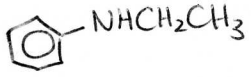
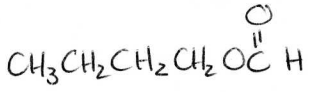
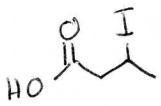
Chem 30B - Some Review Problems for Exam 2

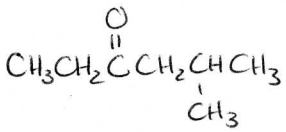
(Note: this selection of problems is <u>not</u> comprehensive!)

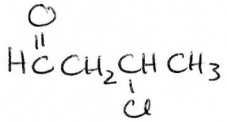
1. Name each of the following molecules.

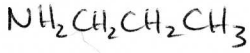
a. 

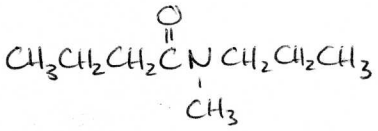
b. 

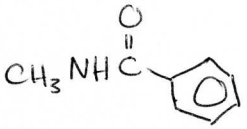
c. 

d. 

e. 

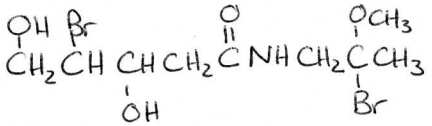
f. 

g. 

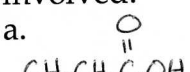
h. 

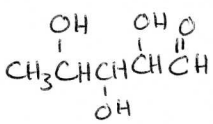
2. Draw the condensed structural formula and the line-bond structure for each of the following molecules.
   a. acetone
   b. propionaldehyde
   c. propionic acid
   d. pentyl butyrate
   e. ethylmethylamine
   f. N-ethylbutyramide

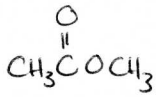
3. Indicate any chiral carbons in the following:

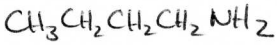


4. Rank the following compounds in order from most soluble to least soluble in water. Explain the reasons for your ranking in terms of the intermolecular forces involved.

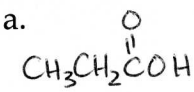
a. 

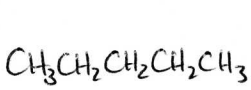
b. 

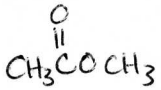
c. 

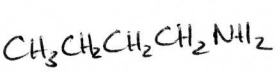
d. 

5. Rank the following compounds in order from highest to lowest boiling point. Explain the reasons for your ranking in terms of the intermolecular forces involved.

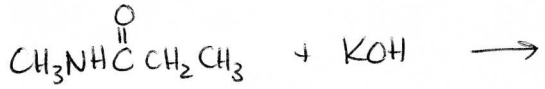
a. 

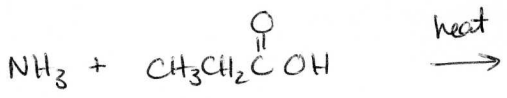
b. 

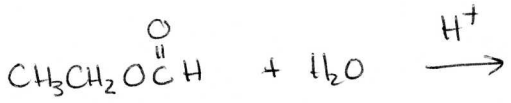
c. 

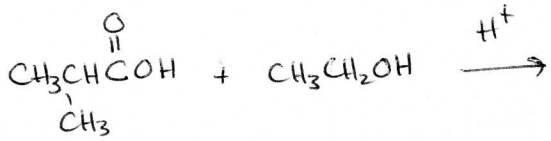
d. 

6. Draw the condensed structural formula of the product(s) that would be obtained in each of the following reactions. If no reaction will occur, write "NR".

a. 

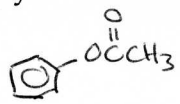
b. 

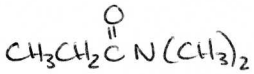
c. 

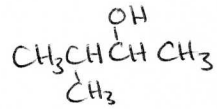
d. 

e. 

7. List the most common properties for amines, aldehydes, ketones, carboxylic acids, esters, and amides.
8. Write the equation for the reaction of butanal with ethanol in an acidic solution. What is this type of reaction called?
9. a. Write the equation for the reaction of propanoic acid with ethanol.
   b. Write the equation for the reaction of propanoic acid with potassium hydroxide.
   c. Write the equation for the reaction of propanoic acid with water.
   d. Write the equation for the reaction of ethylamine with HBr.
   e. Write the equation for the reaction of ethylamine with water.
   f. Write the equation for the reaction of propanoic acid with ethylamine.
   Name the products of each of the above reactions.
10. Given the following products, write the structure of the reactant(s) needed to produce the product. Include any necessary catalysts or reaction conditions, if any.

a. (alcohol + carboxylic acid) → 

b. (amine + carboxylic acid) → 

c. (aldehyde or ketone) → 

11. a. Write the equation for the reduction of 2-pentanone, including the condensed structural formulas of the reactants and products and any necessary catalysts or reaction conditions. **Name the organic products of the reaction.**
    b. Write the equation for the oxidation of 2-pentanone, including the condensed structural formulas of the reactants and products and any necessary catalysts or reaction conditions. **Name the organic products of the reaction.**

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. a. Write the reaction for the acid hydrolysis of ethyl formate.
b. Write the reaction for the base hydrolysis of ethyl formate.

14. Draw the predominant form of Cys-Arg at pH 9.0. What is the total charge on the dipeptide?

15. What is an alpha helix?
What is a beta sheet?
Draw a rough sketch of each of these.

16. What conditions can be used for the hydrolysis of proteins?
What are the products of the hydrolysis of a protein?

17. What type of interaction would you expect between the following side chains? Explain.
a. Asp and Arg
b. Gln and Asn
c. Leu and Ile
d. Cys and Cys
e. Thr and Lys

18. For each of the following levels of protein structure, explain what it is and discuss the types of bonds or interactions involved.
primary structure:
secondary structure:
tertiary structure:
quaternary structure:

19. What is "denaturation" of a protein?

20. Explain <u>how</u> adding a nonpolar organic solvent to an aqueous solution of a protein can denature the protein. Be as specific as possible.

21. Explain <u>how</u> adding a strong acid to an aqueous solution of a protein can denature the protein. Be as specific as possible.

22. Why does a particular enzyme only speed up one specific reaction?

23. In your own words, explain how enzymes speed up reactions. Include anything relevant.

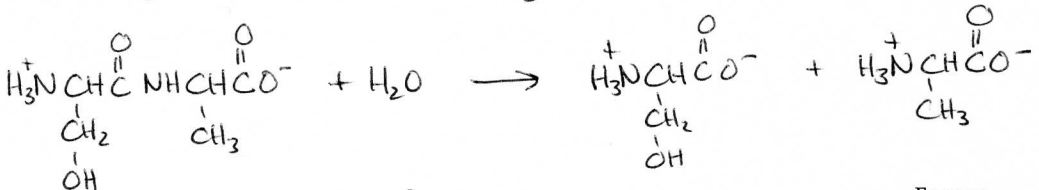
24. As you increase the concentration of substrate in an enzyme-catalyzed reaction, the rate increases. Why does the rate level off as you keep adding more substrate?

25. Draw a graph of the enzyme activity vs. temperature for an enzyme-catalyzed reaction and explain why it has the shape it does.

26. Draw a graph of enzyme activity vs. pH for an enzyme with a pH optimum of 8.0. Why does the activity drop off drastically at a low pH? Explain specifically what is happening at low pH's.

27. There are six major enzyme types: hydrolases, isomerases, ligases, lyases, oxidoreductases, and transferases. For each of the following reactions, state the category of enzyme that catalyzes the reaction and state how you can tell.

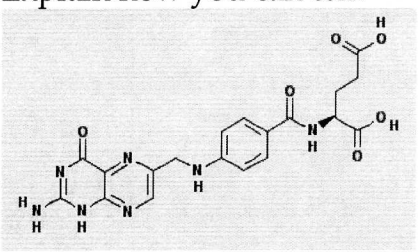
a. 

b. 

c. amino acids + x ATP → protein + x ADP

d. 

28. What is the function of a <u>cofactor</u>?
29. Most chemical reactions get faster as the temperature is increased. Why do enzyme-catalyzed reactions get <u>slower</u> as the temperature increases?
30. Write the reaction for the acid hydrolysis of the dipeptide Asp-Tyr. Assume that initially, the pH is 7.0, and at the end of the reaction, the pH is 2.0. Draw each species involved in the appropriate ionized form.
31. What is the difference between the lock-and-key model and the induced-fit model of enzyme action?
32. Shown here is the structure of a vitamin. Is it water-soluble or fat-soluble? Explain how you can tell.



33. Show how the following reactions can be combined. Determine the overall ΔG for the coupled reactions. Is this spontaneous or nonspontaneous overall? Explain.

Glucose + HPO_4^{2-} → glucose-1-phosphate + H_2O ΔG = 5.0 kcal/mol

ATP + H_2O → ADP + HPO_4^{2-} ΔG = -7.3 kcal/mol

34. What can you say about the structure of a competitive inhibitor? How does it inhibit enzyme function?
35. Where on the enzyme does a noncompetitive inhibitor bind? How does it inhibit enzyme function?
36. a. Write the reaction for the base hydrolysis of N-ethylformamide.
b. Write the reaction for the acid hydrolysis of N-ethylformamide.
Name the products in each case.