Unit 1: Science Skills, Tools and the Scientific Method

Tools of Science

Parts of the microscope:
1. Eyepiece: the part that you look through (closest to the eye) usually 10x
2. Objective Lens: the magnifying part closest to the slide (high power = usually 40x; low power = usually 4x)
3. Fine Adjustment Knob: used to focus on low & high power
4. Course Adjustment Knob: used to focus only on low power
5. Stage: where the slide is placed
6. Stage Clips: hold the slide in place
7. Diaphragm: controls the amount of light used

Total magnification
if a microscope has a 10X eyepiece, and 10X and 40X objectives, then
Total Magnification on low power: 10 X 10 = 100X (it looks 100 times bigger than real life)
Total magnification on high power: 10 X 40 = 400X (it looks 400 times bigger than real life)

If you looked at the letter e under a microscope, what would it look like?
1. Mirror image and flipped upside down.
2. Increasing magnification reduces the field. (Larger image but you see less of it)
3. Increasing the magnification reduces the amount of light. (Field darkens)

New image low power  e  New image high power  ☺

Microscopic Measurement
Unit to use when making measurements under the microscope = micrometer or micron
The symbol for the micrometer or micron is: μm
1 mm = 1000 μm

How to make a wet mount slide:
Put the cells on the center of a slide, put a drop of water with a dropper onto the cells (do not touch the cells); lower a cover slip slowly at an angle (to reduce the number of air bubbles)
How to put stain on a slide without lifting the cover slip:

Put a drop of the stain onto the edge of the cover slip; place a paper towel on the edge of the other side of the cover slip, the paper towel will pull the water from under the cover slip, and in turn pull the stain onto the cells.

Laboratory Tests to Know:

1. **Paper Chromatography** is a laboratory technique that is used to separate different molecules from one another. (Separation of compounds in a solution by size and color).
2. **Gel electrophoresis** - separation of DNA using electrical current by size
3. **Indicators for pH, Glucose, Starch** – color or state change indicating the presence of a particular substance.

Experimentation

The **scientific method** is an organized, logical approach to solve a problem or question

"Pigs Get Hiccups Eating Rotten Cheese"

**Problem, Gather info, Hypothesis, Experiment, Results, Conclusion**

**Independent Variable** is the one thing that “I change” to test my hypothesis. Ex.) The EFFECT of IV (sunlight) on DV (plant growth).

**Dependent Variable** is what changes because of the IV (e.g.- DATA collected)

**Control Group** is the group that is studied under the normal conditions.

**Experimental Group** is the group that is identical to the control group with the **ONE CHANGE** or difference (the Independent Variable).

Organizing Data

Where does the Independent Variable (IV) go on a data table? What about the Dependent Variable (DV)?

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependant Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph on the X-axis</td>
<td>Graph on the Y-axis</td>
</tr>
<tr>
<td>Ex. sunlight <strong>IV</strong></td>
<td>Ex. growth <strong>DV</strong></td>
</tr>
</tbody>
</table>

Labeling a graph:

1. Title the graph (The effect of ____ on _____.)
2. Label the X and Y axis.
3. Determine a proper scale for X and Y axis.
4. Set up a key or legend if necessary.

How can you make an experiment more valid?

1. Repeat the experiment
2. Increase the number of specimens or trials.
3. Peer review
Regents Practice:

1. Conclusions based on an experiment are most likely to be accepted when
   (1) they are consistent with experimental data and observations
   (2) they are derived from investigations having many experimental variables
   (3) scientists agree that only one hypothesis has been tested
   (4) hypotheses are based on one experimental design

2. When using a compound light microscope, the most common reason for staining a specimen being observed is to
   (1) keep the organism from moving around
   (2) make the view more colorful
   (3) determine the effects of chemicals on the organism
   (4) reveal details that are otherwise not easily seen

3. A laboratory technique is illustrated in the diagram below.

   ![](image)

   The technique of lowering the coverslip at an angle is used to
   (1) make organelles more visible
   (2) reduce the formation of air bubbles
   (3) make the specimen transparent
   (4) reduce the size of the specimen

4. Two views through a compound light microscope of a wet-mount slide preparation of cells are shown in the photographs below. Which procedure was most likely followed to obtain view B?
   (1) staining
   (2) using a cover slip
   (3) cleaning the lens
   (4) focusing on high power

5. In an appropriately designed experiment, a scientist is able to test the effect of
   (1) a single variable
   (2) multiple variables
   (3) the hypothesis
   (4) scientific observations
Unit 2: Organization of Life
Organization of living things:
  [smallest] Cells → Tissues → Organs → Organ Systems → Organism [biggest]

The goal is to maintain homeostasis

Homeostasis is the ability of an organism to maintain a stable internal balanced environment. Failure to maintain homeostasis can result in SICKNESS or DEATH

The Cell
Organelles are the small parts that make up a cell (each has at least one specific function)

- a. Vacuoles -- store waste and water (large in plant cells, small in animal cells)
- b. Ribosome – (very small and is often represented by a dot) located on the ER or in cytoplasm. Ribosomes are where proteins are made (protein synthesis).
- c. Mitochondria - (The POWERHOUSE of the cell where energy is made) the Site of cellular respiration in both plant and animal cells.
  
  Formula for cellular respiration:
  
  Glucose + oxygen → carbon dioxide + water + ENERGY (ATP)

- d. Chloroplasts - only in plant cells; where the process of photosynthesis occurs.
  
  Formula for photosynthesis:
  
  Sun’s energy + carbon dioxide + water → glucose + water + oxygen

- e. Nucleus is the control center of the cell and contains DNA (the code of life)

- f. Cytoplasm is the liquid media that fills the cell.

- g. Cell Membrane:
  1. separates the contents of the cell from the outside environment
  2. controls the transport of materials into and out of the cell. (selective permeability)

Life Functions
What are the characteristics of life? Living things perform all of these life functions:

1) Respiration = the release of energy

2) Regulation = controls and coordinates body functions to maintain

*HOMEOSTASIS = maintaining a stable internal environment despite external conditions
3) **Reproduction** = making new organisms (offspring) *not every individual has to do this…but it is necessary for the survival of a species*

4) **Growth** = increasing in size and/or number of cells

5) **Excretion** = getting rid of cellular metabolic wastes

6) **Nutrition** = obtaining and processing food

   **AUTOTROPHIC NUTRITION** = organism uses light energy to make its own food (photosynthesis)

   **HETEROTROPHIC NUTRITION** = organism must obtain food from the environment

7) **Transport** = absorbing and circulating (distributing) materials

8) **Synthesis** = “to make”; going from simple to complex

How do I remember all these? 3RGENTS or RRRGENT

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**Classification**

How do we classify living things? Very broad (general) categories to very specific

<table>
<thead>
<tr>
<th>King</th>
<th>Kingdom (Broadest category)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillip</td>
<td>Phylum</td>
</tr>
<tr>
<td>Came</td>
<td>Class</td>
</tr>
<tr>
<td>Over</td>
<td>Order</td>
</tr>
<tr>
<td>From</td>
<td>Family</td>
</tr>
<tr>
<td>Germany</td>
<td>Genus</td>
</tr>
<tr>
<td>Saturday</td>
<td>Species (most specific)</td>
</tr>
</tbody>
</table>

**SCIENTIFIC NAMES** = **GENUS** + **SPECIES** name

Capital letter + lower case letter

**EXAMPLE:** Homo sapien *(scientific name for a human)*

**Dichotomous keys** (also known as taxonomic keys) are used to identify objects or organisms. In its name, di- means “two” so a dichotomous key is made up of paired statements.

**Key to Writing Implements**

1. Writes with ink .................. go to 2
2. Writes with graphite ............... go to 4
3. Writing tip is metal ................ go to 3
4. Writing tip is felt .................. marker
5. Writing tip contains a ball ball point pen
6. Writing tip does not contain a ball calligraphy pen
7. Body is made of wood ................ regular pencil
8. Body is not made of wood ............ mechanical
Regents Practice:

1. Which is true of organisms that are classified in the same genus?
   (1) They must be in the same phylum, but may be of different species.
   (2) They must be of the same species, but may be in different phyla.
   (3) They must be in the same phylum, but may be in different kingdoms.
   (4) They must be in the same kingdom, but may be in different phyla.

2. An organism forms complex molecules from simpler molecules as a result of which life activity?
   (1) transport  (2) synthesis  (3) transpiration  (4) excretion

3. Which statement best describes an activity that will contribute to the maintenance of homeostasis in an organism?
   (1) A shark swims toward a highly polluted region of the ocean.
   (2) A desert rattlesnake enters an underground burrow on a hot summer day.
   (3) Roots of a willow tree grow away from a moisture-rich region of the soil.
   (4) A polar bear sheds most of its fur during the coldest months of the winter.

4. Chemical bond energy in organic nutrients is changed to a usable form for living things by
   (1) digestion  (2) transport  (3) photosynthesis  (4) respiration

5. Which group of terms is in the correct order from most general to most specific?
   (1) species, phylum, genus, kingdom
   (2) genus, species, kingdom, phylum
   (3) kingdom, phylum, genus, species
   (4) phylum, kingdom, species, genus

6. Which life activity is illustrated by the diagrams below of the same cell?
   ![Day 1](10 µm)  ![Day 5](30 µm)
   (1) reproduction  (2) excretion  (3) transport  (4) growth

7. The scientific name of the common housefly is *Musca domestica*. This name indicates the housefly’s
   (1) genus and species  (2) phylum and genus
   (3) kingdom and phylum  (4) kingdom and species
Unit 3: Cell Processes

Cell theory
1. All living things are made of one or more cells.
2. Cells are the basic units of structure and function in living things.
3. All cells come from other cells.

Passive Transport or Diffusion is the movement of molecules from areas of high concentration to areas of low concentration. (NO ENERGY USED) includes Osmosis which is the movement of WATER from an area of high concentration to low and FACILITATED diffusion.

Active Transport is the moving a molecule from LOW concentration to a HIGH concentration (USES ENERGY in the form of ATP).

Includes endo and exo – cytosis.

Photosynthesis Organisms that can make their own food are known as PRODUCERS and undergo photosynthesis, which takes place in the chloroplast.

Cellular respiration - process which cells get energy from glucose in food. *ENERGY is in the form of ATP!
Regents Practice:
The diagram below represents a specialized cell located in the root of a plant. The arrows in the diagram indicate the movement of molecules of oxygen and water into the cell.

1. Which row in the chart below correctly identifies the process responsible for the movement of each type of molecule represented in the diagram?

<table>
<thead>
<tr>
<th>Row</th>
<th>Water</th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>diffusion</td>
<td>active transport</td>
</tr>
<tr>
<td>2</td>
<td>diffusion</td>
<td>diffusion</td>
</tr>
<tr>
<td>3</td>
<td>active transport</td>
<td>diffusion</td>
</tr>
<tr>
<td>4</td>
<td>active transport</td>
<td>active transport</td>
</tr>
</tbody>
</table>

2. The diagram below represents the major parts of a growing onion plant. Nutrients are represented in the soil around the onion. Which statement best describes how nutrients enter the root cells of the onion plant?

   1) Only nutrients needed by the plant enter root cells.
   2) The nutrients usually move from an area of high concentration in the soil to an area of low concentration in root cells.
   3) Nutrients always move into the plant cells by active transport.
   4) The nutrients always move from an area of low concentration in the soil to an area of high concentration in root cells.

3. Which substance can enter a cell by diffusion without having to be digested?

   1) water  
   2) protein  
   3) starch  
   4) fat

4. The diagram below shows the relative concentration of molecules inside and outside of a cell. Which statement best describes the general direction of diffusion across the membrane of this cell?

   1) Glucose would diffuse into the cell.
   2) Protein would diffuse out of the cell.
   3) Carbon dioxide would diffuse out of the cell.  
   4) Oxygen would diffuse into the cell.
Unit 4: Biochemistry

**Organic Compounds—Carbon** containing compound usually with H, and O in some ratio (referred to as chemicals of life)
ex. Carbohydrates, Proteins, Lipids, Nucleic Acids

**Carbohydrates** are compounds made up of carbon, hydrogen, and oxygen atoms, usually in a ratio of 1 : 2 : 1.
Used as the main source of energy for living things.
Names of sugars end in *-ose* EXAMPLES: glucose, sucrose, lactose

*Dehydration Synthesis* = join together small molecules by removing water (H from one and OH from another)

Molecules can be broken down (digested into glucose by **HYDROLYSIS** (adding water to break it apart)

**Lipids** are biological molecules that are generally not soluble in water (*FATS OILS, and WAXES*). The building blocks of lipids are: FATTY ACIDS & GLYCEROL. Lipids make up membranes, store energy, provide insulation and make up steroids.

**Proteins** are macromolecules that contain nitrogen as well as carbon, hydrogen, and oxygen. Proteins are polymers of molecules called **amino acids**. (Remember: amino acids are the building blocks of all proteins!)

- Proteins work to:
  - Control rates of reactions
  - Regulate cell processes
  - Form cellular structures
  - Transport materials into and out of cells

**Nucleic acids** are macromolecules containing hydrogen, oxygen, nitrogen, carbon, and phosphorus **C H O N P**. Nucleic acids store and **transmit hereditary**, or genetic, information (DNA and RNA)
Regents Practice:
1. Which group consists entirely of organic molecules?
   (1) protein, oxygen, fat 
   (2) protein, starch, fat 
   (3) water, carbon dioxide, oxygen 
   (4) water, starch, protein 

   The diagrams below represent two molecules that are involved in metabolic activities in some living cells.
   ![Diagram](image)

2. The shape of each of the molecules is important because
   (1) molecules having different shapes are always found in different organisms
   (2) the shape of a molecule determines how it functions in chemical reactions
   (3) the shape of a molecule determines the age of an organism
   (4) if the shape of any molecule in an organism changes, the DNA in that organism will also change

3. Even though human proteins are synthesized from only 20 different amino acids, there are thousands of different proteins found in human cells. This great variety of proteins is possible because the
   (1) size of a specific amino acid can vary within a protein
   (2) chemical composition of a specific amino acid can vary
   (3) sequence and number of amino acids can be different in each protein
   (4) same amino acid can have many different properties

4. The basic building blocks of a protein are
   (1) glucose molecules 
   (2) hormones 
   (3) amino acids 
   (4) fats 

5. The function of a specific enzyme is most directly influenced by its
   (1) molecular size 
   (2) carrying capacity 
   (3) physical shape 
   (4) stored energy 

6. The building blocks for this molecule are
   (1) amino acids 
   (2) fats 
   (3) simple sugars 
   (4) molecular bases
# Living Environment Regents Review Study Guide: Second Semester

## Unit 5: Body Systems

<table>
<thead>
<tr>
<th>Body System</th>
<th>Organs</th>
<th>Functions</th>
<th>Diseases/Disorders</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Circulatory (Cardiovascular)</strong></td>
<td>heart, arteries, veins, capillaries</td>
<td>Transports oxygen, food &amp; waste throughout the body</td>
<td>*High blood pressure (Hypertension)  *Heart attack  *Anemia  *Leukemia</td>
<td>* w/respiratory to deliver gases  * w/digestive to absorb and deliver nutrients  * w/excretory to filter/remove waste</td>
</tr>
<tr>
<td><strong>Respiratory</strong></td>
<td>nose, mouth, trachea, diaphragm, bronchi, lungs, pharynx, alveoli, epiglottis</td>
<td>Transports oxygen and CO₂ to and fro the lungs through breathing</td>
<td>* Lung cancer  * Emphysema  * Asthma</td>
<td>* w/circulatory to deliver gases  * w/ muscular to contract diaphragm  * w/excretory to remove waste</td>
</tr>
<tr>
<td><strong>Digestive</strong></td>
<td>mouth, esophagus, stomach, small intestine, large intestine, rectum, anus</td>
<td>Breaks down food mechanically in the mouth then transports the food using peristalsis through the other organs</td>
<td>* Ulcers  * Acid reflux  * Crohn's  * Diarrhea</td>
<td>* w/circulatory to absorb &amp; deliver digested nutrients to cells.  * w/muscular controls the contractions (peristalsis)  * w/ nervous to maintain homeostasis</td>
</tr>
<tr>
<td><strong>Nervous</strong></td>
<td>brain, spinal cord, nerves, nerve cells (neurons)</td>
<td>Coordinates &amp; controls the actions of all organs &amp; systems  Detects, processes &amp; responds to environmental stimuli that is external or internal</td>
<td>*Alzheimer’s  * Multiple Sclerosis  * Stroke  * Parkinson’s  * Epilepsy</td>
<td>* w/ALL other systems – controls and responds to stimuli</td>
</tr>
</tbody>
</table>

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**Note:** The table above summarizes the major body systems, their organs, functions, diseases/disorders, and interactions. Each system plays a critical role in maintaining the body's overall health and homeostasis.
<table>
<thead>
<tr>
<th>Body System</th>
<th>Organs</th>
<th>Functions</th>
<th>Diseases/Disorders</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletal</td>
<td>Bones</td>
<td>Protects organs</td>
<td>Osteoporosis</td>
<td>w/muscular to allow movement</td>
</tr>
<tr>
<td></td>
<td>cartilage</td>
<td>Provides shape &amp; support</td>
<td>Fractures/breaks</td>
<td>w/circulatory to produce blood cells</td>
</tr>
<tr>
<td></td>
<td>ligaments</td>
<td>Stores materials</td>
<td>Scoliosis</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arthritis</td>
<td>*</td>
</tr>
<tr>
<td>Muscular</td>
<td>Cardiac muscle</td>
<td>Allows for movement</td>
<td>Strains/sprains</td>
<td>w/skeletal to allow movement</td>
</tr>
<tr>
<td></td>
<td>Smooth muscle</td>
<td>through contractions/relaxations</td>
<td>Muscular dystrophy</td>
<td>* w/ digestive to allow food through (peristalsis)</td>
</tr>
<tr>
<td></td>
<td>Skeletal muscle</td>
<td>*</td>
<td>* w/respiratory diaphragm controls breathing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tendons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immune</td>
<td>White blood cells</td>
<td>Fight off foreign invaders in the body</td>
<td>HIV/AIDS</td>
<td>w/circulatory to deliver WBC to invaders</td>
</tr>
<tr>
<td></td>
<td>Antibodies</td>
<td>*</td>
<td>* w/integumentary to provide barrier to germs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-cells</td>
<td></td>
<td>* Autoimmune diseases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B-cells</td>
<td></td>
<td>* Allergies</td>
<td></td>
</tr>
<tr>
<td>Endocrine</td>
<td>Glands: Hypothalamus</td>
<td>Regulates body activities using hormones</td>
<td>Diabetes</td>
<td>w/circulatory to deliver hormones</td>
</tr>
<tr>
<td></td>
<td>Pituitary</td>
<td>Manages feedback system</td>
<td>Hypothyroidism</td>
<td>*w/nervous to maintain homeostasis</td>
</tr>
<tr>
<td></td>
<td>Thyroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thymus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adrenal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pancreas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ovaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Testes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excretory</td>
<td>Kidneys</td>
<td>Removes cellular waste products</td>
<td>kidney stones</td>
<td>w/circulatory – filters waste out of the blood</td>
</tr>
<tr>
<td></td>
<td>Ureters</td>
<td></td>
<td>UTI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urinary bladder</td>
<td></td>
<td>Bladder infection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urethra</td>
<td></td>
<td>Renal Failure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lungs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Regents Practice:

1. An organ, such as a kidney, used for transplant needs to be tested for compatibility with the person who is to receive the organ. If this is not done, the
   (1) donated organ might attack the body
   (2) donated organ might attack the immune system
   (3) immune system might attack its own body cells
   (4) immune system might attack the donated organ

2. A student infected by a common cold virus ran a low-grade fever. After a few days, the student’s temperature returned to normal and the student was free of cold symptoms. The fever served as
   (1) an antigen in the circulatory system
   (2) an immune response to a pathogen
   (3) a biological catalyst
   (4) a weakened pathogen

3. An individual eats a hamburger. Which two systems must interact to transfer the nutrients in the hamburger to human muscle tissue?
   (1) respiratory and excretory
   (2) digestive and immune
   (3) digestive and circulatory
   (4) circulatory and respiratory

4. A dead or weakened pathogen used to establish immunity would most likely be found in
   (1) a pesticide
   (2) a vaccine
   (3) an antibiotic
   (4) a toxin

5. During gas exchange, the cell membrane of a single-celled organism has the same function as which organ system in humans?
   (1) nervous
   (2) digestive
   (3) reproductive
   (4) respiratory

6. The diagram shows part of the human body with some organs that help to carry out the removal of wastes. The energy necessary to perform this function comes directly from the
   (1) exchange of H2O and O2 during respiration
   (2) blood flowing through the organs
   (3) ATP molecules produced during cellular respiration
   (4) water that is eliminated by the organs

7. Antibiotics are substances used to help fight an infection of Streptococcus, a bacterium that causes strep throat. Overuse of these antibiotics can
   (1) prevent future infections by these pathogens
   (2) cause a decrease in the production of enzymes
   (3) allow organic molecules to be synthesized
   (4) cause the bacteria to become resistant to treatment
## Unit 6: Cell Processes

<table>
<thead>
<tr>
<th>Mitosis</th>
<th>vs.</th>
<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asexual reproduction</td>
<td>Sexual reproduction</td>
<td></td>
</tr>
<tr>
<td>ONE cell division $1 \rightarrow 2$</td>
<td>TWO cell divisions $1 \rightarrow 4$</td>
<td></td>
</tr>
<tr>
<td>Parent cell divides equally to produce 2 identical daughter cells</td>
<td>Parent cell divides twice to produce either 4 sperm cells or (female) 3 polar bodies + 1 Egg (ovum)</td>
<td></td>
</tr>
<tr>
<td>Genetic makeup identical to parent $2n$ – Diploid #</td>
<td>Genetic makeup $1/2$ of the parent cell $1n$ – Haploid #</td>
<td></td>
</tr>
<tr>
<td>Function: To produce Identical cells used for growth and repair.</td>
<td>Function: To produce sex cells with $1/2$ of the species chromosome number.</td>
<td></td>
</tr>
</tbody>
</table>

*Mitosis is used for growth, repair and asexual reproduction. Meiosis occurs only in the male and female gonads and solely produces gametes.*
Regents Practice:

1. How does the type of reproduction shown in method A in the diagram below differ from the type of reproduction shown in method B?

   (1) Method A illustrates sexual reproduction, and method B illustrates asexual reproduction.
   (2) Offspring produced by method B will be genetically alike, but offspring produced by method A will be genetically different.
   (3) The two cells shown in the last step of method A are genetically alike, but the two cells shown in the last step of method B are genetically different.
   (4) Offspring produced by method A will be genetically like the parent, but offspring produced by method B will be genetically different from the parents.

2. Before they can pass from a parent cell to its offspring cells, the inherited instructions that a human cell carries must first be
   (1) moved into the nucleus
   (2) broken down and made into DNA molecules
   (3) used to make specific protein molecules that form genes
   (4) accurately replicated

3. Female hammerhead sharks sometimes produce offspring by a type of asexual reproduction. These offspring
   (1) are a result of the uniting of a male and a female gamete
   (2) have cells that contain DNA found only in the female shark
   (3) are considered to be a different species from the male parent
   (4) have cells that contain genetic information from both parents

   The diagram below represents reproduction in a yeast cell. The genes in the bud are identical to the genes in the parent.

4. This type of production of offspring is a form of
   (1) sexual reproduction
   (2) asexual reproduction
   (3) gene manipulation
   (4) genetic engineering
Unit 7: Reproduction and Development

Gonads are the sex glands. (Ovaries and Testis)

Gametes are sex cells that unite in fertilization to form a ZYGOTE.

Zygote is a fertilized egg.

Fertilization is when a male and female gamete unit. If the gametes each have 23 chromosomes, then their zygote has 46

Differentiation is the process that transforms developing cells into specialized cells with different structures and functions. Tissues are specialized groups of cells.

Human female reproductive system:
1. Vagina
2. Uterus is where the baby develops
3. Ovaries are the female gonads that produce the egg and important female hormones. The Placenta is the organ that is attached to the baby via the umbilical cord and provides nutrients, oxygen to the fetus and removes waste through the process of diffusion.

   Mother and baby’s blood does not mix!
5. Oviducts or fallopian tubes are the place where fertilization occurs

The menstrual cycle is a series of steps over a 15-30 day period in which the uterus prepares for the implantation of an embryo. The uterine wall builds up for implantation of egg. If no fertilization occurs, the wall breaks down and passes out of body. This is controlled by the action of hormones.

Human male reproductive system:
1. Testis is the male gonads that produce sperm and male hormones like testosterone (letter d shown)
1. For a human zygote to become an embryo, it must undergo
   (1) fertilization   (3) meiotic divisions
   (2) recombination   (4) mitotic divisions

2. German measles is a disease that can harm an embryo if the mother is infected in the early stages of pregnancy because the virus that causes German measles is able to
   (1) be absorbed by the embryo from the mother’s milk
   (2) be transported to the embryo in red blood cells
   (3) pass across the placenta
   (4) infect the eggs

The human female reproductive system is represented below.

![Female Reproductive System Diagram]

3. Within which structure does the placenta normally develop?
   (1) A   (3) C
   (2) B   (4) D

4. After a zygote is formed, specialization of cells occurs. Through which process do the cells of a zygote become specialized?
   (1) sexual reproduction   (3) fertilization
   (2) meiosis   (4) differentiation

5. Three human hormones most directly involved in sexual reproduction are
   (1) estrogen, insulin, and progesterone
   (2) testosterone, estrogen, and insulin
   (3) progesterone, ATP, and testosterone
   (4) estrogen, progesterone, and testosterone

6. Human reproduction usually involves
   (1) internal fertilization and internal development
   (2) external fertilization and external development
   (3) internal fertilization and external development
   (4) external fertilization and internal development
Unit 8: Genetics

**Heredity** is the passing of genetic information from one generation to the next through reproduction. The hereditary information **DNA** is organized in the form of genes located in the **nucleus** of each cell.

Identical genetic copies are known as **Clones**.

**Cancer** occurs when certain genetic mutations in a cell can result in uncontrolled cell division. Cancer can be caused either by heredity or environmental factors like radiation, chemicals or virus.

**DNA** is a double stranded helix polymer of nucleotides that contains the genetic code of the individual. **Nucleotide** is the basic unit of DNA which is made of a **phosphate**, a **sugar** and a **base**.

![DNA helix]

DNA bases are A, T, G, C

Remember: AT Gates-Chili

**RNA** is a single stranded polymer that is produced by DNA.

There are 3 types: Messenger RNA, Transfer RNA and Ribosomal RNA

Bases are A, U, G, C. Notice there is no T in RNA base code rule

How does DNA use RNA to make a protein?

**Protein Synthesis:**

DNA is stuck in the nucleus, so it sends a messenger single-stranded mRNA to the ribosome where the ribosome reads the message and directs the tRNA to bring it amino acids. The ribosome then assembles the amino acids together in the correct order TO MAKE A PROTEIN.

**Mutation** is any alteration of the DNA sequence which changes the normal message carried by the gene.

1. **Substitution** - ONE BASE IS PUT IN THE PLACE OF ANOTHER
2. **Deletion** - A BASE IS LEFT OUT
3. **Addition** - A BASE IS ADDED
4. **Inversion** - BASES ARE SWITCHED

**Gene Expression** An organism's environment can affect the way that some genes are expressed. Example - HIMILAYAN RABBIT – fur color is influenced by temperature.

**Gene Splicing** is cutting DNA and placing it into another organism

**Selective Breeding** is a process of picking parents with favorable traits to produce those traits in the offspring. Ex) domestic animals and hybridization of plants.
Regents Practice:

1. The diagram represents a process used to modify bacterial cells.

![Diagram showing bacterial DNA with arrows X and Y labeled with clones, genes, receptors, and enzymes.]

In the diagram, arrows labeled X and Y represent the use of
(1) clones 
(2) genes 
(3) receptors 
(4) enzymes

2. Before a cell divides, an exact copy of each chromosome is made by the process of
(1) genetic engineering 
(2) replication 
(3) mutation 
(4) recombination

3. Which activity enables humans to produce new genetic combinations in other organisms?
(1) selecting and breeding the organisms for specific traits
(2) increasing the number of enzymes available to the organisms
(3) growing organisms that reproduce asexually
(4) decreasing the amount of DNA in the diet of the organisms

4. A woman changes her hair color to red; however, her children will not inherit this red hair color because the woman does not have
(1) genes for red hair in her skin
(2) genes for red hair in her sex cells
(3) proteins for red hair in the placenta
(4) proteins for red hair in her egg cells

5. A scientist plans to cut a segment of DNA so that it can be inserted into the DNA of a bacterium, a single-celled organism. The scientist needs to use a special type of organic molecule to perform this cutting process. This molecule is
(1) a lipid 
(2) an enzyme 
(3) a carbohydrate 
(4) a hormone

6. The diagram represents a process that occurs in living cells. The process shown in the diagram is
(1) cellular respiration 
(2) gene recombination 
(3) cellular reorganization 
(4) protein synthesis
Unit 9: Evolution

Evolution is the process by which organisms have changed over time from simple, single-celled: complex-single-celled: complex, multicellular to complex organisms.

Fossils have been found that indicate organisms existed well over 3 billion years ago.

Early scientists in the 1700-1800’s such as Jean-Baptiste Lamarck proposed that changes in the environment caused an organism’s behavior to change, leading to greater use or disuse of a structure or organ.

Natural Selection - nature selects those individuals who are best fit for the environment.

Common Ancestor- Species have characteristics in common that show they have a common ancestor.

Overproduction - more offspring are produced than can survive

Competition - the fight for limited resources

Variation - differences among organisms in a species (sexually reproducing organisms have more variation than asexually reproducing organisms)

Adaptive Value Any trait that helps an organism survive and reproduce under a given set of environmental conditions

Extinction is the disappearance of an entire species caused by a failure to adapt to a changing environment. Extinction occurs when the Environment changes and the species cannot adapt.

Ancestry: cladograms or family tree
Regents Practice
The remains of three organisms are shown below

1. A study of these remains would indicate that these organisms have
   (1) identical food preferences           (3) identical body sizes
   (2) structural similarities            (4) habitat similarities

2. Which statement provides evidence that evolution is still occurring at the present time?
   (1) The extinction rate of species has decreased in the last 50 years.
   (2) Many bird species and some butterfly species make annual migrations.
   (3) New varieties of plant species appear more frequently in regions undergoing climatic change.
   (4) Through cloning, the genetic makeup of organisms can be predicted.

The diagram below shows four species of birds that evolved from an ancestral species that had a small, pointed beak. Today, all four species inhabit the same island.

3. Which statement best explains the variation in the beaks of these four species?
   (1) Over time, an abundance of seeds for food led to increased similarities between the species.
   (2) Over time, an abundance of seeds for food led to increased differences between the species.
   (3) Competition for limited food resources led to selection for similar traits.
   (4) Competition for limited food resources led to selection for different traits.

4. The diversity of organisms present on Earth is the result of
   (1) ecosystem stability                  (3) homeostasis
   (2) natural selection                   (4) direct harvesting
Ecology is the study of how organisms interact with the living and nonliving things.

Biotic factors: are living parts of the ecosystem ex. Plants and animals.

Abiotic factors- non-living parts of the environment (rocks, air, ph, sunlight)

Niche is a species’ role in it’s environment (it’s JOB and what it EATS)

Population- all the organisms of a species that live in the same area.

Community - all the different populations in an area.

Biosphere - all of earth’s ecosystems

Competition - is the struggle for resources among organisms.

Limiting Factors are the living and non-living things in the environment that limit the size of populations.

Examples: Food, Shelter, Sun, Space, Oxygen, ETC.

Carrying Capacity is the maximum population (number or organisms of any species) that an ecosystem can support.

Predators kill and eat other organisms called Prey.

Graph of Prey/ predator relationship →

Feeding Relationships:

- Autotrophs - (producers) make their own food by photosynthesis
- Heterotrophs - must eat something for food (consumers)
- Herbivores - can only eat plants
- Carnivores - can only eat animals
- Omnivores - can eat plants & animals (all humans!!!)
- Consumers - same as heterotrophs
- Decomposers - break organisms down and return nutrients to the soil. They are the recyclers in the ecosystem.
- Scavengers - eat dead organisms that they did not kill themselves example: vultures
- Parasites - live off of another organism (host) and do not kill them usually (the parasite

Food Chain is diagram of the linear feeding relationship of organisms in an ecosystem.

Rules in Drawing a Food Chain:
1. All food chains begin with a Producer (Autotroph or Plant)
2. All food chains end with a Decomposer
3. Arrows in a food chain show the direction of the energy flow
   Grass → Grasshopper → Frog → Snake → Hawk → Decomposer
**Food Web** is a diagram composed of many interlocking food chains. It is more accurate than a food chain because most organisms eat more than one type of food in their environment.

**The Sun** is the primary source of life energy on the earth. **Energy Pyramid** is a diagram showing the energy available at each trophic level. The bottom layer (Producers) has the greatest amount of energy and the amount of energy Decreases by 90% at each level as you move UP though the pyramid.

**Ecological Succession** is the orderly sequence of changes in the communities living in a given ecosystem over time.

**Pioneer Organisms** → **Climax Community**

**Material Cycles:**
1. Carbon/ Oxygen Cycle (photosynthesis/ Respiration)
2. Water Cycle (Evaporation, Condensation, Precipitation)
3. Nitrogen Cycle (N\textsubscript{2}, nitrogen fixing bacteria, plants, animals, waste)

**Biodiversity** is a measurement of the degree to which species vary within an ecosystem. The more species present in an ecosystem the higher the biodiversity. **As biodiversity increases, the stability of an ecosystem increases.**

**Renewable Resources** - resources that can replenish themselves if not abused (planting of trees) **Nonrenewable Resources** - resources that take a long time to replace or form (like coal, oil)

**Impact of technology and industrialization:**
1. Industrialization- increases pollution of air and water- uses more energy, water, fossil and nuclear fuels.
2. Water pollution-from sewage, wastes from homes and factories and animal wastes
3. Toxic wastes- DDT
4. Thermal pollution- Heat Pollution
5. Human overpopulation
6. Air pollution- burning fossil fuels, can lead to **acid rain.**
Regents Practice

1. The removal of the predator populations from an ecosystem would most likely result in
   (1) a decrease in all the prey populations
   (2) an increase in all the producer populations
   (3) an increase in ecosystem diversity
   (4) a decrease in ecosystem diversity

2. A corn field includes corn plants, mice, hawks, and various insects, fungi, and bacteria. Which nutritional role is correctly paired with organisms that carry out that role?
   (1) heterotrophs – corn and bacteria
   (2) producers – insects and fungi
   (3) consumers – mice and insects
   (4) decomposers – hawks and bacteria

3. A rich variety of genetic material in an ecosystem will
   (1) reduce the biodiversity of the ecosystem
   (2) decrease the carrying capacity of the ecosystem
   (3) reduce the likelihood of future medical discoveries
   (4) increase the chances that some organisms will survive change

4. Which process occurs at each link in a food chain?
   (1) All the energy is stored in a newly made structure.
   (2) Some energy is released into the environment as heat.
   (3) Chemical energy is recycled.
   (4) Atoms cycle among living organisms, producing energy.

5. If the grass in the front yard of an abandoned house is not cut for several years, the yard may become overgrown with taller grasses, bushes, and shrubs. This is an example of the process of
   (1) evolution
   (2) homeostasis
   (3) ecological succession
   (4) direct harvesting

6. Which human activity most directly causes a significant increase in the amount of carbon dioxide in the atmosphere?
   (1) growing corn for food
   (2) not using products containing plastics
   (3) driving cars long distances
   (4) planting large numbers of trees