[1] Explain the following observations.

(a) Compound A gives an epoxide upon treatment with a base but B does not.

(b) To prepare bromomethane from dimethylether, one needs to use HBr instead of NaBr.

(c) Optically active (R)-2-iodopentane racemizes when stirred in a solution of sodium iodide in acetone.

(d) The S_N1 reaction of C is faster than that of D.

(e) The E2 reaction of E is slower than that of F.

(f) The following compound is notoriously resistant toward S_N2, S_N1, E_1, and E_2 reactions.
An inquisitive orgomaniac, Reggie O’Kemist, decided to study the ring opening reaction of 2,2-dimethyloxirane with some fancy labeling experiments. He was amused when he found out that the position of the $^{18}$O label in the product diol depended on whether the reaction was done in acid or base. His reaction conditions are given below. Rationalize the results. (The oxygen in bold is $^{18}$O.)

![Ring opening reaction](image)

Predict which reaction in each pair given below is faster. For the faster reaction, write the product(s) and identify the mechanism involved.

(a) IBr \(\xrightarrow{\text{NaBr}}\) DMSO
(b) CH$_3$I Br \(\xrightarrow{\text{(CH$_3$)$_3$N}}}\) acetone
(c) CH$_3$OCH$_3$CH$_3$I \(\xrightarrow{\text{NaI}}\) acetone
(d) (CH$_3$)$_3$CCH$_2$CH$_2$CH$_2$Br \(\xrightarrow{\text{(CH$_3$)$_3$N}}\) THF

Propose reasonable mechanisms for the following reactions.

(a) Br$_2$HCH$_2$HCH$_2$Br \(\xrightarrow{\text{KOH/H$_2$O}}\) COC
(b) H$_2$C=C=CH$_2$ \(\xrightarrow{\text{HI}}\) I$_2$
(c) Br$_2$HCH$_2$HCH$_2$H \(\xrightarrow{\text{EtONa}}\) EtOH \(\xrightarrow{\text{EtOH}}\) H$_3$C=HCH$_3$