1. a) Provide a mechanism for the formation of A in the reaction shown below. (10 pts.)

\[
\text{C}_2\text{H}_5\text{I} + \text{CH}_2\text{=CH}_2 \xrightarrow{\text{Bu}_3\text{SnH (slow addition)}} \text{AIBN} \quad \xrightarrow{} \quad \text{A preferred} + \text{B}
\]

b) Explain the preference for the formation of A over B by comparing the stability of the key radical intermediates. Draw an orbital energy diagram to illustrate. (3 pts.)

c) Why must the addition of \text{Bu}_3\text{SnH} be carried out slowly? What is the possible byproduct with a fast addition of this reagent? (2 pts.)
2. Provide the structure(s) of the product(s) for the following reactions. Clearly indicate the stereochemistry if applicable. (2 pts. each, 10 pts. total)

- \[
\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{Et} \xrightarrow{\text{Na, TMSCl, Toluene, heat}} \text{EtO}_2\text{CO}_2\text{Et} \xrightarrow{\text{HCl, THF, heat}} \]

- \[
\text{O} \xrightarrow{1) \text{Mg(Hg), TiCl}_4, \text{THF, 0 }^\circ\text{C}} \xrightarrow{2) \text{K}_2\text{CO}_3, \text{H}_2\text{O}} \]

- \[
\text{tBu}_3\text{CO} \xrightarrow{\text{Na, } \text{Et}_2\text{O, tBuOH (excess)}} \]

- \[
\text{PhS}\text{CH}_2\text{CH}_2\text{CH}_2\text{CH} = \text{CH}_2 \xrightarrow{\text{Bu}_3\text{SnH, AIBN}} \]