A. Show how to prepare each of the following products from the designated starting material.

1. Prepare \( \text{CH}_3 \) from an alcohol

2. Prepare \( \text{CH}_3 \) from an alcohol

3. Prepare \( \text{CH}_3 \) from two different alkenes

4. Prepare \( \text{CH}_3 \) from an alkene

5. Prepare \( \text{CH}_3 \) from an alkene

6. Prepare \( \text{CH}_3 \) from an alkene

7. Prepare \( \text{CH}_3 \) from an alkene

8. Prepare \( \text{CH}_3 \) from a halide

9. Prepare \( \text{CH}_3 \) from a halide
B. Show how to prepare each of the following products from the designated starting material.

1.

2.

C. Show the stereochemistry of the product of the following reaction by drawing a Newman projection of the product in its most stable conformation. Is the product optically active?

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\text{H} & \quad \text{H}
\end{align*}
\]

1) BH₃, THF

2) H₂O₂, HO⁻

D. Write a mechanism for the following reaction showing the correct number of steps and using the arrow formalism correctly.

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\text{OH} & \quad \text{H}^+ \\
\text{H}_3\text{C} & \quad \text{CH}_3 + \text{H}_2\text{O}
\end{align*}
\]

E. Draw an energy diagram to accompany the following mechanism. Label the various energy minima. What should be the product of kinetic control? What should be the product of thermodynamic control?