

# Biology Boot Camp: Multiple Choice Qs

Biology sample scenario  
For use with items 1 and 3  
PLD/CGS Training, Winter/Spring 2012

## Guard Against *Giardia*

Celeste and Aaron knew drinking water containing *Giardia cysts* (microorganisms) can cause health problems in people. In the intestine, *Giardia cysts* develop into adult *Giardia* which can cause illness. Working with the health department, Celeste and Aaron investigated the effect of water temperature on *Giardia cysts*.

**Question:** What is the effect of the temperature of water on the survival of *Giardia cysts*?

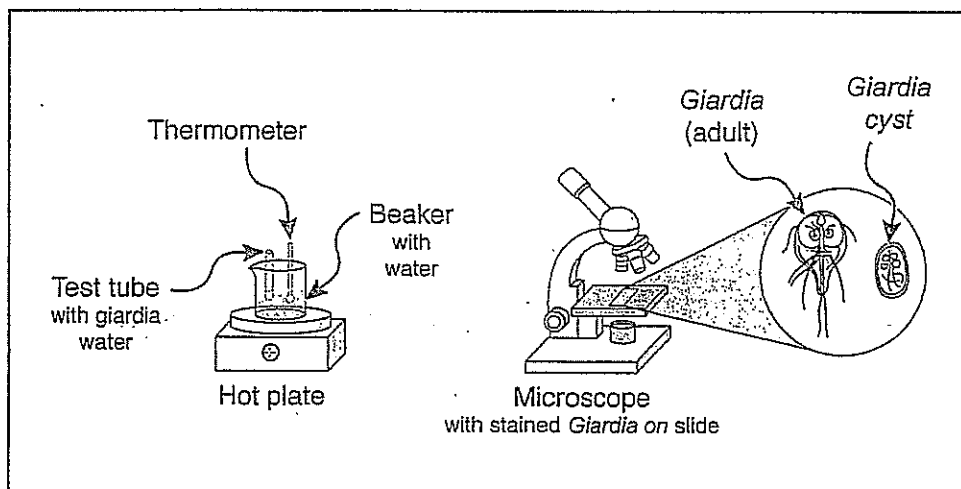
**Prediction:** As the temperature of water increases, the number of *Giardia cysts* surviving will decrease.

### Materials:

water with *Giardia cysts*  
thermometer  
beaker with water  
test tubes labeled #1, #2, #3, and #4  
test tube rack and clamp  
hot plate

microscope  
stain for *Giardia*  
graduated cylinder  
eyedroppers  
microscope slides  
stopwatch

## Controlled Experiment Setup



**Procedure:**

1. Put 10 milliliters of water with *Giardia cysts* into each test tube.
2. Measure and record the temperature of test tube #1.
3. Put the beaker with water on the hot plate and increase the temperature of the water to 40° C, as shown in the Investigation Setup diagram.
4. Put test tube #2 in the beaker and keep the temperature of the water at 40° C for ten minutes. Return the test tube to the rack.
5. Repeat steps 3 and 4 with test tube #3 at 50° C, and #4 at 100° C.
6. Put a drop of water from each test tube on separate microscope slides using clean eyedroppers. Add one drop of the *Giardia* stain to each slide.
7. Put each slide under the microscope and look for *Giardia cysts*. Surviving *cysts* will be stained a different color from the dead *cysts*.
8. Identify 20 *Giardia cysts* and record how many of the 20 were surviving for each water temperature as Trial 1.
9. Clean the equipment and repeat the investigation for Trials 2 and 3.
10. Calculate and record the average of the three trials for each temperature.

**Data:**

**Temperature of Water vs. Surviving *Giardia* Cysts**

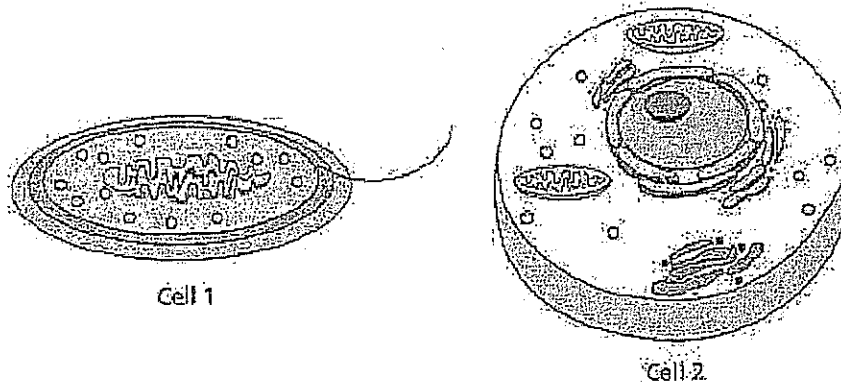
Temperature of Water in each test tube (° C)	Surviving <i>Giardia</i> Cysts (number)			
	Trial 1	Trial 2	Trial 3	Average
22	20	20	19	20
40	2	3	2	2
50	1	1	2	1
100	0	0	0	0

Note: Investigation was conducted in a room with a constant temperature of 22° C.



## CELLS

1. Two cells are shown in the diagram below.



Which statement correctly identifies the cells?

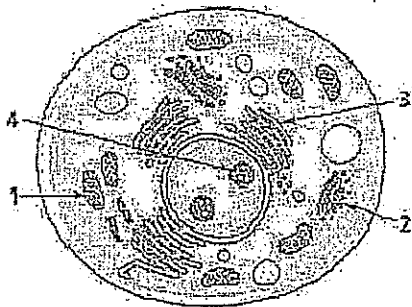
- a. Cell 1 is prokaryotic; cell 2 is eukaryotic.
  - b. Cell 1 is eukaryotic; cell 2 is prokaryotic.
  - c. Both cells are prokaryotic.
  - d. Both cells are eukaryotic.
2. Which best explains why a bacterial cell is classified as a prokaryote?

- a. the presence of a nucleus
- b. the absence of a nucleus
- c. the presence of a cell wall
- d. the absence of a cell wall

3. Which is an organelle that performs cellular respiration and is paired with its correct function?

- a. chloroplast - converts light energy into chemical energy
- b. chloroplast - converts chemical energy into light energy
- c. mitochondrion - converts energy found in glucose into energy used by the cell
- d. mitochondrion - converts cellular energy into glucose chemical energy

4. A diagram of a cell is shown below.



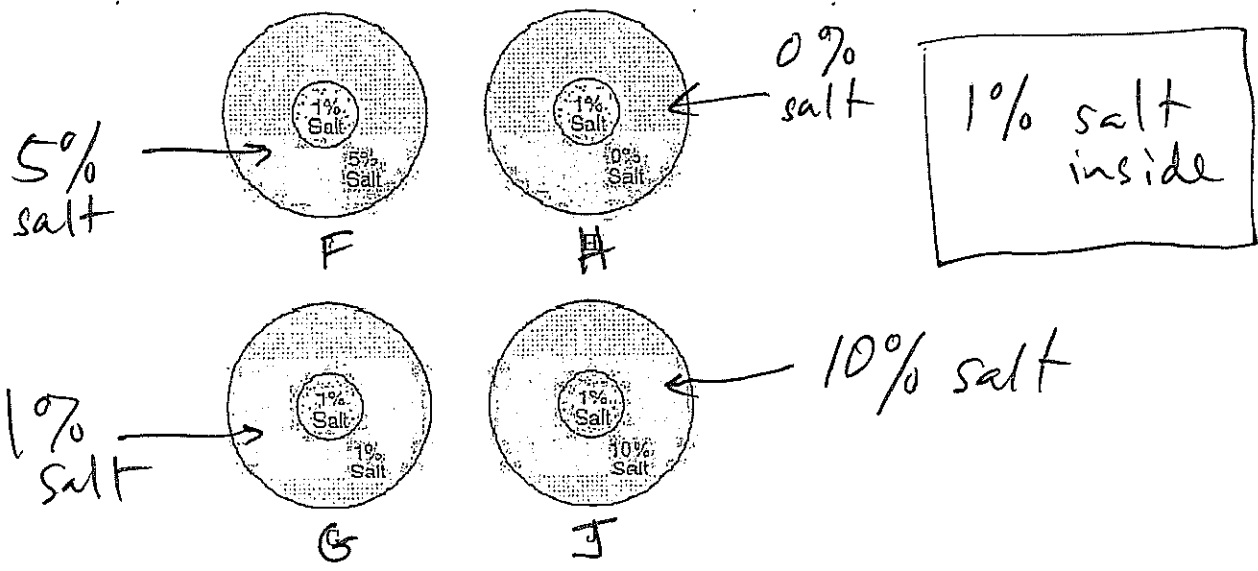
Cellular respiration takes place in which numbered organelle?

- a. 1
- b. 2
- c. 3
- d. 4

# HOMEOSTASIS

1. A student notices that the lettuce in a salad wilts soon after salt is added. Wilting most likely occurs because the lettuce cells
  - a. swell when exposed to salt
  - b. absorb the extra salt
  - c. release water in the presence of salt
  - d. lose oxygen when in contact with salt
  
2. The concentration of glucose must be maintained within a fairly narrow range in most vertebrates. This statement is an example of
  - a. Homeostasis
  - b. Excretion
  - c. Glycolysis
  - d. Fermentation
  
3. In active transport, carrier proteins
  - a. move substances across the cell membrane without the use of energy
  - b. move from low concentration to high concentration by diffusion
  - c. move small molecules through the cell membrane by osmosis
  - d. move substances from a low concentration to a high concentration through the use of energy

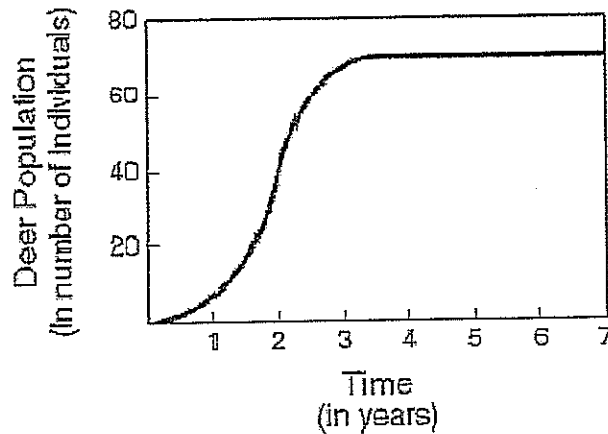
4. A student was studying the responses of cells to solutions of varying salt concentrations. Which solution below would cause no change in cell size?



- a. F
- b. H
- c. G
- d. J

## ECOLOGY

1. In the graph below, what is the population of deer at the carrying capacity of the environment?



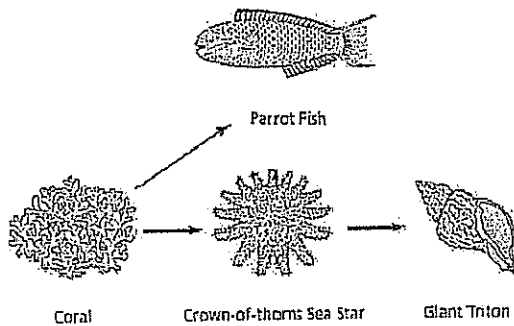
- a. 10
- b. 30
- c. 50
- d. 70

2. An aquatic food chain is shown below.

Algae → Zooplankton → Minnow → Perch → Hawk

- What would most likely result if a waterborne bacteria caused the death of most of the minnow population
- a. decrease in both algae and zooplankton population
  - b. increase in both zooplankton and perch population
  - c. increase in both perch and hawk population
  - d. decrease in both perch and hawk population

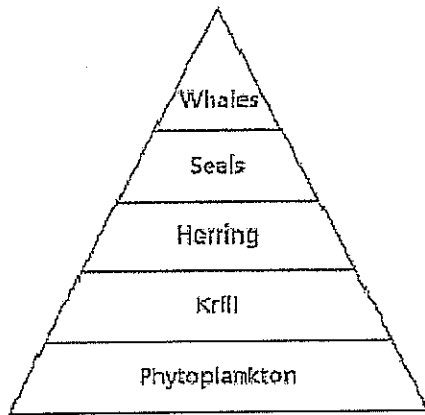
3. The diagram below shows the feeding relationships for four coral reef organisms.



Humans sometimes kill giant tritons in order to collect their attractive spiral shells. If humans kill most of the giant tritons in coral reef, the coral population will most likely

- a. decrease due to a decrease in the parrot fish population
- b. increase due to an increase in the parrot fish population
- c. increase due to a decrease in the crown-of-thorns sea star population
- d. decrease due to an increase in the crown-of-thorns sea star population

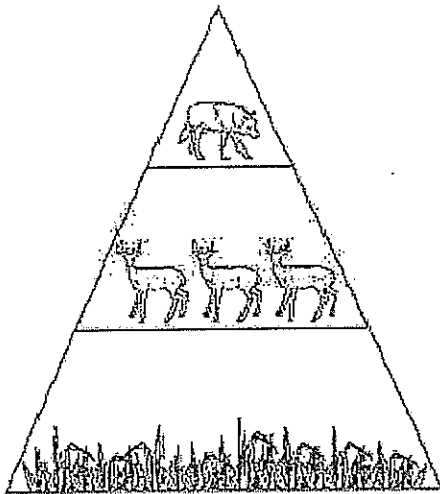
4. An energy pyramid is shown below.



Which organism receives the least amount of energy from the producer?

- a. Whales
- b. Seals
- c. Herring
- d. Krill

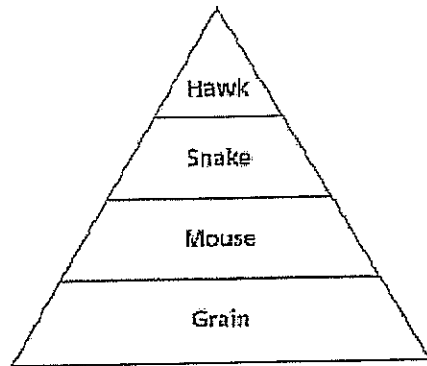
5. An energy pyramid is shown below.



Which best explains why a pyramid is used to represent energy flow within an ecosystem?

- a. Available energy increases when moving up an energy pyramid.
- b. Available energy decreases when moving up an energy pyramid.
- c. The size of the organisms decreases when moving up an energy pyramid.
- d. The population size of the organisms increases when moving up an energy pyramid.

6. The following diagram represents a food pyramid.



Which trophic level has the greatest total amount of energy to transfer to the next level?

- a. Grain
- b. Mouse
- c. Snake
- d. Hawk

7. An isolated population of termites lives in a forest surrounded by mountains. These termites feed on dead wood, grasses, and seeds. This food is broken down by a species of microorganism that lives inside the intestines of the termites. Without the microorganisms, these termites cannot obtain the nutrients they need to survive. One winter, a virus causes most of these organisms to die.

As a result of the microorganism's absence, these termites will most likely

- a. eat different food.
- b. experience a large decline in population.
- c. evolved immediately into a new species.
- d. develop a new species of microorganisms.

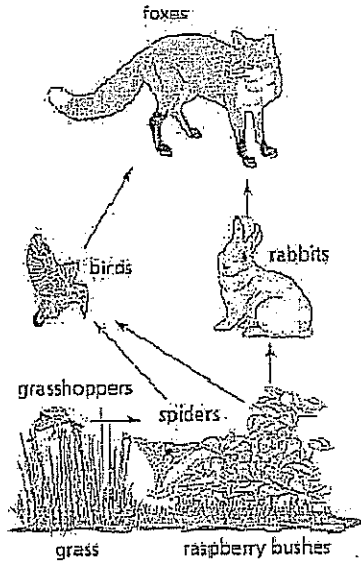
8. Zebra mussels were first discovered in the Great Lakes thirty years ago and have since spread to lakes throughout the region. Zebra mussels reproduce quickly and have few natural predators.

What will most likely happen to other native mussel species in the Great Lakes region?

- a. Native species will begin to interbreed with zebra mussels.
- b. Native species populations will decrease in areas with large zebra mussel populations.
- c. Individuals of the native species will mutate to become more similar to zebra mussels.
- d. Individuals of the native species will mutate to become less similar to zebra mussels.



9. A food web is diagrammed below.



What would most likely happen if the rabbit population decreased as a result of another predator being introduced in the food web?

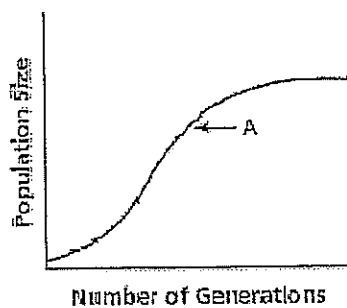
- a. The fox population would decrease.
- b. The food web would not be affected.
- c. The bird population would increase.
- d. The spider population would decrease.

10. An ecosystem has a stable population of white-tailed deer. What is the most likely outcome if a new species of deer that competed for the same resources were introduced?

- a. The white-tailed deer population would increase.
- b. The producer population would decrease.
- c. The white-tailed deer population would not be affected.
- d. The predator population would decrease.

11. A growth curve for a population of crabs on a coral reef is shown below.

Crab Growth on a Coral Reef



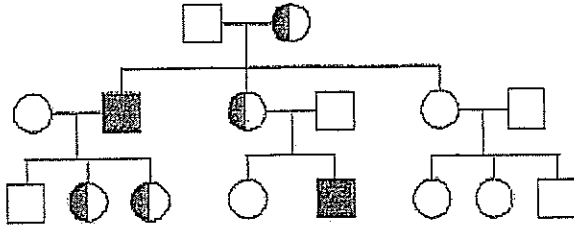
Which statement best explains what is happening at Point A?

- a. Population growth decreases as individual crabs get older.
- b. The population is stabilizing as it approaches carrying capacity.
- c. Destruction of habitat is causing a decline in the population of the crabs.
- d. The introduction of a new predator is causing a decline in population growth of the crabs.

## DNA/GENETICS

- \_\_\_ 1. Which best describe the role of enzymes in a chemical reaction?
- absorb excess energy
  - release unused energy
  - increase the rate of reaction
  - regulate product reactivity
- \_\_\_ 2. Which best describes how enzymes function in the body?
- Enzymes are converted into products by the reactions they catalyze.
  - Enzymes lower the activation energy of reactions.
  - One enzyme can catalyze many different reactions.
  - An enzyme is used once and then destroyed by the cell.
- \_\_\_ 3. Which molecules store and transmit genetic information?
- Lipids
  - Proteins
  - nucleic acids
  - Carbohydrates
- \_\_\_ 4. Antibodies are composed primarily of amino acids. In which class of biomolecules would antibodies belong?
- nucleic acids
  - Carbohydrates
  - Proteins
  - Lipids
- \_\_\_ 5. The enzyme catalase is involved in the breakdown of hydrogen peroxide into water and oxygen. During this reaction, catalase
- is unchanged.
  - is used up.
  - is changed into a product.
  - is formed into a new enzyme.
- \_\_\_ 20. What is the primary function of DNA in organisms?
- binds to specific active sites
  - stores genetic information
  - transports amino acids to the ribosomes
  - produces chromosomes for sexual reproduction
- \_\_\_ 6. In certain species of roses, white roses and red roses are incompletely dominant to each other. When a red rose and a white rose are crossed, a pink rose is produced. What is the probability of producing a white rose when a red rose is crossed with a pink rose?
- 100%
  - 75%
  - 50%
  - 0%

7. The pedigree chart below shows the transmission of genetic traits over several generations.



Key	
Female	Male
Unaffected	Unaffected
Carrier	Affected
Affected	

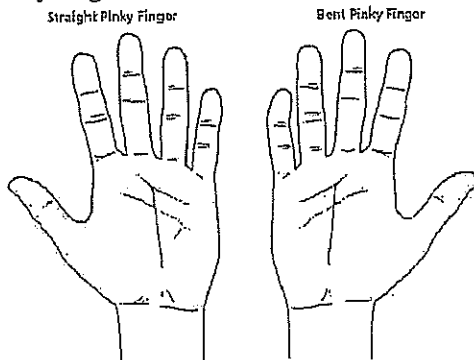
How is this trait inherited?

- autosomal recessive
- autosomal dominant
- sex-linked recessive
- sex-linked dominant

8. In certain species of guinea pigs, black fur is dominant to white fur. If a white male guinea pig is crossed with a black homozygous dominant female, what is the percent probability of having offspring with black fur?

- 100%
- 75%
- 50%
- 25%

9. Diagrams of a bent pinky finger and a straight pinky finger are shown below. The allele for having a bent pinky finger is dominant to the allele for having a straight pinky finger.



If two people who are both heterozygous for the trait of a bent pinky finger have a child, what is the percent probability that the child will have straight pinky fingers?

- 100%
- 75%
- 25%
- 0%

10. In rabbits, short fur (F) is dominant to long fur (f). According to the Punnett square, what is the chance of two heterozygous short-haired rabbits having offspring with short fur?

	F	f
F	FF	Ff
f	Ff	ff

- one in four
- two in four
- three in four
- four in four

11. Which molecule is paired with its correct role in protein synthesis?

- nucleus - forms peptide bonds
- ribosome - carries DNA instructions
- mRNA - joins amino acids
- tRNA - transfers amino acids

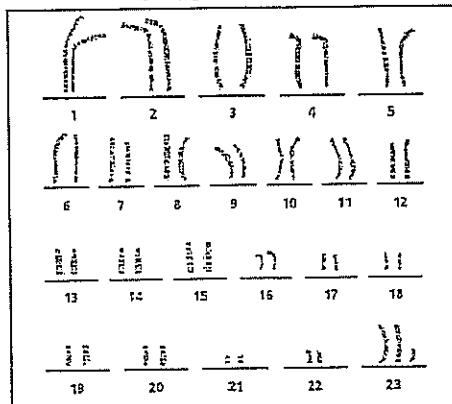
12. During the process of protein synthesis, a section of the DNA molecule is copied into which other molecule?

- nucleic DNA
- cytoplasmic DNA
- messenger RNA
- transfer RNA

13. Which best describes the interaction between DNA and RNA during protein synthesis?

- RNA carries the code to the nucleus where DNA translates the code into a protein
- DNA travels to the ribosome where RNA translates the code into a protein
- RNA carries the code from DNA in the nucleus to the ribosome for protein synthesis
- DNA travels to the cytoplasm while RNA remains in the nucleus

14. A human karyotype is shown in the diagram below.



Which set of chromosomes represents a mutation?

- 2
- 11
- 16
- 23

**Bikini Bottom Genetics 2**

Name \_\_\_\_\_

Use your knowledge of genetics to complete this worksheet.

1. Use the information for SpongeBob's traits to write the phenotype (physical appearance) for each item.

Characteristic	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)
Nose Style	Long (L)	Stubby (l)

- (a) LL- \_\_\_\_\_ (e) Rr- \_\_\_\_\_
- (b) yy- \_\_\_\_\_ (f) ll- \_\_\_\_\_
- (c) Ss- \_\_\_\_\_ (g) ss- \_\_\_\_\_
- (d) RR - \_\_\_\_\_ (h) Yy - \_\_\_\_\_

2. Use the information in the chart in #1 to write the genotype (or genotypes) for each trait below.

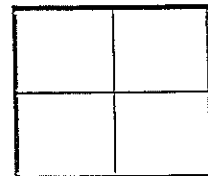
- (a) Yellow body - \_\_\_\_\_ (e) Stubby nose - \_\_\_\_\_
- (b) Roundpants - \_\_\_\_\_ (f) Round eyes - \_\_\_\_\_
- (c) Oval eyes - \_\_\_\_\_ (g) Squarepants - \_\_\_\_\_
- (d) Long nose - \_\_\_\_\_ (h) Blue body - \_\_\_\_\_

3. Determine the genotypes for each using the information in the chart in #1.

- (a) Heterozygous round eyes - \_\_\_\_\_ (c) Homozygous long nose - \_\_\_\_\_
- (b) Purebred squarepants - \_\_\_\_\_ (d) Hybrid yellow body - \_\_\_\_\_

4. One of SpongeBob's cousins, SpongeBillyBob, recently met a cute squarepants gal, SpongeGerdy, at a local dance and fell in love. Use your knowledge of genetics to answer the questions below.

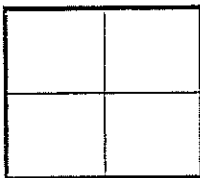
(a) If SpongeGerdy's father is a heterozygous squarepants and her mother is a roundpants, what is her genotype? Complete the Punnett square to show the possible genotypes that would result to help you determine Gerdy's genotype.



What is Gerdy's genotype? \_\_\_\_\_

(b) SpongeBillyBob is heterozygous for his squarepants shape. What is his genotype? \_\_\_\_\_

(c) Complete the Punnett square to show the possibilities that would result if Billy Bob & Gerdy had children.



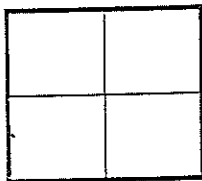
(d) List the possible genotypes and phenotypes for the kids.

(e) What is the probability of kids with squarepants? \_\_\_\_\_ %

(f) What is the probability of kids with roundpants? \_\_\_\_\_ %

5. SpongeBob's aunt and uncle, SpongeWilma and SpongeWilbur, have the biggest round eyes in the family. Wilma is believed to be heterozygous for her round eye shape, while Wilbur's family brags that they are a pure line. Complete the Punnett square to show the possibilities that would result if SpongeWilma and SpongeWilbur had children.

- (a) Give the genotype for each person. Wilma - \_\_\_\_\_ Wilbur - \_\_\_\_\_
- (b) Complete the Punnett square to show the possibilities that would result if they had children.



(c) List the possible genotypes and phenotypes for the kids.

(d) What is the probability that the kids would have round eyes? \_\_\_\_\_ %

(e) What is the probability that the kids would be oval eyes? \_\_\_\_\_ %

6. SpongeBob's mother is so proud of her son and his new wife, SpongeSusie, as they are expecting a little sponge. She knows that they have a 50% chance of having a little roundpants, but is also hoping the new arrival will be blue (a recessive trait) like SpongeSusie and many members of her family. If SpongeBob is heterozygous for his yellow body color, what are the chances that the baby sponge will be blue? Create a Punnett square to help you answer this question.

7. SpongeBob's aunt is famous around town for her itty, bitty stubby nose! She recently met a cute squarepants fellow who also has a stubby nose, which is a recessive trait. Would it be possible for them to have a child with a regular long nose? Why or why not? Create a Punnett square to help you answer this question.

8. If SpongeBob's aunt described in #7 wanted children with long noses, what type of fellow would she need to marry in order to give her the best chances? Create a Punnett square to help you answer this question.

## MITOSIS & MEIOSIS & EVOLUTION

1. Which best describes how meiosis contributes to genetic variation?

- a. increases the rate of reproduction with each generation
- b. produces a new individual different from either parent
- c. decreases the risk of lethal mutations being transmitted
- d. forms new DNA that can resist environmental change

2. Which statement best describes the primary function of DNA replication?

- a. to ensure daughter cells have a complete copy of the DNA
- b. to prevent mutations from occurring in cells
- c. to provide genetic variation within specific organisms
- d. to allow prokaryotic cells to undergo meiosis

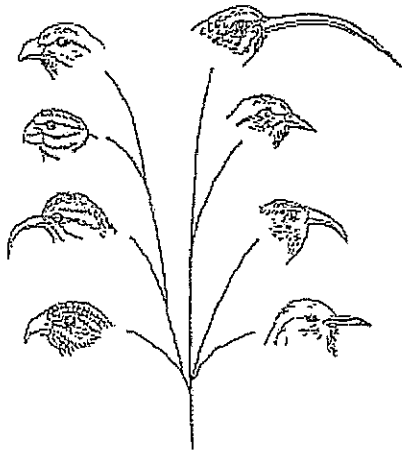
3. Meiotic cell division results in gametes that produce sperm and egg cells by

- a. reducing the daughter chromosome number by 75%
- b. reducing the daughter chromosome number by 50%
- c. increasing the daughter chromosome number by 50%
- d. increasing the daughter chromosome number by 75%

4. Which process most contributes to genetic variation in a population?

- a. crossing over during meiosis
- b. chromosome replication during mitosis
- c. cytokinesis during cellular division
- d. duplication of chromosomes in asexual reproduction

5. A diagram showing the evolution of eight bird species is shown below.








Founder Species

The differences in the species are most likely a result of

- a. length of mating season
- b. population size
- c. color of feathers
- d. available food sources

\_\_\_\_\_ 6. A pictorial chart of five cichlid species of fish is shown below.

Cichlid Fish Species

	<i>Cheilochromis euchilus</i>
	<i>Champsochromis caeruleus</i>
	<i>Alistochromis christyi</i>
	<i>Diplataxodon greenwoodi</i>
	<i>Lichnochromis acuticeps</i>

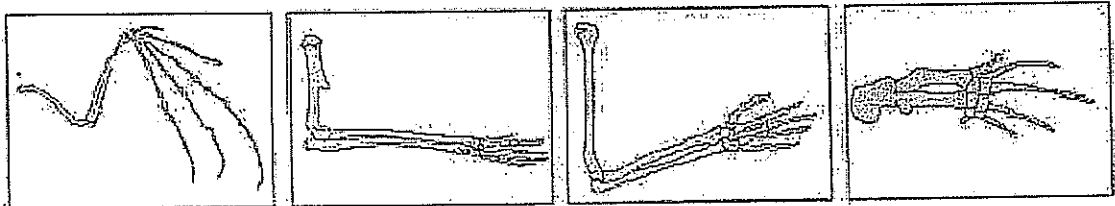
The physical differences among the fish are most likely

- a feeding adaptation due to competition for food
- a swimming adaptation due to water temperature
- an osmotic adaptation due to salinity levels
- a respiration adaptation due to different oxygen levels

\_\_\_\_\_ 7. Which of the following statements describes the process of natural selection?

- Farmers select animals with desirable traits for breeding.
- Populations sharing the same gene pool interbreed and create new species.
- Individuals survive that have inherited traits adapted to their environment.
- New species are formed via genetic engineering.

\_\_\_\_\_ 8. The pictures below show the limbs of four different species.



The four species illustrated most likely have similar limb structures because they all

- share a common ancestor.
- use their limbs for the same functions.
- occupy the same level in a food pyramid.
- adapted to the same environmental conditions.



# PHOTOSYNTHESIS & CELLULAR RESPIRATION

## Effects of Ultraviolet Light on Wheat Crop Production

Experimental Plot (4m X 15m)	Wavelength (nm)	Wave Intensity (Joules/m <sup>2</sup> )	Crop Yield (g/m <sup>2</sup> )
A	357.5	0	110
B	357.6	8	110
C	357.6	20	90
D	357.6	25	20

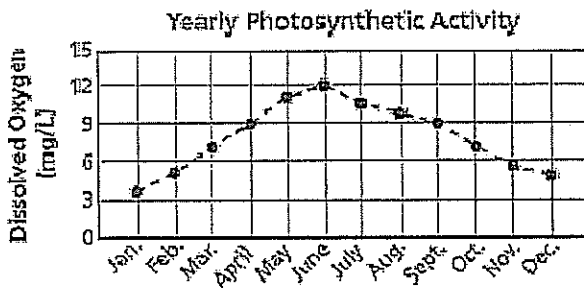
\_\_\_\_\_ 1. Which of these statements is best supported by the data?

- a. Wheat plants exposed to high-intensity ultraviolet light produce fewer seeds.
- b. Chloroplasts of wheat are able to filter out low-intensity ultraviolet light.
- c. High-intensity ultraviolet light may be used to control weed growth.
- d. No exposure to ultraviolet light increases pollination in wheat plants.

\_\_\_\_\_ 2. Which cellular process converts solar energy into chemical energy?

- a. cellular respiration
- b. transpiration
- c. photosynthesis
- d. chemosynthesis

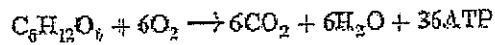
\_\_\_\_\_ 3. An ecologist performed a study to determine how the rate of photosynthetic activity in a lake changed from month to month. The results of the study are shown in the graph below.



Which conclusion is best supported by the evidence?

- a. Photosynthetic organisms were dormant during the months of April through August.
- b. The rate of photosynthesis increased from June through December.
- c. The rate of photosynthesis was greatest during the months of May through July.
- d. Photosynthetic organisms experienced die-off during the months of January through June.

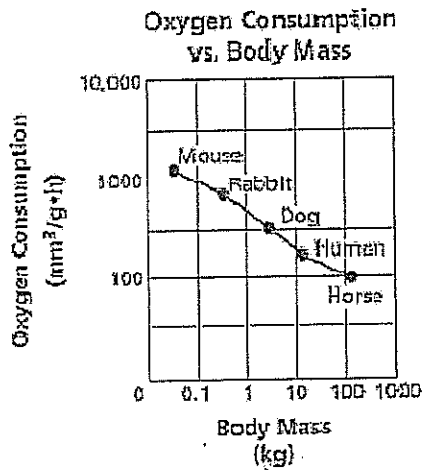
4. The chemical equation below shows the reaction of glucose and oxygen.



Which process does this equation represent?

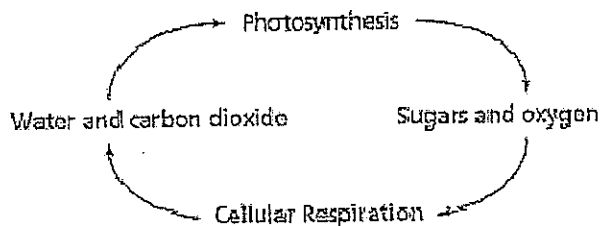
- photosynthesis
- aerobic respiration
- anaerobic respiration
- nitrogen fixation

5. The graph represents the relationship between an organisms' oxygen consumption and body mass.



Which statement is supported by the information shown in the graph?

- The oxygen consumption of an organism is one-half its body mass.
  - The oxygen consumption of an organism is not related to its body mass.
  - As the body mass of an organism increases, oxygen consumption per gram decreases.
  - As the body mass of an organism decreases, oxygen consumption per gram decreases.
6. The diagram shows a relationship between photosynthesis and cellular respiration.



Which statement best describes the interdependence of photosynthesis and cellular respiration?

- The products of photosynthesis are carbon dioxide and water to be used in cellular respiration.
- The reactants of photosynthesis are the products of cellular respiration.
- The reactants of photosynthesis are sugar and oxygen to be used in cellular respiration.
- The products of photosynthesis are the same as the products of cellular respiration.

## INQUIRY

**Directions:** Use the following information to answer the next 3 questions.

Joy and Brian wondered if body temperature affects the rate at which DNA is copied and synthesized during DNA replication. They did the following investigation.

**Question:** What is the effect of body temperature on the rate at which DNA is copied during DNA replication?

**Hypothesis:** The higher the body temperature, the greater the rate of DNA synthesis because the enzyme that copies DNA works best at higher body temperatures.

**Materials:** thermometer, protein assay (measures amount of DNA polymerase that is actively making DNA in the cell), 3 mice with the same mass, identical mouse chambers, chamber heaters, chamber thermostats

**Procedure:**

1. Put 3 mice into identical living chambers and label one chamber "cold", one "normal", and one "hot".
2. Make sure each living chamber receives the same amount of food, water, and light. and water. Keep the chambers at a constant pressure.
3. Adjust the temperatures in each living chamber to represent cold, normal, and hot environmental conditions. Set the chamber labeled "cold" at 65°F. Set the chamber labeled "normal" at 75°F. Set the chamber labeled "hot" at 85°F.
4. Calculate and record the number of active DNA polymerase enzymes as Day 1.
5. Run the experiment for 14 days.
6. Repeat steps 4 and 5 for Day 7 and Day 14.

**Data:**

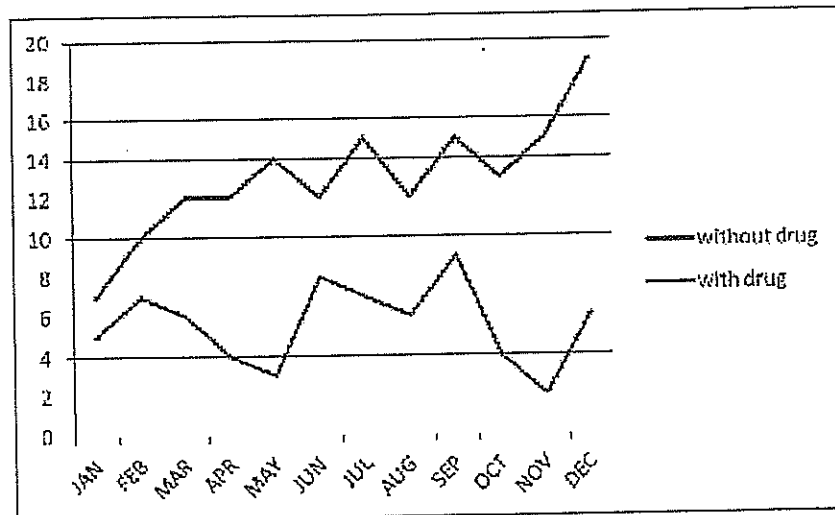
**Body Temperature vs. Number of Active DNA Polymerase Enzymes**

Body Temperature (°F)	Number of Active DNA Polymerase Enzymes		
	Day 1	Day 7	Day 14
65° (Cold Chamber)	234	252	211
75° (Normal Chamber)	272	254	283
85° (Hot Chamber)	344	356	364

1. Which two variables were controlled variables in this investigation?
  - a. Type of living chamber and amount of light
  - b. Amount of food and temperature
  - c. Growth of mice and amount of water
  - d. Type of living chamber and number of active DNA polymerases
2. Which variable was the manipulated variable in this investigation?
  - a. Amount of water in living chamber
  - b. Size of mice after 14 days
  - c. Total days mice were in living chambers
  - d. Temperature of living chambers
3. Which variable was the responding (dependent) variable in this investigation?
  - a. Number of active DNA polymerase enzymes
  - b. Size of mice after 14 days
  - c. Number of days mice were in living chambers
  - d. Temperature of living chamber

Directions: Use the following information to answer the next 2 questions.

Research has shown that a drug can speed up the rate of protein synthesis by increasing the number of mRNA molecules in the cell. A researcher measured the rate of protein synthesis in 10 subjects over the course of one year. A graph of the data is shown below.



4. What extra information could be included to draw better conclusions from this data?
  - a. The age of the researcher
  - b. The number of subjects
  - c. How often the subjects were measured
  - d. The units of the y-axis (vertical axis)
5. What could the researcher have done to improve this experiment?
  - a. Increase the number of subjects
  - b. Increase the dosage of the drug
  - c. Include a second drug
  - d. Shorten the experiment to less than one year