1. Write the mechanism and the product(s) in 3-D of the following reaction showing **all** intermediates and electron-pushing arrows.

```
\begin{center}
\begin{tikzpicture}
\node at (0,0) {OH}; \node at (1,1) {Cl}; \node at (2,2) {KBr}; \node at (3,3) {\text{Product}};
\end{tikzpicture}
\end{center}
```

2. Give the major product(s) of the following reactions showing stereochemistry in 3-dimensions where necessary and including all stereoisomers. Indicate if the product(s) are optically active (O), racemic (R) or achiral (A).

```
a) \begin{center}
\begin{tikzpicture}
\node at (0,0) {OH}; \node at (1,1) {S}; \node at (2,2) {O}; \node at (3,3) {CH}_3; \node at (4,4) {KCOCH}_2CH_3;
\end{tikzpicture}
\end{center}

b) \begin{center}
\begin{tikzpicture}
\node at (0,0) {OH}; \node at (1,1) {HBr}; \node at (2,2) {HBr}; \node at (3,3) {HBr}; \node at (4,4) {HBr};
\end{tikzpicture}
\end{center}

c) \begin{center}
\begin{tikzpicture}
\node at (0,0) {\text{Alkene}}; \node at (1,1) {CH}_2I_2; \node at (2,2) {Zn(Cu)}; \node at (3,3) {CH}_2I_2; \node at (4,4) {CH}_2I_2; \node at (5,5) {CH}_2I_2;
\end{tikzpicture}
\end{center}

d) \begin{center}
\begin{tikzpicture}
\node at (0,0) {\text{Alkene}}; \node at (1,1) {HCBr}_3; \node at (2,2) {KOt-Bu}; \node at (3,3) {KOt-Bu}; \node at (4,4) {KOt-Bu};
\end{tikzpicture}
\end{center}
```

3. Show how you would accomplish the following synthesis. Include all isolated intermediate compounds and reagents over the arrows. Use only the starting alkene as your carbon source.

```
\begin{center}
\begin{tikzpicture}
\node at (0,0) {\text{Alkene}}; \node at (1,1) {\text{Product}}; \node at (2,2) {\text{Product}}; \node at (3,3) {\text{Product}};
\end{tikzpicture}
\end{center}
```