

What is the stereochemistry of this reaction? The addition occurs with suprafacial (*syn*) addition of the two hydrogen atoms to the π bond (i.e. both hydrogen atoms are added to the same face of the π bond)

What is the regiochemistry of this reaction? Since H—H is a symmetrical reagent, there is no regiochemistry to worry about

Is there an intermediate involved in this reaction? Almost certainly, but it does not affect our study of the reaction

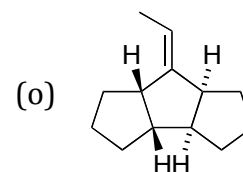
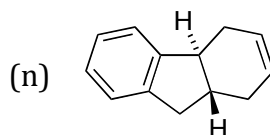
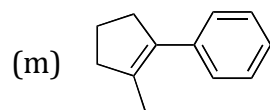
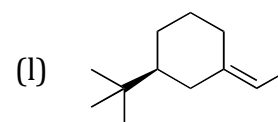
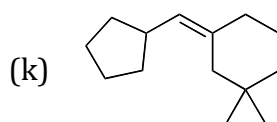
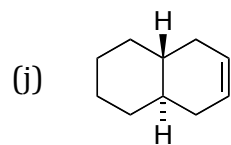
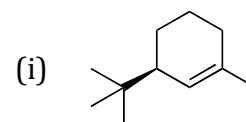
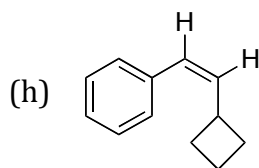
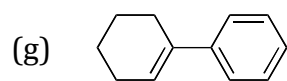
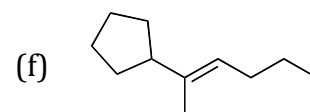
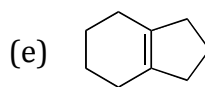
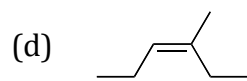
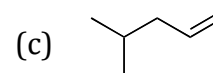
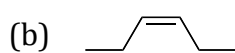
Does this intermediate lead to any special reactivity or observations? N/A

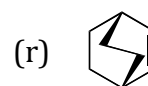
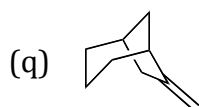
What reagent or combinations of reagents can be used to make the active reagent in this reaction?

- H_2/Pt (EtOH is often used as solvent); H_2/PtO_2 ; $\text{H}_2/\text{H}_2\text{PtCl}_6$
- (platinum catalysts are usually made by reducing a platinum compound with H_2)
- $\text{H}_2/\text{Pd-C}$ (EtOH is often used as solvent)
- $\text{H}_2/\text{Ni}/\Delta/\text{pressure}$ (EtOH is often used as solvent)

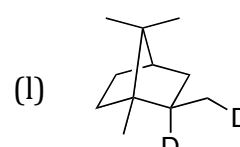
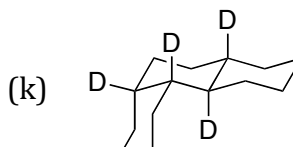
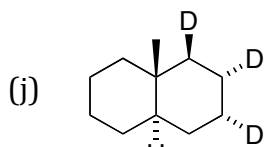
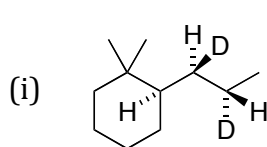
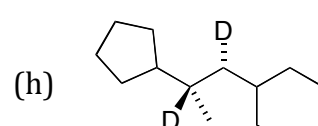
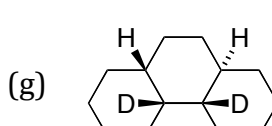
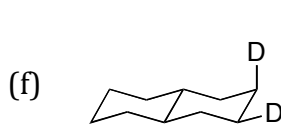
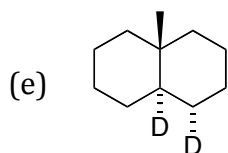
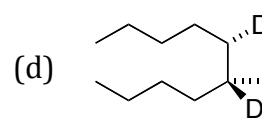
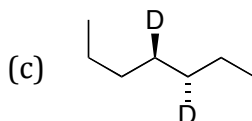
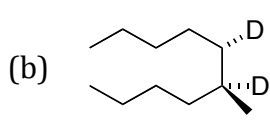
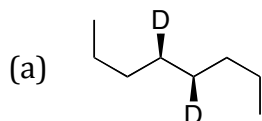
Practice Problems:

What is the major organic product formed by hydrogenation of each of the following alkenes with $\text{D}_2/\text{Pd-C}$?





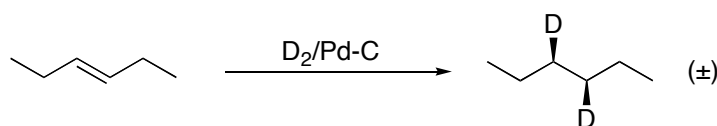
What alkene and reagent combination should be used to prepare each of the following alkanes? Use D_2 as the source of deuterium. [Only one enantiomer is shown, although some products may be racemic; only the diastereoisomer shown should be formed]



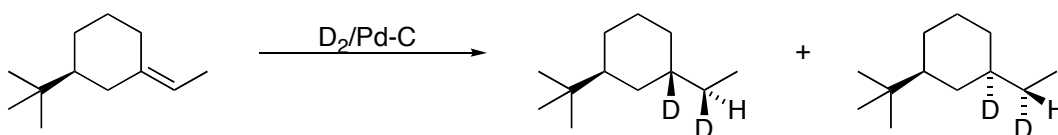
ANSWERS TO SELECTED PROBLEMS

What is the major organic product formed by hydrogenation of each of the following alkenes with $D_2/Pd-C$?

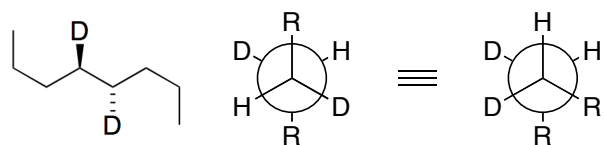
(a) This alkene has an inversion center of symmetry. The suprafacial (*syn*) addition of $D-D$ across the π bond of this alkene will generate two new chiral centers with the same configuration, but the addition to each face is equally likely. The product will be racemic.



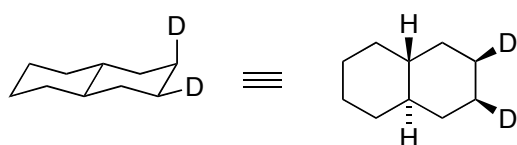
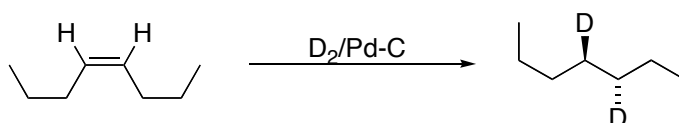
(l) This alkene already has a chiral center, and the hydrogenation will result in two new chiral centers. This means that the products will be diastereoisomers. The alkene π bond has the *E* stereochemistry, so the two new chiral centers will have a fixed relative configuration with respect to each other; only two of the four possible diastereoisomeric products will form because of the suprafacial addition. The two faces of the π bond are not equivalent, so we expect that one of the two products will be formed in greater amount.



What alkene and reagent combination should be used to prepare each of the following alkanes? Use D_2 as the source of deuterium. [Only one enantiomer is shown, although some products may be racemic; only the diastereoisomer shown should be formed]



(c) The two deuteriums in this molecule locate the double bond between carbons 4 and 5 of the chain, making the alkene 4-octene. The Newman projection of the molecule as drawn shows the alkyl groups to be *anti* to each other, and the deuterium atoms to be *anti* to each other. Since the addition occurs with suprafacial stereochemistry, the two deuterium atoms should finish up *syn* (or *gauche*) to each other. When we rotate the front atom of the Newman projection to bring the deuterium atoms into the correct positions, we find that the two alkyl groups are *syn* to each other, as are the two hydrogens. The starting alkene must therefore be the *Z* isomer. The product is a *meso* compound, so we do not have to worry about stereochemistry.



(f) The two deuteriums are both on the top face of the ring system, which locates the double bond between them. The alkene is cyclic, so we do not have to worry about the stereochemistry of the double bond (it must be *Z*), except to ensure that the two other chiral centers in the molecule are of the correct configuration. We can get the configuration by drawing the molecule as the line formula instead of the projection formula.

