1. (9 pts.) Shown below are three structures. Indicate by circling the appropriate answer to the following questions:

a. Is the structure a hemiacetal, an acetal, or neither?
b. Was the structure produced from an aldehyde, a ketone, or neither?
c. Draw the structure of the alcohol if any that was used in the reaction.

A. \( \text{CH}_3\text{CH}_2\text{CCH}_2\text{CH}_3 \)

- Hemiacetal
- Acetal
- neither

Aldehyde: Ketone: neither

Alcohol: \( \text{CH}_3\text{OH} \)

B.

- Hemiacetal
- Acetal
- neither

Aldehyde: Ketone: neither

Alcohol: N/A

C.

- Hemiacetal
- Acetal
- neither

Aldehyde: Ketone: neither

Alcohol: \( \text{CH}_3\text{OH} \)

(2 molecules)
2. (18 pts.) For questions A-H, consider the descriptions below and select from the three fatty acid molecules shown (may be used more than once; more than one answer may be possible):

A. expected highest melting point? A
B. fat at room temperature? A (and B)
C. saturated? A
D. unsaturated? B and C
E. expected lowest melting point? C
F. trans fat? B
G. consumption increases the risk of cardiovascular disease? A and B
3. (33 pts. total; 3 pts. each) **SEQUENCES!** Complete each reaction sequence below by providing the reagents or structures as indicated by the “?”.

*ONLY ANSWERS BY THE “?” WILL BE GRADED.*

If two products are possible, indicate only the MAJOR product.

**1.**

\[
\text{H}_2\text{SO}_4 \quad \text{H}_2\text{O} \quad \text{NaBH}_4 \quad \text{H}_2\text{O} \quad \text{H}_2\text{O} \quad \text{PCC} \quad \text{CH}_2\text{Cl}_2 \quad \text{H}^+ \quad \text{Tollens reagent} \quad \text{Ag(s)}
\]

**2.**

\[
\text{H}_2\text{SO}_4 \quad \text{H}_2\text{O} \quad \text{NaBH}_4 \quad \text{H}_2\text{O} \quad \text{H}_2\text{O} \quad \text{PCC} \quad \text{CH}_2\text{Cl}_2 \quad \text{H}^+ \quad \text{Tollens reagent} \quad \text{Ag(s)}
\]

**3.**

\[
\text{H}_2\text{SO}_4 \quad \text{H}_2\text{O} \quad \text{NaBH}_4 \quad \text{H}_2\text{O} \quad \text{H}_2\text{O} \quad \text{PCC} \quad \text{CH}_2\text{Cl}_2 \quad \text{H}^+ \quad \text{Tollens reagent} \quad \text{Ag(s)}
\]
4. (16 pts. total) SYNTHESIS! For questions A and B design a synthetic sequence using the properly ordered and appropriate reagents on the cover page of this examination to account for the following chemical transformation.

A.

B.
5. (10 pts.) Predict the MAJOR and MINOR products for the reaction listed below AND give the appropriate curved arrow notation for formation of each final product.
6. (4 pts.) **NOMENCLATURE!** Use the appropriate IUPAC notation to **name the following structure:**

![Chemical Structure](image)

7. (10 pts. total; 1 pt. each) **TRUE AND FALSE!** Beside each statement below, write the full word True if the statement is true, or the full word False if the statement is false.

   A. An organic oxidation involves the gaining of oxygen or loss of hydrogen. **TRUE**

   B. A tertiary alcohol can be oxidized to a ketone. **FALSE**

   C. A secondary carbocation is more stable than a tertiary carbocation. **FALSE**

   D. During a reaction with potassium permanganate, a solution with a compound containing an alkene is expected to remain colored purple. **FALSE**

   E. Functional groups are not responsible for the physical properties of a compound. **FALSE**

   F. Aldehydes are more reactive than ketones. **TRUE**

   G. Alcohols have a higher boiling point than alkenes and alkynes due to hydrogen bonding. **TRUE**

   H. Benedicts reagent reduces aldehydes to carboxylic acids. **FALSE**

   I. Amines exhibit hydrogen bonding with water. **TRUE**

   J. In unsaturated fatty acids, the cis isomer predominates over the trans isomer. **TRUE**