Suppose $L_1, L_2 \in NP$. Then

1. Prove that $L_1 \cup L_2 \in NP$?

2. Prove that $L_1 \cap L_2 \in NP$?

3. Can you explain why your arguments in 1. and 2. fail to work for $L_1 \Delta L_2$ (the symmetric difference of $L_1$ and $L_2$)?

Assume $L_1, L_2, L_3 \in NP$. Using set theoretic operations (i.e. union, intersection and complementation) we can create (at most) $2^3 = 256$ different languages from them. Give your best bet (proof is not required) which of the above 256 languages are in $NP$ for every choices of $L_1, L_2$ and $L_3$ (i.e. $L_1 \cup L_2 \cup L_3$).