Unit 4: Lipids:

Essential Oils:
1. Describe what makes something a terpene and identify the isoprene units.
2. Distinguish between the flavor properties of terpenes and phenols.

Fats & Oils
1. List common sources of fats and oils:
2. Draw a typical fatty acid showing the carboxylic acid group and cis double bonds.
3. Compare and contrast saturated and unsaturated fats and fatty acids; structure, properties, origins from plants and animals...etc
4. What are the differences between cis and trans double bonds? **How and why** does the structure of the double bond affect melting point?
5. How are trans-fatty acids produced?
6. What are omega-3 and omega-6 fatty acids and why do we care about them?
7. What are the health ramifications of 1) saturated fatty acids 2) trans fatty acids 3) lack of essential fatty acids?
8. Draw and explain the structure of dietary fats and oils (triacylglycerols = triglycerides).
9. Write out the chemical equation for the hydrogenation (reaction with H₂, Ni catalyst) of fats and oils showing a typical product of complete hydrogenation or partial hydrogenation.
10. What is margarine? Why was it invented? How is it made?
11. What are the advantages of partially hydrogenating vegetable oils? Why are they so prevalent in packaged foods?
12. Write out the chemical equation and explain what happens when a fat or oil undergoes oxidative rancidity reactions.
13. List several ways to slow oxidation/rancidity reactions of fats and oils. Explain how each of these ways works to slow the reaction.
14. Describe brominated vegetable oil (with words and structure) and explain why it is present in citrus flavored drinks like Squirt and Mt Dew.
15. Write out the chemical equation for acid catalyzed hydrolysis reaction (with H₂O, H⁺) of a fat or oil to form glycerol and fatty acids.
16. Write out the chemical equation for the Base catalyzed hydrolysis (Saponification with H₂O, NaOH) to form glycerol and soaps.
17. Draw the structure of a typical soap label its polar and nonpolar parts.
18. Draw a diagram of a micelle and explain how soap works to bring water and oil together.
20. Explain how the structure of a detergent is similar to the structure of a soap.
21. Explain how the structure of a detergent is different than the structure of a soap.
22. What are the advantages of using detergents rather than soaps?
23. What is meant by “hard water”?
24. What is the chemical makeup of soap scum and how is it formed?
25. Why are sulfate detergents preferred over phosphate detergents? (Compare environmental effects).
26. What is an emulsion? Draw a diagram to illustrate and use words to describe both “Oil in water” and “water in oil” emulsions.
27. List some emulsions common in food/cooking (Mayonnaise, salad dressings.....)
28. Describe or recognize the chemical structure of a Phospholipid like Lecithin in soy and egg yolks.
29. How does Lecithin work as an emulsifier? (For example in the making of mayonnaise or traditional ice cream)
30. What is the role of phospholipids in cell membranes?
31. What is the role of phospholipids in the transport of cholesterol in the blood?
32. Recognize the general structure of steroids such as cholesterol.
Unit 5: Carbohydrates
Carbohydrates:
3. Draw or recognize the structure of a simple carbohydrate like glucose.
4. Describe and distinguish between a monosaccharide, disaccharide, oligosaccharides, and polysaccharide.
5. What is an Aldotriose? Aldohexose? Ketohexose? Describe their structure and give examples.
6. Summarize important information about Glucose, Fructose, and Sucrose. (ie. Where they are found in nature, general structures, any other names, importance in our lives such as health or cooking…..)
7. What are sugar alcohols and how are they formed? (For example sorbitol, xylitol, …..)
8. Explain why sugars dissolve in water even though they have so many carbons.
9. Be able to label the partially positive (δ+) hydrogens and the partially negative (δ-) oxygens on the drawing of a simple sugar.
10. Be able to show with structures and chemical drawings how water forms hydrogen bonds with sugars.
11. What is meant by “hydrolysis” in reactions of sugars?
12. Describe the makeup of the disaccharides maltose and lactose.
13. Describe the makeup of amylose in starch.
14. What plants are high in starch?
15. What is the difference between amylease and amylpectin?
16. How are amylease in starch and cellulose in wood structurally similar?
17. How are amylease in starch and cellulose in wood structurally different? (How are the glucose molecules arranged?)
18. What are the differences in properties between amylease in starch and cellulose in wood? (ie digestibility, solubility in water, reaction with iodine, etc….)
19. Complete the hydrolysis reactions of maltose, lactose, and of amylease showing the products formed.
20. What happens when a sugar is “caramelized”? Explain what happens to the chemical composition.
21. What is a roux and how is it made?
22. How does starch work to thicken a sauce or make a gel? Draw a diagram to illustrate a carbohydrate gel.
23. How do artificial sweeteners work? Are they sugars? Why do they taste sweet?
24. Why do banks mark on bills with an iodine pen? Why does instant oatmeal turn blue when mixed with water treated with iodine?
25. How does amylase enzyme work?
26. Why does baby food fed straight from the jar get watery if not used up right away?
27. Are all starches alike? How do they vary?

Unit 6: Proteins & Enzymes:
1. Explain the chemical makeup of a protein.
2. What are the functions of proteins?
   a. Structure like bones, muscles, tendons, skin, hair, hooves, feathers, beaks, horns……
   b. Hormones like insulin
   c. Storage like casein in milk and albumin in eggs.
   d. Catalysts like enzymes
3. Distinguish between nonpolar, polar, acidic, and basic amino acids.
4. Given the structures of the amino acids, draw a simple peptide showing correct amide bonds if given a peptide abbreviation. (ie. Ala-Ser-Glu-Trp)
5. What attractions keep a globular protein in its shape?
6. What are the primary, secondary, tertiary structures of proteins?
7. What does it mean to “denature” a protein?
8. List 5 ways to denature a protein. Explain how each of the ways works to change the protein’s shape. (ie. Whipping, heat, acid, alcohol, heavy metals like Cu, Pb, Ag, Hg…)
9. What does it mean to “hydrolyze” a protein?
10. List ways to hydrolyze proteins. (H₂O with H⁺ or NaOH; Enzymes like bromelain, papain, pepsin……)
11. Draw a diagram showing how proteins in custard, flan, or gelatin coagulate to form gels.
12. What attractions keep a protein meringue or gel together?
13. Why does adding acid to milk cause the casein proteins to form solid cheese? What is happening to the chemical structure of the protein and why?
15. Why is drinking raw egg and then inducing vomiting the way to treat a child that’s swallowed mercury?
16. Why do kitchen stores sell unlined copper bowls for the whipping of egg whites into meringue?
17. How is it that dipping raw fish in acid is like “cooking” without heat?
18. What is an enzyme?
19. What types of reactions to enzymes catalyze?
20. Explain why you can make gelatin with canned pineapple but if you use fresh or frozen pineapple the gelatin won’t gel.
21. From what is gelatin made and how is it made?
22. Why do cut apples, potatoes, banana, avocados, etc….turn brown? (What components are reacting?)
23. How can you slow down the browning of cut apples, potatoes, ….etc? List the ways and tell how each way is preventing the browning.
24. What is the Maillard browning reaction? Why do we want it?
25. What components are necessary for a Maillard reaction to occur?
26. List several examples of foods where their flavor is primarily from Maillard reactions? What combination of ingredients caused the reaction? (ie. Sugary BBQ sauce + meat; egg protein + starch in pretzels; milk protein brushed on wheat pie crust to brown a pie……etc)
27. What is the major protein in wheat? Describe how to isolate gluten from wheat.