[1] Suggest two different (but related) mechanisms for the following reaction, and a simple experiment to distinguish one from the other.

\[
\text{Cyclopentene} + \text{HBr} \rightarrow \text{Bromocyclopentene}
\]

[2] Addition of HCl to 1-methylcyclohexene produces a single product X.

\[
\text{1-Methylcyclohexene} + \text{HCl} \rightarrow \text{X}
\]

(a) What is X and how is it formed?
(b) Would the reaction be endothermic or exothermic? By how much? (Use table on p 279 in text.)
(c) Carefully draw, and label, an energy diagram to describe this reaction.
(d) Give the structure of another alkene which will also lead to X as the sole product upon addition of HCl.
(e) The following reaction, however, might be expected to produce two products, Y and Z. What are they, and how might they be formed? (Hint: Y and Z can each exist as a pair of enantiomers.)

\[
\text{3-Fluorocyclohexene} + \text{HCl} \rightarrow \text{Y} + \text{Z}
\]

[3] Propose reasonable mechanisms for the following reactions.

(a) \[
\text{Cyclopentene} + \text{H}_3\text{O}^+ + \text{H}_2\text{O} \rightarrow \text{OH-Substituted cyclopentene}
\]

(b) \[
\text{Butadiene} + \text{H}_3\text{O}^+ + \text{H}_2\text{O} \rightarrow \text{Cyclopentene} + \text{Cyclopentene}
\]