1. (5 pts) Draw open chain and the cyclic (pyranose) form of $\alpha$-D-glucose.

\[ \text{Diagram of D-glucose open chain and cyclic (pyranose) form} \]

2. a (8 pts) Draw the structure of a disaccharide of D-glucose and D-mannose
-- For this structure the glucose C1 carbon is connected to the C4 of mannose
-- The 1,4 Glycoside linkage is $\beta$.
-- The anomeric carbon of mannose is in the $\alpha$ position.

\[ \text{Diagram of disaccharide of D-glucose and D-mannose} \]

3. a. (3 pts) For the disaccharide shown below draw an arrow $\rightarrow$ to any anomeric carbon(s) that are present

b. (3 pts) Describe glycosidic link -choose one from a-f:
   a) $\alpha$-1,4  b) $\beta$-1,4  c) $\alpha$-1,1  d) $\beta$-1,1  e) $\beta$-1,5  f) $\beta$-1,6

c. (2 pts) Can humans digest this disaccharide? (yes or no) - is cellulose/fiber
4. Shown below are the 4 bases that are present in the DNA molecules.

a. (2 pts) Which bases are complementary base pairs. \( A/T \) and \( G/C \)

b. (6 pts) Draw the hydrogen bonding interactions between one of the base pairs.

5. (8 pts) The Lipid below reacted to make soap (saponification) as you did in lab. What is the missing reagent (\(?\)) and the products of this reaction?

\[
\begin{align*}
\text{CH}_2-O-C-(\text{CH}_2)_4-O-\text{CH}-(\text{CH}_2)_7-\text{CH}_3 + \? & \xrightarrow{\text{NaOH}} \text{CH}_2\text{OH} \\
\text{CH}_2-O-C-(\text{CH}_2)_4-O-\text{CH}-(\text{CH}_2)_7-\text{CH}_3 & \xrightarrow{\text{NaOH}} \text{CH}_2\text{OH} \\
\end{align*}
\]
6. Answer the following for the nucleic acid segment shown below:

a. (2 pts) Is this an DNA or RNA sequence? **DNA**

b. (2 pts) Label all the anomeric carbons present.

c. (2 pts) Label which is the 5' end and the 3' end.

d. (3 pts) Give the base sequence (ACGT etc) going from the 5' end to the 3' end.

\[ 5' \text{ GCA } 3' \]

e. (3 pts) What would be the complimentary sequence for the sequence in question 6e? (denote the 5' and 3' ends)

\[ 3' \text{ CGT } 5' \text{ if DNA} \]
\[ 3' \text{ CGU } 5' \text{ if mRNA} \]
7. a. (3 pts) Write the primary structure of the polypeptide that would be produced by the translation of the mRNA sequence below (use table provided).

b. (2 pts) Write the DNA sequence that created the mRNA structures below

mRNA: 5' AUG-UGC-GAU-UUU-UAG 3'  
apolypeptide: Cys-Asp-Phe

b. DNA sequence: 3' TAC-ACG-CTA-AAA-ATC 5'

8. (5 pts) Write the DNA sequence that would ultimately produce the tripeptide shown below.

8. (5 pts) Write the DNA sequence that would ultimately produce the tripeptide shown below.

9. (5 pts) Show the digestion/hydrolysis products of the disaccharide below.
10. Answer the following for the molecules below (A, B or C)

a. (2 pts) Which compound is NADH (nicotinamide adenine dinucleotide)? (A,B or C) B

b. (3 pts) Which molecule could reduce an aldehyde to an alcohol? (A,B or C) B

c. (2 pts) What sugar is present in the NADH molecule? deoxyribose

d. (3 pts) Which molecule could convert 2-propanol to acetone? (A,B or C) A (NAD⁺)
11. (26 pts) Use the list of compounds shown on the next page to answer question 11 a-l. For each answer write in the number corresponding to the correct structures. There can be more than one answer for each question.

a. Which compound(s) are reducing sugar(s)?  

b. Which compound(s) contain a β Glycosidic linkage? 

c. Which compound(s) when digested (hydrolysis) would produce glucose? 

d. Which compound(s) are sugar alcohols? 

e. Which compound(s) represent a triacylglyceride? 

f. Which compound(s) contain an α (1-6) Glycosidic linkage? 

g. Which compound(s) would you consider to be ‘soap’? 

h. Which compound(s) would you consider a Nucleotide of DNA? 

i. Which compound(s) would you consider a Nucleotide of RNA? 

j. Which compound(s) would you consider a Phosphotriglycerides? 

k. Would you consider compound B a (circle one) a) Fat, b) Oil, c) Carbohydrate d) Nucleotide, e) RNA

l. Which compound(s) are ATP (adenosine triphosphate)? 

![Chemical structures](image-url)
1. (6 pts—2 pts each) Give the IUPAC name for following compounds

- OH
  - cycloheptanol
  - Br—CH₂CH₂CH₂CH₂CH₂CH₃ | 1-Bromo-1-hexane

- Br
  - 5-Bromo-3-Hexanone

2. (4 pts-2 pts each) **Draw the structures** corresponding to the following names.

- 2-bromo-2,4-dimethylheptane
- 4-chloro-1-octene

3. (4 pts) Draw the structure of an Ester that has a molecular formula of C₅H₁₀O₂. Be sure to depict all lone pair electrons.

\[
\text{OH}^\cdot \text{O}^\cdot \text{CH₃}^\cdot \text{CH₂CH₂CH₃}
\]
4. (9 pts) For the molecule below circle and name all the functional groups present (follow the exam used). You do not have to circle the 'alkane' functional group.

b. (4 pts) If NaOH (sodium hydroxide) were added to this compound show which functional group would react with the base to form a salt. Draw the salt that would be formed in the space on the right.

5. (4 pts) Depict the hydrogen bonding interaction that would occur if the alcohol and amine were mixed together. Use $\delta^+$ and $\delta^-$ symbols to show charge separation.

6. (8 pts) For compounds A-D below:
   a) Rank in order of boiling point (lowest to highest). $D > C > A > B$
   b) Rank in order of water solubility (most soluble to least soluble in water) $B > A > C > D$
7 a. (3 pts) Besides Benzene draw a compound that would be considered **Aromatic**.

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[苯环] + many others
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b. (2 pts) could the compound you drew react with bromine?

NO

8. (20 –5 pts each) For the reactions below, draw the major products.

\[
\text{CH}_3\text{CH}_3 + O_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}
\]

\[
\text{Br}_2 + \text{C}_3\text{H}_6 \rightarrow \text{BrCBrC}_3\text{H}_4
\]

\[
\text{C}_3\text{H}_7\text{COOCH}_3 + \text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{C}_3\text{H}_7\text{COOH} + \text{H}_2\text{O}
\]

\[
\text{C}_6\text{H}_4\text{N} + \text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{C}_6\text{H}_4\text{NCH}_2\text{NH}_2
\]
9. (8 pts) Draw the structure of the tripeptide Ser-Glu-Phe

Circle the peptide bond(s). **Note which end** is the C terminus and which is the N terminus.

![Tripeptide structure]

10. (4 pts) Name the peptide below by the 3 lettered abbreviated amino acid notation (as in the previous question).

![Peptide structure]

**Lys-Thr-Tyr-Ala**

11. (6 pts) For each compound shown below, circle all the ‘chiral’ carbons (some may not have any)

![Compounds](chart.png)
12. (10 pts) For the statements below circle true or false:

(T / F) A methylene chloride (CH₂Cl₂) does have an plane of symmetry.

(T / F) A non chiral object (or molecule) can have an enantiomeric form.

(T / F) Enantiomers are mirror images of each other and are superimposable.

(T / F) The amino acid alanine does have a plane of symmetry.

(T / F) A carbon atom with 4 different atoms attached to it does not have a plane of symmetry.

13. (8 pts) Circle what is true or false about proteins.

(T / F) The α helix is considered a secondary structure of proteins and DNA.

(T / F) Hydrogen bonding occurs between the non-polar regions of proteins.

(T / F) The disulfide bond is largely responsible for the ‘curls’ in hair.

(T / F) Serine is the amino acid that can form the disulfide bond.