

Final Review (all study guides combined)

1. Chemical Bonds

-3 types of bonds = ionic, covalent, hydrogen

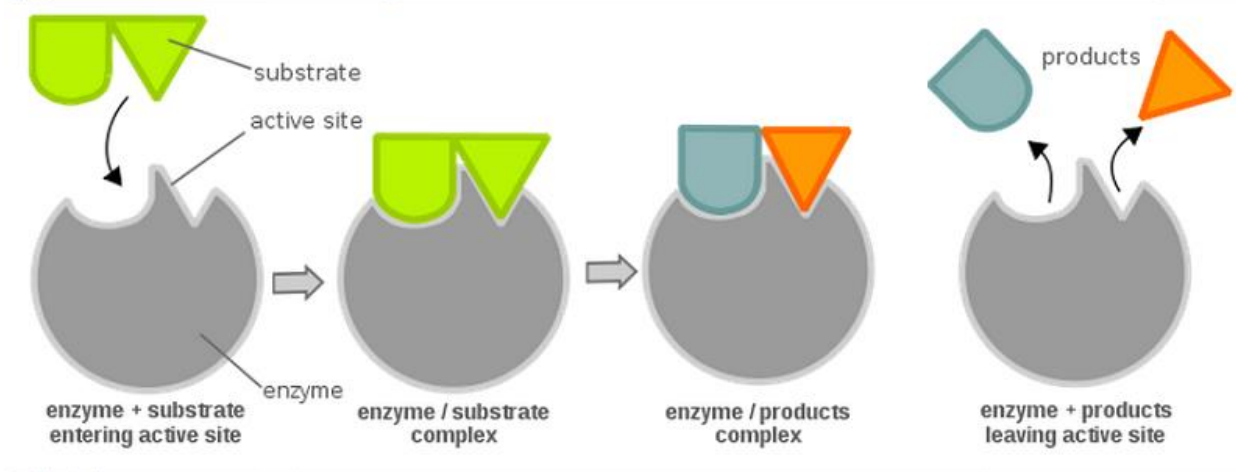
- 1) Ionic = 2nd strongest, formed when 1 atom gives electron(s) to another, ex: NaCl
- 2) Covalent = strongest, formed when atoms share electrons, ex: all organic compounds
- 3) Hydrogen = weakest, formed by hydrogen acquiring an electron from another atom, ex: H₂O

2. Enzymes

-biological catalysts that speed up reactions in the body that would take lots of time by itself

-enzymes speed up chemical reactions

-they can only work in specific conditions, such as a specific pH and temperature



-can put atoms together or break them apart

-structure of enzyme determines function, like a puzzle piece

3. Organic Compounds

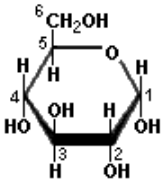
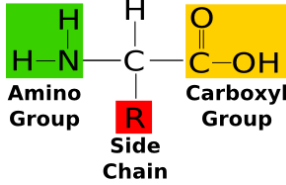
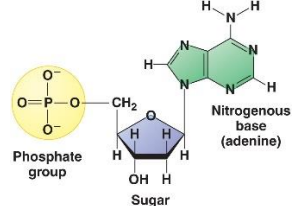
-Carbon properties

-Can form up to 4 covalent bonds, including other carbon atoms

-Has 3 structures: straight chain, branched chain, ring

-Carbon compounds formed with monomers that make up polymers

-4 carbon molecules

| Type of molecule | Carbohydrates | Proteins | Lipids | Nucleic Acids |
|----------------------|---|---|--|---|
| monomer | Monosaccharides | Amino acids | Glycogen + sugar | Nucleotide |
| polymer | Polysaccharides | Proteins | Fats, oils, waxes | DNA, RNA |
| importance | Build cell walls, plants store glucose in starch form | Build different structures, perform different functions | Build cell membranes, used as quick energy | Store genetic information |
| Structure of monomer |  |  | |  |

-dehydration synthesis = water is removed to bond atoms, ex: glucose + galactose = lactose + H₂O

-hydrolysis = water added to split molecules, ex: lactose + water = glucose + galactose

-lipoproteins = proteins that transport lipids through blood plasma to give energy to cells,

-good LP = HDL = keeps bloodstream clean, puts all cholesterol back in liver

-bad LP = LDL = very large, clogs up bloodstream, causing problems

-saturated vs unsaturated = saturated: animal fat, considered bad, higher concentration of H, single bonded, solid at room temp; unsaturated = vegetable oil, lower concentration of H, double bonded, liquid at room temp

4. Homeostasis

= maintenance of internal conditions

-ex: thermostat

-negative feedback system: doing the opposite to maintain balance ex: when too hot, body sweats

-positive feedback system: keeps increasing until negative feedback neutralizes

-when imbalanced, body does opposite, like sweating

5. pH

-0-14, <7=acid, >7=base, 7=neutral

-acids have higher H⁺ concentration than bases

6. Indicators

-Benedict's solution = simple sugar, original color = blue, changes to = green-red

-Biuret's Reagent = proteins, original color = blue, changes to: purple

-Sudan III = lipids, original color = orange, changes to: vivid orange/orange concentrates

-Iodine = starch/complex sugars. Original color = yellow/brown, changes to = blue/black

7. Scientific Method

Steps:

- Observation
- Hypothesis
- Experiment/testing hypothesis
- Analyze data
- Draw conclusions

-Controlled experiment is important because otherwise, the results would be skewed since more than one variable would be changed

-dependent variable = tested (responding)

-independent variable = changed purposely (manipulated)

-controlled variable = stays the same (constant)

-dependent variable = y axis; independent = x axis

8. Properties of Water

-Polarity of water molecule = H atoms are slightly positive, O atom slightly negative

-adhesion= water sticking to something else, like a towel

-cohesion= water sticking to itself, like surface tension

9. Chemistry

-ions = slightly charged atoms

-atoms = building blocks of matter

-elements = a specific type of atom

-chemical compound = elements bonded together

-chemical reactions:

- Reactants and products: reactant + reactant \rightleftharpoons products (arrow goes both ways)
- Activation energy = energy required to start reaction
- Endothermic reaction = products have more energy than reactants
- Exothermic reaction = products have less energy than reactants
- Equilibrium = reactants and products form at the same rate

-solutions:

- Solute = substance that is dissolved
- Solvent = substance that dissolves solute
- Homogeneous mixture = cannot see different parts, cannot be separated easily
- Polar solvents dissolve polar solutes, nonpolar solvents dissolve nonpolar solutes, polar vs nonpolar generally remain separate

-suspensions:

- Precipitate = insoluble solid
- Heterogeneous mixture = can see different parts, separates easily

Cell Test

1. Cell Structures and Organelles

-Nucleus = control center of cell, stores DNA

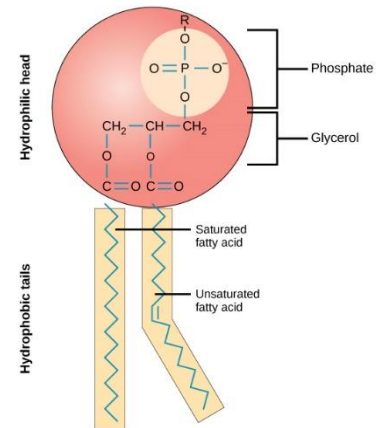
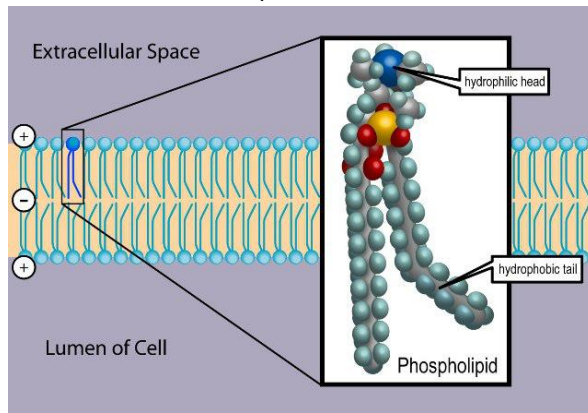
-Nucleolus = makes ribosomes

-Nuclear membrane/Nuclear envelope = protects genetic material

-Cytoplasm = where important chemical reactions take place

-Cell membrane = controls what goes in and out of cell

- fluid mosaic model (molecules found inside membrane)



-made of a phospholipid bilayer with proteins embedded

-phospholipids:

-structure (fatty acid):

-hydrophilic part = head

-hydrophobic part = tail

-Location in cells = cell membrane

-Semipermeable = some can molecules can get through, some cannot

-Ribosomes = make proteins

-Rough ER = makes proteins (ribosomes embedded) and makes lipids

-Smooth ER = makes lipids

-Golgi apparatus = cell's post office, packages, labels, and sends proteins using vesicles

-Lysosomes = kill harmful bacteria and recycle used cell parts

-Mitochondria = break down sugar for the cell to use as energy

-Chloroplasts = produce sugar through photosynthesis

-Vacuole = stores waste, useful materials

-Cytoskeleton = made of microtubules

-Microtubules = thin tube-like structures that go around cell

-Composition = tubulin

-Importance = aids in cell division, help motor proteins travel around cell, gives cell shape

-DNA/Chromatin = stores genetic info

-Centrioles/Centrosome = make microtubules

-Cell wall = gives plant cell box-like shape; composed of cellulose

-Plastids = double membrane bound organelles, ex: chloroplast

-Difference between plant and animal cells:

-Shape: plant = box, animal = bubble/many different sizes

-Organelles: lysosome, centrioles: only in animal; cell wall, chloroplasts, large central vacuole = only in

plant

-Steps for producing and sending a protein: nucleus sends instructions, ribosomes makes it, sent to Golgi apparatus where it is packaged, labeled, and shipped

2. Cell Transport

-Active transport = sending something against concentration gradient, needs energy to do

-Passive Transport = transport that does not require energy, ex: diffusion, osmosis

-Diffusion = high-low concentration

-Osmosis = diffusion of water molecules

-Facilitated diffusion = molecules go through protein channels in membrane which regulate diffusion

-Endocytosis = the cell membrane curving to engulf a molecule

-Exocytosis = cell membrane curving away to get rid of molecule

- Transport proteins = proteins embedded into membrane that control what goes in and out
- Concentration gradient = natural flow of molecules/high to low
- Isotonic = water moves in and out of cell at constant rate
- Hypertonic = solute surrounds cell, which makes the water flow out of cell
- Hypotonic = water surrounds cell, so cell becomes bloated with water
- Surface area to volume ratio = different purposes for cells determine shape, ex: nerve cell = cylinder, fat cell = sphere
- Dynamic equilibrium = equilibrium that changes
- Dialysis tubing = man-made semi permeable membrane

3. Homeostasis

- Definition = maintenance of internal conditions
- Examples: sweat, shiver
- Negative feedback = body returns parameter to normal
- Positive feedback = body increases parameter until negative feedback system kicks in
- Homeostatic imbalances and responses = body too cold = shivers, body too hot = sweat

4. Scientific Method

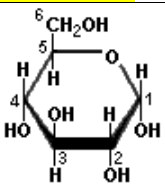
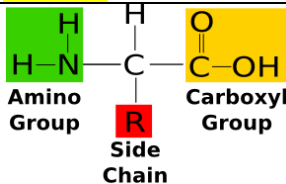
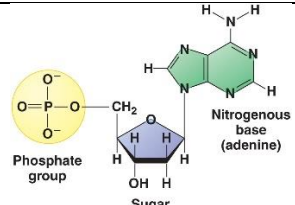
- steps: question, hypothesis, design/perform experiment, analyze data, draw conclusions
- controlled variables = do not change, help experiment be accurate
- dependent variable = measured in response to independent
- independent variable = changed on purpose
- controlled variables= do not change

5. Cell Theory

- prokaryotes vs eukaryotes = no nucleus, nucleus
- 3 parts of theory- 1) All living things composed of cells, 2) Cells are made from other cells, 3) Cells are fundamental basic unit of life
- applies to living things
- Robert Hooke = observed cork cells and put the name "cell" in place
- Endosymbiotic theory:
 - Occurred by cells engulfing other things and they reproduced inside of cell by themselves
 - evidence: mitochondria and chloroplasts have their own membrane and ribosomes, much like a prokaryote

6. Organic Compounds

- 4 types of carbon compounds +where they are found:

| Type of molecule | Carbohydrates | Proteins | Lipids | Nucleic Acids |
|----------------------|---|---|--|---|
| monomer | Monosaccharides | Amino acids | Glycogen + sugar | Nucleotide |
| polymer | Polysaccharides | Proteins | Fats, oils, waxes | DNA, RNA |
| importance | Build cell walls (cellulose), plants store glucose in starch form, | Build different structures, perform different functions, enzymes, | Build cell membranes, used as quick energy | Store genetic information |
| Structure of monomer |  |  | |  |

Cell transport?

Chemical indicator: iodine: indicates presence of starch

Photosynthesis/Cellular Respiration Test

- Energy = the ability to do work
- Forms of energy:
 - Kinetic energy = moving objects contain kinetic
 - Potential energy = stored energy:
 - chemical potential energy: energy stored in molecules, specifically in bonds
 - gravitational potential energy: potential energy due to gravity
 - law of conservation of energy = energy cannot be created or destroyed, only transformed; ex: stove, as heat builds, the energy is released into the air

CHEMICAL ENERGY AND ATP

- ATP = used for energy in cells
- Energy is stored in bonds of ATP
- Energy is released when the third phosphate bond is broken
- Important energy sources: carbohydrates and lipids
- ATP: 3 parts: phosphate group, ribose, adenine
- Phosphate groups = where the energy is stored/third bond
- ADP = adenosine diphosphate
- Cycle: ATP, when used, -> ADP, energy from food is broken down; phosphate group added
- , -> ATP; proteins needed to carry out this process
- calorie = energy needed to raise 1 gram of water 1 degree Celsius
- Calorie = 1000 calories
- Autotroph = producers/ perform photosynthesis
- Heterotrophs = consumers/ do not carry out photosynthesis
- Chemosynthesis = uses chemicals from CO₂ and O₂ to create sugars, found in autotrophs, molecules: carbon dioxide, oxygen, glucose/sugar

PHOTOSYNTHESIS

- Definition = process that captures energy from the sun to make sugars
- Equation = $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- Electromagnetic spectrum = all wave lengths, visible light/white = ROYGBIV
- Chlorophyll a and b = absorb red + blue wavelengths, reflect green wavelengths
- Accessory pigments = light absorbing compounds (chlorophyll a and b)
- Grana = stacks of thylakoids/ coin shaped compartments
- Thylakoid = single coin-shaped compartment
- Stroma = liquid inside chloroplast
- Importance of membrane = where light enters the cell
- Stages of photosynthesis:

LIGHT DEPENDENT REACTIONS

- Sparked by photons from sunlight
- Happens inside thylakoid/thylakoid membrane
- Photosystem 1 and 2 = electron chain that in the end, produces ATP and NADPH
- Reactants = H₂O, sunlight
- Products = ATP, NADPH, O₂

Light dependent reaction

-energy from light independent reaction: NADPH and 2 ATP helps bond together CO₂ molecules together to form glucose

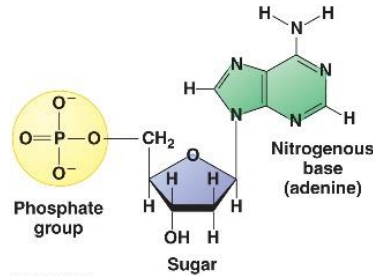
- calvins cycle
- ADP and NAD⁺ are put back into light dependent stage to turn into NADPH and ATP
- overall function of photosynthesis: transform chemical energy of ATP and NADPH into glucose
- use: base of food chain; help regulate air through cycles

LEAVES STRUCTURE

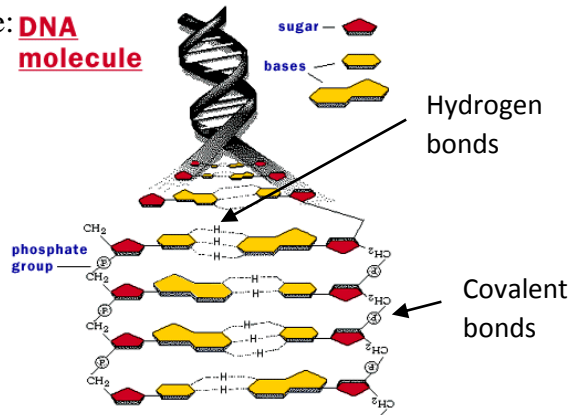
- epidermis = waxy coating that covers leaf, function is to absorb water, protect leaf, etc
- Cuticle = coating over epidermis, function is to prevent water loss
- Guard cells = cells that control stoma, function is to regulate gas in and out of cell by pumping potassium ions into guard cells, creating a hypertonic solution inside; water rushes in and a tunnel is showed
- Palisade layer = where most photosynthesis occurs\ right below epidermis and cuticle
- Spongy mesophyll layer = where gases can flow through/ middle of cell layers
- Veins = transport materials for cells; run throughout cell

Cell Division Test Review

- All scientists = end discovery: DNA contains genetic info, is helical shaped, C=G, A=T
- Monomer of DNA = nucleotide:



- Chargaff's rule = Cs = Gs, As = Ts
- DNA molecule: **DNA molecule**



DNA REPLICATION

- Purpose = copy DNA into identical copies
- Role of enzymes in replication = check DNA for mistakes, unzip the DNA
- Importance of hydrogen bonds = allow DNA to be easily unzipped and copied
- Source of nucleotides for replication = cytoplasm
- Replication result = one old strand, exact copy of original strand
- Replication can happen in a few hours because of enzymes that speed up the reactions

CHROMOSOMES

- Somatic cells = any cell besides sex cells (somatic contain autosomes)
- Germ cells = sex cells; reproduce through meiosis
- Autosomes = first 22 chromosomes
- Sex chromosomes = 1 pair of chromosomes (XX = girl, XY = boy)

- Homologous chromosomes = chromosomes that are exactly alike in shape/size
- Chromosome = contains chromatids/sister chromatids
- Histones = proteins that DNA wraps around in order to become tightly packed and make a chromosome
- Centromere = center of chromosome
- Chromatin = DNA in its unwound state
- Genes = controls heredity
- Genes store genetic code through a code of nitrogen bases (ACGT)
- With the code, genes tell DNA use the code
- Humans have 20,000 genes
- Telomeres = caps at the end of chromosomes; wear out over time; like aglets of a shoe lace
- Diploid = full number of chromosomes
- Haploid = half of chromosomes

CELL CYCLE

- G1 = cell does regular functions
- S = DNA is replicated
- G2 = cell prepares for cell division (makes sure everything is correct)
- Mitosis
- Cytokinesis = cell splits into 2
- Rates of cell division = depends on type of cell
- Limits of cell size = volume cannot be too great since certain functions cannot be carried out quick enough, so cell divides

MITOSIS

- Cells that undergo mitosis = somatic cells
- Result = 2 identical daughter cells
- Prophase = chromosomes formed from DNA
- Metaphase = chromosomes line up in center of cell with spindle fibers attached
- Anaphase = chromosomes split from centromere
- Telophase = chromosomes go to each side, cell pinches together
- Cytokinesis = after mitosis; where cell splits
- Regulation of cell cycle = certain internal + external conditions need to be met
- Apoptosis = planned death of a cell
- Cancer = uncontrolled cell division/growth
- Benign cancer = no cells break away from tumor
- Malignant cancer = cells break away, go into bloodstream, form new tumors
- Causes = carcinogens, too much sun, radiation, chemicals
- Treatments = radiation therapy, chemotherapy
- Asexual reproduction = produces identical offspring
- Type of asexual reproduction = binary fission
- Occurs in most prokaryotes
- Advantages of asexual repro = very predictable, everything is the same
- Disadvantages = organisms cannot adapt (unless mutations occur)
- Advantages of sexual repro = organisms can adapt/diversity of species
- Disadvantages = not everything is the same

MEIOSIS

- Reproduction of germ cells
- Product of meiosis = 4 haploid cells, genetically different from each other
- Stages: PMAT I, PMAT II

- Gametogenesis = reproduction of gametes/sex cells

MULTICELLULAR ORGANISMS

- Stages:

- 1) Cell
- 2) Tissue
- 3) Organ
- 4) Organ system
- 5) Organism

- Cell differentiation = simple cell changing into a specialized cell

STEM CELLS

- Cells that can change into a specialized cell
- Different types of stem cells
- Importance = can repair tissue that is lost or form into a type of cell when the body needs it