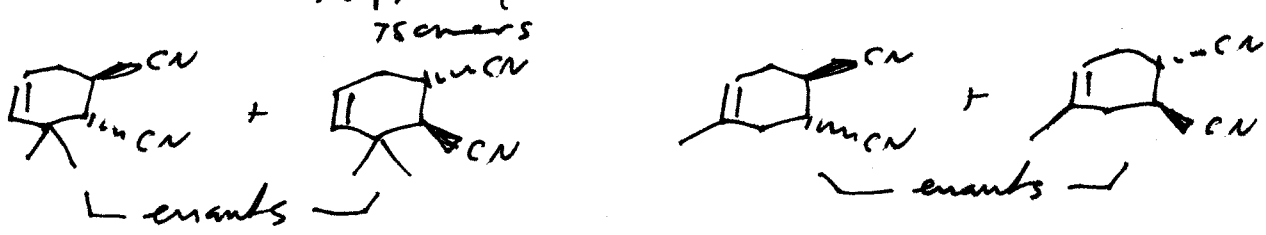
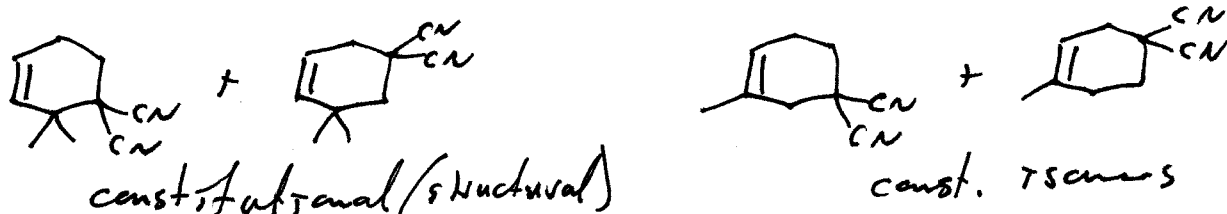
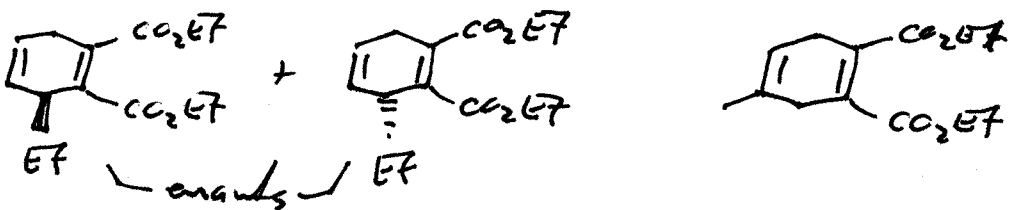
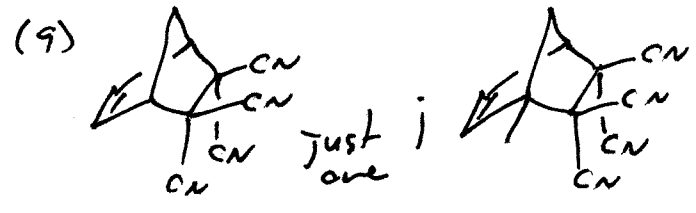


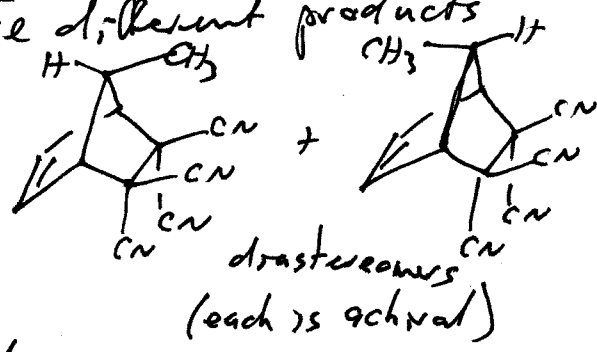
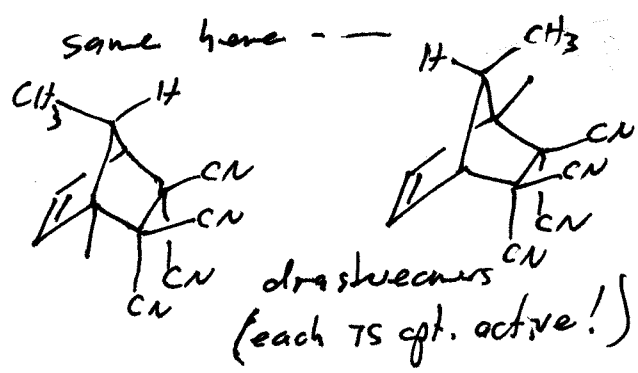
1.



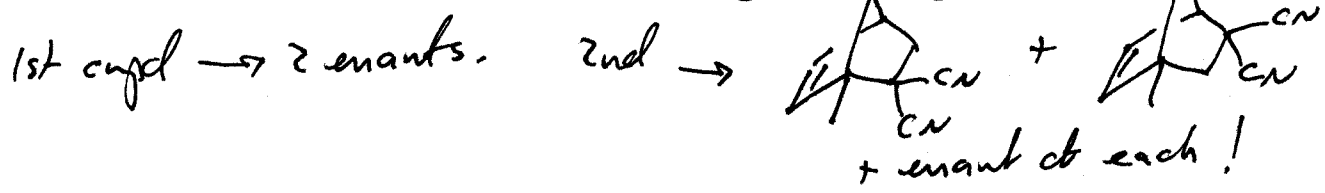
2. This is an exercise in symmetry + thinking through the different combinations of diene + dienophile orientations



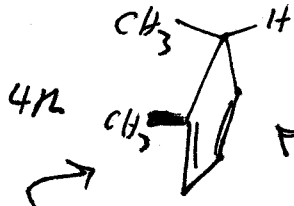
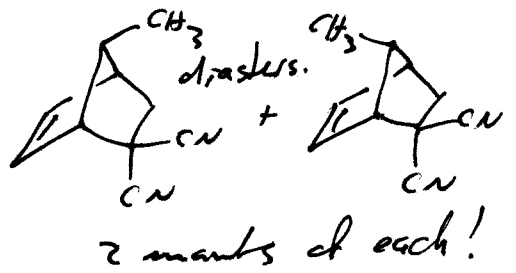
find
or
back -
pick one -
now notice that rxn on the front face + rxn on the back face of the diene give different products



(b) now the dienophile is unsymmetrical end-to-end $\text{H}_2\text{C}=\text{C}(\text{CN})_2$



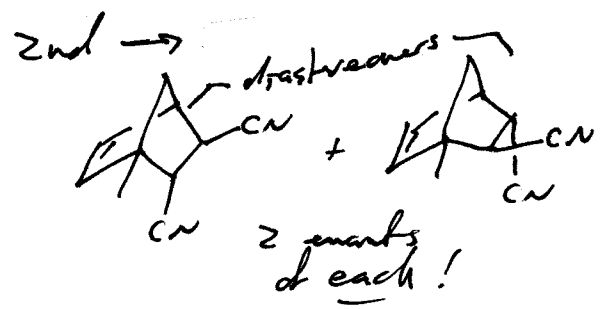
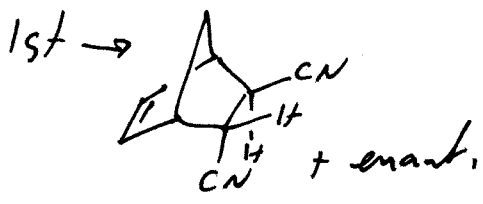
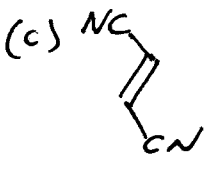
3rd - faces of diene are different, so



dieneophile this way - CNs "front" or "back"

dieneophile this way - CNs "front" or "back"

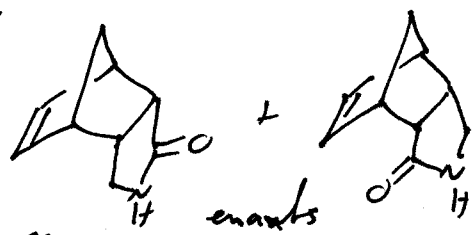
→ 4 products! draw 'em



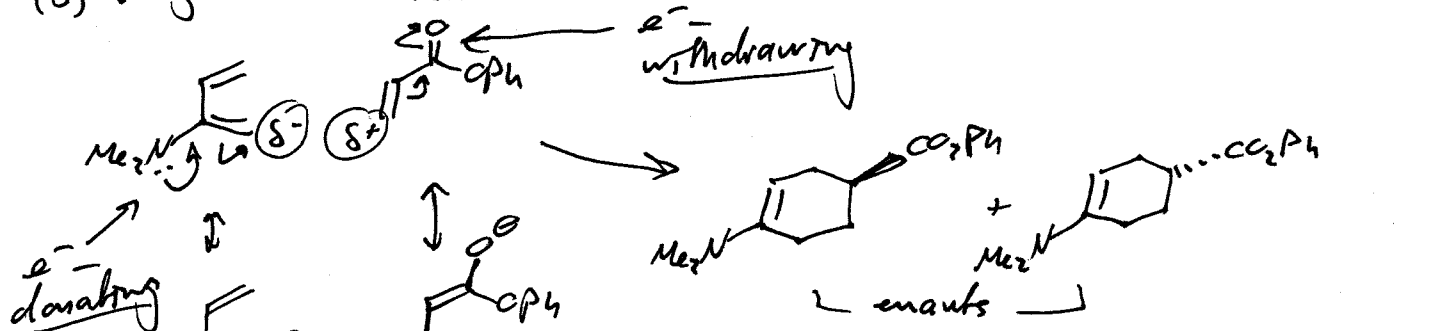
3rd → again, front + back, 2 enantiomers of each

4th → 4 enantiomers produced - diastereomeric - each as a single enantiomer.

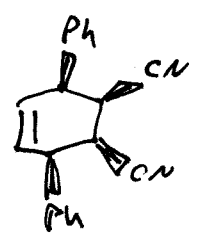
3. (a) endo effect



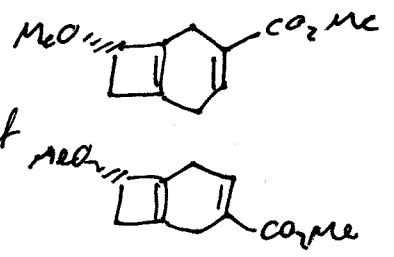
(b) "regiochem effect"



(c) endo effect →

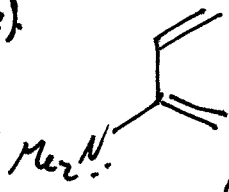


(d) diene substit not in conj

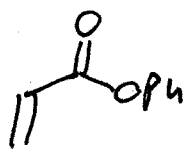


3

(e)



$LU \rightarrow \alpha - 0.67\beta$

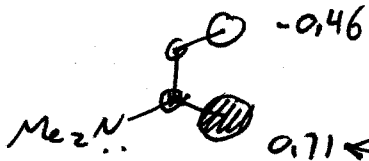
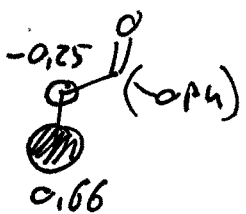


$LU \rightarrow \alpha - 0.38\beta$



$HOMO \rightarrow \alpha + 0.49\beta$

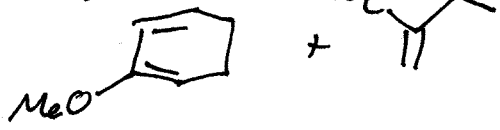
$LUMO \rightarrow \alpha + 0.99\beta$



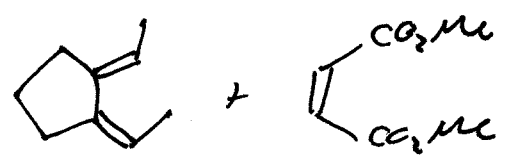
Bringing these together as drawn matches the two large p-orbitals! \Rightarrow maximum stabilize.

4.

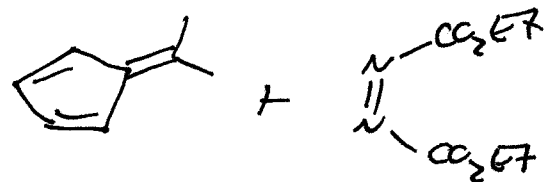
(a)



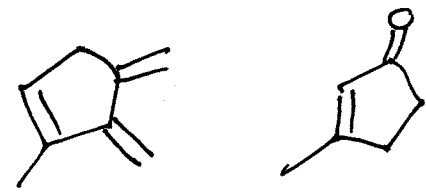
(b)



(c)



(d)



(bad problem - this pair of reactants can combine in 2 orientations - is one preferred? unclear.)