BIOLOGY AHA SGO POST-TEST REVIEW

BSCS Biology Textbook Chapters = 1, 2, 3, 4, 5, 6, 8

Nature of Science

A. Terms:

1. **Observation:** What is seen or measured.
2. **Inference:** A conclusion based on observation or evidence.
3. **Hypothesis:** An untested prediction. A good hypothesis states both cause and effect ("If-then" statement).
4. **Theory:** A broad explanation of natural events that is supported by strong evidence.

B. **Graphing**

C. **Controlled Experiment:** Compares the results of an experiment between two (or more)
groups.

1. **Experimental group:** Group being tested or receiving treatment. (ex: new drug)
2. **Control group:** "Normal" group. Should be identical to experimental group in every way except one: it does not receive the treatment (i.e.: no drug, or given the original drug or a placebo).
3. **Placebo:** A sugar pill or other "fake" treatment give to the control group so subjects do not know which group they are in.
4. **Independent Variable:** Variable that is being tested; the variable the experimenter is manipulating (ex: new drug). In a graph the independent variable is always plotted on the X-axis.
5. **Dependent Variable**: Variable that is measured at the end of an experiment; the results (ex: does patient get better?) The dependent variable is always plotted on the Y-axis.)
6. **Control Variable:** Variable that stays the same or constant throughout the experiment (the same in both the experimental and control group).

D. **Characteristics of a good experiment.**

1. Can be repeated by anyone and get the same results.
2. Have large sample size/many test subjects.
3. Are performed for longer periods of time.
4. Test only one variable.

5. Are peer reviewed – examined by several scientists to determine its accuracy.
6. Does not have to agree with the hypothesis. A scientist's guess is allowed to be incorrect – and usually is.
7. Is objective – the experiment and conclusion are fair and unbiased. Fact and opinion are not mixed.

EXAMPLE OF EXPERIMENT

A scientist is testing the effect of temperature on the growth of a common houseplant. The scientist believes that higher temperatures will result in an increase in growth of the plant.

Hypothesis: If the temperature is increased, the growth of the houseplant will increase because higher temperatures are required for the plant enzymes to function correctly.

Independent Variable: The temperature the houseplant is placed in (Scientist is manipulating the temperature of the room the plant is in.)

Dependent Variable: The growth of the houseplant as **measured** by its height (Scientist is measuring the height of the plant.)

Control Variables: Type of plant, amount of water plant receives, amount of sunlight plant receives, location of plant, and amount of nutrients (Scientist is keeping all these factors the same in all groups of plants.)

Control Group	***Experimental Group(s)***
House plants found at normal temperature (room temperature)	Group 1: Plants found at 20 deg. C Group 2: Plants found at 30 deg. C Group 3: Plants found at 40 deg. C Group 4 Plants found at 50 deg. C

Whenever you are designing an experiment, make sure to have all of the components above!

EVOLUTION

A. Basically states that modern species evolved from earlier, different species and share a common ancestor.

Main Mechanisms of Biological Evolution

1. Mutations	• **Mutations** *are changes in DNA* • Gives rise to variation among individuals • May be passed onto the next generation of offspring if mutation occurs in egg cell or sperm cell
2. Migration	• Immigration or emigration can cause a change in a population's gene pool. This process is called **gene flow.**
3. Genetic Drift	• Caused by an unusual event that Happens by chance • ***Kills* or *somehow separates*** all **except** a few individuals in a population
4. Natural Selection**	• *Process by which traits that improve an organism's chances for survival and reproduction are passed on more frequently to future generations than those that do not.*

B.** Charles Darwin proposed that **natural selection** is the mechanism that causes species to change. The requirements in natural selection are:

1. Overproduction of offspring.
2. Competition for limited resources.
3. Survival and reproduction OR death.
4. Individuals vary in characteristics, some of which are heritable.
5. Individuals vary in fitness, or reproductive success.

C. Organisms that are better adapted to their environment and able to reproduce
successfully are considered "fit". Unfit organisms die, and their traits are eventually removed from the gene pool.

NOTE: Evolutionary fitness has nothing to do with physical fitness. Stronger is not always better.

D. Evolution is usually driven by a change in the environment.

E. To evolve, variations must exist in a species BEFORE the environment changes. **They do not get a trait just because it is needed.**

F. **Variations** exist primarily as the result of **sexual reproduction and mutation.**

G**. Species with more variation** are better able to survive environmental changes. **Adaptations** are heritable traits (can be passed onto offspring) that increases an individual organism's fitness.

H. **Gradualism** *is a theory that says change occurs slowly*. **Punctuated equilibrium** *is a theory that says evolution happens in quick spurts.*

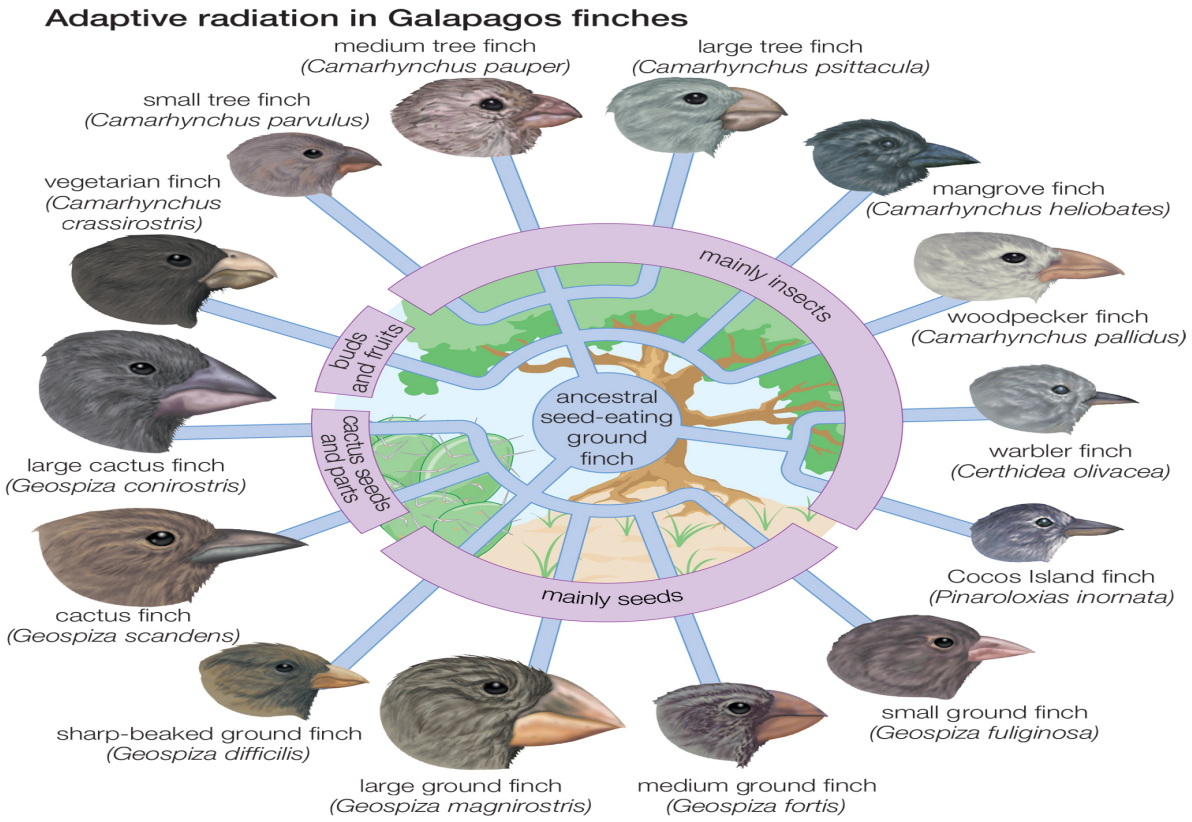
I. Creation of new species usually requires geographic isolation, which eventually results in reproductive isolation.

J. **Evidence in support of evolution** comes from the fields of geology (fossil record and radioactive dating), genetics, biochemistry, anatomy and embryology (among others).

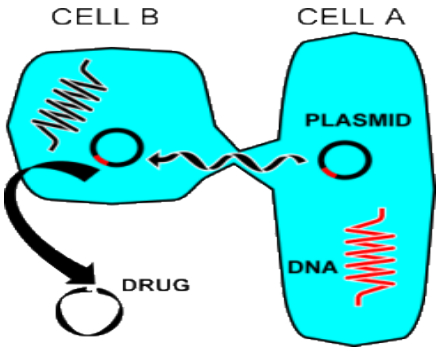
- ***Fossil Evidence*** shows structures of older organisms. They show the history of life on earth and how different groups of organisms have changed over time.
- ***Similarity in DNA*** shows the relationship between species (most convincing piece of evidence)
- ***Embryological Development***: In their early stages of development, chickens, turtles and rats look similar, providing evidence that they shared a common ancestry.
- ***Anatomical Evidence:***
  1. **Homologous structures** in different organisms are inherited from a ***common ancestor***.
  2. **Analogous structures** are inherited from unique ancestors and have come to resemble each other because they ***serve a similar function***.
  3. **Vestigial structures** are remains of a structure that was functional in some ancestors but **is no longer functiona**l in the organism in question.
     --- Most birds have well-developed wings; some bird

species have reduced wings and do not fly.
--- Humans have a tailbone but no tail.

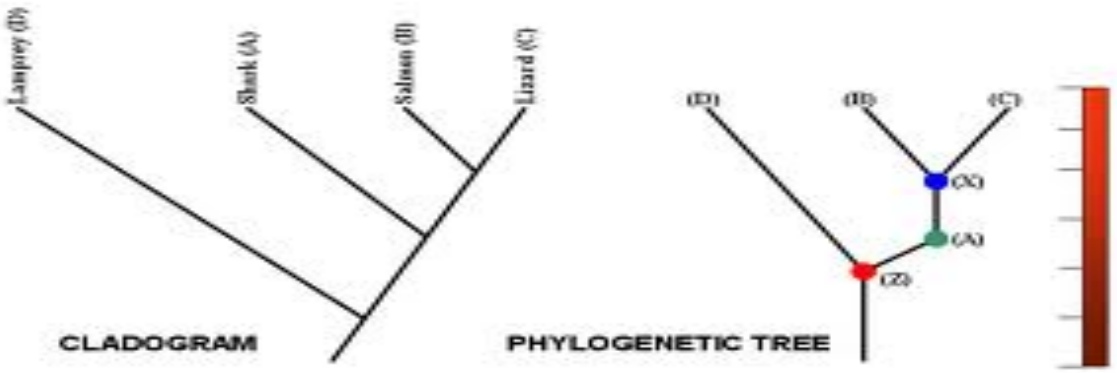
- ***Geographic Distribution of Related Organisms***: Organisms in different areas of the world look similar when found in similar environments.



Galapagos Finches eventually developed different sized and shaped beaks depending on the food commonly found in the island they lived on.



To the left are two bacteria cells. The plasmid (circular DNA) contains genes that code for antibiotic resistance. Bacteria cells with this antibiotic resistance gene will not be killed by antibiotics. They can pass this on to other bacteria cells through conjugation (bacteria sex). Antibiotic resistance is a form of natural selection.



Cladograms and phylogenetic trees show evolutionary relationships. The points where lines intersect indicate a *common ancestor*. When species share a common ancestor, it means that they are closely related. You can expect their DNA sequences to have many similarities.

Homeostasis (Equilibrium)

Homeostasis *is the ability of an organism to maintain internal balance*.

All living things must maintain homeostasis.

1. To maintain homeostasis, organisms carry out the same basic life functions: nutrition, excretion, transport, respiration, growth, synthesis, regulation and synthesis. (Be familiar with these terms!)
2. All life processes make up an organism's metabolism.
3. Failure to maintain homeostasis causes disease and death.

RESPIRATION: Organisms get energy by breaking the bonds of sugar molecules. The released energy is used to make a molecule of ATP, which gives all organisms their energy. Oxygen is required. Carbon dioxide is a waste product.

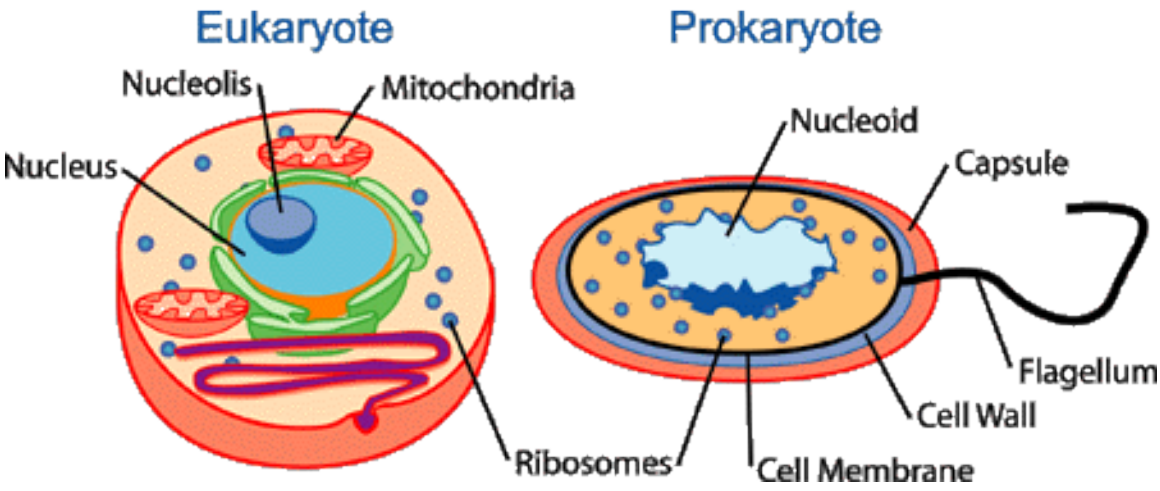
1. **Aerobic respiration requires oxygen**, and yields more ATP (energy) for a molecule of sugar than **anaerobic (no oxygen) respiration**.
2. When humans are forced to get energy from anaerobic respiration, we produce lactic acid that damages muscles ("the burn" you feel during exercise).

Chemistry of Life

1. The most **common elements** in living things are (in order) Carbon, Hydrogen, Oxygen and Nitrogen (CHON).
2. **Organic Compounds** have Carbon AND Hydrogen (ex: $C_6H_{12}O_6$ is organic, H_2O, CO_2, and NO_3 are not). Organic molecules are also larger than inorganic molecules.

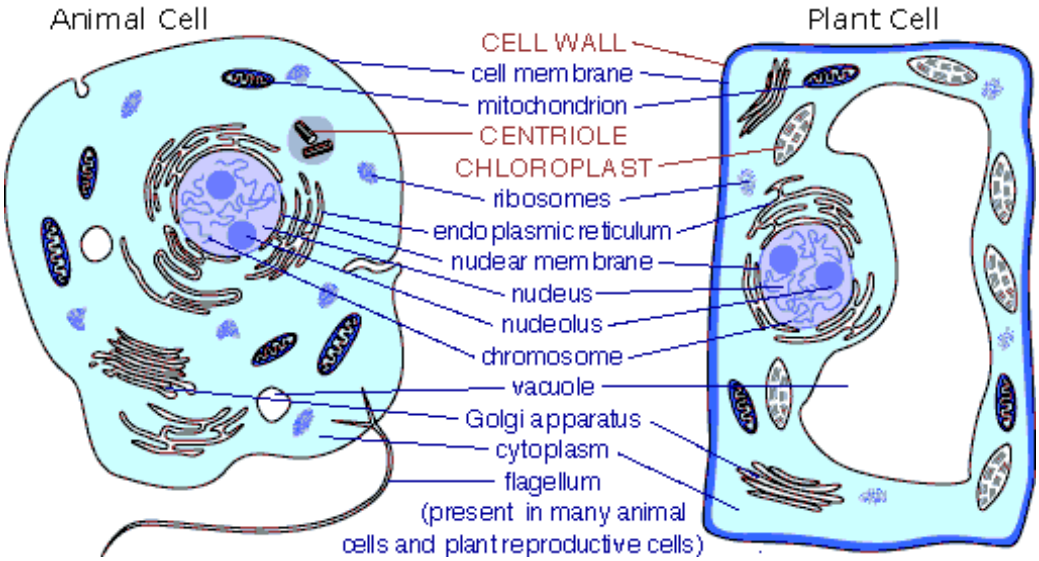
CELLS

Cells *are the basic unit of life*. All living things are made of cells.



PROKARYOTE VS EUKAROYTE

- ***Prokaryotes do not have a nucleus or membranous structures inside*** (DNA flows in the cytoplasm)
- ***Eukaryotes have a nucleus***



STRUCTURES FOUND IN **PLANTS ONLY**: Chloroplast, cell wall
STRUCTURES FOUND IN **ANIMALS ONLY**: Centrioles

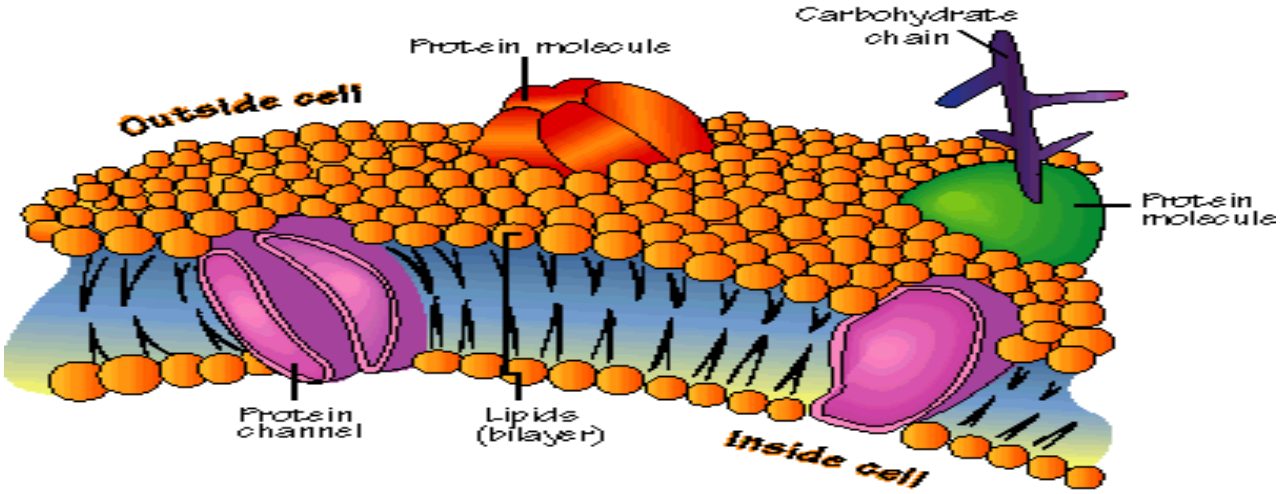
MAIN ORGANELLES INSIDE THE CELL

Cell Structure (Organelle)	***Function***
Cell membrane**	SEPARATES INSIDE AND OUTSIDE OF CELL. The membrane enclosing a cell is made up of two lipid layers called a "bilipid" membrane. The lipids that are present in the plasma membrane are called "phospholipids." These lipid layers are made up of a number of fatty acid building blocks. The fatty acid that makes up this membrane has two different parts to it- a small water loving head- hydrophilic head.
Cell wall (plants only)	PROTECTION and SUPPORT. Plasmodesmata are openings found in the cell wall used to communicate and transport materials between plant cells because the cell membranes are able touch and therefore exchange needed materials.
Nucleus	HOLDS DNA. The nucleus is the control center of the cell. It is the largest organelle in the cell and it contains the DNA of the cell.
Ribosome	PROTEIN SYNTHESIS. Organelles that help in the synthesis of proteins. Some ribosomes are found in the cytoplasm, but most are attached to the endoplasmic reticulum. While attached to the ER, ribosomes make proteins that the cell needs and also ones to be exported from the cell for work elsewhere in the body
Cytoplasm	SPACE-FILLER. All the contents not in the nucleus. "Free space" filled with mostly water.
Vacuole	STORAGE. Contains large amounts of water and stores other important materials such as sugars, ions and pigments.
Mitochondria	PROVIDES ENERGY. Packages the energy of the food into ATP molecules
Chloroplast *(plant only)*	PHOTOSYNTHESIS. The cell organelle in which photosynthesis takes place. In this organelle the light energy of the sun is converted into chemical energy. Contains chlorophyll (pigment that makes plants green.)

The Cell Membrane**

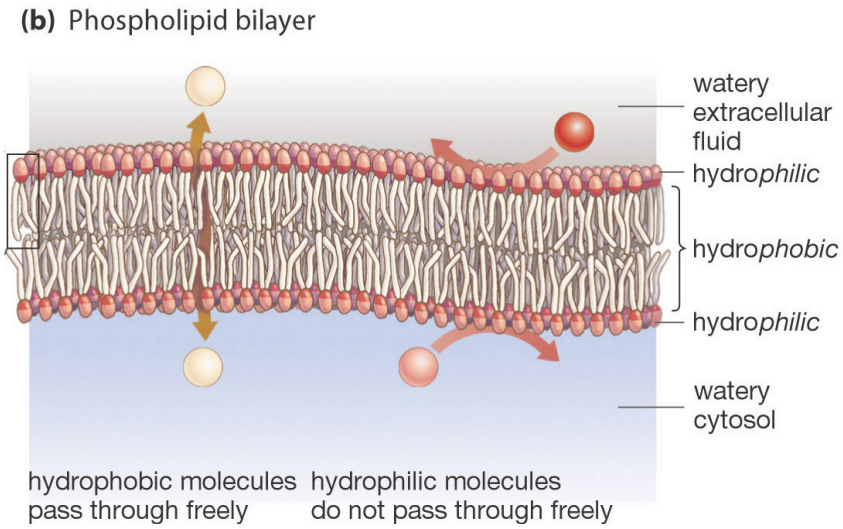
4. **The cell membrane** is made of lipids and proteins. It shows ***selective permeability*** – that is only some molecules can pass through it (typically small molecules like water and oxygen). Large molecules (like starch or protein) need to be moved by active transport.

a. NOTE: Students often assume cells have a cell wall OR a cell membrane. ALL cells have a cell membrane, including those with cell walls (plants, fungi, some bacteria and protists). The cell wall is mostly for protection; the cell membrane is needed to control movement into and out of the cell. The animal kingdom is the only kingdom that completely lacks cell walls.



Functions of the Cell Membrane

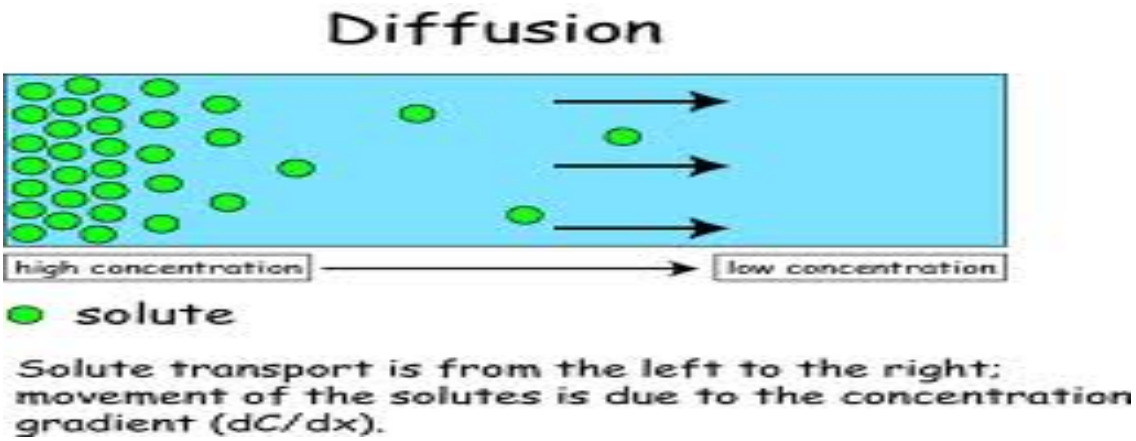
- ✓ **Protective barrier**
- ✓ **Regulate transport in & out of cell (selectively permeable)**
- ✓ **Allow cell recognition**
- ✓ **Provide anchoring sites for filaments of cytoskeleton**



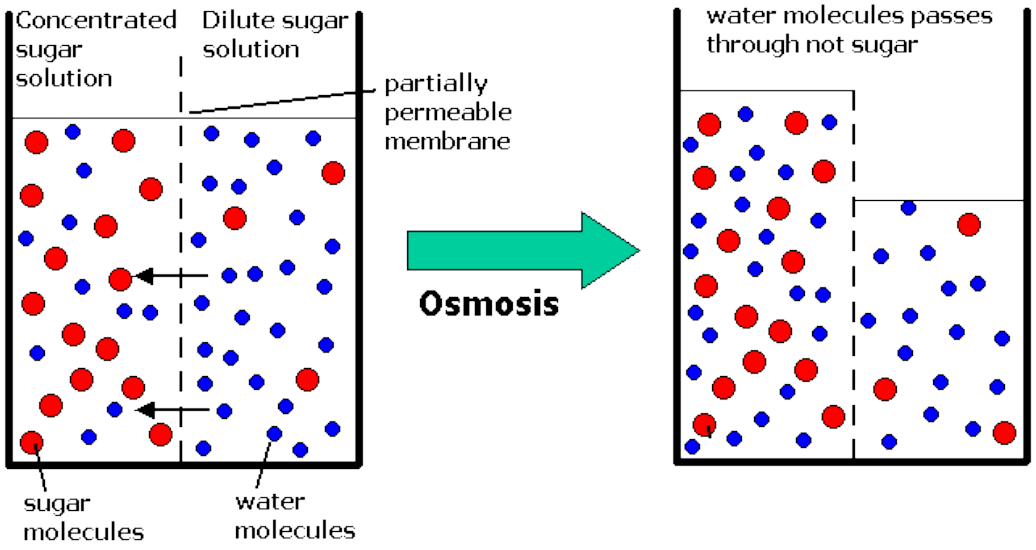
- **Polar heads are hydrophilic "water loving"**
  - **Hydrophilic DO NOT pass through easily**
  - **Ions or anything charged molecules cannot pass through easily**
- **Nonpolar tails are hydrophobic "water fearing"**
  - **Hydrophobic molecules DO pass easily**
  - **Hormones, steroids, and uncharged molecules pass through easily (carbon dioxide and oxygen are nonpolar)**

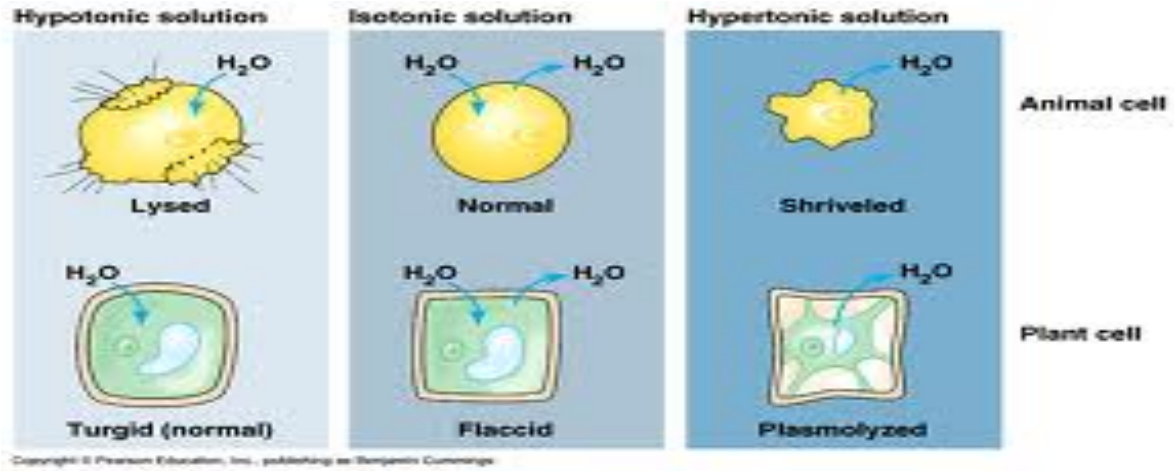
MOVEMENT OF MATERIALS IN AND OUT OF THE CELL

1. **PASSIVE TRANSPORT =** *movement of materials WITH the concentration gradient. NO ENERGY REQUIRED.*
   - **Diffusion:** *The passive movement of material from an area of HIGH concentration to an area of LOW concentration*



- **Osmosis:** *The diffusion of water through a selectively permeable membrane*

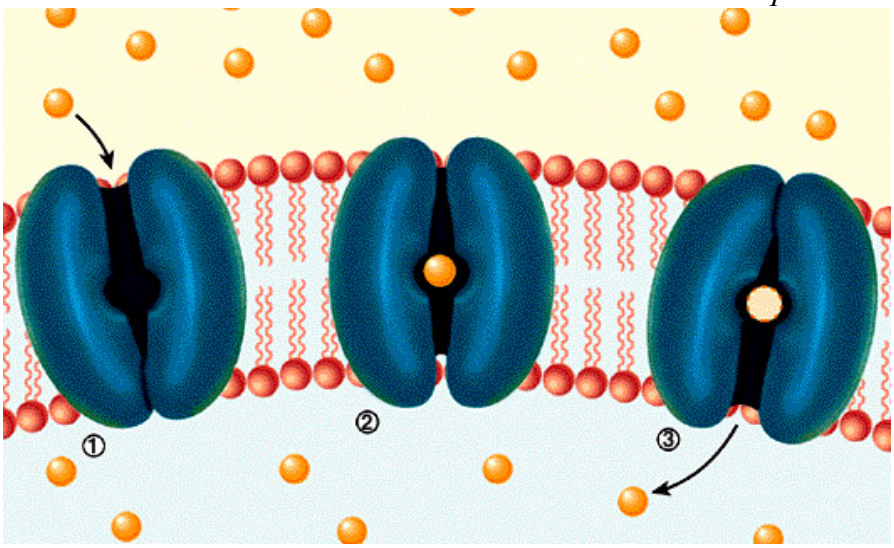




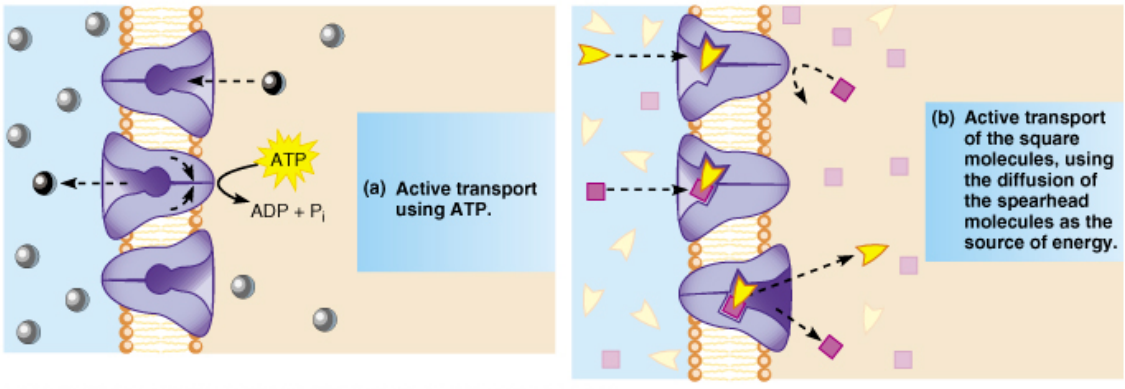
Hypotonic	**Isotonic**	**Hypertonic**
INSIDE: higher concentration of solute OUTSIDE: lower concentration of solute NET FLOW OF WATER: Water flows from the outside the inside of the cell.	INSIDE: equal concentration of solute OUTSIDE: equal concentration of solute NET FLOW OF WATER: Water moves in and out of the cell, but has NO NET MOVEMENT.	INSIDE: lower concentration of solute OUTSIDE: higher concentration of solute NET FLOW OF WATER: Water flows from the inside to the outside of the cell.

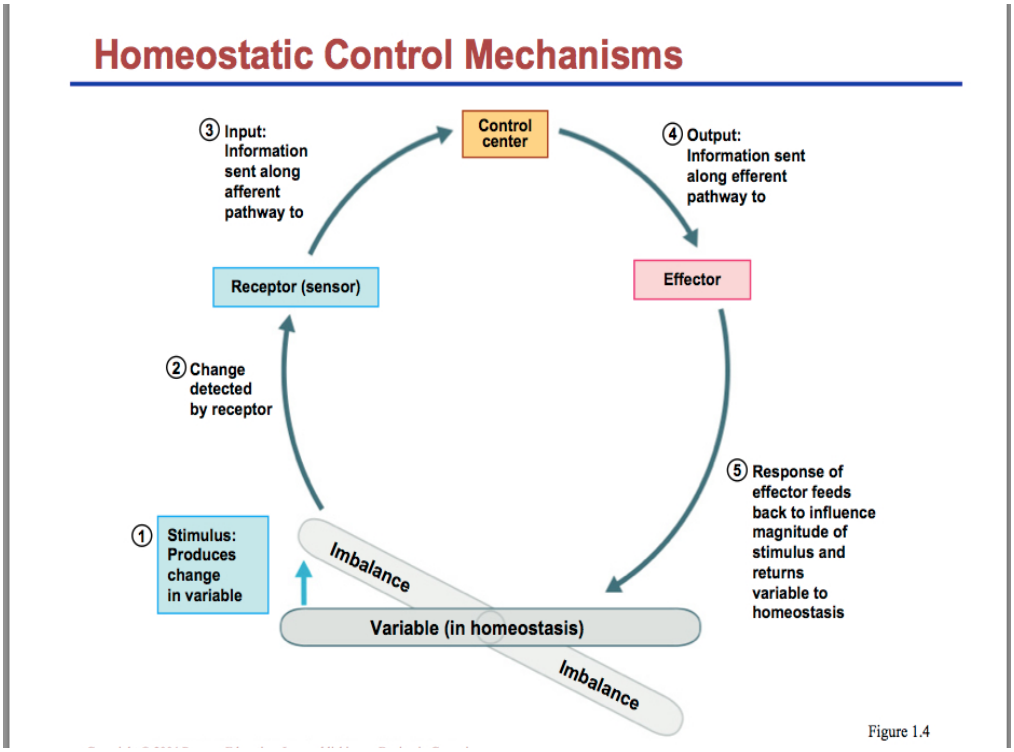
*Remember water "follows" the solute.

- **Facilitated Diffusion:** *The passive movement of material from an area of high concentration to an area of low concentration THROUGH A PROTEIN CHANNEL. Some molecules need "help" passing through the membrane because of size or polarity. Protein channels help "facilitate" this movement. This is still PASSIVE because NO ATP is required.*



2. **ACTIVE TRANSPORT =** *Movement of materials from LOW concentration to HIGH concentration using a protein carrier that <u>requires energy</u> (costs ATP). Oftentimes referred to as moving AGAINST the concentration gradient.*





ACIDS, BASES, and pH

1. The separation of water molecules into ions causes solutions to be acidic, basic, or neutral.

2. The pH scale measures how acidic or basic a solution is.

- **<u>pH of 7—Neutral</u>: Equal concentrations of H^+ and OH^-**
- **<u>pH below 7—Acidic</u>: Relatively high concentration of H^+**
- **<u>pH above 7—Basic/Alkaline:</u> Relatively high concentration of OH^-**

Acids	**Bases**
1. Taste Sour 2. Affect indicators (red = acid) 3. Neutralize Bases 4. Often produce hydrogen gas 5. pH between 0 and LESS than 7 6. The closer pH is to 0, the stronger the acid	1. Taste Bitter 2. Feel Slippery 3. Neutralize Acids (Antacids) 4. Affect indicators (base=blue) 5. pH between >7 and 14 6. Dissolve grease (Drano, Windex) 7. The closer pH is to 14, the stronger the base

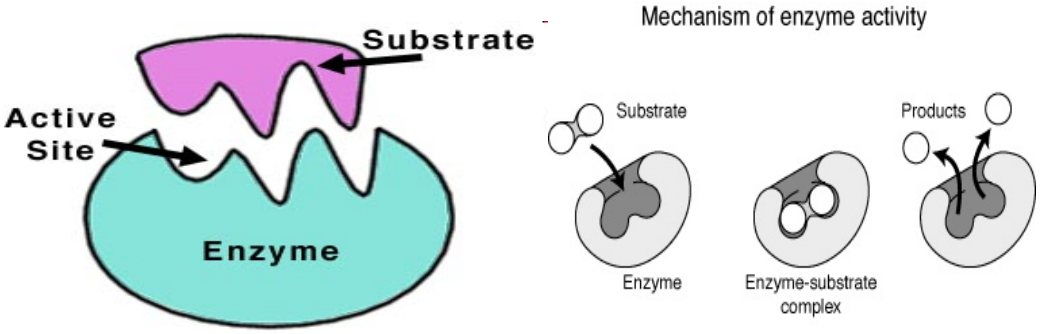
- pH = measure of how acidic a compound is
  - High pH = less acid (a.k.a. more basic/alkaline)
  - Low pH = more acidic (a.k.a. less basic/alkaline)

It is important for the body to maintain acid-base homeostasis because the body's proteins may denature (unfold) if the pH is too high or too low. All proteins work best at certain pH, depending on the type of protein it is.

*****A BUFFER system helps maintain the internal pH of the body. A buffer is a solution that resists a change in pH.**

ENZYMES

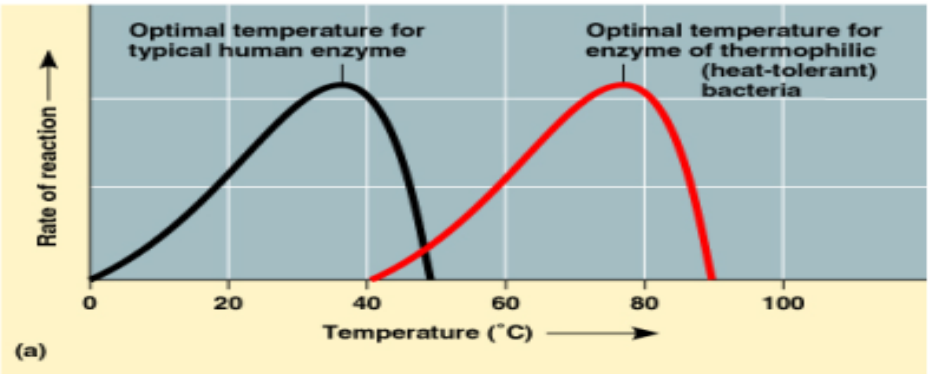
Enzymes are catalysts – they affect the rates of chemical reactions.
All enzymes have a specific shape that fits perfectly with another molecule called a substrate



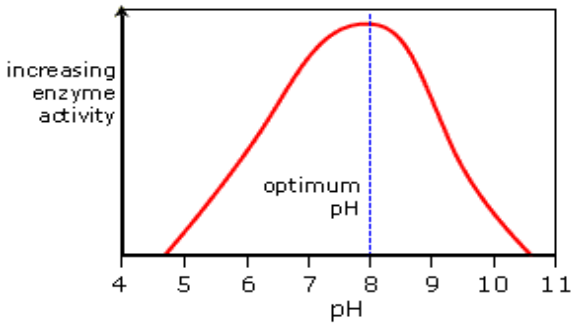
1) **lock and key model** – one type of enzyme fits one type of molecule. Change its shape and the enzyme will no longer work or will slow down

significantly. **Substrate,** *or reagent(s)*, fits into the **active site**, *where chemical reactions occur*.

2) **Very high temperatures** cause proteins and enzymes to lose their shape so that they no longer work properly. This is why high fevers are dangerous.

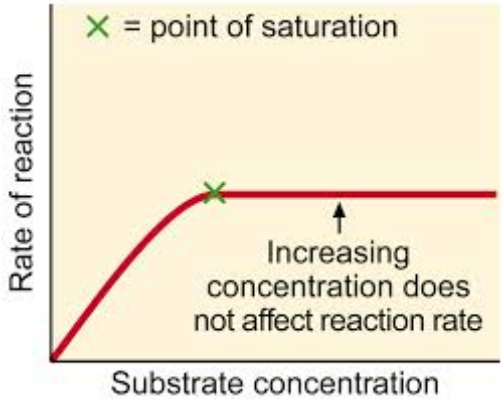


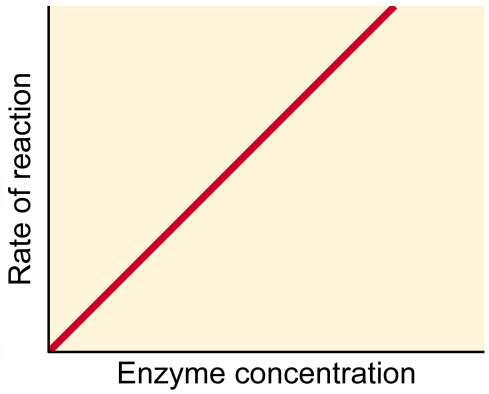
3) It is important for the body to maintain acid-base homeostasis because the body's **proteins may denature (unfold) if the pH is too high or too low**. All proteins work best at certain pH, depending on the type of protein it is.



4) **Substrate concentration and enzyme concentration** also affect enzyme activity.

- Doubling substrate concentration may increase enzymatic reaction. (up to a certain point)
- Doubling enzyme concentration may also increase enzymatic activity.





Enzyme	Location	Temperature (°C)	pH
ptyalin	mouth	36.7–37.0	6.5–7.0
pepsin	stomach	37.3–37.6	1.0–3.0
trypsin	small intestine	37.3–37.6	7.5–9.0

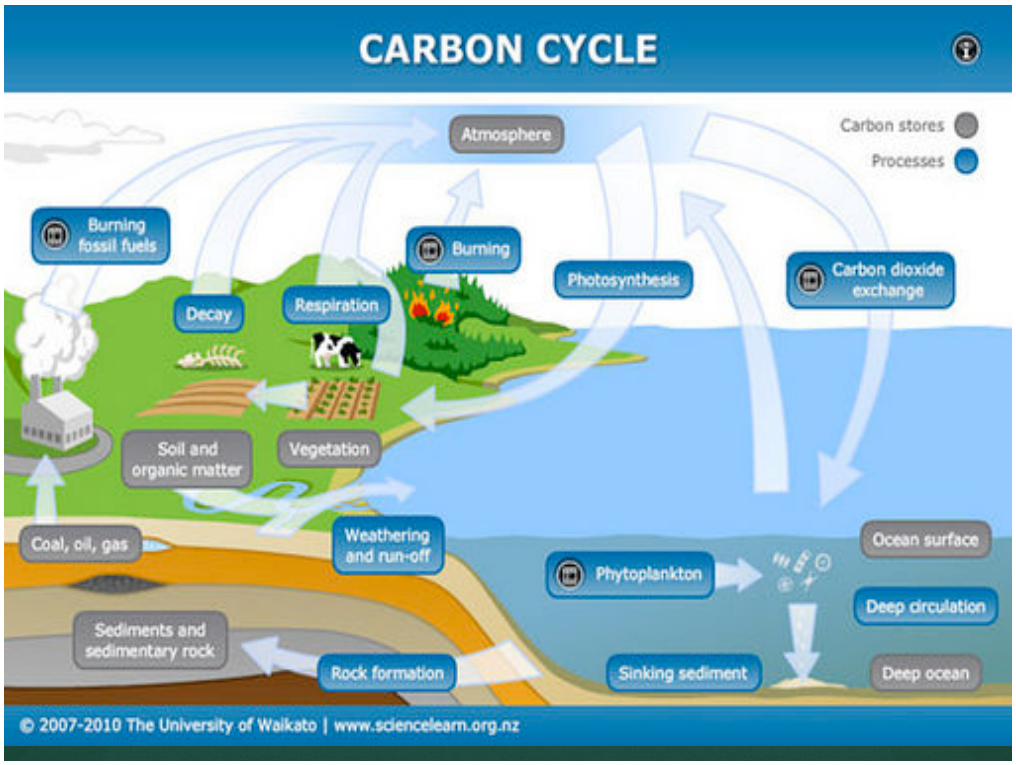
****If the enzyme is placed at a temperature outside of its optimal temperature range, it can denature (unfold), which changes the shape of its active site. Changing the shape of its active site means it can no longer participate in chemical reactions (or at least it slows it down significantly) since it cannot bind to the substrate. The same effect is seen is it is placed in an environment outside its optimal pH range.**

MACROMOLECULES

Macromolecules *are large organic molecules necessary for life*.

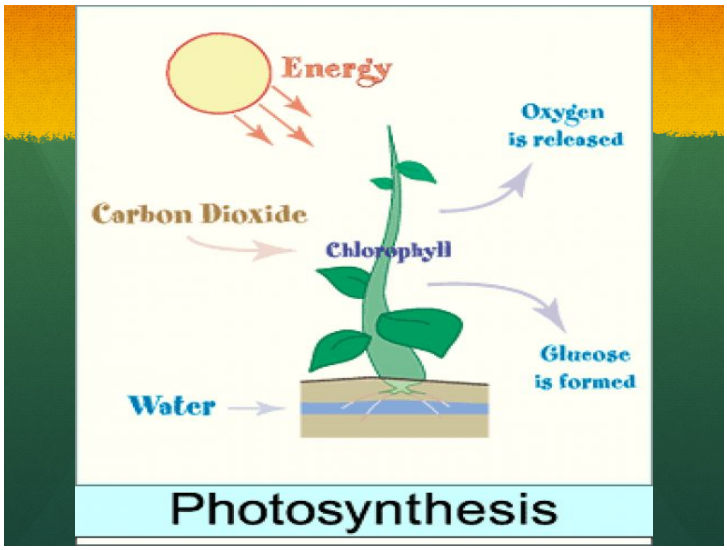
Macromolecules	*Function*	*Examples*
Lipids:	• Many functions: long-term energy storage (provides greatest amount of energy), insulation, makes up cell membrane, nerve insulation	Fats, waxes, hormones, triglycerides, vitamin K
Proteins:	• Enzyme is one of the most important type of protein. • Serve many functions: movement, transport, structure, defense, and hormones • Proteins are made from	Amylase, pepsin, ATP synthase *Most enzymes have the suffix "–ase"

	amino acids. • Proteins also make hormones and many body and cell structures	
Nucleic Acids	• Direct protein production • Provides code for different traits	DNA and RNA
Carbohydrates	• Provides short-term energy and structure • *Monosaccharride* = cannot be broken down (e.g. glucose) • *Disaccharride* = contains two monosaccharides (e.g. sucrose) • *Polysaccharride* = contains more than two monosaccharides (e.g. cellulose, glycogen, and starch)	Glucose, starch, glycogen, chitin *Many sugars have the suffix "–ose"



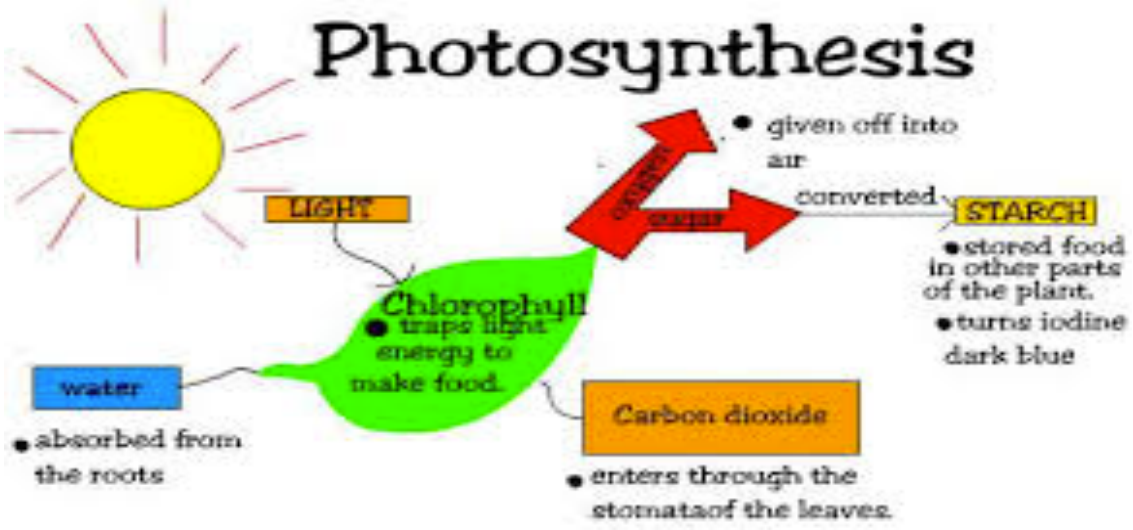
Sources of carbon:

- **Cellular respiration**
- **Burning of fossil fuels**
- **Exhaust from automobiles and factories**



Photosynthesis is carried out by plants, alga and blue-green bacteria (autotrophs). It takes the radiant energy of the sun and puts it in the bonds of sugar molecules. Photosynthesis occurs mostly in the chloroplast of plant cells.

- ***Materials needed for photosynthesis***: carbon dioxide (CO_2), water, and energy from the sun
- ***Products of photosynthesis:*** sugar molecules (glucose) and oxygen
- **ONLY PRODUCERS (AUTOTROPHS) UNDERGO PHOTOSYNTHESIS**

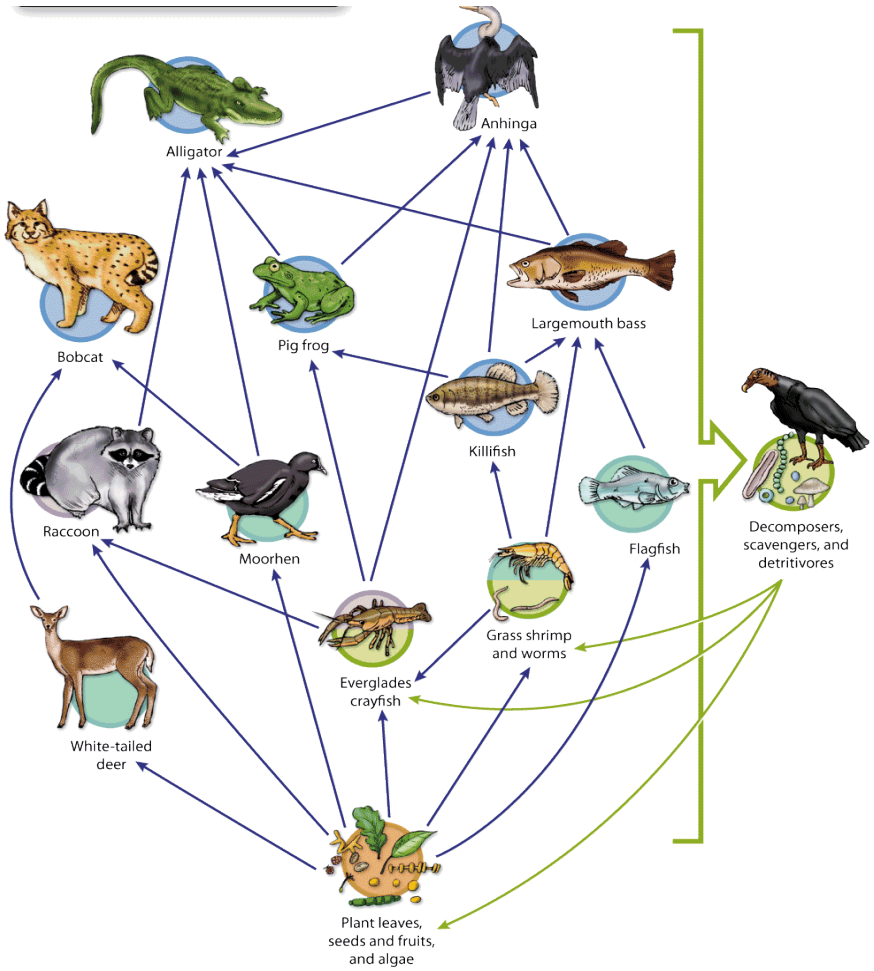


Cellular Respiration: Organisms get energy by breaking the bonds of sugar molecules. The released energy is used to make a molecule of ATP, which gives all organisms their energy.

- ***Materials needed for cellular respiration:*** sugar and oxygen (anaerobic)
- ***Products of cellular respiration:*** energy (ATP) , carbon dioxide, and water
- **CONSUMERS and PRODUCERS UNDERGO CELLULAR RESPIRATION**

ECOLOGICAL RELATIONSHIPS

A. Understand how organisms interact with their environment (food webs, nutrient cycles). **Ecosystem** *includes all of the living things and their physical environments within a particular area.*



- **Food chain:** Linear series of feeding relationships
- **Food web:** Shows the overlapping and interconnected food chains

present in a community

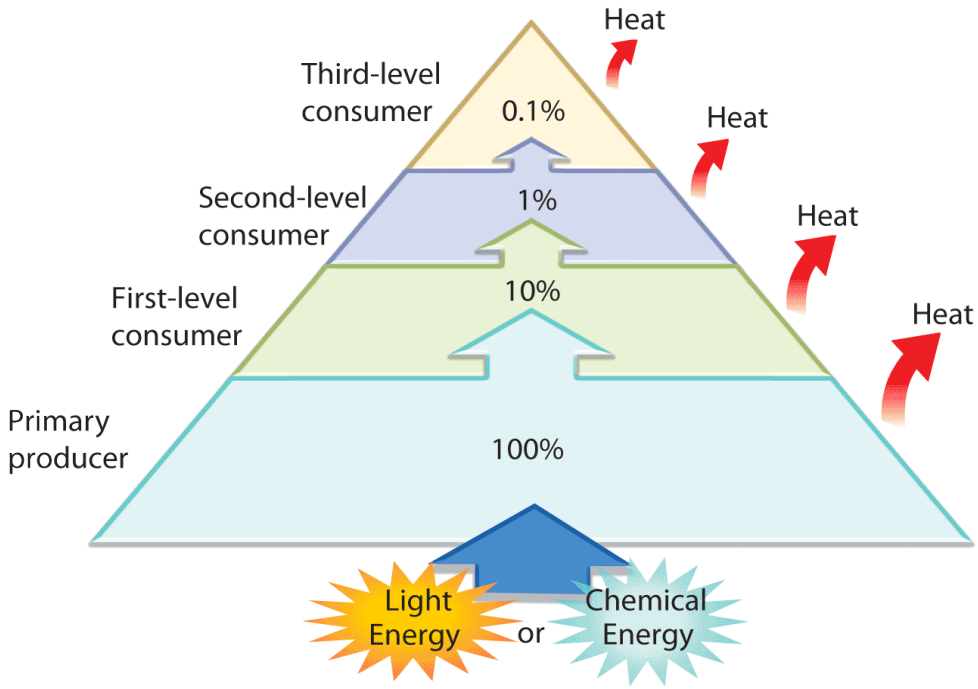
SPECIES INTERACTIONS

Interaction	*Effect on Species A*	*Effect on Species B*	*Description*
Commensalism	**+**	**0**	One species benefits while the other is not affected
Competition	**-**	**-**	Species are competing for the same resource
Mutualism	**+**	**+**	Both species benefit
Parasitism	**+**	**-**	One species benefits while the other is harmed
Predation	**+**	**-**	One species is hunted while the other hunts

B. **Energy** is needed to keep an ecosystem going. The energy comes from the sun and is made usable by **producers** (plants and other autotrophs). They create their own food through photosynthesis.

C. Energy is passed on to other organisms in the form of food. Since all organisms must use energy for their own needs, most energy is lost before it can be passed to the next step in the food chain. As a result, organisms high on the food chain have less energy available to them and must have smaller populations.

Consumers • *rely on other organisms for energy and nutrients* • Use oxygen to break bonds in sugar and release its energy through cellular respiration (primary producers do this, too)	
Herbivores	*Eat plants*
Carnivores	*Eat meat*
Omnivores	*Eat both plants and meat*
Detritivores	*Eat dead bodies; scavengers. Helps recycle nutrients within an ecosystem*
Decomposers	*Breaks down nonliving matter. Helps recycle nutrients within an ecosystem*



- *An organism's rank in a feeding hierarchy is its* **trophic level**.
- **Primary producers** always occupy the first trophic level of any community.
- In general, only about **10% of the energy** available at any trophic level is passed to the next; most of the rest is lost to the environment as heat.

E. There are many roles in an ecosystem (niche), but competition between species usually results in only one species occupying a niche at any one time. Often, organisms with similar needs will divide resources.

"Most of the important things in the world have been accomplished by people who have kept on trying when there seemed no hope at all." - Dale Carnegie

POPULATION

- ***Immigration*** = organisms coming into a population
- ***Birth Rate (Natality)*** = Rate at which organisms reproduce
- ***Emigration*** = organisms leaving a population
- ***Death Rate (Mortality)*** = Rate at which organisms die

Population Growth Rate = (Immigration + Birth Rate) – (Emigration + Death Rate)

Abiotic factors *are parts of an ecosystem that have never been living.*
Example: sunlight, water, air, rocks
Biotic factors *are parts of an ecosystem that are living or used to be living.*
Example: rotting tree, plants, bacteria, squirrels

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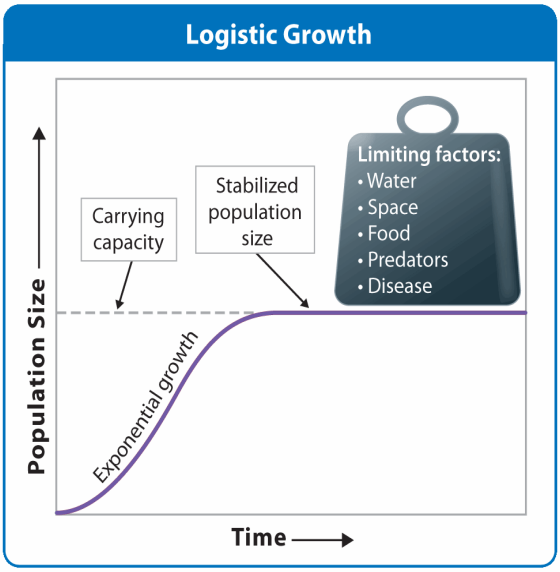
<td> 
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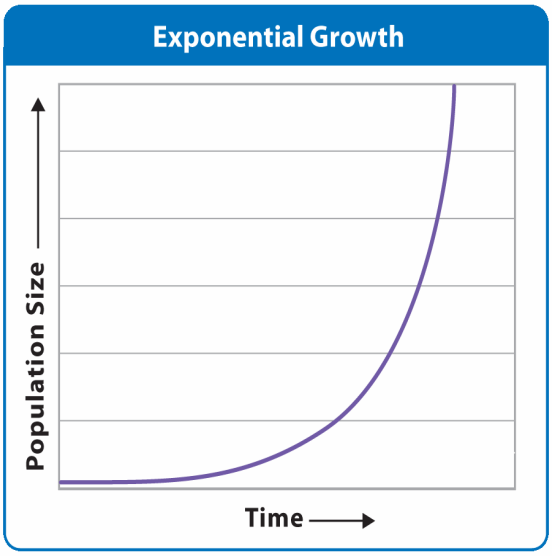
<td> 
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- ***Carrying capacity*** **– largest population size a given environment can sustainably support**
- **Growth almost always slows and stops due to limiting factors.**

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- **Population increases by a fixed percentage every year.**
- **Normally occurs only when small populations are introduced to an area with ideal environmental conditions**
- **Rarely lasts long**

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Studying Strategies

1. ***Outlining/rewriting your notes.***
2. ***Explaining*** a concept to a classmate or family member.
3. Creating ***possible questions*** you may be asked about and having a classmate answer them.
4. ***Flashcards.***
5. ***Drawing diagrams*** to show relationships between concepts and topics.
6. ***Video Tutorials*** on the following websites:
    - www.youtube.com
    - www.khanacademy.org
7. ***Quizlet*** (online flashcards). (www.quizlet.com)
8. Creating ***mnemonics***, or something that helps you remember.
    (For example, to help you remember the colors of the rainbow: ROYGBIV R = red, O = orange, Y = yellow, etc…)
9. Creating a ***cheat sheet*** that contains only the most important concepts and details. (Of course, don't count on that cheat sheet on being there for the actual exam!)

Exam Taking Tips

1) Draw diagrams to help you visualize the questions asked - where possible.

2) Read introductory paragraphs and study diagrams before looking at questions. Underline key words. Read all choices before deciding on an answer, sometimes a question has a good and a better answer. Always choose the best answer.

3) If you are not sure of an answer, try to eliminate choices that you think are clearly wrong and narrow down your choices. Then make your most careful guess.

4) Skip over hard questions that are stumping you. Go back to them later. Something else in the test may give you a clue to the harder problems.

5) Don't leave any questions blank. Check your test a second time, but only change an answer if you find an obvious mistake. Your first choice is usually correct.

6) Take your time.

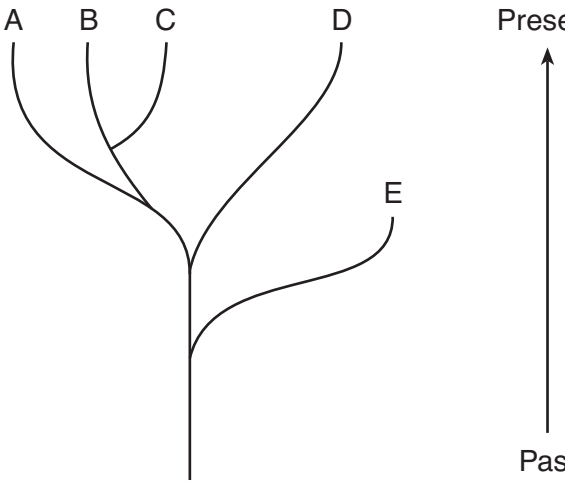
7) Have a healthy meal for breakfast the morning of and a good night sleep is as important as the above items. (Hunger and sleep deprivation both disrupt homeostasis!!!)

PRACTICE QUESTIONS

1 Chemicals that help chemical reactions occ faster rates in living organisms are known as

(1) biotic resources
(2) simple sugars
(3) oxygen molecules
(4) organic catalysts

The diagram below represents an evolutio tree.



Which statement best describes species *E*?

(1) Species *D* is an ancestor of species *E*.
(2) Through natural selection, species produced increased survival mechanisms
(3) Species *E* had greater success due patterns of behavior.
(4) Species *E* had insufficient adap characteristics for survival in a chan environment.

Researchers have found that formaldehyde and asbestos can alter DNA base sequences. Based on this research, the use of these chemicals has been greatly reduced because they

(1) may act as fertilizers, increasing the growth of algae in ponds
(2) have been replaced by more toxic compounds
(3) are capable of causing mutations in humans
(4) interfere with the production of antibiotics by white blood cells

When the adaptive characteristics of a species are insufficient to allow its survival, that species is likely to

(1) mate with other species
(2) produce a beneficial mutation
(3) form a fossil
(4) become extinct

The molecule represented below is found in living things.

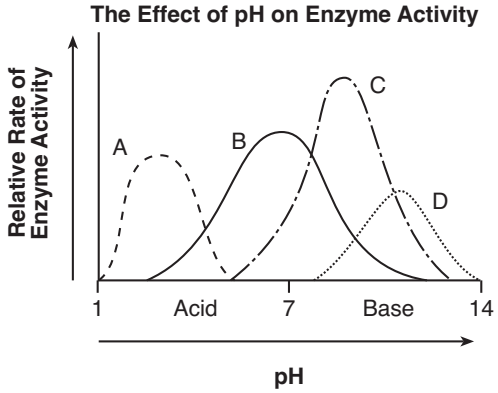
Which statement describes one characteristic of this molecule?

(1) It is the template for the replication of genetic information.
(2) Organic catalysts are made up of these molecules.
(3) It is different in each cell of an organism.
(4) Cell membranes contain many of these molecules.

Base your answers to questions 37 through 39 on the information and graph below and on your knowledge of biology.

The pH of the internal environment of lysosomes (organelles that contain digestive enzymes) is approximately 4.5, while the pH of the surrounding cytoplasm is approximately 7. The average pH of the human stomach during digestion is approximately 2.5, while the average pH of the small intestine during digestion is about 8.

The graph below shows how pH affects the enzyme activity of four different enzymes, *A*, *B*, *C*, and *D*.



37 What will most likely happen to the action of an enzyme from the small intestine if it is placed in an environment similar to the environment in which enzyme *C* functions best?

(1) It would no longer be able to function because the environment is too acidic.
(2) It would adapt to the new environment and start carrying out the same function as enzyme *C*.
(3) It would continue to function because it is able to modify the pH of the environment.
(4) It would be able to function because the pH of the environment is similar to that of the intestine.

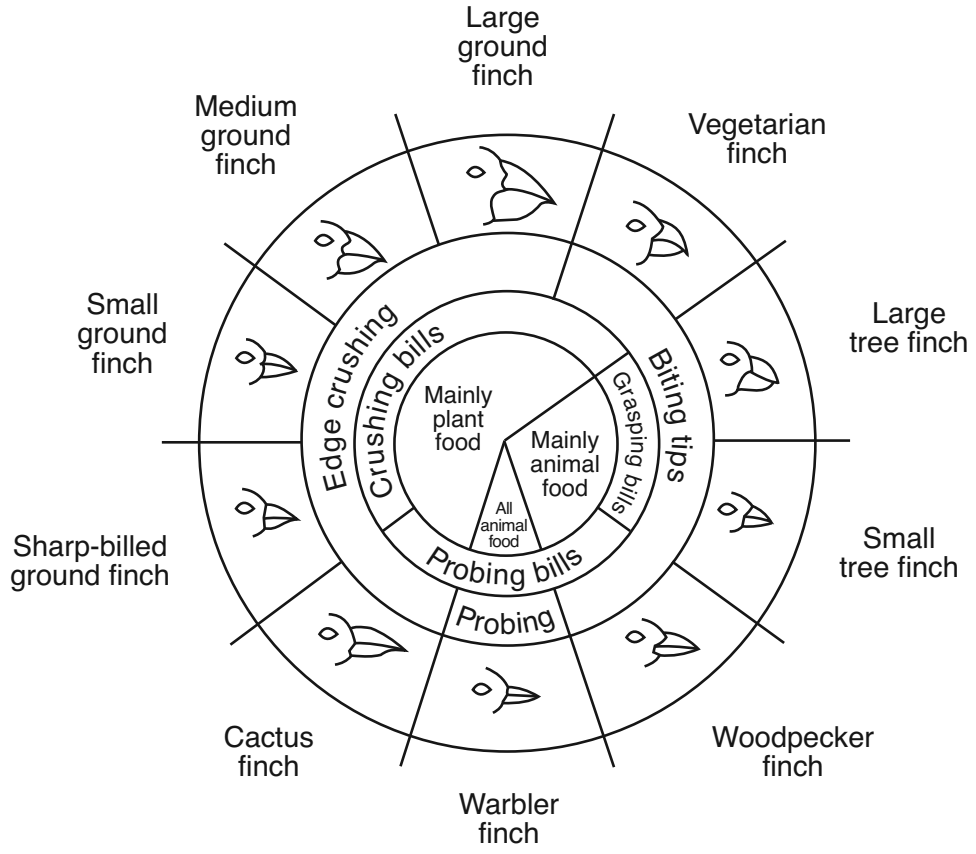
38 Lysosomes break open during the process of digestion, releasing enzymes into the cytoplasm. Which statement may explain why the entire cell may not be digested?

(1) The acidic environment of the cytoplasm destroys the enzymes.
(2) Antibodies in the cytoplasm break down foreign enzymes.
(3) The pH of the cytoplasm causes the enzymes to function less effectively.
(4) Enzymes can function only in the location where they are synthesized.

39 Which enzyme functions best in a pH environment most similar to that of human stomach enzymes?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

Base your answers to questions 71 and 72 on the diagram below that shows variations in the beaks of finches in the Galapagos Islands and on your knowledge of biology.



From: *Galapagos: A Natural History Guide*

71 The diversity of species seen on the Galapagos Islands is mostly due to

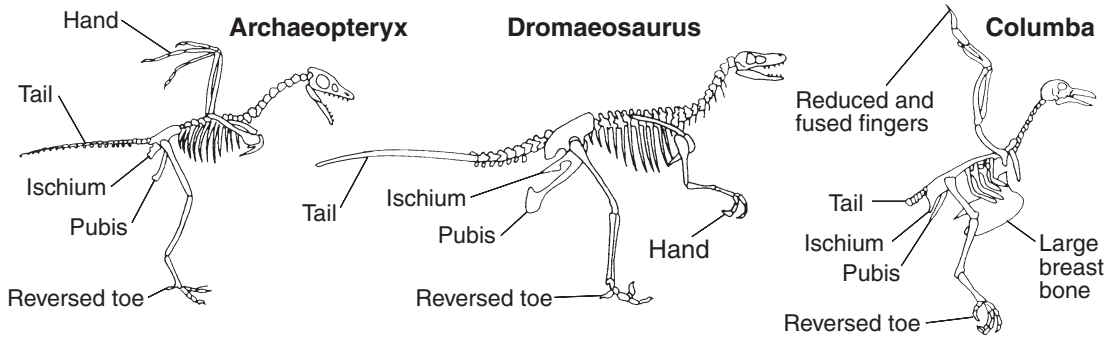
(1) gene manipulation by scientists

(2) gene changes resulting from mitotic cell division

(3) natural selection

(4) selective breeding

The remains of three organisms are shown below.



A study of these remains would indicate that these organisms have

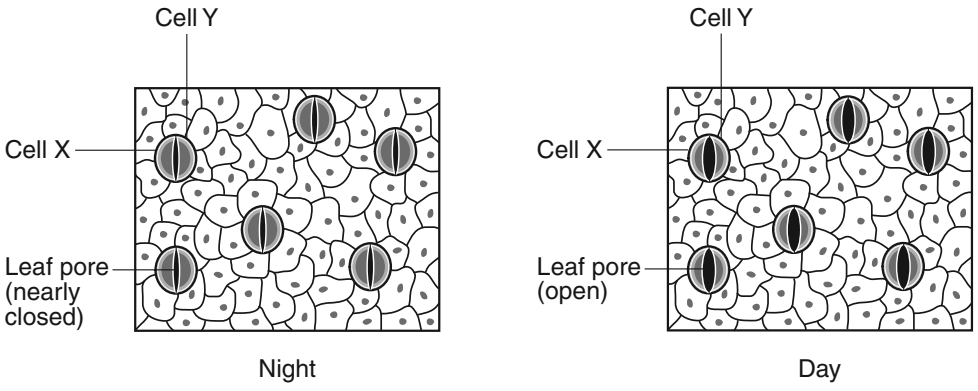
(1) identical food preferences
(2) identical body sizes
(3) structural similarities
(4) habitat similarities

One possible pathway for the evolution of elephants is represented in the diagram below

Which two cell structures work together in the process of protein synthesis?

(1) nucleus and chloroplast
(2) ribosome and vacuole
(3) nucleus and ribosome
(4) mitochondrion and cell membrane

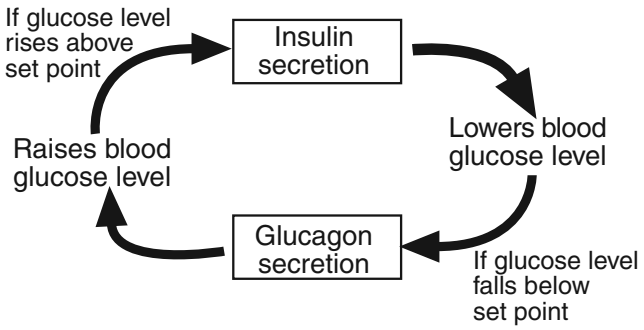
The diagram below represents changes in the sizes of openings present in leaves as a result of the actions of cells *X* and *Y*.



The actions of cells *X* and *Y* help the plant to

(1) maintain homeostasis by controlling water loss
(2) store excess heat during the day and remove the heat at night
(3) absorb light energy necessary for cellular respiration
(4) detect changes in the biotic factors present in the environment

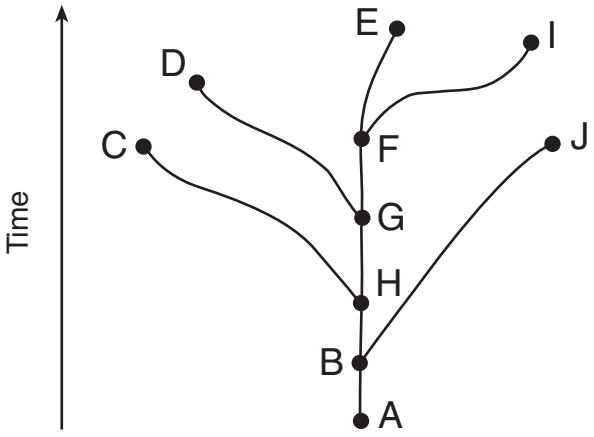
The diagram below represents a sequence of events that occurs in the human body throughout the day.



These events can best be described as an example of

(1) an energy cycle
(2) recycling of inorganic materials
(3) a feedback mechanism
(4) a learned behavior

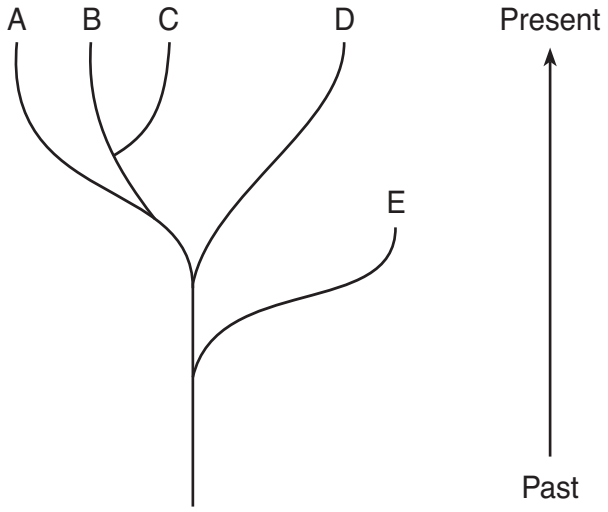
The evolutionary pathways of ten different species are represented in the diagram below.



Which two species are the most closely related?

(1) *C* and *D*
(2) *E* and *I*
(3) *G* and *J*
(4) *A* and *F*

33 The diagram below represents an evolutionary tree.

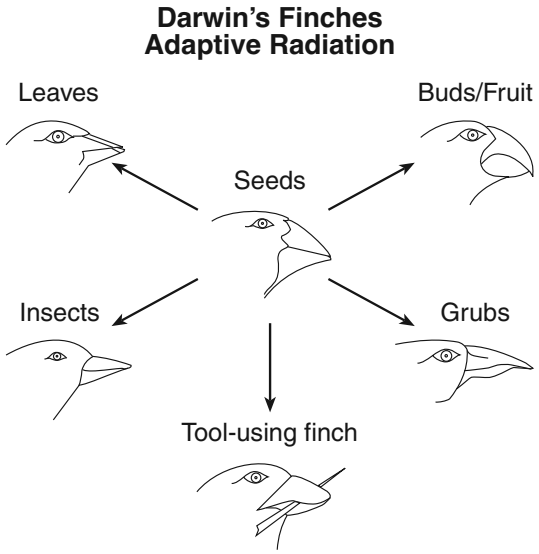


Which statement best describes species *E*?

(1) Species *D* is an ancestor of species *E*.
(2) Through natural selection, species *E* produced increased survival mechanisms.
(3) Species *E* had greater success due to patterns of behavior.
(4) Species *E* had insufficient adaptive characteristics for survival in a changing environment.

Base your answers to questions 73 and 74 on the information and diagram below and on your knowledge of biology.

Finches on the Galapagos Islands are thought to have originated from South America and to have evolved into new species over the last 10,000 years. Some of this evolution is represented in the diagram below.



Note: The answers to questions 73 and 74 should be recorded on your separate answer sheet.

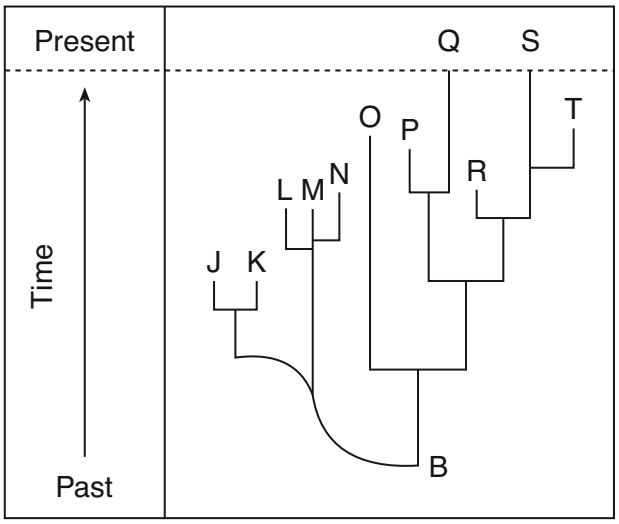
73 The success of the finches on the Galapagos was most likely due to the

(1) large numbers of other birds competing for food
(2) mutations occurring in every offspring
(3) birds occupying the same island
(4) birds adapting to different niches

74 The seed-eating finch was most likely the

(1) largest finch
(2) common ancestor
(3) parent of the other finches
(4) most successful

36 Some evolutionary pathways are represented in the diagram below.



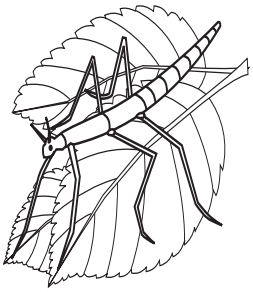
An inference that can be made from information in the diagram is that

(1) many of the descendants of organism *B* became extinct
(2) organism *B* was probably much larger than any of the other organisms represented
(3) most of the descendants of organism *B* successfully adapted to their environment and have survived to the present time
(4) the letters above organism *B* represent members of a single large population with much biodiversity

10 Natural selection and its evolutionary consequences provide a scientific explanation for each of the following *except*

(1) the fossil record
(2) protein and DNA similarities between different organisms
(3) similar structures among different organisms
(4) a stable physical environment

10 The illustration below shows an insect resting on some green leaves.



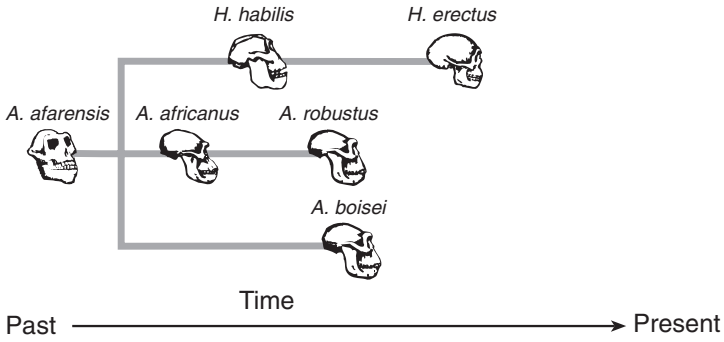
The size, shape, and green color of this insect are adaptations that would most likely help the insect to

(1) compete successfully with all birds
(2) make its own food
(3) hide from predators
(4) avoid toxic waste materials

19 Which order of metabolic processes converts nutrients consumed by an organism into cell parts?

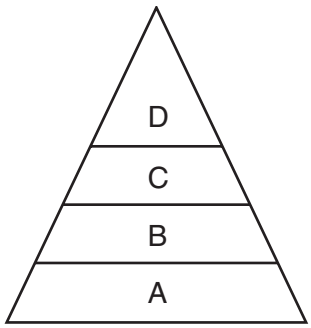
(1) digestion → absorption → circulation → diffusion → synthesis
(2) absorption → circulation → digestion → diffusion → synthesis
(3) digestion → synthesis → diffusion → circulation → absorption
(4) synthesis → absorption → digestion → diffusion → circulation

37 According to the diagram below, which three species lived on Earth during the same time period?



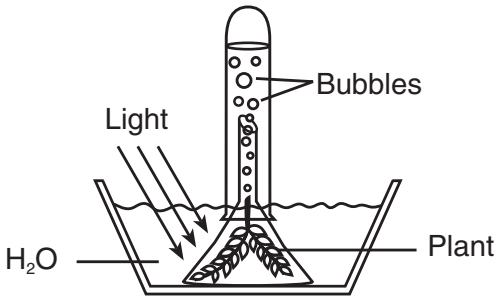
(1) *robustus, africanus, afarensis*
(2) *habilis, erectus, afarensis*
(3) *habilis, robustus, boisei*
(4) *africanus, boisei, erectus*

Which process provides the initial energy to support all the levels in the energy pyramid shown below?



(1) circulation
(2) photosynthesis
(3) active transport
(4) digestion

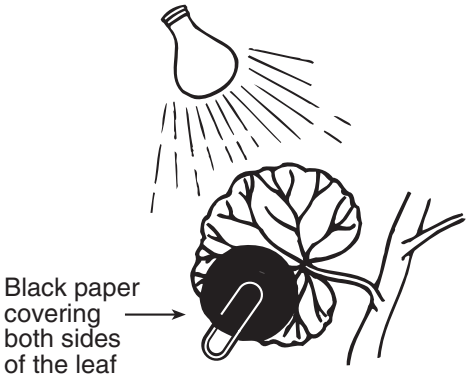
The green aquatic plant represented in the diagram below was exposed to light for several hours.



Which gas would most likely be found in the greatest amount in the bubbles?

(1) oxygen
(2) nitrogen
(3) ozone
(4) carbon dioxide

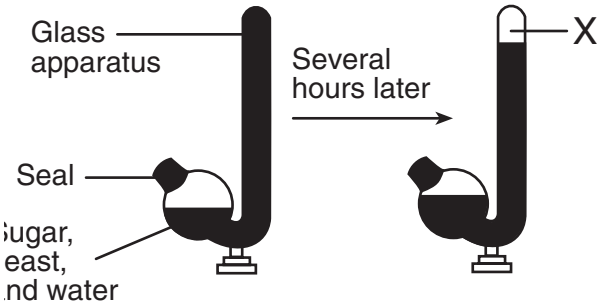
An experimental setup is shown below.



Which hypothesis would most likely be tested using this setup?

(1) Light is needed for the process of reproduction.
(2) Glucose is not synthesized by plants in the dark.
(3) Protein synthesis takes place in leaves.
(4) Plants need fertilizers for proper growth.

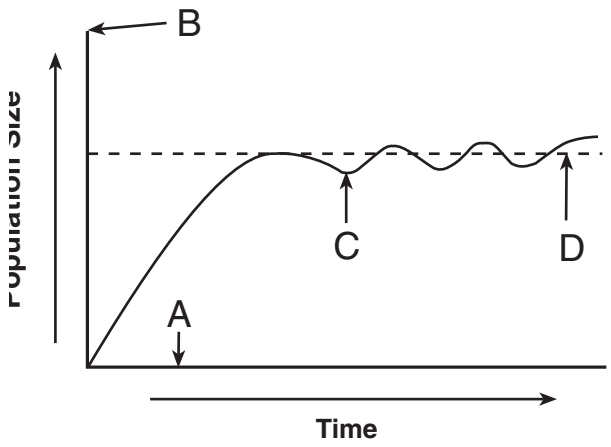
An investigation was carried out and the results are shown below. Substance *X* resulted from a metabolic process that produces ATP in yeast (a single-celled fungus).



Which statement best describes substance *X*?

(1) It is oxygen released by protein synthesis.
(2) It is glucose that was produced in photosynthesis.
(3) It is starch that was produced during digestion.
(4) It is carbon dioxide released by respiration.

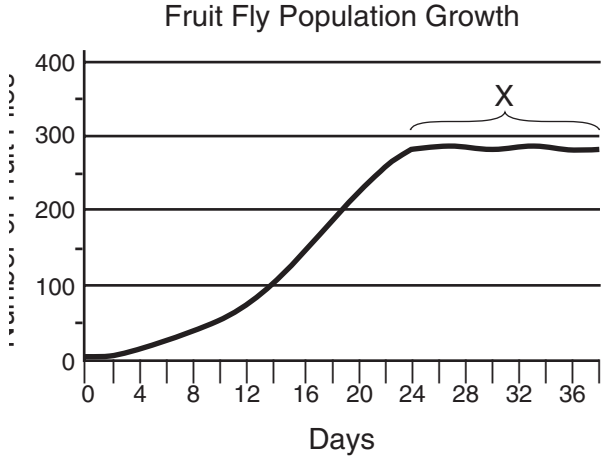
The growth of a population is shown in the graph below.



Which letter indicates the carrying capacity of the environment for this population?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

Which statement best describes the fruit fly population in the part of the curve labeled *X* in the graph shown below?

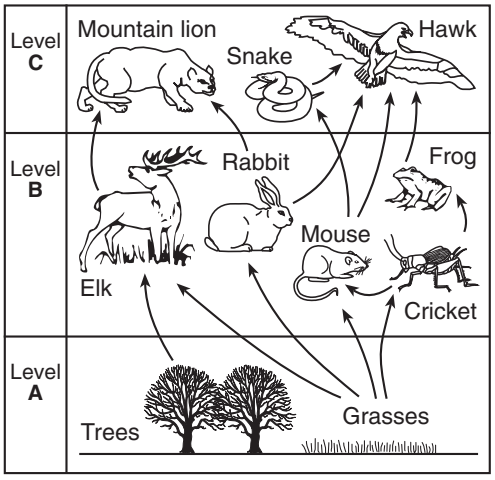


(1) The fruit fly population has reached the number of organisms the habitat can support.
(2) The fruit fly population can no longer mate and produce fertile offspring.
(3) The fruit fly population has an average life span of 36 days.
(4) The fruit fly population is no longer able to adapt to the changing environmental conditions.

Lichens and mosses are the first organisms to grow in an area. Over time, grasses and shrubs will grow where these organisms have been. The grasses and shrubs are able to grow in the area because the lichens and mosses

(1) synthesize food needed by producers in the area
(2) are at the beginning of every food chain in a community
(3) make the environment suitable for complex plants
(4) provide the enzymes needed for plant growth

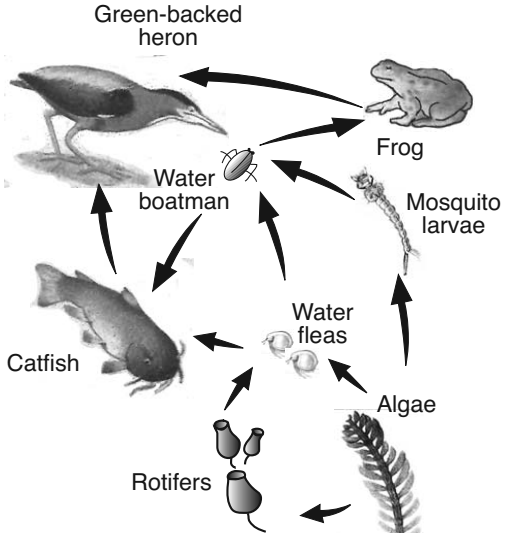
A food web is represented below.



Which statement best describes energy in this food web?

(1) The energy content of level *B* depends on the energy content of level *C*.
(2) The energy content of level *A* depends on energy provided from an abiotic source.
(3) The energy content of level *C* is greater than the energy content of level *A*.
(4) The energy content of level *B* is transferred to level *A*.

4 A pond ecosystem is shown in the diagram below.

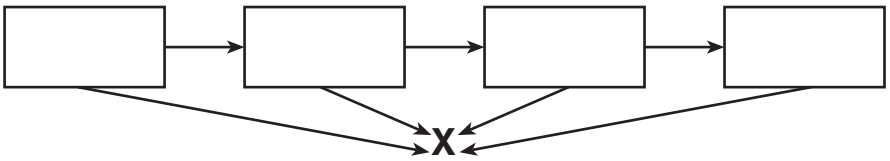


(Not drawn to scale)

Which statement describes an interaction that helps maintain the dynamic equilibrium of this ecosystem?

(1) The frogs make energy available to this ecosystem through the process of photosynthesis.
(2) The algae directly provide food for both the rotifers and the catfish.
(3) The green-backed heron provides energy for the mosquito larvae.
(4) The catfish population helps control the populations of water boatman and water fleas.

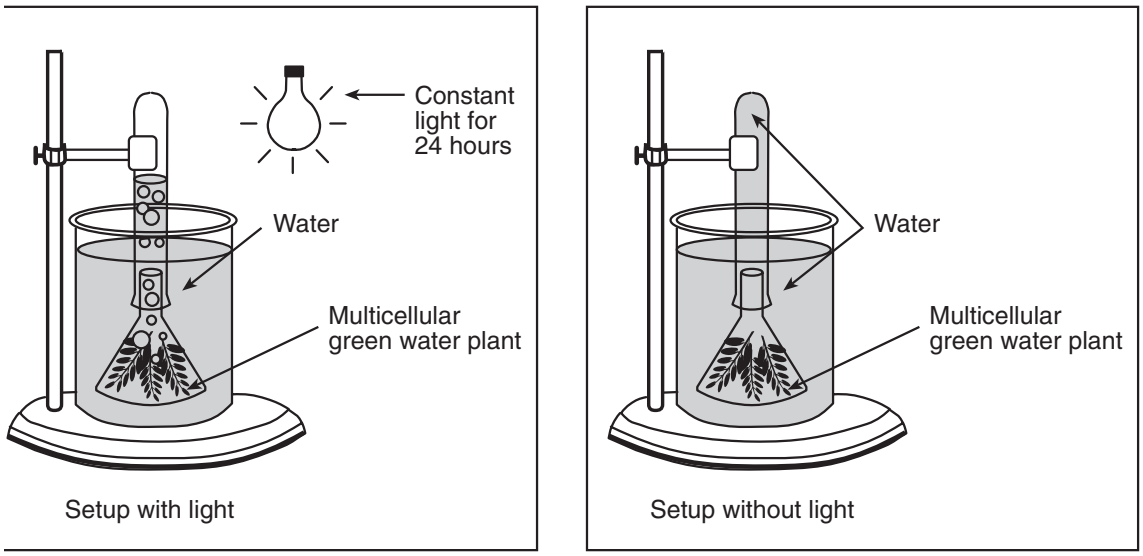
The diagram below represents some energy transfers in an ecosystem.



Which type of organism is most likely represented by letter *X*?

(1) decomposer
(2) autotroph
(3) producer
(4) herbivore

An experimental setup is shown in the diagram below.



Which hypothesis would most likely be tested using this setup?

(1) Green water plants release a gas in the presence of light.
(2) Roots of water plants absorb minerals in the absence of light.
(3) Green plants need light for cell division.
(4) Plants grow best in the absence of light.

The Pine Bush ecosystem near Albany, New York, is one of the last known habitats of the nearly extinct Karner Blue butterfly. The butterfly's larvae feed on the wild green plant, lupine. The larvae are in turn consumed by predatory wasps. The four groups below represent other organisms living in this ecosystem.

Group A	Group B	Group C	Group D
algae mosses ferns pine trees oak trees	rabbits tent caterpillars moths	hawks moles hognosed snakes toads	soil bacteria molds mushrooms

40 The Karner Blue larvae belong in which group?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

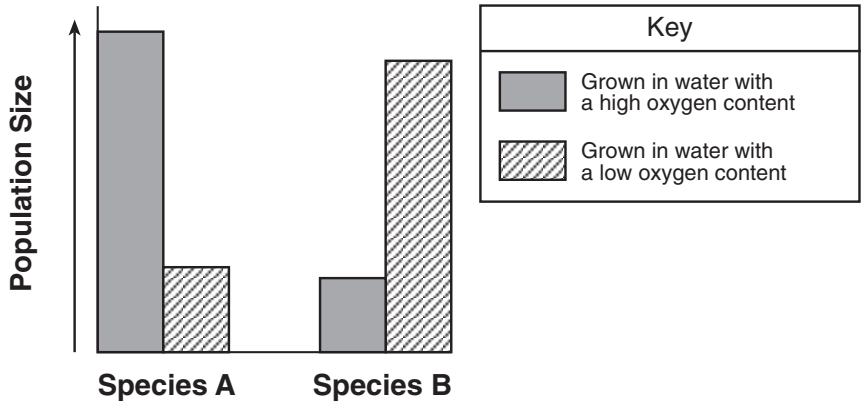
41 Which food chain best represents information in the passage?

(1) lupine → Karner Blue larvae → wasps
(2) wasps → Karner Blue larvae → lupine
(3) Karner Blue larvae → lupine → wasps
(4) lupine → wasps → Karner Blue larvae

42 Which group contains decomposers?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

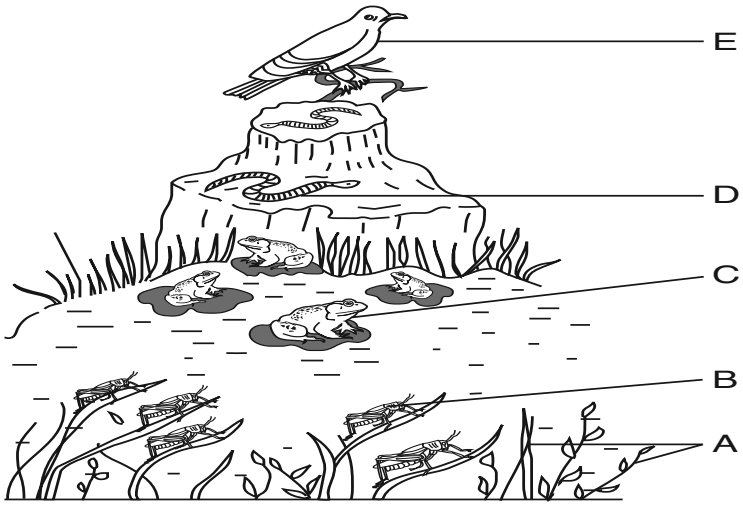
A graph of the population growth of two different species is shown below.



Which conclusion can be drawn from information in the graph?

(1) Oxygen concentration affects population sizes of different species in the same manner.
(2) Species *A* requires a high oxygen concentration for maximum population growth.
(3) Species *B* requires a high oxygen concentration to stimulate population growth.
(4) Low oxygen concentration does not limit the population size of either species observed.

Base your answers to questions 38 and 39 on th diagram below that represents an energy pyramid in meadow ecosystem and on your knowledge of biolog



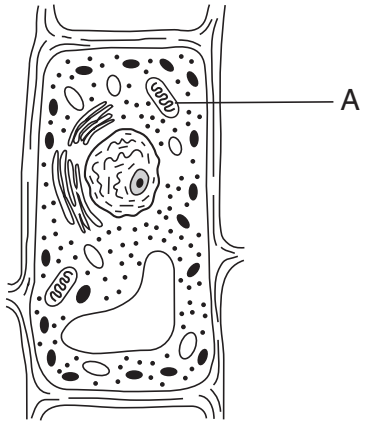
38 Which species would have the largest amount c available energy in this ecosystem?

(1) *A*
(2) *B*
(3) *C*
(4) *E*

39 Which two organisms are carnivores?

(1) *A* and *B*
(2) *A* and *E*
(3) *B* and *D*
(4) *C* and *E*

The diagram below represents a plant cell.



Which process takes place in structure *A*?

1) cellular respiration
2) heterotrophic nutrition
3) digestion of fats
4) protein synthesis

“Most of the important things in the world have been accomplished by people who have kept on trying when there seemed no hope at all.” - Dale Carnegie