Chemistry 1120 Exam 4 Study Guide

Chapter 12

12.1 Identify and differentiate between macronutrients (lipids, amino acids and saccharides) and micronutrients (vitamins and minerals).

- Master Tutor Section 12.1
- Review Section 12.1 in the Concept Summary
- For practice, do Exercises 12.1, 12,2

12.2 Know sources of saturated and unsaturated fatty acids and that most lipids are triglycerides. Proteins have an RDI established and complete proteins contain all the essential amino acids. Starches (amylose and amylopectin) are complex carbohydrates and sugars (mono- and disaccharides) are simple carbohydrates. Fiber (cellulose) has no nutritive value.

- Master Tutor Section 12.2
- Review Section 12.2 in the Concept Summary
- For practice, do Exercise 12.7

12.3 & 12.4 Know vitamins can be fat-soluble (nonpolar) or water soluble (polar organic) in nature. Many water-soluble ones function as coenzymes. Minerals as ions or compounds and are categorized as major (ie. calcium) and trace (ie. copper) based on the amounts required.

- Master Tutor Sections 12.3, 12.4
- Review Sections 12.3, 12.4 in the Concept Summary
- For practice, do Exercises 12.10-12.15, 12.17, 12.18

12.5 Recognize the sun as the ultimate source of energy on Earth. Know and interpret the photosynthesis and respiration reactions. Realize all carbon in the food we eat was taken from the atmosphere.

- Master Tutor Section 12.5
- Review Section 12.5 in the Concept Summary
- For practice, do Exercise 12.20

12.6 Recognize metabolism can be anabolic (building up) or catabolic (breaking down) in nature. The catabolism of food involves 3 stages. Stage I is the digestion (hydrolysis of macronutrients into components (is. Proteins into amino acids).

Stage II breaks the components down into acetyl coenzyme A molecules. In Stage III, the acetyl coenzyme A feeds the citric acid cycle and ATP is made.

- Master Tutor Section 12.6
- Review Section 12.6 in the Concept Summary
- For practice, do Exercises 12.26, 12.28

12.7 a) Know mitochondria are considered the "power houses" of cells because they make ATP. ATP synthesis is localized on the mitochondrial inner membrane cells that require large amounts of ATP (ie. muscle cells) have large amounts of mitochondria. ATP is the currency of energy and is used almost immediately.
b) Know and apply the ATP hydrolysis (reacts with water) reaction: ATP + H2O ⍰ Pi + ADP + energy

- Master Tutor Section 12.7
- Review Section 12.7 in the Concept Summary
- For practice, do Exercises 12.32, 12.36, 12.37

12.8 Know coenzyme A is made from pantothenic acid. Coenzyme NAD+ is made from the vitamin nictotinamide and ADP. Coenzyme FAD is made from the vitamin riboflavin and ADP. ADP contains the nucleotide adenosine. FAD is used to oxidize C-C bonds to C=C.

- Master Tutor Section 12.8
- Review Section 12.8 in the Concept Summary
- Review Learning Checks 12.1, 12.2
- For practice, do Exercises 12.45, 12.46

Chapter 13

13.1 Identify monosaccharides (glucose, fructose and galactose) resulting from carbohydrate digestion. Know glucose is the major food molecule and that carbohydrates supply 45-55% of the body's energy needs.

- Master Tutor Section 13.1
- Review Section 13.1 in the Concept Summary
- For practice, do Exercise 13.2

13.2 Know the liver is the main organ that controls blood sugar (glucose) levels. A concentration of 70-110 mg/100mL of blood is considered normal. Below that is called hypoglycemia, above that is called hyperglycemia. When glucose levels are above the renal threshold, glucose will show up in the urine (glucosuria).

- Master Tutor Section 13.2
- Review Section 13.2 in the Concept Summary
- For practice, do Exercises 13.4, 13.6

13.3 Know glycolysis produces 2 pyruvate molecules and 2 ATP molecules from every glucose molecule. Glycolysis has 3 regulatory enzymes. The first, hexokinase, is controlled by feedback inhibition. The next 2 (phosphofructokinase and pyruvate kinase) are inhibited by high ATP concentrations. Pyruvate kinase converts phosphoenolpyruvate to pyruvate.

- Master Tutor Section 13.3
- Review Section 13.3 in the Concept Summary
- Review Learning Check 13.1
- For practice, do Exercises 13.9, 13.10, 13.11

13.4 Recognize that because NAD+ needs to be continuously regenerated for glycolysis to occur, the body will convert pyruvate to lactate under anaerobic conditions. Under aerobic conditions, the pyruvate is converted to acetyl CoA and eventually to CO2. Yeast will anaerobically ferment glucose to ethanol (alcohol) and CO2.

- Master Tutor Section 13,4
- Review Section 13.4 in the Concept Summary
- Review Learning Check 13.2
- For practice, do Exercises 13.18, 13.20

13.5 a) Know the citric acid cycle (AKA Kreb's cycle, tricarboxylic acid cycle) will not operate in the absence of oxygen, NAD+ and/or FAD. The citric acid cycle oxidizes carbon to CO2 and one of the main control enzymes is citrate synthetase which is activated by ADP and inhibited by ATP and NADH.
b) Know the "fuel" for the citric acid cycle is acetyl CoA, which supplies 2 carbons. For every acetyl CoA, 2 CO2 molecules, 3 NADH molecules, 1 FADH2 molecule and 1 GTP molecule are produced. No ATP is directly produced.

- Master Tutor Section 13.5
- Review Section 13.5 in the Concept Summary
- For practice, do Exercises 13.24, 13.26, 13.28

13.6 Know the electron transport chain uses electrons and protons from the oxidation of food to reduce molecular oxygen to water. The electron transport chain

is found in the mitochondria and uses iron (Fe2+ and FE3+) containing cytochromes.

- Master Tutor Section 13,6
- Review Section 13.6 in the Concept Summary
- For practice, do Exercises 13.33, 13.34

13.7 Recognize ADP is changed to ATP through the process of oxidative phosphorylation which is linked to the electron transport chain. The chemiosmotic hypothesis states that protons (H+) are pumped across the inner mitochondrial membrane by the electron transport chain when it oxides NADH and FADH2. The later influx of these protons then operates the enzyme F1-ATPase, which change ADP to ATP. For each FADH2 oxidized, 1.5 ATP molecules are formed. For each NADH oxidized, 2.5 ATP molecules are formed. This results in 10 ATP molecules for every acetyl CoA going through the citric acid cycle.

- Master Tutor Section 13.7
- Review Section 13.7 in the Concept Summary
- Review Learning Check 13.3
- For practice, do Exercises 13.38-13.40, 13.42

13.8 Know that the complete oxidation of one glucose molecule by brain and muscle cells produces 30 ATP molecules. Whereas, liver cells will produce 32 ATP molecules.

- Master Tutor Section 13.8
- Review Section 13.8 in the Concept Summary
- For practice, do Exercises 13.47, 13.48

13.9 Identify glycogenesis as the body's way of storing energy by changing glucose to glycogen. This process requires UTP and occurs mainly in liver and muscle cells. Glycogenolysis is the reverse process, changing glycogen to glucose when energy is needed.

- Master Tutor Section 13.9
- Review Section 13.9 in the Concept Summary
- Review Learning Check 13.4
- For practice, do Exercises 13.50, 13.52

13.10 Know glucose can be made from glycerol, certain amino acids or lactate through gluconeogenesis. During anaerobic respiration, lactate from the muscles is

sent to the liver where it is converted into glucose through the Cori cycle. The glucose is then sent back to the muscles.

- Master Tutor Section 13.10
- Review Section 13.10 in the Concept Summary
- For practice, do Exercise 13.56

13.11 Know how glucagon, insulin and epinephrine interact and regulate blood glucose levels.

- Master Tutor Section 13.11
- Review Section 13.11 in the Concept Summary
- For practice, do Exercises 13.61, 13.62

Chapter 14

14.1 Recognize fats have the highest energy density in calories/g. During digestion, fats (triglycerides) are hydrolyzed to glycerol and fatty acids. After passing through the intestinal wall, triglycerides are reassembled and packaged into complexes called chylomicrons. These chylomicrons then travel through the lymph system to the circulatory system and eventually to the liver.

- Master Tutor Section 14.11
- Review Section 14.11 in the Concept Summary
- For practice, do Exercises 14.1, 14.2

14.2 Know adipose tissue is used to store triglycerides (lipids) which can then be mobilized through hydrolysis (adding water) breaking them down into glycerol and fatty acids.

- Master Tutor Section 14.2
- Review Section 14.2 in the Concept Summary
- For practice, do Exercise 14.8

14.3 Know glycerol from lipids in the blood stream can be used to make glucose or used to provide energy to the cell. To provide energy, glycerol is converted to dihyroxyacetone phosphate, which is an intermediate in glycolysis.

- Master Tutor Section 14.3
- Review Section 14.3 in the Concept Summary
- For practice, do Exercises 14.11, 14.12

14.4 a) Know fatty acids must first be oxidized to fatty acyl CoA before it can pass through the mitochondrial membrane and enter the fatty acid spiral to undergo □-oxidation. Calculate the number of times a fatty acid passes through the spiral and the number of acetyl CoA produced (is. 10 carbon fatty acid □ 5 acetyl CoA in 4 trips).
b) Recognize every pass through the fatty acid spiral produces 1 acetyl CoA, 1 NADH, and one FADH2 (except the last pass). Calculate the number of FADH2 or NADH produced from a fatty acid (is. 10 carbon fatty acid □ 4 FADH2 + 4 NADH produced)

- Master Tutor Section 14.4
- Review Section 14.4 in the Concept Summary
- Review Learning Check 14.1
- For practice, do Exercises 14.13, 14.16, 14.19, 14.22

14.5 Recognize fatty acids can produce more ATP per molecule than a similar sized carbohydrate. Know each acetyl CoA can produce 10 ATP going through the citric acid cycle and electron transport chain and each NADH and FADH2 going through the electron transport chain will produce 2.5 and 1.5 ATP molecules, respectively. Calculate the total number of ATP produced by the complete oxidation of a fatty acid (ie. a 6- carbon fatty acid □ 38 ATP).

- Master Tutor Section 14.5
- Review Section 14.5 in the Concept Summary
- Review Learning Check 14.2
- For practice, do Exercises 14.24, 14.25, 14.26

14.6 Know diabetes mellitus causes an imbalance in carbohydrate and lipid metabolism, leading to an increase of acetyl CoA in the blood stream from fatty acid catabolism. The liver responds by making ketone bodies from the excess acetyl CoA. Know the 3 ketone body identities and the structure of acetone. An excess of ketone bodies in the blood is called ketonemia, while higher levels can lead to ketosis, which symptoms include acetone breath and ketone bodies in the urine.

- Master Tutor Section 14.6
- Review Section 14.6 in the Concept Summary
- For practice, do Exercises 14.28, 14.31

14.7 Recognize fatty acid synthesis occurs in the cell's cytoplasm, whereas □-oxidation is in the mitochondria. Synthesis involves different reactions than the reverse of □-oxidation; however, acetyl CoA (2-carbons) is the basic building block.

Therefore, fatty acids made by a cell can only have even numbers of carbon atoms in them.

- Master Tutor Section 14.7
- Review Section 14.7 in the Concept Summary
- For practice, do Exercises 14.33, 14.34, 14.35

14.8 Know the human body has an amino acid pool that is supplied by the digestion of proteins from food, the breakdown of body proteins (tissues, enzymes, etc), and the synthesis of amino acids by the liver. The majority of the amino acids in the pool are used to make new body proteins including enzymes. Protein turnover is how fast a newly synthesized body protein is returned to amino acid pool. Enzymes have the shortest (minutes) turnover half-life.

- Master Tutor Section 14.8
- Review Section 14.8 in the Concept Summary
- For practice, do Exercises 14.38, 14.40

14.9 Know the catabolism of nitrogen atoms from amino acids follow the steps of: 1. Transamination (the transfer of -NH2 from one molecule to another), 2. Deamination (removal of an =NH2 to make NH4+, and 3. Urea formation (NH4+ (ammonium) ions are converted to urea and excreted). Identify aspartate and glutamate as key amino acids involved in nitrogen catabolism. Know carbamoyl phosphate is the fuel for the urea cycle.

- Master Tutor Section 14.9
- Review Section 14.9 in the Concept Summary
- Review Learning Checks 14.3, 14.4
- For practice, do Exercises 14.44, 14.50

14.10 Know that an amino acid carbon skeleton can be catabolized into pyruvate, an intermediate of the citric acid cycle, or acetyl CoA. Those converted into pyruvate or an intermediate in the citric acid cycle can be used to make glucose and are called glucogenic amino acids. Those converted into acetyl CoA can be used to make fatty acids or ketones bodies and are called ketogenic amino acids.

- Master Tutor Section 14.10
- Review Section 14.10 in the Concept Summary
- For practice, do Exercise 14.55

14.11 Differentiate between essential and non-essential amino acids.

- Master Tutor Section 14.11
- Review Section 14.11 in the Concept Summary
- For practice, do Exercise 14.60