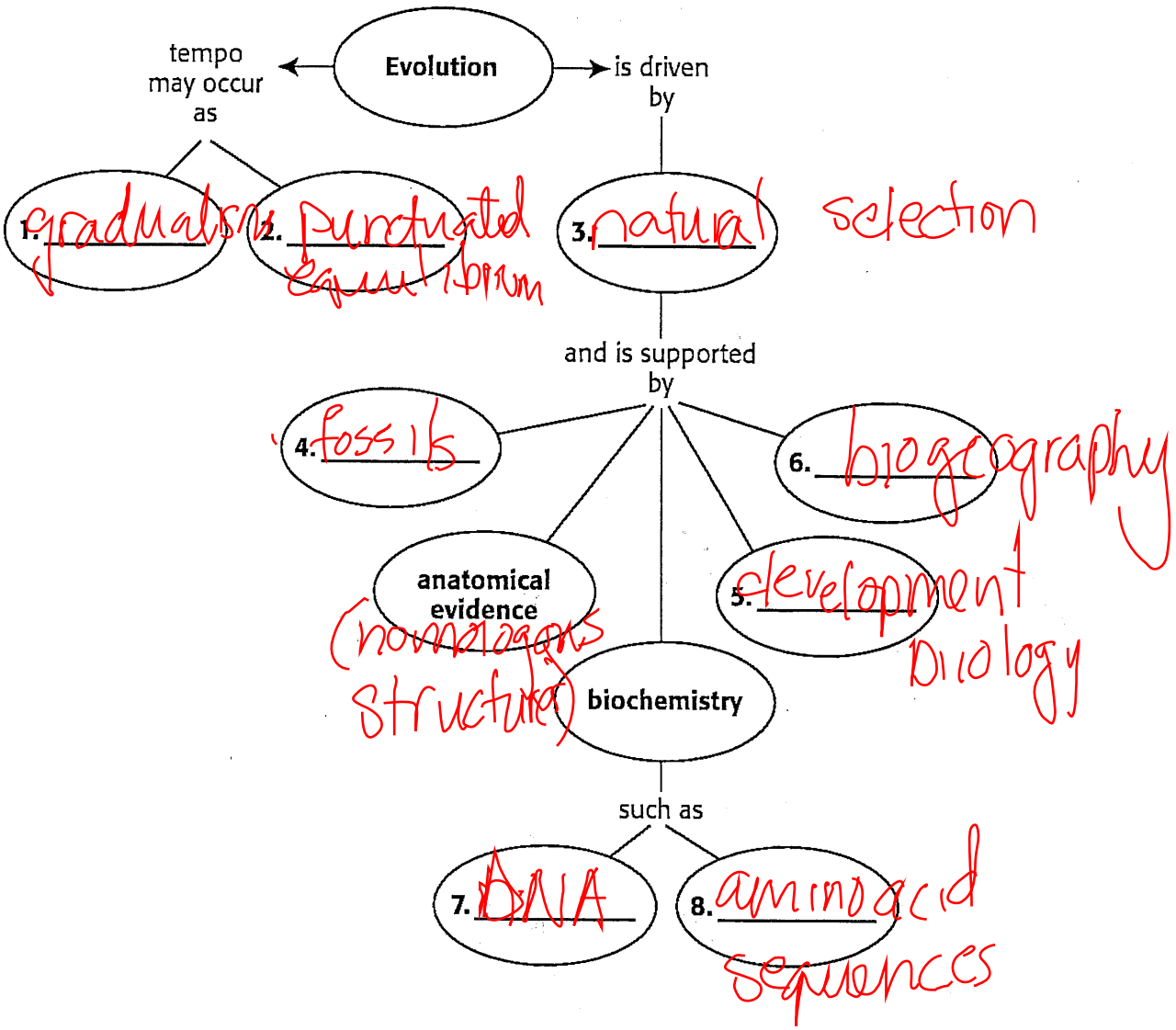
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

Using the terms provided below, complete the concept map showing the theory of evolution by natural selection.

amino acid sequences	DNA sequences	homologous structures
biogeography	fossils	natural selection
developmental biology	gradualism	punctuated equilibrium



Chapter 16 Review

What is a theory?

What does evolution mean in biology?

Who was Darwin? WHat was his theory?

What is evolution?

What is artificial selection

Darwin's observations of finches indicated descent with _____

According to Malthus, human populations grow in what mathmatical way?

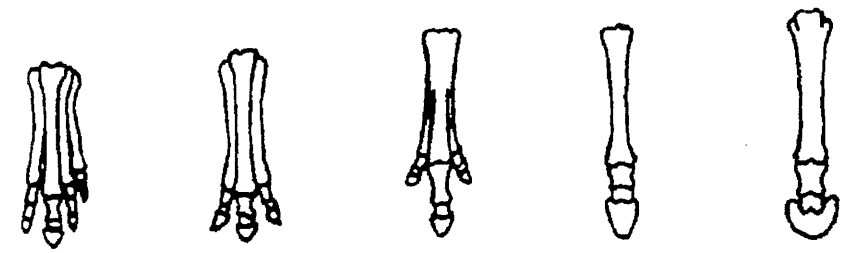
What is overproduction? Selection? Adaptation?

What is natural selection? What are the steps involved?

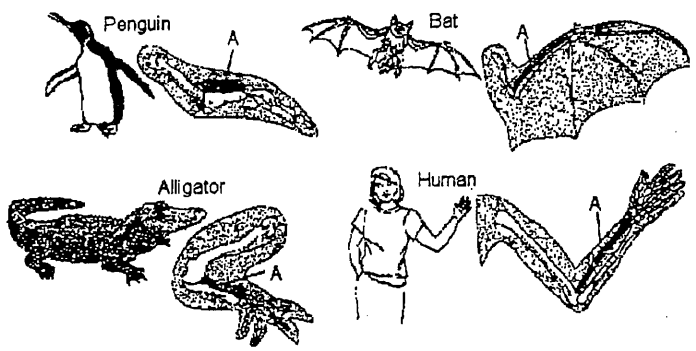
What are the major points of Darwin's view of natural selection?

What is genetic variation in populations? Why are they important?

What is an adaptation? A variation?



What is adaptive radiation? What is punctuated equilibrium?



The similarity of these structures suggests that the organisms _____

Refer to the illustration above. The bones labeled A are known as _____

What are homologous structures? How can you tell they are?

What is the relevance of comparative embryology?

What facts support the theory of evolution?

What is biogeography?

What predictions are made by the modern theory of evolution?

How are darwinb's theory of evolution and genetics related? Does one support the other?

What is speciation? What is microevolution? What is macroevolution?

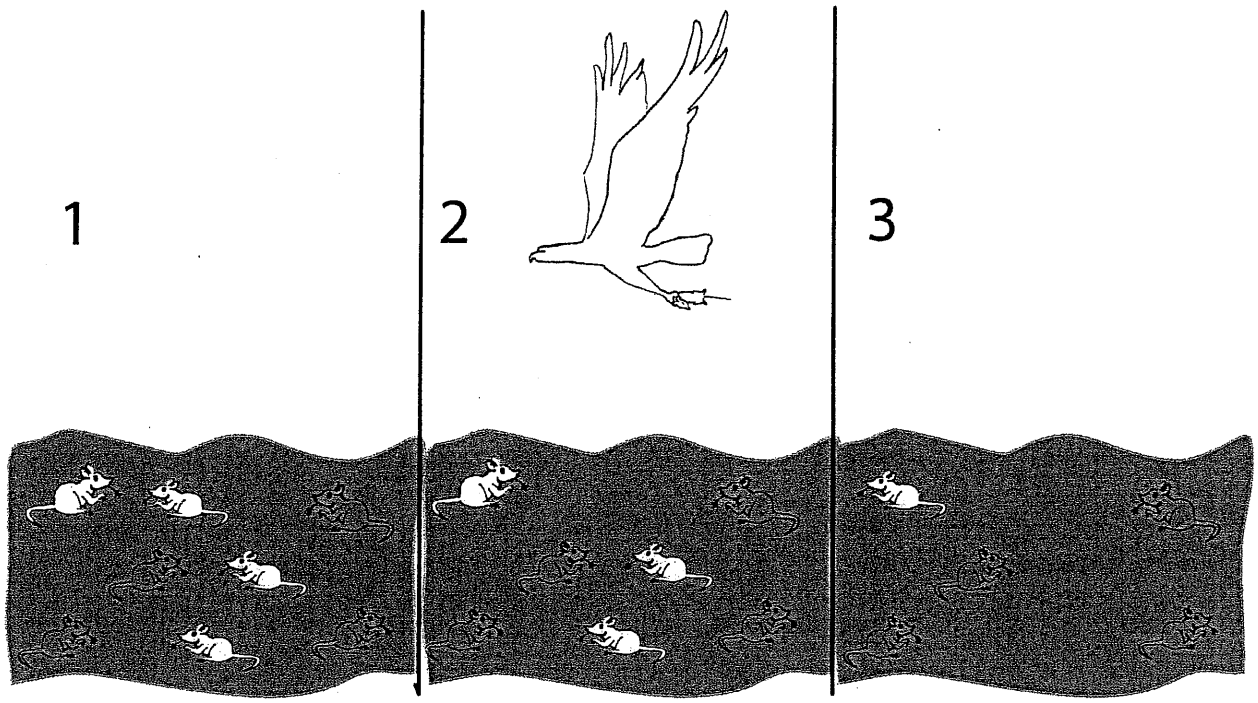
What process is migration and mutation important in?

What is punctuated equilibrium?

What is gradualism in evolution?

Evolution by Natural Selection

Describe what is happening in figures 1-3. Is the population of mice different in figure 3 than in figure 1? Explain why.



Living things that are well adapted to their environment survive and reproduce. Those that are not well adapted don't survive and reproduce. An **adaptation** is any characteristic that increases **fitness**, which is defined as the ability to survive and reproduce. What characteristic of the mice is an adaptation that increased their fitness?

The table below gives descriptions of four female mice that live in a beach area which is mostly tan sand with scattered plants. According to the definition given for fitness, which mouse would biologists consider the fittest? Explain why this mouse would be the fittest.

Color of fur	Black	Tan	Tan and Black	Cream
Age at death	2 months	8 months	4 months	2 months
# pups produced by each female	0	11	3	0
Running speed	8 cm/sec.	6 cm/sec.	7 cm/sec.	5 cm/sec.

If a mouse's fur color is generally similar to its mother's color, what color fur would be most common among the pups?

A more complete definition of fitness is the ability to survive and produce offspring who can also survive and reproduce. Below are descriptions of four male lions. According to this definition of fitness, which lion would biologists consider the "fittest"? Explain why.

Name	George	Dwayne	Spot	Tyrone
Age at death	13 years	16 years	12 years	10 years
# cubs fathered	19	25	20	20
# cubs surviving to adulthood	15	14	14	19
Size	10 feet	8.5 feet	9 feet	9 feet

Suppose that Tyrone had genes that he passed on to his cubs that helped his cubs to resist infections, so they were more likely to survive to adulthood. These genes would be more common in the next generation, since more of the cubs with these genes would survive to reproduce.

A characteristic which is influenced by genes and passed from parents to offspring is called **heritable.** Over many generations heritable adaptive characteristics become more common in a population. This process is called **evolution by natural selection**. Evolution by natural selection takes place over many, many generations.

Evolution by natural selection leads to adaptation within a population. The term evolution by natural selection does not refer to individuals changing, only to changes in the frequency of adaptive characteristics in the population as a whole. For example, for the mice that lived in the beach area with tan sand, none of the mice had a change in the color of their fur; however, due to natural selection, tan fur was more common for the pups than for the mother mice.

In summary, a heritable characteristic that helps an animal or plant to have more offspring which survive to reproduce will tend to become more common in a population as a result of evolution by natural selection.

Questions

1. Explain why a characteristic which helps an animal to live longer will generally tend to become more common in the population as a result of evolution by natural selection.

_____

2. Not all characteristics which contribute to longer life become more common in the population. Some characteristics contribute to long life, but not more offspring. For example, a female cat which is sterile and cannot have any offspring may live longer because she will not experience the biological stresses of repeated pregnancies. Explain why a characteristic like this which contributes to a long life, but with few or no offspring, would not become more common as a result of evolution by natural selection.

_____

_____

Simulation of Natural Selection

A simulation is a good way to simplify the problem in such a way that we can observe how evolution by natural selection may work in a real population. This simulation involves pom poms that can reproduce. These pom poms live out their lives on a Black Forest or Red Grassland habitat in the middle of the classroom. The only concern our

pom pom creatures have is the presence of ravenous hunters (that's you!). All we need is a system that has three necessary conditions for evolution by natural selection.

1. **Variation in characteristics**: For natural selection to occur, different individuals in a population must have different characteristics. In our simulation, pom poms vary in color; they are black, red, and white. The hunters vary as well; hunters have three distinct types of feeding structures: forks, knives, and spoons.
2. **Differences in fitness**: For natural selection to occur, the different characteristics of different individuals must contribute to differences in fitness (i.e. differences in ability to survive and reproduce). It seems possible that variation in pom pom color will influence the probability that a pom pom is snatched up by a hungry hunter. It also seems possible that different feeding types may vary in their success in capturing pom poms. These differences contribute to survival and therefore success in reproducing.
3. **Heritability of characteristics**: For natural selection to occur, the characteristics that affect fitness must be heritable (i.e. passed by genes from one generation to the next). In our simulation, a pom pom that is born into the pom pom population is the same color as its parent and a hunter that is born into the hunter population has the same feeding structure as its parent.

Here is exactly what we will do:

1. Your class will be split into two groups which will carry out the simulation using two different habitats: Black Forest (represented by a rough black material such as faux fur) and Red Grassland (represented by a red fleece material).

2. Pom poms come in three colors: black, red, and white. Your teacher will "plant" an equal number of each color on the Black Forest and on the Red Grassland at the beginning of the simulation. Which color pom pom do you think will be more likely to survive in each habitat?

   Black Forest:

   Red Grassland:

   Why do you think that?

   _____

   _____

   _____

3. Now it is time to arm the hunters. There are three different feeding types: forks, knives, and spoons. Your teacher will distribute the feeding structures so that there are equal numbers of each. You will also be given a cup. This cup will serve as your "stomach". To capture a pom pom, you must use only your fork, knife or spoon to lift the pom pom from the habitat and put it into your cup. Which feeding structure do you think will do better in each habitat?

   Black Forest:

   Red Grassland:

   Why do you think that?

4. Your teacher will record the initial numbers of each type of pom pom and each type of hunter in each habitat on the board.

5. At your teacher's signal, start feeding. Don't be shy about competing with your fellow hunters. However, once a pom pom is on a fork, knife or spoon it is off limits. When your teacher calls time, **STOP** feeding.

6. Now count how many pom poms you have eaten and line up with your classmates who were feeding on the same habitat, from fewest pom poms eaten to most pom poms eaten. Only the top half of the hunters will survive and reproduce. Your teacher will tell you who lives and who dies. Those who die will be reborn as the children of the survivors and will now have the same type of feeding structure as their parents had.

7. Your teacher will count how many pom poms of each color were eaten, calculate how many pom poms survived, and help the surviving pom poms reproduce. Only the pom poms that were not eaten will reproduce.

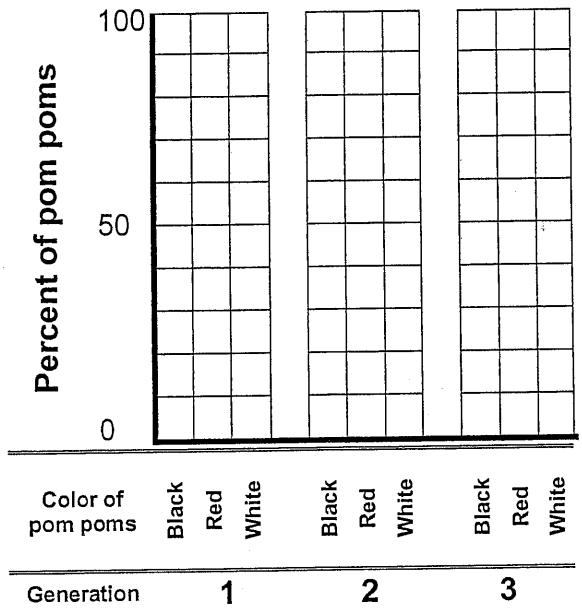
8. You will run through the simulation one more time. Your teacher will post on the board the numbers of pom poms of each color and hunters of each type at the beginning of the simulation (generation 1) and at the end of each cycle (generations 2 and 3). Copy down the numbers on the board in the table on the next page. Then, for each generation of pom poms in each habitat, calculate the percent that are black, red, or white. Similarly, for each generation of hunters in each habitat, calculate the percent that have spoons, forks, or knives as their feeding implement.

	Red Grassland				Black Forest			
	Pom poms				Pom poms			
	Black	Red	White	Total	Black	Red	White	Total
Generation 1 Number								
Percent				100%				100%
Generation 2 Number								
Percent				100%				100%
Generation 3 Number								
Percent				100%				100%

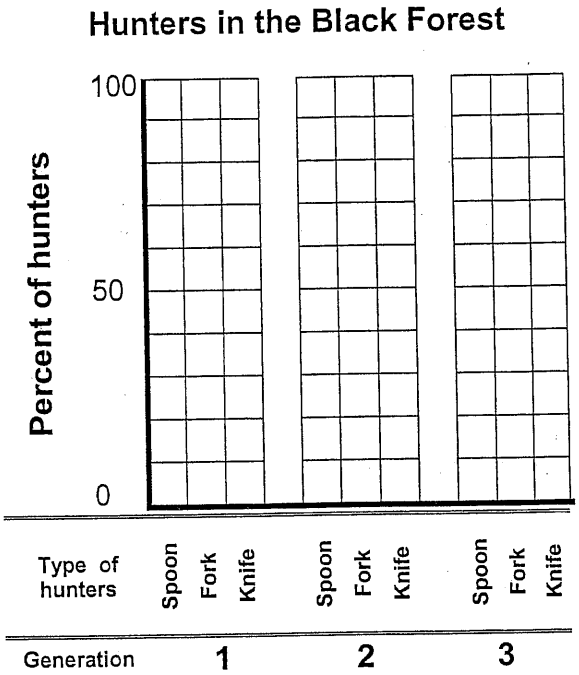
	Red Grassland				Black Forest			
	Hunters				Hunters			
	Spoon	Fork	Knife	Total	Spoon	Fork	Knife	Total
Generation 1 Number								
Percent				100%				100%
Generation 2 Number								
Percent				100%				100%
Generation 3 Number								
Percent				100%				100%

9. Use the data to complete the following 4 bar graphs. This will allow you to observe the changes in the percent of pom poms of each color and hunters of each type over the three generations in each habitat.

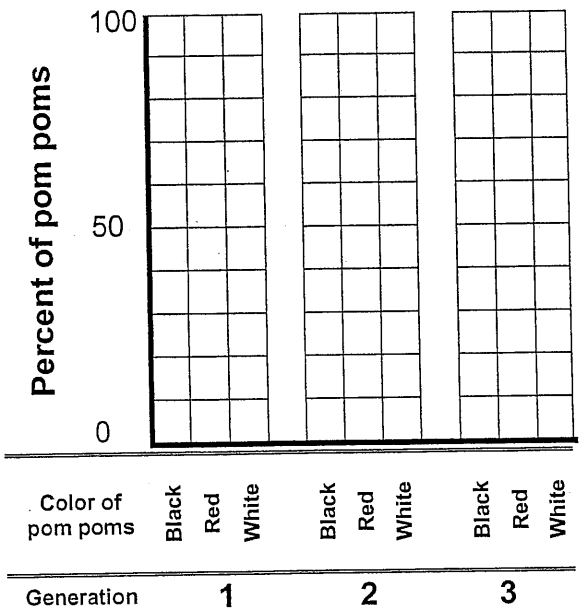
Pom poms in the Black Forest



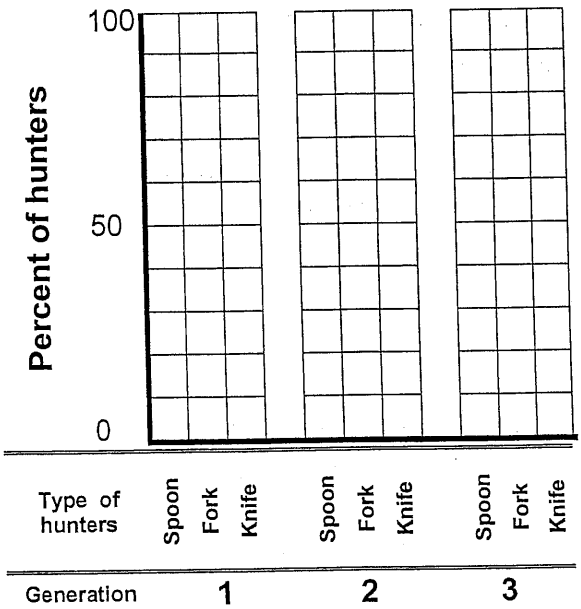
Hunters in the Black Forest



Pom poms in the Red Grassland



Hunters in the Red Grassland



10. Did evolution by natural selection occur in each pom pom population? In other words, did one pom pom color become more common over time while the other colors became less common? What traits contributed to the survival of pom poms that survived to reproduce?

Black Forest:

Red Grassland:

Remember that the pom pom populations were the same on the Black Forest and Red Grassland at the beginning. Explain why the trends differ in these two different habitats and the two populations of pom poms end up so differently.

11. For each population of hunters, did one feeding type become more common while other feeding types became less common? What traits contributed to the survival of hunters that survived to reproduce?

Black Forest:

Red Grassland:

Explain the differences in the trends in the feeding type of the hunters in the two habitats.

12. Did any individual pom poms change color or adapt? If not, then why did the colors of the pom poms in the final population differ from the colors of the pom poms in the original populations?

13. If we ran the simulation for 50 more generations, what would you predict about the colors of the pom poms and the hunter types in each habitat?

Black Forest:

Red Grassland:

14. What do you think would happen to the pom pom population if the black forest experienced a decade long drought and became red grassland? First, make your prediction of what would happen if the population of pom poms in the black forest at the beginning included red, white and black pom poms.

Next, suppose that natural selection over many generations had resulted in only black pom poms surviving in the black forest, and then a prolonged drought resulted in this habitat turning into a red grassland. Would natural selection for pom pom color occur?

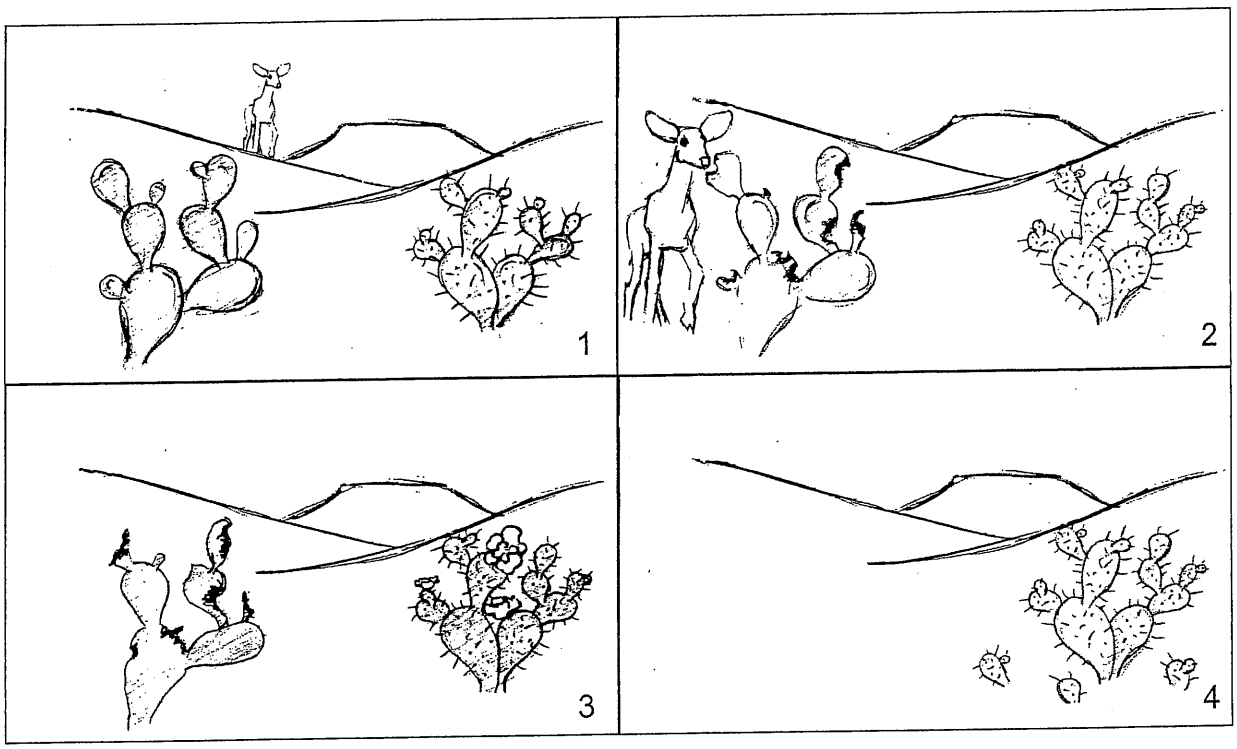
Based on this example, explain why evolution by natural selection can not occur if there is no variation in a characteristic.

15. Explain why evolution by natural selection can not occur if the variation in a characteristic does not contribute to differences in fitness. Suppose, for example, that all the hunters in the simulation were blind-folded and could only find pom poms by touch. Would you expect evolution by natural selection in the color of the pom poms?

16. Explain why evolution by natural selection can not occur if the variation in a characteristic is not heritable. Suppose, for example, a tree limb fell on a young lion and broke his leg, and the leg never healed normally. Obviously, this would affect the lion's ability to survive and reproduce. However, if this lion did manage to have cubs, the offspring would each have four normal legs. Explain why natural selection does not operate on characteristics like this which affect fitness but are not heritable.

17. "Survival of the fittest" is a common expression. What do you think most people mean by this expression? How would you explain this expression to help someone understand how natural selection actually functions?

18. Below is a series of pictures representing changes in a population of cacti. Pictures 1 and 2 show what happened when a deer came to eat, picture 3 shows the cacti a few weeks later (notice the flowers on the right-hand cactus), and picture 4 shows the situation a few months later.



Recall that the three conditions listed below are necessary for natural selection to take place.

1. **Variation in characteristics within the population:** In picture 1, what is the main difference between the cactus on the left and the cactus on the right?

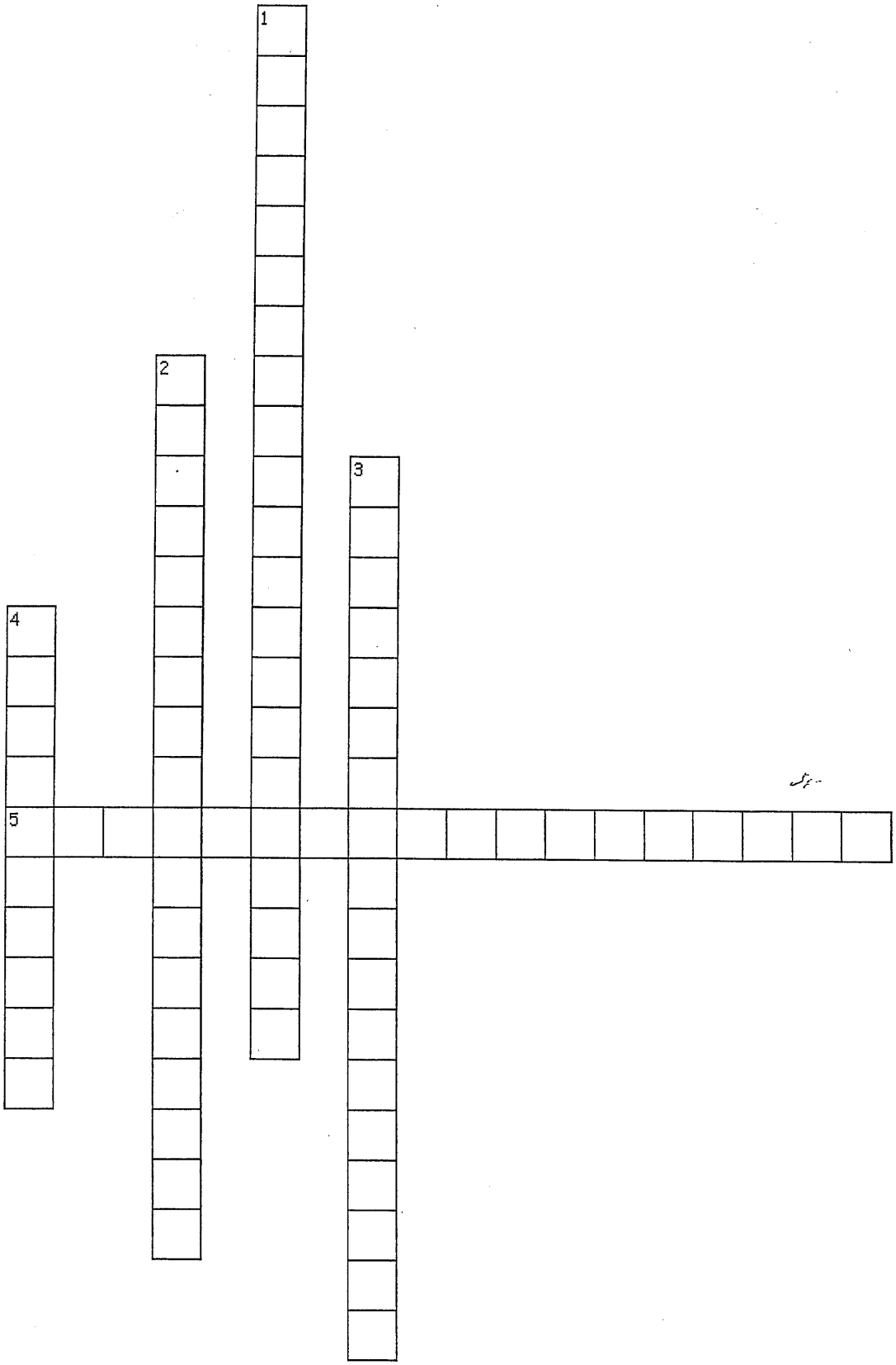
2. **Differences in survival and reproduction, fitness**: Why would a deer be more likely to eat the cactus on the left than the cactus on the right?

   What effect does the deer's behavior have on the survival and reproduction of these two types of cactus?

3. **Heritability of characteristics from parent to offspring:** The difference between the cacti is a heritable characteristic (see picture 4).

Do you think that evolution by natural selection is occurring in this cactus population? Explain why or why not.

Ch 17 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard for each term with the word on one side and the definition on the back



Across

5. the study of the frequency and interaction of alleles and genes in populations

Down

1. a state in which a population can no longer interbreed with other populations to produce future generations
2. a state in which the allele frequencies of a population remain in the same ratios from one generation to the next
3. a line graph showing the general trends in a set of data of which most values are near the mean
4. a taxonomic classification below the level of species; refers to populations that differ from, but can interbreed with, other populations of the same species

population genetics	
normal distribution	
genetic equilibrium	
reproductive isolation	
subspecies	

I. POPULATION GENETICS-Microevolution can be studied by observing changes in the numbers and types of alleles in populations. The study of _____ in this sense is population genetics.

II. PHENOTYPIC VARIATION-Biologists study polygenic phenotypes by measuring each individual in the population and then analyzing the distribution of the measurements.

A. The variety of _____ that exists for a given characteristic depends on how many genes affect it. Polygenic characters are influenced by several genes. Examples include human eye color and height.

B. A _____ is an overview of the relative frequency and range of a set of values.

1. Often, some values in a range are more common than others.
2. A normal distribution, or _____, is one that tends to cluster around an average value in the center of the range.

III. MEASURING VARIATION AND CHANGE-Genetic variation and change are measured in terms of the _____ of alleles in the gene pool of a population.

A. A frequency is the proportion or ratio of a group that is of one type. To study genetic change, the _____ of each allele in a population can be tracked over time.

B. The particular combination of alleles in a population at any one point in time makes up a _____

Frequency of *AA* — Frequency of *Aa* — Frequency of *aa*

$$p^2 + 2pq + q^2 = 1$$

IV. SOURCES OF GENETIC VARIATION-The major source of new alleles in natural populations is mutation in _____

A. Evolution cannot proceed if there is no variation.

B. Mutation generates new alleles at a slow rate.

C. Only mutations in germ cells (egg and sperm) are _____ to offspring.

V. EQUILIBRIUM AND CHANGE-The _____ principle predicts that the frequencies of alleles and genotypes in a population will not change unless at least one of five forces acts upon the population. The forces that can act against genetic equilibrium are _____, _____.

- A population in which no genetic change occurred would be in a state of _____.
- Genetic change in a population can be measured as a change in genotype frequency or allele frequency.
- A change in one doesn't necessarily mean a change in the other.

A. Gene Flow-_____ occurs when genes are added to or removed from a population. Gene flow can be caused by migration, the movement of individuals from one population to another.

B. _____-In sexually reproducing populations, any limits or preferences of mate choice will cause nonrandom mating.

C. _____-Chance events can cause rare alleles to be lost from one generation to the next, especially when populations are small. Such random effects on allele frequencies are called genetic drift.

D. Mutation-_____ can add a new allele to a population.

E. Natural Selection

1. _____ acts to eliminate individuals with certain traits from a population.

2. As individuals are eliminated, the alleles for those traits may become less frequent in the population.

3. Thus, both allele and genotype frequencies may change.

Hardy-Weinberg principle

Frequencies of alleles and genotypes in a population will not change unless at least one of five forces acts on the population.

Forces that Can Change Allele Frequencies	
Force	**Description**
Gene flow	Individuals that join a population might bring in new alleles. Individuals that leave a population might remove alleles from the population.
Nonrandom mating	In nonrandom mating, individuals may have a limited choice of mates, or they may prefer mates with certain traits. Thus, certain alleles may get passed to more offspring than other alleles.
Genetic drift	Chance events, such as fire or flood, can cause rare alleles to be lost from a population.
Mutation	Mutations can create new alleles.
Natural selection	Natural selection can remove individuals with certain traits from a population. The alleles for those traits may become less common in the population.

VI. SEXUAL REPRODUCTION AND EVOLUTION-Sexual reproduction creates the possibility that mating patterns or behaviors can influence the gene pool of a population.

A. For example, in animals, females sometimes select mates based on the male's size, color, ability to gather food, or other characteristics. This kind of behavior is called sexual selection and is an example of _____

B. Another example of nonrandom mating is inbreeding, in which individuals either self-fertilize or mate with others like themselves. Inbreeding is more likely to occur if a population is small. In a small population, all members are likely to be closely related.

VII. POPULATION SIZE AND EVOLUTION-Allele frequencies are more likely to remain stable in _____ populations than in small populations.

A. Population size strongly affects the probability of genetic change in a population.

B. Genetic drift is a strong force in small populations and occurs when a particular allele disappears.

VIII. NATURAL SELECTION AND EVOLUTION- Natural selection acts only to change the relative _____ of alleles that exist in a population. It acts on genotypes by removing unsuccessful phenotypes from a population. Natural selection is a result of the following facts:

A. All populations have genetic variation.

B. Individuals tend to produce more _____ than the environment can support.

C. Populations depend upon the reproduction of individuals.

IX. Genetic Results of Selection

A. The result of natural selection is that each allele's frequency may increase or decrease depending on the allele's effects on _____ and reproduction.

B. Although natural selection is not the only force that can cause evolution, it is a powerful force.

X. Why Selection is Limited

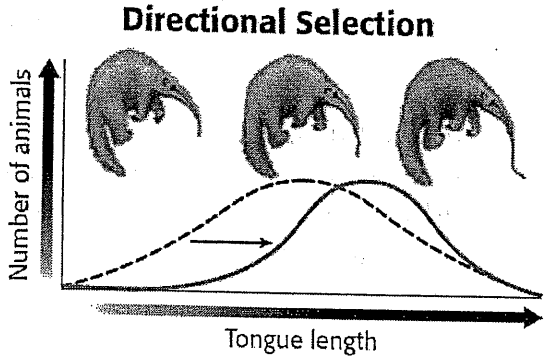
A. The key lesson that scientists have learned about evolution by natural selection is that the environment does the selecting.

B. Only characteristics that are _____ can be targets of natural selection. If a mutation results in rare recessive alleles, for example, selection cannot operate against it.

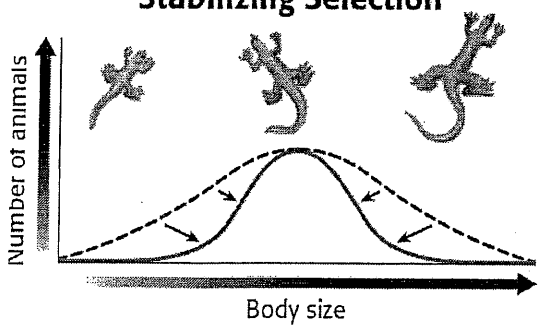
C. For this reason, genetic disorders (such as cystic fibrosis in humans) can persist in populations.

XI. PATTERNS OF NATURAL SELECTION- Three major patterns are possible in the way that natural selection affects the distribution of polygenic characters over time. These patterns are directional selection, stabilizing selection, and disruptive selection.

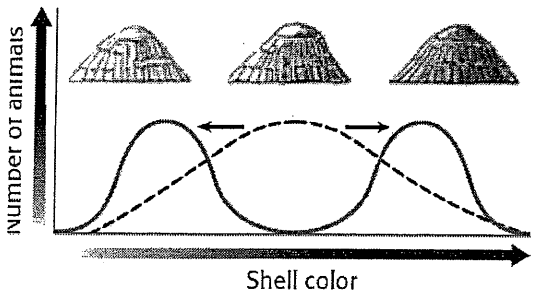
1. _____In directional selection, the "peak" of a normal distribution moves in one direction along its range.
2. In this case, selection acts to eliminate on extreme from a range of phenotypes, making them less common.
3. _____In stabilizing selection, the bell-curve shape becomes narrower. In this case, selection eliminates individuals that have alleles for any extreme type.
4. Stabilizing selection is very common in nature.
5. _____In disruptive selection, the bell curve is "disrupted" and pushed apart into two peaks.
6. In this case, selection acts to eliminate individuals with average phenotype values.



Stabilizing Selection



Disruptive Selection



XII. DEFINING SPECIES- A species is generally defined as a group of natural populations that can interbreed and usually produce _____ offspring. This definition is based on the biological species concept.

XIII. FORMING NEW SPECIES-Speciation has occurred when the net effects of evolutionary forces result in a population that has unique features and is reproductively isolated. _____ is the process of forming new species by evolution from preexisting species.

A. In each place, natural selection acts upon each population and tends to result in offspring that are better adapted to each specific environment.
B. If the environments differ, the adaptations may differ. This is called _____ and can lead to the formation of new species.

XIV. Reproductive Isolation- Reproductive isolation is a state in which two populations can no longer interbreed to produce future offspring. From this point on, the groups may be subject to different forces, so they will tend to diverge over time. Any of the following mechanisms may contribute to the reproductive isolation of populations:

A. Geography
B. Ecological Niche

C. Mating Behavior and Timing
D. Polyploidy
E. Hybridization

Mechanisms of Reproductive Isolation	
Mechanism	**Description**
Geography	A physical barrier may form that separates populations. The barrier prevents the populations from interbreeding. Over time, if the populations diverge enough, they will not be able to interbreed, even if the barrier is removed.
Ecological niche	Divergence can happen when populations use different niches.
Mating behavior and timing	Many species that reproduce sexually use specific behaviors to attract mates. These behaviors may include sounds or actions. The individuals of some species mate at particular times. If two populations develop different mating behaviors or mate at different times, they may no longer interbreed.
Polyploidy	A polyploid individual may not be able to mate with others in the population because it cannot pair gametes. However, it may be able to reproduce with other polyploid individuals or self-fertilize. The offspring would form a new population.
Hybridization	In hybridization, two closely related species mate and produce offspring. In many cases, the offspring are not fertile or are not adapted to survive in their environment. However, some hybrids may be able to survive and produce fertile offspring. These hybrids may form a new species.

XV. EXTINCTION: THE END OF SPECIES-The species that exist at any time are the net result of both speciation and extinction. Extinction occurs when a species fails to produce any more descendants. Extinction, like speciation, can only be detected after it is complete.

A. More than _____ of all of the species that have ever lived becoming extinct.
B. Many cases of extinction are the result of environmental change.
C. If a species cannot adapt fast enough to changes, the species may be driven to extinction.

HOMEWORK DATE DUE

CH 17 SEC 1

1. How do scientists study microevolution?

2. How does the number of genes that affect a phenotype relate to the variation in traits?

3. How do scientists measure phenotypic variation?

4. How do scientists measure genetic variation?

5. A population consists of 100 individuals. In this population, 61 people have unattached earlobes. Of these individuals, 33 are homozygous dominant and 28 are heterozygous. The remaining individuals have attached earlobes. What is the frequency of each genotype? What is the frequency of each allele?

6. What is the major source of variation in a population?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE

CH 17 SEC 2

1. What five forces can cause allele frequencies in a population to change?

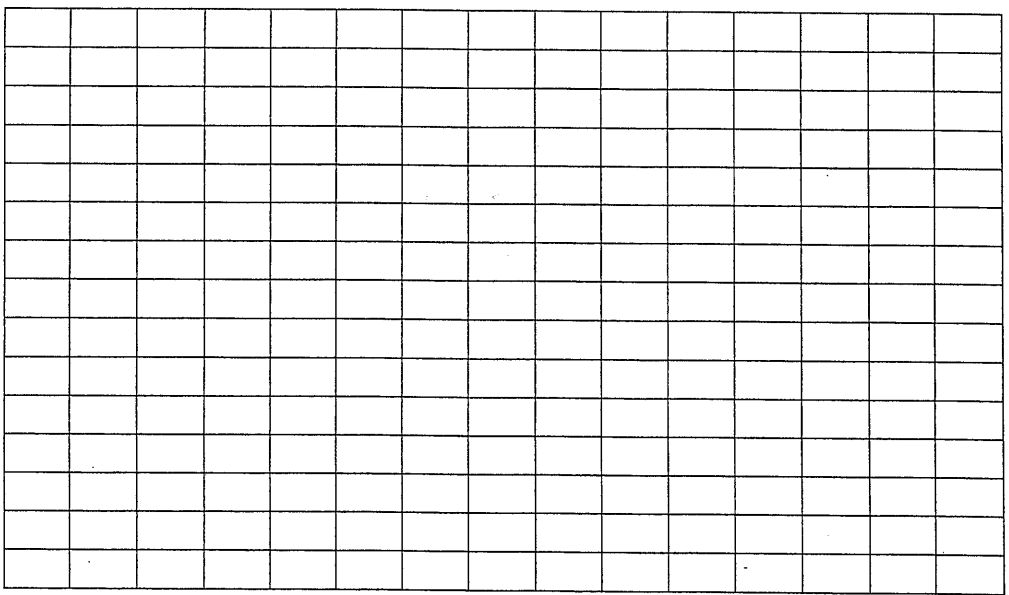
2. How would a beneficial mutation affect original allele frequencies for a particular character?

3. Why is genetic drift more likely to occur in a small population than in a large population?

4. List two limitations of natural selection.

5. On a particular island, birds have a variety of beak sizes. Those with the largest beaks can eat hard seeds, and those with the smallest beaks eat smaller, softer seeds. An environmental change on this island eliminates the plants that produce small, soft seeds. Over time, what will happen to the beak sizes of the birds? Draw a graph to show the pattern of natural selection that is likely to happen on the island. Be sure to label the axes of your graph.

6.



BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 17 SEC 3

1. Why do scientists use more than one definition for *species*?

2. What are the five mechanisms that can cause reproductive isolation of a population?

3. Scientists studied the mating activity of four closely related species of frogs and recorded the peak mating times of each species. Which two species show the greatest amount of divergence in mating activity? Explain your answer.

4. What two forms of evidence show that a new species has formed?

5. If you represented evolution with a diagram of a tree, what part of the tree would represent speciation? How would you represent extinction? Draw Below

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

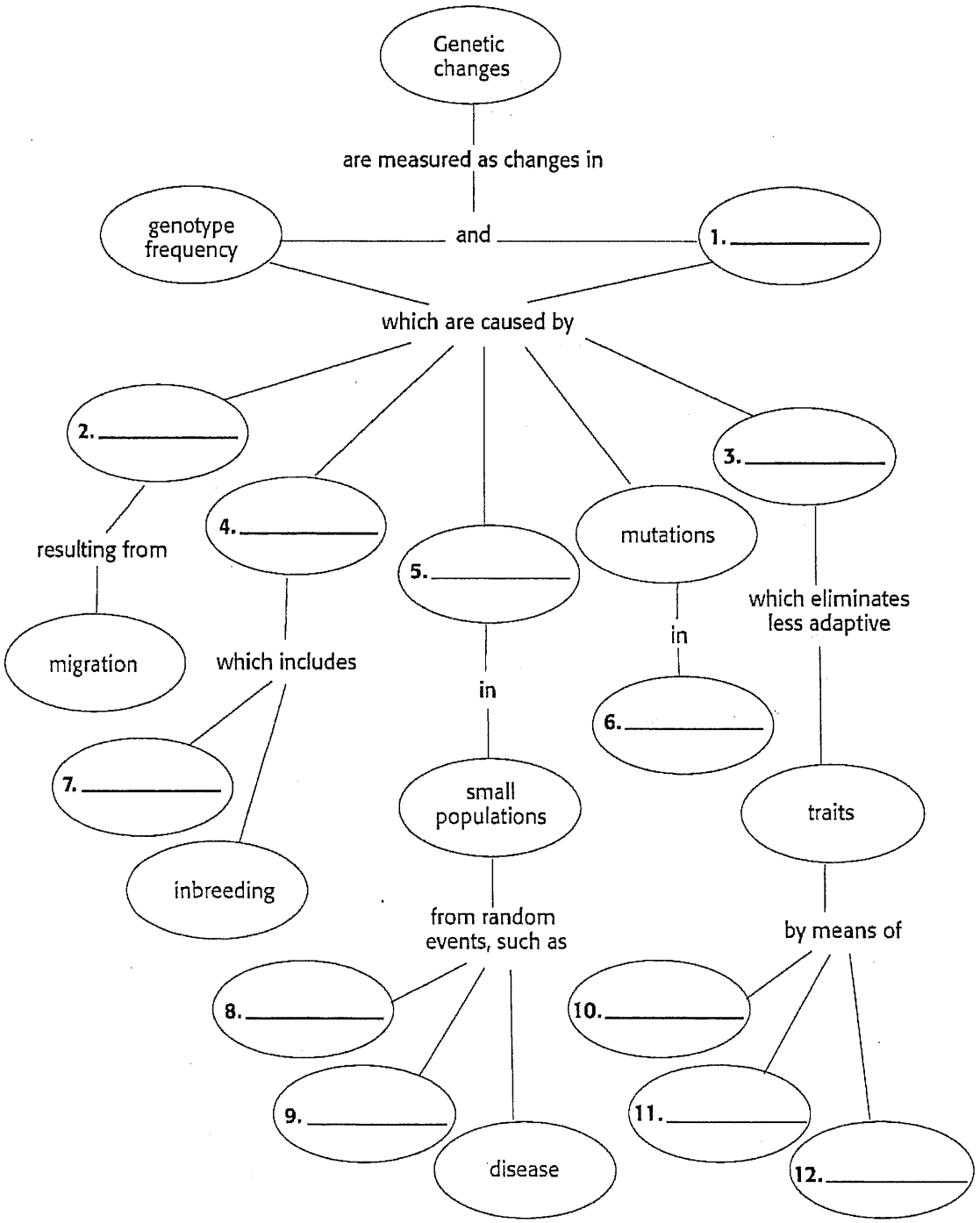
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

Using the terms provided below, complete the concept map showing how genetic changes occur in populations.

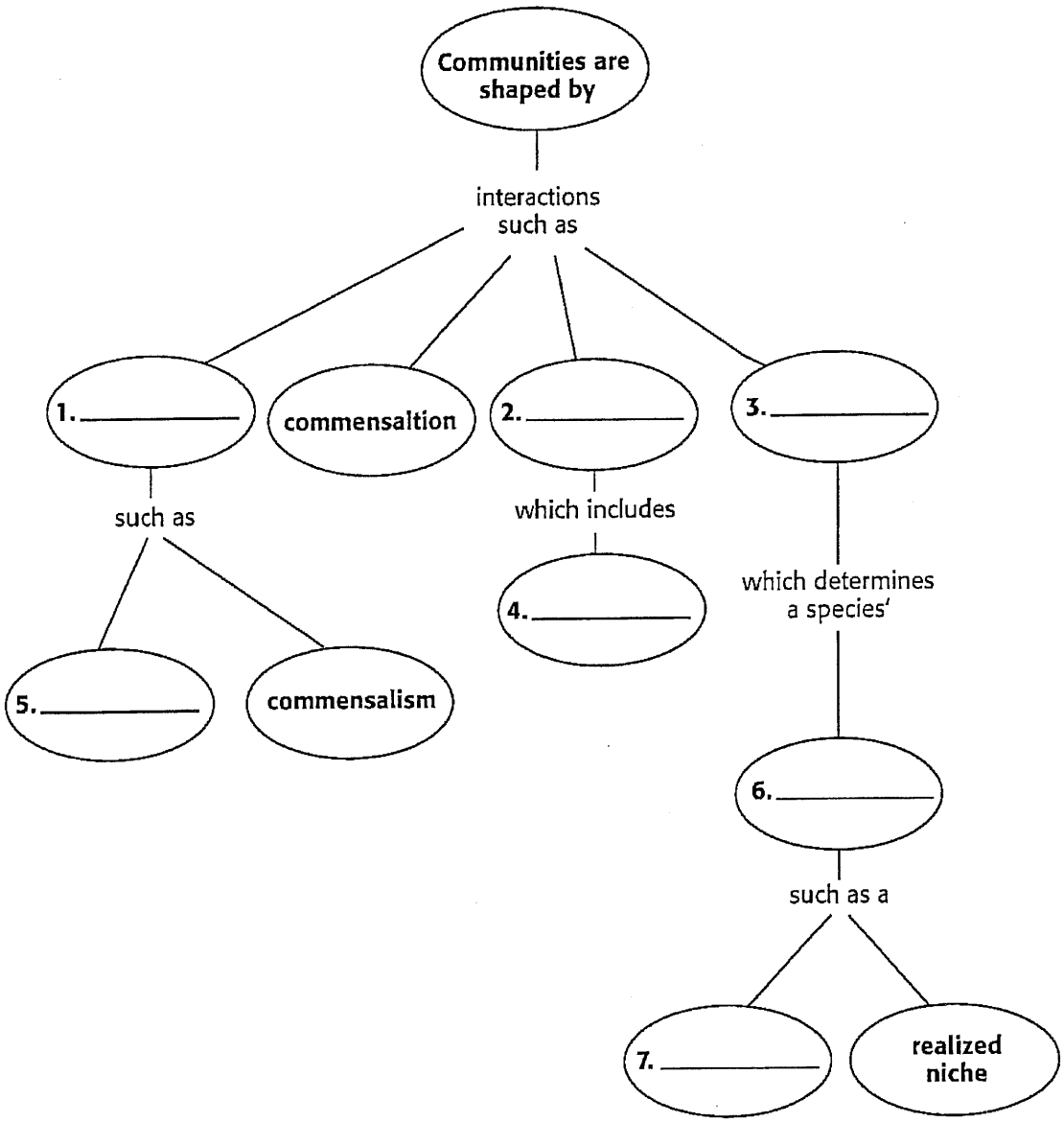
allele frequency	fire	natural selection
directional selection	gene flow	nonrandom mating
disruptive selection	genetic drift	sexual selection
drought	germ cells	stabilizing selection



Concept Mapping

Using the terms provided below, complete the concept map showing the characteristics of biological communities.

competition	niche	symbiosis
fundamental niche	parasitism	
mutualism	predation	



1. Genetic variation and change are measured in terms of the frequency of alleles in the _____ of a population.
2. To study genetic variation, what must be counted or estimated in a population?
3. What is macroevolution?
4. What is microevolution?
5. Population genetics involves the study of _____
6. The sum of allele frequencies for any one characteristic in a population is
7. What condition absolutely must be present in a population before evolution can act upon it?
8. Why are mutations in body cells not a source of genetic variation?
9. What is the Hardy-Weinberg principle?
10. What causes Hardy-Weinberg principle to not be in proportion?
11. What is gene flow?
12. What is homozygous?
13. What is heterozygous?
14. What happens to a population that inbreeds?
15. What is inbreeding?
16. Which is a probable origin of many recessive genetic disorders?
17. In natural selection, what does the selecting?
18. What is directional selection?
19. What is stabilizing selection?
20. What is disruptive selection?
21. What is directional selection?
22. A population of clams lives in a rocky intertidal zone where black lava has flowed into an area of white sand and bleached coral. The clams' shells range in color from white to black with a shade of gray in between. The white clams and the black clams each outnumber the gray clams ten to one. What type of selection is in effect here?
23. According to the biological species concept, any populations that do not share future offspring are _____
24. When a species begins to occupy more than one niche, and divergence and speciation occur as a result, the species is said to have undergone _____
25. Why is accidental polyploidy in an individual considered a form of reproductive isolation?
26. How can geography lead to reproductive isolation?

27. When a species fails to produce any more descendants, it is said to be _____.

28. Under which circumstance could a well-adapted species become poorly adapted?

29. Extinction, like speciation, can be detected only after it is _____.

Natural Selection Lab

Procedures:

1. You will pick an animal to represent your team. Each team will be the lab table (4).
2. Each team will have to "hunt" to capture as many prey as you can in 30 seconds. Each person will go once and have 30 seconds. Once you capture as many "prey" as you can, you must go back to the start line and count the different colored prey.
3. Record the number of prey of each color in the chart below.
4. You will then have a second round representing a second season. You must go "hunting' in the same order as before.
5. Graph the class totals on the graph on the following page

Round 1	green	yellow	Red	blue
Hunter 1				
Hunter 2				
Hunter 3				
Hunter 4				
total				

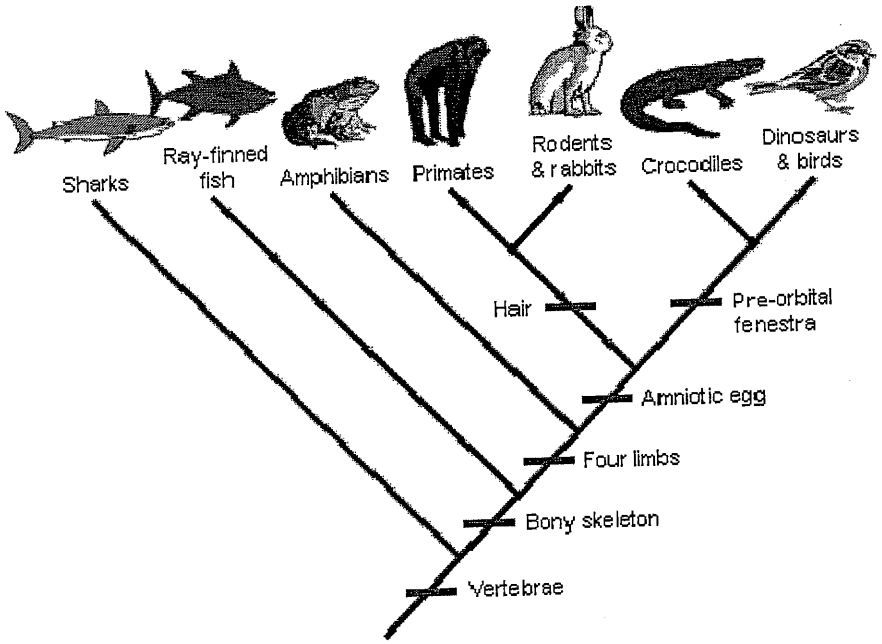
Round 2	green	yellow	Red	blue
Hunter 1				
Hunter 2				
Hunter 3				
Hunter 4				
total				

Round 1	green	yellow	Red	blue
Class totals Hunter 1				
Class totals Hunter 2				
Class totals Hunter 3				
Class totals Hunter 4				
total				

Round 2	green	yellow	Red	blue
Class totals Hunter 1				
Class totals Hunter 2				
Class totals Hunter 3				
Class totals Hunter 4				
total				

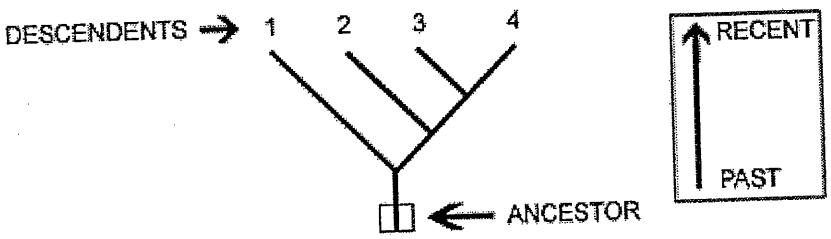
eras

http://www.ucmp.berkeley.edu/exhibits/geologictime.php

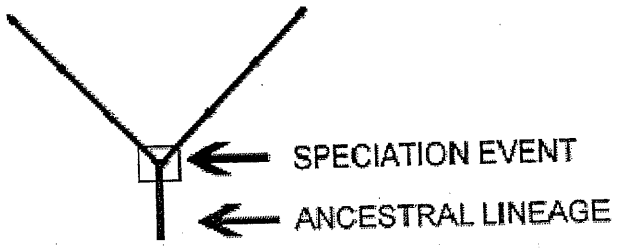


Understanding phylogenies

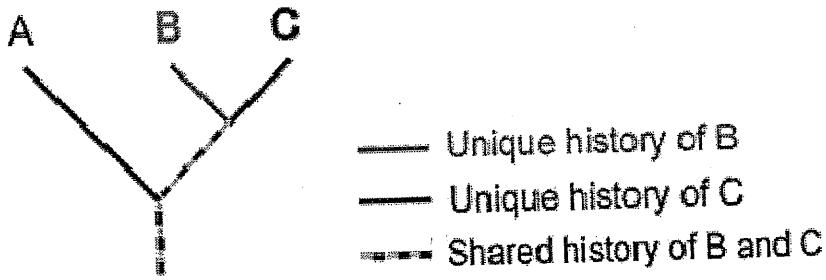
Understanding a phylogeny is a lot like reading a family tree. The root of the tree represents the ancestral lineage, and the tips of the branches represent the descendents of that ancestor. As you move from the root to the tips, you are moving forward in time.



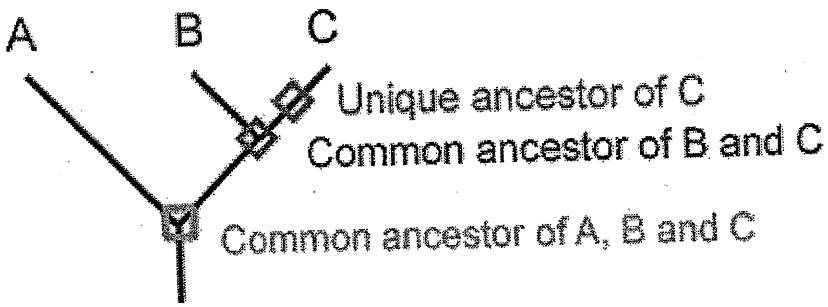
When a lineage splits (speciation), it is represented as branching on a phylogeny. When a speciation event occurs, a single ancestral lineage gives rise to two or more daughter lineages.



Phylogenies trace patterns of shared ancestry between lineages. Each lineage has a part of its history that is unique to it alone and parts that are shared with other lineages.



Similarly, each lineage has ancestors that are unique to that lineage and ancestors that are shared with other lineages — common ancestors.



Understanding phylogenies (2 of 2)

A clade is a grouping that includes a common ancestor and all the descendents (living and extinct) of that ancestor. Using a phylogeny, it is easy to tell if a group of lineages forms a clade. Imagine clipping a single branch off the phylogeny — all of the organisms on that pruned branch make up a clade.

SEXUAL AND HARDY-WEINBURG LAB

Materials

60 index cards with "A" alleles

60 index cards with "a" alleles

Population One (Random)

1. Each student will select 2 cards from the gene pool.
2. Determine the genotype of each student (first generation) and record the data on the Chart. You will write down the frequencies of each allele
3. "Mate" with another student. Decide which one will be offspring 1 and offspring 2 – whichever person has the lower number on their envelope will be offspring 1.
4. When mating, face each other with both allele index cards inside the envelopes. Together, count to three and then pull out one allele from the envelope (don't look at the allele you are taking). The two alleles (one from each student) represent the first offspring.
5. The other set of alleles-one from each student is the second offspring.
6. Exchange the cards with your mate..
7. When I call time,the first generation dies out and one student assumes the genotype of offspring 1, while the other student in each pair assumes the genotype of the second offspring. (Index cards represent genes.).
9. Count the number of each of the possible genotypes (AA, Aa, and aa) that occurred in the second generation and determine the frequency of each of the alleles (A and a).
10. Repeat steps 4-9 until you have the data recorded for at least five generations.
11. Copy the information from the board onto the chart.

Population Two (Selection)

Follow the same procedure as in population one, but conditions are altered so that any offspring that are homozygous recessive "aa" will not survive and must be replaced (Go to the gene pool and pick 2 more cards). Only "AA" and "Aa" individuals will occur in generation two and higher. Repeat steps four through nine until data is recorded for at least five generations.

Answer the questions and graph the number of alleles in each heneration for population 1 and 2.

1. What conditions make the Hardy-Weinberg not valid (wrong)?

   _____

   _____

   _____

2. Does this activity give accurate data for the Hardy Weinberg principle? Why or why not?

   _____

   _____

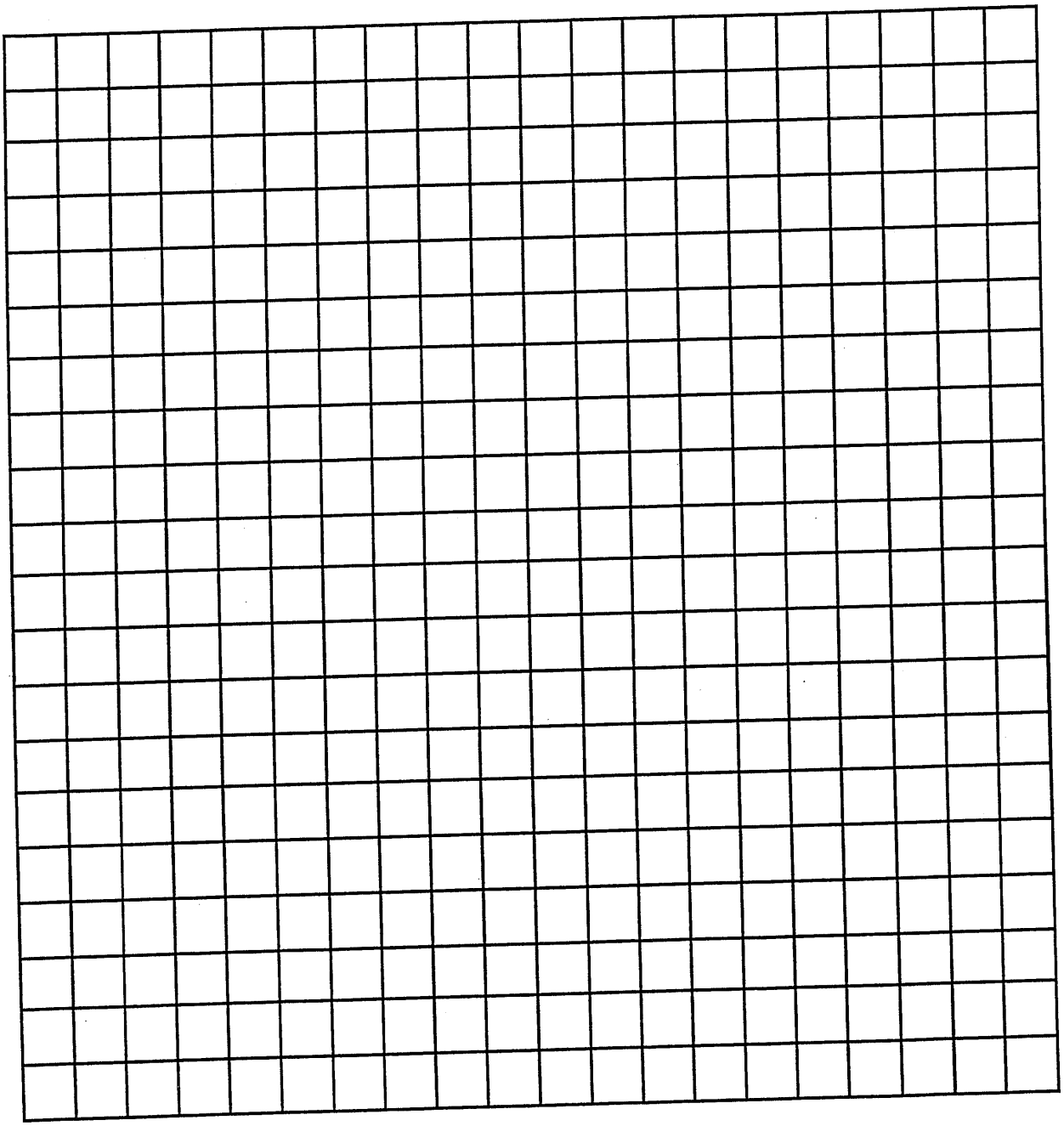
   _____

3. You will graph the information on the following chart and type a 2 paragraph summary to submit as your lab report. Name must be included and graph must be created using a ruler or you will receive a zero.

Hardy-Weinberg Lab

Round1	AA	Aa	aa
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Totals			

Round2	AA	Aa	aa
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Totals			



Name _____ Class _____ Date _____

Genetic Drift

OBJECTIVES

- **Investigate** the effect of population size on genetic drift.
- **Analyze** the mathematics of the Hardy-Weinberg principle.

MATERIALS

- buttons, blue (10 to 100)
- buttons, red (10 to 100)
- buttons, white (10 to 100)
- jar or beaker, large, plastic

Preparation

1. **Scientific Methods** **State the Problem** How does population size affect allele frequencies? Read the procedure to see how you will test this.
2. **Scientific Methods** **Form a Hypothesis** For a hypothesis that predicts the results of this procedure for three different population sizes.

_____

_____

Procedure

1. Prepare to model the populations. First, assign each color button to one of the alleles (I^A, I^B, or i) of the ABO blood types. Notice how each possible pairing of alleles matches one of the four types (A, B, AB, or O). Then choose three different population sizes. Also choose one ratio of alleles at which to start all three populations (for example, I^A: I^B: i = 2: 2: 1). Create tables for your data.
2. Represent the first population's alleles by placing the appropriate number of blue, red, and white buttons in a jar.
3. Randomly select two buttons from the jar to represent one person. Record this person's genotype and phenotype. Tally the total number of each allele within this generation.
4. Repeat step 3 until you have modeled the appropriate number of people in the population. Place the buttons back into the jar.
5. Empty the jar. Refill it with the number and color of buttons that matches the tallies recorded in step 4.
6. Repeat steps 3 through 5 until you have modeled four generations.

Name _____ Date _____ Class _____

Classic
Lab

Could you beat natural selection?

Natural selection uses the principle of survival of the fittest. Fitness is often defined as the suitability of an organism to a given environment. It might be the case, however, that a certain set of features or characteristics that are favorable to an organism in one environment might prove to be unfavorable in a different environment. In some cases it might be true that altering the environment of an organism might decrease its chances of survival. In this lab, you will learn more about natural selection and survival of the fittest by deciding which characteristics are more favorable for survival in a variety of environments.

Objectives

- Locate organisms (represented by chips) in the natural environment of the classroom.
- Make a prediction about survivability of two sets of organisms.
- Simulate predator/prey relationships.
- Complete data tables.
- Graph results.

Materials

Part A

clear plastic chips
plastic chips in three additional colors
graph paper
colored pencils
calculator

Part B

one page of newspaper apartment rentals or stock quotes
sheet of plain paper, the same size as the newspaper
envelope of paper circles representing prey
forceps or pencil with eraser
stopwatch or watch with second hand
calculator

Procedure

Part A. Predator/Prey Relationships

1. Read and complete the lab safety form.
2. There are 100 plastic chips hidden around the room. You will have 3 min to search for them. Gather the ones that you find, and note the locations where they were found.
3. Stop after 3 min and count the number of chips that you found.
4. Work with your classmates to tabulate the total number of chips found by the class.
5. Complete **Table 1** showing the following information: original number of chips, color of chips, number of chips found by you, location found, number found by the rest of the class.
6. Use the graph paper to graph the results of the class with your data. In a bar graph, plot your data in one color and the class data in another.

Part B. Camouflage

1. Work with a partner. Decide which partner will be the predator and which will work with the prey (the "prey manager"). You must keep these roles throughout the exercise.
2. The predator hunts at twilight and in the early evening. The prey are the newsprint circles and the plain circles. These two sets of circles live in two different environments—newsprint paper and plain paper. The predator does not prefer one kind of circle over the other and simply feeds on any circles it come across.
3. With your partner, come up with a prediction explaining how the newsprint circle and the plain circle will be consumed or conserved. Write your prediction in the appropriate spot in the *Data and Observations* section.
4. The predator should wait in the hallway until called in by the prey manager.
5. **Figure 1** The prey manager should distribute both sets of circles randomly over the printed sheet of paper. This person needs to ensure that the circles are not piled up on each other and that they are distributed evenly over the paper.
6. When the prey has been distributed, the prey manager should bring in the predator. The predator should look at the paper and, using forceps or a pencil eraser, count how many circles of each type he or she can pick up in the span of 10 s. The prey manager should keep time.
7. After 10 s have passed, the predator should call out the number of newsprint circles and plain circles he or she picked up, and the prey manager should record these numbers in **Table 2.**
8. **Figure 2** The team should prepare for a second feeding. This time the predator should cover his or her eyes while the prey manager places both sets of circles on the plain paper. Again, count the number of circles the predator picks over the span of 10 s.
9. Repeat steps 4–8 two more times. Between each pair of trials, have the predator return to the hallway.
10. When the trials are finished, return the prey to the envelope and return all the supplies to your teacher.

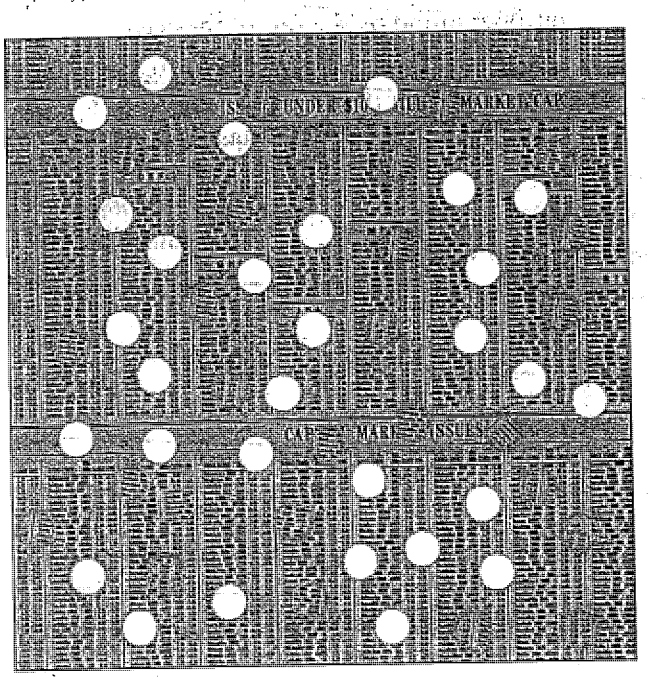


Figure 1

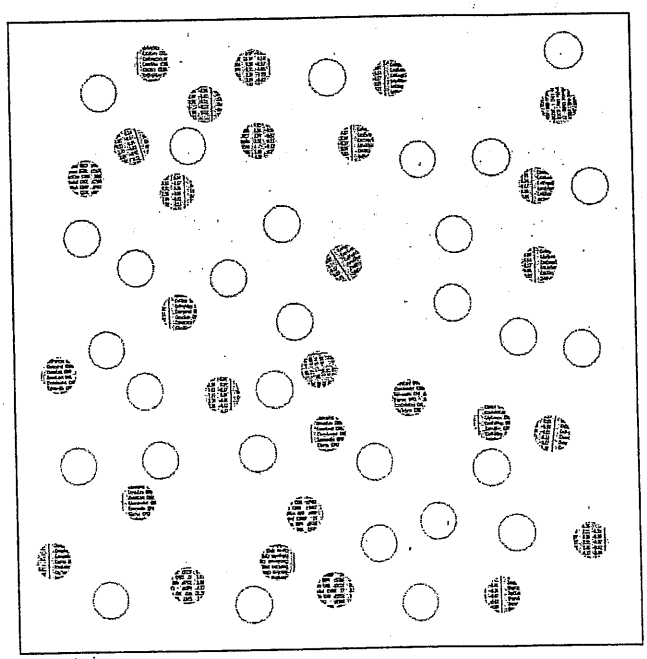


Figure 2

Name _____ Date _____ Class _____

Classic **Lab 17, Could you beat natural selection?** continued

Data and Observations

Table 1

Chips Data					
Chip	Original Number	Number Found by Me	Total Number Found	Number Left	Percentage of Chips Left
Clear					
Red					
Yellow					
Blue					

Prediction for Part B:

_____

_____

Table 2

Circles Data				
	Plain Background		Newspaper Background	
	Plain Circles	Newsprint Circles	Plain Circles	Newsprint Circles
Total population				
	Number of Plain Circles Consumed	Number of Newsprint Circles Consumed	Number of Plain Circles Consumed	Number of Newsprint Circles Consumed
Trial 1				
Trial 2				
Trial 3				
Team average				
Percentage of circles that died				
Percentage of circles that survived				

Analyze and Conclude

1. Which of the four kinds of chips were most easily found?

2. Chips of which color were most difficult to find?

3. What environmental factors in the room allowed some protection for the chips?

4. Analyze which characteristics were favorable for these organisms and which characteristics made their survival less likely? Explain your answers.

5. For Part B, how do the phenotypes of each species of circle affect the survival of the organisms?

6. **Error Analysis** What are some possible sources of error in your experiment?

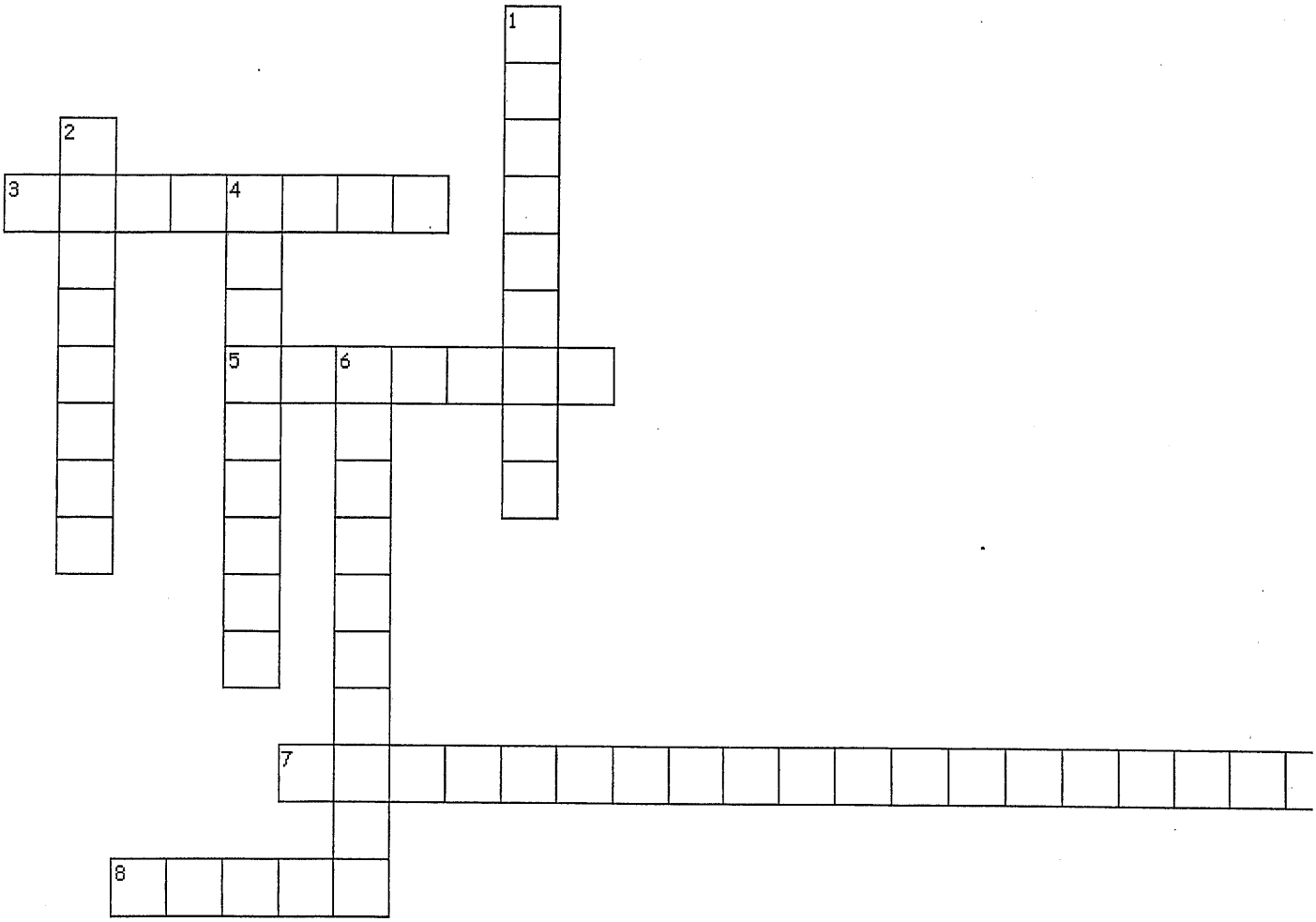
7. After completing Part B of the laboratory, what can you conclude about the role of an organism's surroundings on its survival? Was this demonstrated by your experiences in Part A?

Inquiry Extensions

1. This lab has shown a relationship between coloration and natural selection. What organisms use camouflage to increase their chances of survival? Create an electronic slide show to demonstrate and explain how these adaptations benefit the organism.
2. What other phenotypes (outward appearances) or physical characteristics contribute to an organism's survival? Given what you know about trends in environmental conditions, write a description of an adaptive characteristic that would benefit, during the next 100 years, an existing species that you encounter near your home.

Ch 18 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the back



Across

3. extremely small, single-celled organisms that usually have a cell wall and that usually reproduce by cell division; members of the domain Bacteria
5. prokaryotes that are distinguished from other prokaryotes by differences in their genetics and in the makeup of their cell wall; members of the domain Archaea
7. a system for giving each organism a two-word scientific name that consists of the genus name followed by the species name
8. the level of classification that comes after family and that contains similar species

Down

1. the evolutionary history of a species or taxonomic group
2. the science of describing, naming, and classifying organisms
4. an organism made up of cells that have a nucleus enclosed by a membrane, multiple chromosomes, and a mitotic cycle; members of the domain Eukarya
6. a phylogenetic classification system that uses shared derived characters and ancestry as the sole criterion for grouping taxa

taxonomy	
genus	
binomial nomenclature	
phylogeny	
cladistics	
bacteria	
archaea	
eukaryote	
taxonomy	
genus	
binomial nomenclature	
phylogeny	
cladistics	
bacteria	
archaea	
eukaryote	

Chapter 18 Classification

I. THE NEED FOR SYSTEMS- Biologists use taxonomic systems to organize their knowledge of organisms. These systems attempt to provide consistent ways to name and categorize organisms.

A. The practice of naming and classifying organisms is called _____. Taxonomic systems do not use common names, which may be confusing because they are different in different places.

B. Taxonomic systems use categories to organize organisms.

C. The general term for any one of these categories is a _____ (plural, _____).

II. SCIENTIFIC NOMENCLATURE-All scientific names for species are made up of two Latin or Latin-like terms. A simpler and more consistent system was developed by Swedish biologist Carl _____ in the 1750s.

III. Naming Rules

A. Linnaeus' unique, two-part name for a species is now called a scientific name.

B. No two species can have the same scientific name.

C. When you write the scientific name, the genus name should be _____ and the species identifier should be _____. Both terms should be _____. Ex- *Homo sapiens*

IV. THE LINNAEAN SYSTEM-The eight basic levels of modern classification are _____PHYLOGENETICS- _____ is the ancestral relationships between species.

A. Not all similar characteristics are inherited from a common ancestor. Consider the wings of an insect and the wings of a bird.

B. Through the process of convergent evolution, similarities may evolve in groups that are not closely related.

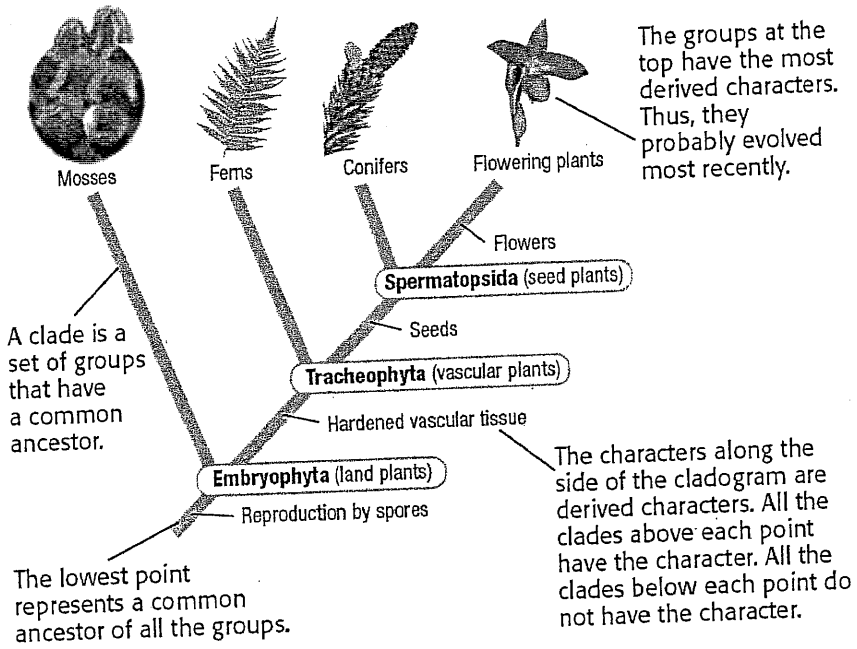
1. Similar features may evolve because the groups have adopted similar _____ or lifestyles.
2. Similarities that arise through _____ evolution are called analogous characters.

V. CLADISTICS- Cladistic analysis is used to select the most likely phylogeny among a given set of organisms.

A. _____ focuses on finding characters that are shared between different groups because of shared ancestry.

B. Cladistics infers relatedness by identifying shared derived and ancestral characters among groups, while avoiding analogous characters.

1. A _____ character is defined as ancestral if it is thought to have evolved in a common ancestor of both groups.
2. A _____ character is one that evolved in one group but not the other.
3. All groups that arise from one point on a cladogram belong to a _____
4. A clade is a set of groups that are related by descent from a single ancestral lineage.
5. Each clade is usually compared with an outgroup, or group that lacks some of the shared characteristics.



VI. INFERRING EVOLUTIONARY RELATEDNESS-

A. Morphological Evidence- _____ refers to the physical structure or anatomy of organisms. An important part of morphology in multicellular species is the pattern of development from embryo to adult.

B. Molecular Evidence- Scientists can now use genetic information to infer phylogenies. Genetic sequence data are now used widely for cladistic analysis.

C. Evidence of Order and Time

1. Cladistics can determine only the relative order of divergence, or branching, in a phylogenetic tree.
2. The fossil record can often be used to infer the actual time when a group may have begun to "branch off."
3. DNA mutations occur at relatively constant rates, so they can be used as an approximate "genetic clock."
4. Scientists can measure the genetic differences between taxa and estimate time of divergence.

VII. THE THREE-DOMAIN SYSTEM-TMajor taxa are defined by major characteristics, including:

A. Cell Type: prokaryotic or eukaryotic

B. Cell Walls: absent or present

C. Body Type: unicellular or multicellular– Nutrition: autotroph (makes own food) or heterotroph (gets nutrients from other organisms)

D. Genetics: Related groups of organisms will also have similar genetic material and systems of genetic expression. Organisms may have a unique system of DNA, RNA, and proteins.

VIII. _____

A. Bacteria are prokaryotes that have a strong exterior wall and a unique genetic system.

B. All bacteria are similar in structure, with no organelles

C. Bacteria are the most abundant organisms on Earth and are found in every environment.

IX. _____

A. Archaea have a chemically unique cell wall and membranes and a unique genetic system.

B. Scientists think that archaea evolved in a separate lineage from bacteria early in Earth's history.

X. _____

A. Eukaryotes are organisms composed of eukaryotic cells.

B. All eukaryotes have cells with a nucleus and other internal compartments.

C. Also, true multicellularity and sexual reproduction only occur in eukaryotes. – True multicellularity means that the activities of individual cells are coordinated and cells themselves are in contact.

XI. KINGDOMS OF EUKARYA

A. Kingdom Plantae

1. Almost all plants are autotrophs that produce their own food by absorbing energy and raw materials from the environment. The process that makes food, photosynthesis, occurs in chloroplasts.
2. The plant cell wall is made of a rigid material called cellulose.
3. Sexual reproduction is an important part of the life cycle of most eukaryotes.

B. Kingdom Animalia

1. Animals are multicellular heterotrophs.

2. Animal cells lack a rigid cell wall.

C. Kingdom Fungi

1. Fungi are heterotrophs that are mostly multicellular.
2. Their cell wall is made of a rigid material called chitin.
3. Fungi are considered to be more closely related to animals than to any other kingdom.

D. Kingdom Protista

1. Kingdom Protista is a "leftover" taxon, so it is a diverse group.
2. Any single-celled eukaryote that is not a plant, animal, or fungi can be called a protist.
3. Protists did not descend from a single common ancestor.
4. For many years, biologists recognized four major groups of protists:
   a) *flagellates,*
   b) *amoebas,*
   c) *algae*
   d) *parasitic protists.*

HOMEWORK DATE DUE_____

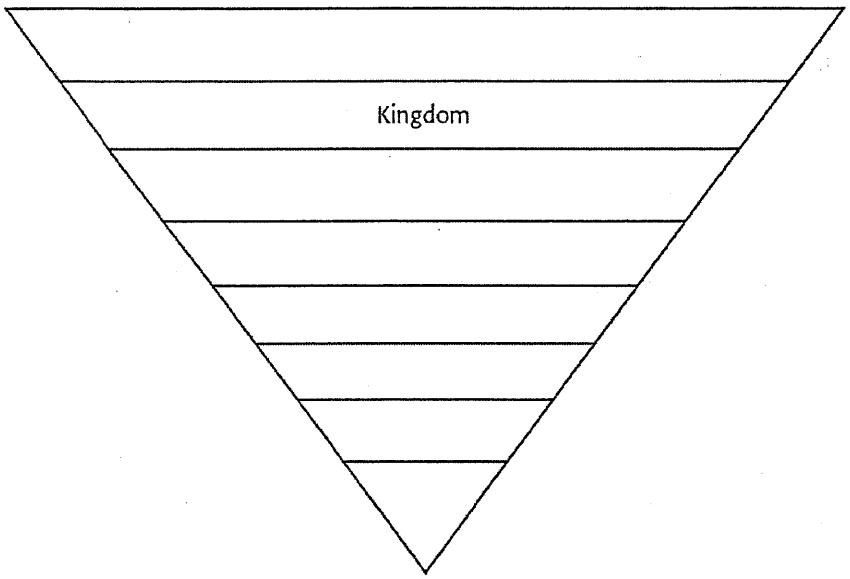
CH 18 SEC 1

1. What are two reasons common names for species can be confusing?

   _____

   _____

2. Complete the hierarchy below to show the eight levels of classification in the Linnaean system. Start at the top with the most general level.



3. Circle the cheetah's correctly written scientific name.

   Acinonyx jubatus *Acinonyx jubatus*

   Acinonyx Jubatus *acinonyx jubatus*

4. If two organisms are classified in the same order, what other levels of classification do they share?

   _____

   _____

5. Are there more phyla or genera on Earth? Explain your answer.

   _____

   _____

   _____

   _____

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

_____

ANSWER_____

_____

_____

_____

HOMEWORK DATE DUE_____

CH 18 SEC 2

1. What are two reasons grouping organisms by similar structures and features can be a problem?

2. List three sources of evidence that scientists use to construct cladograms.

3. Many scientists who study dinosaurs have stated that dinosaurs are not extinct. Explain this view.

4. Use the information in the table to draw a cladogram that represents a possible phylogeny for a house cat. In your cladogram, be sure to include the derived characters.

Animal	Four legs	Internal fertilization	Hair
Salmon	no	no	no
Frog	yes	no	no
Lizard	yes	yes	no
House cat	yes	yes	yes

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

ANSWER_____

HOMEWORK DATE DUE_____

CH 18 SEC 3

1. What are the six kingdoms scientists use today to classify all organisms?

2. Which two domains are made up of prokaryotes?

3. Which domain contains multicellular organisms?

4. What is an *extremophile*? Which domain contains extremophiles?

5. Why do systems of classification change?

6. Into which kingdom would you classify a unicellular organism that has a nucleus but no cell wall? Explain your answer.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

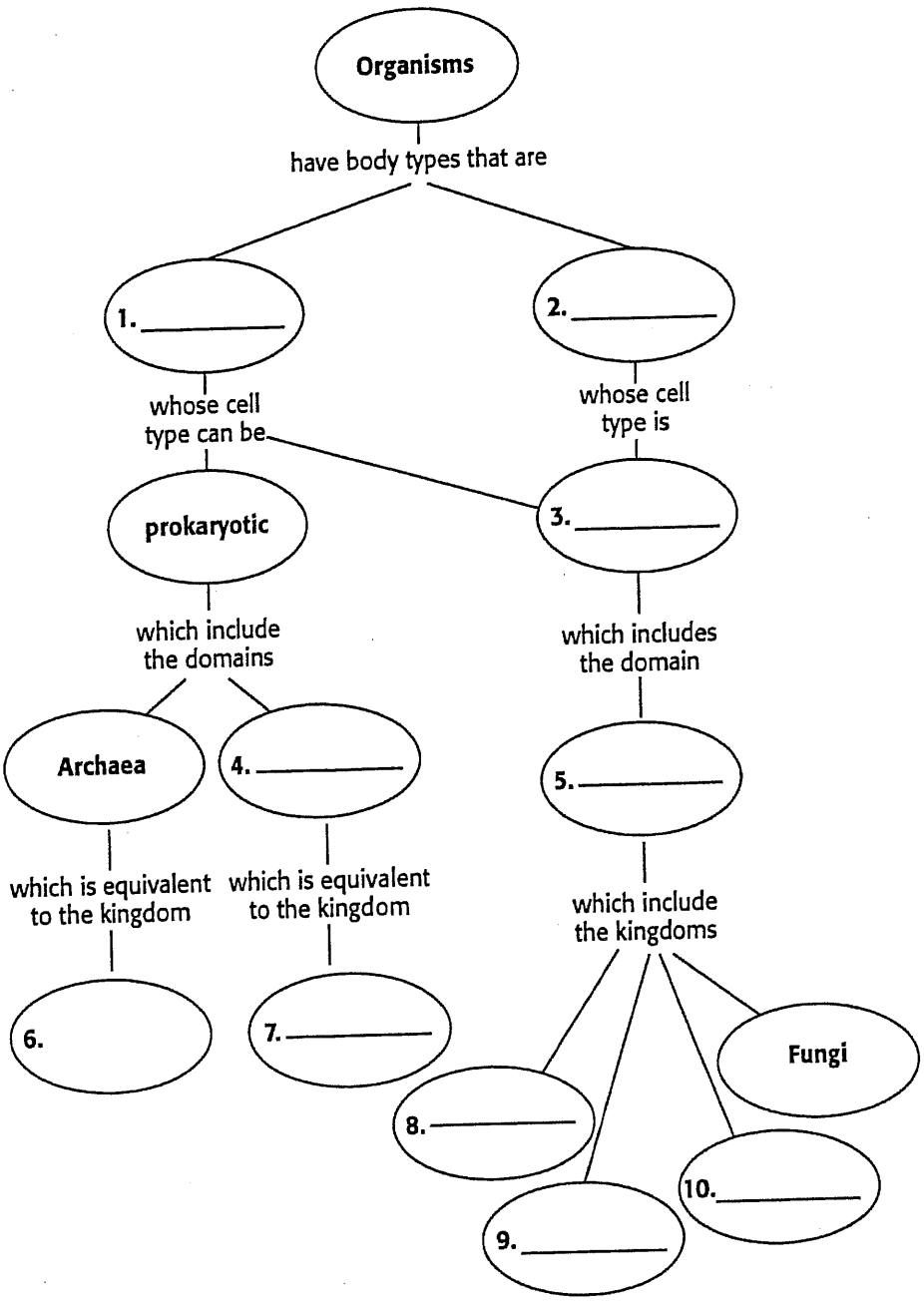
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

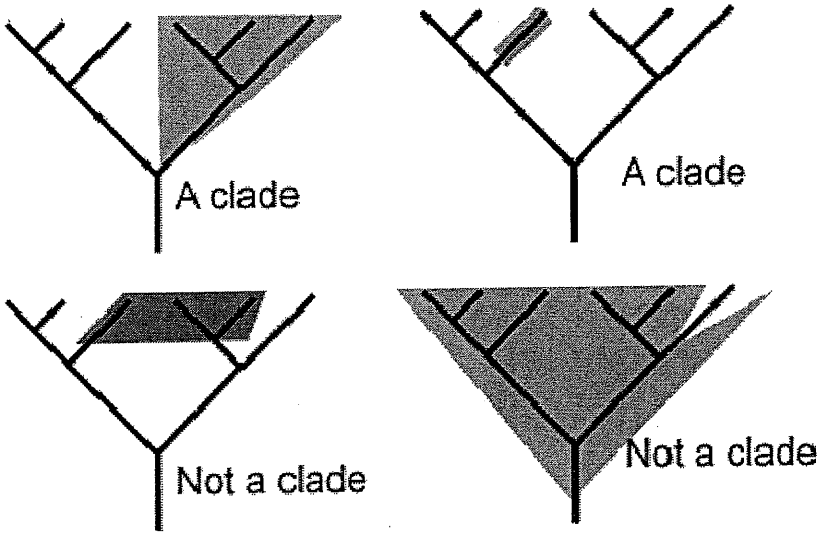
Using the terms provided below, complete the concept map that shows the classification of organisms.

Animalia	Bacteria	eukaryotic	Protista
Archaebacteria	Eubacteria	multicellular	unicellular
Eukarya	Plantae		

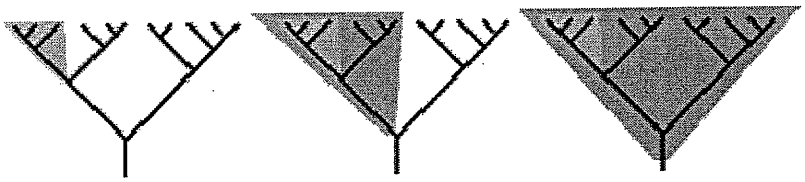


Chapter 18 Review

1. Which two kingdoms contain both unicellular and multicellular organisms?
2. Which two kingdoms contain both unicellular and multicellular organisms?
3. What is the difference between plants and animals?
4. Write the correct order of classification levels.
5. What charecteristics are used to differentiate kingdoms?
6. Which kingdoms include eukaryotes? Which kingdoms include prokaryotes?
7. The kingdoms Eubacteria and Archaebacteria were once grouped in a kingdom called _____. What do they have in common?
8. What are derived characters? Would you expect to see them in closely related organisms?
9. What is a cladogram?
10. What is a phylogenetic tree? A cladogram? What is the difference between the two?
11. Convergent evolution produces analogous characters in different species as the result of _____
12. What is convergent evolution? What are analogous characters? Homologous characters?
13. What is an analogous structure?
14. Placement in each level of classification is based on what type of characteristics?
15. What is the highest level of classification? In other words, what is the largest division a group of organisms can belong to?
16. What are plants and animals sorted into groups based on?
17. In linnean system, what identifies a unique organism?
18. What is binomial nomenclature? Who invented it?
19. What is taxonomy?

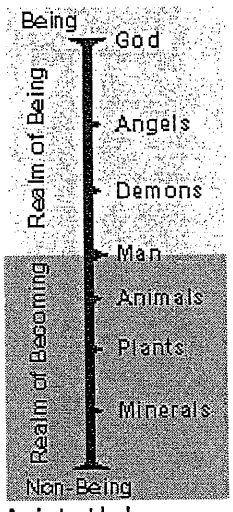


Clades are nested within one another — they form a nested hierarchy. A clade may include many thousands of species or just a few. Some examples of clades at different levels are marked on the phylogenies below. Notice how clades are nested within larger clades.



So far, we've said that the tips of a phylogeny represent descendent lineages. Depending on how many branches of the tree you are including however, the descendents at the tips might be different populations of a species, different species, or different clades, each composed of many species.

Trees, not ladders



Aristotle's

System lab

Often, more than one way exists to organize or group things. In this lab, you will work with others to decide on a system.

Procedure

1. Work with lab partner. Examine the assortment of objects in the bucket
2. Sort your objects into groups of "related" objects. Try to get every object into a group with at least one other object.
3. Choose a name for each group and draw your tree on the next page
4. Choose one object from your collection, and trade it for an object from another pair of students.
5. Try to fit the new object into one of your groups.

Analysis

1. **List** and define each of your group names from step 3.

2. **Describe** how you classified the new object in step 4.

3. **Predict** whether another person would be able to "correctly" classify one of your objects by using your list of groups. Explain your reasoning.

4. **Draw** a classification tree with each of the objects including the names of your cateogories on the next page.

D. [illegible]

Dichotomous Keys

OBJECTIVES

- **Identify** objects by using a dichotomous key.
- **Design** a dichotomous key for a group of objects.

MATERIALS

- objects, common (6 to 10)
- labels, adhesive
- pencil

Procedure

USE A DICHOTOMOUS KEY

1. Work with a small group. Use the dichotomous key below to identify the leaves shown on p. 438 of your textbook. Identify one leaf at a time. Always start with the first 2 statements (1a and 1b). Follow the direction beside the statement that describes the leaf.
2. Proceed through the key until you get to the name of a tree. Record your answer for each leaf shown on the following sheet.

Key to Forest Trees		
1a	Leaf edge is smooth or barely curved.	go to 2
1b	Leaf edge has teeth, waves, or lobes.	go to 3
2a	Leaf has a sharp bristle at its tip.	shingle oak
2b	Leaf has no bristle at its tip.	go to 4
3a	Leaf edge has small, shallow teeth.	Lombardy poplar
3b	Leaf edge has deep waves or lobes.	go to 5
4a	Leaf is heart shaped.	eastern redbud
4b	Leaf is not heart shaped	live oak
5a	Leaf edge has more than 20 large lobes.	English oak
5b	Leaf edge has more than 20 waves.	chestnut oak

A	
B	
C	
D	
E	
F	

DESIGN A DICHOTOMOUS KEY

3. Chose 6 to 10 objects from around the classroom or from a collection supplied by your teacher.
4. Study the structure and organization of the dichotomous key, which includes pairs of contrasting descriptions that form a "tree" of possibilities. Use this key as a model for the next step.
5. Work with the members of your group to design a new dichotomous key for the objects that your group selected. Be sure that each part of the key leads to either a definite identification of an object or another set of possibilities. Be sure that every object is included.
6. Test your key using each one of the objects in your collection.

EXCHANGE AND TEST KEYS

7. After each group has completed the steps above, exchange your key and your collection of objects with another group. Use the key you receive to identify each of the new objects. If the new key does not work, return it to the group so corrections can be made.

CLEANUP

8. Clean up your work area and return or dispose of materials as directed by your teacher. Wash your hands thoroughly before you leave the lab and after you finish all of your work.

Analyze and Conclude

1. **Draw** your own dichotomous key on the last page for the objects you were provided
2. **Scientific Methods** **Critiquing Procedures** What other characteristics might be used to identify leaves by using a dichotomous key?

_____

_____

3. **Analyzing Results** What challenges did your group face while making your dichotomous key?

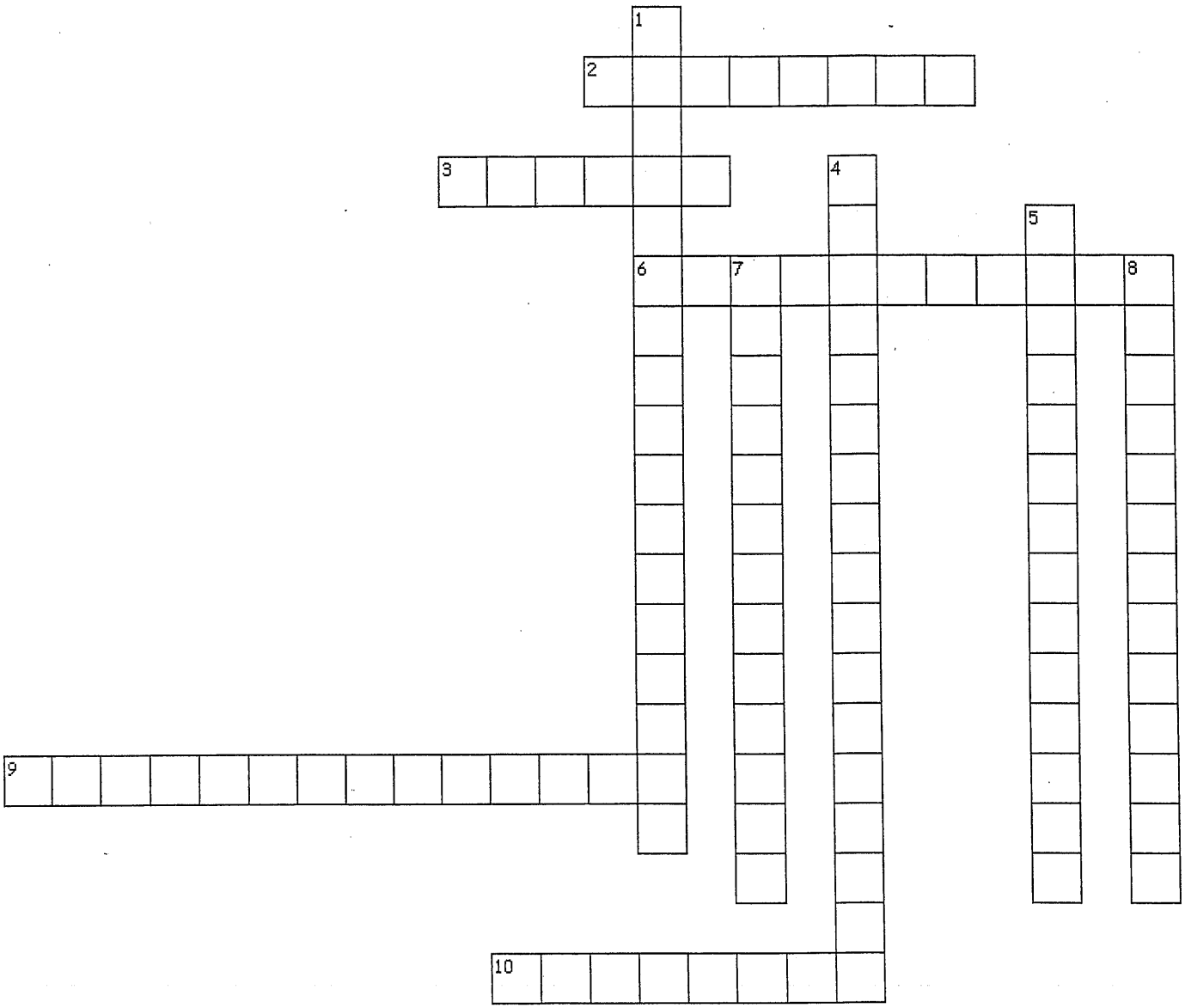
4. **Evaluating Results** Were you able to use another group's key to identify the group's collection of objects? Describe your experience.

5. **Scientific Methods** **Analyzing Methods** Does a dichotomous key begin with general descriptions and then proceed to more specific descriptions, or vice versa? Explain your answer by using examples.

6. **Scientific Methods** **Evaluating Methods** Is a dichotomous key the same as the Linnaean classification system? Explain your answer.

	DESCRIPTION	GO TO
1A		
1B		
2A		
2B		
3A		
3B		
4A		
4B		
5A		
5B		
6A		
6B		
7A		
7B		
8A		
8B		
9A		
9B		
10A		
10B		
11A		
11B		
12A		
12B		
13A		
13B		

Ch 19 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard for each term with the word on one side and the definition on the back



Across

2. the time required for half of a sample of a radioactive substance to decay
3. record the history of life in the geologic past as indicated by the traces or remains of living things
6. a hollow microscopic spherical structure that is usually composed of proteins or a synthetic polymer
9. an episode during which large numbers of species become extinct
10. a type of RNA that can act as an enzyme

Down

1. a method of determining the absolute age of an object by comparing the relative percentages of a radioactive (parent) isotope and a stable (daughter) isotope
4. the standard method used to divide Earth's long natural history into manageable parts
5. a method of determining whether an event or object, such as a fossil, is older or younger than other events or objects
7. bacteria that carry out photosynthesis; blue-green algae
8. a mutually beneficial relationship in which one organism lives within another

microsphere	
ribozyme	
fossil record	
relative dating	
radiometric dating	
half life	
geologic time scale	
mass extinction	
cyanobacteria	

Chapter 19 History of Life on Earth

I. LIFE'S BUILDING BLOCKS-Among the hypotheses that address the origin of life, one states that early biological molecules formed close to _____. Organic molecules may also have arrived on early Earth on meteorites.

A. Hydrothermal Vents-The heat from hydrothermal vents could have provided energy for chemical reactions. Within the sea, biological molecules would have been protected from harmful solar radiation.

B. Space-Some _____ contain amino acids. Such molecules could have arrived on early Earth, when frequent meteorite impacts were common.

II. THE FIRST CELLS- Many scientists think that the formation of _____ may have been the first step toward cellular organization.

A. Forming a Cell – When studying the behavior of organic molecules in water, scientists have observed that lipids tend to combine in water. Certain lipids, when combined with other molecules, can form a tiny droplet that has a surface that resembles a _____.

B. Further research has shown that short chains of amino acids can form tiny spherical structures called _____. Microspheres could not be considered cells unless they had the characteristic of heredity.

Event	Description
Evolution of prokaryotes	The oldest known fossils are of prokaryotes. They are more than 3.5 billion years old. Scientists think that some of the first prokaryotes were marine cyanobacteria (singular, **cyanobacterium**), which could carry out photosynthesis.
Formation of oxygen	Oxygen gas was rare in Earth's early atmosphere. By about 2.4 billion years ago, cyanobacteria had begun to add oxygen to the atmosphere by carrying out photosynthesis.
Formation of the ozone layer	As the amount of oxygen in Earth's atmosphere increased, the ozone layer began to form. The ozone layer protected early organisms from ultraviolet rays in sunlight. As a result, organisms were eventually able to survive on land.

III. Origin of Heredity - Scientists have studied the origins of heredity by studying the formation of proteins. In the laboratory, scientists have _____ been able to make proteins or DNA form spontaneously in water. They have been able to form short chains of RNA, the nucleic acid that helps to carry out the instructions of DNA.

A. RNA molecules may have been the first self-replicating molecule.

B. –RNA can form spontaneously in water without DNA.

C. -RNA was the first self-replicating molecule that stored information and catalyzed the formation of the first proteins.

IV. THE FOSSIL RECORD-Both the _____ distribution of organisms and when they lived on Earth can be inferred from the fossil record.

A. These fossils form when organisms or traces of organisms are rapidly buried in fine _____ that are deposited by water, wind, or volcanic eruptions.
B. Many species have lived in environments where fossils _____.

V. ANALYZING FOSSIL EVIDENCE-In order to analyze fossil evidence, paleontologists use both relative and absolute dating methods to date fossils.

A. According to the law of superposition, _____ strata are covered by _____ strata.
B. Types of Fossils

1. _____ fossils are the most common types of fossils.
2. In some cases, an organism breaks down, leaving a hollow space called a _____
3. This mold may fill with minerals, preserving the shape of the organism.
4. In rare cases, fossils are preserved in hardened plant sap, or _____. In these fossils, soft parts of tissue are preserved in detail.

VI. Relative Age- A process called relative dating is used to estimate the ages of fossils found within strata. Relative dating _____ reveal a _____. But it can reveal the _____ that strata and the fossils within them were laid down over time. Paleontologists organize fossils into a sequence based on the relative age of the strata in which the fossil was found.

A. An _____ fossil is a fossil of an organism that was common and had widespread geographic distribution during a certain time in Earth's history.
B. _____ fossils are used to estimate the age of other strata that contain the same type of fossil.
C. Scientists have compared patterns of strata and index fossils within them to make the geologic time scale.

VII. Absolute Age- A method called _____ _____ estimates the age in years of an object by measuring certain _____ isotopes that the object contains.

A. An _____ is a form of an element whose atomic mass differs from that of other atoms of the same element.
B. Radioactive isotopes, or _____, are unstable isotopes that break down and give off energy in the form of charged particles, or radiation. This breakdown is called _____ _____
C. The time required for half of a sample of parent radioisotope to decay into a daughter isotope is the isotope's half-life. Each radioisotope has a specific _____.
D. The rate at which a radioisotope _____ is not affected by external factors.
E. By comparing the amounts of certain radioisotopes and their daughter isotopes, scientists can calculate how many half-lives have passed since a material formed. – One radioisotope that is widely used to date organic materials is carbon-14. The half-life of carbon-14 is relatively short—_____.
F. _____ is used to measure the age of carbon-containing materials that are younger than 75,000 years old.
G. To find the age of older materials, scientists must measure other radioisotopes.

VIII. DESCRIBING GEOLOGIC TIME-The geologic time scale is based on evidence in the fossil record and has been shaped by mass extinctions. Divisions of Geologic Time

A. Earth has existed for more than _____.
B. From the beginning of Earth to about 542 million years ago is often referred to as Precambrian time.
C. From the end of Precambrian time to the present, Earth's history is divided into three eras: the Paleozoic Era, the Mesozoic Era, and the Cenozoic Era.
D. These three eras are further divided into periods.
E. Humans appeared during the Quaternary Period.

IX. Mass Extinction When large numbers of species become extinct, the event is called a _____. The fossil record shows _____ mass extinctions in Earth's history. Evidence indicates that worldwide geologic and weather changes are common factors that contribute to mass extinctions.

A. Mass extinctions may have contributed to overall _____ on Earth.
B. After a mass extinction, opportunities open for new life-forms to emerge.
C. Mass extinctions have been used to mark the divisions of geologic time.
D. Large mass extinctions mark the boundaries between _____
E. Smaller mass extinctions mark the divisions between _____

HOMEWORK DATE DUE

CH 19 SEC 1

1. Why do scientists think that RNA may have been the molecule that first carried genetic information?

2. How do scientists think the first organic compounds formed?

3. How did Miller and Urey add energy to the mixture of chemicals in their device?

4. What were two kinds of complex organic molecules that formed during the Miller-Urey experiment?

5. The compounds that Miller and Urey used in their experiment were probably not found on early Earth. Why are the results of their experiment still useful today?

6. What are two possible places that the organic molecules on Earth could have come from?

7. According to scientists, what two types of structures may have been the first steps toward the formation of cells?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 19 SEC 2

1. How does the fossil record provide evidence that evolution has occurred?

_____

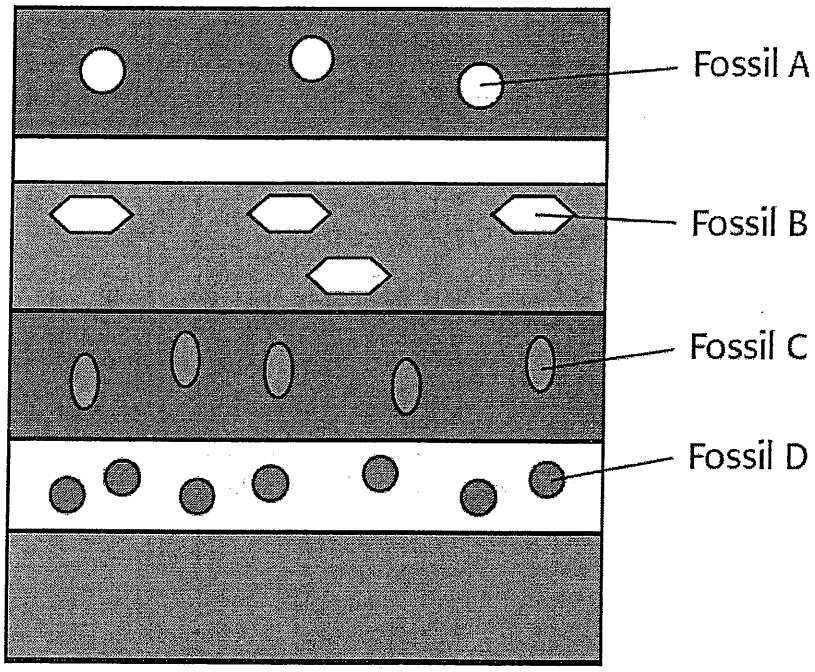
_____

2. The diagram below shows several rock layers that contain fossils. Which fossil is probably the oldest? Which fossil is probably the youngest?

_____

_____

_____



3. How is the fossil record related to the geologic time scale?

_____

_____

_____

_____

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

_____

ANSWER_____

_____

_____

_____

HOMEWORK DATE DUE

CH 19 SEC 3

1. What type of organism was probably one of the first prokaryotes to evolve?

2. Where did most of the oxygen in Earth's atmosphere probably come from?

3. How did the increasing amounts of oxygen in Earth's atmosphere allow organisms to live on land?

4. Why do scientists think that mitochondria and chloroplasts evolved through endosymbiosis? Give two reasons.

5. Name three kinds of organisms that evolved during the Paleozoic Era.

6. Name three kinds of organisms that evolved during the Mesozoic Era.

7. Name two kinds of organisms that are dominant in the Cenozoic Era.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

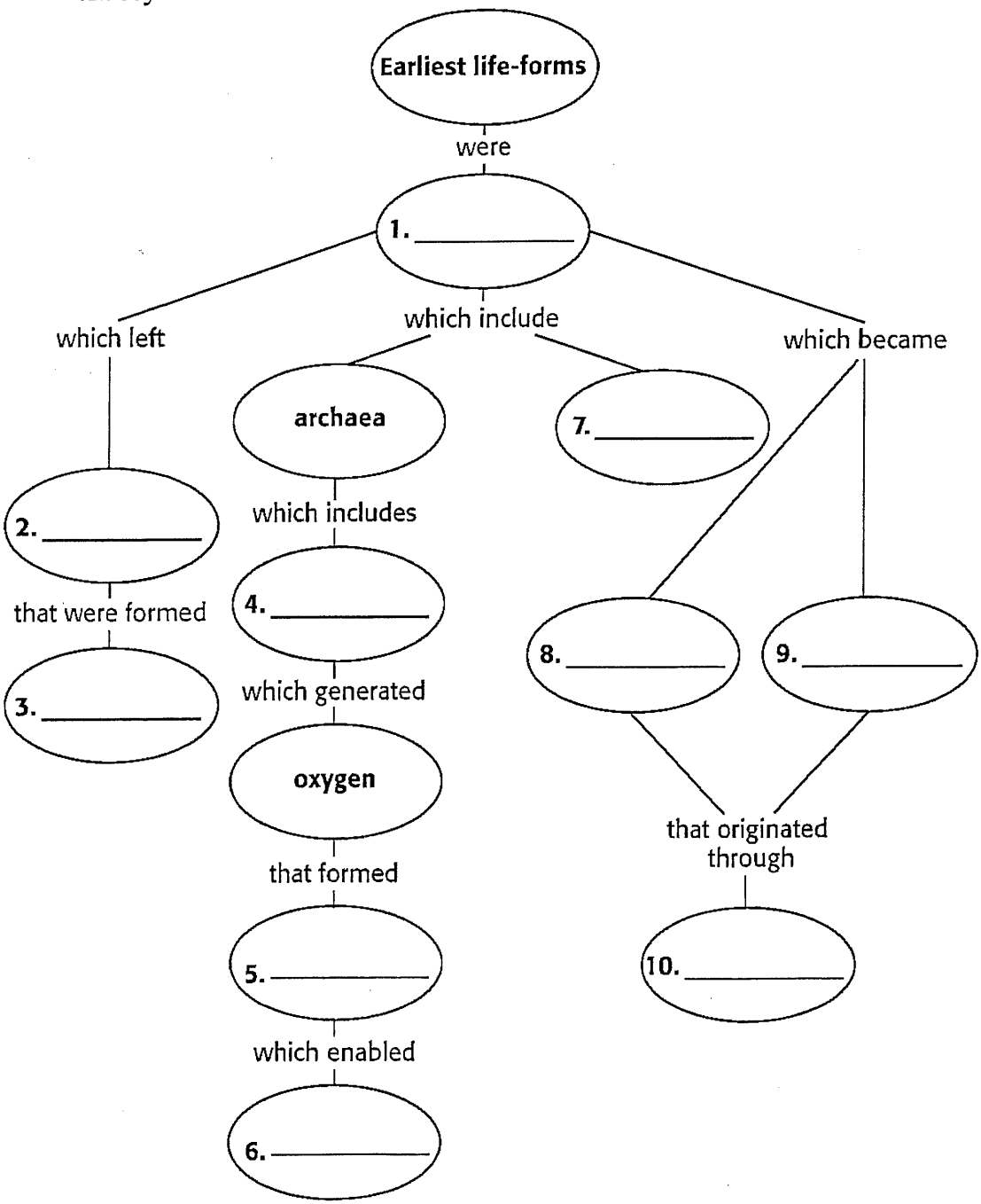
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

Using the terms and phrases provided below, complete the concept map showing the evolution of early life-forms.

bacteria	fossils	ozone
chloroplasts	life on land	prokaryotes
cyanobacteria	mitochondria	2.5 billion years ago
endosymbiosis		



1. What are microspheres?
2. The age of Earth is estimated to be about _____
3. What is relative dating?
4. What is absolute dating?
5. The geologic time scale is based on _____.
6. What do mass extinctions determine ?
7. Cyanobacteria changed the young Earth's atmosphere by producing

   _____
8. Pre-eukaryotic cells lacked _____
9. What is endosymbiosis?
10. A layer of ozone in the atmosphere was critical to the formation of life on land because

    _____
11. The first organisms to populate the surface of the land were _____
12. All of the major phyla of animals on Earth today are _____
13. While there was no soil present, plants were able to invade the surface of the ancient Earth

    because they _____
14. The first animals to invade the land were the _____
15. Arthropods were successful first where, then where?
16. Two-thirds of all terrestrial life disappeared in the last mass extinction approximately

    _____years ago

History of Earth Timeline Lab

Procedures:

1. Read Chapter 19- History of Life. Using the timeline, have 22 cards or toilet paper sized pieces of paper with the designated events found in the coloring sheets. You may draw or color pictures to describe what was happening and have how many millions of years ago it occurred.
2. You will use a roll of toilet paper to create a timeline. Assuming that the roll of toilet paper has 500 sheets, determine the millions of years each square represents. The earth is approximately 5 billion (5000000000) years old. Divide 5 billion by the number of squares you have in your roll.
3. Tape the beginning of the roll to the farthest point in the hall.
4. You will put the events in order by taping the correct card to the toilet paper at the appropriate point in the timeline.
5. In order to complete the lab in time, each lab group will have a designated person for each- one to measure, one to put the cards on the roll, one person to do any mathematical calculations to find the distance between each event and one person to read the timeline for the correct order.
6. When you are finished, I will check your work for accuracy.
7. Answer the questions following.

Questions

1. In your own words, summarize how long photosynthesis has been on earth. What impacts has photosynthesis had besides helping plants.

   _____
   _____
   _____

2. Do you believe humans are finished evolving? What do you base this answer on?

   _____
   _____
   _____

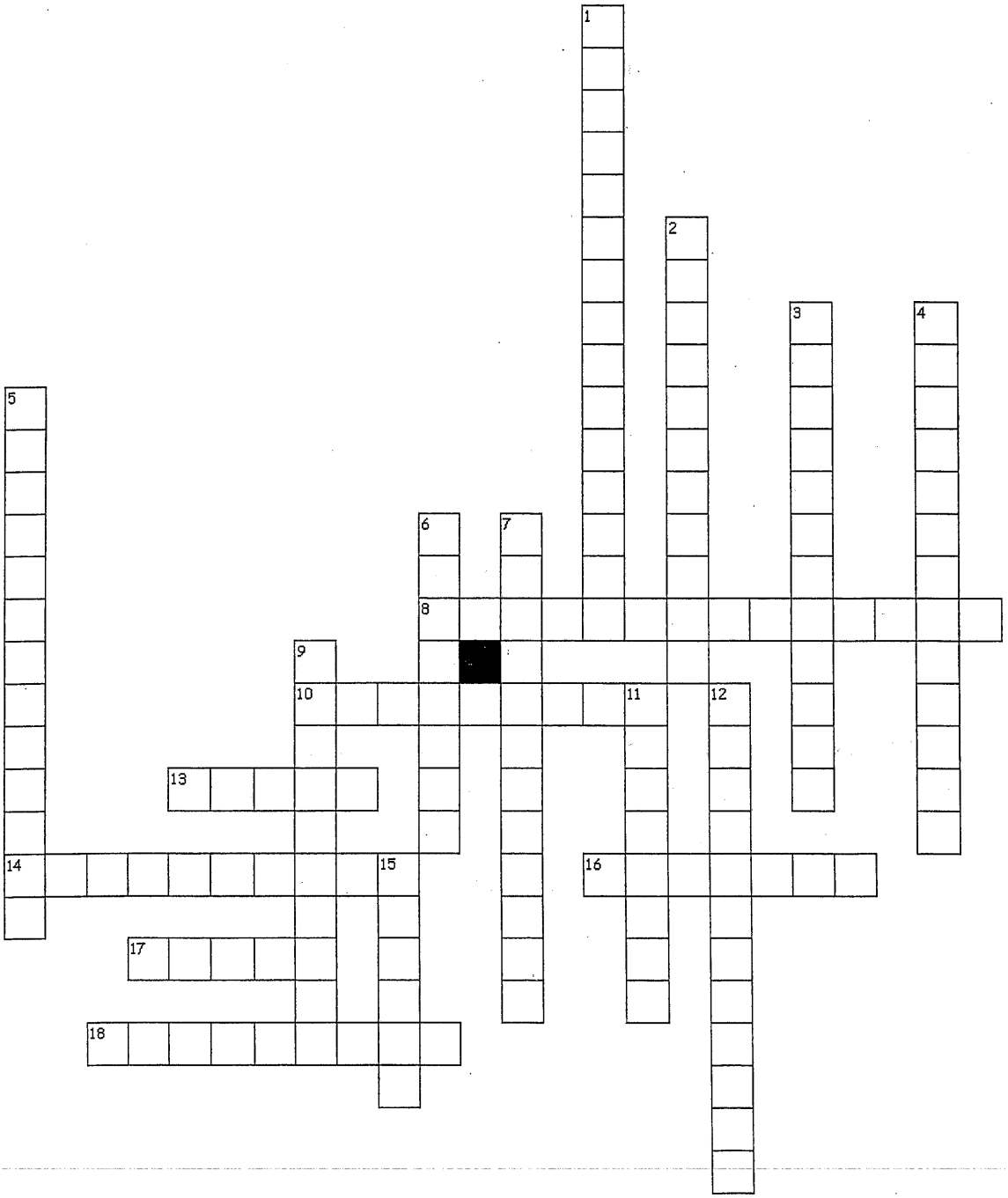
3. Looking at the rate of mass extinctions prior to now, is there a regular period that these occur?

   _____
   _____
   _____

4. Knowing that 99% of all species are now extinct how does this timeline help put this in perspective- what do you notice about the rate of evolution and extinction.

   _____
   _____
   _____

Ch 20 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard for each term with the word on one side and the definition on the back



Across

8. the transfer of genetic material in the form of DNA fragments
10. a thick-walled structure that forms inside bacteria and resists harsh conditions
13. viral replication that results in the destruction of a host cell and the release of many new virus particles
14. a substance that can inhibit the growth of or kill some microorganisms
16. a circular DNA molecule in bacteria
17. a substance that is produced by one organism that is poisonous to other organisms
18. viral replication in which a viral genome is replicated as a provirus without destroying the host cell

Down

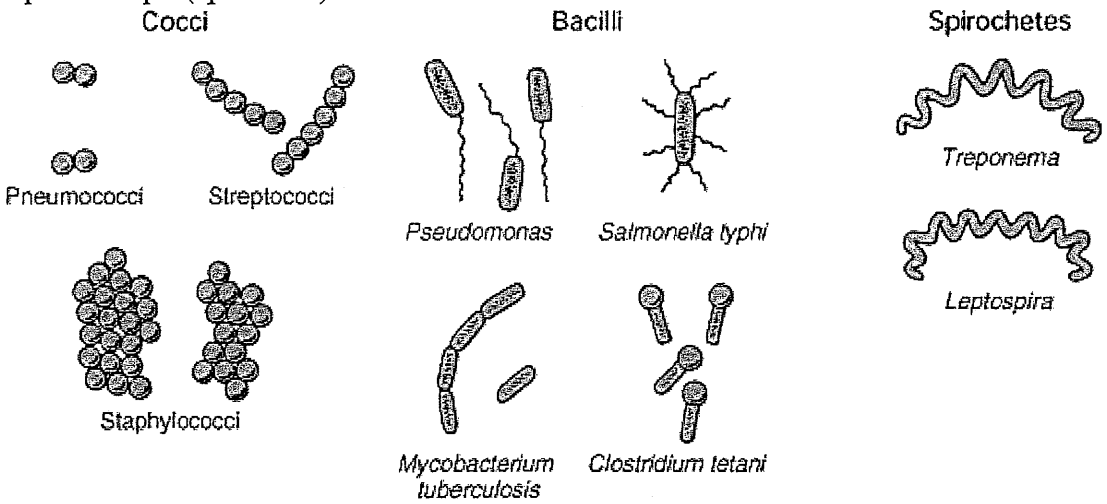
1. a four-stage procedure for identifying a pathogen
2. a type of sexual reproduction in which two cells join to exchange DNA
3. a prokaryote that has a small amount of peptidoglycan in its cell wall, has an outer membrane, and is stained pink during Gram staining
4. a virus that infects bacteria
5. a protein-carbohydrate compound that makes the cell walls of bacteria rigid
6. an organism or virus that causes disease; an infectious agent
7. a prokaryote that has a large amount of peptidoglycan in its cell wall and is stained violet during Gram staining
9. the ability of an organism to tolerate a chemical or disease-causing agent
11. a membranelike layer that covers the capsids of some viruses
12. the transfer of DNA from one bacterium to another through a virus
15. a protein sheath that surrounds the nucleic acid core in a virus

plasmid	
peptidoglycan	
Gram positive	
Gram negative	
conjugation	
transformation	
transduction	
endospore	
capsid	
envelope	
bacteriophage	
lytic	
lysogenic	
Kochs postulates	
pathogen	
toxin	
Antibiotic resistance	

Chapter 20 Bacteria and Viruses

I. Prokaryotes are divided into two major groups: the domain Archaea and the domain Bacteria. Prokaryotes are single-celled organisms that do not have membrane bound organelles. They are generally found in three shapes:

A. a rod shape (bacillus)
B. a sphere shape (coccus)
C. spiral shape (spirillum).

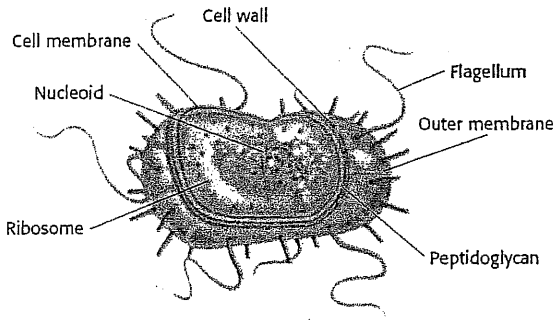


II. Domain Archaea- _____ are found in many places, including extreme environments such as salt lakes and hot springs. Archaea are structurally very different from Bacteria. Some Archaean molecules are more similar to those found in eukaryotes. Others are unique among living organisms.

III. Domain Bacteria – Most known prokaryotes are members of the domain Bacteria. Bacteria can be found virtually everywhere. One square inch of skin has an average of 100,000 bacteria!

IV. BACTERIAL STRUCTURE-. Bacteria have genetic material in the form of DNA (circular). Bacteria often have small extra loops of DNA called _____.

A. Bacteria have ribosomes and many types of enzymes.
B. Bacterial cell membranes are lipid bilayers. Outside the cell membrane, bacteria have rigid cell walls that can be one or two layers thick.
C. The bacterial cell wall is made of a protein-carbohydrate compound called _____ and may also include a membrane covering the peptidoglycan layer.



E. coli is a common bacterium that lives in the intestines of humans.

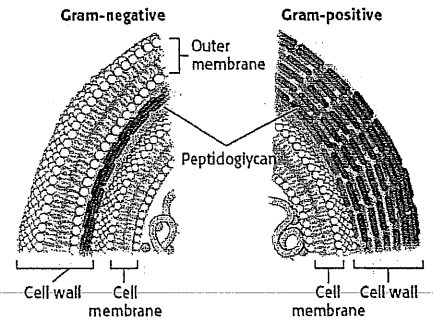
V. GRAM STAINING- The presence of this membrane allows biologists to group bacteria into two categories using a technique called the Gram stain.

A. Gram-Positive Bacteria-usually less dangerous

1. The first dye is dark purple. Gram-positive bacteria trap the dark purple dye because their peptidoglycan layer is very thick.
2. The second, pink dye is also absorbed, but it cannot be seen because the purple dye is much darker. As a result, Gram-positive bacteria appear _____ after staining.

B. Gram-Negative Bacteria- _____ bacteria

1. The thin peptidoglycan layer of Gram-negative bacteria does not trap the purple dye.
2. When the pink dye is added, it is absorbed by the cell. Because the pink dye is the only dye present in Gram-negative bacteria, they appear _____ after staining.
3. The outer membrane of Gram-negative bacteria makes them more resistant to host defenses and to medicines.



Gram-negative bacteria have an outer membrane but Gram-positive bacteria do not.

VI. OBTAINING ENERGY AND NUTRIENTS-Grouping prokaryotes based on their energy source separates them into photoautotrophs, chemoautotrophs, and heterotrophs.

A. Photoautotrophs- Organisms that get their energy from sunlight through _____ are called photoautotrophs.

1. These bacteria include purple _____ bacteria, green sulfur bacteria, and _____.
2. Green and purple sulfur bacteria can grow only in _____-free environments.
3. _____ are abundant today and are a major component of the _____ that floats in the oceans. They produce a great deal of our oxygen and probably formed Earth's oxygen atmosphere.

B. Chemoautotrophs

1. Prokaryotes called chemoautotrophs are the only organisms that can get their energy from inorganic sources.
2. They use molecules that contain _____ or _____ and simple organic molecules to obtain energy.
3. In the presence of hydrogen-rich chemicals, chemoautotrophic bacteria can form all of their own amino acids and proteins.

C. Heterotrophs

1. Most prokaryotes are _____ and get both their energy and their nutrients from other organisms.
2. Most absorb nutrients from dead organisms, but some are _____ or _____.
3. Many heterotrophic bacteria live in the presence of oxygen, but some can live without it.

VII. REPRODUCTION AND ADAPTATION-Prokaryotes reproduce by binary fission; exchange genetic material through conjugation, transformation, and transduction; and survive harsh conditions by forming endospores.

A. BINARY FISSION-Prokaryotes usually reproduce _____ by binary fission. In this process, a single cell divides into two identical new cells. Mutations do occur during prokaryotic reproduction, and new forms emerge frequently.
B. There are three ways that prokaryotes can form new genetic combinations.

1. _____ occurs when two bacteria exchange genetic material._____ often convey antibiotic resistance.
2. _____ occurs when bacteria take up DNA fragments from their environment.
3. _____ occurs when genetic material, such as a plasmid, is transferred by a _____.

C. ENDOSPORES-Some bacteria survive harsh conditions by forming thick-walled structures called endospores.

1. _____ form inside the bacteria. They surround the DNA and a small bit of cytoplasm.
2. Endospores can survive _____, _____, and _____. They show no signs of life and can be revived after hundreds of years.

VIII. VIRUS- Viruses are not considered living because they are missing key characteristics of living organisms.

A. Viruses do have genetic material, but they cannot _____ on their own.
B. Viruses reproduce by infecting cells. Viruses use the cell's ribosomes, ATP, enzymes, and other molecules to make more viruses.
C. Viruses do not grow. Instead, they are assembled into their full size within a cell.
D. Viruses do not carry out any _____ activities, do not have any cytoplasm or organelles, and do not maintain _____

Virus	Disease	Symptoms
Influenza virus	flu	fever, headache, tiredness, muscle aches, cough
Varicella zoster virus	chickenpox, shingles	fever, tiredness, itchy or painful blisters
Measles virus	measles	fever, cough, runny nose, pink-eye, a rash that covers the body
Mumps virus	mumps	fever, headache, muscle aches, tiredness, loss of appetite, swelling of salivary glands
HIV virus	HIV infection/AIDS	early symptoms: fever, tiredness, swollen lymph nodes; later symptoms: weight loss, infections, death
Human papilloma virus	HPV infection, cervical cancer	usually no symptoms; occasionally genital warts; can cause cervical cancer
Hepatitis B virus	hepatitis, liver cancer	jaundice, tiredness, abdominal pain, nausea, joint pain, liver disease, liver cancer, death
West Nile virus	West Nile virus infection	fever, headache, bodyache; in rare cases coma, numbness, and paralysis

IX. VIRAL STRUCTURE-All viruses have nucleic acid and a capsid. There are 2 types

A. DNA Viruses

1. The genetic material of a DNA virus can become _____ into the host cell's DNA or may remain separate.
2. The virus makes copies of its DNA by using the host cell's enzymes and nucleotides.
3. Viral DNA also directs production of mRNA and proteins that are assembled into new viruses.

B. RNA Viruses

1. Reproduction of RNA viruses can occur by one of two methods.
2. In one method, the viral RNA may be used directly to make mRNA, which is used to make more viral RNA.
3. In the second method, the viral RNA is transcribed into DNA, _____ into the host cell's DNA, and then transcribed into viral mRNA.
4. Viruses that use this method of reproduction are called _____

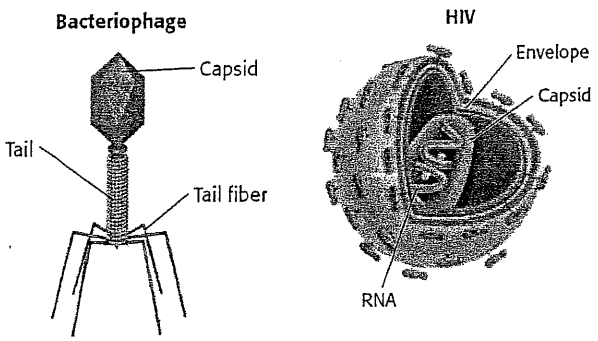
X. PARTS OF A VIRUS

A. _____- The protein coat, or capsid, of a virus encloses its genetic material. Viruses recognize their hosts by specific proteins on a host cell's surface. The

proteins on the host cell must match proteins on the capsid of the virus, as a key matches a lock.

B. _____- Many viruses, such as HIV, have a membrane, or envelope, surrounding the capsid. The envelope gives the virus an overall spherical shape, but the capsid can have a very different shape. The envelope is made of proteins, lipids, and glycoproteins, which are proteins with attached carbohydrate molecules.

C. _____- Viruses that infect bacteria are called bacteriophages or just phages. Phages have a complicated structure. A T2 bacteriophage, for example, has a capsid attached to a tail with tail fibers. A long DNA molecule is coiled within the polyhedron. The tail and tail fibers function like a tiny syringe, which injects the viral DNA into its bacterial host.



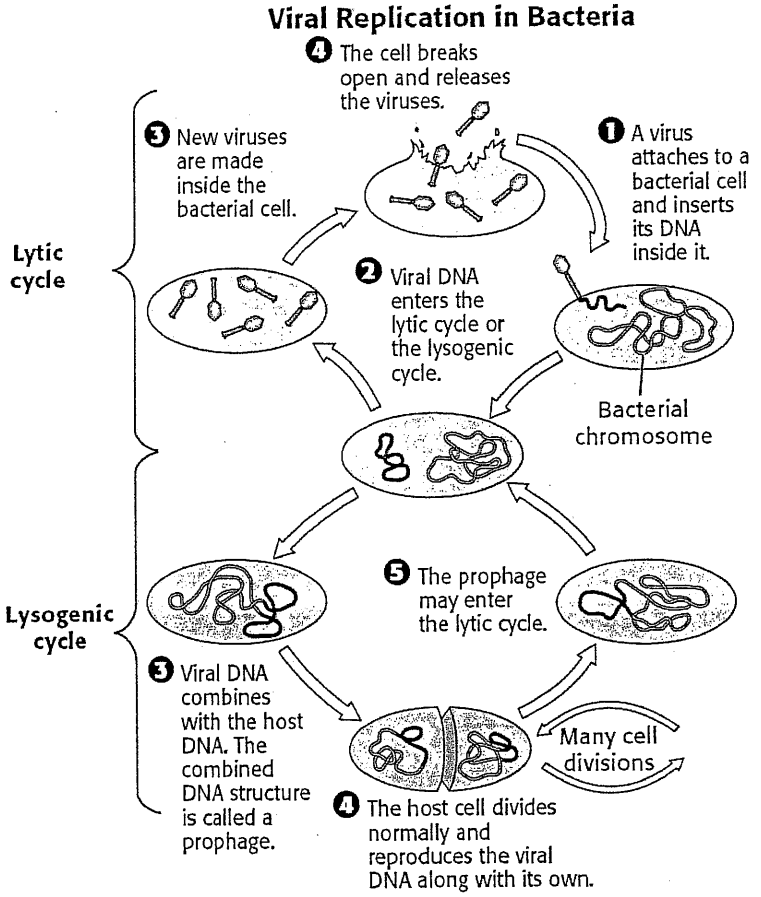
XI. REPRODUCTION- Viruses can reproduce by a lytic life cycle and a lysogenic life cycle. A viral infection begins when the genetic material of a virus enters a host cell. Once inside the cell, a virus can reproduce by two different processes.

A. Lytic Cycle- The cycle of viral infection, reproduction, and cell destruction is called the _____.

1. Viral genetic material that enters a cell remains separate from the host cell's DNA.
2. The virus uses the host cell's organelles, enzymes, and raw materials to replicate the virus's DNA and to make viral proteins. The proteins are assembled with the replicated viral DNA to form complete viruses.
3. The host cell _____ _____, releases newly made viruses, and dies. The new virus particles can infect other host cells.
4. Viruses that reproduce only by the lytic cycle are often called virulent.

B. Lysogenic Cycle- When viral DNA becomes part of its host cell's DNA, the virus is called a _____.

1. When the host cell replicates its own DNA, the cell also replicates the _____. New cells are produced that contain the provirus. Many cells may be produced that contain the viral DNA.
2. New virus particles are not assembled, and the host cell is not _____.
3. This process is called the _____ cycle. After days, months, or even years, the provirus may leave the host's DNA and enter a lytic cycle.
4. If the virus never enters the lytic cycle, it may become a permanent part of its host's genome.
5. A virus whose reproduction includes the lysogenic cycle is called a temperate virus.



XII. VIROIDS AND PRIONS-Viroids and prions are molecules that are able to reproduce and cause disease.

A. _____- A viroid is a single strand of RNA that has no capsid. The RNA of viroids is much smaller than that of viruses. Viroids can replicate inside a host's cell to make new viroids. Viroids cause abnormal development and stunted growth in plants.

B. _____- Prions are nonfunctioning, misshapen versions of proteins. They attach to normal proteins that are found in the brain. The misfolding spreads like a chain reaction and destroys brain tissue. Prions can be transmitted by eating food contaminated with infected brain tissue.

XIII. ROLES OF BACTERIA AND VIRUSES- Bacteria play important roles in the environment and in industry. Both bacteria and viruses are important in research.

A. Bacteria play a vital role in all of Earth's ecosystems by producing oxygen, making nitrogen available, and decomposing organisms. Many form important symbiotic relationships.

B. Bacteria are important in a variety of industries such as food production, chemical production, mining, and environmental cleanup.

XIV. KOCH'S POSTULATES AND DISEASE TRANSMISSION- The four main steps in Koch's postulates are finding and isolating the pathogen, growing the pathogen, infecting a healthy animal, and then isolating the same pathogen. German physician Robert Koch developed a technique for diagnosing the cause of an infection. Koch's four-step procedure, known as Koch's postulates, is still used today to identify a disease-causing agent, or pathogen.

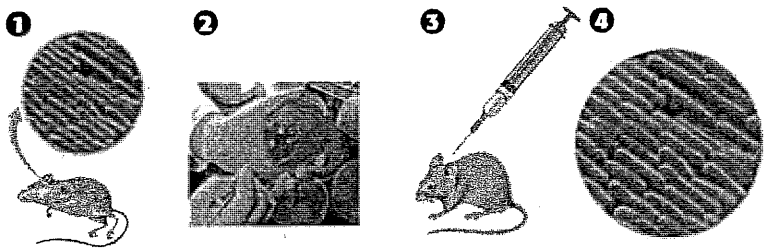
A. Step 1: The pathogen must be found in an animal with the _____ and not in a healthy animal.
B. Step 2: The pathogen must be _____ from the sick animal and grown in a laboratory culture.
C. Step 3: When the isolated pathogen is injected into a healthy animal, the animal must _____ the disease.
D. Step 4: The pathogen should be taken from the second animal, grown in the lab, and shown to be the _____ as the original pathogen.

1. Diseases that can spread from person to person are considered _____.
2. Some contagious diseases must be transmitted directly from one host to another by contact.
3. Other diseases can survive outside a host for a period of time. These diseases can be transmitted through the air, in contaminated food or water, or on contaminated objects.

Koch's Postulates

❶ Finding the Pathogen
The pathogen must be found in an animal that has the disease. It must not be present in healthy animals.

❷ Growing the Pathogen
The pathogen must be taken from an animal that has the disease and grown in a laboratory culture.



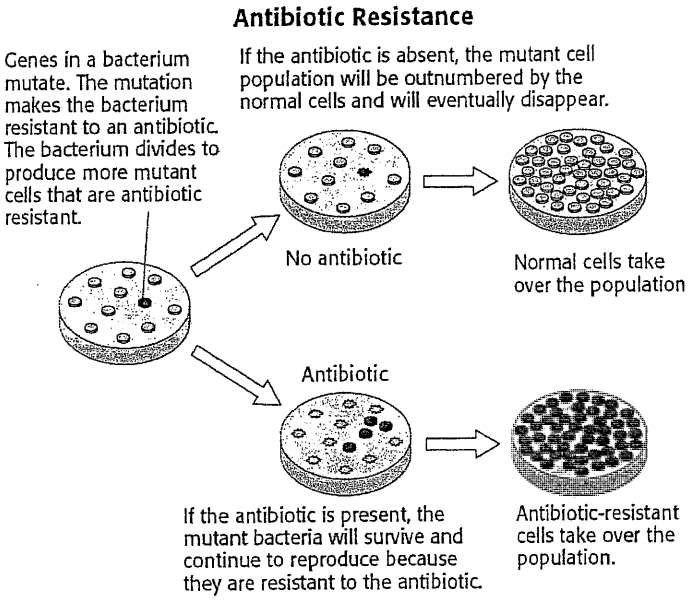
❸ Infecting a Healthy Animal
The pathogen from the laboratory culture is injected into a second animal that is healthy. The second animal must develop the same disease as the first animal.

❹ Finding the Same Pathogen
The pathogen must be taken from the second animal and grown in a laboratory culture. This pathogen culture must be the same as the pathogen culture from the first animal.

XV. BACTERIAL DISEASES-Bacteria can cause disease by producing toxins and by destroying body tissues. The most common way that bacteria cause disease is by producing poisonous chemicals, called toxins. _____ may be released or stored inside the bacteria until the bacteria die. A second way that bacteria cause disease is by producing _____ that break down the host's tissues into nutrients that the bacteria can use.

XVI. ANTIBIOTIC RESISTANCE-Antibiotic resistance spreads when sensitive populations of bacteria are killed by antibiotics. As a result, resistant bacteria thrive.

A. Antibiotic resistance is the ability of bacteria to _____ antibiotics. Mutations for antibiotic resistance arise naturally and often in bacteria.
B. Plasmids containing antibiotic-resistance genes can pass between bacteria during conjugation.
C. When the antibiotic is present, vulnerable bacteria are killed. Resistant bacteria survive and reproduce. In this way, antibiotic-resistant bacteria become the _____ type in the population.



XVII. VIRAL DISEASES-Because viruses enter host cells to reproduce, it is difficult to develop a drug that kills the virus without harming the living host.

A. Viruses can be transmitted by any action that brings virus particles into contact with a host cell.
B. Many symptoms of a viral infection, such as aches and _____, result from the body's _____ to infection.
C. Many viral diseases can be prevented through _____. A vaccine is a weakened form of a pathogen that prepares the immune system to recognize and destroy the pathogen.

XVIII. EMERGING DISEASES-_____ diseases are infectious diseases that are newly recognized, that have spread to new areas or a new host, or that have reemerged when a disease that was once considered under control begins to spread.

A. Diseases can spread to new areas or a new host when people come into contact with a pathogen in a different way than in the past.
B. Environmental changes can cause diseases to emerge.
C. Human _____ plays an important role in emerging disease.

Benefit To	Description
Ecosystems and other organisms	• Bacteria produce oxygen, make nitrogen available to plants, and decompose dead organisms. • Many bacteria form relationships that benefit other organisms. For example, bacteria inside the large intestines of humans produce vitamin K.
Industry	• Bacteria are used to make foods such as pickles, soy sauce, and sourdough bread. • Bacteria are used to produce certain chemicals. • Mining companies use bacteria to extract valuable minerals, such as copper. • Bacteria are used to clean up oil spills and to clean the water in sewage treatment plants.
Scientific research	• Bacteria and viruses are used in genetic research. They provide information about DNA replication, transcription, and translation. • Viruses are used to deliver genetic material directly to target cells.

HOMEWORK DATE DUE_____

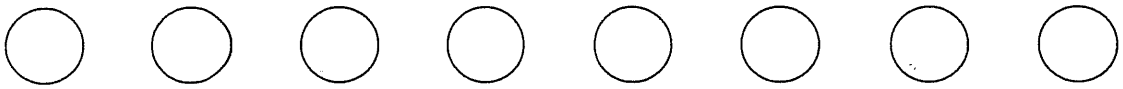
CH 20 SEC 1

1. What are the two major domains of prokaryotes?

2. Describe two ways in which the structure of Gram-positive bacteria is different from that of Gram-negative bacteria.

3. What are chemoautotrophs?

4. If eight bacterial cells each undergo binary fission, how many bacterial cells will result?



5. How do endospores help bacteria survive harsh conditions?

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

ANSWER_____

HOMEWORK DATE DUE

CH 20 SEC 2

1. Summarize Use the words "yes" and "no" to indicate whether each property listed below describes living things, viruses, or both.

PROPERTY	LIVING THINGS	VIRUSES
Made of cells		
Have genetic material		
Can grow		
Can reproduce on their own		
Can only replicate DNA inside host cells		

2. What two structures do all viruses have?

3. What structures help a bacteriophage inject its DNA into a bacterium?

4. Describe three ways in which the lysogenic cycle and lytic cycle are different.

5. When a host cell divides in the lysogenic cycle, what genetic material does each new cell receive?

6. What is a prion and how does it cause disease?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 20 SEC 3

1. What are three ways in which bacteria benefit ecosystems?

2. What is the second step in Koch's Postulates?

3. What are two ways that bacteria cause disease?

4. Why are some diseases that were once easy to treat with antibiotics now more difficult to treat?

5. Why are viral diseases difficult to cure?

6. What has caused diseases such as whooping cough, measles, and diptheria to reemerge?

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

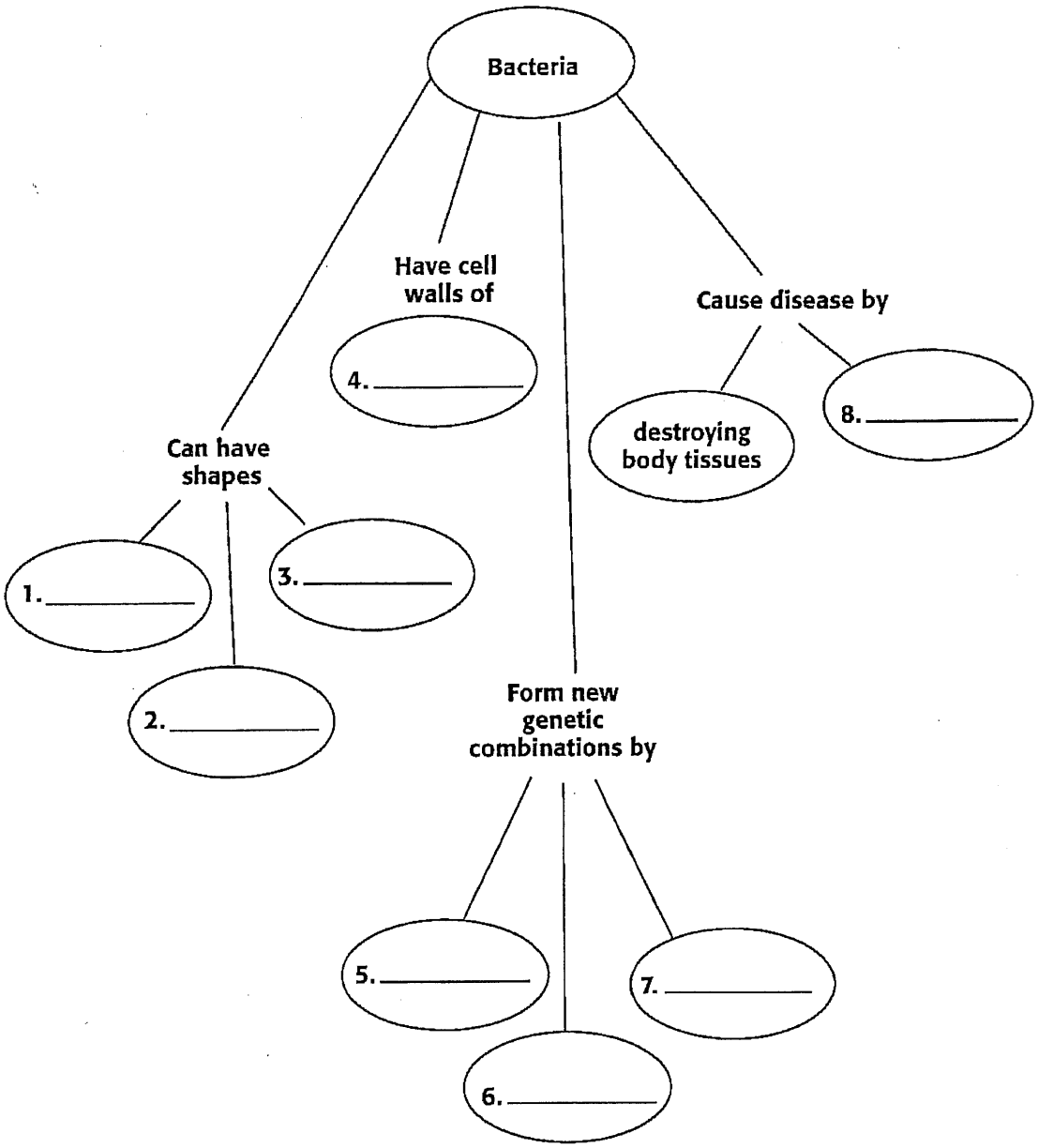
ANSWER_____

Name_____ Class _____ Date _____

Concept Mapping

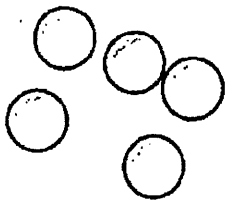
Using the terms and phrases provided below, complete the concept map showing the characteristics of bacteria.

bacillus	peptidoglycan	transformation
coccus	toxins	spirillum
conjugation	transduction	

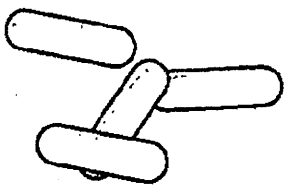


Ch 20 Review

1. Describe the chromosome of a bacteria.
2. Structures found in bacterial cells but not in eukaryotic cells are
3. What are the shapes of these?



Organism A



Organism B

Organism C

4. What are plasmids?
5. What are prions?
6. Cell organelles that Escherichia coli and other bacteria have in common with eukaryotes are _____
7. It is important to distinguish between Gram-positive and Gram-negative bacteria in diagnosing a bacterial infection because _____
8. What is the difference between eukaryotic and prokaryotic cell walls?
9. what make up bacterial cell walls?
10. Cyanobacteria are photoautotrophs because they require _____
11. What are nitrogen-fixing bacteria?
12. What is conjugation?
13. What is binary fission?
14. What is a bacterial endospore?
15. Are viruses alive? Why or why not?
16. What are viruses doing in biology?
17. What are the parts of a typical virus?
18. What types of viruses are there?
19. What is an RNA virus?
20. What is a DNA virus?
21. What is a retrovirus?
22. The function of a bacteriophage's tail and tail fibers is to inject _____
23. What is a lytic cycle?
24. What is the lysogenic cycle?
25. What is a virulent virus?

26. The cycle of viral infection, replication, and cell destruction is called the virus's

_____

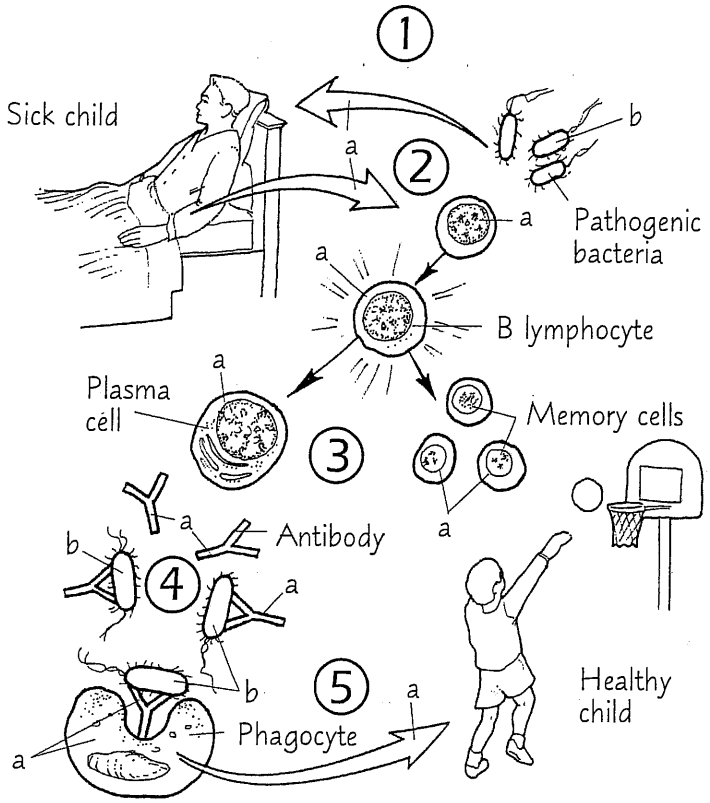
27. What is a prion?

28. What is Koch's postulate?

TYPES OF IMMUNITY

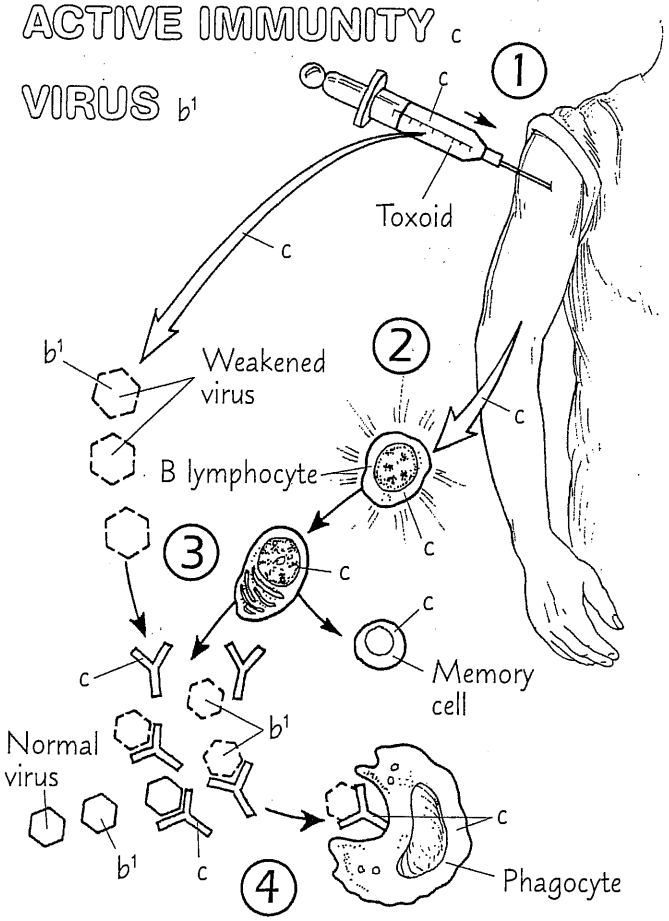
NATURALLY ACQUIRED ACTIVE IMMUNITY a

BACTERIUM b



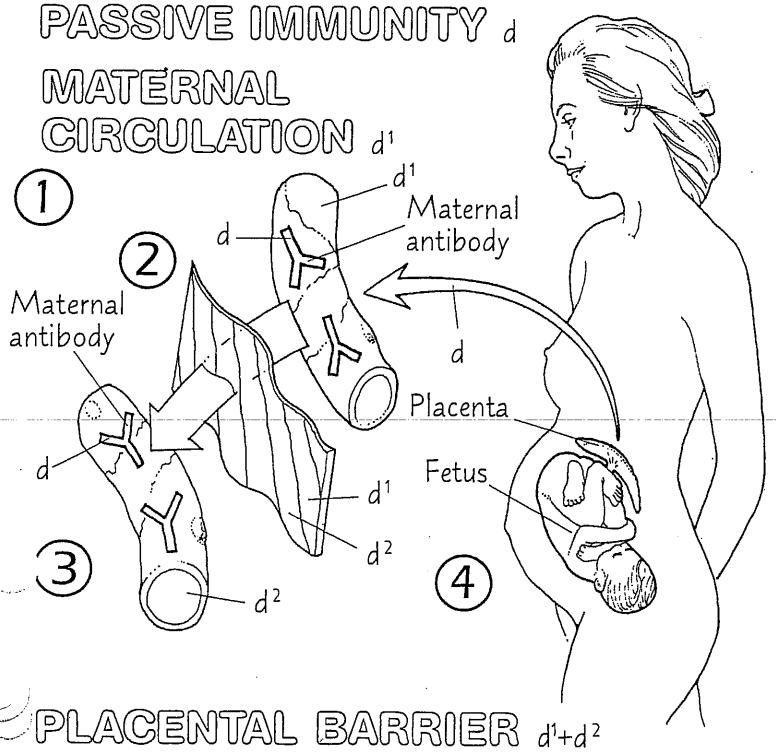
ARTIFICIALLY ACQUIRED ACTIVE IMMUNITY c

VIRUS b^1



NATURALLY ACQUIRED PASSIVE IMMUNITY d

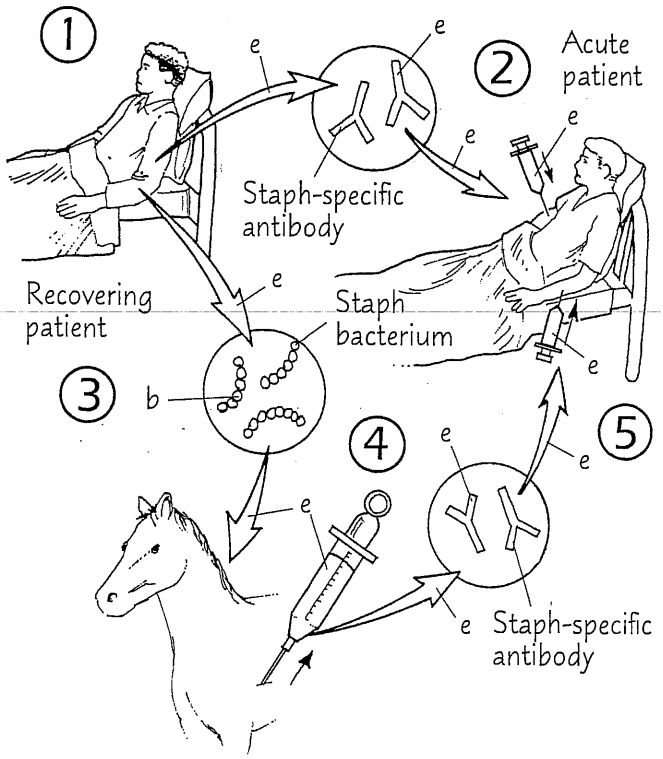
MATERNAL CIRCULATION d^1



PLACENTAL BARRIER d^1+d^2

FETAL CIRCULATION d^2

ARTIFICIALLY ACQUIRED PASSIVE IMMUNITY e



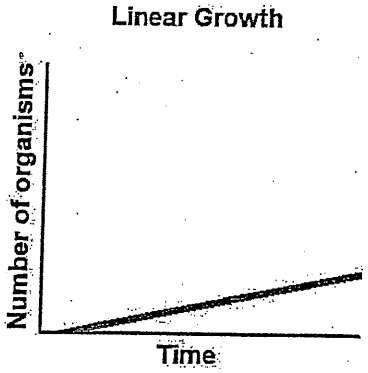
Name _____ Class _____ Date _____

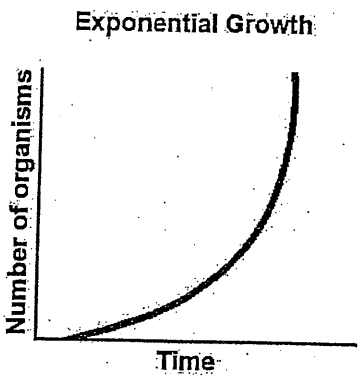
Two Kinds of Growth

Can you visualize the difference between linear growth and exponential growth?

Procedure

1. Place grains of rice in the cups of an egg carton in the following sequence: Place one grain in the first cup. Place two grains in the second cup. Place three grains in the third cup. In each of the remaining cups, place one more grain of rice than in the cup before.
2. Use a line graph to graph the results of step 1.
3. Repeat step 1, but use the following sequence: Place one grain in the first cup, two in the second cup, and four in the third cup. In each remaining cup, place twice as many grains as placed in the cup before.
4. Use a line graph to graph the results of step 3.





Analysis

1. **Match** your graphs to the graphs shown.

_____

_____

_____

2. **Critical Thinking** **Analyzing Terminology** Linear growth is also called *arithmetic growth,* and exponential growth is also called *geometric growth.* Propose an explanation for the use of these terms.

_____

_____

_____

Bacterial Observation

There are millions of kinds of bacteria, yet bacteria only appear in a few basic shapes.

Procedure

1. Using a compound light microscope, observe prepared slides of bacteria that are listed on board.
2. Draw each type of bacteria that you see under high power.

Analysis

1. Describe the shapes of the bacteria that you saw.

_____

_____

_____

2. State whether you saw a nucleus or organelles in any of the bacteria that you observed.

_____

_____

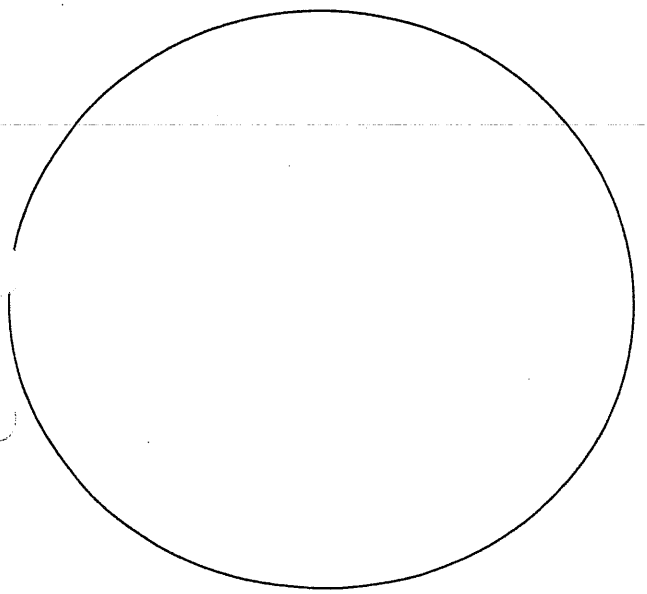
_____

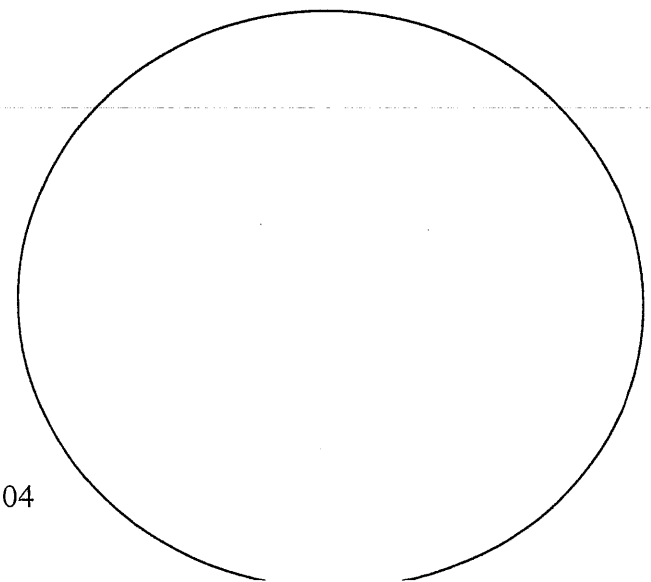
3. Predict whether bacterial cells are larger or smaller than animal cells.

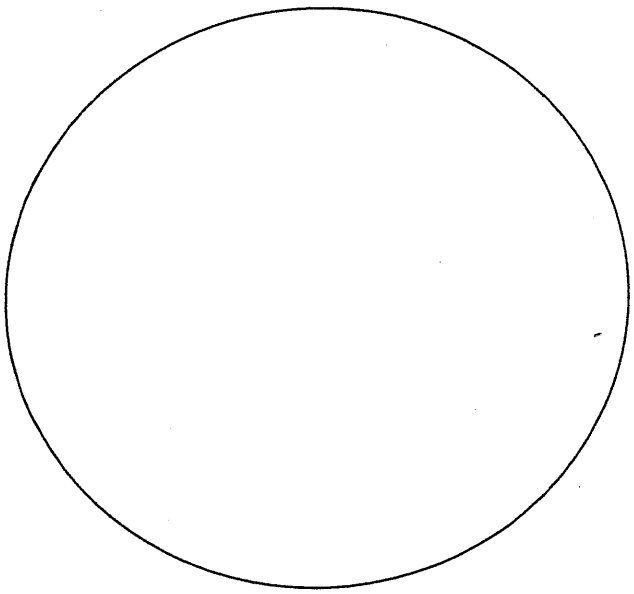
_____

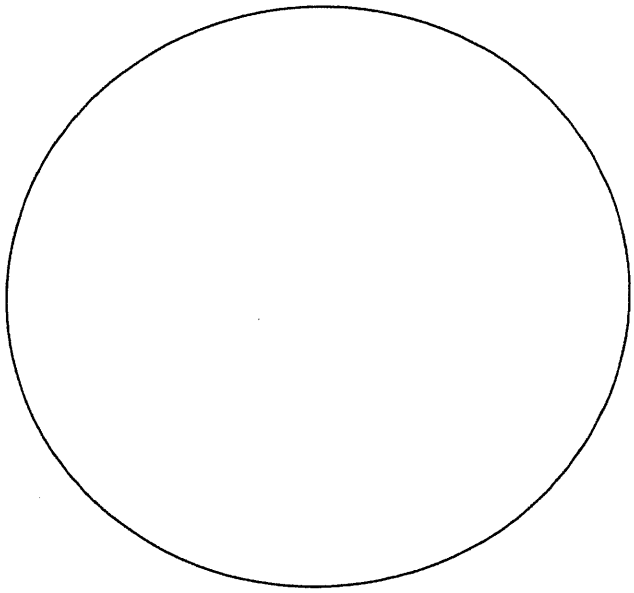
_____

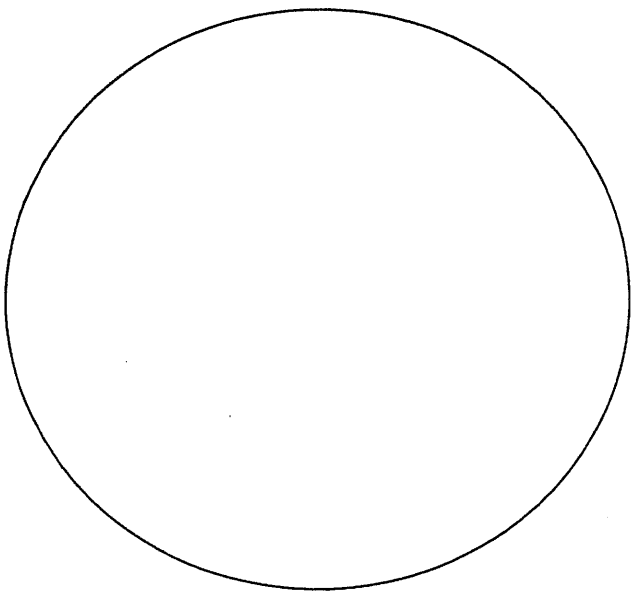
_____

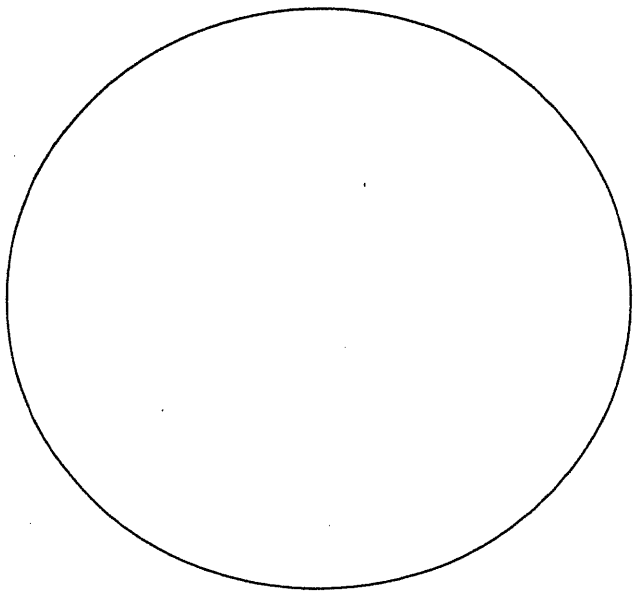












Are You Cavity Prone? BioKit®

Name _____

Date _____

In this exercise, you will determine your susceptibility to dental cavities.

DIRECTIONS

1. Obtain a paraffin block, sterile petri dish, sterile pipet, and Snyder test agar tube.
2. Place the Snyder test agar tube into the water bath just long enough to liquify the agar. Remove the tube and allow it to cool to 50° C, which feels comfortably hot to the touch.
3. To remove bacteria from the teeth, soften a piece of paraffin under the tongue. *Chew for three minutes,* moving the paraffin from side to side. Do not swallow the saliva: as it accumulates, deposit it into the sterile petri dish. Keep the lid of the sterile petri dish closed at all times except when depositing saliva. At the end of three minutes, deposit all the accumulated saliva into the petri dish. Discard the paraffin.
4. Remove a pipet from the packaging, being careful not to touch the tip. Do not lay the pipet down.
5. Remove the cap from the Snyder test agar tube and flame the top of the tube over the Bunsen burner for a few seconds. With the sterile pipet, measure 0.25 ml saliva (Fig. 1), being careful not to introduce bubbles. Transfer the saliva to the Snyder test agar tube. Do not allow the pipet tip to touch the agar or the sides of the tube. Flame the mouth of the tube again. Replace the cap of the test tube. Discard the pipet, the petri dish, and saliva.
6. While the agar is still liquid, rotate the test tube between your palms to mix the saliva and the agar (Fig. 2).
7. Label your tube with your initials and the date. After the agar has solidified, place your tube in an incubator set at 37° C.
8. Record the date and time that you inoculated your tube (added bacteria from saliva) on the Student Data Sheet (Table 1).
9. Check the tube at 24, 48, 72, and 96 hours after inoculation. Observe the color of the agar to see if the bromocresol green indicator has turned yellow. Compare your tube with the negative (uninoculated) control tube. Record your results in Table 1.
10. After 96 hours, refer to Table 2 and determine your individual susceptibility to cavities.

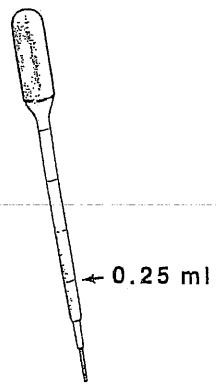


Figure 1 Proper amount of saliva to be inoculated into Snyder test agar tube.

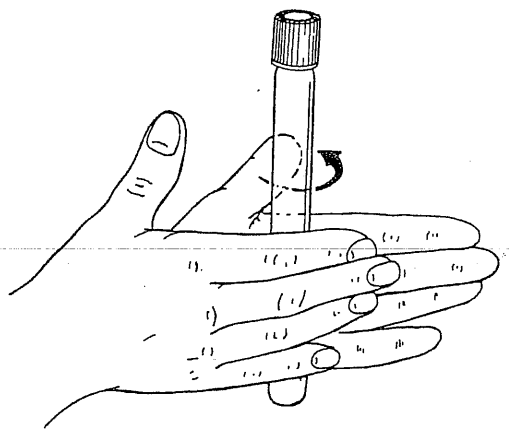


Figure 2 Proper method of mixing agar and saliva.

TABLE 1
Student Data Sheet

Date	Day	Hours from inoculation	Time	Color of agar	Results
	1	0		Green	None
	2	24			
	3	48			
	4	72			
	5	96			

Agar is green (no color change): –
Agar is yellow: +

TABLE 2
Cavity Susceptibility

	Incubation time (hours)			
Interpretation	24	48	72	96
Marked	+	+	+	+
Moderate	–	+	+	+
Slight	–	–	+	+
Negative	–	–	–	+
Negative	–	–	–	–

Agar is green (no color change): –
Agar is yellow: +

QUESTIONS

1. How did the results of your test compare to the number of dental cavities you have had?

2. How did the results of other students compare with your results?

3. What factors affect a person's susceptibility to dental cavities?

4. Which one of the factors does this experiment explore?

5. What was the purpose of the control tube in this exercise?

6. Name the ways to prevent tooth decay.

Most Contaminated Area Contest
Bacterial Staining

OBJECTIVES

- **Prepare** and **stain** smears of bacteria.
- **Identify common areas of contamination in a school.**

MATERIALS

- paper towels
- microscope slides (3)
- culture tubes of bacteria (3)
- sterile cotton swabs
- beaker, 150 mL
- methylene blue stain in dropper bottle
- 70% isopropyl alcohol
- pencil, wax
- Bunsen burner with striker
- test-tube rack
- forceps or wooden alligator-type clothespin
- water, 75 mL
- microscope, compound

Procedure

1. Put on safety goggles, gloves, and a lab apron.

2. **CAUTION: Alcohol is flammable. Do not use alcohol in the room when others are using a Bunsen Burner.** Use alcohol and paper towels to clean your lab table and gloves. Allow the table to air-dry.
3. **CAUTION: Microscope slides are fragile and have sharp edges.** Use a wax pencil to label three microscope slides "A," "B," and "C."

4. **CAUTION: I will not allow you near the flames- please stay back and have slides ready.**

PRE-LAB:

1. You will prepare your bacterial culture prior to Monday's lab. In order to see where you may personally be exposed to bacteria, I will allow you to go to your shops to culture objects.
2. You will only have one petri dish per lab group. You may break this down into quarters by using a wax pencil on the underside of the petri dish (where agar is). You must also write both science numbers. Do not use any other type of marker these dishes must go into the incubator. Failure to follow this may result in melting of the dish and a ZERO for the lab.
3. Use a clean, dry cotton swab and move the cotton over your object of interest several times. Then rub the cotton gently on the agar in the designated area. Do not puncture or rip the agar as this will cause you to get zero growth
4. You do not need gloves for this part- these are objects that you touch every day.
5. Tape the top to the plate on 2 spots only and place with top closest to the table in the pepsi rack. Remember to have both of your science numbers on the plate.

PART A: MAKING A SMEAR

5. Draw the contents on the Petri dish below, using color and giving a brief description of its appearance.

9. Make a smear of bacterial culture A by rubbing the swab on the slide. Spread a thin layer of culture over the middle of the slide. Cover about half of the slide and allow it to dry.

10. Throw out the swab in a proper container.

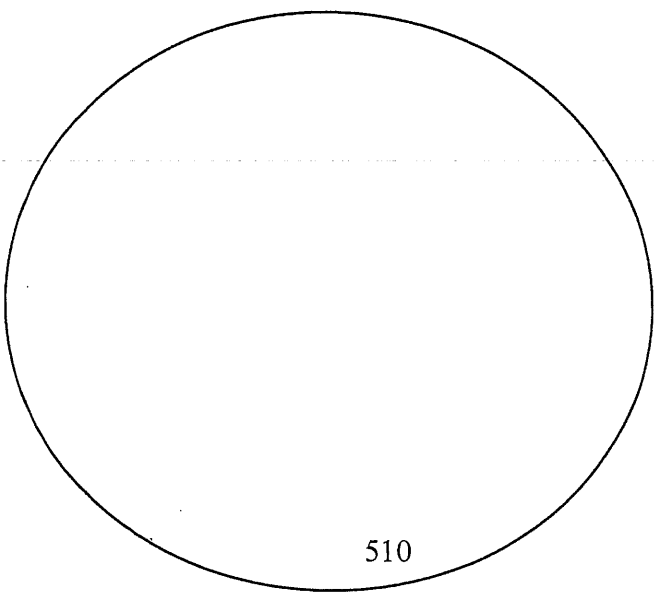
11. Repeat steps 5 through 10 for any colonies you see that are distinct from each other.

PART B: STAINING BACTERIA

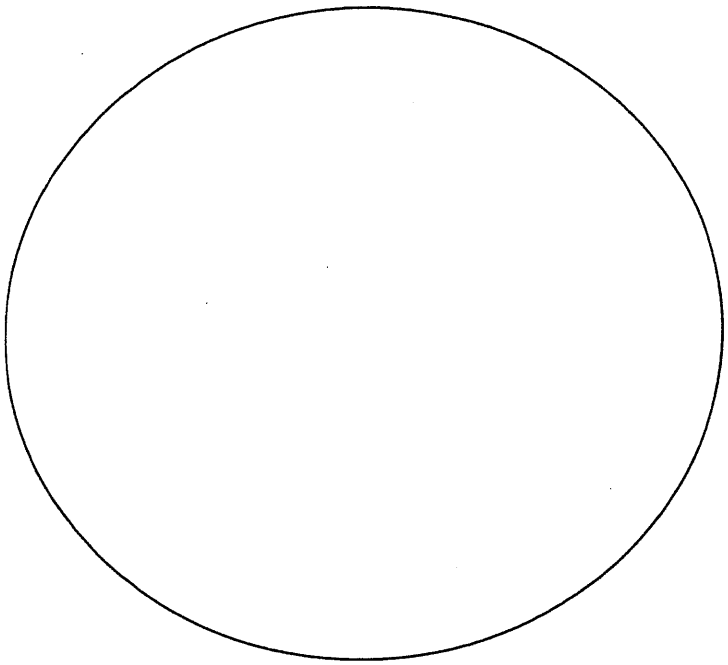
12. You must heat fix the bacteria prior to staining. This also kills the bacteria. Using microscope slide forceps, pick up each slide one at a time, and pass it over the flame several times. (Hint: Do not hold the slide constantly over the open flame.) Let each slide cool.
13. Using microscope slide forceps, place one of your slides across the top of a 150 mL beaker half-filled with water.
14. **CAUTION: Methylene blue will stain your skin and clothing.** Place 2 to 3 drops of methylene blue stain on the dried bacteria. Do not allow the stain to spill into the beaker.
15. Let the stain stay on the slide for 2 minutes.
16. Dip the slide into the water in the beaker several times to rinse it. Gently pat the slide dry with a paper towel. Do not rub the slide.
17. Repeat steps 14 through 17 for your other two slides.
18. Allow each slide to completely dry before looking at your slides under the microscope.

Petri dish appearance

Day 2



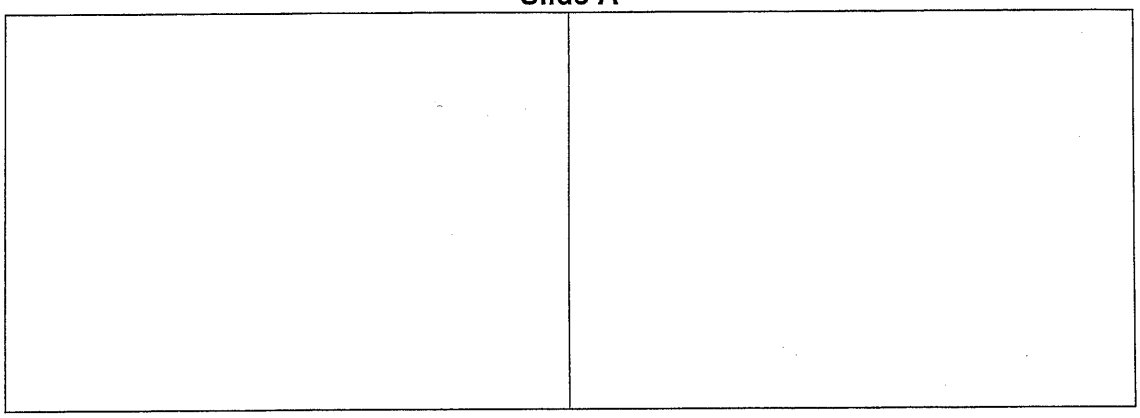
Day 3



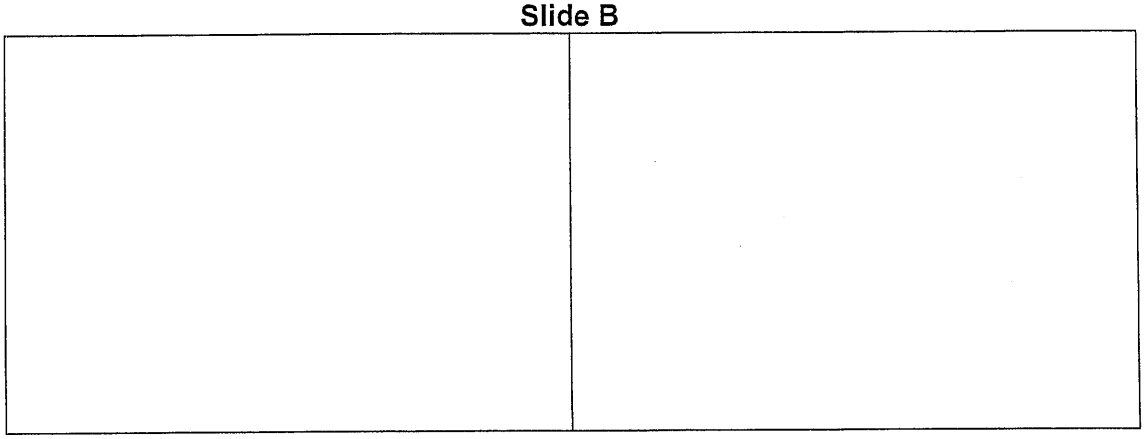
PART C: OBSERVING BACTERIA

19. Look at each slide under the microscope on low and high power. Make a sketch of a few cells that you see on each slide.

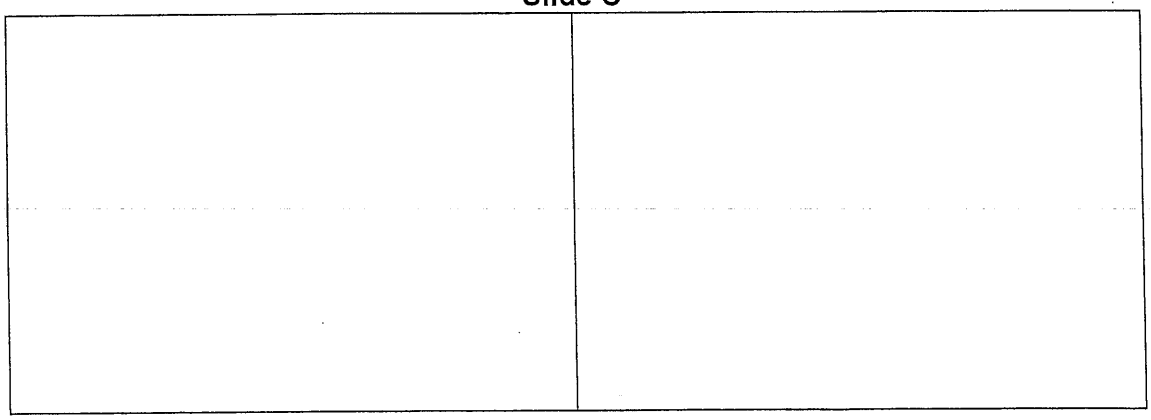
Slide A



Slide B



Slide C



20. Clean up your lab materials! You must clean and rinse your slides and put your microscopes on the back table.

Questions

1. Describe the shape of the cells of each type of bacteria that you looked at. How were the cells grouped?

2. How did you classify the bacteria in cultures A, B, and C: as coccus, bacillus, or spirillum?

3. Which were the easiest to identify? Which characteristics of the bacteria were must difficult to see. Be specific. Explain your answer.

4. Write a question about bacteria that could be answered with a new investigation.

5. Microbiologists are scientists who study organisms too small to be seen by the naked eye. Research what you consider to be the coolest bacterial pathogen and write a one to two paragraph summary about the organism.

6. Identify at least 3 of the colonies on your Petri dish using the materials at each lab table. You should use the bacterial morphology from the microscope to identify the organism. For extra credit, you may submit up to 3 digital microscope photos from class with the identification of the organism,

1. _____ *

2. _____ *

3. _____ *

4. Write a question about bacteria that could be answered with a new investigation.

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1. _____ *

2. _____ *

3. _____ *

Name _____ Class _____ Date _____

A Model for Disease Transmission

Pre-Lab Discussion

A *disease* is a condition that interferes with the normal functioning of a living thing but is not the result of an injury. Generally, a disease has certain symptoms. The disease can affect the entire body or only parts of the body. People can be born with certain diseases, such as genetic disorders. Other diseases can develop during a person's lifetime.

An *infectious disease* is one that is caused by an organism or virus that enters the body. Most disease-causing microorganisms do not move from one person to another on their own. Instead, the microorganisms are transmitted through contact with an infected person or a contaminated object or substance.

In this investigation, you will observe how easily a harmless microorganism is transmitted from person to person.

Problem

How easily can infectious disease be spread?

Materials *(per group of four students)*

4 petri dishes containing sterile nutrient agar
Glass-marking pencil
Sterile cotton swabs
Sterile distilled water
Yeast culture
Wire inoculating loop
Bunsen burner
Flint striker or matches

Safety

Put on a laboratory apron if one is available. Put on safety goggles. Handle all glassware carefully. Note all safety alert symbols next to the steps in the Procedure and review the meanings of each symbol by referring to the symbol guide on page 10.

Procedure

1. Assign a number from 1 to 4 to each member of your group.
2. Using a glass-marking pencil, draw a line on the bottom of an agar plate to divide it in half. Label one side of the plate "Control" and the other side "Experimental." Also write your assigned number on the bottom of the plate.
3. Swab your left hand with a sterile cotton swab moistened in sterile distilled water. Then swab one corner of the control side of the agar with the same swab.
4. Sterilize a wire loop by passing it through the flame of a Bunsen burner until the entire length of the wire has been heated to a red glow. **CAUTION:** *Put on safety goggles whenever you use a Bunsen burner.*
5. Streak your plate with the sterilized wire loop as shown in Figure 1. The streak should begin from the point at which the plate was touched with the swab. **Note:** *The wire loop should be sterilized after each use by heating as before.*

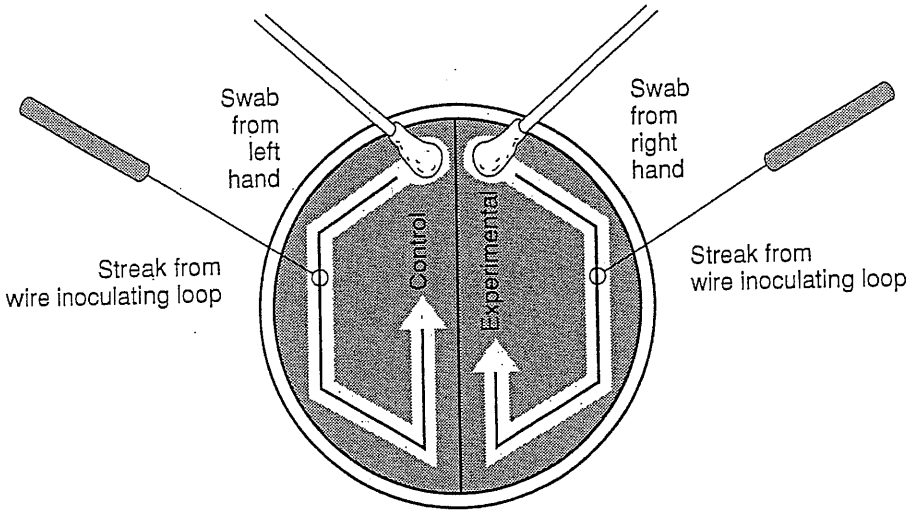


Figure 1

6. Your teacher should swab the right hand of group member 1 with a culture of yeast. Group member 1 should then shake hands with group member 2. Group member 2 should then shake hands with group member 3. Finally, group member 3 should shake hands with group member 4.
7. You and your group members should swab the right hand with sterile cotton swabs moistened with sterile distilled water. Then using the same swab, you all should swab one corner of the experimental side of your individual agar plate and repeat steps 4 and 5 of the Procedure.
8. Wash your hands thoroughly with soap and water after swabbing.
9. You and your group members should cover all the agar plates and incubate them in an inverted position for 48 hours, after which they should be examined.

Observations

1. Compare the control and experimental sides of the plates. Describe the differences between them. _____

_____

_____

_____

Name _____ Class _____ Date _____

2. Why is it necessary to compare your control plates with the yeast culture?

_____

_____

Analysis and Conclusions

1. How are most disease-causing microorganisms transmitted? _____

_____

_____

2. How were the yeast colonies transmitted from plate 1 to plates 2, 3, and 4?

_____

_____

3. Which plate should have contained the greatest number of yeast? Which plate should have contained the least? Explain your answer. _____

_____

_____

_____

Critical Thinking and Application

1. What do you think is the best way to prevent the transmission of infectious diseases?

_____

_____

_____

2. How would population density influence the transmission of diseases?

_____

_____

_____

3. List three infectious diseases that are commonly spread among human populations.

_____

_____

_____

4. List three ways in which diseases can be directly and indirectly spread.

_____

_____

_____

5. Children must be immunized for certain diseases before they enter school. Why is immunization required by law? _____

_____

_____

Going Further

1. Test the sensitivity of the bacteria in your plates to antibiotics. Using forceps, place a pretreated antibiotic disk in the center of each of your petri dishes. Turn the petri dishes upside down and incubate them at 37°C for 24 to 48 hours. When incubation is complete, some areas on the surface of the agar should look cloudy or white. These areas have bacteria growing on them. Check for clear or less dense circular regions around each disk. A clear region around the disk indicates that the antibiotic has either killed bacteria or inhibited their growth.
2. Carry out an experiment to show that microbes are sprayed into the air by talking and laughing. Talk for 30 seconds facing a sterile nutrient agar plate held 15 cm from your mouth. Repeat this procedure with a second agar plate held at arm's length from your mouth. Repeat the same procedure for two more agar plates, but this time cough onto each. Repeat the procedure for two more agar plates, but this time laugh in the direction of each plate. Cover each plate and incubate them at room temperature for 24 to 48 hours. Observe the amount of microbial growth on each plate. Write a brief report explaining your results.

Name _____ Class _____ Date _____

Quick Lab **DEMONSTRATION**

Using Bacteria to Make Food

Although some bacteria cause diseases, many bacteria are beneficial to humans. For instance, certain types of bacteria are used to make a variety of foods, including cottage cheese, sour cream, vinegar, sauerkraut, pickles, and yogurt. Foods made from these bacteria may provide health benefits beyond good nutrition. Eating yogurt that contains live bacteria, for example, may increase resistance to intestinal infections, fight vaginal yeast infections, and decrease the risk of colon cancer.

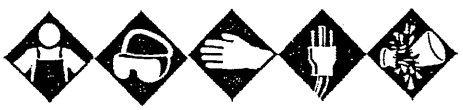
In this lab, you will use bacteria to turn milk into yogurt. The bacteria will come from a small amount of yogurt containing live bacteria.

OBJECTIVES

- **Observe** the production of yogurt.
- **Test** the pH of yogurt and of milk before and after incubation with bacteria.

MATERIALS

- aluminum foil
- beaker, 1 L
- beaker, 600 mL
- beaker tongs
- gloves, disposable
- hot plate
- lab apron
- milk, 400 mL
- oven mitts
- pH paper or pH test strips
- safety goggles
- tap water
- teaspoon
- thermometer
- water bath or incubator
- yogurt, plain, with live cultures



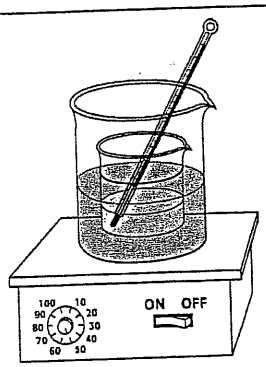
Procedure

1. Put on safety goggles, disposable gloves, and a lab apron.
2. Pour 400 mL of milk into a 600 mL beaker.
3. Measure the pH of the milk with pH paper or a pH test strip. Record the pH in **Table 1.**
4. Pour 400 mL of tap water into a 1 L beaker. Set the beaker on a hot plate. Place the beaker of milk inside the beaker of water, as shown in **Figure 1.** Place a thermometer in the milk.
5. Turn on the hot plate. **CAUTION: Do not touch the hot plate while it is on. It will become very hot. After you turn off the hot plate, allow it to cool for at least 15 minutes before you touch it.** Heat the milk to 81°C for 10

minutes. Be careful to avoid boiling the milk.

TABLE 1 pH OF MILK AND YOGURT

Substance	pH
Milk, before heating	
Milk, after heating and cooling	
Milk and yogurt, just after mixing	
Milk and yogurt, after 24 h incubation	



6. Turn off the hot plate. Use beaker tongs and oven mitts to carefully remove the beaker of milk and set it on your lab table. Allow the milk to cool for 10 minutes and measure the pH again. Record the pH in **Table 1.**
7. Add one teaspoon of yogurt to the cooled milk. Stir the milk and yogurt gently until they are thoroughly mixed. Measure the pH of the mixture. Record the pH in **Table 1.**
8. Cover the beaker with aluminum foil. Incubate the milk at about 39°C in a water bath or incubator overnight.
9. After 24 hours, measure the pH of the newly formed yogurt. Record the pH in **Table 1.**

Analysis and Conclusions

1. **Describing Events** Describe the changes that occurred in the milk.

_____

_____

_____

2. **Analyzing Data** What evidence do you have that a chemical reaction occurred in the milk?

_____

_____

_____

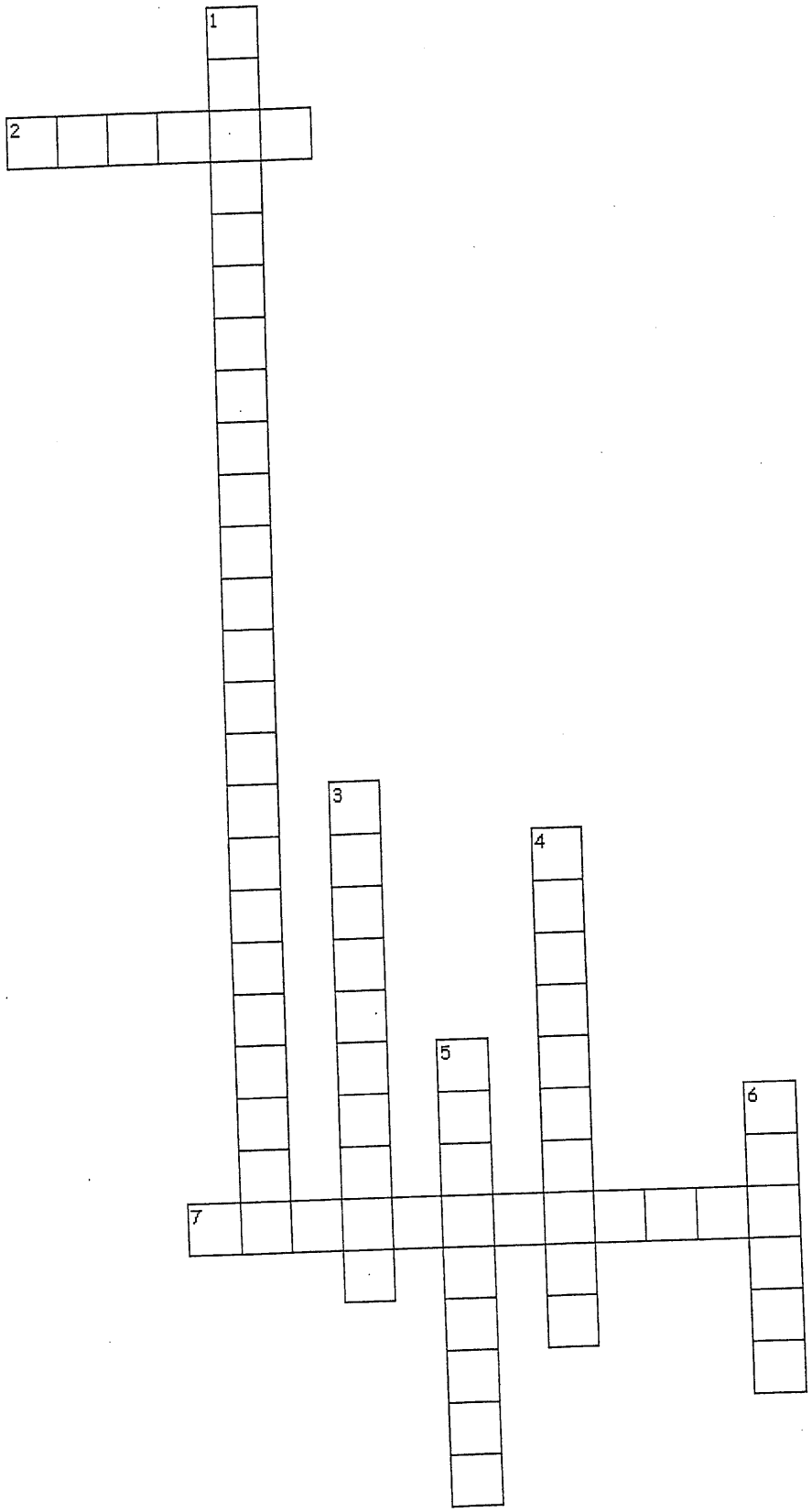
3. **Evaluating Methods** What other evidence could be collected to indicate that yogurt was produced in the beaker?

POINTS	3	2	1	0
CONTENT	ALL INFO IS GIVEN IN COMPLETE SENTENCES AND IS ACCURATE	INFORMATION/DESCRIPTIONS NOT COMPLETE	SOME INFORMATION IS INACCURATE	MOST INFORMATION IS MISSING OR INCORRECT
NEATNESS	INFORMATION IS LEDGIBLY HAND PRINTED ON 5X7 INDEX CARD	WRITING IS SLOPPY OR INCORRECT LAYOUT IS USED	WRITING IS DIFFICULT TO READ OR IN CURSIVE, IMPROPER FORMAT OF INFO IS USED	WRITING IS NOT LEDGIBLE OR NOT PRESENT
REPRESENTATION OF ORGANISM	SIZE, SHAPE AND APPEARANCE ARE CORRECT	ONE OF THE THREE CATEOGORIES(SIZE, SHAPE,APPEARANCE) IS MISREPRESENTED	TWO OF THE THREE CATEOGORIES(SIZE, SHAPE,APPEARANCE) IS INACCURATE	ALL CATEOGORIES(SIZE, SHAPE,APPEARANCE) AREINACCURATE
PRESENTATION OF ORGANISM	MODEL IS COMPLETE WITH GOOD WORKMANSHIP	MODEL WAS NOT PLANNED WELL BUT ACCURATELY REPRESENTS ORGANISM	MODEL IS SLOPPY OR DOES NOT STAY TOGETHER	MODEL SHOWS POOR WORKMANSHIP AND/OR IS FALLING APART

TOTAL_____

Ch 21 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the



back

Across

2. the cell that results from the fusion of gametes
7. a cytoplasmic extension that functions in food ingestion and movement

Down

1. within the life cycle of an organism, the occurrence of two or more distinct forms that differ from each other in method of reproduction
3. the multinucleate cytoplasm of a slime mold that is surrounded by a membrane and that moves as a mass
4. a rapid increase in the population of algae in an aquatic ecosystem
5. a thick-walled protective structure that contains a zygote
6. a haploid reproductive cell that unites with another gamete to form a zygote

gamete	
zygote	
zygospore	
alternation of generations	
pseudopodium	
plasmodium	
algal bloom	
gamete	
zygote	
zygospore	
alternation of generations	
pseudopodium	
plasmodium	
algal bloom	

Chapter 21 Protists

I. CHARACTERISTICS OF PROTISTS -Protists are eukaryotic organisms that cannot be classified as fungi, plants, or animals.

A. Several important characteristics evolved in protists. Those characteristics include membrane-bound organelles, complex _____ and flagella, sexual reproduction with _____, and multicellularity.

B. Multicellularity allows cells to specialize, which in turn allows for the development of tissues, organs, and organ systems.

II. REPRODUCTION -Protists can reproduce asexually by _____, budding, and fragmentation. Protists can also reproduce sexually by fusion of gametes.

III. CLASSIFYING PROTISTS -The classification of organisms currently grouped in the kingdom Protista is likely to change as scientists learn more about how these organisms are related to each other and to members of other kingdoms. Molecular studies suggest that protists could be classified into up to 20 kingdoms.

IV. ANIMAL-LIKE PROTISTS - Animal-like protists ingest other organisms to obtain energy. Animal-like protists are often called *protozoa,* which means "first animals." All animal-like protists are unicellular, most can move, and most reproduce asexually by binary fission.

A. Amoeboid Protists - Amoeboid protists include a wide variety of organisms that move by using extensions of their cells called _____. Pseudopodia are also used to surround and engulf food particles.

B. Ciliates - Most or all of the body of a ciliate is covered by a tough yet flexible outer covering and short, hairlike structures called _____. Ciliates move and hunt for food by beating their cilia. Most ciliates are free-living and can be found in fresh water and salt water.

C. Flagellates - _____ are protists that have whip-like structures called *flagella.* Some flagellates also have cilia or form pseudopodia.

D. Sporozoans - Animal-like protists that form sporelike cells when they reproduce are called _____. Sporozoans lack flagella, cilia, and pseudopodia and thus do not move. All sporozoans are _____ and cause disease. Sporozoans reproduce both asexually and sexually.

Some Groups of Animal-like Protists		
Group and example	**Major structures**	**Other characteristics**
Amoeboids (*Amoeba proteus*) 	• pseudopodia to move and capture prey	• found in fresh water, salt water, and soils • most free-living; some parasitic
Ciliates (*Paramecium*)	• short, hair-like structures called *cilia* for movement and hunting for food • tough, flexible outer covering for protection	• typically free-living • found in fresh water and salt water
Flagellates (*Leishmania*)	• flagella (one or many) for movement • cilia for movement in some • pseudopodia for movement and catching prey in some	• many free-living; some parasitic • free-living species typically found in fresh water
Sporozoans (*Plasmodium*)	• spore-like cells for reproduction	• parasitic • cause disease • do not move

V. PLANTLIKE PROTISTS -Plantlike protists obtain energy through photosynthesis. Plantlike protists include the organisms commonly called *phytoplankton* and algae.

A. Diatoms - _____ are photosynthetic, unicellular protists with unique double shells. Their shells are made of silica or calcium carbonate and have distinct patterns. Diatom shells are like small _____ with lids. Diatoms tend to get smaller with each generation. When they reach a certain minimum size, they reproductive sexually and produces full-sized offspring.

B. Euglenoids - _____ are freshwater protists that have one or two flagella. Many euglenoids are photosynthetic. Some are both photosynthetic and heterotrophic. Others lack chloroplasts and ingest their food. Some have an _____, a light-sensitive organ that helps them move toward light.

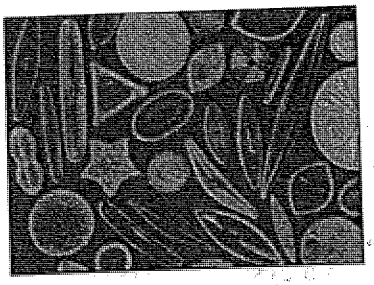
C. Dinoflagellates - _____ are unicellular protists that typically have two flagella. Most dinoflagellates are photosynthetic. Most dinoflagellates have protective coats that may contain silica. The _____ coats give dinoflagellates unusual shapes. As its flagella beat, a dinoflagellate spins through the water like a top.

D. Red Algae - Most _____ are multicellular. They are usually found in warm ocean waters. The pigments in red algae absorb blue light that penetrates deep into water. As a result, red algae are able to grow at greater depths than other algae are. Some red algae have calcium carbonate in their cell walls. These coralline algae play an important role in the formation of coral reefs.

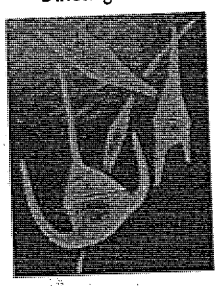
E. Brown Algae - _____ are multicellular protists that are found in cool ocean environments. The largest brown algae are kelp that can reach 60 m (197 ft) in length. Blades often have air-filled sacs that help the algae float close to the surface of the ocean. Brown algae are the only algae that form more than one tissue type.

F. Green Algae - _____ are a very diverse group of protists. They form a major part of marine plankton. Some inhabit damp soil and resemble plants. Some are symbiotic within the cells of other organisms. Green algae are similar to plants in several ways. They use the same photosynthetic pigments that plants do, they use starch to store energy, and their cell walls contain cellulose. Green algae are thought to have given rise to the first true plants.

Diatoms



Dinoflagellates



Some Groups of Plant-like Protists		
Group and example	**Major structures**	**Other characteristics**
Diatoms (*Cyclotella*)	• glassy double shells made of silica or calcium carbonate	• unicellular • found in salt water and fresh water
Euglenoids (*Euglena*)	• flagella for movement • in some, an eyespot that detects light	• unicellular • found in fresh water • some heterotrophic
Dinoflagellates (*Ceratium*)	• typically two flagella for movement • cellulose coats for protection	• unicellular • many found in salt water • some heterotrophic
Red algae (*Corillina*)	• pigments that can absorb blue light in deep water	• mostly multicellular • typically found in warm ocean environments • in some, calcium carbonate in cell walls
Brown algae (*Macrocystis*)	• a root-like *holdfast* • a stem-like *stipe* • leaf-like *blades*	• multicellular • found in cool ocean environments • the only algae that have differentiated tissues
Green algae (*Ulva*)	• cell walls contain cellulose	• some unicellular; some multicellular • use same photosynthetic pigments that plants do

VI. FUNGUSLIKE PROTISTS -Funguslike protists absorb nutrients from their environment and reproduce by releasing spores. Funguslike protists were once classified as fungi. However, molecular analyses reveal that they are not closely related to fungi.

A. Slime Molds - Slime molds form spores and absorb nutrients from soil, decaying wood, or animal dung. Cellular slime molds usually exist as single-celled amoebas. A plasmodial slime mold is a plasmodium, a mass of cytoplasm that has many nuclei.

B. Water Molds and Downy Mildews - Water molds and downy mildews typically form multicellular filaments that resemble fungi. Many of these protists decompose dead organisms. Others are common parasites of aquarium fish.

1. In 1846, one type of water mold destroyed almost the entire potato crop in Ireland, which led to the _____.

2. In 1879, a downy mildew of _____ almost wiped out the French wine industry.

VII. PROTISTS AND DISEASE -Protists cause a number of human diseases, including giardiasis, amebiasis, toxoplasmosis, trichomoniasis, cryptosporidiosis, Chagas disease, and malaria.

A. Giardiasis - _____ is a disease caused by an intestinal parasite of the genus *Giardia.* The parasite enters the body as a cyst. The cyst releases two flagellated protists As the protists move through the intestine, they cause severe diarrhea and intestinal cramps that may last for two to six weeks. The disease is rarely fatal.

B. Amebic Dysentery - The parasite *Entamoeba histolytica* causes two forms of diarrheal illness. One form, _____, is mild and can last a couple of weeks. _____ is a severe form of amebiasis. Symptoms of amebic dysentery include pain, bloody diarrhea, and fever. In rare cases, amoebas travel to the liver, lungs, or brain and can be fatal.

1. *E. histolytica* forms cysts that are transmitted in contaminated _____, most commonly in countries that have poor sanitation.

2. *E. histolytica* can also be transmitted on _____, vegetables, and other foods that have been washed with contaminated water and eaten raw.

C. Toxoplasmosis - _____, caused by the protist *Toxoplasma gondii,* is spread by cats and by eating undercooked meat that contains cysts. Infected _____ release spores in their feces for up to two weeks after infection.

1. If a pregnant woman is infected, her fetus can suffer eye or brain damage.

2. To avoid toxoplasmosis, cook meat fully and wash hands thoroughly after gardening or changing a cat's litter box. Pregnant women should avoid changing cat litter.

D. Trichomoniasis - _____ is one of the most common sexually transmitted infections in the United States. Men often have no symptoms, but can still spread the infection. Women who are infected typically experience discolored discharge, genital itching, and the urge to urinate. If a pregnant woman is infected the baby can die

E. Cryptosporidiosis - Cryptosporidiosis, commonly called _____, is caused by protists of the genus *Cryptosporidium.* It can be spread by contaminated _____ or objects and in uncooked food. The most common symptoms of crypto are severe cramps and diarrhea that may last up to two weeks.

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F. Chagas Disease - _____ disease, or American trypanosomiasis, is caused by the protist *Trypanosoma cruzi.* This disease occurs in South and Central America. It is spread by _____. The chronic stage can result in heart disease, abnormal heartbeat, heart failure, heart attack, and enlargement of the esophagus and the large intestine.

G. Malaria - _____ is caused by several types of sporozoans of the genus *Plasmodium.* Malaria is spread by the bite of the *Anopheles* _____. When an infected mosquito bites a human, it injects saliva containing the parasite. Malaria kills up to 3 million people every year.

1. Plasmodium is developing resistance to many drugs, so treatment is becoming more difficult.

2. Efforts to control malaria include distribution of insecticide treated mosquito nets and fumigation to kill mosquitoes.

VIII. PROTISTS AND THE ENVIRONMENT -Protists produce oxygen, take up carbon dioxide, are important producers in aquatic food webs, can produce deadly blooms, serve as nutrient recyclers, and have symbiotic relationships with many animals and plants.

Algal Blooms

1. An algal bloom is a rapid increase in the population of algae in an aquatic ecosystem.

2. A red tide is caused by a bloom of dinoflagellates that produce powerful toxins. Humans can become ill if they eat fish or shellfish during a _____.

3. One genus of dinoflagellates, *Pfiesteria,* produces a powerful toxin that can become airborne. This toxin can cause memory and concentration problems as well as skin rashes.

4. When an algal bloom dies, the bacteria that consume and decompose the algae deplete the oxygen levels in the water.

5. As a result, large numbers of fish and other marine animals may die.

IX. PROTISTS AND INDUSTRY Protists are important in many foods, in industrial and consumer products, and in scientific research.

A. Carrageenan, agar, and alginate substances produced by algae. These substances are used as thickening agents in foods such as ice cream, salad dressings, and gelatin desserts.

B. The empty shells of _____ are used as abrasives in cleaning agents, such as toothpaste. Diatoms are also used in diatomaceous earth as a natural product to control insect pests.

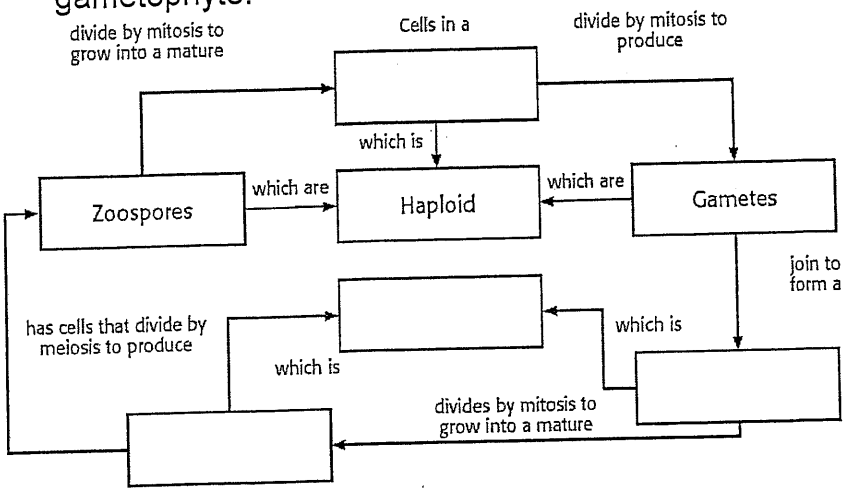
Protist or protist product	Uses
Carrageenan, agar, and alginate	thickener in foods such as ice cream, salad dressings, and gelatin desserts
Agar	gelatin capsules for medication
Carrageenan	paints, fire-fighting foam, and cosmetics
Empty shells of diatoms	abrasives in cleaning agents and toothpastes, reflective roadway paint, natural insect control
Slime molds	studied as models of cell movement and cell signaling

HOMEWORK DATE DUE

CH 21 SEC 1

1. A classmate tells you that he saw a unicellular organism through a microscope and concluded that it was a protist. Is his conclusion valid? What other information do you need?

2. Complete the concept map below to describe alternation of generations.Use the following terms: gamete, zygote, zoospores, haploid, diploid, sporophyte, and gametophyte.



3. How do the offspring of asexual reproduction differ from the offspring of sexual reproduction?

4. Why will the classification of protists likely change in the near future?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

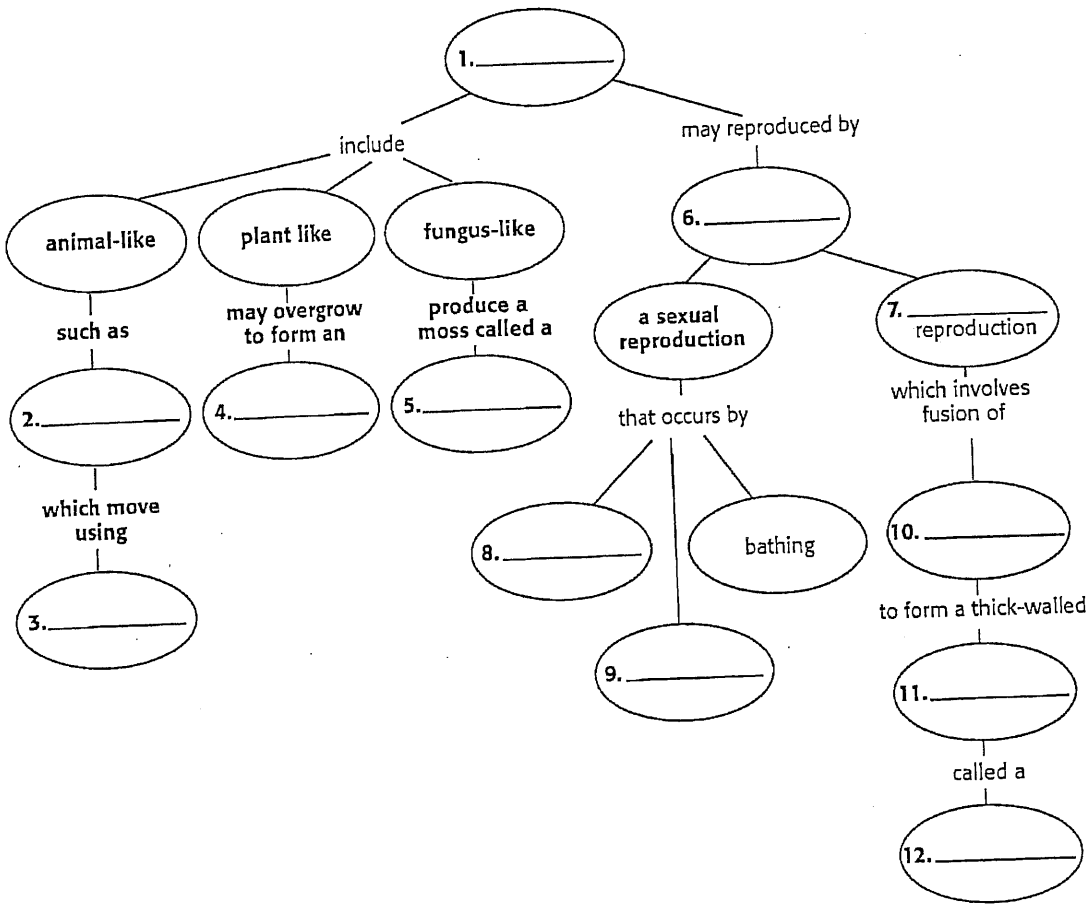
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

Using the terms and phrases provided below, complete the concept map showing the characteristics of protists.

algal bloom
alternation of generations
amoebas
binary fission
fragmentation
gametes
plasmodium
protists
pseudopodia
sexual
zygospore
zygote



Ch 21 Review

1. What type of organisms are in the Kingdom Protista?
2. What things do organisms in Protista have?
3. Eukaryotes that lack the features of animals, plants, or fungi are classified in the kingdom _____
4. What asre pseudopodia?
5. What are flagella?
6. If something is unicellular and has a cell wall, what type of reproduction does it use?
7. Amoebas capture food by _____
8. How do diatoms reproduce?
9. What are algae? Where are they found?
10. What are euglenoids? How do they eat?
11. What is conjugation?
12. What is giardiasis?
13. What is Chagas disease?
14. What is amoebic dysentery?
15. What is malaria?
16. What is toxoplasmosis?
17. Protists that play an important role in aquatic food webs are called _____
18. The evolution of the plant kingdom can be inferred by studying _____
19. A mass of cytoplasm that has many nuclei is a(n) _____
20. A protist that almost destroyed the entire potato crop in Ireland in 1846 is a _____
21. When an algal bloom dies, the bacteria that decompose the algae do what to the water?

Protistan Responses to Light

OBJECTIVES

- **Identify** several types of protists.
- **Compare** the structures, methods of locomotion, and behaviors of several kinds of protists.
- **Relate** a protist's response to light to the protist's method of feeding.

MATERIALS

- protist slowing agent
- mixed culture of protists
- microscope slides
- toothpicks
- paper, white
- scissors
- sunlit windowsill or lamp
- plastic pipets with bulbs
- compound microscope
- coverslips
- construction paper, black
- paper punch
- forceps

Preparation

1. **Scientific Methods** **State the Problem** How do protists respond to various amounts of light?
2. **Scientific Methods** **Form a Hypothesis** Form a testable hypothesis about how protists will respond to various levels of light.

_____

_____

Procedure

MAKE A WET MOUNT OF PROTISTS

1.  Put on safety goggles, gloves, and a lab apron.

2.  **CAUTION: Do not touch your face while handling microorganisms.** Place a drop of protist slowing agent on a microscope slide. Add a drop of liquid from the bottom of a mixed culture of protists. Add a coverslip.
3. View the slide under low power and high power of a microscope.
4. Make a drawing of each type of protist. Note whether the protist moves, and try to determine how it moves.

Movement:	Movement:
Movement:	Movement:

5. Repeat step 1, but do not use slowing agent. Note the alteration in movement.

TEST PROTISTAN RESPONSES TO LIGHT

6. Place a wet mount of protists on a piece of white paper. Then, place the paper and the slide on a sunlit windowsill or under a table lamp.
7. Punch a hole in a piece of black construction paper that has a slight curl, as shown in the photo on p. 513 of your textbook. Position the black paper on top of the slide so that the hole is in the center of the coverslip.
8. To examine the slide, first view the area in the center of the hole under low power. (Note: Do not disturb the black paper, and do not switch to high power. Switching to high power will move the paper.) Then, have a partner carefully remove the black paper with forceps while you observe the slide. Note any movement of the protists in response to the change in light.

12.  Clean up your lab materials according to your teacher's instruction. Wash your hands before you leave the lab.

Analyze and Conclude

1. **Summarizing Results** Describe the various types of locomotion that you observed in protists, and give examples of each type.

2. **Scientific Methods** **Analyzing Results** Identify which protists were affected by light, describe how they were affected, and note how long the effects lasted once reintroduced to darkness.

3. **Scientific Methods Drawing Conclusions** How are a protist's response to light and its method of feeding related? Reproduction?

4. **Summarizing Results** Taking into account what you have witnessed in this lab, explain why classifying organisms in the kingdon Protista is so difficult.

Extensions

5. **Research** Investigate livestock diseases that are caused by parasitic protists. Which of these diseases are most common in the United States?

6. **Research** Find out how backpackers can avoid getting diseases that are caused by protists and transmitted in water.

Protozoa
Beginner's Slide Set

The slides in this set provide a general survey of the free-living protozoans. A study of the organisms on these slides will give some idea of the great diversity found in these "simple" microorganisms. Use the accompanying Protozoa sheet for help with identification. No one slide or view of a protozoan can reveal all the details shown in these somewhat idealized drawings. Do not be surprised if you fail to see some structures or details.

Traditionally, protozoans have been considered one-celled animals and given a phylum, the Protozoa (first animals) within the animal kingdom. More recent classification schemes assign protozoans to a separate kingdom called the Protista or Protoctista. In truth, a bewildering variety of evolutionary lines are represented by the protozoans, and all these classifications are more-or-less arbitrary. In this discussion, we use "protozoan" to mean a eukaryotic (nucleated), single-celled microorganism with animal-like characteristics. We divide the protozoans represented in this set into three groups: amoebas, flagellates, and ciliates. This is for convenience only and should not be looked upon as a formal classification.

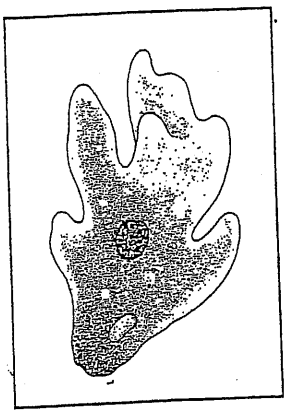
We have stained these protozoans to feature some of their cellular structures, especially the nuclei. While excellent for showing structure, these slides cannot convey a feeling for the dynamics of the living organism. We encourage you to observe living protozoans from cultures or other natural sources as a companion exercise. There are several illus-trations of protozoa which are not included in the slide set but are often found in natural collections.

Magnifications of 100× to 400× are suitable for these slides. Chlamydomonas is small enough for the use of an oil immersion lens. Remember to begin with the microscope's lowest magnification; then go to a higher magnification, if necessary. It is not always true that greater magnification produces better viewing. A clear, sharp image at 200× is more useful than a blurred image at 600×.

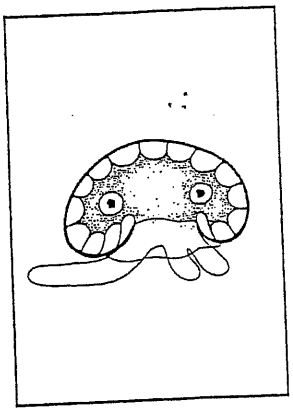
Observe standard laboratory safety procedures when working with microscopes and microscope slides. Examine each slide for cracks or chips; broken glass can cut. If you use natural light as the light source for your microscopes, remember that direct sunlight focused through a microscope can damage the eyes. Use indirect natural light or artificial light.

Amoebas

These protozoans crawl about by extending a lobe of protoplasm (a pseudopod or false foot). Pseudopods are temporary features, forming and then disappearing. Compared to other protozoans, amoebas are extremely simple in structure. Some have a shell or test, others do not.



Amoeba



Arcella

Amoeba. As it crawls about, an amoeba is constantly changing shape. Notice the many pseudopods. You may find a large, clear bubble in some of the amoebas. This is a contractile vacuole, and it serves to expel excess water from the cell. The almost spherical, dark-stained nucleus is easily visible. An amoeba "eats" by flowing around and completely engulfing a smaller protozoan or other food objects. The food is then pinched off inside the amoeba in a little bubble called a food vacuole. You may see several of these. The cell also contains various crystals and other small objects.

Arcella. Arcella is an amoeba that produces a thick shell or test that almost completely encloses it. The test is transparent, yellowish, domed, and circular when viewed from above. There is a central hole on the bottom through which an arcella extends its pseudopods. There are two widely spaced nuclei that look somewhat like eyes.

Flagellates

Flagellates move by means of one or more long, slender strands of protoplasm that extend from the main body of the cell. The flagellum (whip) lashes about in the water and pulls the protozoan forward. You are unlikely to see the thin flagellum unless you have good eyes and an excellent microscope.

Many flagellates contain chloroplasts and are photosynthetic. Because of this plantlike characteristic, many botanists consider photosynthetic flagellates to be algae.

Euglena. Euglena is a spindle-shaped, photosynthetic flagellate that is common in fresh water. The anterior (front) of the cell where the flagellum attaches is more rounded than the posterior. The large spherical nucleus is easily seen. The chloroplasts, which are green in the living cell, are discolored by the stain, but search for them using high-power magnification.

Chlamydomonas. This is a spherical or egg-shaped flagellate. Each cell contains a large, cup-shaped chloroplast that wraps around the inside of the cell. Two flagella, attached to the more pointed end of the cell, propel chlamydomonas through the water. This is a very common protozoan in standing water, such as small pools, puddles, and aquariums. It often becomes so abundant that the water turns green. Some kinds of chlamydomonas contain red pigments and can grow on snowbanks. This causes the red snows that sometimes occur in mountains or far northern areas.

The chlamydomonas cell is very small, so switch to the high power of your microscope. You will see two dark spots inside the cell. The one nearest the pointed end of the cell is the nucleus. The other spot is a food storage body. Chlamydomonas, like the green plants, stores food as starch. Also like a green plant, chlamydomonas has a cell wall of cellulose.

Chilomonas. This flagellate is similar in appearance to euglena. However, it lacks chloroplasts, has two flagella, and is somewhat smaller. Starchlike granules are visible in the cytoplasm. Chilomonas is common in water, such as hay infusions, that has decaying plant material. It is often used as a food organism in the culture of larger protozoans .

Ciliates

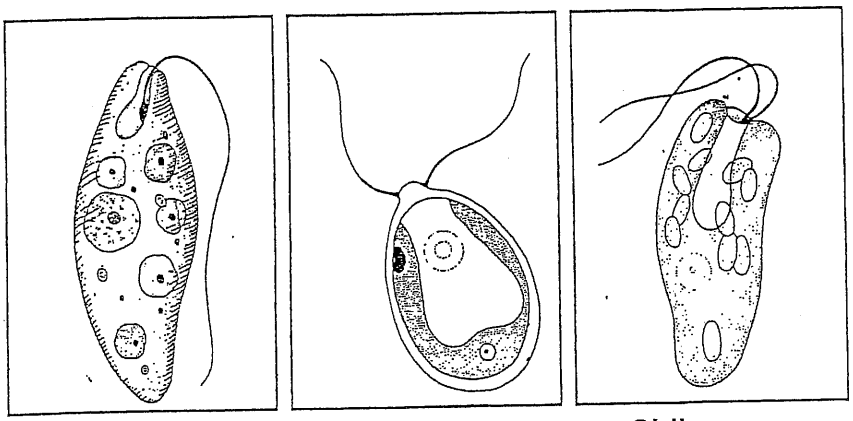
A cilium is a tiny, hair-like projection that covers all or part of the surface of the protozoans called ciliates. Each cilium is identical in internal structure to a flagellum, but it is much shorter and there are often hundreds of them, even thousands on each ciliate cell. Cilia are sometimes fused into bundles (called cirri), or sheets (called membranelles). Cilia function as oars, feet, lips, teeth, and perhaps sense organs. Ciliates tend to be highly complex cells and live in practically any habitat that has water.

Ciliates have two or more nuclei. Often there is a macronucleus and a micronucleus, although many other combinations occur.

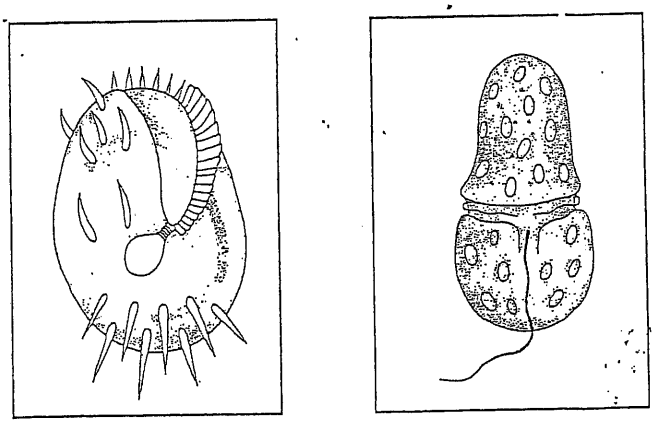
Paramecium. With the possible exception of amoeba, paramecium is the best known of all the protozoans. Paramecium is sometimes called the " slipper animal" because its shape suggests the outline of a bedroom slipper. There is usually a macronucleus and one or more micronuclei, depending on the species. The micronuclei often cannot be seen, either because they do not stain well or because they are hidden by the macronucleus. As a paramecium swims forward, it sweeps bacteria and other food particles along a groove on its side. The groove empties into the gullet. Food particles collect in the gullet, and a food vacuole forms. You can often see one or more food vacuoles. Contractile vacuoles are sometimes visible near either end of the cell. They are often star-shaped because they have radiating canals that reach into the surrounding cytoplasm.

Didinium. The anterior end of didinium is flattened with a projecting conical snout. There are two bands of cilia, one ringing the flattened end,

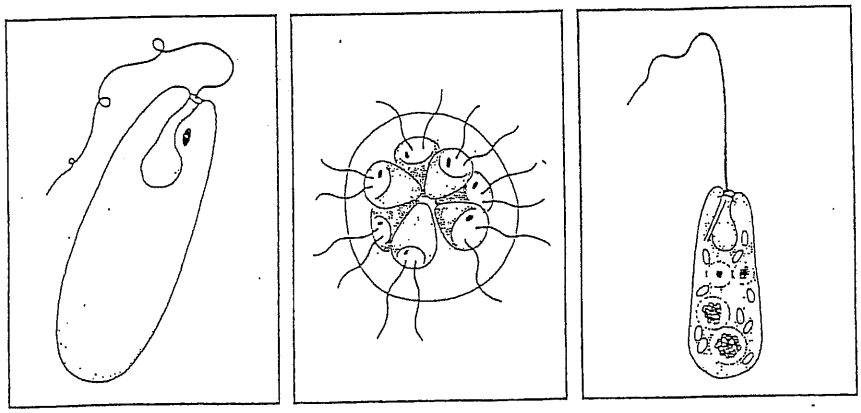
Vorticella. This is a stalked, sessile (fixed in place) protozoan. The main body of the cell is bell-shaped. A set of membranelles surrounds the mouth area. Their actions sweep bacteria and other food particles into the mouth where food vacuoles form. The macronucleus is band-shaped. The long stalk has a contractile fibril. When the fibril contracts, the stalk coils like a spring. Vorticella is often found attached to water plants.



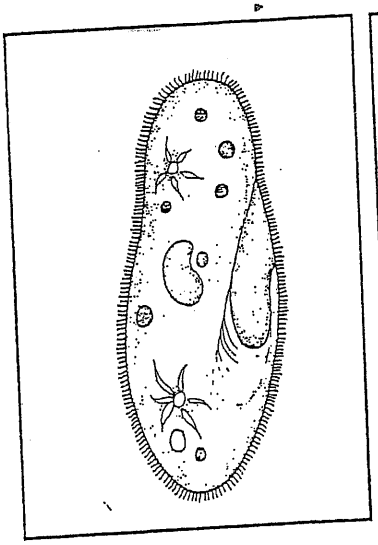
Euglena Chlamydomonas Chilomonas



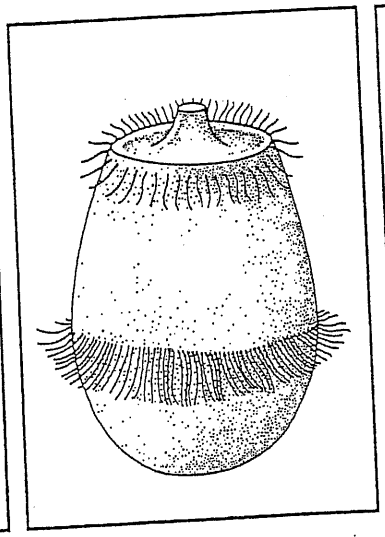
Euplotes Dinoflagellate



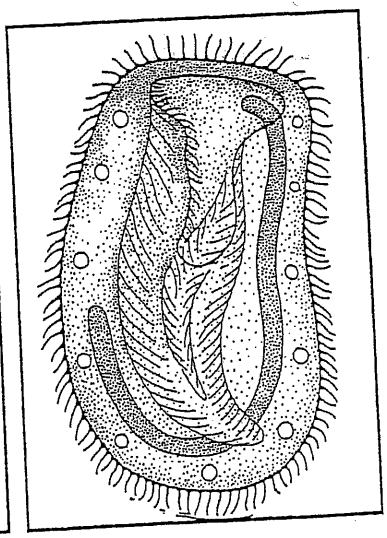
Haematococcus Pandorina Peranema



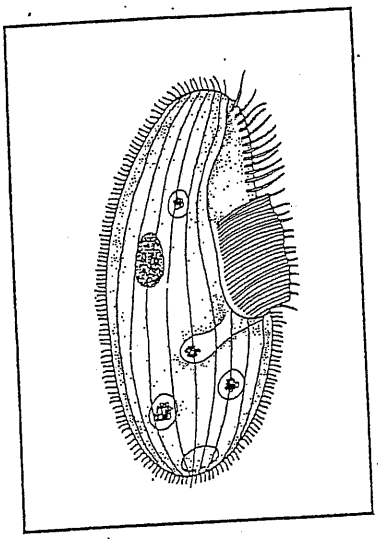
Paramecium



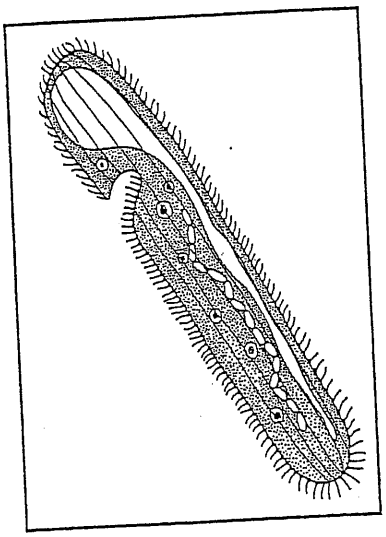
Didinium



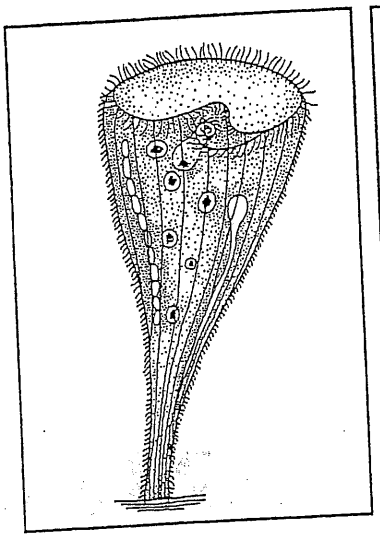
Bursaria



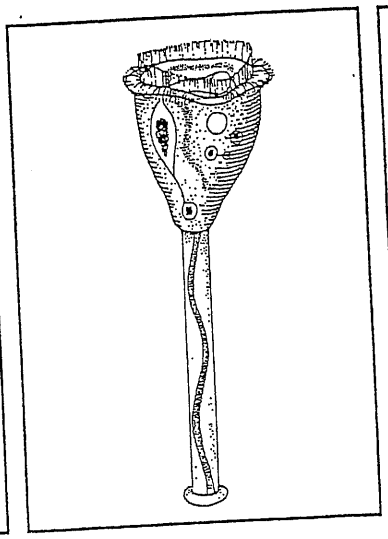
Blepharisma



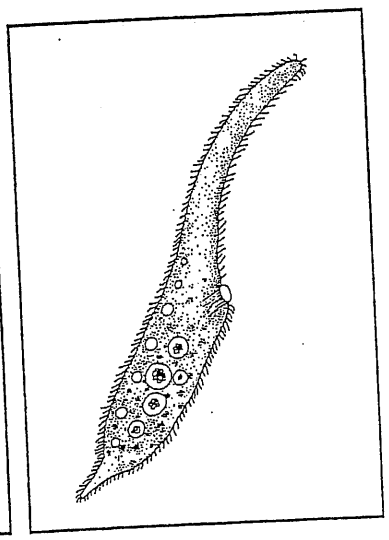
Spirostomum



Stentor



Vorticella



Dileptus

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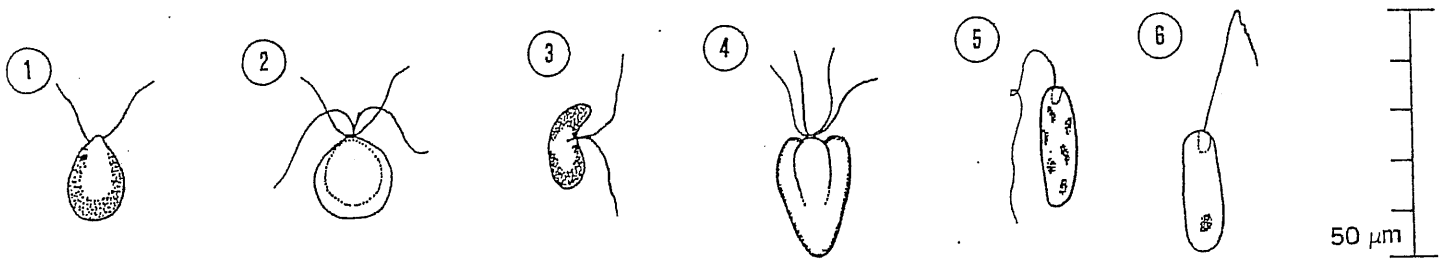
Student Worksheet
Investigating Microlife

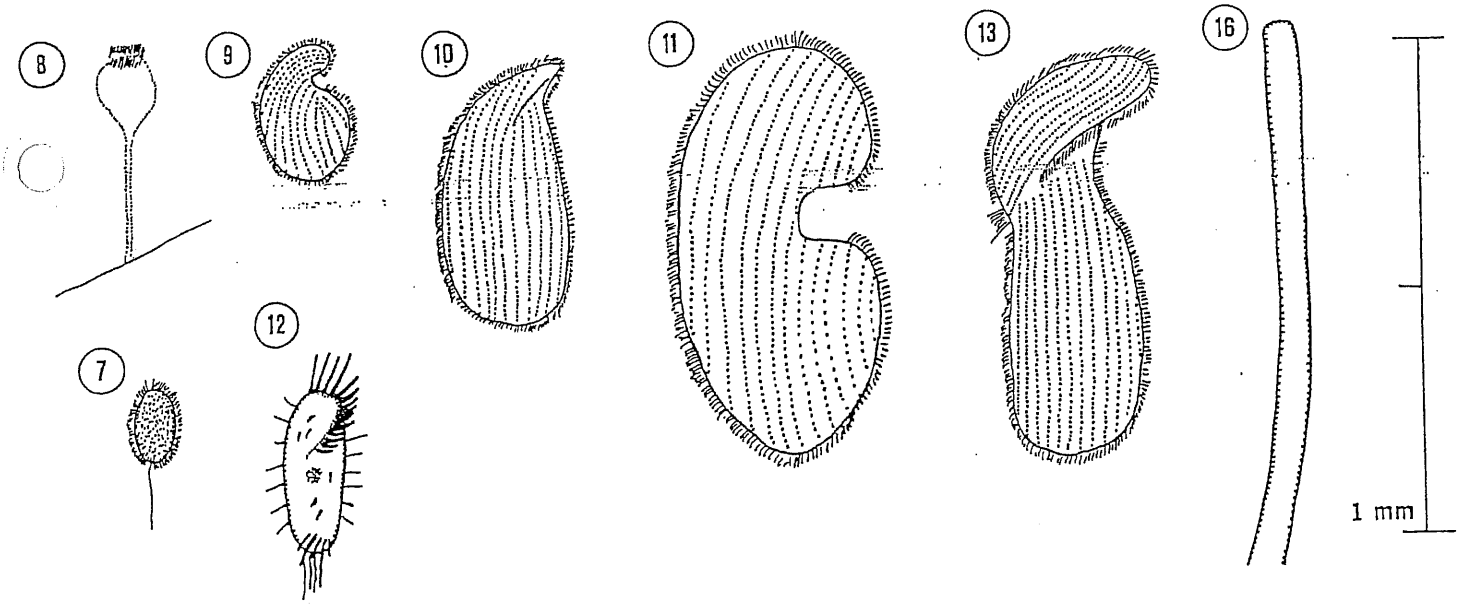
Techniques

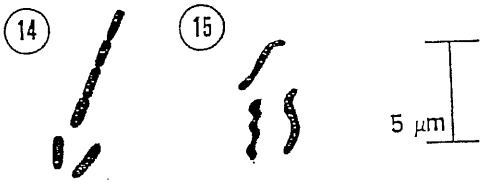
The most important technique for you to master is that of making a wet mount. A wet mount is really a sandwich of a drop of water between two glass surfaces — a microscope slide and a coverglass. To make a wet mount, place a drop of water in the center of a microscope slide. To slow the faster-moving microlife forms, add a drop of Detain directly on top of the first drop. Mix the two drops using a toothpick. Cover this mixture with a coverglass by laying it down on top of the mixed water drop at an angle.

Observe your wet mount by first using low power (100X) magnification. Scan the slide for slowly moving microlife forms. Once you have found one, switch to high power (430X) to better observe and identify them using the dichotomous key.

A stained smear is another technique that is used to observe and identify microlife. In this technique you air dry a drop of water on a microscope slide and then stain the dried microlife forms using a simple or water-based stain. The dichotomous key will help you identify these forms by their shape. Your teacher will provide specific instructions on how to prepare a stained smear.







1 Chlamydomonas
2 Trachelomonas
3 Protochrysis
4 Pyraminonas
5 Euglena
6 Peranema
7 Urotrichia
8 Vorticella
9 Colpoda
10 Chilodenella
11 Tillina
12 Oxytricha
13 Metapus
14 Bacillus bacteria
15 Spirillium bacteria
16 Nematode

WARD'S

Ward's Natural Science Establishment, Inc.

Rochester, New York

Santa Fe Springs, California

St. Catharines, Ontario

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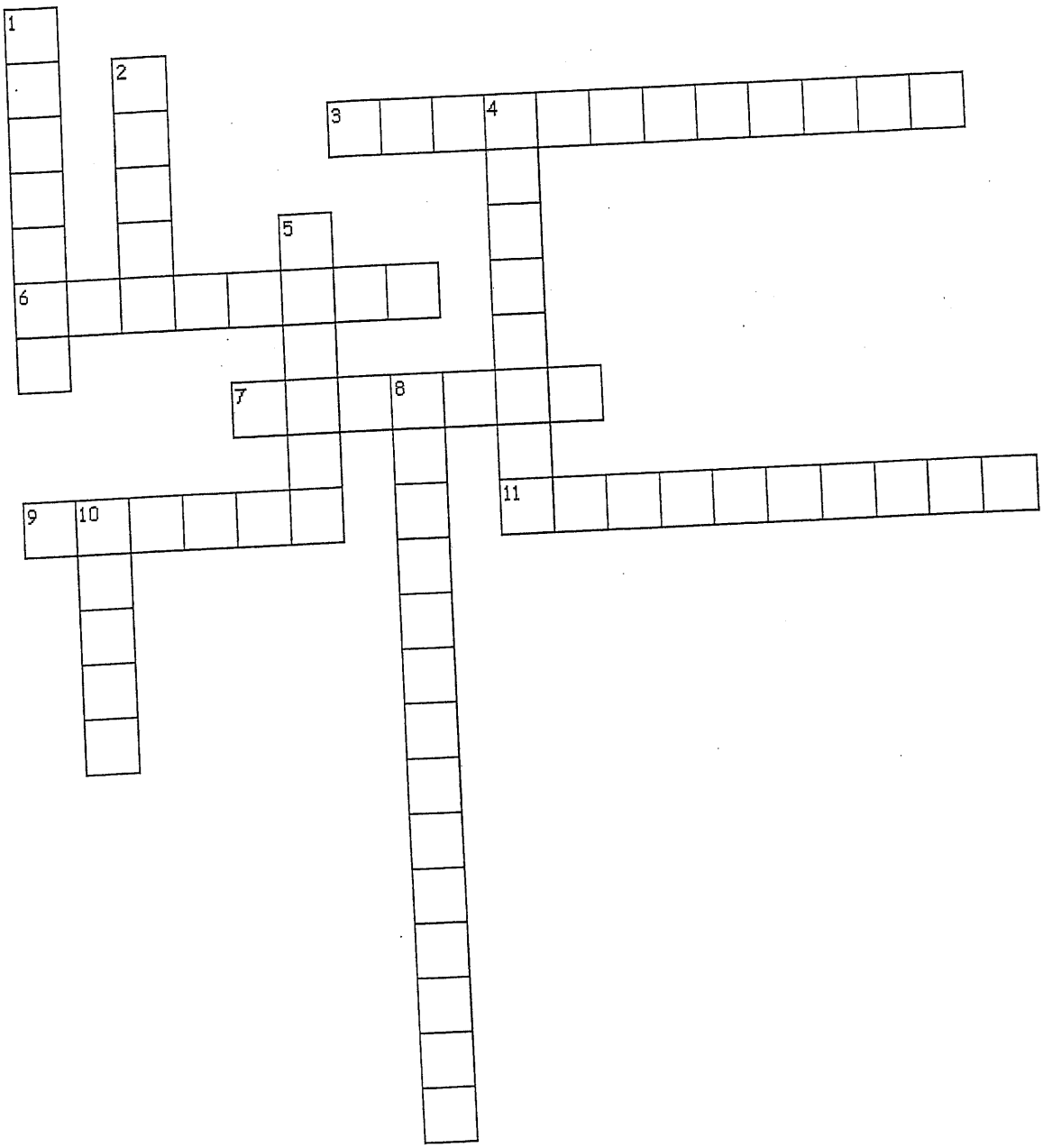
Ch 22 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the back



Across

3. a fungus that infects the skin, hair, or nails
6. the microscopic structure that produces spores in club fungi
7. a rootlike structure that holds fungi in place and absorbs nutrients
9. a carbohydrate found in the cell walls of fungi and other organisms
11. a symbiotic association between fungi and plant roots

Down

1. an organism that absorbs nutrients from dead or decaying organisms
2. the microscopic structure that produces spores in sac fungi
4. the mass of fungal filaments that forms the fungal body
5. a fungus in a symbiotic association with a photosynthetic partner
8. a sexual structure that contains zygotes
10. a filament of a fungus

‹in	
hypha	
mycelium	
rhizoid	
saprobe	
zygosporangium	
ascus	
basidium	
ichen	
mycorrhiza	
dermatophyte	

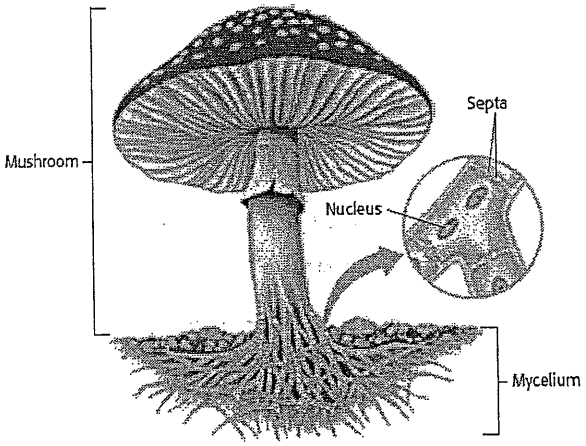
Chapter 22 Fungi

I. WHAT ARE FUNGI?-Fungi have threadlike bodies, their cell walls are made of chitin, and they absorb nutrients from their environment.

A. A fungus body is made of long, slender filaments. The filaments weave more tightly to form reproductive structures, like _____ and _____.

B. Fungi have cell walls that contain _____. Chitin is a tough carbohydrate that is also found in the hard outer covering of insects and other organisms.

C. Fungi obtain energy by breaking down organic and inorganic material in their environment and absorbing the nutrients.



The enlarged image shows hyphae in the mycelium. Septa separate the cells in these hyphae. Gaps in the septa allow nutrients to flow through the hyphae.

II. STRUCTURE AND FUNCTION-A typical fungal body is made of filaments that allow the fungus to have a large surface area and to absorb nutrients efficiently.

A. Body Structure- The threadlike strands of a fungus body are called _____ (singular, hypha). The cells of the hyphae are haploid, are almost identical, and generally perform the same functions. In some fungi, these cells do not have walls that separate the cells. Others fungi have partial cell walls, called septa. Gaps in the septa allow cytoplasm, nutrients, and some organelles to flow through the hyphae. Hyphae form a tangled mass, often many meters long, called a _____. In some fungi, hyphae also form rootlike structures, called rhizoids, that hold the fungus in place and absorb nutrients.

B. Obtaining Nutrients– Fungi release enzymes that break down organic and inorganic matter into nutrients. Fungi absorb the nutrients across their cell walls. Fungi that absorb nutrients from dead organisms are called _____. _____ recycle nutrients that otherwise would stay trapped in the bodies

of dead organisms. Fungi that absorb nutrients from living hosts are called _____. In humans, fungal parasites sometimes cause diseases, such as athlete's foot and ringworm.

III. YEAST AND MOLD- The words yeast and mold refer to stages of the fungus life cycle that are shared by several types of fungi.

A. Some fungi exist primarily in a unicellular state. The common name for this unicellular stage is yeast.
B. Yeasts usually reproduce asexually by budding, a process in which part of the parent pinches off to form a new organism. Under very specific conditions, yeasts can form multicellular hyphae and may reproduce sexually.
C. A mold is a rapidly growing, asexually reproducing stage of some types of fungi. The term mold refers only to the asexual phase. Some fungi that form molds have no observed sexual stage and are grouped with imperfect fungi.

IV. SAC FUNGI-sac fungi are characterized by an ascus, a saclike sexual reproductive structure that produces spores.
V. CLUB FUNGI-Club fungi are characterized by a _____, a clublike sexual reproductive structure that produces spores. When the fungus reproduces sexually, a ring of mushrooms appears. The largest known organism on the planet is a club fungus in Oregon that is _____ across.

Phylum	Type of fungi	Reproductive characteristics
Chytridiomycota	chytrids	produce spores or gametes that have flagella
Zygomycota	zygote fungi	sexual reproductive structures contain zygotes in a tough capsule
Ascomycota	sac fungi	saclike sexual reproductive structures produce spores
Basidiomycota	club fungi	clublike sexual reproductive structures produce spores

VI. FUNGAL PARTNERSHIPS-Fungi form mutualistic _____ associations to form lichens and mycorrhizae. In a _____ relationship, both members benefit.

A. Lichen

1. A _____ is an association between a fungus and a photosynthetic partner, such as a cyanobacterium, a green alga, or both.

2. Lichens can survive in extreme environments, such as on volcanic rock and arctic tundra.
3. Lichens can be damaged by chemicals in their environment and serve as indicators of air pollution.

B. Mycorrhiza

1. A _____ is an association between fungi and the roots of nearly all plants.
2. The fungal _____ grow inside or around the plant root and out into the soil.
3. The hyphae transfer phosphorus and other minerals from the soil to the roots of the plant.

VII. FUNGI AND INDUSTRY-Fungi are used for food, medicines, research, alternative fuels, and pest control.

VIII. Fungi are probably most familiar as food. White button, shiitake, and portabella mushrooms are common in grocery stores.

A. Yeast is used in _____, brewing, and _____.
B. Fungi also produce the citric acid that is used in soft drinks and candies.
C. Fungi are an important part of the medical industry. They produce the antibiotics _____ and _____.
D. Black bread mold produces cortisone, a drug used to treat skin rashes and to reduce joint swelling.
E. Yeast cells have been genetically engineered to make a vaccine for _____
F. Yeast produces _____, a fuel alternative to gasoline.
G. The use of fungal insect parasites to kill crop-destroying insects helps reduce the use of harmful pesticides.

IX. FUNGI AND THE ECOSYSTEM-Fungi play important ecological roles by decomposing organic matter and by breaking down and absorbing minerals from rocks and soil.

A. The main role of fungi in ecosystems is _____ of dead organisms.
B. As part of _____, fungi slowly break down _____ and prepare environments for other organisms.
C. As part of _____, fungi absorb minerals from the soil and transfer them to plant roots. Almost all _____ have mycorrhizae.

X. FUNGI AND DISEASE-Fungi cause disease by absorbing nutrients from host tissues and by producing toxins.

A. Fungal Infections

1. _____ are fungi that infect the skin and nails. They cause athlete's foot, jock itch, toenail fungus, and ringworm.
2. These fungi absorb nutrients and release metabolic wastes that irritate the skin.
3. _____ is a normal resident of the human body.
4. Antibiotics, hormonal changes, or illness can cause yeast to grow too much. The result is a _____.
5. _____ is a lung infection caused by a fungus that grows in bat and bird feces. When its spores are inhaled, this fungus can cause severe respiratory illness. The fungus sometimes spreads from the lungs to other organs. If untreated, it is fatal.
6. Because fungi grow within the tissues of their host, fungal infections can be difficult to cure. Surface treatments may only relieve the symptoms. Oral medication can cure an infection but can cause damage to the _____ or other organs.

B. Fungal Toxins

1. Many fungi produce dangerous toxins.
2. Toxins in _____ can cause vomiting, diarrhea, liver damage, and even death.
3. A type of fungus that contaminates corn, peanuts, and cottonseed produces aflatoxins and causes liver cancer.
4. Indoor molds can aggravate _____.

Disease	Description
Toenail fungus	Dermatophytes that infect the nails cause toenail fungus.
Ringworm and athlete's foot	Dermatophytes that infect the skin can cause ringworm and athlete's foot. These fungi absorb nutrients from the skin and release metabolic wastes that irritate the skin.
Yeast infections	Yeast normally lives inside the body. However, antibiotics, hormones, or illness may enable the yeast to grow too much. This results in a yeast infection. Yeast infections occur on tissues of the reproductive organs and in the mouth.
Histoplasmosis	Histoplasmosis is a lung infection caused by a fungus that grows in bat and bird feces. When its spores are breathed in, this fungus can cause serious respiratory illness.

HOMEWORK DATE DUE

CH 22 SEC 1

1. What are three characteristics that all fungi share?

2. How do fungal parasites obtain nutrients?

3. How does the structure of a mycelium help a fungus take in nutrients from the soil?

4. How does the structure of septa help a fungus move nutrients from one cell to another in hyphae?

5. What type of reproduction takes place in a mushroom?

6. What is different about the division of nuclei to produce haploid spores in asexual reproduction and in sexual reproduction?

7. How does sexual reproduction in fungi begin?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

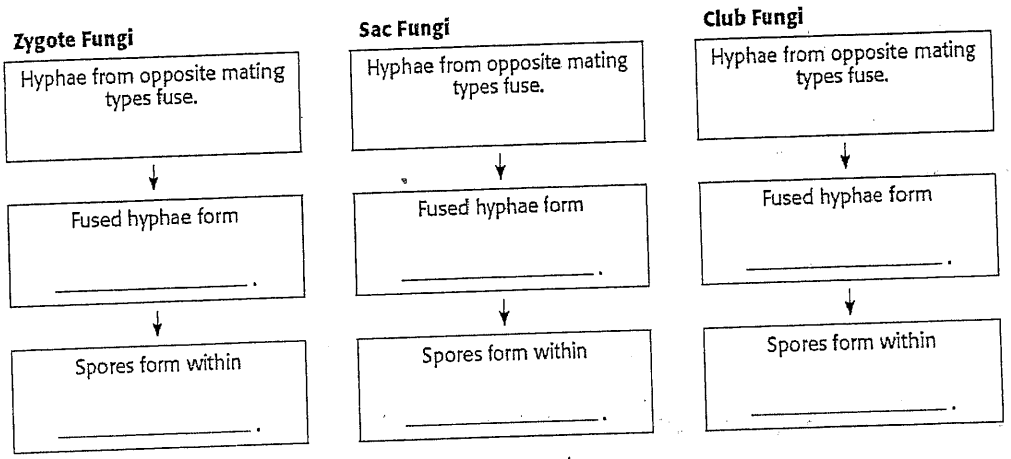
ANSWER

HOMEWORK DATE DUE

CH22 SEC 2

1. What do the similarities between chytrids and protists suggest?

2. Fill in the blank spaces in the diagrams below to show the characteristic sexual reproductive structures of each type of fungi.



3. What feature of a zygosporangium allows it to protect zygotes?

4. What type of structure are mushrooms, and in what types of fungi do they appear?

5. How do both organisms in a mycorrhiza benefit from their symbiotic relationship?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 22 SEC 3

1. Name four foods that are made using fungi.

2. How have scientists used yeast in the medical industry?

3. What two antibiotics are made using fungi?

4. What is the main role of fungi in ecosystems?

5. What role do fungi play in mycorrhizae?

6. How do fungi make the minerals in rocks available to other organisms?

7. Name four diseases that fungi can cause in humans.

8. What are aflatoxins, and how can they be harmful to humans?

9. Why can it be dangerous to eat mushrooms in the wild?

BELLRINGER CIRCLE M T W TH FRI DATE
QUESTION_____

ANSWER_____

CH 22 review

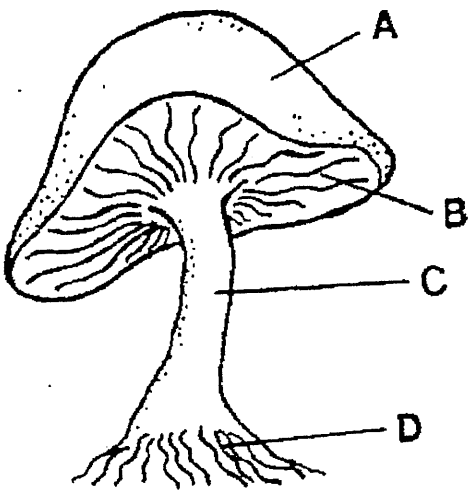
What is chitin?

What are fungi bodies made of?

The individual filaments that make up the body of a fungus are called

What are several types of fungus?

What are the parts of this structure (A-D)



How do fungi obtain food?

How do fungi digest food?

How are fungal spores formed?

The group of fungi that includes the molds that often grow on bread is the _____

What are ascomycetes? How do they reproduce?

Mushrooms, puffballs, and shelf fungi are examples of

In a symbiotic association, such as a lichen, a fungus provides mineral nutrients to a(n) _____

What are mycorrhizae?

Where do mycrorhizzae grow?

What is a lichen?

What human uses are there for fungi?

What role do fungi have in the ecosystem?

The fungi in lichens prepare the environment for the growth of plants by

What ways do fungi cause disease?

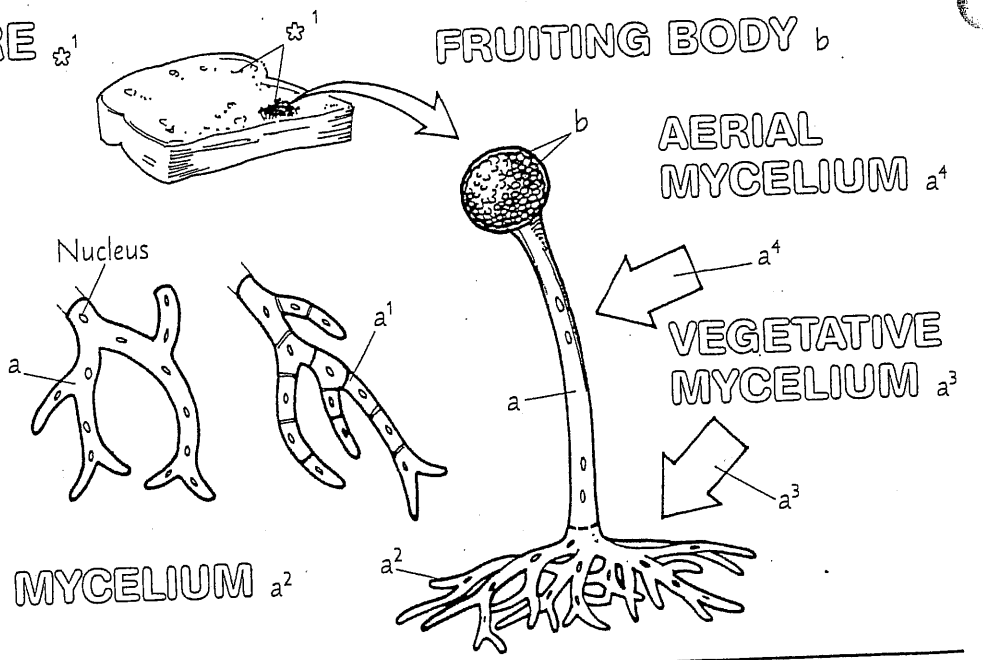
What is a dermatophyte?

INTRODUCTION TO FUNGI

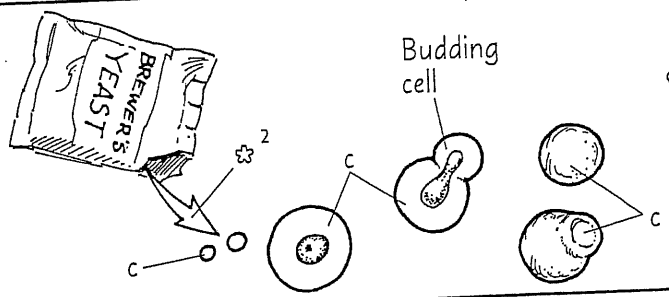
MOLD STRUCTURE ✿1

NONSEPTATE HYPHA a

SEPTATE HYPHA a1



YEAST STRUCTURE ✿2



EUMYCOTINA ✿

OOMYCETES d

ANTHERIDIUM e

OOGONIUM f

OOSPHERE g

OOSPORE h

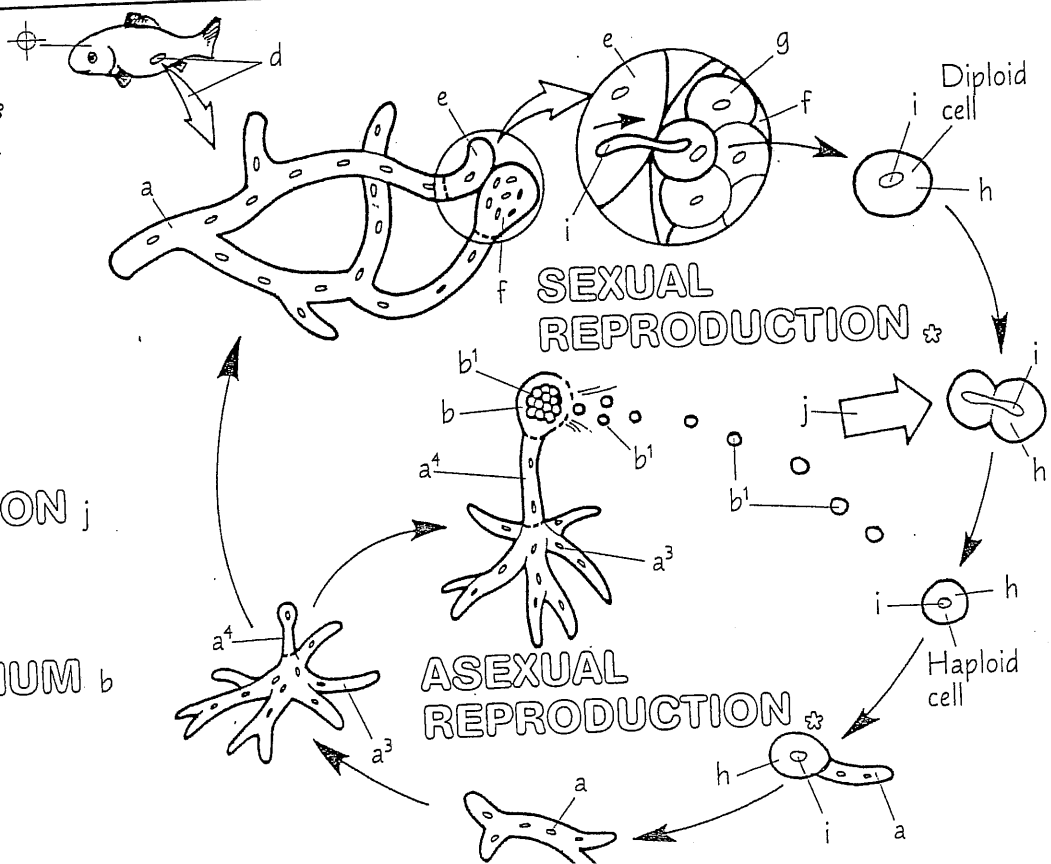
NUCLEUS i

MEIOTIC DIVISION j

ZOOSPORANGIOPHORE a4

ZOOSPORANGIUM b

ZOOSPORE b1



Lichen/ Moss Observation

Materials

samples of mosses and lichens
Microscopes
Digital stereoscope
slide, cover slip
forceps,
dissecting needle

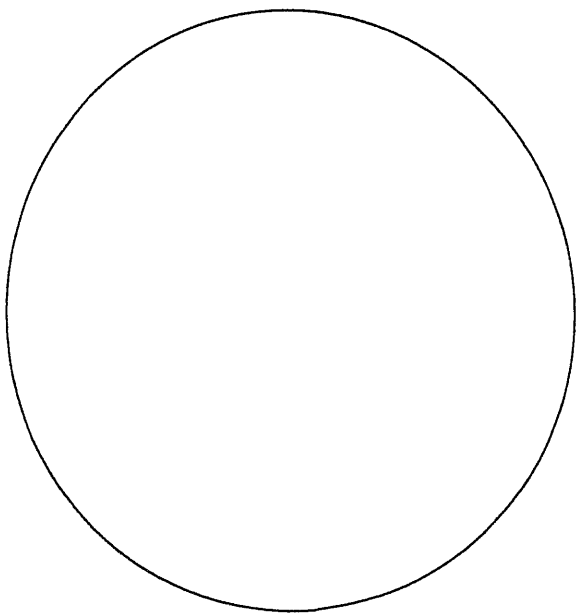
Procedure

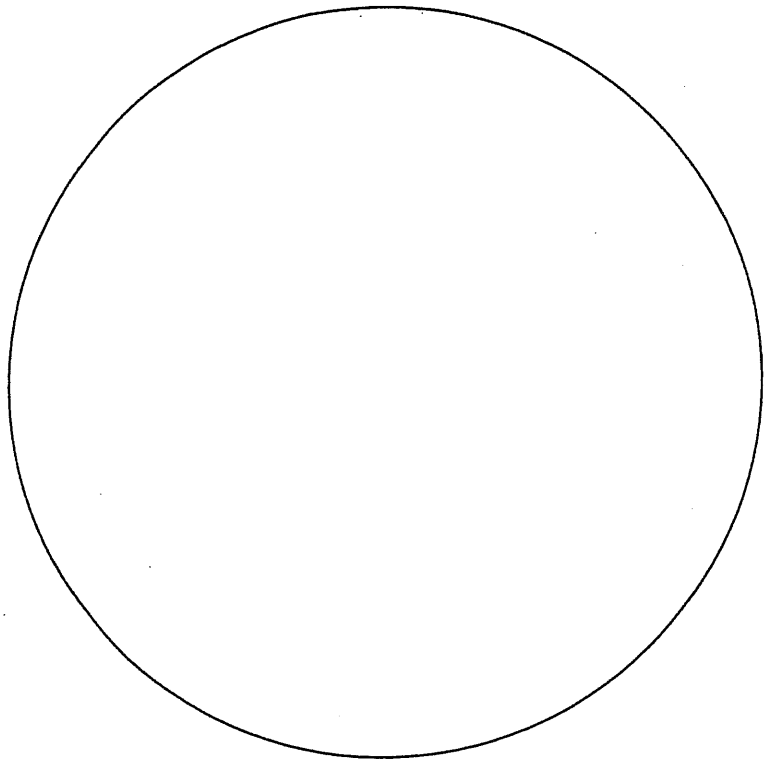
1. Place a piece of the lichen on your slide. Add a drop of water and gently pull the lichen open.
2. Look at the lichen under the digital stereoscope. Try to identify the algae part and the fungi part. Sketch what you see below. (circle 1). Print out your digital picture and LABEL the parts you see.
3. Place a piece of the moss on your slide. Add a drop of water and examine your sample with the hand lens. Draw what you see below. (circle 2- label) Print out your digital picture and LABEL the parts you see.
4. Now place a coverslip over a very small piece of the moss and look at it under low power with the microscope. Draw what you see below.
5. You will be handing in a copy of the lichen and the moss stereoscope pictures. They MUST be labeled- either by hand or using the computer.
6. The lichen is an example of a symbiotic relationship. Define *symbiosis*:___
   _____
   _____
7. What does the algae give to the relationship?_____
   _____
   _____

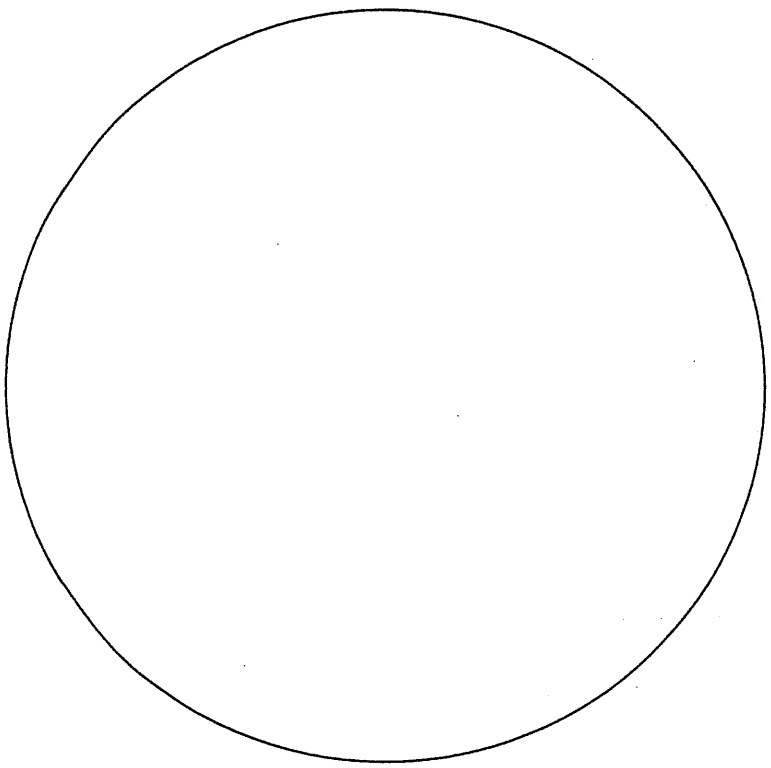
What does the fungi give to the relationship?

_____

Drawings







Name _____ Date _____

Reproduction In Fungi

All fungi reproduce asexually by forming microscopic, one-celled structures called spores. These cells, once released from the parent, will form a new organism if supplied with moisture and food. Fungi form many more spores than will ever mature into new organisms. Chances are a few spores will find suitable growth conditions and will form new organisms.

In this investigation you will:

(a) examine spores from three different fungi.
(b) compare the shape and numbers of spores formed by these three fungi.
(c) estimate the number of spores formed by one mushroom by using a sampling technique.

Materials

microscope	dropper
glass slide	bread mold
coverslip	tweezers
water	*Peziza* (preserved)
pencil with eraser	mushroom
scissors	hand lens or dissecting microscope

Procedure

Part A. Reproductive Structures of Bread Mold

• Use a hand lens or dissecting microscope to observe the mold growing in a dish. This mold is common bread mold.

1. Describe the appearance of bread mold. _____

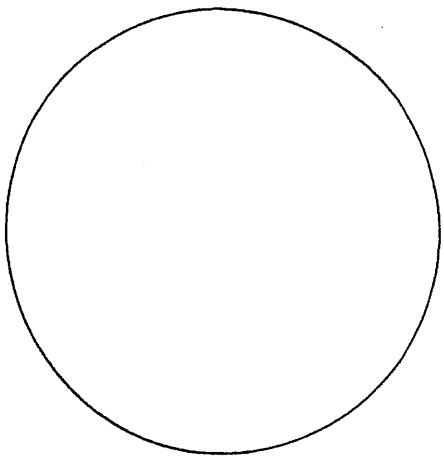
_____

2. What color is the bread mold? _____

• Use tweezers to remove a small piece of the mold from the dish and prepare a wet mount.

• Observe the mold under low and high powers.

A number of structures resembling "lollipops" can be seen. Each stalk has a ball-like structure called a sporangium sitting on top of it. The sporangia are covered with many tiny black dotlike structures called spores. Some spores may have broken loose and can be seen free of the sporangia. Spores are the reproductive parts of fungi. Spores are one cell in size and can form a new fungus if they are provided with ideal growing conditions.



bread mold spores

3. Describe the shape of bread mold spores.

_____

4. Are there few or many spores formed by one fungus? _____

• Diagram what you see in the space provided. Label the spores.

Name _____ Date _____

Part D. Calculating the Number of Spores Formed by One Mushroom

How many spores are produced by one mushroom? It would be a difficult and unpleasant task to count each spore. There is a way, however, of determining the approximate number of spores formed. A sampling technique and some simple mathematics may be used to help determine the approximate number of spores.

- Using the gill wet mount from Part C, count the number of spores that can be observed on one gill under high power. The area you are looking at is called a high power field of view or high power field. Use the row marked Trial 1 in Table 1 to record your result.

- Move your slide so that you are looking at a new high power field of the same gill. Count and record spore numbers again using the row in Table 1 marked Trial 2.

- Average the number of spores counted in Trials 1 and 2 and record this number in Table 1.

TABLE 1. SPORES COUNTED UNDER HIGH POWER

TRIAL	NUMBER OF SPORES
1	
2	
Total	
Average	

TABLE 2. CALCULATING THE NUMBER OF SPORES ON ONE MUSHROOM

	SAMPLE DATA AND CALCULATIONS	YOUR DATA AND CALCULATIONS
Average number of spores counted under high power	(A) 10	(A′) (From Table 1)
Area of one high power field (Assume ALL scopes are the same)	(B) .08 mm^2	(B′) .08 mm^2
Area of one gill measuring 10 × 2 mm (Assume all gills are the same size)	(C) 20.0 mm^2	(C′) 20.0 mm^2
Number of high power fields on each gill	(D) $\frac{C}{B}$ or $\frac{20.0\ mm^2}{.08\ mm^2} = 250$	(D′) $\frac{C'}{B'}$ or $\frac{20.0\ mm^2}{.08\ mm^2} = 250$
Number of spores on one side of gill	(E) A × D or 10 × 250 = 2500	(E′) A′ × D′ or _____ × 250 = _____
Number of spores on both sides of gill	(F) E × 2 or 2500 × 2 = 5000	(F′) E′ × 2 or _____ × 2 = _____
Average number of gills on one mushroom	(G) 160	(G′) 160
Number of spores on one mushroom	(H) F′ × G′ or 5000 × 160 = 800,000	(H′) F′ × G′ or _____ × 160 = _____

- Compute the total number of spores in one mushroom, following the steps shown in Table 2. The first column is done for you as an example. You complete the second column. (Note: Assumptions have been made with certain values or numbers to help simplify the calculations.)

Analysis

1. (a) What colors were the fungi used in this investigation? _____

   (b) Do fungi have chlorophyll? _____

   (c) What do your answers to (a) and (b) tell you about how fungi obtain food? _____

   _____

   _____

2. Write a general description of the spores seen in this investigation. Include shape, number of cells, and size. _____

   _____

   _____

3. Use a word or phrase that best describes the number of spores formed by

   (a) bread mold _____

   (b) *Peziza* _____

   (c) mushroom _____

4. Fungi cannot always be seen growing in nature. Yet, the potential for producing new fungi is tremendous.
   (a) What evidence do you have from Part D of this investigation that one fungus has a high reproductive capability? _____

   _____

   (b) Why are there so few fungi if their reproductive capability is so high? _____

   _____

5. There are two places in Part D where assumptions were made.

   (a) How could the assumption that all gills measure 10 mm × 2 mm be corrected? _____

   _____

   _____

   (b) How could the assumption that all mushrooms have 160 gills be corrected? _____

   _____

   _____

Part B. Reproductive Structures of Cup Fungus

• Observe the mold called *Peziza* or cup fungus. What you are looking at is the reproductive structure of this fungus.

Describe the appearance of *Peziza*. _____

_____

6. What color is *Peziza*? _____

• Prepare a wet mount of *Peziza* by following these steps:

• *Step 1:* Use scissors to cut off a very small piece of *Peziza*. **CAUTION:** *Always be careful with scissors.*

• *Step 2:* Place the fungus on a clean glass slide.

• *Step 3:* Add 2 to 3 drops of water.

• *Step 4:* Place a coverslip over the water and fungus.

• *Step 5:* Using the eraser end of a pencil, gently press down on the top of the coverslip to spread out the fungus.

• *Step 6:* Observe the fungus under low and high powers.

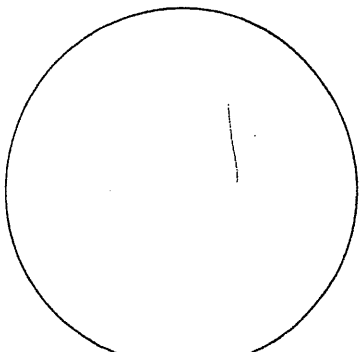
• Look for areas on the slide where one or two fingerlike tubes, asci, can be clearly seen. (The entire fungus is made up of asci.) Each ascus contains spores.

7. Describe the shape of cup fungus spores. _____

_____

8. How many spores are present within each ascus? _____

• Diagram what you see in the space provided. Label the spores.



Peziza spores

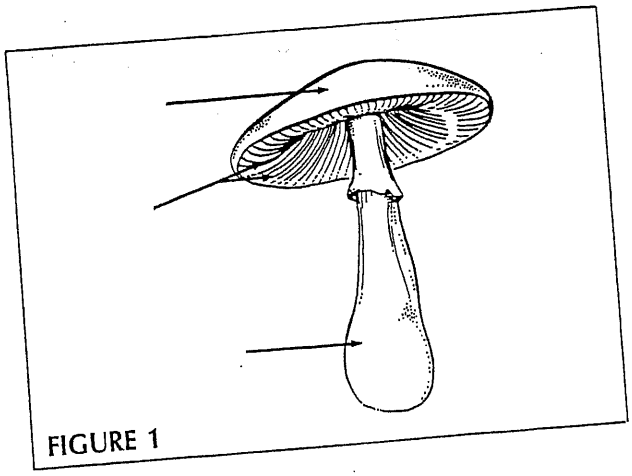


FIGURE 1

Part C. Reproductive Structures of a Mushroom

• Identify the three main parts of a mushroom. They are (a) stipe—stalklike part of mushroom, (b) pileus—cap on top of mushroom, and (c) gills—thin, dark brown strips on underside of pileus.

• Label these three parts on Figure 1. These three parts of the fungus are its reproductive structures.

9. What color is a mushroom? _____

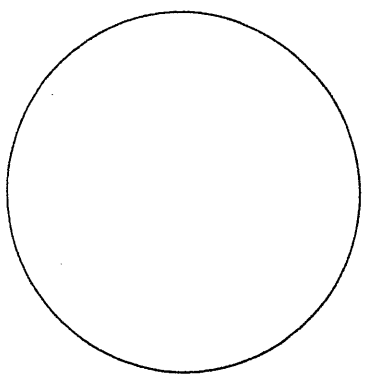
• To observe the reproductive structures of a mushroom, follow the six steps listed in Part B for making a wet mount. This time, however, remove a gill from the mushroom and place it on a glass slide. The tiny dark brown dotlike structures seen through the microscope are spores.

10. Describe the shape of mushroom spores.

_____

11. Are there few or many spores found on one gill? _____

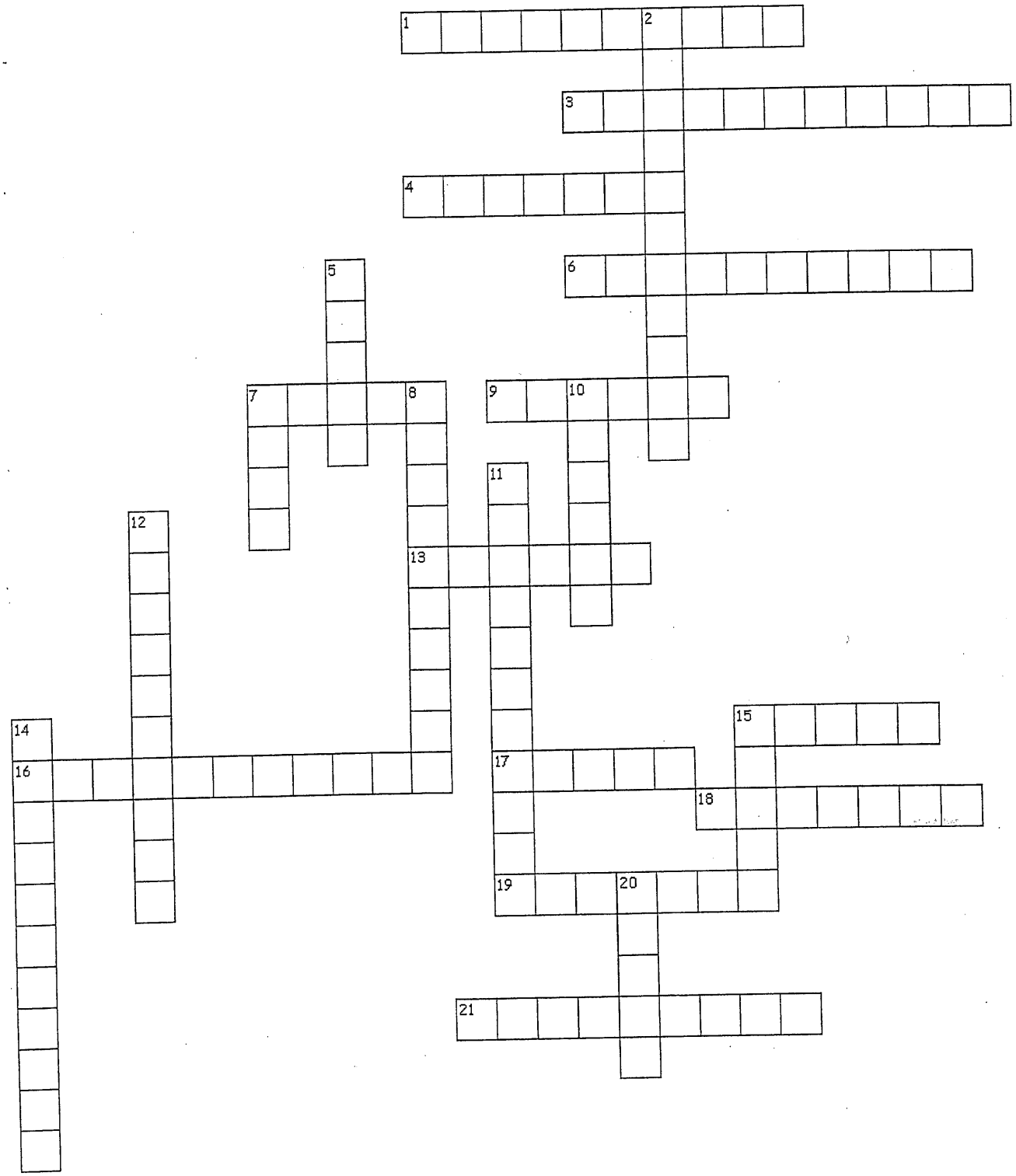
• Diagram what you see in the space provided. Label the spores. Save your wet mount for Part D.



mushroom spores

Ch 23 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the back



Across

1. a vascular seed plant whose seeds are not enclosed by a fruit
3. the transfer of pollen from the male reproductive structures (anthers) to the tip of a female reproductive structure (pistil) of a flower in angiosperms or to the ovule in gymnosperms
4. a horizontal, underground stem that provides a mechanism for asexual reproduction
6. a flowering plant that produces seeds within a fruit
7. a cluster of sporangia
9. the female reproductive part of a flower that produces seeds and consists of an ovary, style, and stigma
13. the tip of a stamen, which contains the pollen sacs where pollen grains form
15. the leaf of a fern or palm
16. a female reproductive structure that produces a single egg and in which fertilization and development take place
17. an angiosperm that produces seeds that have two cotyledons
18. a waxy or fatty and watertight layer on the external wall of epidermal cells
19. an angiosperm that produces seeds that have only one cotyledon
21. the embryonic leaf of a seed

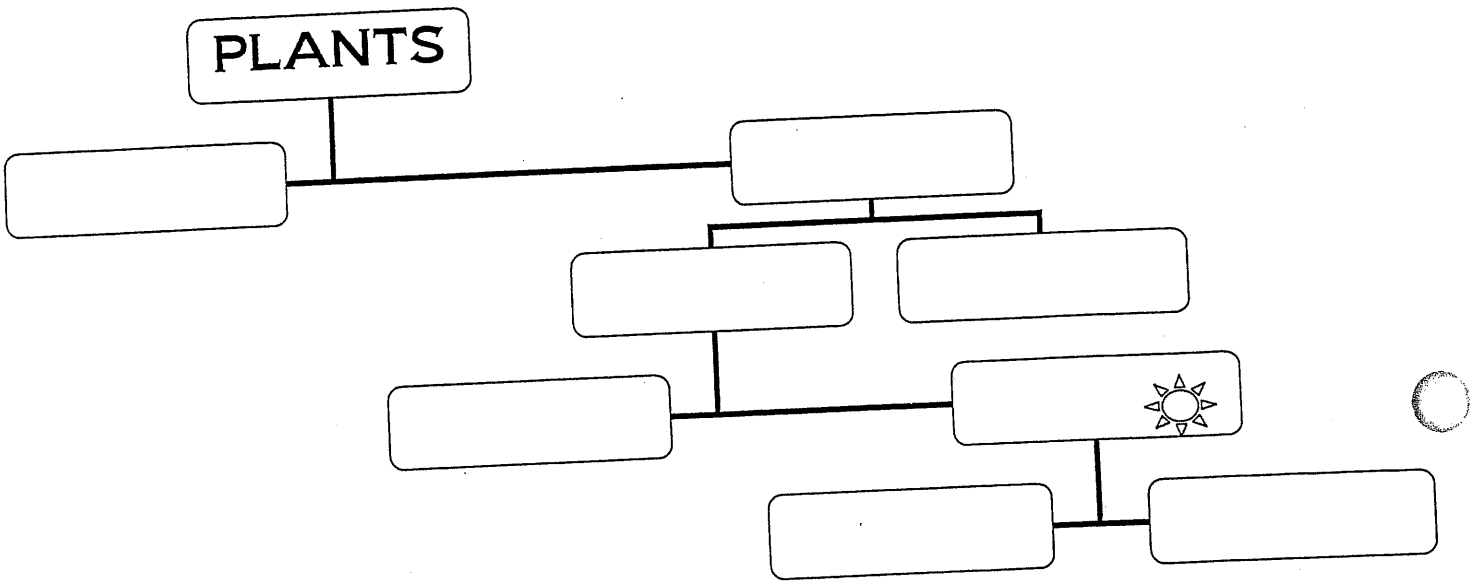
Down

2. the structure that contains the male gametophyte of seed plants
5. a reproductive cell or multicellular structure that is resistant to environmental conditions
7. a plant embryo that is enclosed in a protective coat
8. a specialized sac, case, capsule, or other structure that produces spores
10. the male reproductive structure of a flower that produces pollen and consists of an anther at the tip of a filament
11. a reproductive structure that produces male sex cells in seedless plants
12. in plants and algae that have alternation of generations, the diploid individual or generation that produces haploid spores
14. in alternation of generations, the phase in which gametes are formed; a haploid individual that produces gametes
15. a mature plant ovary; the plant organ in which the seeds are enclosed
20. a structure of a seed plant that contains a female gametophyte and that develops into a seed after fertilization

cuticle	
spore	
sporophyte	
gametophyte	
archegonium	
antheridium	
sporangium	
rhizome	
frond	
sorus	
gymnosperm	
angiosperm	
ovule	
seed	
pollen grain	
pollination	
monocot	
cotyledon	

Chapter 23 Plant Diversity and Life Cycles

2 Types of plants: nonvascular (no water/food carrying tubes) and vascular plants (has xylem and phloem).Vascular plants are further broken down into seedless and seed. Seed plants are then broken down into gymnosperms and angiosperms. Angiosperms can be either monocot or dicot



I. PLANT LIFE CYCLES-Plants have life cycles in which _____ gametophytes alternate with _____ sporophytes. A life cycle in which a gametophyte alternates with a sporophyte is called _____ of _____.

II. <u>NONVASCULAR PLANTS</u>-Nonvascular plants are small plants that reproduce by means of spores.

A. NO CONDUCTING TISSUE-They lack true _____, _____, and _____, which are complex structures that contain vascular, or conducting, tissues. In nonvascular plants, water and nutrients are transported by _____ and _____, which move materials short distances and very slowly. This method of transport greatly limits the size of

a nonvascular plant's body. Thus, all nonvascular plants are relatively small. Mosses, liverworts, and hornworts are examples of nonvascular plants.

B. REPRODUCTION IN NONVASCULAR PLANTS-In the life cycle of nonvascular plants, the gametophyte is the _____ generation. Gametophytes must be covered by a film of _____ in order for fertilization to occur.

III. SEEDLESS VASCULAR PLANTS-Sporophytes of seedless vascular plants have vascular tissue, but _____ lack vascular tissue. Because of their vascular system, vascular plants grow much larger that nonvascular plants and also develop _____ roots, stems, and leaves.

A. Seedless Vascular Types

1. There are two major groups of seedless vascular plants: _____ (lycophytes) and _____ and related species (monilophytes).

2. Unlike true mosses, club mosses have roots, stems, and leaves. Their leafy green stems branch from an underground rhizome. A _____ is a horizontal, underground stem.

3. Most fern sporophytes have a rhizome that is anchored by roots and have leaves called _____. The coiled young leaves of a fern are called _____.

4. _____ are related to ferns. They have hollow vertical stems with joints and whorls of scalelike leaves that grow at the joints.

B. REPRODUCTION IN SEEDLESS VASCULAR PLANTS- Some ferns have sporophytes that are as large as _____ In most species of seedless vascular plants, both eggs and sperm are produced by the _____ _____.

IV. VASCULAR SEED PLANTS-Seed plants are traditionally classified into two groups—_____ and _____.

A. Seeded Vascular Types

1. _____ are seed plants whose seeds do _____ develop within a _____ Most of these seeds develop in a _____.The word gymnosperm comes from the Greek words gymnos, meaning "naked," and sperma, meaning "seed."

2. _____ are seed plants whose seeds develop enclosed within a _____. Fruits develop from part of a flower.The word angiosperm comes from the Greek words angeion, meaning "case," and sperma, meaning "seed."Therefore, angiosperms are

_____ plants. Most species of _____ plants are flowering plants.

B. REPRODUCTION IN SEED PLANTS-Unlike seedless plants, seed plants do not require water to reproduce sexually. Reproduction in seed plants is also characterized by a greatly reduced gametophyte and a dominant _____.

1. Following fertilization, the _____ and its contents develop into a _____

2. The male gametophyte of seed plants develops inside a _____.

3. The transfer of pollen grains from the male reproductive structures of a plant to the female reproductive structures is called pollination.

4. After fertilization, the ovule is called a seed and contains an _____.

5. Dispersal may prevent competition for water, nutrients, light, and living space between _____ and _____

6. Many seeds have structures that help _____ or _____ carry them away from their parent plant.

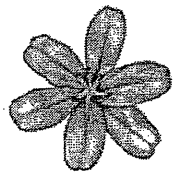
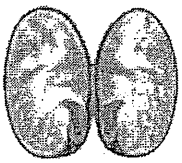
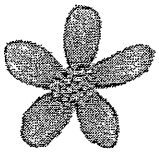
V. GYMNOSPERMS- There are four major groups of gymnosperms: conifers, cycads, ginkgoes, and gnetophytes. Conifers are the most familiar gymnosperms. Conifers have leaves that are needle-like or that are reduced to tiny scales.Some examples of conifers are _____ and _____

VI. ANGIOSPERMS-Botanists traditionally divide the angiosperms into two subgroups—_____ and _____. Angiosperms are the most successful group of plants and range in size from tiny herbs to giant trees.

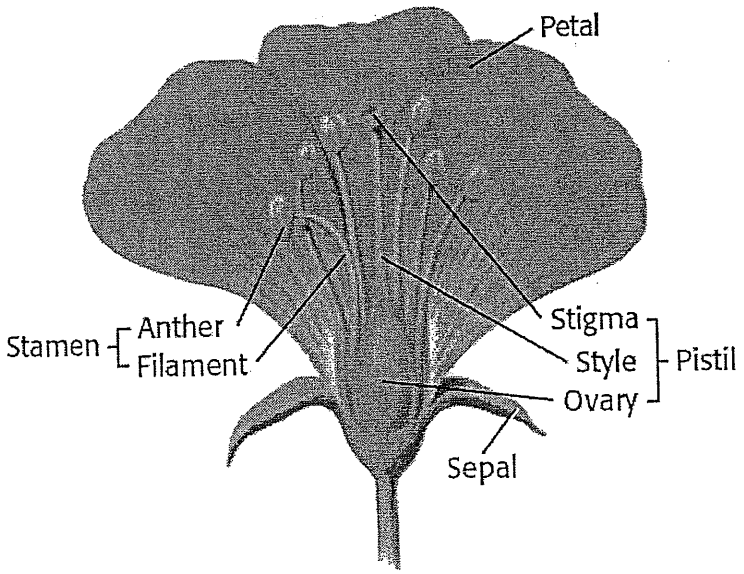
A. _____- Monocots are flowering plants whose seeds have _____ seed leaf, or _____. Most monocots have long, narrow leaves with _____ veins and produce flowers whose parts are in multiples of _____

B. _____- Dicots are flowering plants whose seeds have _____ seed leaves. Most dicots have leaves with _____ veins and produce flowers whose parts are in multiples of _____

Characteristics of monocots and dicots:

Comparing Monocots and Dicots			
Plant type	**Leaves**	**Flower parts**	**Examples**
Monocots 	parallel venation 	usually occur in threes 	lilies, irises, palms, orchids, coconuts, onions, bananas, tulips, and grasses (including wheat, corn, rice, and oats)
Dicots 	net venation 	usually occur in fours or fives 	beans, lettuce, oaks, maples, roses, carnations, elms, cactuses, and most broad-leaved forest trees

C. REPRODUCTION IN ANGIOSPERMS- A flower is a specialized reproductive structure of angiosperms. The male and female gametophytes of angiosperms develop within flowers, which promote pollination and fertilization more efficiently than do cones. The female part of a flower provides a pathway for sperm to reach the eggs without having to swim through water. Flower parts are arranged in _____ concentric whorls.



A typical flower contains sepals, petals, stamens, and one or more pistils.

D. POLLINATION- The flowers of many angiosperms are adapted for pollination by wind or by animals.

1. Flowers may have brightly colored petals, sugary nectar, strong odors, and shapes that attract _____ Flowers are a source of food for pollinators such as insects, birds, and bats.

2. Some flowers, such as those of grasses or oaks, are pollinated by wind. _____-_____ flowers are usually small and lack bright colors, strong odors, and nectar.

E. FRUITS-Although fruits provide some protection for developing seeds, they primarily function in _____ _____

1. A fruit is a structure that develops from an _____ of a flower and contains _____.

2. Many fruits are eaten by _____. The fruits' seeds are dispersed as they pass _____ through the animals.

3. Other fruits, such as the maple seed, have structures that help them _____ on wind or water.

VII. VEGETATIVE REPRODUCTION- Plants reproduce _____ in a variety of ways that involve nonreproductive parts, such as _____, _____, and _____. The reproduction of plants from these parts is called _____ _____.

A. In most plants, _____ reproduction is faster than _____ reproduction. By reproducing vegetatively, a single plant can spread rapidly in a habitat that is ideal for its growth.

B. People often grow plants from vegetative parts that are specialized for vegetative reproduction. For example, in _____ such as potatoes, a single tuber can be cut or broken into pieces such that each piece has at least one bud. Each of these pieces can grow into new shoots.

HOMEWORK DATE DUE_____

CH 23 SEC 1

1. What are four key characteristics of plants?

2. Where in plant cells does photosynthesis take place?

3. How can fungi benefit plants?

4. How do roots help vascular plants survive on land?

5. What is alternation of generations?

6. What are gametophytes, and what is their role in plant reproduction?

7. In the life cycle of a plant, how do sporophytes form?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 23 SEC 2

1. Why are nonvascular plants small?

2. Identify three groups of nonvascular plants.

3. What is the main generation in the life cycle of a nonvascular plant?

4. Describe two ways in which seedless vascular plants are different from nonvascular plants.

5. In addition to gametes, what is needed for fertilization to occur in both nonvascular plants and seedless vascular plants?

6. What is the role of spores in the reproduction of nonvascular plants and seedless vascular plants?

7. What two structures on the gametophytes of nonvascular plants and seedless vascular plants produce eggs and sperm?

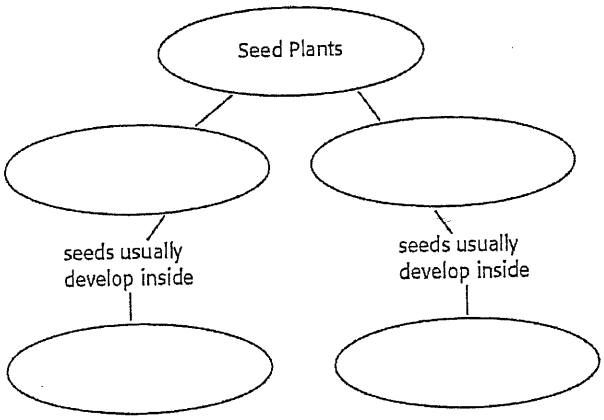
BELLRINGER QUESTION_____ CIRCLE M T W TH FRI DATE

ANSWER_____

HOMEWORK DATE DUE_____

CH 23 SEC 3

1. Fill in the Concept Map below to show the two main groups of seed plants and where their seeds develop.



2. In seed plants, how does the size of the gametophyte compare with the size of the sporophyte?

3. How does seed dispersal benefit both parent plants and their offspring?

4. Name the four major groups of gymnosperms.

5. In conifers, how are pollen grains typically carried to seed cones?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

PLANT REVIEW

Most of the energy used by life on Earth comes from the _____

Light energy is converted to chemical energy through the process of _____

As light intensity increases, the rate of photosynthesis _____

Low temperatures may cause photosynthesis to occur _____

Which of the following environmental factors does not affect the rate of photosynthesis? _____

The name of the process that takes place when organic compounds are broken down in the absence of oxygen is _____

Fermentation enables glycolysis to continue under _____

If oxygen is absent during the second stage of cellular respiration, _____

Cells produce ATP most efficiently in the presence of _____

The ancestors of today's land plants were probably _____

The waxy protective covering of a land plant is called a _____

The diploid form in a plant's life cycle is called the _____

The haploid form in a plant's life cycle is called the _____

Fiddleheads are produced by _____

Flowering plants are classified as monocots or dicots according to the number of their _____

The primary function of root hairs is _____

The center region of ground tissue in a herbaceous stem is known as the _____

Leaves connect to the stems of plants at the_____

Plants grow in regions of active cell division called _____

During periods of primary growth at apical meristems, stems and roots do what? _____

what is an autotroph? _____

ATP is composed of a nitrogenous base, a sugar, and _____

ATP is called a cell's energy "currency" because _____

An enzyme that catalyzes the synthesis of ATP is _____

Chlorophyll is green because _____

The major atmospheric by-product of photosynthesis is _____

what has photosynthesis done to the atmosphere? _____

When glycolysis occurs, what happens to glucose? _____

What is the net gain of ATP molecules in glycolysis? _____

Cellular respiration takes place in two stages: _____ _____

Which processe produces the most ATP? _____

If a flower has 9 petals, the leaves will have _____

The stomata prevent water vapor and carbon dioxide from entering and leaving the leaf. The size of the stomata are controlled by_____

NAME_____SCI#_____

Ch 24 Lab-Plant Structure and Processes

Procedure

During active photosynthesis, plants transport water in xylem elements from the roots to the leaves for photosynthesis. This is possible because stomates are open so that plants can exchange oxygen and carbon dioxide. Open stomates also allow for water loss. As a result, water is transported from the roots to the leave due to the adhesion-cohesion transpiration pull that occurs in the xylem. In this exercise, you will determine the location of the xylem vessels and the amount of dye movement in an hour. You will also observe the appearance of stomata in leaves exposed to light and those kept in the dark.

1. Obtain a fresh piece of celery stalk with leaves.
2. Cut off and discard the bottom 5 cm of the stalk while holding the stalk under water.
3. Quickly transfer the cut stalk into beakers with two different food colors
4. Allow the celery to remain overnight
5. Examine the celery stalk and the leaves. Complete a drawing using colors to represent where the food coloring was deposited.
6. Cut a thin slice of stalk and a thin slice of leaf from the colored celery. Draw the celery under both low and high power in your notebook.
7. Next, take 2 pieces of palm leaf – one from the side exposed to overnight light and one from the side kept in darkness. Make sure to not get the two mixed up.
8. Paint a thin layer of clear nail polish on a 1 × 1 cm area of a leaf on a plant kept in light and on a plant kept in darkness. Let the nail polish dry for 5 min
9. Place a 4 to 5 cm strip of clear tape over the nail polish on each leaf. Press the tape firmly to the nail polish.
10. Carefully pull the tape off each leaf. Stick each piece of tape to a microscope slide. Label the slides appropriately.
11. View each slide with a microscope, first under low power and then under high power.
12. Draw and label what you see on each slide and be sure to label below the celery drawings.

NAME_____ SCI#_____

Questions and Analysis

1. Describe any differences in the stomata of the palm leaves-are the stomata of the leaves in the dark different? Were there any differences in the stomata of the palm versus the celery?

_____

_____

_____

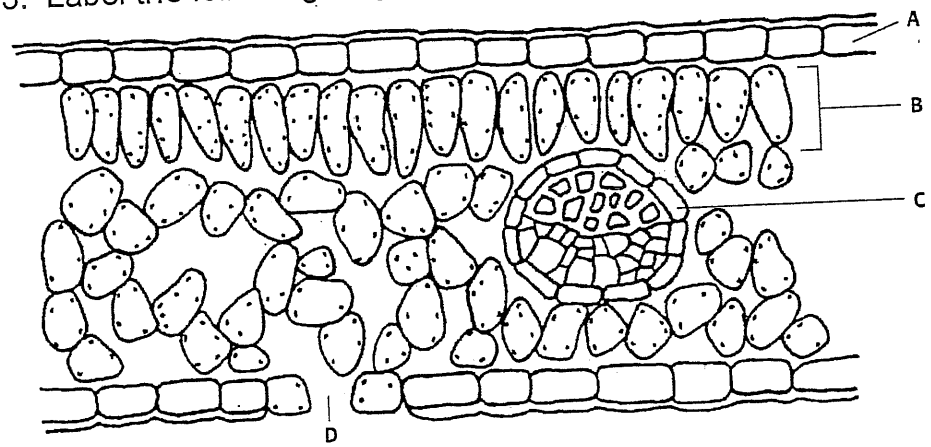
2. Did the food coloring mix together in the vascular bundles? How was the food coloring deposited in the leaves?

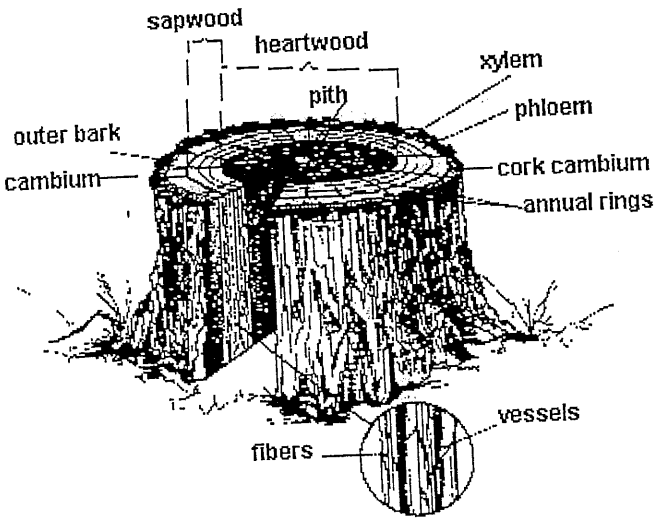
_____

_____

_____

3. Label the following diagram





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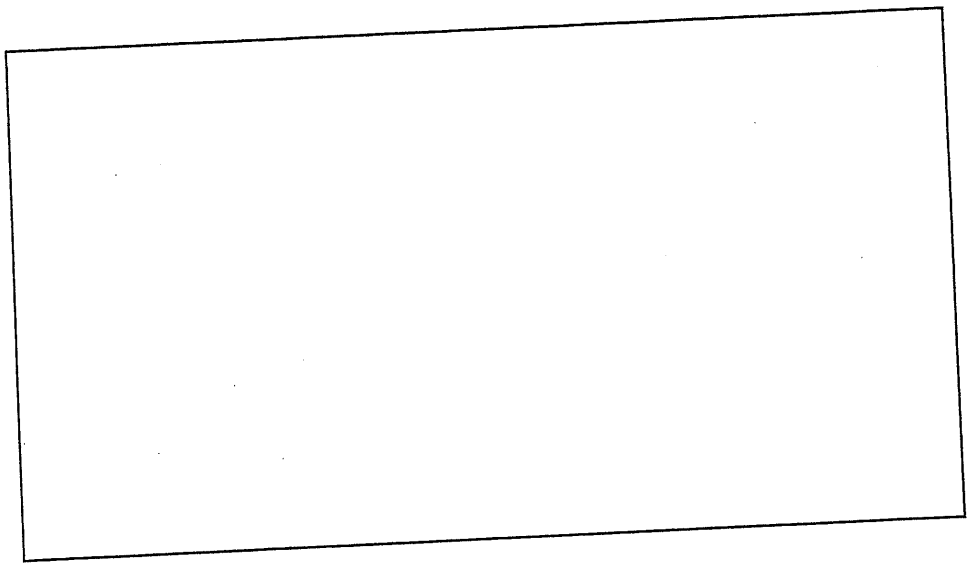
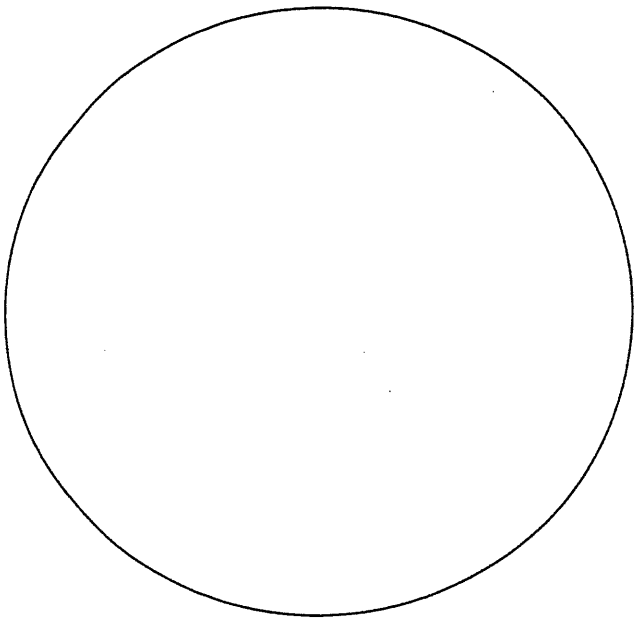
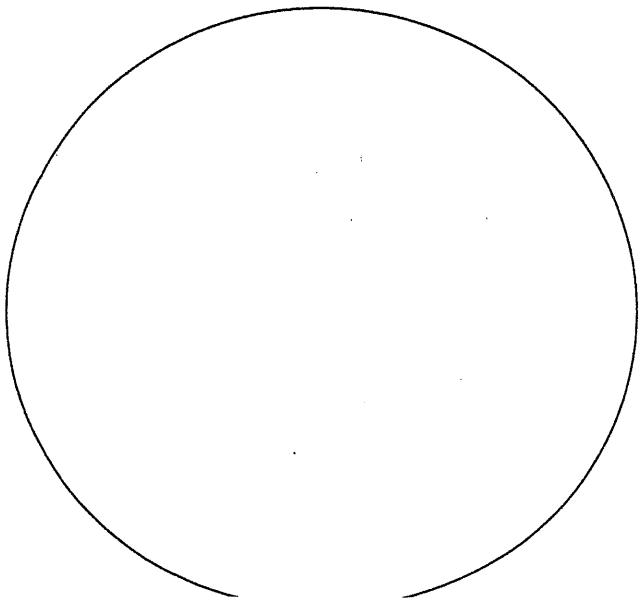
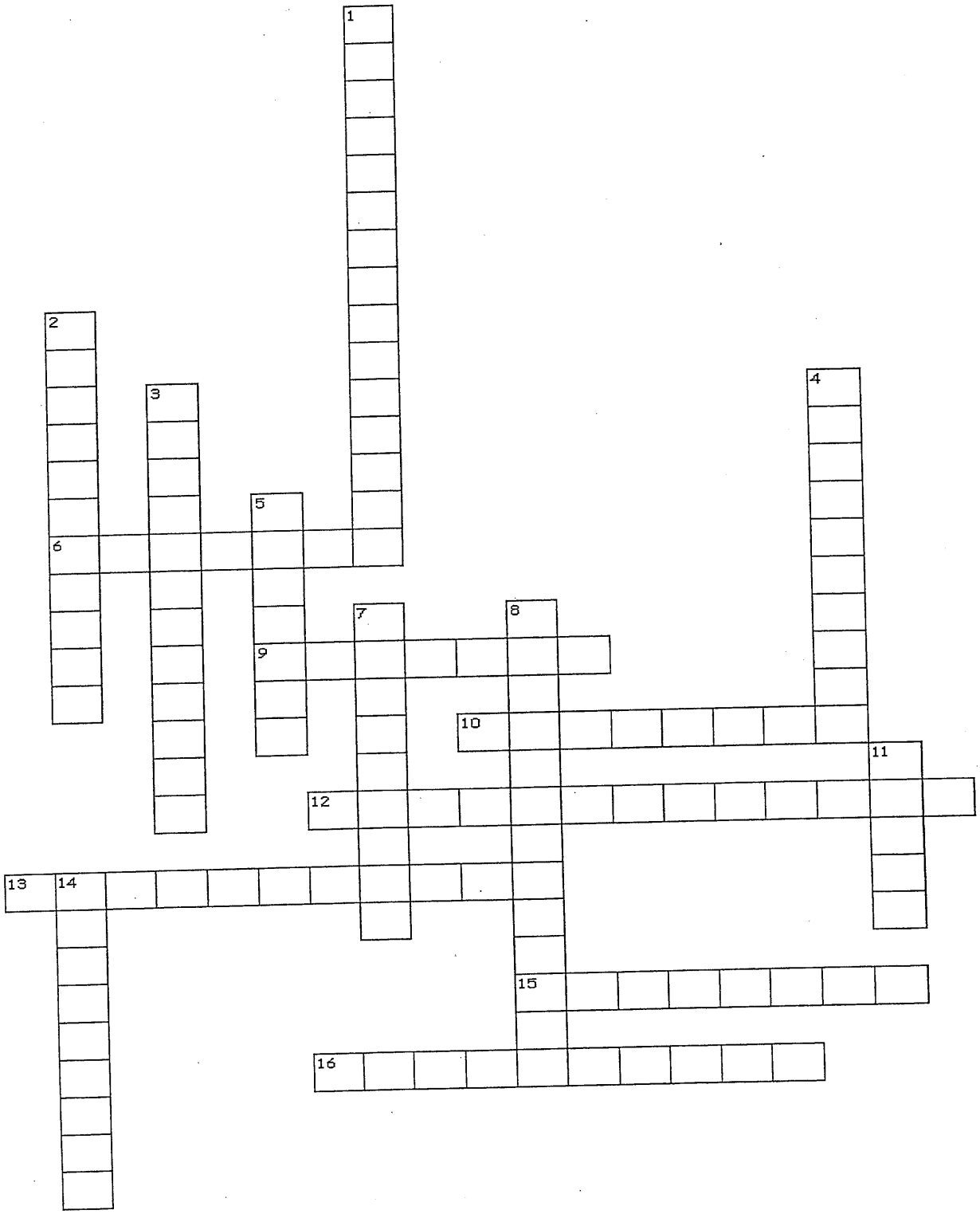






Ch 4 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the



Across

6. the average weather conditions in an area over a long period of time

9. level one of the steps in a food chain or food pyramid

10. a photosynthetic or chemosynthetic autotroph that serves as the basic food source in an ecosystem

12. a triangular diagram that shows an ecosystem's loss of energy, which results as energy passes through the ecosystem's food chain

13. the exchange of oxygen and carbon dioxide between living cells and their environment

15. an organism that eats other organisms or organic matter instead of producing its own nutrients or obtaining nutrients from inorganic sources

16. the replacement of one type of community by another at a single location over a period of time

Down

1. the cyclic movement of phosphorus in different chemical forms from the environment to organisms and then back to the environment

2. the movement of carbon from the nonliving environment into living things and back

3. the variety of organisms in a given area, the genetic variation within a population, the variety of species in a community, or the variety of communities in an ecosystem

4. an organism that feeds by breaking down organic matter from dead organisms

5. a place where an organism usually lives

7. a group of various species that live in the same habitat and interact with each other

8. the cycling of nitrogen between organisms, soil, water, and the atmosphere

11. a large region characterized by a specific type of climate and certain types of plant and animal communities

14. a community of organisms and their abiotic environment

community	
ecosystem	
habitat	
biodiversity	
succession	
climate	
biome	
producer	
consumer	
decomposer	
trophic level	
energy pyramid	
carbon cycle	
respiration	
nitrogen cycle	
phosphorus cycle	

Chapter 4 Ecosystems

I. **ECOSYSTEMS**-An ecosystem includes a community of organisms and their physical environment.

A. A group of various species that live in the same place and interact with one another is called a _____.

B. The group, along with the living and nonliving environment, make up an ecosystem.

C. _____ describes living factors in an ecosystem.

D. The physical or nonliving factors of an environment are called _____ factors. Examples of abiotic factors are oxygen, water, rocks, sand, sunlight, temperature, and climate.

E. A _____ is the place where an organism lives.

F. The variety of organisms (the number of different species)in a given area is called _____.

1. Physical factors can have a big influence on biodiversity. Ex.-temp, drought, fire
2. Ecosystems with high _____ (many different species) are often more able to resist damage.
3. When biodiversity decreases in any ecosystem, that ecosystem is not as healthy as it could be.

II. **SUCCESSION**- The replacement of one kind of community by another at a single place over a period of time is called _____ .An ecosystem responds to a disturbance in such a way that the ecosystem is restored to _____.

The first organisms to appear in a newly made habitat are called _____ species.
_____ are pioneer species that change rock to soil so plants can start to grow. Then other species will replace the pioneer species.

III. **MAJOR BIOLOGICAL COMMUNITIES**-Two key factors of climate that determine biomes are _____ and _____.

A. A _____ is a large region characterized by a specific kind of climate and certain kinds of plant and animal communities.

B. The kinds of species that live in a particular place are determined by climate. Most organisms are adapted to live within a particular range of temperatures and cannot survive at temperatures too far above or below that range.

IV. **TERRESTRIAL BIOMES** -Earth's major terrestrial biomes can be grouped by latitude into tropical, temperate, and high-latitude biomes.

Biome Group	Biome	Climate
Tropical	tropical rain forest	warm; rainy
	savanna	warm; dry and wet seasons
	tropical desert	warm; dry
Temperate	temperate grassland	cool; moderate precipitation
	temperate forest	mild; rainy
	temperate desert	wide temperature range; dry
High-latitude	taiga	cold; wet
	tundra	very cold; dry

V. **AQUATIC ECOSYSTEMS**-Aquatic ecosystems are organized into freshwater ecosystems, wetlands, estuaries, and marine ecosystems.

A. _____ ecosystems are located in bodies of fresh water, such as lakes, ponds, and rivers. These ecosystems have a variety of plants, fish, arthropods, mollusks, and other invertebrates.

B. _____ provide a link between the land and fully aquatic habitats. Water-loving plants dominate wetlands. Wetlands moderate flooding and clean the water that flows through them.

C. An _____ is an area where fresh water from a river mixes with salt water from an ocean. Estuaries are productive ecosystems because they constantly receive fresh nutrients from the river and the ocean.

D. _____ ecosystems are found in the salty waters of the oceans. Kelp forests, seagrass communities, and coral reefs are found near land. The open ocean, far from land, has plankton and large predators, such as dolphins, whales, and sharks.

VI. **TROPHIC LEVELS-** In an ecosystem, energy flows from the sun to producers to consumers to decomposers. Each step of energy transfer is a trophic level. There are three types f organisms in the energy cycle.

A. _____ are the organisms that use sunlight to make energy for everyone else on earth. These are photosynthetic organisms and not limited to plants (ex. Blue green algae).

B. _____ are organisms that eat other organisms instead of producing their own food.

C. _____, such as _____ and _____, are organisms that break down the remains of organisms to return the materials to the producers.

VII. **FOOD CHAINS/ WEBS-** "who's eating who"

A. The first trophic level of ecosystems is made up of _____. Plants, algae, and some bacteria use the energy in sunlight to make carbohydrates.

B. The second trophic level of a food chain is made up of _____ which eat producers. A cow is an example of an herbivore.

C. The third trophic level includes animals that eat _____. Any animal that eats another animal is a _____.

D. Other carnivores are on the fourth trophic level or an even higher trophic level because they eat other _____.

E. _____, such as bears, are animals that are both herbivores and carnivores.

F. In most ecosystems, energy does not follow a simple food chain- these are not stable. The many foods that each organism eats and their interconnections is a _____.

VIII. **LOSS OF ENERGY**-Energy is stored at each link in a food web. Some energy that is used dissipates as heat into the environment and is not recycled.

A. When something is eaten, about _____ of the foods energy is used by the consumer to live (lost as heat)

B. Only about _____ is stored in the animal's body as fat or as tissue.

C. This amount of stored energy (_____ is all that is available to organisms at the next trophic level (whoever eats it)

D. An energy pyramid is a triangular diagram that shows an ecosystem's loss of energy, which results as energy passes through the ecosystem's food chain.

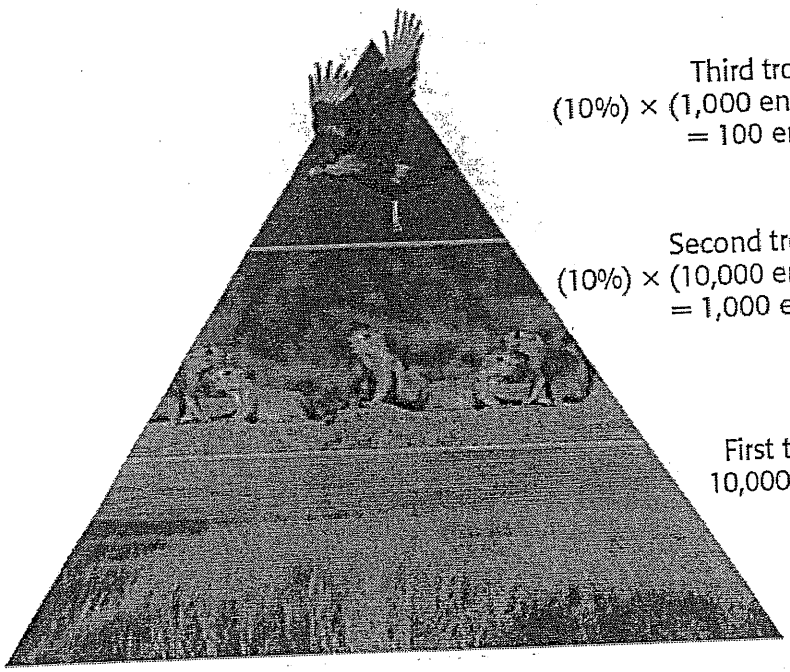
1. Each layer in the energy pyramid represents one trophic level.

2. Producers form the pyramid's base, which is the lowest trophic level. The lowest level has the most energy in the pyramid.

3. The energy stored by the organisms at each trophic level is about _____ the energy stored by the organisms in the level below. So, the diagram takes the shape of a pyramid.

4. Big predators, such as lions, are _____ compared to herbivores.

5. Big predators are rare because a lot more energy is required to support a single predator than a single herbivore. Many ecosystems do not have enough energy to support a large population of predators.



X. **WATER CYCLE**- The water cycle continuously moves water between the atmosphere, plants, and bodies of water.

1. Water _____ (in clouds) condenses and falls to Earth's surface as _____ (rain, snow, hail).

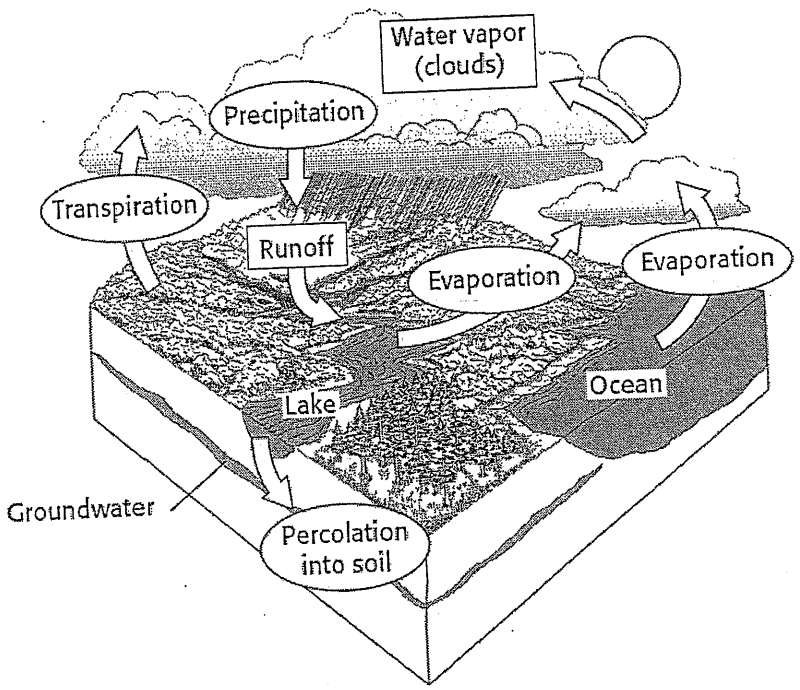
2. Some of this water _____ (soaks into the soil) and becomes _____ (water stored in underground cavities- this is where you get water if you have a well).

3. Other water runs across the surface of Earth into rivers, lakes, and oceans.

4. The water in rivers, lakes streams and oceans is heated by the sun and reenters the atmosphere by _____.

5. Water also evaporates from trees and plants in a process called _____.

6. This evaporated water (vapor) rises until it _____ in clouds and starts the cycle again.



Water cycles through an ecosystem.

Processes that Are Part of the Water Cycle	
Process	**Description**
Condensation	Water vapor in the air cools and becomes liquid.
Precipitation	Water falls to Earth as rain, snow, hail, or sleet.
Percolation	Water enters the soil and becomes groundwater.
Evaporation	Liquid water warms and forms water vapor.
Transpiration	Water vapor evaporates from plants.

X. **CARBON AND OXYGEN CYCLES-** Carbon and oxygen cycles are vital and revolve around each other.

A. Plants use the _____ _____, CO_2, in air to build organic molecules during the process of photosynthesis. During photosynthesis, oxygen is released into the surroundings.

B. Respiration is the process of exchanging oxygen and CO_2 between organisms and their surroundings.

C. Carbon is also released into the atmosphere in the process of _____. Combustion is the burning of a substance.

D. Fossil fuels are formed from the remains of dead plants and animals, which are made of carbon. The burning of fossil fuels releases _____ _____ into the atmosphere.

XI. **NITROGEN CYCLE-** Nitrogen must be cycled so that the nitrogen is available for organisms to make proteins and DNA

A. The atmosphere is about _____ nitrogen gas, N_2. But most organisms cannot use _____ _____. It must be changed into a different form.

B. In a process called _____ _____, bacteria convert nitrogen gas, N_2, into ammonia, NH_3.

C. Nitrogen-fixing bacteria live in the _____ and on the roots of some plants. Nitrogen may also be fixed by lightning.

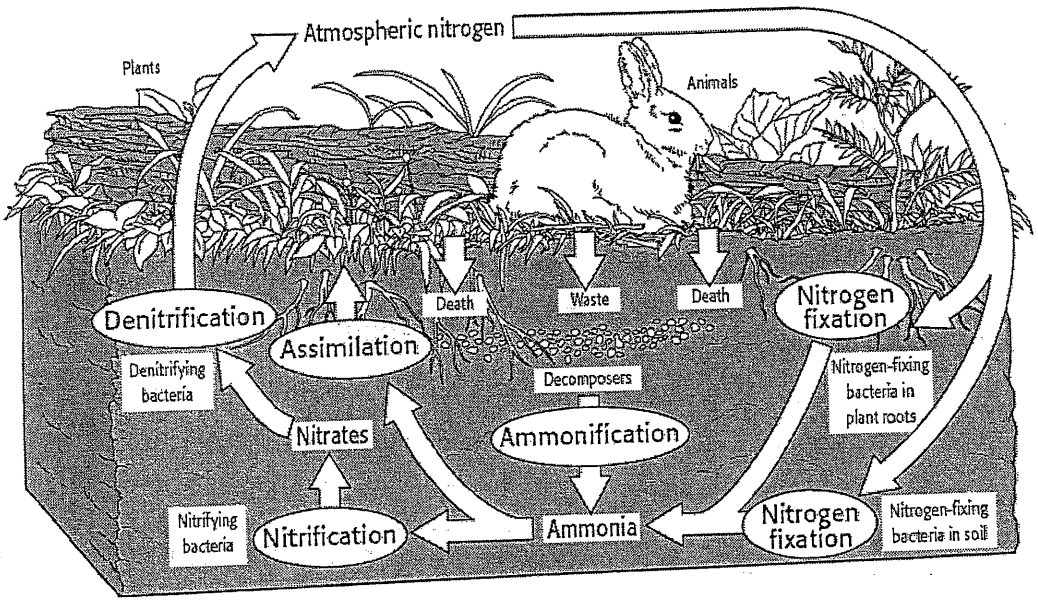
D. Nitrogen is also fixed when humans burn fuels in vehicles and industrial plants.

E. _____ is the process in which plants absorb nitrogen. When an animal eats a plant, nitrogen compounds become part of the animal's body.

F. During _____, nitrogen from animal waste or decaying bodies is returned to the soil by _____.

G. During _____, ammonia, NH_3, is converted to nitrite and then nitrate.

H. During _____, nitrate, NO_3, is changed to nitrogen gas, N_2, which returns to the atmosphere.



Nitrogen cycles through an ecosystem.

Processes that Are Part of the Nitrogen Cycle	
Process	**Description**
Nitrogen fixation	Bacteria change nitrogen gas into ammonia.
Ammonification	Bacteria change nitrogen from animal waste or decaying organic matter into ammonia and return it to the soil.
Nitrification	Bacteria change ammonia into nitrates.
Assimilation	Plants get nitrogen by absorbing nitrates or ammonia.
Denitrification	Bacteria convert nitrates into nitrogen gas.

XII. **PHOSPHORUS CYCLE**- phosphorus is important for ATP (energy currency) and DNA.

A. Phosphorus is found in soil and rock as _____ which dissolves in water to form phosphate.

B. The roots of plants absorb phosphate. Humans and animals that eat the plants use the organic phosphorus.

C. When the humans and animals die, phosphorus is returned to the soil by _____ and water.

HOMEWORK DATE DUE_____

CH 4 SEC 1

1. What two types of factors make up an ecosystem?

2. How does an ecosystem restore equilibrium after a major change?

3. Explain how the location and temperature of a high-latitude biome is different from the location and temperature of a tropical biome.

4. What are the two major components of climate?

5. Suppose you relocate a fish from a freshwater ecosystem to a marine ecosystem. What abiotic factor in the marine ecosystem will most likely make it hard for the fish to survive?

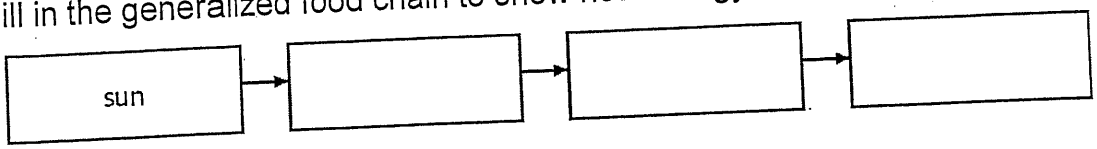
BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 4 SEC 2

1. Fill in the generalized food chain to show how energy flows through an ecosystem.



2. What is the difference between an omnivore and a herbivore?

_____

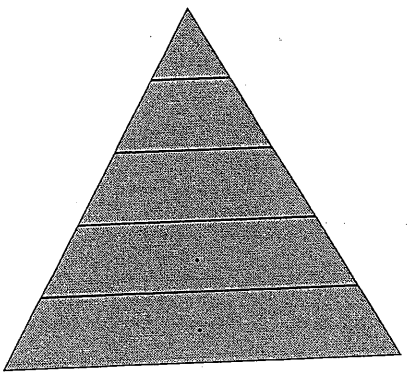
_____

_____

3. Why is there more energy in the bottom trophic level of an energy pyramid than in the next highest trophic level?

_____

_____



4. Name two types of organisms that are decomposers.

_____

_____

5. A lion stores 100 energy units after eating zebra meat from the trophic level below it. How many energy units did the zebra meat have?

_____

_____

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

_____

_____

ANSWER_____

_____

_____

_____

HOMEWORK DATE DUE_____

CH 4 SEC 3

1. What role does precipitation play in the water cycle?

2. How might an increase in the burning of fossil fuels affect the carbon cycle?

3. What role do decomposers play in the phosphorus cycle?

4. How are the processes of nitrogen fixation and denitrification different?

5. If nitrogen-fixing bacteria did not exist in an ecosystem, what would organisms be unable to make?

6. *How are photosynthesis and respiration different?

7. In the water cycle, what do the processes of transpiration and evaporation have in common?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

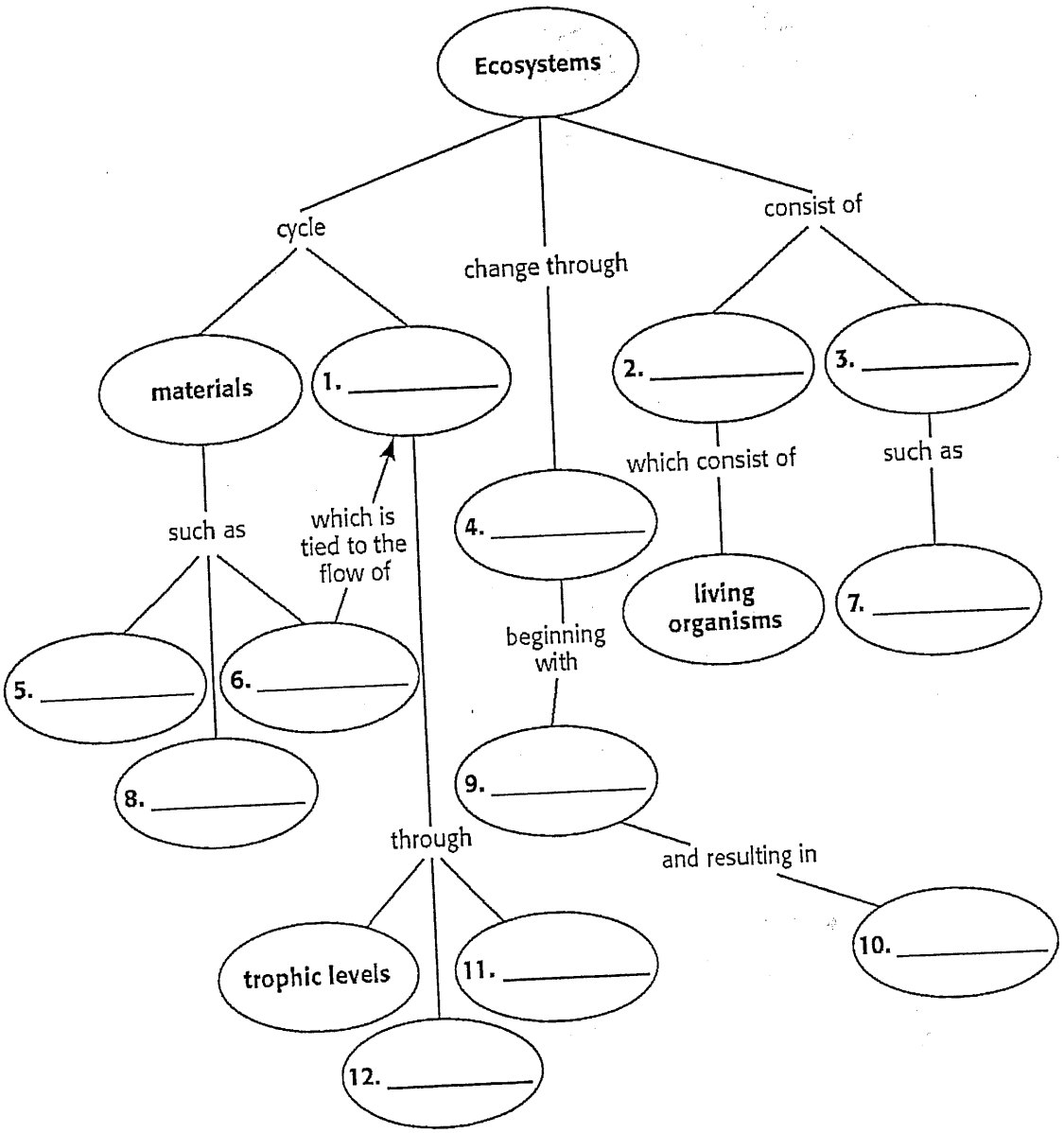
ANSWER

Name_____ Class _____ Date _____

Concept Mapping

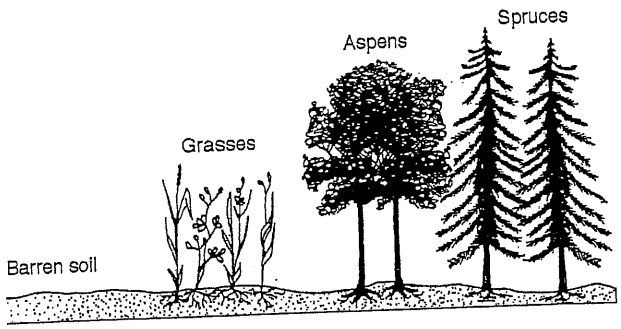
Using the terms and phrases provided below, complete the concept map showing the characteristics of ecosystems.

abiotic factors	energy	food webs	soil
biotic factors	equilibrium	nitrogen	succession
carbon	food chains	pioneer plants	water



Ch 4 Review

1. A group of organisms of different species living together in a particular place is called a _____
2. What is an ecosystem?
3. What is a population?
4. What is a community?
5. What is a habitat?



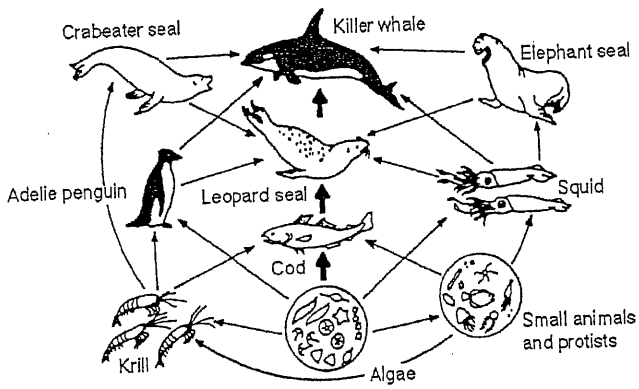
6. When the settlers arrived in New England, many forests were turned into fields. Eventually, some fields were abandoned and then grew back into forests. This is best described as

_____

7. Which of the following factors is not helpful in defining a biome?
8. Which two key factors determine the climate of a region?
9. In biomes where precipitation is low, most organisms have adaptations to _____
10. At least half of the world's species of land organisms live in a _____
11. Which biome receives the most precipitation on average?
12. An area where fresh water from a river mixes with salt water from an ocean is a(n)

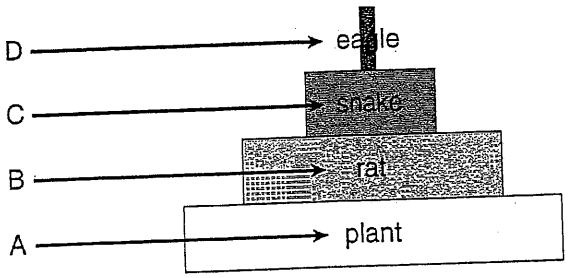
_____

13. What organisms are on the first trophic level? Second?
14. What are examples of decomposers?



15. The photosynthetic algae are _____
16. Killer whales feed at the _____

596



17. How much energy is available to the organisms in level C?
18. Precipitation that percolates into the soil becomes _____
19. All living things are made of _____
20. What are fossil fuels? Where do they come from?
21. What are the parts of the nitrogen cycle?
22. Nitrogen is a component of _____
23. What is the phosphorous cycle?
24. In water, calcium phosphate dissolves to form which substance that is taken up by the roots of plants?
25. Phosphorus is often found in soil and rock in which form?

TRAGEDY OF THE COMMONS GAME

Instructions for the Multi-person Version

These instructions will allow you to simulate the dynamics of the Tragedy of the Commons in your class. To play it requires that all the students can be assembled in a classroom with enough computers with Internet connections to allow all students to be online simultaneously (students can double up if need be). It helps if the instructor's computer has a projector connected so the results can be easily seen and discussed. The basic elements consists of a game played in several rounds, during each of which all students decide how many cows they will place on the commons. Each student is a farmer who has their own webpage on which they enter the number of cows they wish to graze on the commons for that round. After all students have confirmed that they have submitted their number of cows to the program (and have a "Please Wait" screen), the instructor goes to the instructor's page (ncowmanage.shtml) and clicks the submit button to tell the program to calculate the results for that round (the program has no way to know when the "round" has ended unless the instructor clicks the submit button). The instructor has the option of revealing the names of the "farmers" by entering the numbers for the rounds for which names should be printed – if no numbers are entered, no names appear; if "1, 3, 5" are entered (after round 5 is complete, presumably), names appear for the results of round 1, 3, and 5 but not for rounds 2 and 4.

THE MOST IMPORTANT INSTRUCTION OF THE GAME IS #7, namely, that the instructor NOT click the submit button on the management page until AFTER each round (including the first round) has been completed but then you MUST click it after all the students have submitted for each round.

- Example pages of the game once its been played.
- My lecture notes for when I run the game simulation in my class.
- Online video (via Modem or DSL or T1/Lan) of one of the Tragedy of the Commons simulations I ran while at Stanford University. (Courtesy of Stanford University & the Research Channel)
- Go to the game page. Class password required.

Instructions

Running the game requires two URLs, one for students and one for you as the instructor or game manager.

1) Contact Ronald Mitchell at rmitchel@uoregon.edu to set up a password and folder which will allow you to play the game.

2) As a homework exercise, have all students go to the main Tragedy of the Commons page and follow the link for the one-person version of the game that shows them how easy it is to optimize use of a private farm. This part is important to make the point that what causes the Tragedy of the Commons is not greediness but whether access is common or private. The students should think about the fact that they are equally "greedy" in both cases but that in the private farm case their "greed" leads them to find the optimal number of cows and then only graze that number for eternity, which they will see is not true in the Commons case. It usually takes people about 8 or 9 tries to optimize milk production in this "game against nature" in which the real analogy is just in trying to figure out the "carrying capacity" of the farm which would be dictated by such factors as rainfall, soil quality, and the size of the farm. To help students understand the difference between the dynamics of a private farm and a commons, you might have them notice that, if they knew the right number of cows to optimize on

the farm, there would be no point in playing the game, whereas in the Tragedy of the Commons case they do know the optimal number of cows they should put on after the first round (its in the results and is 20 cows per farmer, regardless of how many farmers there are and whether or not any students decide to abstain from putting cows on the commons – this keeps the game more interesting and forces the students to make harder choices).

3) About a week before you want to run the simulation, get two or three students or colleagues together in the computer lab you plan to use and do a test run of the game to make sure you understand how to use it. It is not a professionally designed computer program which does not catch or notify you of most errors – it just doesn't work properly. But, if you follow these instructions carefully, it will work fine – its been used by many instructors before. I will give you two passwords – one for use in testing and one for the real class.

4) Assuming the test went fine, bring all your students into one computer lab room. There is not a limit on how many can play, but my experience suggests that having more than 25 students playing at one time tends to overload the server and slow things down. Each student will need his/her own terminal, or you can have students pair up.

5) On the day of the game, have all students return to the main Tragedy of the Commons page and have them enter the password you were given (usually the instructor's last name). Filling in the password will direct them to a page where they fill in their name which will create a webpage and game account in their name and they can play the Tragedy of the Commons game.

6) Once play begins, *MAKE SURE* that they follow the instructions on the screens, and wait on the "Please Wait Here" page, or it will prevent the game from working properly.

7) The instructor (NOT the students) manages the game from http://www.uoregon.edu/~rmitchel/commons/gamespace/*password*/manage.shtml (replace "password" with the same password the students are using). Manage the game as follows:

- Ensure ALL students have submitted their cow number for a round and have gotten to the "Please Wait Here" page,
- Then, click the submit button on the page at http://www.uoregon.edu/~rmitchel/commons/gamespace/*password*/manage.shtml
- Make absolutely sure NOT to click the submit button before a round is over and NOT before the first round is played (doing so will prevent the game from working).
- The submit button will cause the program to tally the results and will automatically refresh students webpages. Students do not need to click on anything.
- As noted, this page allows you to keep names secret (the default) or disclose them. You can use this to encourage students to think about how information on who the "bad guys" are (those who graze more than the 20 per-person optimum) helps (or doesn't help) resolve a Tragedy of the Commons game.

8) Let me reiterate that instructors should "test drive" the game with 2 or 3 students or colleagues to avoid unnecessary errors and embarrassment.

I make this game available as a free public service. I certainly hope and will try to ensure it works but I cannot be responsible for problems or for spending too much time running it. I would, of course, appreciate suggestions for improvements, but cannot promise to respond to requests for them. I hope that you will only make appropriate use of the game, will urge your students to do the same, and give me appropriate credit for writing the game.

Water Cycle

The cycling of water in an ecosystem is necessary for the organisms that are part of the ecosystem. In this activity, you will model the water cycle.

Procedure

1. Place a small, dark-colored bowl inside a large, sealable, plastic freezer bag. Position the bag so that the opening is at the top.
2. Fill the bowl halfway with water. Place three drops of red food coloring in the water. Seal the bag.
3. Place the bowl and bag under a strong and warm light source, such as a lamp or direct sunlight.
4. Leave the bag in the light for one hour. Observe the bag at regular intervals.

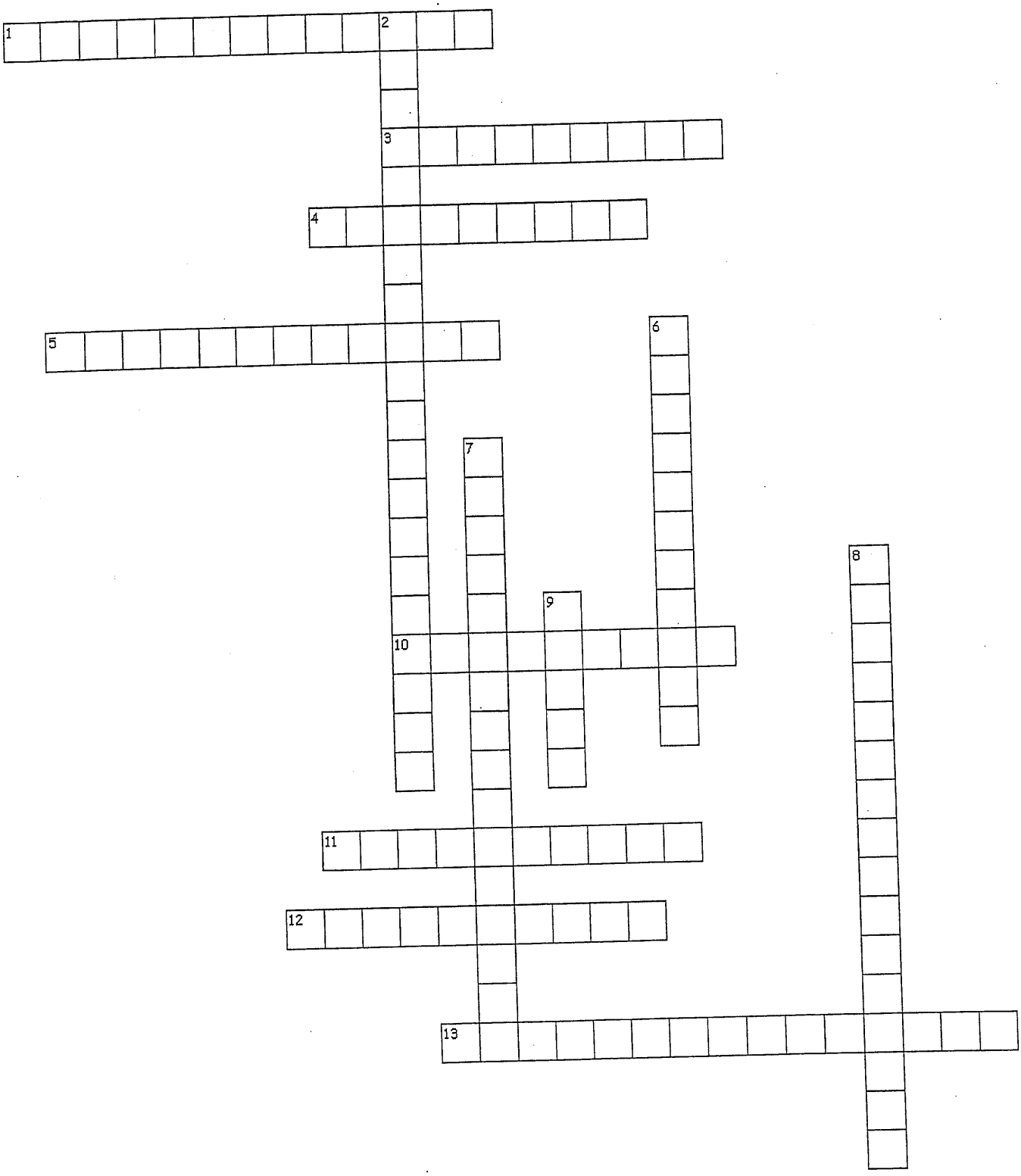
Analysis

1. **Describe** how your model mimics the behavior of water in the environment.

2. **Predict** how organisms such as plants would be affected if water did not cycle through the environment.

Ch 5 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

for each term with the word on one side and the definition on the back



Across

1. the range of resources that a species uses, the conditions that the species can tolerate, and the functional roles that the species plays as a result of competition in its fundamental niche

3. an interaction between two organisms in which one organism, the predator, kills and feeds on the other organism, the prey

4. a relationship between two species in which both species benefit

5. a relationship between two organisms in which one organism benefits and the other is unaffected

10. a relationship in which two different organisms live in close association with each other

11. a group of organisms of the same species that live in a specific geographical area and interbreed

12. a relationship between two species in which one species, the parasite, benefits from the other species, the host, which is harmed

13. a species that is critical to the functioning of the ecosystem in which it lives because it affects the survival and abundance of many other species in its community

Down

2. the exclusion of one species by another due to competition

6. the evolution of two or more species that is due to mutual influence

7. the largest ecological niche where an organism or species can live without competition

8. the largest population that an environment can support at any given time

9. the unique position occupied by a species, both in terms of its physical use of its habitat and its function within an ecological community

Ch 5

pulation	
carrying capacity	
edation	
coevolution	
parasitism	
symbiosis	
mutualism	
commensalism	
niche	
fundamental niche	
realized niche	
competitive exclusion	
keystone species	

B. An ecosystem can support only so many organisms. The largest population that an environment can support at any given time is called the _____.

IV. **FACTORS THAT AFFECT POPULATION SIZE-** Water, food, predators, and human activity are a few of many factors that affect the size of a population.

A. Remember, nonliving factors that affect population size are called _____ factors. Weather and climate are the most important abiotic factors.

B. A factor that is related to the activities of living things is called a _____ factor. Food, such as grass or other animals, is a biotic factor.

C. Biotic factors are often _____ because they can have a stronger influence when crowding exists.

D. As the density of a population increases, the effects of starvation, predators, and disease often also increase.

V. **HUMAN POPULATION**

A. Two thousand years ago, there were only 300 million people. Around the time of the Industrial Revolution, the human population started to accelerate rapidly.

B. Human population began accelerating exponentially starting in the late 1700s. Now, there are more than _____ people, and some scientists think that the population will grow to _____ billion in 50 years

C. Advances in agriculture have allowed efficient production of crops and other foods. More food supports more people.Medical advances have also allowed the human population to increase. _____ have lowered the death rate. Other medical advances have allowed adults to live longer lives.

VI. **PREDATOR-PREY INTERACTIONS**-Back-and-forth evolutionary adjustment between two species that interact is called coevolution.

A. One of the most common interactions in communities is that between predators and their prey. _____ is the act of one organism killing another for food.

B. _____ are animals that eat plants. Unlike predators, herbivores do not often kill the plants. But plants do try to defend themselves with thorns and foul taste or pois

VII. **SYMBIOTIC RELATIONSHIPS**-Symbiosis is a relationship in which two species live in close association with each other.

A. **Parasitism** is where one organism feeds on another organism (called a host). The relationship benefits the _____

1. The host is almost always larger than the parasite and is usually harmed but not killed.

2. Parasites often live on or in their host. Therefore, the parasite depends on its host not only for food but for a place to live as well.

3. Hosts try to keep parasites from infecting them. Hosts can defend themselves with their immune systems or behaviors such as scratching. Parasites may evolve ways to overcome the host's defenses.

B. **Mutualism** is a relationship between two species in which _____. An example is lichen, an algae and fungus that live together and provide benefits for both.

C. **Commensalism** is where two species have a relationship in which one species _____ and the other _____.

	ORGANISM 1	ORGANISM 2
MUTUALISM	+	+
COMMENSIALISM	+	Neither + or -
PARASITISM	-	-

VIII. **NICHE**- A niche includes the role that the organism plays in the community. This role affects the other organisms in the community.

A. The unique position occupied by a species, both in terms of its physical use of its habitat and its function in an ecological community, is called a niche.

B. A niche is not the same as a _____. A _____ is the place where an organism lives.

IX. **COMPETITION** -

A. The entire range of conditions where an organism or species could survive is called its _____.

B. Many species share parts of their fundamental niche with other species. Sometimes, species compete for limited resources. Because of this competition, a species almost never inhabits its entire fundamental niche.

C. The actual niche that a species occupies in a community is called its _____.

D. Sometimes, competition results in fights between rivals. Sometimes, one species wins, and the other loses. The loser is _____ from the habitat.

E. Other times, competitors can survive together in the same habitat. They are able to survive together because they divide the resources.

F. No two species that are too similar can coexist because they are too similar in their needs. One will be slightly better at getting the resources on which they both depend.

G. The more successful species will dominate the resources. The less successful species will either die off or have to move to another ecosystem.

H. Eventually, the better competitor will be the only one left. One species eliminating another through competition is called _____

X. **ECOSYSTEM RESILIENCY**- Interactions between organisms and the number of species in an ecosystem add to the resiliency of an ecosystem.

A. Ecosystems can be destroyed or damaged by severe weather, humans, or invasive species.

B. Higher _____ often helps make an ecosystem more resilient.

C. Predators can influence more than their prey. When predators eat one species, they may _____ among other species.

D. A _____ is a species that is critical to an ecosystem because the species affects the survival and number of many other species in its community.

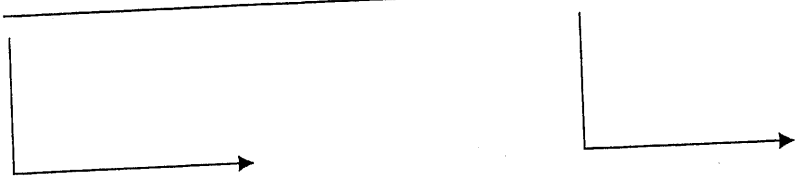
HOMEWORK DATE DUE_____

CH 5 SEC 1

1. Why do biologists study populations?

2. One group of rabbits lives in a forest in New York. Another group of rabbits of the same species lives in a forest in Connecticut. Are these two groups of rabbits part of the same population? Explain your answer

3. Describe how a graph showing exponential growth is different from a graph showing logistic growth.



4. Give two examples of abiotic factors that can affect population size.

5. Give an example of how a biotic factor can affect a population.

6. Give one example of how advances in science and technology have allowed the human population to increase rapidly.

7. Give one example of a biotic factor that could affect the size of the human population. Describe how a change in this biotic factor could affect the human population.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 5 SEC 2

1. Give one difference and one similarity between mutualism and commensalism.

Description of relationship	What type of relationship is this?
Bears kill and eat salmon.	
Shrimp in coral reefs eat parasites off of large fish. The shrimp and the fish are both helped.	
Leeches suck blood from mammals. The leech is helped, and the mammals are harmed.	
Rabbits eat plants.	
Orchids grow along the trunks of trees to get more sunlight. The trees are not harmed.	

2. How might two species in a predator-prey relationship coevolve?

3. Some plants produce chemicals that can kill organisms that eat them. Is this an example of predation? Explain your answer.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 5 SEC 3

1. How is a niche different from a habitat?

2. How is a fundamental niche different from a realized niche?

3. Why don't most species occupy their entire fundamental niches?

4. How can species with similar fundamental niches coexist?

5. In general, how does the number of species in an ecosystem affect the stability of the ecosystem?

6. Give two examples of factors that can damage or destroy an ecosystem.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

Natural Selection Simulation

OBJECTIVES

- **Model** natural selection.
- **Relate** favorable mutations to selection and evolution.

MATERIALS

- antlers
- grass
- water
- rock (shelter)
- wolf tail
-
-
-

Procedures:

1. You will be assigned a starting group- either deer or environment. You will line up at that line outside and put the correct "disguise" on. Deer will have antlers, environment will not. Environment will pick either shelter, food or water. Deer must pick the environment they will be attempting to obtain- shelter, food or water.

2. You will keep your back turned until the whistle is blown. The environment will try to avoid being captured by the deer that is looking for that particular environment. Deer will attempt to obtain the environment it is seeking. You will have 15 seconds. Deer can only get ONE environment per round!!

3. If the environment does not get captured, you get to go back to the environment line. If the deer does not obtain its needed environment, it dies and becomes the environment. The dear that did not get its environment goes to the environment line.

4. Deer that got its correct environment go back to the deer line ALONG WITH THE ENVIRONMENT IT CAPTURED! Both are deer and will pick the environment factor each will seek for the next round.

5. Stay in a single file for counting with back to the other team until whistle blows.

6. There will be fifteen rounds.

7. After 15 rounds, a wolf will be introduced to the environment. The wolf (picked by me) will start in its lair and must wait for 5 seconds before trying to capture a deer. The wolf can only catch 1 deer per round. The deer and

environment will continue to play as before- going to their correct lines with each round.

8. A wolf will die and become part of the environment if it can not capture a deer each round. If the wolf does capture a deer, it must escort the deer back to its lair before the whistle blows or it dies and becomes the environment. If the wolf and captures deer make it back to the lair before the whistle, both become wolves and start from the lair with a 5 second delay in the next round.

9. Complete the table with your class data. You have also been provided with a prior year's data. You must complete the graphs for your class and the sample class. A color key must be included.

10. Any person that can remain on the environment side for all 30 rounds will receive a prize!

QUESTIONS:

1. What relationship is there between the deer and environment between years 1-15? Does that change when wolves are introduced?

   _____

   _____

   _____

2. If the wolves had not been introduced, would the graph have gone up, stayed the same or decreased for the deer population?

   _____

   _____

   _____

3. The environment (water and shelter) are considered _____ factors.

4. Food would be considered a _____ factor.

5. From your personal experience with the Oh Deer Activity, why do some years (rounds) have more deer than environment, and other years, the opposite is true.

   _____

   _____

   _____

   _____

CLASS DATA

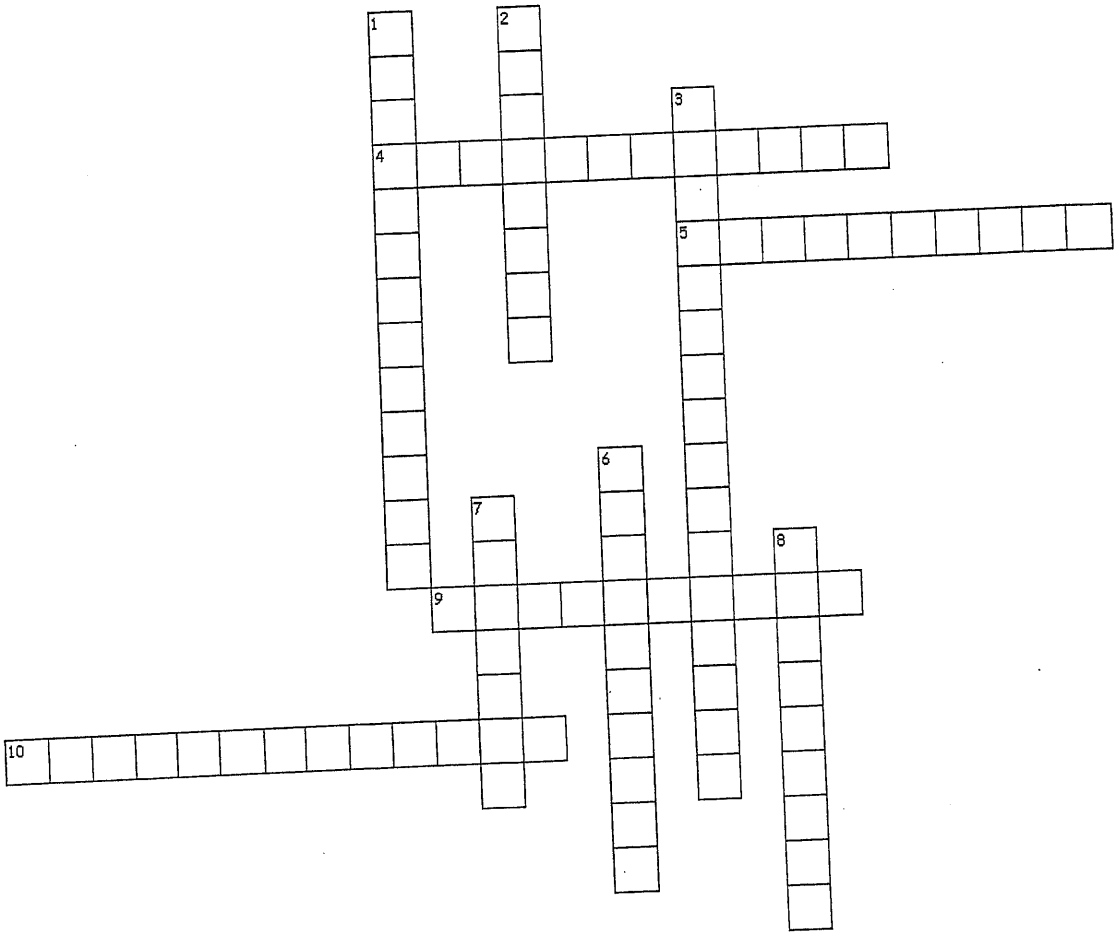
round	env	deer	round	env	deer	wolves
1			16			
2			17			
3			18			
4			19			
5			20			
6			21			
7			22			
8			23			
9			24			
10			25			
11			26			
12			27			
13			28			
14			29			
15			30			

SAMPLE DATA

round	env	deer	round	env	deer	wolves
1	13	12	16	13	12	1
2	9	16	17	13	10	2
3	7	18	18	13	8	4
4	5	20	19	15	2	8
5	7	18	20	19	4	2
6	9	16	21	17	6	2
7	11	14	22	15	8	2
8	13	12	23	17	4	4
9	15	10	24	17	6	2
10	13	12	25	15	8	2
11	11	14	26	13	10	2
12	13	12	27	13	8	4
13	11	14	28	15	6	4
14	11	14	29	19	4	2
15	13	12	30	17	6	2

Ch 6 Crossword/ Vocab Flash Cards- complete the crossword and make a flashcard

or each term with the word on one side and the definition on the back



Across

4. the variety of organisms in a given area, the genetic variation within a population, the variety of species in a community, or the variety of communities in an ecosystem
5. a form of tourism that supports the conservation and sustainable development of ecologically unique areas
9. a nonrenewable energy resource formed from the remains of organisms that lived long ago; examples include oil, coal, and natural gas
10. the process of clearing forests

Down

1. a gradual increase in the average global temperature
2. precipitation that has a pH below normal and has an unusually high concentration of sulfuric or nitric acids, often as a result of chemical pollution of the air from sources such as automobile exhausts and the burning of fossil fuels
3. the warming of the surface and lower atmosphere of Earth that occurs when carbon dioxide, water vapor, and other gases in the air absorb and reradiate infrared radiation
6. the death of every member of a species
7. a process in which the materials of Earth's surface are loosened, dissolved, or worn away and transported from one place to another by a natural agent, such as wind, water, ice, or gravity
8. the process of recovering valuable or useful materials from waste or scrap

fossil fuel	
acid rain	
global warming	
green house effect	
erosion	
deforestation	
biodiversity	
extinction	
recycling	
ecotourism	

Chapter 6 The Environment

I. HUMANS AND THE ENVIRONMENT-As human population increases, the impact of humans on the environment increases. The more that the human population grows, the more sources from the environment we will need to survive.

II. RESOURCES- _____ resources are natural resources that can be replaced at the same rate at which they are consumed. _____ resources are resources that form at a rate that is much slower than the rate at which they are consumed.

A. A renewable resource's supply is either so large or so constantly renewed that it will never be used up. However, a resource can be renewable but still be used up if it is used faster than it can be renewed.

B. Most of our energy today comes from _____. Fossil fuels are nonrenewable energy resources that formed from the remains of organisms that lived long ago. Fossil fuels such as coal, oil, and natural gas, are nonrenewable resources because it takes millions of years for them to form.

C. We use fossil fuels at a rate that is faster than the rate at which they form. So, when these resources are gone, millions of years will pass before more have formed.

III. THE ENVIRONMENT AND HEALTH-Pollution and habitat destruction destroy the resources we need to live, such as the air we breathe, the water we drink, and the food we eat.

A. Air pollution can cause headaches, sore throats, nausea, and upper respiratory infections. It has also been linked to lung cancer and heart disease.

B. Some chemical pollutants in drinking water can lead to _____ and cancer.

C. Many infectious diseases, such as _____, are spread by water polluted by sewage.

D. _____ _____ can also affect our safety. Cutting down trees increases the number of landslides and floods, which can cause deaths and injuries.

IV. ATMOSPHERIC POLLUTION-Air pollution causes respiratory problems for people, results in acid rain, damages the ozone layer, and may affect global temperature.

A. _____ is precipitation that has an unusually high concentration of sulfuric or nitric acids, which is caused by pollution.

615

B. The _____ layer protects life on Earth from the sun's damaging ultraviolet (UV) rays. The ozone layer has been damaged by chlorofluorocarbons (CFCs). CFCs are human-made chemicals that are used as coolants in refrigerators and air conditioners and as propellants in spray cans. (CFCs)

V. GLOBAL WARMING - Global warming is the gradual increase in the average global temperature. The _____ effect is necessary to keep Earth's temperatures stable and is normal. The extent to which this is raising the average temperature is controversial

A. The greenhouse effect is the warming of the surface and lower atmosphere of Earth that happens when greenhouse gases in the air absorb and reradiate heat.

B. Examples of greenhouse gases are

1. _____ (carbon dioxide from burning gas, wood, and other combustion
2. _____ Vapor- becomes associated with carbon diodide in the air
3. CH3-_____- from cows "chewing their cud" As cattle increase, so does the amount of methane they produce.

Possible damage from global warming includes melting ice sheets, sea level rise, destruction of coastal ecosystems, and changes in weather patterns

VI. WATER POLLUTION- Water pollution can come from fertilizers and pesticides used in agriculture, livestock farms, industrial waste, oil runoff from roads, septic tanks, and unlined landfills.

A. Pollution enters groundwater when polluted surface water _____ down through the soil.

B. Landfills and leaking underground septic tanks are also major sources of groundwater pollution.

C. When pollutants run off land and into rivers, both aquatic habitats and public water sources may be contaminated.

D. Fertilizers from farms, lawns, and golf courses can run off into a body of water, which increases the amount of nutrients in the water leading to an excessive growth of algae.

E. _____ can deplete the dissolved oxygen in a body of water. Fish and other organisms then suffocate in the oxygen-depleted water.

VII. SOIL DAMAGE- Soil erosion destroys fertile soil that we need in order to produce food.

A. Fertile soil forms from rock that is broken down by _____.

B. Nutrients that make soil fertile come from the weathered rock as well as from bacteria, fungi and the remains of plants and animals.

C. The processes that form just a few centimeters of fertile soil can take thousands of years.

D. The greatest threat to soil is _____. _____ is a process in which the materials of Earth's surface are worn away and transported from one place to another by wind, gravity, or water.

1. Many farming methods can lead to soil erosion by loosening the topsoil and removing plants that hold the soil in place. The topsoil can then be washed away by wind or rain.

2. _____ agricultural practices can prevent erosion.

3. Terracing changes a steep field into a series of flat steps that stop gravity from eroding the soil.

4. Planting a cover crop, such as soybeans, restores nutrients to the soil.

5. _____, or planting a different crop every year, slows down the depletion of nutrients in the soil.

6. In contour plowing, rows are plowed in curves along hills instead of in straight lines. The rows act as a series of dams, which prevent water from eroding the soil.

VIII. ECOSYSTEM DISRUPTION-Ecosystem disruptions can result in loss of _____, food supplies, potential cures for diseases, and the balance of ecosystems that supports all life on Earth.

A. Over the last 50 years, about half of the world's tropical rain forests have been cut down or burned for timber, pastureland, or farmland. This process of clearing forests is called _____.

B. Habitat destruction and damage cause more extinction and loss of biodiversity than any other human activities do.

C. Ecosystem disruption decreases the number of Earth's species. Biodiversity affects the stability of ecosystems and the sustainability of populations. _____ is the variety of organisms in a given area.

1. Every species plays an important role in the cycling of energy and nutrients in an ecosystem. Each species either depends on or is depended on by at least one other species.

2. When a species disappears, a strand in a food web disappears. If a keystone species disappears, other species may also disappear.

D. CONSERVATION AND RESTORATION-> _____ involves protecting existing natural habitats. _____ involves cleaning up and restoring damaged habitats.

IX. REDUCE REUSE RECYCLE-We can reduce our use of resources, such as water and fossil fuels for energy. We can reuse goods rather than disposing of them. Furthermore, we can cycle waste to help protect the environment.

A. One of the best ways that you can help solve environmental problems is by reducing the amount of energy that you use and the amount of waste that you produce.

B. The process of reusing things instead of taking more resources from the environment is called _____Recycling existing products generally costs less than making new ones from raw materials does.

X. aware of environmental issues. Education also shows people how they can help address such issues. Expressing support, or advocating, for efforts to protect the environment can help get more people involved in these efforts.

A. Educating the public about the environment helps gain public support for solving environmental issues.

1. _____ is one way to educate the public about the environment. Ecotourism is a form of tourism that supports conservation of the environment.

2. Often, an ecotourist is given an opportunity to help solve environmental problems as part of his or her tour.

Renewable resources	Nonrenewable resources
wind energy	oil
solar energy	coal
fresh water	natural gas
trees and other living things	precious metals and minerals

HOMEWORK DATE DUE_____

CH 6 SEC 1

1. How does a growing human population affect resources?

2. Complete the table below to identify each resource as renewable or nonrenewable. For renewable resources, indicate if the resource could become nonrenewable.

Resource	Renewable or nonrenewable?
Trees	Renewable; could become nonrenewable
Gold	
Sunlight	
Fish	
Clean air	
Steel	

3. What are three examples of fossil fuels?

4. Why is natural gas a nonrenewable resource?

5. Identify one nonrenewable resource that you used today.

6. Name two environmental disturbances that can affect our health.

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 6 SEC 2

1. Identify three effects of air pollution.

2. How do increased CO_2 levels in the atmosphere lead to climate change?

3. Why is soil erosion a problem for humans?

4. How does deforestation affect biodiversity?

5. Why can the loss of one species lead to the loss of other species?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

ANSWER

HOMEWORK DATE DUE_____

CH 6 SEC 3

1. Why is conservation of a habitat better than restoration?

2. Complete the table below to identify each example as a way to reduce, reuse, or recycle. You may have more than one answer for each example.

Example	Reduce, reuse, or recycle?
Using low-flow shower heads	
Using ceramic plates instead of paper ones	
Walking to school instead of riding in a car	
Making new aluminum cans from old ones	
Giving old clothes to a charity	
Carrying groceries in a cloth bag instead of a paper or plastic one	

3. Identify three technologies that can help reduce air pollution.

4. How are education and advocacy related?

5. How does planning for the future relate to conservation?

BELLRINGER QUESTION CIRCLE M T W TH FRI DATE

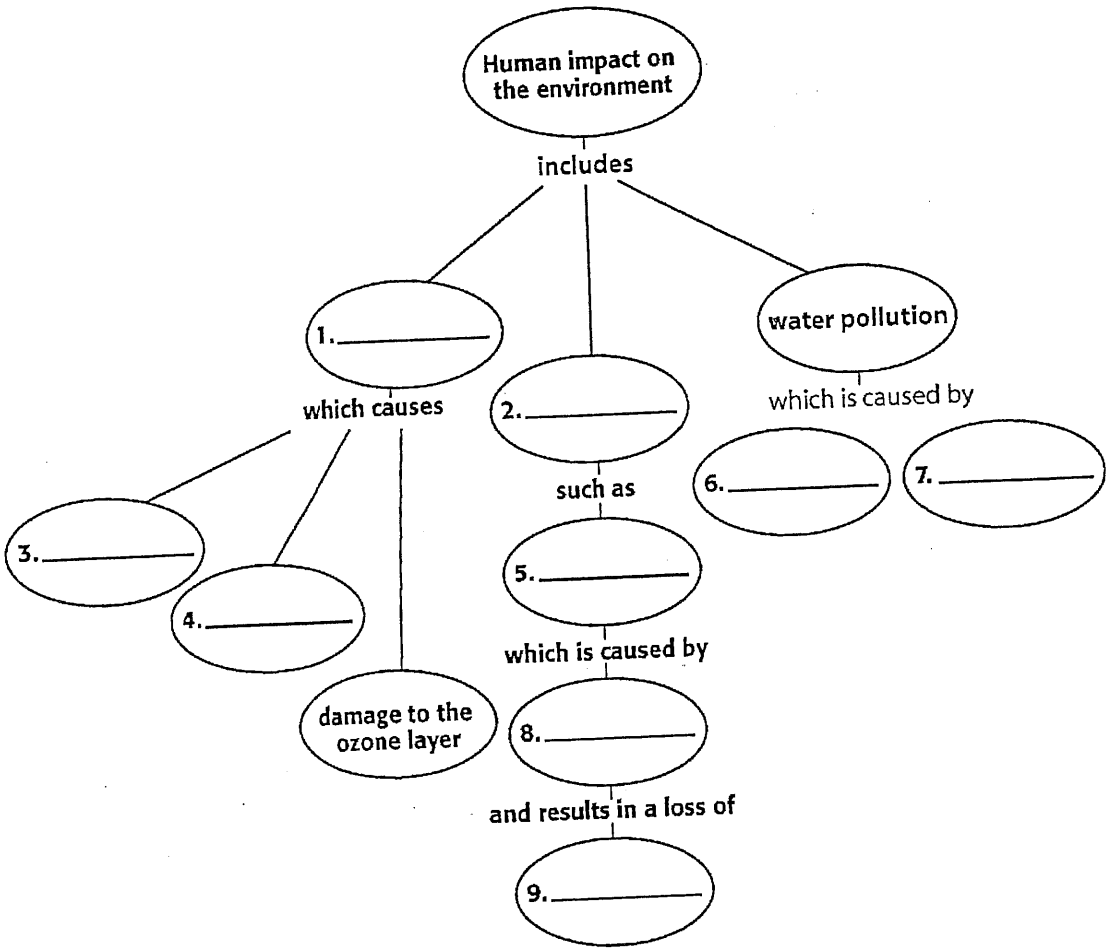
ANSWER

Name_____ Class _____ Date _____

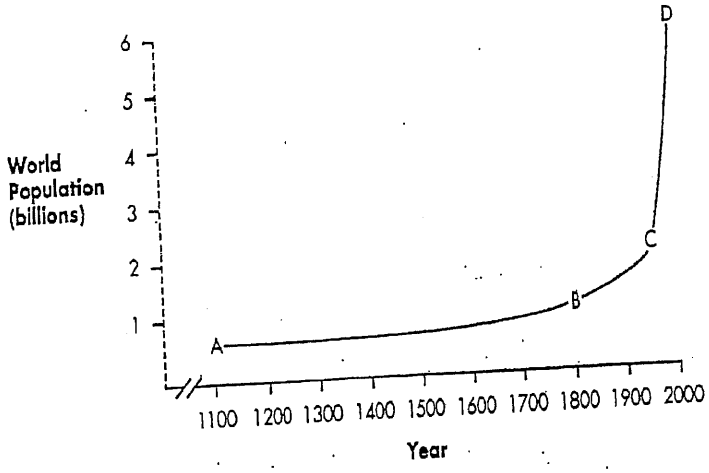
Concept Mapping

Using the terms and phrases provided below, complete the concept map showing the impact of humans on the environment.

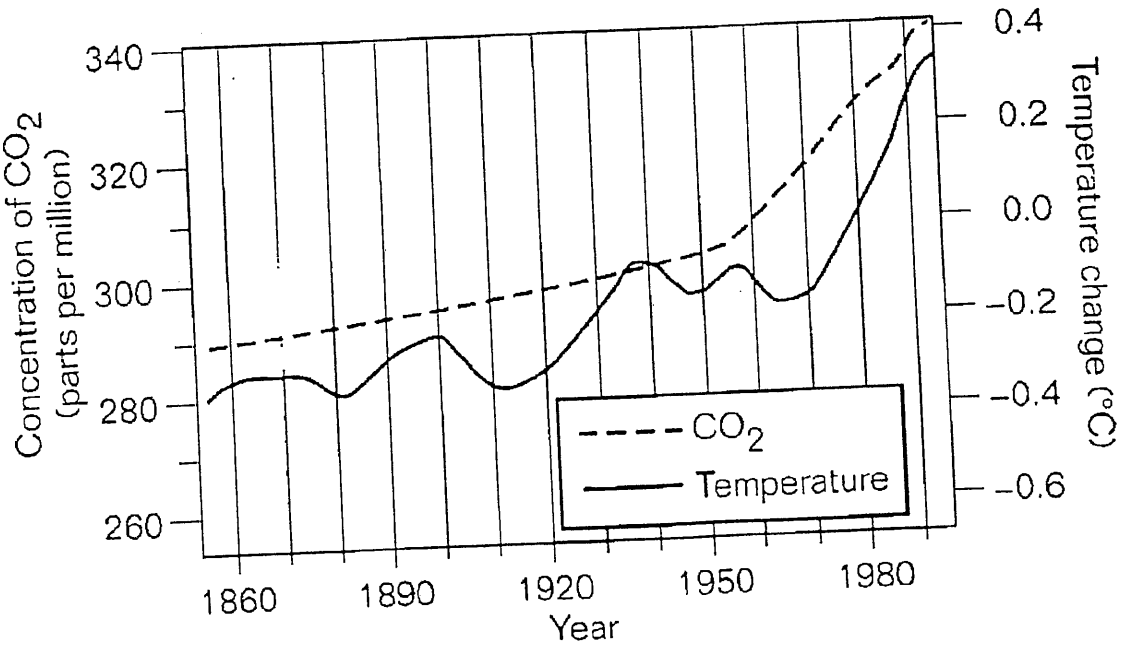
acid rain
agricultural runoff
air pollution
biodiversity
deforestation
ecosystem disruption
global warming
habitat destruction
industrial waste



Chapter 6 Review



1. The American Revolution began in 1776. According to the graph, what was the approximate world population at that time?
2. Which letter in the graph indicates the approximate world population in the year 1950?
3. What is a renewable resource?
4. Why is coal a nonrenewable resource?
5. What is a CFC and why are they dangerous?
6. What does ozone in the atmosphere do?
7. What is a product of burning fossil fuels?
8. What are greenhouse gases? What do Greenhouse gases do?
9. What is the Greenhouse Effect?



10. What is this graph showing?

11. What is carbon diaxide levels since 1980

12. What do alagal blooms do to fish?

13. Crop rotation helps to conserve fertile soil by

14. What human activities cause an decrease in biodiversity?

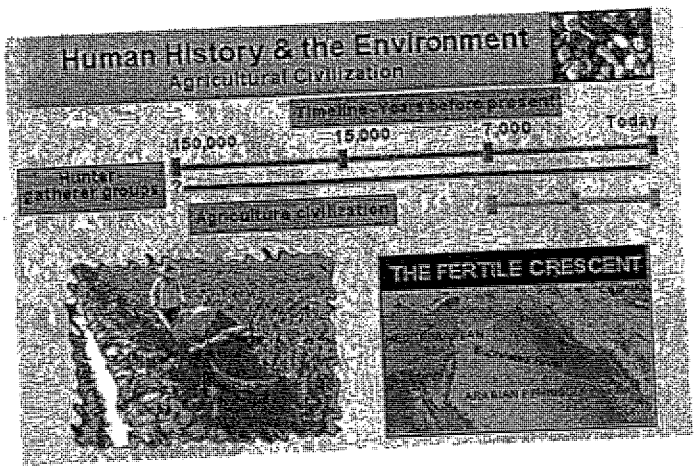
15. Why is it importnat to conserve the tropical rainforest?

16. Draining a pond to remove polluted sediments and then refilling the pond is an example of

17. How can each person reduce resource use?

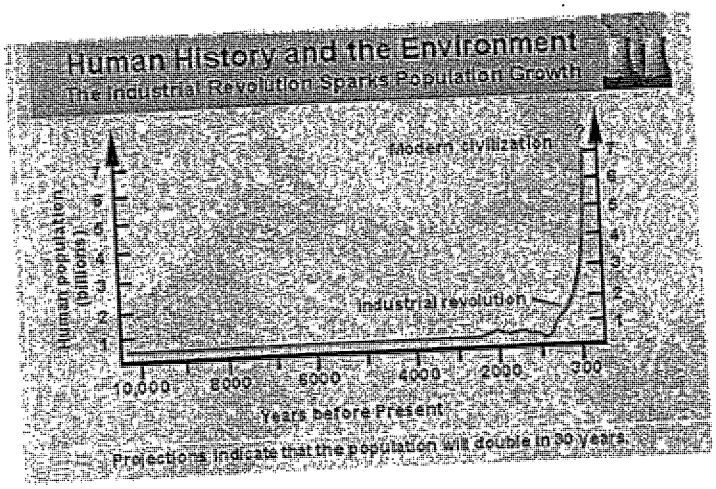
Study Guide #1
HUMAN IMPACTS: A BRIEF HISTORY

Every organism impacts the environment in which it lives. Like other organisms, humans draw their basic survival needs from the environment. Unfortunately, some human activity has had adverse impacts on the environment, leading to environmental pollution, habitat destruction, natural resource exploitation, and the loss of **biodiversity**.



Looking back in time, our predecessors lived simple **hunter-gatherer** lifestyles. They hunted animals, gathered fruits and vegetables, and scavenged the prey of other animals. They lived in small groups and moved in accordance with changing environmental conditions. Although their impacts on the environment were relatively small, hunters and gatherers certainly altered their environment. For example, they played a significant role in the extinction of several large animals.

New environmental impacts came about a few thousand years ago as people developed simple agricultural practices. **Slash and burn** farming in forested areas; the invention of the plow, which allowed people to farm the rich soil of grasslands; and the domestication of animals created a dependable food supply. This, in turn, gave rise to the first major civilizations in an area that became known as the **Fertile Crescent,** which was in an area near the Tigris and Euphrates rivers in the Middle East. Overuse of the land, however, eventually caused the land to yield less food, and the civilizations declined. Today, much of the Fertile Crescent is desert.



In the eighteenth century, the **Industrial Revolution** brought a shift from the small scale production of hand-made goods to the large scale production of machine-made goods. As a result, industrialized countries shifted from rural, agricultural based economies to economies that were more urban and industrial. The introduction of large industrial factories brought about a new era of **environmental pollution**.