Chapter 5: Biochemistry

-**Names of all macromolecule monomers(including the 3 parts of a nucleotide) and polymers, the names of the bonds formed between monomers of each class.**

**-Dehydration synthesis and Hydrolysis reactions**

-Calculate the number of glycosidic bonds formed/broken given number of monosaccharides present

-# of bonds = number of monosaccharides-1

-Determine the chemical formula of a polysaccharide based on number of monosaccharides present (don’t forget to subtract out the water molecules at the end!).

-if 6 molecules of glucose are joined together to form a polysaccharide, what will the chemical formula of the resulting molecule be? 6(C6H12O6) - 5(H2O)= C36H62O31

-Calculate the number of peptide bonds in a polypeptide, given the number of amino acids present.

-# of bonds = number of amino acids -1

-Calculate potential combinations of amino acids given all 20 or just a few.

-For a dipeptide, how many combinations of 3 amino acids (Thr, Ala, Glu) are possible: (number of amino acids) length of polypeptide🡪 32=9

-If the polypeptide is 4 amino acids long, out of all 20 amino acids, how many combinations are possible? 204= 160,000

-If the polypeptide is 4 amino acids long and given 4 amino acids (Arg, Tyr, Gly, Met), how many polypeptides that USE ALL 4 DIFFERENT AMINO ACIDS can be made? (I will use small numbers for these if they appear on the test)

4 x 3 x2 x 1= 24 (or draw a “tree”)

-E**lements present in each of the biological macromolecules**.

Proteins: C, H, O, N, S

Carbohydrates: C, H, O (specifically in some form of the ratio CH2O)

Lipids: C, H, O, P

Nucleic Acids: C, H, O, N, P

-**Identify molecular structures according to macromolecule class, based on atoms present in molecule and structure (additionally, polysaccharide vs di and mono, phospholipid vs triglyceride vs steroid)**

-**Be able to identify polar and nonpolar molecules**.

-Polar molecules are indicated by the presence of O, S, P or N in biological molecules because they are electronegative elements

-their large proton nuclei are good at attracting electrons closer to them

And therefore they hold partially negative charges when bound to much less

Electronegative atoms, like H, who would then hold a partially positive charge.

-Nonpolar molecules are indicated by two of the same atoms bound together, like O2 (the oxygen atoms would share electrons equally because their nuclei have an equally positive pull on the shared electrons), or the presence of large hydrocarbon chain/s (fatty acids) or ring structures (steroids)

-**Main properties of each class of macromolecules**.

-Proteins:

-Given a picture, classify amino acid side chains as polar or nonpolar, and neutral, basic, or acidic, infer hydrophobicity from this.

-**Polar/Hydrophilic** amino acids will be visibly charged and have an O,N, or S at the tip of the R group.

-**Basic** Amino acids will remove H+ from solution, they are proton acceptors, these will have an amine group (NH3+, NH2+) at the tip of their R group , they will be positively charged if alone in an aqueous environment

-**Acidic** amino acids will add H+ to solution, they are proton donors, these will have a carboxyl group (COO-) at the tip of their R group, they will be negatively charged if alone in an aqueous environment.

-**Nonpolar/Hydrophobic** amino acids will be neutral in charge and havea hydrocarbon chain or ring/s at the tip of the R group

-Predict the location of an amino acid in a protein in a membrane-bound protein, or in an aqueous solution, given polarity or charge.

-Protein structure:

-Primary= amino acid sequence

-Secondary= Hydrogen bonding via alpha helices or beta pleated sheet

-Tertiary= Side chain interactions (van der waals, di-sulfide bridges…)

-Quarternary= interactions between multiple polypeptides (only for proteins consisting of 2 or more polypeptide chains)

-Lipids: triglycerides (fats) and steroids are hydrophobic, phospholipids are amphipathic

-Carbohydrates: polar

-DNA/RNA: structural differences and adherence to complementary bases, and their importance.

**-Common monosaccharides, disssacharides, and polysaccharides of carbohydrates and polysaccharide functions.**

-Common monosaccharides that form common disaccharides

-Glucose + Fructose 🡪 Sucrose

-Glucose + Galactose🡪 Lactose

-Glucose +Glucose 🡪 Maltose

-Polysaccharides of glucose: cellulose, chitin, glycogen, amylose, amylopectin

-Cellulose: plant cell walls (structural)

-Chitin: contains N appendage, exoskeletons of bugs, fungi cell walls (structural)

-Glycogen: human energy store in liver/muscles, primary energy (storage)

-Amylose (starch): plant energy store, less branched (storage)

-Amylopectin (starch): plant energy store, more branched (storage)

-**Main functions of lipids**:

-secondary/long term energy storage

-insulation, protection

-electrical conductivity

**Chapter 6: Cell Parts and Functions**

**Study the matching worksheet (made from text page 122 and chapter 6) given out on Monday, attached in the e-mail.**

-know functions and order of protein product transport from the rough ER

-according to these functions be able to identify which organelles would be prevalent in a specialized cell given a specific function of that cell type.

-Know what proteins compose the cytoskeletal elements and what their main functions are.

For example:

A cell that is responsible for producing steroids likely contains an excess of which organelle?

-Smooth ER because this is where lipids are synthesized. (you will have choices on your test)

**Chapter 7: Membrane Structure and Function**

-Study the two matching worksheets you were given on Monday.

-compares passive transport and active transport

-roles of glycoproteins in membranes

-role of cholesterol in membranes

-Components of the cell membrane that make it selectively permeable

-Purpose of the sodium-potassium pump

-Adaptations for salt water organisms

-Given a problem with a selectively permeable membrane and concentrations of solutes and whether or not they can cross the membrane, determine outcome of pictured and labeled U tubes.

-Determine direction of osmosis for a cell in hyper, hypo, and isotonic solutions. BEWARE OF WORDING!

-iso means same, equal movement of water between cell and environment

-hyper means more

-if the cell is hypertonic to the solution, water will move into the cell

-if the solution is hypertonic to the cell, water will move out of the cell

-hypo means less

-if the cell is hypotonic to the solution , water will move out of the cell

-if the solution is hypotonic to the cell, water will move into the cell

-Determine given molecules (structure or generalized names), those that would be easiest and hardest to transport through the membrane

**Chapter 8: Metabolism**

-Energy is required for life

-The universe favors entropy

-catabolism vs anabolism/ endergonic vs endergonic given chemical reaction or graph of free energy

- read graph of energy throughout chemical reaction, know the effect of an enzyme on these graphs

-conservation of metabolic processes throughout evolution

**Chapter 9 and 10: Photosynthesis and Cellular Respiration**

-structures of mitochondria and chloroplasts, know that membranes are used in prokaryotic cells

-comparisons between mitochondria and chloroplasts, structure, DNA, enzyme, ribosome content

-mitochondria and chloroplasts as proof of evolution from line of ancient cells

-establishment of proton gradients using ETC and where they are pumped to and from in mitochondria and chloroplasts

-remember plants also perform cellular respiration (all living organisms do)

-terminal electron acceptors in ETC in chloroplasts and mitochondria and which membrane the ETC is embedded in in each organelle

-ATP production across steps of eukaryotic cellular respiration

-aerobic vs anaerobic respiration in terms of energy production

-the importance of glycolysis as proof of evolution from a single line of ancient cells

-presence of 2 forms of chlorophyll with different wavelength absorption, as well as other pigment molecules with different wavelength absorption

-read wavelength graphs to determine efficiency of photosynthetic processes

**Chapter 11: Cell Communication**

-paracrine, autocrine and endocrine signaling

-meaning of transduction, ligand, protein phosphatase

- general role of phosphorylation and phosphorylation cascades.

-importance of Calcium ions in signaling

-apoptosis as part of normal morphogenesis

**Chapter 12: The Cell Cycle**

-order and main events of interphase (G1, S, G2) and mitosis (PPMAT and cytokinesis)

-occurs in somatic cells, produces 2 identical diploid cells

- role of centrosome in mitotic spindle formation and what cytoskeletal element composes these fibers (microtubules)

-cleavage furrow and cell plate

-cycle regulation: check points, cyclins and cdks

-cancer results from uncontrolled cell growth and division

**Chapter 13: Meiosis**

-how meiosis contributes to genetic variation

-occurs in gametes, produces 4 different haploid cells

-fertilization further increases genetic variation of zygote

-crossing over process and effect on genetic variation, independent assortment

-karyotypes and irregular karyotypes, nondisjunction

**Chapter 14 and 15: Genetics**

-true breeding, homozygous, heterozygous, genotype, phenotype, epistasis

-tay sachs, sickle cell, cystic fibrosis, PKU, Huntingtons, down syndrome

-P cross, F1 cross, F2 outcome

-9:3:3:1 ratio significance

- laws of idependent assortment and segregation

-cross outcomes of mono and dihybrid crosses

-codominance vs incomplete dominance

-read a pedigree

-x-linked crosses and blood type crosses

-gene linkage

THERE WILL NOT BE A CHI SQUARE PROBLEM, YOU'RE WELCOME