Name: _____

# Living Environment Regents Review

## Topic One: Chemistry of Living Things

**I.** All living things must maintain _____in order to stay alive.

A) **Homeostasis**: A _____state in the body.

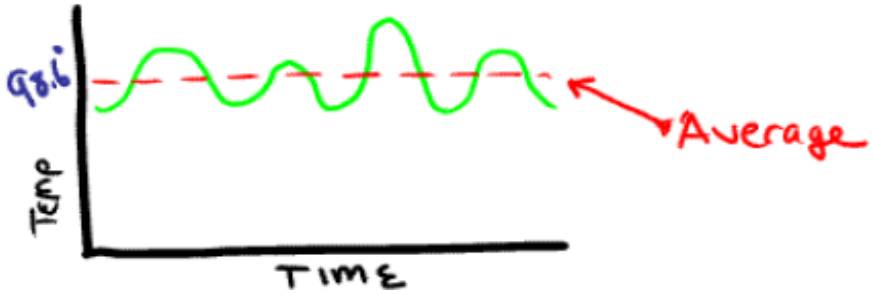
B) Failure to maintain homeostasis results in _____or death.

C) Homeostasis is often maintained using _____mechanisms.

1. Feedback mechanisms are _____in which the product of one reaction causes another to start or stop.

D) While organisms are balanced, they are not unchanging. The term used to describe the balanced state is_____**.**

1. **Dynamic Equilibrium:** A balanced state created by many small, _____changes.




**Word Bank:** feedback opposing dynamic-equilibrium cycles disease balanced homeostasis

**II. Life Processes:** All living things carry out the same basic chemical_____. Taken together, these process make up an organism's_____.

A) **Metabolism:** All chemical processes used to maintain_____.

1. _____**:** Using nutrients for growth, synthesis, repair and energy.
2. _____**:** Converts energy in food into a usable form (ATP).
3. _____: Making complex chemicals from simple substances.
4. _____: Absorbing and distributing materials throughout the body.
5. _____: The control and coordination of life processes.

6. _____: Removing of wastes produced by metabolic activities.
7. _____: Passes on genes to offspring.

**Word Bank**: homeostasis processes metabolism reproduction excretion regulation transport synthesis respiration nutrition

**III. Inorganic Chemicals**: _____compounds

A) _____ ( $H_2O$) : Most common substance in all living things (about 60% of body mass)

- Needed for chemical _____(won't happen in "dry" conditions)
- Dissolves other molecules into_____**,** allowing them to be **transported** through the body.

B) _____ ($O_2$): Needed by **most** (not all) organisms for **cellular respiration**.

- Released by plants and algae as a waste product of_____**.**
- **Aerobic respiration:** Process that uses oxygen to extract _____from glucose (sugar). Used by most organisms.
- Anaerobic respiration: Process that extracts energy from glucose _____using oxygen. Gives _____energy, so only used by some simple organisms (some bacteria, yeast). These organisms do not need to _____in oxygen.

**Word Bank**: solution reactions water simple breathe without less energy oxygen photosynthesis

C) **Carbon Dioxide** ($CO_2$): With water, used by plants to make glucose (**photosynthesis)**.

- Waste product of_____.

D) **Nitrogen** ($N_2$): Most common gas in air (70%)

- Needed to make_____.
- Converted into _____by soil bacteria. Nitrates are _____by plants and then eaten by animals.
- Excreted as waste in ammonia or _____.

E) Acids and Bases: Used for different functions in body (such as digestion).

- Measured by the _____scale
- Very high and very low pHs are usually_____.
- pH can affect rates of chemical reactions; for example, digestive _____work fastest in acidic environments, which is why we make stomach _____(hydrochloric acid, or HCl).

**Word Bank**: urea absorbed nitrates protein acid enzymes lethal pH aerobic-respiration.

**IV. _____Compounds**: Larger, more complex chemicals. Always contain the elements like carbon (C)and hydrogen (H). Synthesized from simpler substances (building blocks).

A) **Carbohydrates:** Sugars and_____.

1. **Building blocks**: simple_____.
2. Functions:
   - _____energy.
   - _____energy (starch in plants).

B) **Lipids:** fats, _____and waxes.

1. Functions:
   - Store energy.
   - Cell membrane.
   - Water_____.
   - _____.

**Word Bank**: store provide sugars starches organic oils proofing insulation

C) **_____:** Complex compounds that carry out all the body's activities.

1. **Building blocks:** _____.
2. After water, proteins are the most _____substances in the body.
3. Have many different functions as determined by their_____.

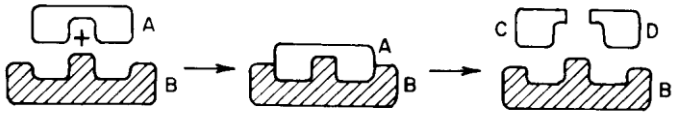
4. **Lock and _____Model:** Proteins must have the right shape to "___" with other molecules.
    - **Changing the shape of a protein will change what it can interact with its_____.**

5. Important types of proteins:
    - **Hormones** and **neurotransmitters** – carry _____through the body.
    - Cell receptors – in cell membrane; _____hormones and neurotransmitters.
    - Antibodies –_____foreign **pathogens**
    - **Enzymes**- act as **catalysts**, _____all chemical reactions in the body.
        - High temperatures will cause enzymes to denature (lose their shape) and stop_____. This is why high fevers are_____.

D) **Nucleic Acids (DNA and RNA)**: Make up _____and chromosomes.

1. **Building blocks**: Nucleotides; molecular _____(ATCGU)

**Word Bank**: functioning dangerous controlling attack receive messages genes bases function key fit shape plentiful amino-acids proteins enzyme




A starch (A) is broken down by an _____(B) into two simple sugars (C, D). This is also a good example of the **lock and key model**.

## Topic Two: The Cell

**I. Definition:**_____.

**II. Cell Theory** has three parts:

1. _____.
   Unicellular – single celled organisms (amoeba, paramecium)
   Multicellular – have more than 1 cell; may be only a few (vorticella), or many *trillions* of cells (humans). Almost all structures in multi-celled organisms are made of or by cells.
2. _____.
   Everything you do is the result of the work of your cells – walking, talking, even thinking and feeling. When you get sick, it is because your cells are not working correctly.
3. _____.
   This seems obvious now, but at one time people believed in *spontaneous generation*, the idea that living things regularly emerged from nonliving things.

B) **Exceptions to the Cell Theory**

1. _____are not made of cells. However, they also do not carry out all life processes, so many biologists do not consider them true living things.
2. _____obviously could not come from another cell.

**III. Organization**

_____– A cell part

**Cell**

_____– A group of specialized cells

_____– Group of tissues that work together

_____– Group of organs that work together

**Word Bank**: viruses tissue organ organ-system organelle The-first-cell

All life functions are the result of the cell activities

All cells come from pre-existing cells.

All organisms are made of one or more cells

basic unit of structure and function in an organism

**IV. Cell Organelles:** These are the tiny cell parts that make up a cell.

**1.** _____

- Controls the cell
- Contains hereditary material (chromosomes, genes, DNA)

**2.** _____

- Fluid/liquid in the cell – mostly water
- Helps transport material

**3.** _____

- Carries out cellular respiration.
- Gives cell energy (Powerhouse of the cell).

4. _____

- Makes proteins from amino acids.

**5.** _____

- Stores food, water and waste
- Food vacuoles may digest large molecules.
- Waste vacuoles may excrete waste out the cell membrane

**6.** _____

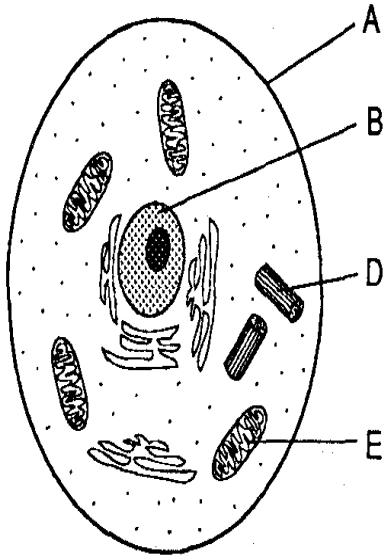
- Carries out **photosynthesis**
- Plant and algae cells only

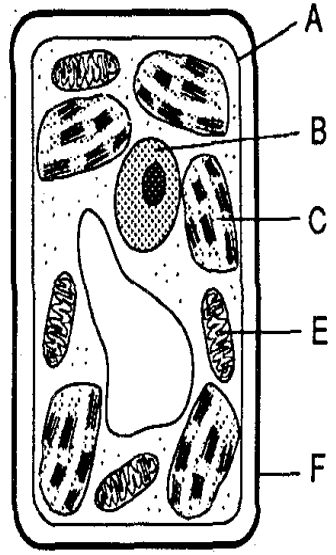
**7.** _____

- Gives shape, structure and protection.
- NEVER found in animal cells.

**8.** _____

- Separates cell interior from environment
- Controls what enters and leaves the cell using_____.
- Has _____that pick up signals from other cells.




Has _____ which are proteins that identify the cell; prevent the cell from being attacked by the immune system.

**Word Bank:** antigens transport chloroplast cell-wall receptor-proteins cell-membrane vacuole ribosome mitochondrion cytoplasm nucleus

## Topic Three: Nutrition, Photosynthesis and Respiration

**Reminder:** All life processes are **chemical activities** which make up your_____.

I. **Nutrition**: Taking in nutrients (_____) for various activities including:
   1. Respiration (_____)
   2. Growth
   3. Repair
   4. _____

A) **Ingestion: _____.**

B) **Digestion**:_____.
   1. Nutrients must be broken down into smaller parts so that they can be _____into the blood and cells of organisms.
      - Starches are digested into_____.
      - Proteins are digested into_____.

**Word Bank:** amino-acids absorbed sugars synthesis taking-in-nutrients metabolism breaking down-nutrients food energy

C) **Autotrophic Nutrition:** Organisms take _____materials (_____, $H_2O$) and convert them into organic nutrients (_____).
   **1.** Auto =_____; troph = _____so Autotroph = _____.
   **2.** _____is most common form of autotrophic nutrition
   3. **Ex:** plants,_____.

D) **Heterotrophic Nutrition:** Organisms must _____nutrients made by other organisms.
   1. Hetero =_____, so Heterotroph =_____.
   2. All _____and _____are heterotrophs.
   3. Includes:
      - _____: consumes animals.
      - _____: consumes plants.

- _____: consumes both.
- _____: breaks down dead matter.

**Word Bank:** other fungi animals consume feeds-on-others self photosynthesis self-feeding glucose simple-organic decomposers $CO_2$ omnivore herbivore carnivore other feeding algae

II. **Photosynthesis:** Process in which sun's energy is trapped in the chemical _____of sugar.

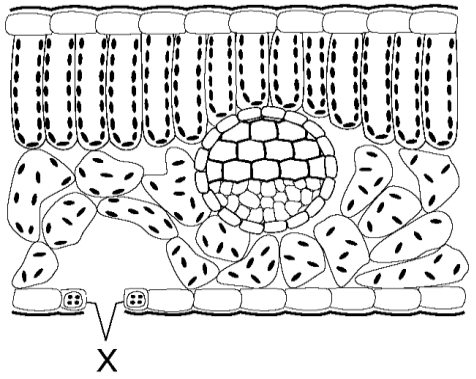
A) Requires_____, **$CO_2$** and **$H_2O$**.

B) Makes _____(**$C_6H_{12}O_6$**) as food.

C) _____and _____are waste products.

D) Benefits:

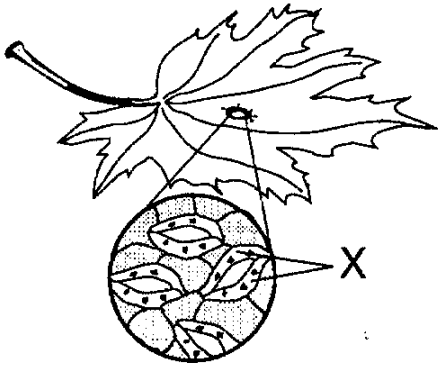
1. Provides _____for all plants, animals and other organisms.
2. Provides oxygen to_____.
3. Removes _____from atmosphere.




E) Plant adaptations:

1. **Chloroplast**: Cell organelle that does_____.
2. Gas exchange:
   - **Stomata :** _____under a leaf; let gases in and out
   - **Guard cells:** open and close stomata to prevent_____.
3. Transport:
   - **Xylem and Phloem:** "tubes" _____food and water throughout the plant.

**Word Bank**: photosynthesis transport dehydration holes oxygen water carbon-dioxide bonds glucose sunlight food stomates




Two different views of the _____and their **guard cells** (X).

III. **Cellular Respiration:** Process that takes _____from sugar molecules and places it in molecules of_____**.**

A) ATP is the _____all life uses for **energy**.

- No organism can get energy from _____or sugar without first putting the energy into ATP.

B) Requires_____, oxygen and water.

C) _____and _____are waste products.

D) Most organisms carry out **aerobic respiration** (uses oxygen) in their_____.

E) **_____respiration** does not require oxygen, but gives less ATP (energy) for each molecule of sugar.

- When exercise causes human muscles to run out of_____, their cells will do **anaerobic respiration**. The waste product, _____, causes muscles to "burn" so that you will **stop**.

**Word Bank**: ATP molecule energy glucose lactic-acid sunlight carbon-dioxide water mitochondria anaerobic

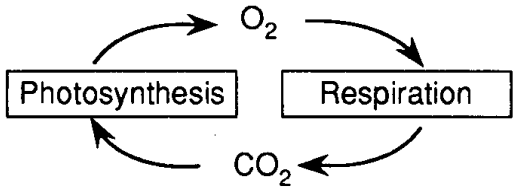
F) **Photosynthesis and Cellular Respiration are _____reactions!** They are also important in _____oxygen, carbon, hydrogen and water through the environment.

_____

_____+ $CO_2$ + $H_2O$ → glucose + $O_2$ + $H_2O$

_____

glucose + $O_2$ + $H_2O$ → $CO_2$ + $H_2O$ + _____




G) **Common mistakes:**

- "Plants use photosynthesis, animals use respiration."
  *<u>All</u> organisms, including plants, use respiration to get their_____.*

- "Respiration is breathing."

*Breathing is **not** respiration. Breathing _____the gases needed for respiration. Inhaling and exhaling does not give you ATP.*

- "Oxygen is used to breathe."
  *This is backwards. Breathing is used to get oxygen which is used for respiration. Without oxygen, you have no_____, no ATP, and no energy.*

- "All living things need oxygen/need to breathe."
  *Anaerobic organisms do not need oxygen, and do not have to_____.*

**Word Bank**: cycling opposite exchanges energy respiration ATP sunlight cellular-respiration photosynthesis breathe

## Topic Four: The Human Body

**I. Organization:** The human body is made up of_____.

A) All humans (and most other organisms) begin life as a _____cell.

1. This single cell is called a_____.
2. The nucleus of this cell has _____the genes needed to become a complete organism.

B) Humans grow as a result of _____cell division).

1. This quickly increases the number of cells in the body until there many _____of cells.
2. Since all new cells come from the same single cell, they all share the same_____.

C) As cells divide, they begin to develop into specialized_____.

1. _____or **Differentiation:** Process in which a cell changes to have a special shape and function.
2. Cells specialize by _____specific genes on or off.
   - Ex: A ___blood cell has turned off all genes needed to make skin, bone, or nerves. It still has those genes, but only the genes _____to be a white blood cell remain turned on.

D) As the body continues to develop, tissues will work together to form_____.

E) Organs will work together to form_____.

F) Org an systems will work together to help a person **maintain_____**.

**Word Bank**: trillions cells single tissues zygote needed white all mitosis specialization genes homeostasis organs turning organ-systems

**II. Nervous System**

A) The nervous system _____your body with electrochemical_____.

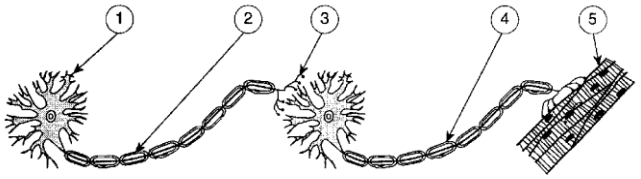
1. The chemical portion of a nerve impulses is called a_____.
2. Neurotransmitters released by 1 nerve cell are received by _____in the cell membrane of the next nerve cell.

3. The _____of the receptor molecule determines which neurotransmitter it can receive.

B) A nerve cell is also called a_____.

C) The main organs of the nervous system are the _____and_____.

D) The **spinal cord** controls _____and relays impulses between the brain and body.



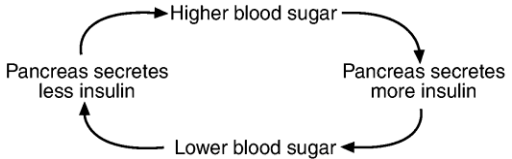

**Two neurons** carry an impulse to a _____cell. (3) shows where a **neurotransmitter** would carry the _____from one cell to the next.

**Word Bank:** shape regulates reflexes impulses neurotransmitter receptor-proteins muscle neuron brain signal spinal-cord

## III. Endocrine System

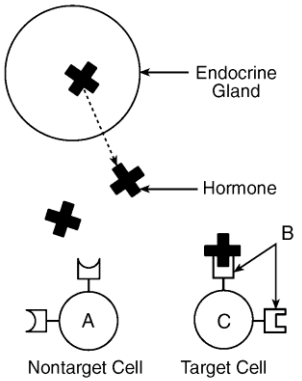
A) Uses **_____**to **regulate** the body.

1. A hormone is a chemical _____secreted by endocrine **glands.**
2. Hormones are slower than nerve impulses, but with _____lasting effects.
3. Hormone levels are controlled by _____**mechanisms**.




**A feedback mechanism**

**Receptor Molecules** in the cell membrane can only accept _____of the correct shape. This is a good example of the **Lock and Key**




4. **_____molecules** on the surface of the cell membrane receive hormones. **As with all proteins, it is the _____of the receptor molecule that determines which hormone it can receive.**

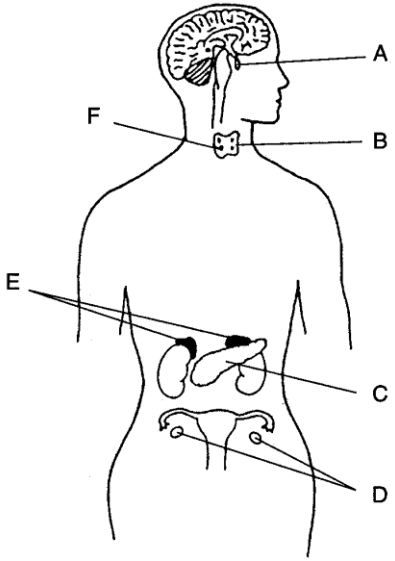
B) The _____makes _____and glucagon which control blood sugar.

- **Common mistake:** "Insulin lowers blood pressure."
  *Insulin (and glucagon) directly control blood _____(or glucose) levels, not blood pressure.*

C) Adrenal glands make _____when the body is under stress.

D) **Testosterone** (male), **estrogen** and **progesterone** (female) are the sex hormones. These are made in the _____(testes for males, ovaries for females).

**Word Bank**: longer hormones feedback messenger receptor shape pancreas gonads insulin adrenaline sugar molecule




**The brain (nervous system) and some endocrine glands.**

## IV. Circulatory System

A) Moves _____through the body to the organs and cells that need them.

B) Transported material includes:

1. _____and _____from **intestines** to all cells of body.
2. _____from lungs to all cells of the body.
3. _____from glands to target cells
4. _____from all cells to the **excretory organs.**

C) Materials usually enter and leave the blood through_____**.**

1. **Diffusion**: Process in which material moves from a ___concentration to a low concentration.
   - **Ex**: There is a high concentration of oxygen in the lungs, so oxygen will diffuse from the lungs into the_____, which has less oxygen.
2. **_____:** Microscopic blood vessels where diffusion occurs.

D) The _____is the pump that drives the circulatory system.

E) _____carry oxygen and carbon dioxide

1. Hemoglobin: _____in red blood cells that carries oxygen.

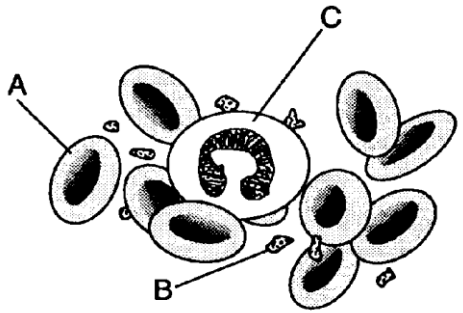
F) _____is the fluid of the blood. It transports everything *except oxygen*.

G) Platelets _____the blood.

H) Common mistakes:

1. "The heart pumps oxygen to the brain."
   *Technically true, but the heart pumps blood (which carries the oxygen)* _____*in your body.*
2. "Oxygen diffuses into and out of the heart."
   *No materials* _____*in or out of the blood when it is in the heart. This* _____*occurs in capillaries.*

**Word Bank**: material nutrients water protein high diffusion oxygen hormones wastes clot capillaries heart blood red-blood-cells everywhere plasma diffuse only white-blood-cells




Red blood cells (A), platelets (B) and _____(C)

**V. Respiratory System:**

A) Breathing provides _____needed for **cellular respiration** (which uses energy from sugar to make_____).

B) Excretes the waste _____which is produced from cellular respiration.

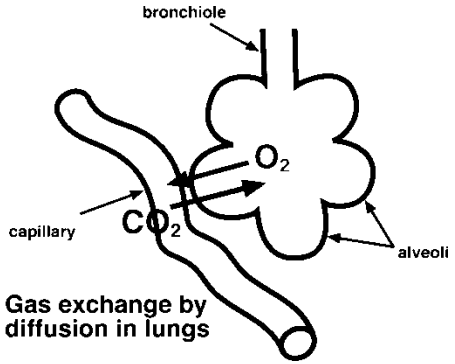
C) The _____is the muscle that allows breathing to occur.

D) You breathe faster when $CO_2$ builds up in the _____(not when you need oxygen).

E) The _____**a**re microscopic sacs where oxygen enters the blood and $CO_2$ leaves the blood.

1. The alveoli are surrounded by _____which pick up oxygen and drop off $CO_2$.

**Word Bank**: diaphragm capillaries oxygen ATP alveoli blood $CO_2$



**Gas exchange by diffusion in lungs**

**VI. Digestive System:**

A) Food is _____down so that it is small enough to enter the body tissues/cells.

**1.** Food is broken down mechanically and_____.

**2.** Nutrients and water are _____into the body in the small and large intestines.

B) The digestive system is a one way _____through the body that includes the **mouth**, **stomach** and **intestines**.

C) Food is moved through the digestive system by muscular contractions (_____).

D) Undigested food is _____as solid waste (**feces**).

E) Common mistakes:

1. "The digestive system excretes waste."
   *The digestive system does not excrete waster (see excretory system)*.
2. "The digestive system gives you energy."
   *The digestive system gives_____. Energy is gained by cellular respiration.*

**Word Bank:** passage chemically nutrients absorbed peristalsis broken eliminated excretes

**VII. Excretory System:**

A) Removes waste produced by the _____of your body.
   1. These wastes include _____,_____,_____ and_____.

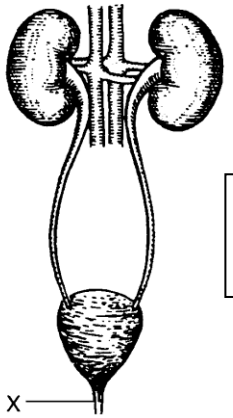
B) **Lungs** excrete _____and_____.

C) The **skin** excretes _____and _____as sweat.

D) The **kidneys** excrete _____and _____and other substances as urine.
   1. _____also control the amount of water in your body.

E) **The _____filters toxins and dead red blood cells from the blood.**

F) Common mistake:
   1. "The body excretes feces."
      *Feces never enters cells of the body, so technically it is not excreted. The correct term is "_____" or "egested."*




**Kidneys and Urinary Tract** - part of the human excretory system.

**Word Bank**: cells salt (2) water (4) urea (2) liver $CO_2$ (2) kidney eliminated excretory

**VIII. Immune System**

A) The job of the immune system is to protect the body against_____.

B) **Pathogen:** _____.
   1. Types of pathogens include viruses, bacteria, and_____.

C) **_____Blood Cells** are the main components of the immune system.
   1. Different w.b.c's have different roles, including:
      - _____pathogens.
      - "____" pathogens for destruction by other wbc's.
      - Destroy pathogen by _____it.
      - Destroy pathogen using_____.
      - Make_____.

D) **Antibodies** are _____made by white blood cells to attack pathogens.
   1. Every antibody is specific in its_____– it can attack one and only one _____of pathogen. As with all proteins, this is because the shape of the antibody must fit its _____(lock and key model).

**Word Bank**: parasites identify pathogens disease-causing-organism tag white chemicals proteins eating antibodies action type target

E) **Antigens** are protein "_____" that identify a cell or virus.

1. Your blood type is determined by your _____(you can have A or B antigens, both or nether (type O).
2. Any cell of virus with the wrong antigen will be seen as _____by your immune system, attacked, and destroyed. This is why you must match blood types before receiving blood or an organ_____.

F) **A _____is an injection of a dead or weakened pathogen.**

1. Triggers the body to make antibodies _____that pathogen.
2. Effective against both _____and bacteria.
3. Can only _____disease, not cure it.

G) _____are drugs used to stop infections by **bacteria**.

1. Antibiotics will not _____against viruses.
2. Unlike vaccines, antibiotics can _____diseases.

H) **Common mistake:**

1. "Antibodies are cells that attack pathogens." *Antibodies are_____, not cells.*

**Word Bank**: tags vaccine foreign antibiotics antigens transplant prevent cure against viruses work proteins

**IX. Interactions between body systems**

A) The different systems of the body work together to maintain homeostasis. For example:

1. *Nutrients from the _____system are transported to cells by the _____system.*
2. *Wastes from the _____system are removed by the _____system.*
3. *The _____and _____systems work together to control the body.*
4. *The _____system protects the _____system from disease.*

**Word Bank**: respiratory immune nervous (2) endocrine excretory circulatory digestive

## X. Diseases and Disorders

A) Typically the exam asks you to name a disease, what _____it, its effect on the_____, and how to prevent/treat/cure it. The most important diseases and disorders for you to know are:

### 1. AIDS

- Caused by the _____virus (a pathogen)
- Weakens human immune system, leaving body _____to other diseases.
- Spread through bodily_____, usually sexual contact, intravenous (IV) drug use (sharing needles), or blood_____.
- Can't be cured, but spread may be _____by sexual abstinence, "safe" sex (using condoms), not sharing needles, or _____blood before using it for a transfusion.

**Word Bank**: HIV transfusions causes prevented vulnerable fluids testing body

### 2. Cancer

- Caused when a cell reproduces (divides) at an _____rate, forming a **tumor**.
- Cancer cells **do not specialize** and take _____from healthy tissue.
- May be caused by_____, chemicals (such as asbestos or cigarette smoke), and viruses.
- Treatments include surgery, radiation therapy, and_____.

### 3. Diabetes

- Affects body's ability to control blood_____.
- Some diabetics may be treated using injections of _____made by genetically engineered bacteria.

### 4. Allergies

- Occur when the immune system _____to a harmless substance (such as pollen)
- _____is a form of allergy caused by a reaction to dust particles in the air.

**Word Bank**: radiation sugar chemotherapy insulin uncontrolled resources reacts asthma

## Topic Five: Reproduction

**I. Asexual reproduction:**

A) Advantages: _____

B) Disadvantage: _____

**II. Sexual reproduction:**

A) Advantage: _____

B) Disadvantage: _____

**Word Bank**: slower-harder-risker no-variety faster-easier-safer variety

**III. Mitosis**

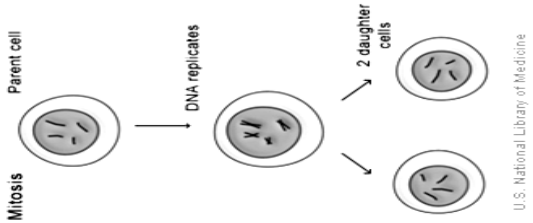
A) Used in all forms of _____ reproduction.

B) The number and types of chromosomes in the daughter cells are _____ as in the parent cell.

C) Large organisms use mitosis for _____and _____. Simple organisms use it to _____.

D) One division of a cell → two identical, _____ (2n) cells.

1. Diploid: Cell with a _____ sets of chromosomes.




**Mitosis vs. Meiosis.** Notice the number of _____ stays the same in mitosis, and is halved in meiosis.

**IV. Meiosis**

A) Makes _____ used in sexual reproduction.

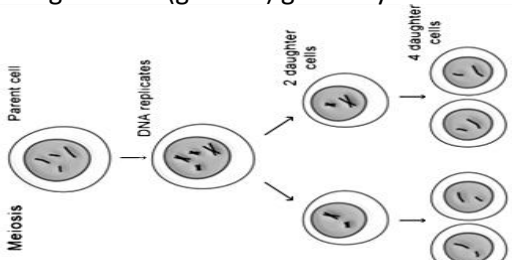
1. Gamete: _____ cells; egg and sperm

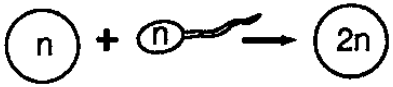
B) One cell divides *twice* → four DIFFERENT _____ (1n) cells.

1. Haploid: Cell with _____ set of chromosomes ( ½ normal)

C) Separates pairs of chromosomes so that offspring get _____ chromosome of each pair from that parent.

D) Each daughter cell (gamete) gets only one half of the chromosomes of the "_____" cell.



**Word Bank**: two the-same healing growth gametes one asexual one reproduce diploid sex haploid parent chromosomes

**V. Male Reproductive System**

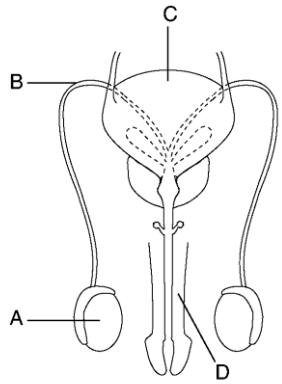
A) Testes produce and _____ sperm.
   1. Sperm are haploid cells made by _____
   2. Sperm are produced in large numbers throughout a males _____.
   3. Sperm are _____ than the egg and mobile
   4. Sperm only provide offspring with 23 chromosomes – everything else is in the _____.

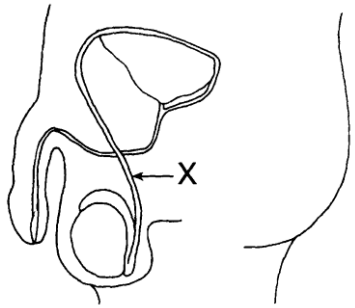
B) Testosterone is the male sex hormone, and is made in the _____.

C) Penis transfers _____ into the female reproductive system.

D) Semen is the _____ that carries sperm.
   1. Semen contains sugar to give sperm _____.

**Word Bank**: testes meiosis store egg fluid energy smaller life sperm




**VI. Female Reproductive System**

A) _____ produce eggs.
   1. Eggs are haploid cells made by _____.
   2. Females are born with all eggs they will ever _____.
      - An egg is not fully developed until _____.
      - Females are born with _____ of eggs, enough for several lifetimes.
   3. Eggs are largest _____ in the body.
   4. Eggs do not _____on their own.
   5. Contain 23 chromosomes and all cell parts (mitochondria, ribosomes, etc.) that the offspring will need to _____ and develop.

B) The _____ cycle lasts 28 days (on average)
   1. Ovulation – _____ of an egg (typically 1 per cycle)
   2. Menstruation – _____ of the uterine wall if fertilization doesn't occur
   3. If pregnancy occurs, the menstrual cycle will temporarily _____.

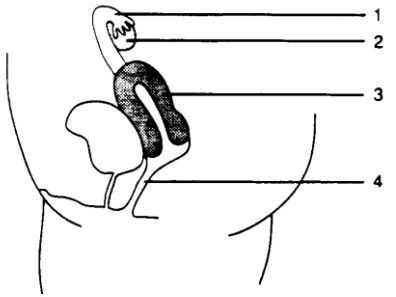
C) The _____ carries the egg to the uterus.
D) The _____ is the womb where the baby will develop.
E) The vagina is the _____ canal where the baby will leave the body.

**Word Bank**: millions need meiosis ovulation ovaries uterus release fallopian-tubes move cells grow menstrual shedding stop birth

**VII. Development**

A) Fertilization occurs in the _____.
   1. A fertilized egg is called a _____.
   2. Fertilization _____ the complete set of chromosomes, so the zygote is diploid (23 from the egg + 23 from the sperm = _____).

B) A zygote _____ in the following order:
   1. Cleavage – A form of _____; cells divide but do not differentiate
   2. Differentiation – Cells begin to form into tissues and _____.
   3. _____
   4. _____– most major organs are formed (but not completed)
      - Continues to grow through cell _____ (mitosis)



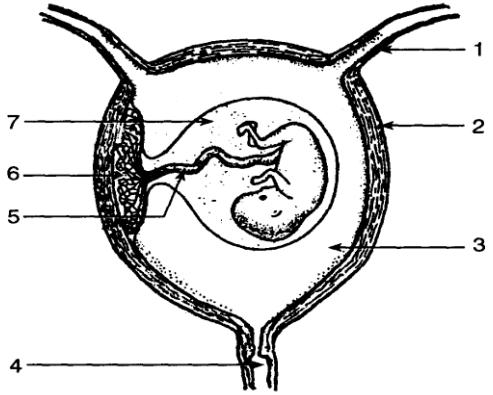

C) The_____ transfers nutrients and oxygen from the mother's blood into the blood of the fetus through the process of _____.
   1. The _____ of the mother and fetus do not mix.
   2. The fetus is attached to the placenta by the _____.
   3. Waste produced by the fetus is also _____ by the placenta.
      - Waste ($CO_2$, urea, salts) _____ from placenta into mother's blood.
      - Since the fetus does not eat solid food, it does not have to eliminate _____.

D) The child is vulnerable to alcohol, drugs, etc. because organs and systems are still _____.

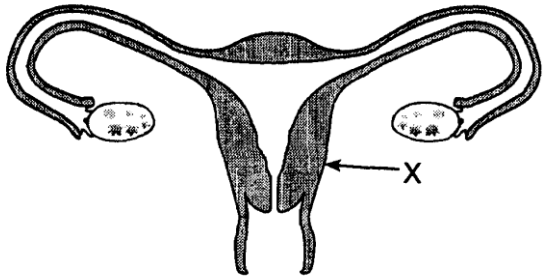
**Word Bank**: restores fallopian-tube 46 zygote mitosis embryo fetus placenta organs diffusion umbilical-cord

division blood removed *diffuse* feces developing
born correct process

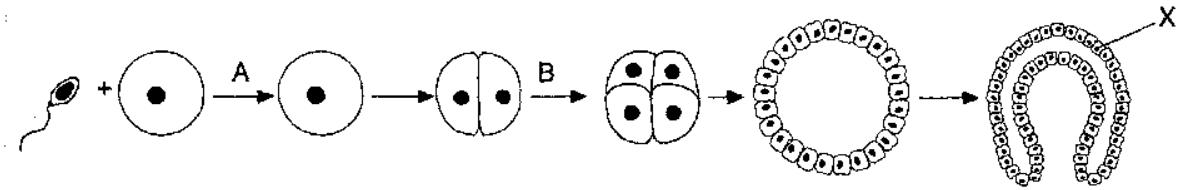
**Late Development** – The fetus pictured here is nearly ready to be _____. Note the umbilical cord, placenta and amniotic sac.




**Fertilization** restores the _____number of chromosomes.




**Early development –** Fertilization (A) forms a single celled **zygote** which then begins the process of **cleavage (B)** which will eventually create a layered ball of cells that will form the embryo.



## Topic Six: Genetics

**I. Chromosomes:**

A) Humans have _____ chromosomes, or _____ homologous pairs.
   1. **Homologous:** Chromosomes with the _____ genes, size and shape.

B) **Chromosome pairs** carry genes for the same _____.
   1. Most organisms have _____ genes for each trait - 1 from each parent, 1 on each member of the homologous pair.

C) **Sex chromosomes –** In humans, females are _____ and males are _____.
   1. The Y chromosome is much _____ than the X, so it is missing many genes. This means many genes on the X chromosome do not have a "_____" so:
      - If a male has a recessive trait on the X chromosome, the Y chromosome will not be able to "_____" it with a dominant gene, so...
      - This makes _____ more likely to have some traits (like color blindness). These are called **sex _____ traits.**

D) **Common mistake**: "Humans have 23 _____ (or 46 pairs of chromosomes, or some other incorrect number)."
   *These numbers are often confused. You must memorize them correctly.*

**Word Bank**

46 same traits XY smaller hide partner 23
linked two XX males chromosomes

**II. Chromosomes and Genes**

A) Each chromosome has hundreds or thousands of _____.

B) **Each gene codes for a particular _____.**
   1. **Common mistake:** "Genes/DNA are made from protein."
      *Genes carry the instructions to make protein. The genes themselves are made from* _____.
   2. While genes determine our traits, **the _____ can affect expression of genes.**

**Word Bank**: genes protein nucleic-acids environment

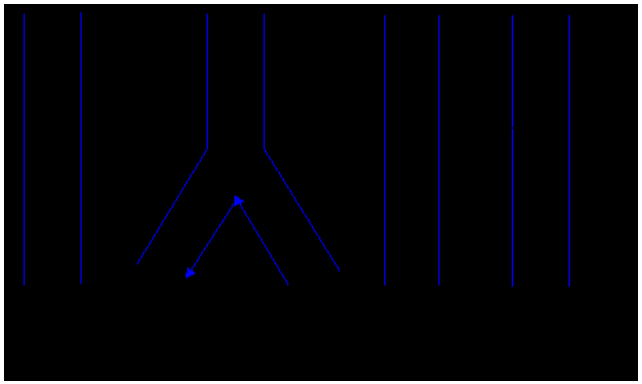
**III. DNA**

A) DNA is the chemical that makes up your _____ and chromosomes.
   1. Analogy: If your genes and chromosomes are the "instruction manual" for your body, DNA would be the paper it is _____ on.

B) The shape of a DNA molecule is a_____, which resembles a twisted ladder.

C) The shape of DNA allows it to _____ (copy) itself almost perfectly.

D) DNA is made of 4 bases: _____.
   1. The DNA to DNA base pairs are: _____ and _____
      - The DNA to RNA base pairs are _____ and _____



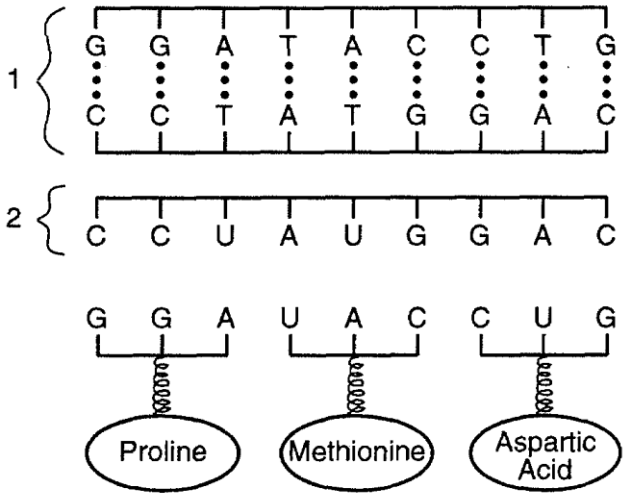
**Word Bank**

C-G double-helix A-T genes A-U replicate A-T-C-G C-G printed

**IV. Protein Synthesis**: This is how genes _____ your body:

A) A _____ is a sequence of **amino-acid bases** in DNA**.**
   - Each codon represents a specific **amino acid**.
   - _____ assemble amino acids in the same order that they are listed in the DNA codons.
   - The amino acids will make a _____.
   - The _____ of the amino acids (determined by the DNA sequence) determines the shape of the protein.
   - The shape of a protein _____ its function.
   - Therefore: The sequence of bases in DNA will determine the _____ of all the proteins in the body.
   - The proteins build and run the body.

B) _____ carries the genetic code to **ribosomes**.




**Word Bank**

ribosomes function amino-acid protein control three RNA shape bases shape determines codon order

The order of DNA _____ in your genes determines the order of _____ in your proteins, which determines the protein's _____ and function.

**Therefore: How your body functions depends on the order of the bases in your genes!**

V. **Mutations:** Any _____ in an organism's genetic material.

A) Can only be passed on if they occur in _____ cells (sperm or egg).

B) Common **_____ agents** include radiation, chemicals and viruses.

1. Mutagenic agent: Any _____ factor that causes mutations.

C) **Gene mutations** may cause a change in a gene which can change the _____ of a _____. This will have an _____ on the way the protein works (if it still works at all).

1. Gene mutations are caused when DNA bases are in some way _____.

D) **Chromosome mutations** are usually caused when a person _____ too many or too few chromosomes.

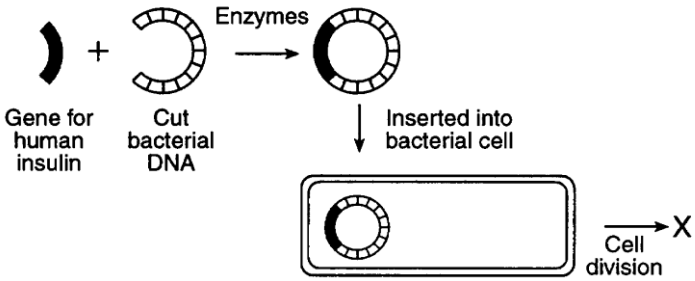
1. Chromosome mutations affect many genes at once. Most are _____.
2. **Down's Syndrome**: Non lethal mutation, caused by inheritance of an ____ copy of chromosome 21. (Note – only chromosome 21 can cause Down Syndrome).

**Word Bank**

change shape environmental inherits effect protein reproductive changed mutagenic extra lethal

VI. **Genetic technology:**

A) **Selective breeding**: Controls the breeding of animals or plants to produce offspring with _____ traits.
Ex: Dogs are **selectively bred** for temperament and a variety of _____ traits (coat type, color, size).




B) **Genetic engineering:** "_____" a gene from one organism and "pastes" it into the DNA of a new organism.

1. _____are used to cut and paste the DNA segments.
2. Organism that receives the new gene will begin to make the _____, _____ or hormone coded for by that gene.

**Word Bank**

desirable protein cuts enzyme appearance restriction-enzymes

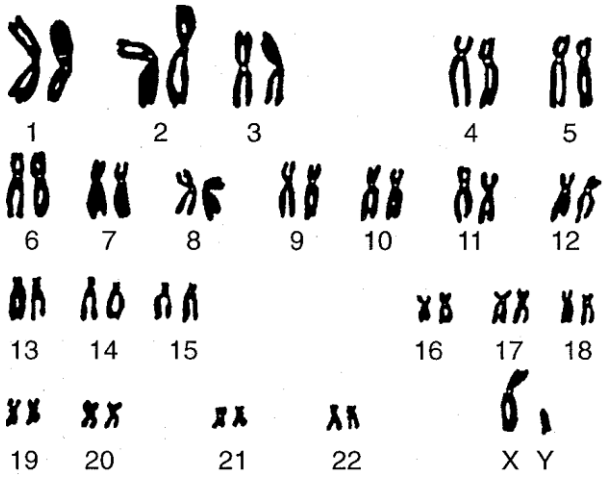
3. The new protein/enzyme/hormone will be exactly the same as the one produced by the _____ organism.
4. _____are often used because they are simple and reproduce quickly.
5. The example of gene splicing you MUST know:
   - **Bacteria have been engineered to make _____ for diabetics.**
   - **Bacteria have been engineered to make _____.**
   - In both cases the _____ hormones are safe to use because they are identical to normal human hormones.

**Word Bank**

original engineered bacteria insulin growth-hormone

C) New technologies (**karyotyping, DNA fingerprinting**) are making it easier to diagnose and treat genetic _____, though we cannot yet cure them.
   1. **_____:** A photograph of an organism's chromosomes.
      - Can determine if a person has a chromosome ____ such as Down Syndrome.
   2. **DNA _____**, or gel electrophoresis, creates banded patterns based on a person's DNA base sequence.
      - Each fingerprint is unique, so it can be used to _____ people.
      - Fingerprints of relatives are similar to each other, so can be used to determine genetic _____ between two people, or even two groups of organisms.

D) Genetic research has posed many _____ problems (ie right and wrong) that science alone cannot answer.
   1. Ethics: Study of what is _____ right or wrong.




**A karyotype** shows all 23 pairs of human chromosomes. Note the last pair identifies this as a male.

**Word Bank**

disease karyotype disorder fingerprinting identify
relationships morally ethical

## Topic Seven: Evolution

**I. Evolution**:

_____

**II. Modern Theory of Evolution:**

**A) Charles Darwin:**

1. Was not the first to think of _____, but he did figure out how it works (mostly).
2. Darwin didn't know about _____, so he couldn't know about mutations.

**B)** The _____ theory (which combines Darwin's ideas with genetics and other new ideas) contains the following ideas:

1. Earth is old (4.55 billion years) and is constantly _____.
2. As the environment changes, evolution causes species to _____ to their environment.
3. _____ is the **mechanism** that causes species to change.
4. **Common Descent:** Modern species evolved from _____, different species and share a _____ **ancestor**.
5. Species that can not adapt become _____.
6. New traits arise in a species from _____ and _____.

**Word Bank**

genes changing common evolution adapt

modern earlier natural-selection extinct mutations

gene-recombination

**III. Environment and Evolution**: Species usually _____ when the environment changes.

**A)** Changes need to be long term – species do not evolve because of changes in the _____.

**B)** Changes can include:

1. Climate change
2. Change in temp
3. Change in _____ availability
4. Change in _____ availability
5. Introduction of _____ species (new food, new predator)
6. Species may be moved to a new _____ (accidentally taken to an island for example)

**C)** Environmental change **DOES NOT CAUSE** _____ to occur. A temperature or climate change does not itself force a species to change its _____ characteristics.
1. If this were the case, then all _____ would be able to _____ to the new environment, and _____ would be a very rare event.

**Word Bank**

season evolve inherited location evolution water
food adapt new species extinction

**IV. Natural Selection:** The basic steps in natural selection are:

**A)** _____: Members of a species are different from each other due to _____ and sexual reproduction.
1. No variation = no evolution or natural selection, as there is nothing to "_____."
   - Species with no variation are usually the first to _____ when the environment changes.

**B)** _____: Too many offspring are produced.

**C)** _____: Offspring must struggle to survive and reproduce.

**Word Bank**

die mutations select variation overproduction competition

**D)** _____:

1. Offspring who inherited "fit" traits are, on average, better able to get _____, escape from predators and find mates.
2. Offspring with "unfit" traits will have more difficulty _____ and finding mates.
3. **Fitness:** A _____ of how well a trait helps an organism to survive and reproduce in its environment. Note that there is no absolute rule for fitness – what is fit in one environment may be _____ in another.
4. **Note:** This "selection" is not a conscious act – no one is "choosing" who survives and who doesn't. It is the result of the conditions of the organism's _____.

**Word Bank**

unfit survival-of-the-fittest environment surviving resources measure

**E)** _____:

1. More ____ organisms reproduce and pass on their genes than unfit organisms.
2. On average, the next generation will have more traits from the "fit" parents than the _____ ones.
3. NOTE: Traits are still inherited _____. Individuals offspring of "fit" parents can still _____ "unfit" traits (though it will be unlikely to survive and reproduce). It is only by looking at the ENTIRE population that you will see the "fit" traits become more _____.

**F)** _____: Evolution does not happen overnight. It takes many generations of _____ selection to weed out the unfit traits.

**Word Bank**

reproduction randomly inherit repetition fit
unfit common repetitive

**V. Speciation:** The process of making a new species from an _____ one.

A) **_____ Isolation**: A population is separated into 2 or more different habitats.
B) **New _____ and adaptation:** Each population adapts to its new environment in different ways. This results in physical and _____ differences between the two populations.
C) **Add time:** The longer two populations are _____, the greater their differences will become.
D) **_____ Isolation:** Eventually the populations change so much that they are unable to interbreed, even when brought together.
    1. **Once two populations can no longer _____ together, they are considered new species.**

**Word Bank**

genetic reproductive breed apart geographic variation existing

**VI. Classification**- Organisms are classified based on their _____ relationship.
    a. _____ are large groups of related organisms (fungi, bacteria, protists, animals, plants).
    b. A **species** is able to successfully _____ amongst its members.
        i. Note that this is not a perfect definition – Lions and tigers can breed together, as can dogs and wolves. Because evolution is a constantly ongoing and a _____ process, there are many, many examples in which the lines between _____ are blurry (see Ring Species)
    c. Branching _____ diagrams (cladograms) are often used to show evolutionary relationships.

**Word Bank**

reproduce kingdoms tree evolutionary species gradual relationships

**VI. Evidence:** Evidence in _____ of evolution comes from many fields:

a. **_____ record** preserves extinct species as well as transitional forms between different types of organisms.
b. **Radiometric _____** of rocks consistently confirm the age of the Earth and fossils
c. Comparisons of the _____ (physical structures), embryology (development), chemistry and genes of species confirm expected _____.
d. **Direct observation**: Humans have seen evolution occur both in _____ and in the lab. Examples include:
    i. **Bacteria** evolving _____ to antibiotics.
    ii. **Insects** evolving resistance to _____.
    iii. Modeling natural selection with _____ breeding to alter a species' traits.
    iv. _____ examples of speciation

**Word Bank**

| | | | | |
|---|---|---|---|---|
| anatomy | support | relationships | dating | fossil |
| nature | resistance | pesticides | selective | observed |

**II. Common Mistakes**

A) "Stronger organisms are more _____ than weak ones."
*Evolutionary fitness is not _____ fitness. Fitness is determined by who is better _____ to survive in a particular environment and who can pass on their _____. Stronger is not always _____. There are many examples of species for whom it is better to be slow, _____, or stupid, than fast, strong or smart. It all depends on the _____ you are in.*

B) "The organism evolved to live in its environment."
*Individual organisms do not _____. Only _____ can evolve.*

C) "The organism could not adapt and it went extinct."

*Individual organisms die; they cannot go _____. Only _____ can become extinct.*

**Word Bank**

| | | | | | |
|---|---|---|---|---|---|
| adapted | weak | fit | genes | physical | better |
| environment | evolve | populations | extinct | species | |

A) "The bacteria became resistant to antibiotics when they were exposed to them"
*To evolve, _____ must exist in a species BEFORE the _____ changes (pre-adaptation). Bacteria who did not already have a _____ to antibiotics would die when exposed to them, a Chihuahua who is left out in the cold will not grow _____, warm fur and a squirrel who plays in traffic will not evolve _____ resistance.*

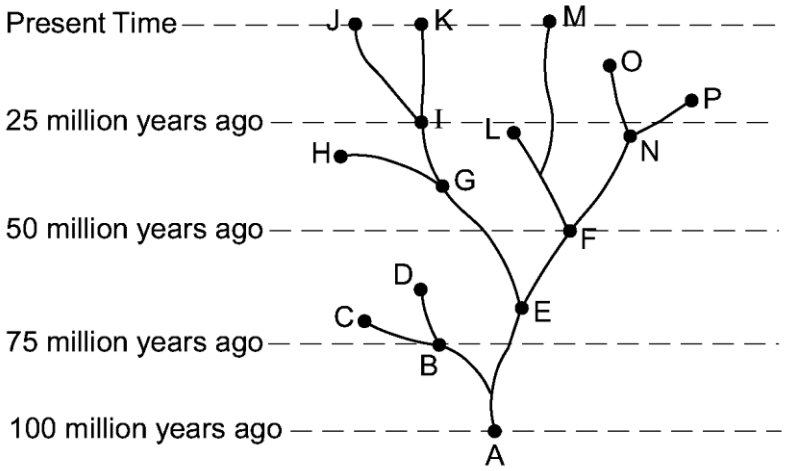
B) "Giraffes got long necks because they _____ them to eat leaves at the tops of trees." *Species do not _____ traits because they need them - Life would be much better if we could! _____ necked giraffes were never given long necks any more than slower antelopes are given _____ when confronted by a predator. The reason there are no short necked giraffes (or slow antelope) is that they were out _____ by members of their species with more _____ traits. Better answers are*

- "Giraffes evolved long necks because the ones with longer necks were better _____ to get food than short neck giraffes."
- "Giraffes evolved long necks because more short necked giraffes _____, and more long neck giraffes lived and _____."

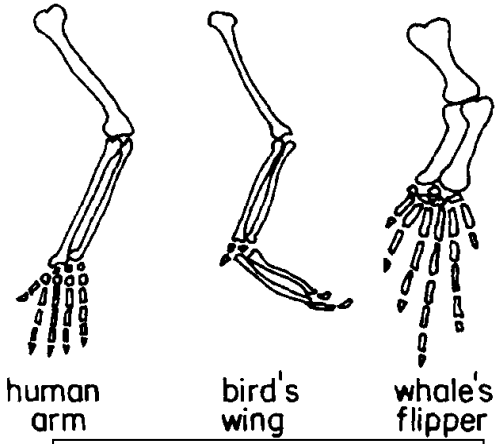
**Word Bank**

| | | | | |
|---|---|---|---|---|
| long | environment | variations | resistance | automobile |
| speed | needed | evolve | short | competed |
| reproduced | fit | adapted | died | |

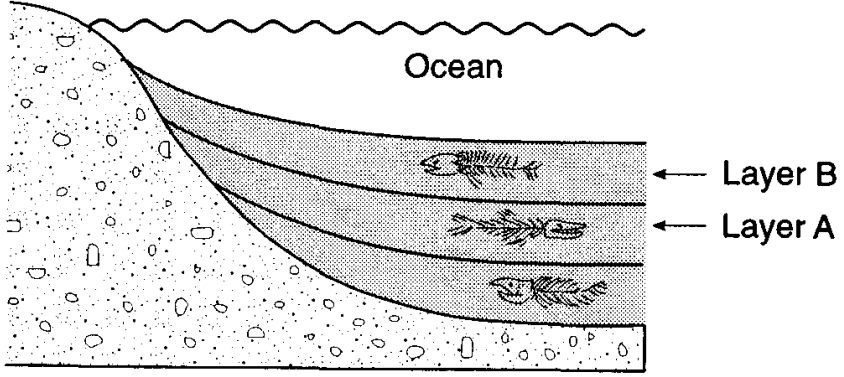
I.



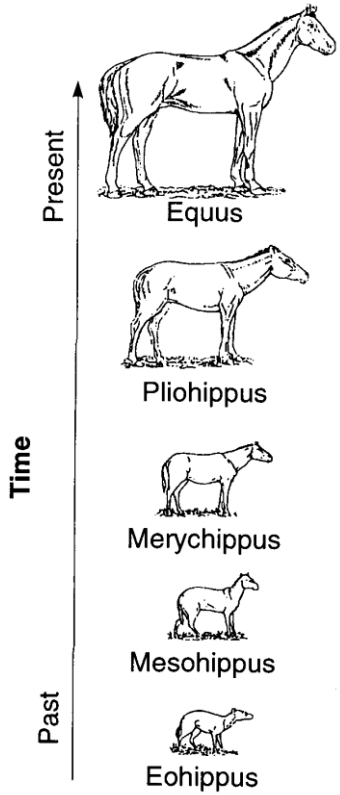

**Evolutionary trees** can show the relationship between living and extinct species.




**Homologous Structures** reveal that the same body parts can be modified to perform different functions.




Deeper fossils are typically older than those above them.




**Transitional forms** for many species can be found in the fossil record. This diagram shows the evolution of the modern horse from a small, many-toed ancestor.

## Topic Eight: Ecology

**Ecology:** Study of organisms and their _____.

A) **Habitat:** Where an organism _____.

B) **Niche:** What an organism _____ and how it gets nutrients.

1. **Two species in an ecosystem trying to fill the same niche will create** _____, which usually results in only one species _____ a niche at any one time. Organisms with similar needs will often _____ resources to reduce competition (ex: birds eat insects during the day, bats eat _____ at night).

**Word Bank**

competition does divide lives insects occupying environment

C) **How organisms _____ with each other:**

1. Competition: occurs when two or more organisms _____ the same resource.
   Ex: A squirrel and a chipmunk _____ for food.
2. Feeding: One organism _____ on another.
   - _____ – An autotroph; organisms that makes its own nutrients from simple substances.
   - Consumer – A _____; may be an herbivore, carnivore, omnivore or decomposer.
3. _____: A close relationship between two organisms in which at least one benefits.
   - Can include 2 organisms working together for _____ benefit (bee and flower) or 1 organism harming another (parasite-host).

**Word Bank**

feeds mutual interact compete symbiosis producer need heterotroph

**II. Organization**

A) Abiotic Factors are _____ things.

B) Biotic Factors are _____ things.

C) Levels of organization:

Population – one _____ in an area.

Community – _____ species in an area.

Ecosystem – All species and _____ factors in an area.

Biome – Similar _____ (desserts, rain forests, etc.)

Biosphere – All of _____ecosystems.

**Word Bank**

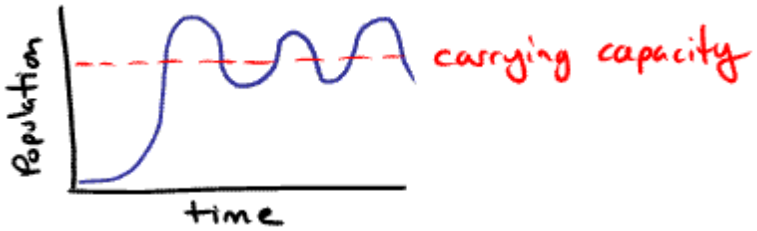
species living ecosystems all abiotic non-living Earth's

**III. Populations**: A given area can only supply enough _____ for a limited number of organisms.

A) Carrying capacity: _____ population that an ecosystem can support.

B) Limiting factors: Anything which limits the _____ of a population, including: food, water, sunlight, soil, predators and disease.

C) _____: When a population exceeds the carrying capacity. Usually results in a large number of organisms dying off until a new balance is _____. This fluctuation in population is an example of dynamic _____.




**Word Bank**

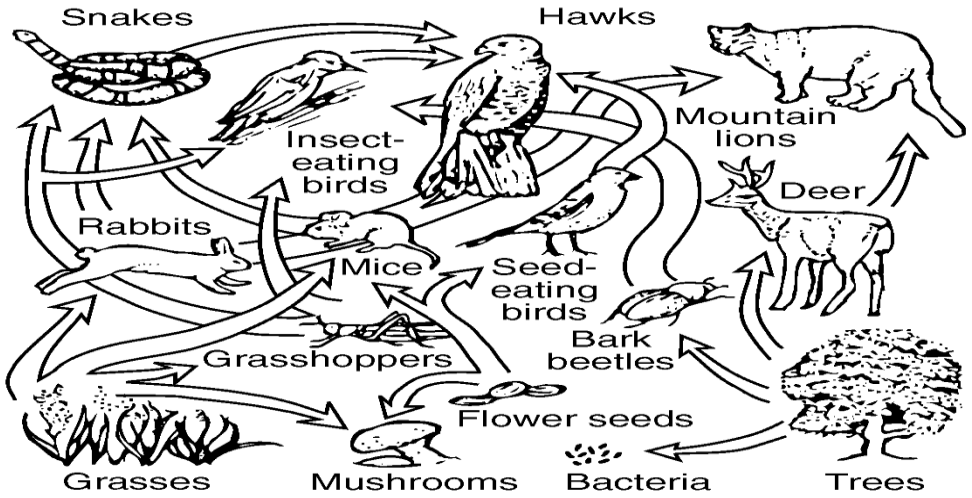
size resources equilibrium largest reached overpopulation

## IV. Energy in an Ecosystem

A) Sunlight provides all _____ for life on Earth.

B) Sun's energy is stored in the chemical bonds of food through the process of _____.

C) Food chain – Shows 1 way that energy can "_____" through an ecosystem.




D) Food web – Shows many _____ pathways.

**Word Bank**

many energy flow photosynthesis

E) Energy pyramid: Shows that energy gets _____ with each step in a food chain

1. Energy is lost because every organism uses some of the energy for it's own life _____. Only about 10% of energy is _____ from one step to the next.
2. This is why populations of _____ are typically less than the populations of their prey.


**Word Bank**

processes predators lost passed

V. **Biodiversity** refers to the variety of _____ on earth.

A) **_____ ecosystems** (those with many types of species) are more stable than ones that are not diverse.

B) As habitats are lost and species become _____, biodiversity is reduced. This is considered to be bad because:

1. Ecosystems with low diversity are less _____ than ecosystems with more diversity,
2. Ecosystems with low diversity take longer to recover from environmental _____.
3. Humans use organisms for many things such as _____ and medicine; by reducing _____ we are losing potentially valuable resources.

**Word Bank**

diverse life changes biodiversity food stable extinct

VI. **Ecological Succession**: Process in which existing communities are gradually replaced by a series of _____ communities.

A) The organisms in each _____ of succession change the environment, and allow new organisms to move in and replace them.

B) **Climax Community**: _____ stage of succession.

1. The climax community is determined by the _____ climate.
   - Ex: Kansas has very fertile soil, but not enough rain to support trees, so succession _____ with grasses and shrubs.

C) Any temporary _____ of a community will begin the process of succession all over again.

- Ex: If a forest fire _____ all the trees in an area, succession will eventually return the area back into a forest, but it much first pass through all the _____ stages.

**Word Bank**

kills local necessary disruption stops stage new final

**VII. Human Impact**: Human _____ can have both a negative or positive impact on the environment.

A) **The primary reason humans have a _____ impact on the environment is because the human population is growing, which places a greater demand on _____ such as food, water and space.**

B) **There are no easy solutions to any ecological _____. Every _____ can have negative consequences. Choosing the "right" actions requires weighing the _____ with the risks.**

C) _____ actions that generally have a negative impact on the environment include:

1. Development/_____
2. Pollution
3. Farming
4. _____/overgrazing
5. Clear cutting/_____
6. Introduction of _____ species

**Word Bank**

negative industrialization solution resources deforestation actions benefits problem human overhunting foreign

D) **Actions being taken by humans to reduce or repair _____ to the environment include:**

1. Recycling _____
2. Conserving _____ resources
3. Using _____ resources (ex: solar over fossil fuels)
4. _____ of habitats and endangered species
5. Use of biological controls instead of pesticides and _____
6. Farming native plants (ex: cocoa in the rainforest)

7. Planting _____ to replace those cut down.
8. Rotating crops or planting cover crops to reduce soil _____.
9. Passing _____ to control pollution, land management, hunting, fishing, etc.

**Word Bank**

available trees loss damage protection wastes cleaner herbicides laws

**VIII. Specific Environmental Problems:**

A) Acid rain

1. **Cause**: Burning fossil fuels which emit _____ and $SO_2$ which react with water to form acid.
2. **Negative effect**: _____ of soil and water which kills plants and wildlife.
3. **What can be done**: Reduce use of _____ fuels. Use air scrubbers to reduce _____. Use _____ to neutralize acid. _____ have a pH level between 0 and near 7. Bases have a pH level from near 8 to 14. A pH of 7 is _____.

**Word Bank** acidification fossil $NO_2$ acids emissions buffers neutral bases

B) Depletion of ozone layer

1. **Cause**: Using CFC's in coolants and _____ sprays.
2. **Negative effect**: Increases skin _____.
3. **What can be done**: _____ using CFCs.

C) Industrialization

1. **Cause**: Change from agriculture to factory or _____.

2. **Negative effect**: Increased _____. Uses more land and _____.

3. **What can be done**: _____ to regulate pollution, recycling, set aside land for preservation and state and national _____.

**Word Bank**

stop resources aerosol parks pollution industry cancer laws

D) Loss of habitat (ex: _____)

1. **Cause**: Industrialization, farming and housing

2. **Negative effect**: Species lose habitat which is a loss of biodiversity and possible _____. This may disrupt the food chain and ecosystems.

3. **What can be done**: _____ the development of industries. Preserve the _____ and national parks.

E) Loss of bio diversity

1. **Cause**: _____ loss, overhunting/harvesting, pollution, climate change and introduction of new species.

2. **Negative effect**: Extinction. Ecosystems become less _____. Potential loss of valuable _____.

3. **What can be done**: Regulate hunting / fishing / _____. Endangered species act _____ endangered species. Breeding programs to increase _____.

**Word Bank:** habitat resources stable protects population extinction regulate land collecting deforestation

F) Global warming
1. **Cause**: Greenhouse gas _____ ($CO_2$) from fossil fuels.

2. **Negative effect**: May lead to habitat loss, loss of biodiversity, extinction and climate _____.

3. **What can be done**: Reduce emissions. Use _____ fuels and alternative energy. _____ energy. Plant trees. Use new _____.

G) Introduced _____
1. **Cause**: _____ species brought to new ecosystems by human travel and trade.

2. **Negative effect**: Alien species can out compete _____ species. Reduces biodiversity.

3. **What can be done**: Use biological controls to _____ species or limit population. Control trade and sale of _____ plants and animals. Screen cargo ships, planes, etc. for "_____."

**Word Bank:** technology emissions conserve change species native exotic cleaner remove foreign hitchhikers

## Topic Nine: Experiments and Graphing

**I. Terms:**

A) **_____:** What is seen or measured.

B) **_____:** A conclusion based on observation or evidence.

C) **Hypothesis:** A _____based on available evidence. A good hypothesis states both cause and _____.

1. A correct hypothesis can be _____and **falsified** (proven incorrect) using an **experiment**.

2. The easiest way to write a correct hypothesis is as an **"_____"** statement. (ex: If I give patients this pill, then they will not get sick.)

D) **Theory:** An _____of natural events that is supported by strong evidence.

1. Theories tie together many scientific facts, hypotheses and _____.

2. **Common Mistake:** "Theories are things that are _____, or are not proven." *This is an incorrect use of the word "theory" in a scientific _____. A scientific theory is **not** a simple _____or conjecture, and **is** strongly supported by_____.*

**Word Bank**

effect explanation inference tested evidence if-then-because prediction context observation opinions guess laws

**Example of a Controlled Experiment:**

**_____:**
**If** people chew gum **then**, it will improve their memory **because** of the ingredients . . .

**_____variable:**
Chewing gum – some people will chew gum, some will not.

**Dependent variable**
Memory – _____groups should have their memory checked both before and after the experiment to see if it was improved.

**_____Group**
Group that chews gum.

**_____Group**
Doesn't chew gum (remember – the control group never receives the new treatment)

**Constants**
Should be the _____for both groups:
People in each group should be of similar health with _____memory, with similar mixes of sexes, ages, and ethnicities. Each group should also be _____in the same way.

**_____collected**
You should test people's memories both before and _____the experiment.

**Word Bank**: similar data tested experimental after same independent control all hypothesis

**II.** **_____Experiments:** Compares the results of an experiment between one or more experimental groups with a "_____" group.

A) **Experimental group:** Group being _____or receiving treatment.

B) **_____group:** "Normal" group. Should be _____to experimental group in every way except *one*: it does not receive the new treatment.

C) **Placebo:** A sugar pill or other "fake" treatment _____to the control group. Usually only needed when using human subjects.

D) _____**Variable:** _____that is being tested (ex: new drug, new fertilizer).

1. The "If" part of an "If-then" hypothesis.
2. The independent variable is always plotted on the _____axis.

E) **Dependent Variable:** Variable that is _____at the end of an experiment; the results.

1. The "then" part of an "If-then" _____.
2. The dependent variable is always plotted on the _____ axis.

**Word Bank**

measured hypothesis tested independent control X variable identical normal controlled Y given

## III. Graphs and Data Tables

A) _____are used to organize data which will be plotted in a graph.

1. First column in the table is for the _____**variable**.
2. _____column is another for the **dependent variable.**
3. Each column should be _____, and include units of measurement.
4. Data in the table must be _____in ascending or descending order.

B) Both the x and y axis of the graph must be _____or titled. These labels are typically the _____ones used in the data table. Once again units of _____must be written with the title.

1. The **independent variable** is always plotted on the _____.
2. The **dependent variable** is always plotted on the _____.

**Word Bank**

labeled measurement x-axis same second arranged independent titled data-tables y-axis

**Data Table**

| **Temperature** (°C) | **Heart Rate** (beats/min) |
|---|---|
| 5 | 108 |
| 10 | 150 |
| 15 | 180 |
| 20 | 270 |
| 25 | 300 |

C) The x and y axis must be _____.

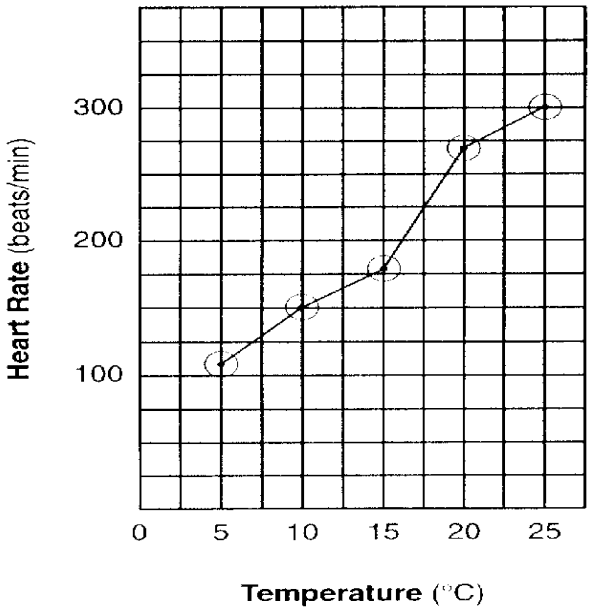
1. **These numbers must increase by a uniform _____** (that is you must count by 1's, 2's, 5's, 10's, etc).
2. **Your numerical scales should take up most of the _____.** _____it all into the bottom corner makes the graph impossible to read and no credit will be given.
3. The **numbers must line up with the ____lines** of the graph, not with spaces between them.
4. **You do not need to start numbering your axis with _____.**

D) To date, all graphs drawn on the LE Regents have been _____**graphs**. Any student who draws a bar graph instead of a line graph will be _____credit for this part of the test.

E) All points plotted on your graph must be **surrounded by a** _____(or sometimes a square or triangle, depending on the directions).

**Word Bank**

line 0 axes squeezing denied circle grid numbered increment



**Characteristics of a good experiment:**

F) **Can be _____the same way and get the same results.**

G) **Have _____sample size/many test subjects.**

H) **Are performed over _____periods of time.**

I) **Test only one _____variable.** All other characteristics of the _____groups should be the same.

J) **Are _____reviewed –** examined by other scientists to determine its accuracy.

K) **Must test the hypothesis and show _____it is wrong or right**.

L) **Is objective –** the experiment and conclusion are fair and _____. Fact and opinion are not _____.

M) The experiment follows established _____and **legal** standards.

**Word Bank**

mixed whether tested large longer peer
independent unbiased repeated ethical

## Topic Ten: The State Labs (Part D)

**I. Making Connections (aka The Clothespin Lab)**

A) **Part A**

1. **What you did:** measured how exercise affected _____ rate.
2. **What you learned:** exercise _____ pulse rate.

B) **Part A2**

1. **What you did:** Squeezed a clothespin for 1 minute, then _____ it again for another minute
2. **What you learned:**
   - If you squeezed more in the second round, it may have been because your finger muscles were "warmed up" from increased _____.
   - If you squeezed less the second round, it may have been because your finger muscles were _____.

C) **Part B**

1. **What you did:** Designed an experiment to test how exercise _____ squeezing a clothespin.
2. **What you learned:** How to _____ an experiment (see pages 3-5).

**Word Bank**

increases affects design fatigued pulse squeezed circulation

## II. Relationships and Biodiversity (*Botana curus* lab)

A) **What you did:** Compared 4 species of plants, based on _____ (physical) and _____ (chemical and genetic) traits.

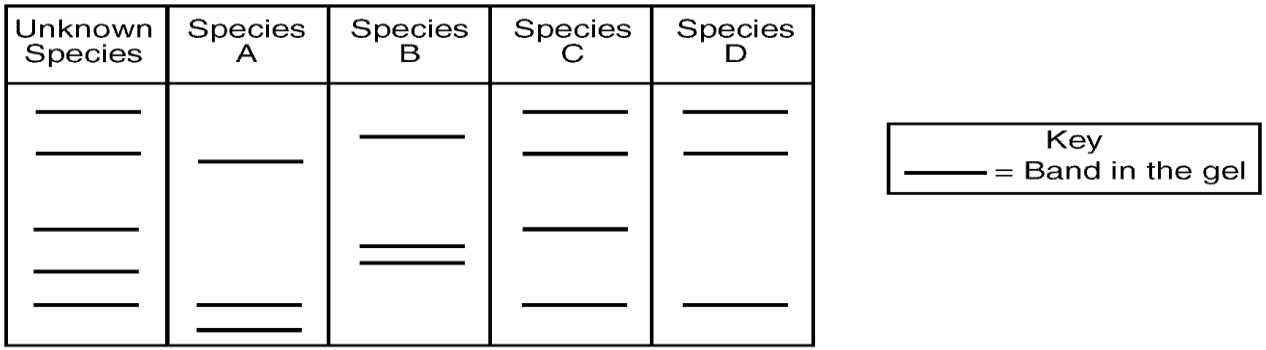
B) **What you learned:**

1. Species that are related _____ similar traits.
2. Different techniques (such as **gel electrophoresis** and **paper chromatography**) can be used to determine _____ between organisms.
3. _____ species should be protected because they may offer benefits to humans.

**Word Bank**

molecular endangered relationships share structural

Results of Gel Electrophoresis of DNA from Five Plant Species




**Gel _____ –** A technique used to show how species are related to one another.

**Restriction enzymes** cut DNA into _____, which are placed into a well in a gel plate.

An **electric current** carries the DNA fragments through the gel, separating them according to _____ (smaller pieces of DNA are carried farther from the well than larger pieces). **This creates a pattern of _____ which is unique for every organism.**

Related organisms will show similar banding patterns because their DNA have similar base sequences.

**Word Bank**

fragments size bands similar electrophoresis

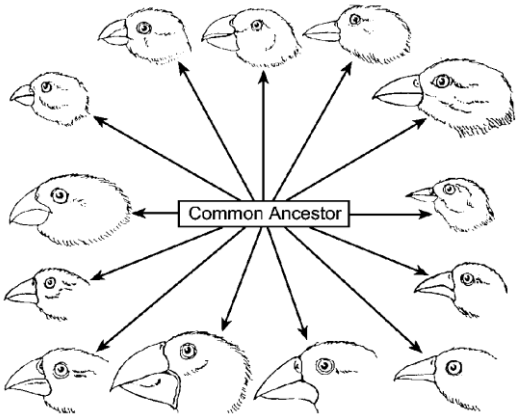
**III. Beaks of Finches**

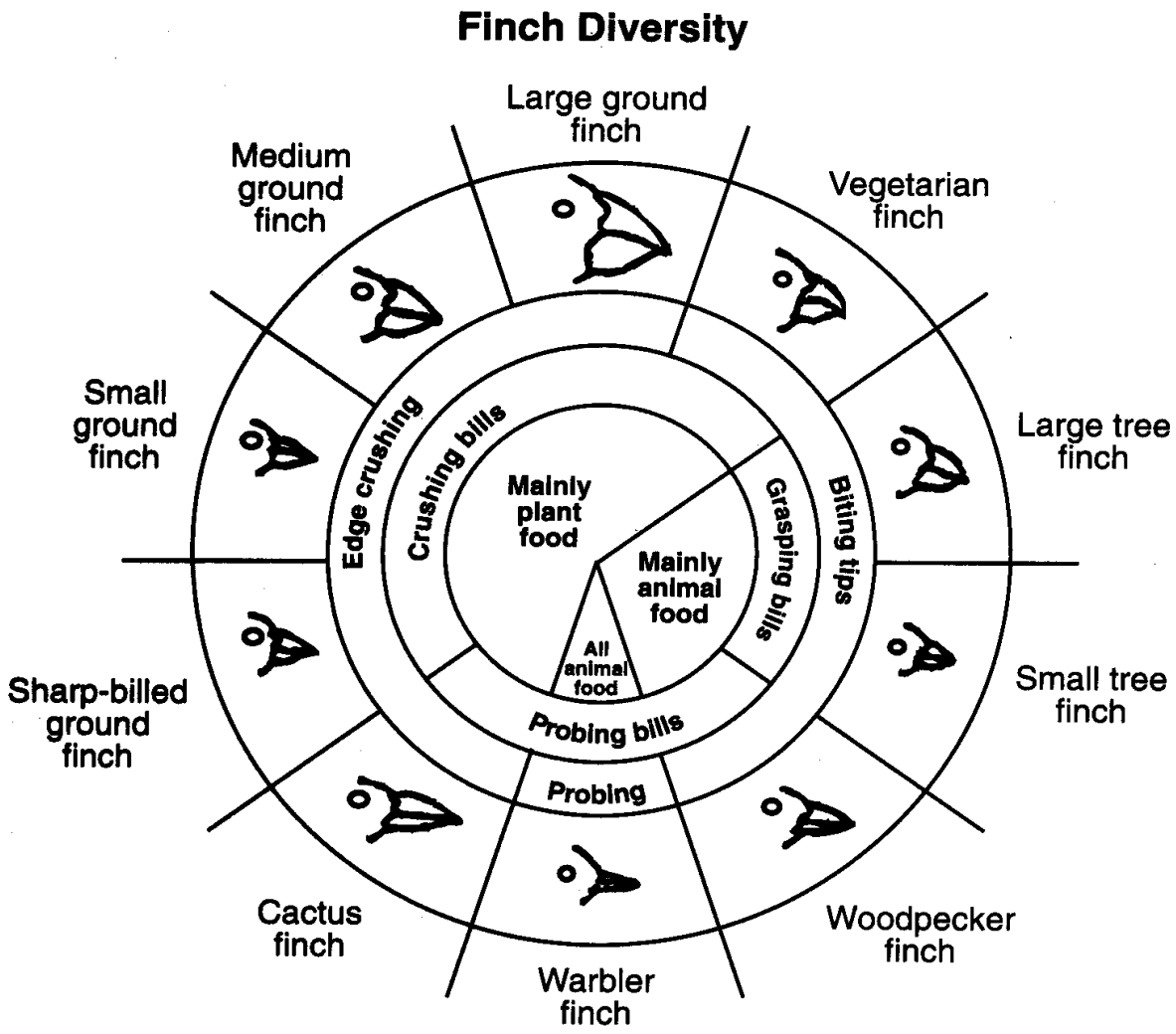
A) **What you did:** Played different finch species _____ for food.

B) **What you learned:** Different environmental conditions (food) _____ different species of finch, allowing some to _____ and reproduce, but not others.

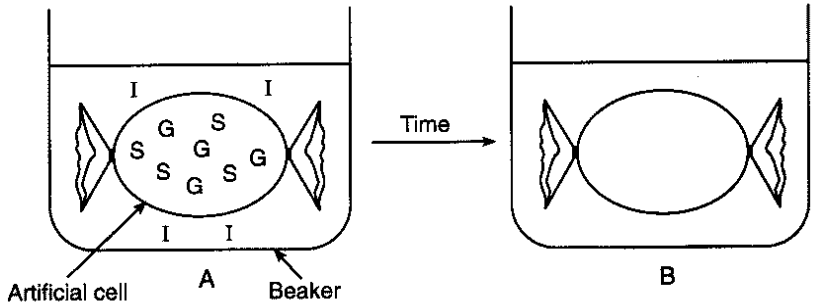
**Word Bank**

favored survive competing



## IV. Diffusion Through A Membrane




A) **Part A**

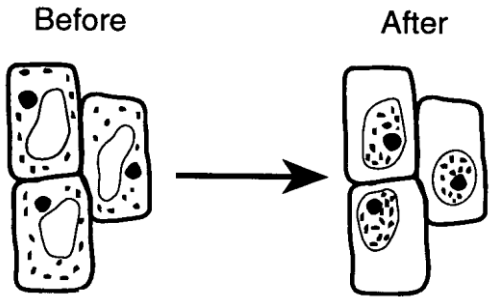
1. **What you did:**
   - Made a model _____ using **dialysis tubing**.
   - Put _____ and starch inside your "cell."
   - Put starch indicator (_____) outside cell
2. **What you saw:**
   - Inside of cell turned black because iodine _____ *into* the cell
   - Because outside of the cell was not black, you know the starch did not diffuse through the _____.
   - Used blue glucose indicator (Benedict's solution) to _____ that glucose did diffuse through the membrane.
3. **What you learned**
   - _____ molecules (glucose, iodine) can **diffuse** through a membrane on their own.
   - Large molecule (starch) _____ diffuse through a membrane on their own.
   - You can use _____ to identify the presence of specific substances.

**Word Bank**

iodine indicators diffused cannot membrane cell glucose see small

B) **Part B**

1. **What you did:**
   - Looked at red onion cells under the _____.
   - Added _____ water to the onion cells.
   - Added distilled (pure) _____ to the onion cells.
2. **What you saw:**
   - Salt water caused the onion cells to _____.
   - Distilled water caused the cells to _____ back to normal.
3. **What you learned:**
   - **Salt water causes water to diffuse _____ of a cell.**
   - **In pure water, water will diffuse _____ a cell.**




**Word Bank:** swell out salt shrivel water into microscope