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STUDY GUIDE FOR CHEMISTRY 161 FINAL EXAM
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DISCLAIMER: This is a guide only. The great majority of the exam will focus in these areas but I may push beyond what's listed here in certain instances. You may use this sheet at your own risk.

FORMAT: The final exam will be all Scantron and will involve True/False and Multiple Choice questions.

Water, Acids, and Bases; Bonding; Thermodynamics

- Thoroughly understand water's hydrogen-bonding properties
- Be able to do a buffer problem
- Know the meaning of low vs high pKa (e.g. low pKa means good acid, etc.)
- Be able to draw or recognize the basic functional groups and bonds of the four groups of macromolecules
- Understand micelles, solvation, and the hydrophobic effect
- Understand the difference between spontaneity and rate, and how to make non-spontaneous reaction spontaneous

Amino Acids and Peptides

- Be able to draw an amino acid structure, given the side chain. Although there are no short answer questions on this test, you will need to be able to draw these structures to correctly answer multiple choice or true/false questions
- Be able to draw a peptide, given the side chain
- Be able to classify amino acid side chains (e.g. polar, non-polar, etc.)
- Be able to calculate the charge on an amino acid or peptide, given the pH and pKa's

Proteins and Enzymes

- Be able to describe or recognize the different levels of protein structure
- Be able to provide some biological examples of helical and sheet structure
- Know the forces involved in stabilizing a folded protein
- Know the reasons why enzymes are great catalysts
- Understand the reaction coordinate diagram and be able to label it
- Know active site, transition state, substrate, coenzyme
- Know Michaelis-Menten kinetics (Km, Vmax, M-M and L-B plots), including inhibition
- You do not need to know about serine proteases (at all)
- Be able to recognize plots of pH and temp vs enzyme activity
- Know the different types of enzyme regulation
- Know the features of allosteric enzymes

Carbohydrates

- Know the general features of monosaccharides (aldose vs ketose, etc.), including being able to identify the anomeric carbon
- Be able to find hemiacetal and acetal groups in sugars

- Be able to identify a reducing vs non-reducing sugar
- Know the monosaccharides glucose, galactose, fructose, and ribose
- Know the disaccharide sucrose
- Know the structures and functions of the polysaccharides glycogen, starch, cellulose, and chitin
- Know the differences between hetero and homopolysaccharides, and the different kinds of glycoconjugates (proteoglycans vs glycoproteins)

Lipids

- Know how lipids are distinguished as a group
- Be able to recognize the major classes
- Understand the factors affecting membrane fluidity
- Know the basic features of membrane proteins
- Know the basic concepts and types of membrane transport

Nucleic Acids

- Be able to recognize nucleoside and nucleotide structures
- Know the basic features of B-DNA, including the forces that stabilize the molecule
- Know the types and function of RNA
- Know the steps of cloning and applications of nucleic acid hybridization

Metabolism (both old and new material)

- Pathways we will have covered: glycolysis, lactate and ethanol fermentation, gluconeogenesis (including the Cori cycle), TCA cycle, glycogenolysis (degradation), glycogenesis (synthesis), fatty acid oxidation, key features of fatty acid synthesis, key reactions of photosynthetic light-independent reactions (Calvin cycle)
- Know the different oxidation states of carbon
- Recognize and know the general function of the members of the supporting cast (ATP, NAD, FAD, CoA)
- Know the meaning and use of standard reduction potentials
- Know the fates of pyruvate and acetyl CoA, depending on hormones and feeding status
- For all pathways:
    - Be able to choose the right description of a pathway, and its outcome (e.g. ATP production, production of glucose to raise blood sugar, etc.)
    - Be able to predict the direction of regulation (e.g. would a given enzyme or pathway be stimulated or inhibited by ATP?)
    - Be able to classify metabolic reactions by type (there are five types)
    - Be able to classify the enzyme catalyzing the reaction by type (one of six we've studied)
- Know the overall result of catabolic vs anabolic metabolism (e.g. NADH produced, ATP consumed, etc.).

Additional new material

- Understand the basic concepts of the glyoxylate cycle (two unique reactions, 4 carbons feed in as AcCoA, 4 carbons come out as succinate; these carbons are precursors for carbohydrates. Plants can make CHO from fatty acid carbons but animals cannot).
- Know the types of electron carriers and the location of electron transport
- Know the major complexes of electron transport
- Know the evidence for the order of electron transport
- Know the chemiosmotic hypothesis and the evidence that supports it
- Know the parts of the ATP synthase and how it functions
- Know the other uses of the proton gradient given in class
- Know the general steps of fat digestion and transport
- Understand the transport of fatty acids into mitochondria
- Understand the basis of greater energy yield in fats vs CHO's
- Understand the tissue specialization of ketone bodies and their overproduction in diabetes and starvation
- Know the basic features of the light reactions of photosynthesis
    - Structure of chloroplasts and location of various parts of PS (PSI, PSII, proton flow, etc.)
    - Basic features of light harvesting complexes and pigments
    - Basic features and function of PSII, including energy source, electron donor and carriers (to the level presented in lecture)
    - Basic features and function of PSI, including electron source, carriers, and terminal electron acceptor (to the level presented in lecture)
    - Photophosphorylation
- Know the three stages (carbon fixation, reduction, regeneration) and the key reactions discussed for the light-independent reactions of photosynthesis
    - The Rubisco reaction
    - The two gluconeogenic reactions of the reduction phase
    - The overall process of regeneration (5 C3 are used to make 3 C5)
    - Be able to compare structures in Calvin cycle and tell what happened (e.g. isomerization, reduction, epimerization, etc.)
- Be able to compare gluconeogenesis in animals vs plants
- Know the overall reaction (and cost) for photosynthesis
- Be able to define photorespiration and to indicate how C4 and CAM plants have adapted to it
- Be able to answer how photosynthesis is regulated (to the level presented in lecture)