

Chem 352

Final Exam Pathways

Lecture 7 - Introduction to Metabolism

- A. While this lecture contains no specific pathways that you will need to know, it does present some of the common themes for the pathways that you will need to know. You should take a close look at this material

Lecture 8, Part I - Glycolysis

- A. Glycolytic pathway
1. Know the balanced chemical equations for the 10 steps from the phosphorylation of glucose to the production of pyruvate
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
 - iv. The enzyme classes for each reaction
 - v. The overall balanced reaction
- B. The fates of pyruvate
1. Know the balanced chemical equations for the following fates of pyruvate
 - a. Alcohol fermentation
 - b. Lactate fermentation
 - c. Oxidative decarboxylation to Acetyl-CoA (Lecture 8, Part III)
 - d. Carboxylation to oxaloacetate followed by decarboxylation to phosphoenolpyruvate (Lecture 8, Part II)
 - e. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
 - iv. The enzyme classes for each reaction

Lecture 8, Part II - Gluconeogenesis, Pentose Phosphate Pathway, and Glycogen Metabolism

- A. Gluconeogenesis
1. Know the balanced chemical equations for the 11 steps from the carboxylation of pyruvate to the production of glucose.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
 - iv. The enzyme classes for each reaction
 - v. The overall balanced reaction
- B. Pentose Phosphate Pathway

1. Know the balanced chemical equations for the 3 steps in the oxidative stage of the pentose phosphate pathway, from the oxidation of glucose 6-phosphate to the production of ribulose 5-phosphate.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
- C. Glycogen synthesis
 1. Know the balanced chemical equations for the 3 steps leading the the addition of one glucose monomer to the non-reducing end of a glycogen molecule, starting with glucose 6-phosphate
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
- D. Glycogen degradation
 1. Know the balanced chemical equations for the 1 step leading the removal of one glucose monomer from the non-reducing end of a glycogen molecule.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzyme involved

Lecture 8, Part III - Citric acid Cycle

- A. Conversion of pyruvate to acetyl CoA
 1. Know the balanced chemical equation for the conversion of pyruvate to acetyl-CoA.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzyme involved
- A. Citric Acid Cycle
 1. Know the balanced chemical equations for the 8 steps from the synthesis of citrate to the production of oxaloacetate.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
 - iv. The enzyme classes for each reaction
 - v. The overall balanced reaction
- B. Glyoxylate Pathway
 1. Know the balances chemical equations for the shunt that cuts of the CO₂-producing reactions in the citric acid cycle.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved

Lecture 8, Part IV - Electron Transport Chain and Oxidative Phosphorylation

- A. Electron transport chain
1. Be able to describe the roles for each of the complexes in the electron transport chain
 - a. What mobile carriers gets oxidized and reduced by each complex
 - b. What is the overall reaction equation
 - c. How is oxidation coupled to the synthesis of ATP from ADP and P_i ?

Lecture 9 - Photosynthesis

- A. Light Reactions
1. Role of the special pair
 2. Photosystem I (PSI) combined with cyt *bc* found in
 - a. What gets oxidized in reduced
 - b. What is the role of cyt *bc*.
 - c. What chemical form(s) is/are the light energy converted to?
 3. Photosystem II (PSII) combined with cyt *bc*.
 - a. What gets oxidized in reduced
 - b. What is the role of cyt *bc*.
 - c. What chemical form(s) is/are the light energy converted to?
 4. The combined PSI and PSII with cyt *bf*.
 - a. What gets oxidized in reduced
 - b. What is the role of cyt *bf*.
 - c. What chemical form(s) is/are the light energy converted to?
- B. Dark reactions
1. Know the balanced chemical equations for the steps from the phosphorylation of ribulose 5-phosphate to the production of glyceraldehyde 3-phosphate (carboxylation and reduction phases)
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The names of the enzymes involved
 2. Know the metabolic purpose for the regeneration phase.
 3. Know the metabolic purpose of C_4 photosynthesis.

Lecture 10, Part I - Lipid Metabolism

- A. Fatty acid synthesis
1. Know the balanced chemical equation for the reaction used to activate acetyl-CoA to malonyl-CoA
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The name of the enzyme involved
 - iv. The name of the coenzyme involved
 2. Know the balanced chemical equations for the reactions involved in one round of fatty acid synthesis (elongation)
 - a. Know
 - i. The structures of the intermediates involved
 3. Know the balanced chemical equations for the reactions involved in one round of fatty acid synthesis (elongation)
 - a. Know the balanced chemical equation for the thiolase reaction.

- i. Know
 - 1) The structures of the intermediates involved
- 4. Be able to describe the role that the citrate/pyruvate shuttle plays in fatty acid synthesis in eukaryotic cells.
- B. Cholesterol Synthesis
 - 1. Know the balanced chemical equations for the reactions used to convert acetyl-CoA to isopentenyl diphosphate
 - a. Know
 - i. The structures of the intermediates involved
- C. Fatty acid oxidation
 - 1. Know the balanced chemical equations for the reactions involved in one round of fatty acid oxidation.
 - a. Know
 - i. The structures of the intermediates involved
 - 2. Be able to describe the role that the carnitine cycle plays in fatty acid oxidation in eukaryotic cells.
 - 3. Be able to estimate the number of ATP that can be formed from ADP and P_i from the complete oxidation of a saturated fatty acid.
- D. Ketone bodies
 - 1. Know the balanced chemical equations for the reactions used to convert acetyl-CoA to the three common ketone bodies; acetoacetate, β -hydroxybutyrate, and acetone.
 - a. Know
 - i. The structures of the intermediates involved
 - 2. Be able to describe the metabolic role for ketone bodies.

Lecture 10, Part II - Amino Acid Metabolism

- A. Ammonia assimilation
 - 1. Know the balanced chemical equations for the reactions used to assimilate nitrogen as ammonia into an organic form.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The name of the enzyme involved
- B. Transamination
 - 1. Know the balanced chemical equations for the reaction used to transaminate amino acids.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The name of the enzyme involved
 - iv. The name of the coenzyme involved
- C. Amino acid biosynthesis
 - 1. Know the balanced chemical equations for the biosynthesis of the following amino acids, starting at either a glycolytic or citric acid cycle intermediate.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved

- iii. For glycine, know the name of the coenzyme involved.
- D. The Urea Cycle
 - 1. Know the balanced chemical equations for the urea cycle.
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - 2. Be able to describe the metabolic role played by the urea cycle.

Lecture 10, Part III - Nucleotide Metabolism

- A. Know the structures of the common nucleotides used to synthesize DNA and RNA
- B. Know the source of each of the atoms found in the purine ring
- C. Know the source of each of the atoms found in the pyrimidine ring
 - 1. Know the balanced chemical equation for the reaction used to form carbamoyl phosphate from glutamine(NH_3) and HCO_3^- .
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The name of the enzyme involved
 - 2. Know the balanced chemical equation for the reaction used to form carbamoyl aspartate
 - a. Know
 - i. The structures of the intermediates involved
 - ii. The names of the intermediates involved
 - iii. The name of the enzyme involved