1. Provide products of each reaction. Include all stereoisomers. Indicate if a product is: achiral (by the letter A), chiral (C), a meso compound (M). If a racemic pair is produced by the reaction enclose the enantiomers in a circle.

a) \[ \text{Reaction } a \]

b) \[ \text{Reaction } b \]

2. Name the following compound. Use the IUPAC system and include configurational (R,S) designations.

3. Which of the following energy diagrams represents the fastest reaction? Explain why.

A \[ \text{Diagram } A \] 
B \[ \text{Diagram } B \] 
C \[ \text{Diagram } C \] 
D \[ \text{Diagram } D \]
4. Draw the planar representation and the chair conformations for cis-(1,2)-dibromo-trans-4-tertbutyl cyclohexane and explain which one is more stable (for the chair conformations).

5. a) Circle the structures that represent a conformation of 2,2-dimethylbutane sighting along any C-C bond.

\[ \text{H}_3\text{C} \quad 2 \quad 3 \quad \text{CH}_3 \]

\[ \text{Me} \quad \text{Me} \quad \text{Me} \quad \text{Me} \quad \text{Me} \]

\[ \text{Et} \quad \text{H} \quad \text{Me} \]

\[ \text{Me} \quad \text{Me} \quad \text{Me} \quad \text{Me} \]

\[ \text{Me} \quad \text{Me} \quad \text{Me} \quad \text{Me} \]

b) Complete each of the Newman projections below to show the most stable and less stable conformations of 2,2-dimethylbutane, sighting along the C_2-C_3 bond.

\[ 2 \]

\[ 2 \]

c) Use the above Newman projections to calculate the barrier to rotation of 2,2-dimethylbutane sighting along the C_2-C_3 bond.

Barrier to rotation =
6. Show how to convert 9-octadecynoic acid to the following:

(a) (E)-9-Octadecenoic acid (elaidic acid)
(b) (Z)-9-Octadecenoic acid (oleic acid)
(c) 9,10-Dihydroxyocadecanoic acid
(d) Octadecanoic acid (stearic acid)

7. Show reagents and experimental conditions required to bring about the following transformations:

8. Which of the following reagents react with 2-butyne to form (Z)-2-butene?

1. H₂/Lindlar catalyst
2. (sia)₂BH followed by CH₃COOH
3. Na/NH₃

a. only 1
b. only 3
c. only 2 and 3
d. only 1 and 2