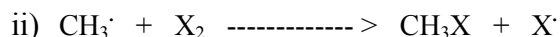
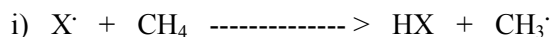
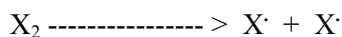


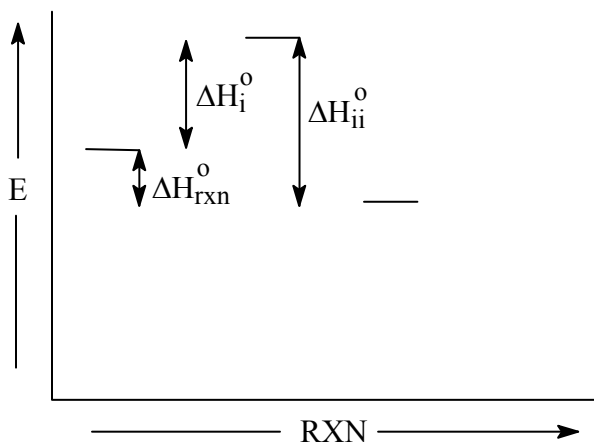
Consider the free radical halogenation ( $X_2$ ) of **methane** with both **fluorine ( $F_2$ )** and **bromine ( $Br_2$ )**. Use the information below and the data table provided to answer the following questions.  
 $CH_4 + X_2 \rightarrow CH_3X + HX$



- a) Using the two propagation steps shown above (i and ii), calculate  $\Delta H_i$  and  $\Delta H_{ii}$  and  $\Delta H_{rxn}$  for the reaction with both  $F_2$  and  $Br_2$  (see BDE values below).  
 b) Are the reactions endo- or exothermic overall? **Exothermic**.  
 c) Which step is the rate determining step in the **bromination** reaction?  
**Step i**

- d) Which reaction is likely *not* a safe reaction to carry out in the lab? Why?  
**Fluorination. The first step is very exothermic thus low  $E_{act}$ .**

- e) On the axes below, construct a reaction profile for the **bromination** propagation steps. Keep your profile roughly to scale. With vertical arrows, **Label  $\Delta H^\circ$**  for step i, ii, and for the overall reaction.



Bond	Bond Dissociation Energy (KJ/mol)
CH <sub>3</sub> -H	438
CH <sub>3</sub> -Br	293
CH <sub>3</sub> -F	456
H-Br	366
H-F	569
Br-Br	193
F-F	157

