1. (Re-submitted from PS #7): Account mechanistically for the fact that (S)-ketone 1 is racemized in the presence of acid or base. Write two mechanisms: one for the racemization in acid, one for the racemization in base.

![Mechanism of Racemization of (S)-Ketone 1](image)

2. Explain why acetylacetone (2), unlike simple ketones and aldehydes, exists mainly in its enol form at equilibrium.

![Formation of Enol from Acetylacetone](image)

3. When treated with base, ketones 3 and 4 can, in principle, each generate two different enolates. Propose structures for the enolates.

![Proposed Enolates for Ketones 3 and 4](image)

4. Write a mechanism for the alkylation of β-diketone 5 to give α-methylated product 6.

![Mechanism of Alkylation of β-Diketone 5](image)

5. In the above reaction, a small amount of vinyl ether 7 is isolated as well. Account for the formation of this product.

![Formation of Vinyl Ether 7](image)
6. Enolate formation from tert-butyl ethyl ketone 8, followed by addition of benzaldehyde provides a mixture of four stereoisomeric aldol products (A-D). The $^1$H and $^{13}$C NMR spectra of A and B are identical. The $^1$H and $^{13}$C NMR spectra of C and D are identical. The spectra of A and C, while similar, are not exactly the same. Propose structures for A, B, C, and D.