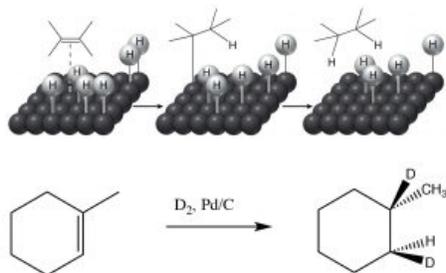


## 5.3: Reduction of Alkenes-

The historical meaning of “reduction” involved reactions with hydrogen ( $\text{H}_2$ ), and conversely, oxidation meant reaction with oxygen ( $\text{O}_2$ ). This makes sense from the perspective that carbon is slightly more electronegative than hydrogen, so that a  $\text{C}-\text{H}$  bond is polarized as  $\text{C}^{\delta-}$  and  $\text{H}^{\delta+}$ . Therefore, adding hydrogen to a  $\text{C}=\text{H}$  will increase (slightly) the negative charge on the carbon. (Similarly, a  $\text{C}-\text{O}$  bond is polarized  $\text{C}^{\delta+}$  and  $\text{O}^{\delta-}$ , so that adding more oxygens to a carbon increases the amount of positive charge on the carbon.) Even today we refer to adding hydrogen across pi bonds as a reduction. However, alkenes do not normally react with hydrogen; typically a catalyst (usually a transition metal) is necessary for the reaction to occur. In general, the catalyst is supplied as a finely divided powder adsorbed onto an inert substance such as charcoal. The most common catalysts are platinum or palladium on charcoal ( $\text{Pt}/\text{C}$  or  $\text{Pd}/\text{C}$ ). Typically, the substance to be reduced is dissolved in a solvent, the catalyst is added, and then hydrogen is bubbled through the mixture. The catalyst adsorbs both  $\text{H}_2$  and the alkene onto its surface and this interaction weakens both the  $\text{H}_2$  bond and the pi bond. The hydrogen then migrates to the adsorbed alkene and adds across the double bond. The reaction is *stereospecific* in that both H’s add from the same side—a syn addition. This can be seen more clearly if we use deuterium instead of hydrogen—both the D’s add from the same side.



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