

Key Ideas for Living Environment Regents Quarter Final Review

Safety in the Biology Lab

- ◆ Follow teacher and lab directions carefully
- ◆ Tie long hair back
- ◆ Roll up loose fitting sleeves
- ◆ Tuck all loose jewelry into clothes
- ◆ Protect eyes with goggles
- ◆ Protect hands with gloves
- ◆ Protect clothes with aprons
- ◆ Do not cork test tubes when heating
- ◆ Point the mouth of the test tube away from you and others when heating
- ◆ Do not eat or bring in food into lab
- ◆ Do not point dissecting instruments at others; use carefully at all times

Science Method

- ◆ *Steps of Scientific Method*
 - a. state problem
 - b. conduct background research
 - c. make hypothesis (educated guess in statement form – when in doubt, use If... then...format to write your hypothesis)
 - d. design and conduct experiment
 - e. collect data
 - f. analyze results
 - g. make conclusions (inferences)
 - h. repeat your experiment to **VALIDATE** your findings and make your results more **RELIABLE**.
- ◆ *variable*: what you are changing in the experiment
- ◆ *control*: what you compare the variable to
- ◆ *controlled experiment*: when you investigate **ONE** variable by changing it and compare it to the control in order to make a valid conclusion
- ◆ *independent variable*: what is being changed in the experiment
- ◆ *dependent variable*: what you are measuring
- ◆ *constants*: all other potential variables that must remain the same in both experimental and control groups (for example using the same number of plants, the same kind of plants, same kind of pots, exposing plants to the same amount and intensity of light, etc...)
- ◆ *sample size*: you always try to test a large population when studying living organisms in order to minimize the effects of individual differences on the results of the experiment.
- ◆ *placebo*: a substance given to the control group in an experiment that looks, tastes, and/or feels like the medicine but has no medicine in it. Example – a sugar pill or an injection with salt water.
- ◆ *double blind study*: neither the participants or the people administering the medication/placebo know which group is experimental or control. Used to minimize the psychological effects in subjects feeling better or worse by knowing who may influence the outcome of the experiment.
- ◆ *Graphing*:
 - a. x axis – independent variable
 - b. y axis – dependent variable
 - c. axes scales – intervals should be of equal value. (evenly numbered and spaced)
 - d. axes should be labeled
 - e. only plot points that are given **DO NOT** extend your line to the x or y axis unless there are points plotted on either of these axes
 - f. connect points with straight lines!

- g. when directed, surround points with appropriate symbols

Microscopes and Tools of the Biologist

◆ *Compound Light Microscope*

- a. Uses two lenses and light to form the image
- b. Used to view transparent, microscopic specimens
- c. *object*: specimen
- d. *image*: the specimen as viewed through the microscope
- e. *magnification*: enlarges the specimen; multiply eyepiece lens by objective lens to get total magnification ($10x \times 45x = 450x$ – total magnification)
- f. *resolution*: the ability of a microscope to distinguish between two objects close together so that you see each one clearly. *Resolution is the limiting factor of the microscope.*
- g. *ocular*: eyepiece, has a magnifying lens
- h. *objectives*: further magnify the image
- i. *coarse adjustment*: for general focus, used only with low power.
- j. *fine adjustment*: used to clearly focus the image, used under low and high power
- k. *diaphragm*: regulates the amount of light that comes through the microscope
- l. *field of view*: the circular area you see in the microscope.
- m. The image is upside down and backwards when compared to the object.
- n. When you move the specimen to in one direction, the image moves in the opposite direction.
- o. When moving from low to high power, the field of view gets darker and the image is enlarged (you see less of the image but in greater detail).
- p. The image must be centered under low power so that it will be in view when moving to high power.
- q. Use *micrometers* when measuring specimens using a microscope.
- r. $1\text{mm} = 1,000$ micrometers (μm)
- s. when converting from mm to μm , move 3 places to right ($43\text{mm} = 43,000\mu\text{m}$)
- t. when converting from μm to mm, move 3 places to left ($520\mu\text{m} = .520\text{mm}$)
- u. when making a *wet mount*, place the cover slip at an angle on the slide to avoid getting too many bubbles that will interfere with viewing the image.

◆ *Dissecting Microscope*

- a. Used to view opaque and/or small living/dead organisms
- b. Image is in 3D
- c. Object and image oriented the same way. Move object in one direction, the image moves in the same direction.

◆ *Stains*: used to make transparent parts of specimens easier to view under a microscope.

- a. Lugol's Solution (Iodine, starch indicator): generally used for plant cells, indicator for starch, turns from red-brown to blue black in the presence of starch (plant cells have lots of starch – such as the cell membrane made up of cellulose which is a starch)
- b. Methylene blue: most often used for animal cells
- c. *Staining Technique*: when staining specimens already in a wet mount (on a microscope slide) place a paper towel on one side and the stain dropper on the other. The paper towel attracts the water under the slide, drawing the stain through the specimen.

◆ *Graduated Cylinder*: take measurement at the meniscus (the bottom of the curved line).

◆ *Measurements with ruler*: $1\text{cm} = 10$ mm

◆ *Forceps*: looks like tweezers, used to pick up tiny objects

◆ *Pipette*: used to transfer small amounts of liquid

◆ *Scanning Electron Microscope*: moves a narrowly focused beam of electrons across an object and detects the patterns made by the electrons scattered by the object and the electrons knocked loose from the object. From these patterns a three-dimensional image of the object is created. Can only be used with small, dead samples. High resolution and magnification ex; look inside the stomach of an insect or inside a chloroplast

- ◆ **Phase Contrast Microscope:** uses the differences in the phase of light transmitted or reflected by a specimen to form distinct, contrasting images of different parts of the specimen so that you can observe living cells carrying out life functions.
- ◆ **Ultracentrifuge:** separate materials by density – ex: organelles in crushed cells, cells in blood sample

Life Functions

- ◆ **Nutrition:** all the activities an organism performs to obtain or manufacture its food
 - ingestion: taking in of food
 - digestion: breaking large complex food molecules into smaller simpler ones
 - egestion: elimination of indigestible wastes
- ◆ **Transport:**
 - absorption: movement of materials across a cell membrane
 - circulation: distribution of materials within a cell (*cyclosis*) or throughout the organism
- ◆ **Excretion:** the removal of *cellular metabolic* wastes (wastes that have been created as a result of biochemical reactions)
- ◆ **Respiration:** the release of chemical bond **ENERGY** from food particles like glucose through a series of cellular biochemical reactions (**REMEMBER!!!** Energy is **NEVER** produced, created, or manufactured – the energy is **RELEASED** by chemical reactions and **CONVERTED** into a useable form for cellular life activities)
- ◆ **Growth and Development:**
 - growth: increase in size and number of cells
 - development: maturation of the organism
- ◆ **Synthesis:** the building of large complex molecules from smaller simpler ones (opposite of digestion)
- ◆ **Regulation:** control and coordination of life functions
- ◆ **Reproduction:**
 - cellular level: for repair, maintenance, and replacement of cells
 - organism level: not necessary for the survival of the single organism, but reproduction is necessary for the survival of the species.
 - ◆ **Metabolism:** sum total of all the biochemical reactions in an organism
- ◆ **Homeostasis:** internal stable state of an organism
- ◆ **Stimulus:** any action that provokes a reaction
- ◆ **Response:** the action that occurs as a result of being stimulated

Cells

- ◆ **Prokaryotic cells:** cells that DO NOT have an organized nucleus – genetic material is found in the cytoplasm. Also has few organelles
- ◆ **Eukaryotic cells:** cells that DO have a membrane bound nucleus with genetic material contained within the nucleus: have many organelles to carry on life functions.
- ◆ **Cell Theory:**
 - all living organisms are made up of cells
 - the cell is the unit of structure and function of all living organisms
 - all cells come from pre-existing cells
- ◆ **Exceptions to the Cell Theory**
 - mitochondria & chloroplast** – these organelles are structures within cells, but contain DNA and have the ability to reproduce.
 - **Endosymbiotic hypothesis:** concerns the origin of mitochondria and chloroplasts, two organelles contained within various eukaryotic cells. According to this hypothesis, these organelles originated as separate prokaryotic organisms that were taken inside one of the earliest forms of a eukaryotic cell.
 - **where did the first cell come from?**

-- **Viruses** – are made up of a protein jacket and contain DNA/RNA but the only thing they can do is reproduce inside living hosts.

◆ Organization of cells from smallest to largest:

--cells~tissues~organs~organ systems~organisms

◆ Organelles: structures inside living cells that carry on life functions

--cell membrane: made up of a double layer of phospholipids and protein molecules

* **semipermeable**: selectively allows certain substances to pass through the membrane based on size and charge.

* separates the cell from the outside environment

* protection for the inner parts of the cell

--cytoplasm: fluid of the cell, mostly made up of water

* where the cell organelles are found

* site of all biochemical reactions of the cell

--nucleus: “brain” of the cell

* controls and coordinates the life activities of the cell

* houses the chromosomes & nucleolus

--chromosomes: contains the individual’s genetic (hereditary) information

* made up of DNA

* contains genes which carry the coded information of how to assemble polypeptide chains in order to make proteins.

* from largest to smallest: nucleus~chromosomes~genes~DNA

--nucleolus: found inside the nucleus

* site of the synthesis of ribosomes

--ribosomes: found free floating in the cytoplasm or embedded on the surface of the rough endoplasmic reticulum

--rough endoplasmic reticulum (ER): “hallways” of the cell

* long winding channel like organelle with ribosomes on the surface, often found near nucleus

* involved in transport and synthesis of proteins throughout cell.

--smooth endoplasmic reticulum (ER)

* similar in structure to rough ER but NO RIBOSOMES on surface

* involved in transport and synthesis of materials other than proteins in cell

--mitochondria: “powerhouse” of cell (slipper shaped)

* site of cellular aerobic respiration

* oxygen and enzymes to release energy from the bonds of glucose molecules for life functions

* contains DNA, can reproduce

--lysosomes: “Lysol” of the cell

* contain digestive enzymes

* in single celled organisms, help with food digestion (see vacuoles below)

* in multicellular organisms, digest worn out organelles, bacteria and viruses

--vacuoles: “warehouse” of cell

* membrane bound organelle involved in storage of various substances

* plants typically have 1 or 2 large vacuoles; animal cells have smaller vacuoles

* food vacuole: in single celled organisms, lysosomes join up with food vacuoles and put their digestive enzymes inside the vacuoles.

~enzymes digest the food into small particles that can pass through the vacuole membrane into the cytoplasm of the cell

~this is done to separate the enzymes so that the organism (single cell) will not digest itself

* contractile vacuole: for osmotic water balance (see transport)

--golgi body (complex) – UPS of cell

* flattened membranes (like pancakes) with small sacs (vesicles) sent out with packaged materials to other parts of cell or for export outside of cell

* packages, processes, and secretes materials in vesicles to be used outside cells

--centrioles – **IN ANIMAL CELLS ONLY**

* pair of barrel shaped organelles made up of tubules; usually found near the nucleus

* involves in cell reproduction in animal cells only

--chloroplasts – *IN PLANT CELLS ONLY*

* contain *chlorophyll* – green pigment that absorbs sunlight, making it available so photosynthesis to occur

--cell wall – nonliving, made of cellulose (starch) – In Plant Cells

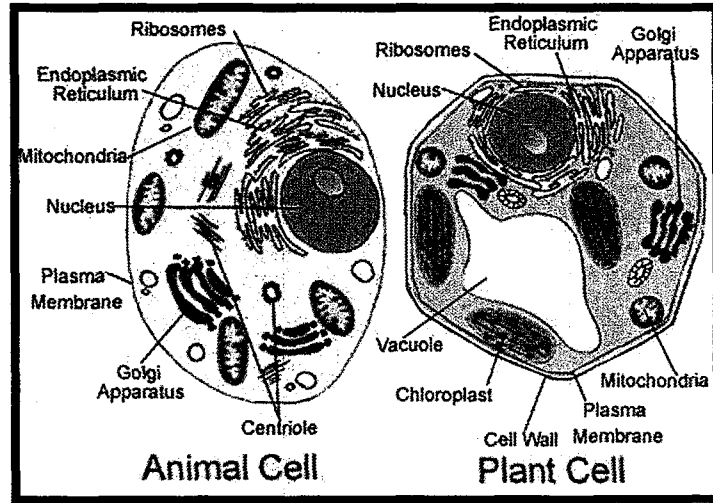
*provides support, rigidity, and structure for plant cells

Bio A vocabulary:

Plastids: specialized organelles that contain DNA, ribosomes, and pigments – involved in food synthesis and food storage

Chromoplasts: plastids that contain pigments other than chlorophyll

Leucoplasts: colorless plastid used to store food for some plants



Scientists

- ◆ **Leeuwenhoek:** examined microscopic organisms under the microscope such as pond organism, blood cells, sperm – described and made drawing of what he viewed
- ◆ **Hooke:** credited with viewing the first cell under the microscope – really looked as dead cork cells only with cell walls
- ◆ **Brown:** credited with identifying the nucleus of the cell
- ◆ **Schleiden:** all plants are made up of cells
- ◆ **Schwann:** all animals are made up of cells
- ◆ **Virchow:** all cells come from pre-existing cells

I hope this helps – don't let this be the end of your studying – practice Regents questions online to help you with your studying!

