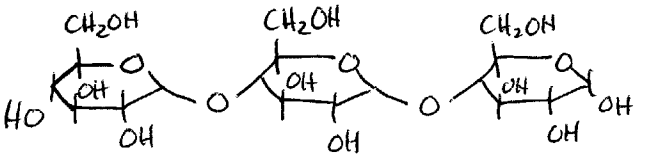
**Review Questions for Exam 3 – Chem 30B**
(Note: this selection of problems is **not** comprehensive!)

1. The overall reaction for the complete oxidation of glucose is the following:
$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$ + energy
a. At which steps in the process is $CO_2$ produced?
b. At what point is $O_2$ used?
2. a. What type of reaction is step 9 of glycolysis? What happens to the structure of the substrate in this step?
b. What type of reaction is step 3 of glycolysis? What happens to the structure of the substrate in this step?
c. What type of reaction is the conversion of pyruvate to acetyl CoA? What happens to the structure of the substrate in this step?
d. What type of reaction is step 8 of the citric acid cycle? What happens to the structure of the substrate in this step?
e. What happens to the structure of the substrate in step 5 of the citric acid cycle?
3. Under what conditions is pyruvate converted to lactate? Why does this happen?
4. What happens to the pyruvate that is formed by glycolysis under anaerobic conditions in yeast? What is this reaction used for?
5. Determine the total yield of ATP, NADH, and $FADH_2$ from the hydrolysis and complete oxidation of the following trisaccharide. Show your work. How many molecules of $CO_2$ will be formed and in what steps? Determine the total overall yield of ATP (including ATP produced in the electron transport chain).

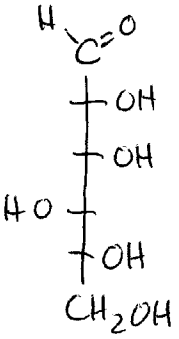


6. Determine the total yield of ATP, NADH, and $FADH_2$ from the conversion of 1 molecule of 1,3-bisphosphoglycerate to $CO_2$. Show your work. How many molecules of $CO_2$ will be formed and in what steps? Determine the total overall yield of ATP (including ATP produced in the electron transport chain).
7. Determine the total yield of ATP for the complete oxidation of one molecule of fructose-6-phosphate. Express your answer as a range.
8. If one molecule of glyceraldehyde-3-phosphate is converted to acetyl CoA, how many molecules of ATP and NADH are produced? Determine the total overall yield of ATP (including ATP produced in the electron transport chain).
9. Explain how the energy from NADH or $FADH_2$ is converted to ATP.
10. Explain the similarities and differences between amylose, amylopectin, glycogen, and cellulose. Mention type of monomers, type of glycosidic bonds, presence or absence of branching, and source.
11. a. Draw an α-1,4 glycosidic bond between two molecules of glucose.
b. Draw a β-1,4 glycosidic bond between two molecules of glucose.
c. Draw an α-1,6 glycosidic bond between two molecules of glucose.
12. a. What is Benedict's or Fehling's test? What does a positive test look like? What does it mean if the test is positive?
b. For the iodine test: what does a positive test look like? What does it mean if the test is positive?
c. If you add bromine to a solution: what does a positive test look like? What does it mean if the test is positive?

13. Draw the Fischer projection and the cyclic form for glucose, galactose, and fructose. Label each one as either α or β.

14. a. What are anomers? Give an example of molecules that are anomers.
b. What are diastereomers? Give an example of a pair of diastereomers.
c. What are enantiomers? Give an example of a pair of diastereomers.

15. Given the following Fischer projection:



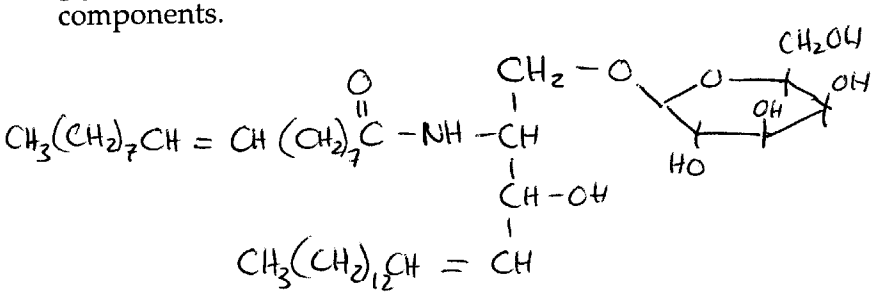
a. How many chiral carbons?
b. Classify the type of monosaccharide.
c. Is it D or L?
d. Draw a diastereomer and label it as D or L.
e. Draw an enantiomer and label it as D or L.
f. Draw the ring form of the original monosaccharide and label it as α or β.
g. Draw the structure of a disaccharide of two of the (original) monosaccharides connected by an α-1,4 glycosidic bond.
h. Draw a disaccharide (using the same monosaccharides) with a β-1,4 glycosidic bond.

16. Draw the structures of sucrose, maltose, and lactose. Which one is not a reducing sugar, and why? What are the hydrolysis products of each of these disaccharides?

17. When starch is hydrolyzed completely, what is/are the product(s)? What reaction conditions are needed?

18. Draw an example of a wax.

19. Given the following structure, classify it as a wax, a triacylglycerol, a glycerophospholipid, a sphingolipid, a glycosphingolipid, or a steroid. Identify the components.



20. Given the structure of choline, sphingosine, and stearic acid, draw the structure of a sphingolipid containing stearic acid and choline (and phosphate and sphingosine).

21. a. Draw the structure of a glycerophospholipid.
b. Draw the structure of a sphingomyelin.
c. Draw the structure of a glycolipid.
d. Draw the structure of cholesterol. (No need to memorize how to draw it, but just look it up and draw it for practice. Be able to recognize cholesterol and other steroids.)

22. What happens when a triglyceride is hydrogenated? How does this affect the texture and the melting point?

23. a. Explain how soaps are used to clean greasy dishes.
    b. How are soaps made from fats or oils? Write an example of a saponification reaction.
24. Explain and draw a diagram of the structure of a cell membrane. What types of molecules are membranes composed of?
25. a. Draw the Fischer projection of L-galactose.
    b. Would you expect L-galactose to be soluble or insoluble in water? Explain.
26. Draw an example of a ketopentose (as a Fischer projection). Draw the enantiomer and a diastereomer of the original ketopentose. Label each drawing as either D or L.
27. Explain the difference between fats and oils. What is it about the structure of the molecules that gives rise to the different properties of fats vs. oils?
28. Oleic acid is a monounsaturated fatty acid. Stearic acid is a saturated fatty acid. Look up the structures, and draw the line-bond structure of each. Which will have the higher melting point and why?
29. Explain the different ways that molecules or ions can get from one side of a cell membrane to the other.
30. Explain what happens in the electron transport chain.
31. Which steps in the citric acid cycle are oxidation-reduction reactions? How can you tell?