

LIVING ENVIRONMENT MIDTERM STUDY SHEET

➤ SCIENTIFIC METHOD/EXPERIMENTAL DESIGN

- Scientific method = method of designing and carrying out a scientific procedure; generally in 7 or so steps
- State the problem -- Form a hypothesis -- Set up and conduct an experiment -- Analyze results -- Draw conclusions -- Repeat -- Peer review and publish
- Scientific theory is a widely accepted explanation of an aspect of the natural world. Based on observation, controlled experiments, supported data. Can change with new information.
- Conducting a controlled experiment involves:
 - An independent variable -- The factor being changed, appears on the x-axis of a graph
 - A dependant variable -- The factor being tested/measured, appears on y-axis
 - A control group -- The group that receives no treatment, used for comparison
 - An experimental group -- Group that is being tested/receives treatment

➤ CHARACTERISTICS OF ALL LIVING THINGS

- All living things:
 - Respond to their environment
 - Grow and change
 - Reproduce and have offspring
 - Have a complex chemistry
 - Maintain homeostasis
 - Are made of cells
 - Pass traits to offspring

➤ LIFE FUNCTIONS

- 8 life functions that are carried out by ALL living things. Can be remembered using the mnemonic 3RGENTS
 - Respiration = the release of energy of food in the presence of oxygen -- produces ATP and glucose
 - Reproduction = sexual vs. asexual (1 vs 2 parents). The act of producing similar offspring
 - Regulation = Control and coordination of various activities of an organism, including response to stimuli
 - Growth = When an organism increases in number of cells and in size
 - Excretion = The removal of chemical and metabolic waste
 - Nutrition = Taking in food, breaking down large food molecules so they can be used by the body (digestion), getting rid of everything else
 - Transport = The movement of materials throughout the organism
 - Synthesis = The binding of small molecules used to build more complex molecules.

➤ CELLS

- Cell theory = all living organisms are composed of one or more cells. The cell is the basic unit of structure and organisation in organisms. Cells arise from pre-existing cells.
- Contain organelles (a tiny structure that carries out a specific function within a cell):
 - Nucleus = brain/control center of the cell. Contains DNA.
Regulation/reproduction
 - Cell membrane = thin, flexible barrier around a cell, regulates what enters and leaves the cell. Transport/regulation
 - Cytoplasm = the area inside a cell between the nucleus and cell membrane, where organelles can be found. Transport, growth
 - Chloroplasts = organelles that capture energy from sunlight and use it to produce food for the cell (PLANTS ONLY) Nutrition/synthesis
 - Cell wall = stiff wall surrounds the cell membrane (PLANTS ONLY) Growth
 - Ribosome = organelle in which amino acids are hooked together to make proteins (site of protein synthesis)
 - Endoplasmic reticulum = organelle that makes lipids, breaks down substances, packages proteins for golgi complex. Transportation
 - Mitochondria = powerhouse of the cell. Organelle that breaks down molecules to make energy. Respiration
 - Golgi complex = Processes and transports proteins and other materials out of the cell (kinda like the UPS of the cell). Regulation/transport
 - Vacuole = Stores materials like water. Excretion/nutrition/regulation
 - Lysosome = Organelle that digests food particles, wastes, cell parts, and foreign invaders (consumes cell when it dies). Regulation
- A prokaryotic cell doesn't contain a nucleus or any membrane bound organelle (ex. bacteria)
- A eukaryotic cell does contain nucleus and membrane bound organelles (ex. Plants, fungi, humans, insects)
- Plant cells have large vacuoles, cell walls, chloroplasts. Animal cells have small vacuoles, no cell wall, no chloroplasts.
- Levels of organisation:
 - Organelles --- cells --- tissues --- organs --- organ systems --- organism

➤ TRANSPORT/DIFFUSION

- In passive transport/diffusion, molecules always move from high to low until they reach equilibrium.
- Osmosis refers only to the diffusion of water molecules across a membrane:
 - Humans = 70% H₂O and 30% other molecules
 - Concentrations are equal in and out of cell = normal
 - Higher concentration of water inside than out = cell will shrink (ex. Cell in salt water)
 - Lower concentration of water inside = cell will swell (ex. Cell in distilled water)
 - Human red blood cells placed in a 2% salt solution appear to shrink, but those placed in a .4% salt solution appeared to burst

- Active transport:
 - Movement of material across cell membrane AGAINST concentration gradient
 - Proteins “pump” molecules with addition of ATP
 - Needs ATP
 - Goes from low to high concentration

➤ BIOCHEMISTRY

- 4 molecules that make up everything are Carbon, Hydrogen, Oxygen, and Nitrogen
- Organic molecules are molecules that have Carbon and Hydrogen somewhere within them
- 4 macromolecules:
 - Lipids == Fatty acids ----- 1 glycerol + 3 fatty acids=1 lipid. Make up cell membrane
 - Proteins == Amino acids ----- Functions include : Enzymes (help carry out chemical reactions), structural support, transporting molecules in and out of cell (cell membrane), antibodies (fights disease), regulating body metabolism (hormones), intercellular communication (hormones and receptors), energy
 - Carbohydrates == Simple sugars (glucose) ----- give us energy, stores extra sugar as complex carbs
 - DNA/RNA == Nucleotides
- Enzymes
 - Biological catalyst that aids and speeds up chemical reactions
 - Reactants ----- Products
 - Substrate ----- enzymes ----- Products:
 - Lactose ----- Lactase ----- glucose + galactose
 - Maltose ----- Maltase ----- glucose
 - Enzymes are proteins, so they need a perfect fit to work properly
 - If shape is altered (denatured), the enzyme cannot function and the reaction rate will decrease.
 - Enzymes have an optimum temperature where they work best, and an optimum pH. The closer you are to optimum conditions, the faster the rate of reaction will be.
 - Substrate aids enzymes/connects with enzymes (reactants)
- Plant anatomy
 - Chloroplast = site of photosynthesis
 - Guard cell = mostly at the bottom of the leaf, cause stoma (pores) to open/close.
Carbon dioxide comes in, oxygen comes out.
 - Materials that plants need:
 - Sun
 - Water
 - Carbon dioxide
- Photosynthesis
 - CO₂ -----sunlight energy-----Oxygen
 - Water + Carbon dioxide -----light----- glucose +oxygen

- Chloroplast captures light and uses it to to turn water and carbon dioxide to sugar and oxygen
 - Cellular Respiration
 - Process in which glucose is converted into usable energy (ATP)
 - Aerobic respiration = w/ oxygen, Anaerobic respiration = w/o oxygen
 - ATP = Adenosine Triphosphate, high energy molecules that cells run on. Need for life functions. Energy is stored in ATP bonds, and you need to break them to get the energy
 - Sugar + oxygen ----- water + energy (ATP) + CO₂
 - Aerobic respiration formula:
 - Glucose+oxygen ----- CO₂+H₂O+ATP
 - Anaerobic respiration formula:
 - Fermentation; glucose ----- lactic acid + 2ATP (ex. Humans, bacteria)
 - Glucose ----- alcohol + carbon dioxide + 2ATP (ex. yeast)
- HUMAN BODY SYSTEMS
 - Digestive System:
 - Nutrients
 - Give us energy
 - Substances found in food that supply raw materials
 - Carbs, fats, proteins, vitamins, minerals, water
 - Breakdown of food and absorption of nutrients
 - Ingestion ----- digestion/absorption ----- egestion
 - Mechanical digestion:
 - Large pieces of food break down into smaller pieces by cutting, grinding, and tearing. Small pieces increases the surface area
 - Chemical digestion:
 - Large and insoluble nutrients (macromolecules) broken down into smaller, soluble molecules (building blocks) w/ the help of enzymes
 - Gastrointestinal tract:
 - Mouth ---- esophagus ---- small intestine ---- large intestine
 - Peristalsis = wavelike muscle contractions that push food down
 - Accessory structures = salivary glands, pancreas, liver, gallbladder
 - Small intestine:
 - Absorbs nutrients
 - Folded surfaces are covered with finger like projections called villi and microvilli
 - Villi increase surface area so nutrients can enter at every point
 - Building blocks absorbed by capillaries (and lacteals)
 - Circulatory System
 - Moves materials through the body to organs and cells that need them
 - Heart, blood vessels (veins, arteries, capillaries), blood that flows through them
 - Transports nutrients oxygen, glucose, water:
 - Nutrients and water ---- from intestines to body cells

- Oxygen ---- from lungs to body cells
- Wastes ---- from all cells to excretory/respiratory systems
- Hormones ---- from glands to target cells
- The human heart:
 - Made up of mostly muscle
 - 2 sides (right=deoxygenated blood, left=oxygenated blood)
 - Separated by Septum (wall) --- prevents mixing of two kinds of blood
 - 4 chambers - atria and ventricles
 - Atria (atrium singular) = upper, receives blood
 - Ventricles = lower, pumps blood out of heart
 - Valves prevent the backflow of blood between atria and ventricles
 - Veins carry blood to the heart, arteries carry blood away from the heart
 - Contents of blood:
 - 2 things
 - Plasma - fluid (mostly water). Transports everything except CO₂ and O₂
 - Cells:
 - Red blood cells (RBC): contains hemoglobin (a protein) ----- transports O₂ and CO₂
 - White blood cells (WBC): help fight infection
 - Platelets: involved in blood clotting
- Blood vessels
 - Blood moves through 3 types of blood vessels:
 - Arteries: Carry blood away from the heart to the tissues of the body (ex. aorta)
 - Capillaries: Exchange of nutrients, oxygen, and wastes
 - Veins: Returns blood to the heart (ex. Vena cava)
 - Things get transported via diffusion (usually in capillaries since they're the thinnest)
 - Oxygen is high in the lungs and low in the blood, goes to body cells
 - Nutrients are high in the intestines and low in the blood, go to body cells
 - CO₂ and waste are high in cells, low in the blood, go to lungs/excretory
- Respiratory System
 - Involves gas exchange environment and lungs
 - Obtain oxygen for body cells and eliminate CO₂
 - Oxygen is inhaled through the nasal or oral cavity, travels down resp. System to the lungs, where CO₂ leaves the red blood cells in the capillaries and is exhaled
 - The O₂ that is in the lungs/alveoli enters the blood (oxygenates blood) and the blood is then carried back to the heart and pumped to body cells
 - Mouth/nose ---- pharynx (throat) ---- larynx ---- trachea ---- left and right bronchus (within lungs) ---- bronchioles ---- alveoli

- To or from lungs = pulmonary
- Respiratory surface stays moist at all times (so gasses can diffuse across membrane)
 - Thin enough for gasses to diffuse
 - Closely connected to transport system
 - Needs air source
- Lungs expand and retract due to volume and pressure changes in chest cavity and actions of rib cage/diaphragm
- Breathing rate is sensitive to concentration of CO₂ in blood (high = increase, low = decrease)
- Immune System
 - Main function is protection against disease and recognize antigens
 - Antigen: A specific protein marker on foreign cells
 - Pathogen: an infectious agent that causes disease or illness to host (ex. Bacteria, virus)
 - Made up of white blood cells:
 - Macrophages/Phagocytes = engulf pathogens
 - Lymphocytes = recognize antigens
 - T-cells = kill pathogens or mark them for destruction (killer/helper/memory)
 - B-cells = Produce specific antibodies (plasma cell/memory)
 - Protection against disease:
 - Non-specific immune response
 - First line of defense = keep them out
 - Skin & secretions of skin (tears, saliva, mucous)
 - May get in through cuts, mouth, nostrils, etc.
 - Second line of defense = inflammatory response
 - Macrophages come to area
 - Body temp. Increase (fever)
 - Specific immune response:
 - Pathogen has reached your body cells
 - Lymphocytes and antibodies created
 - Stages of antibody mediated immunity:
 - Antigen detection
 - Activation of helper T-cells
 - Antibody production by B-cells
 - Antibodies = a protein that helps destroy a pathogen. Each antibody is specific to an antigen (perfect fit).
 - Antibiotics are for bacterial and fungal infections and are prescribed after an infection is contracted to slow the growth of the bacteria.
 - The first antibiotic ever was penicillin

- Vaccines are used mainly for viruses (and some bacteria like Tetanus). A dead or weakened form of the virus is injected to produce immunity by stimulating the production of antibodies.
 - Autoimmune disease = immune system targets own cell proteins
 - Celiacs disease, Lupus, arthritis, etc.
 - HIV ----- AIDS
 - Attacks own immune system
 - Invades and destroys helper T-cells
 - Can't make antibodies properly or eliminate cells containing HIV
 - Decreased body's ability to fight the infection
 - Constant helper T-cells being infected & destroyed === AIDS
- Excretory System
 - Wastes of metabolism are removed from the body
 - Lungs ---- liver ---- sweat glands ---- kidneys
 - Lungs = excrete CO₂ and water vapor (both are wastes of cellular resp.)
 - Liver = Removes amino group from amino acids. Deamination gets rid of excess amino acids -- aminos are converted to urea. Liver also breaks down RBCs
 - Sweat glands = excrete water, salts, small amt. of urea. Diffuse from capillaries into glands to ducts to pores. Sweat is the result of the diffusion.
 - Kidneys = remove urea from the blood, regulate concentrations of substances in body fluids.
 - Nephron = functional unit of kidney. Consists of a glomerulus surrounded by a cup shaped structure called Bowman's capsule. Substances diffuse into this capsule (filtration)
 - Urinary system: Urine flows from kidneys to ureters, then to urinary bladder, then urethra, where it leaves the body
- Nervous system/Endocrine system
 - Specialized receptors receive stimuli, leads to a response
 - Feedback mechanisms:
 - The level/activity of one substance influences the level/activity of another organ
 - Stimulus ----- Response (ex. Hot ----- sweat)
 - System is made up of neurons (nerves are a bundle of neurons)
 - Central nervous system = brain and spinal cord:
 - Brain =
 - Cerebrum = Center for voluntary actions (thought, memory, learning, reasoning)
 - Cerebellum = Coordinates movement and helps maintain balance.
 - Medulla = controls involuntary activities (breathing, heart rate)
 - Spinal cord

- Coordinates activities between brain and body.
- Peripheral nervous system = all nerves outside CNS
- Neurons and nerves transmit impulses:
 - Impulse reaches terminal branch of 1 cell
 - Release neurotransmitter which carries impulse
 - Diffuse across synapse (space between nerve cells)
 - Stimulate dendrites of 2nd neuron (bind to receptor, perfect fit)
- Pathway of a stimulus:
 - Stimulus ---- receptor ---- sensory neuron ---- Interneuron ---- motor neuron
 - Reflexes are controlled by spinal cord, no brain involvement