1. Name the following molecules:

![Molecule 1](image1)

![Molecule 2](image2)

![Molecule 3](image3)

2. Explain the difference between...
   (a) Ribose and deoxyribose

   (b) Major and minor groove

   (c) Basic and acidic amino acids

   (d) Fats and Oils

   (e) Exons and Introns

   (f) Activation Energy and \( \Delta H \)
3. Show all alkenes with the formula $C_3H_{10}$.

4. For the molecule shown to the right...
   (a) What is the formula?
   (b) What functional groups are present?
   (c) How many sp2 carbons are present?
   (d) How many chiral carbons are there?

5. Complete the following reactions:

   ![Diagram of chemical reactions]
6. Define the following:
   (a) Reducing sugar
   (b) Isoelectric point
   (c) Enantiomers
   (d) Mutarotation
   (e) Anti-parallel
   (f) Anti-codon

7. What are the three types of RNA? Briefly describe the function of each.

8. Describe in general terms how you would separate a racemic mixture.

9. Why might an error in DNA replication NOT lead to a mutation?
1. Name the following molecules:

- 5-chloro-6-ethyl-4-fluoro-7-methyl-3-octanone
- 4-isopropyl-N,N-diethyl-N-pentyl heptanamide
- 3-chloro-5-ethyl-6,6-dimethyl-1-heptyne
- 3-bromo-5-chloro-2,6-dimethyl benzoic acid

2. Explain the difference between...
   (a) Ribose and deoxyribose
   - Sugar in DNA, no OH on C#2
   - Sugar in RNA, OH on C#2

   (b) Major and minor groove
   - The larger and smaller gap between the 2 strands of DNA

   (c) Basic and acidic amino acids
   - The R group in an amino acid may contain a second amine (basic) or carboxylic acid (acidic)

   (d) Fats and Oils
   - At least one cis non-conjugated double bond

   (e) Exons and Introns
   - So-called "nonsense" DNA that does not code, generally irrelevant DNA that code for particular amino acids

   (f) Activation Energy and ΔH
   - Energy required to start a reaction
   - Energy difference between reactants and products
3. Show all alkenes with the formula C₅H₁₀.

4. For the molecule shown to the right...
   (a) What is the formula?
   (b) What functional groups are present?
   (c) How many sp2 carbons are present?
   (d) How many chiral carbons are there?

5. Complete the following reactions:
6. Define the following:
(a) Reducing sugar
   Able to react with Benedict's to produce a brownish red.
(b) Isoelectric point
   pH at which amino acid is in zwitterion.
(c) Enantiomers
   Non-superimposable mirror images
(d) Mutarotation
   Equilibrium between α, β, and straight chain forms.
(e) Anti-parallel
   Peptide but forms an opposite direction.
(f) Anti-codon
   Complementary to codon, found on the bottom of tRNA and related to transfer mRNA.

7. What are the three types of RNA? Briefly describe the function of each.
   - Messenger → copy of gene
   - Ribosomal → assists in protein construction
   - Transfer → carries amino acid to specific site (via codon and anti-codon) for protein structure.

8. Describe in general terms how you would separate a racemic mixture.
   - React with optically pure compound (R*) to form diastereomers.
   - Separate according to convenient properties. Then remove the R*.

9. Why might an error in DNA replication NOT lead to a mutation?
   1. Proofread
   2. Redundancy
   3. Inter
   4. Different amino acid may not alter protein function.
1. Name the following molecules:

![Molecule 1]

![Molecule 2]

![Molecule 3]

![Molecule 4]

2. Complete the following reactions:

![Reaction 1]

![Reaction 2]

![Reaction 3]

![Reaction 4]
3. Consider the bases in DNA (you may use just the letter)
   (a) Which ones base-pair together?
   (b) Which ones are purines?
   (c) Which one is not found in RNA?

4. There are four so-called “levels” of protein structure. List them below and give a brief explanation of each.

5. What is the definition of a mutation?

6. In the space below, draw…
   (a) a detergent
   (b) a basic amino acid

7. Compare RNA with DNA in terms of the following:
   (a) The sugar
   (b) The phosphate group
   (c) The average length
8. Examine the molecule and answer the following questions:
   (a) What is the formula?
   (b) How many chiral carbons?
   (c) How many optical isomers?
   (d) Is this molecule conjugated?
   (e) Is it water soluble?
   (f) How many sp2 hybridized carbons?
   (g) Is it an acid, a base, or neither?
   (h) Is it a terpene?

9. Give all the ether isomers with the formula C₄H₁₀O.

10. Give all the aldehyde isomers with the formula C₅H₁₀O.

11. How would you separate a mixture that contained an alcohol, a phenol, and a carboxylic acid?
1. Name the following molecules:

- 3,4-dimethyl hexanoic acid
- benzyl isobutyl ether
- 4-chloro-2,2-dimethyl cyclopentanone
- 3-fluoro-5-isopropyl benzene trichloride

2. Complete the following reactions:

\[
\begin{align*}
\text{H}_2\text{O} & \quad \text{H}_3\text{O}^+ \\
\text{\text{C}_5\text{H}_10\text{O}_{18}} & \quad \text{\text{C}_5\text{H}_10\text{O}_{18}} \\
\text{\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}} & \quad \text{\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}} \\
\text{\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}} & \quad \text{\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}} \\
\text{\text{Br}_2} & \quad \text{\text{Br}_2} \\
\text{\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}} & \quad \text{\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}} \\
\end{align*}
\]
3. Consider the bases in DNA (you may use just the letter)
   (a) Which ones base-pair together? \( G-C \)  \( T-A \)
   (b) Which ones are purines? \( G \), \( A \)
   (c) Which one is not found in RNA? \( T \)

4. There are four so-called "levels" of protein structure. List them below and give a brief explanation of each.
   - Primary: Sequence of amino acids
   - Secondary: Pairs of amino acid
   - Tertiary: Shape of protein
   - Quaternary: Shape relative to other proteins.

5. What is the definition of a mutation?
   DNA error that leads to altered protein function.

6. In the space below, draw...
   (a) a detergent
   (b) a basic amino acid

   ![Chemical structures]

7. Compare RNA with DNA in terms of the following:
   (a) The sugar
       \( RNA: \text{Sugar} = \text{Ribose} \)
       \( DNA: \text{Sugar} = \text{Deoxyribose} \)
   (b) The phosphate group
       Identical
   (c) The average length
       DNA is much longer.
8. Examine the molecule and answer the following questions:
   (a) What is the formula?
   (b) How many chiral carbons?
   (c) How many optical isomers?
   (d) Is this molecule conjugated?
   (e) Is it water soluble?
   (f) How many sp2 hybridized carbons?
   (g) Is it an acid, a base, or neither?
   (h) Is it a terpene?

9. Give all the ether isomers with the formula C₄H₁₀O.

10. Give all the aldehyde isomers with the formula C₅H₁₀O.

11. How would you separate a mixture that contained an alcohol, a phenol, and a carboxylic acid?

   Add weak base first, such as NaHCO₃.
   Carboxylic acid will react to form the sodium salt and can be removed.
   Now add stronger base, like NaOH.
   Phenol will react to form the sodium salt and can be removed.
   Only alcohol remains.