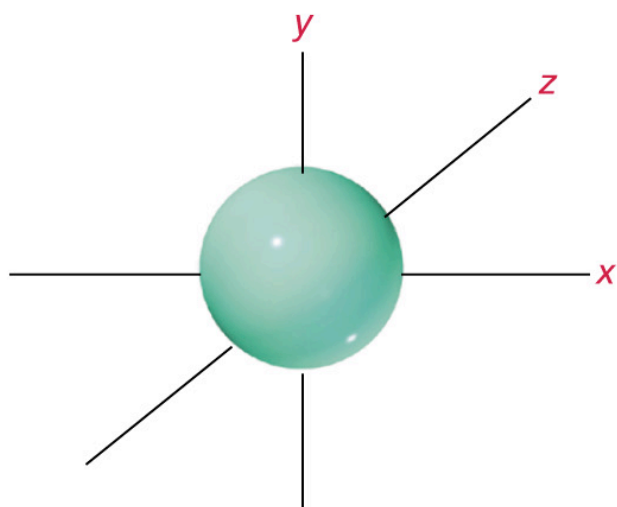
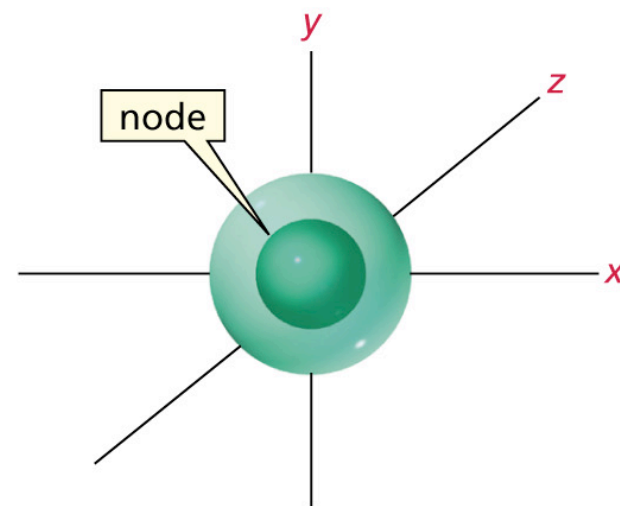


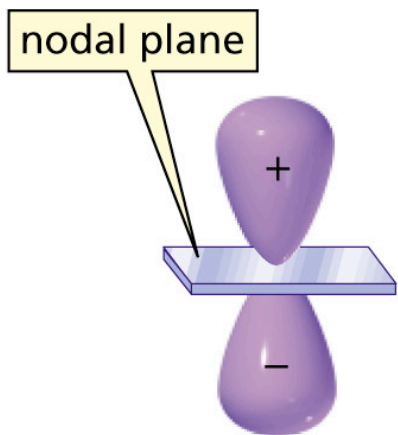
**1s atomic orbital**



**2s atomic orbital**  
**node not shown**

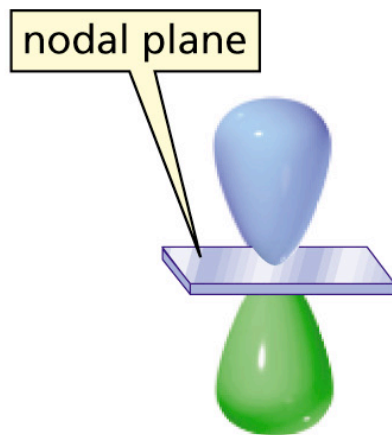


**2s atomic orbital**  
**node shown**

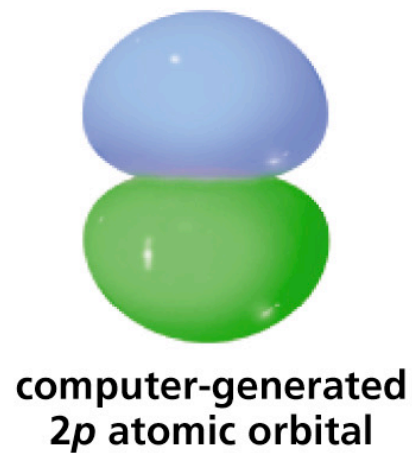


**2p atomic orbital**

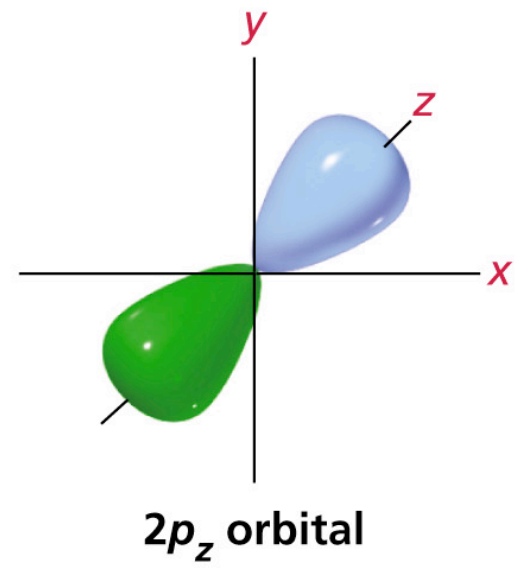
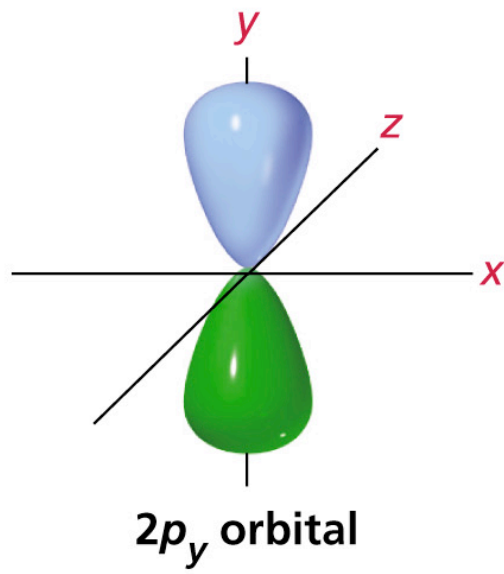
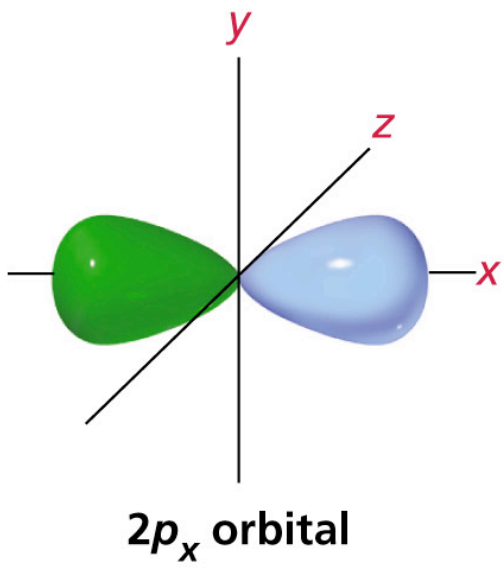
or



**2p atomic orbital**



**computer-generated  
2p atomic orbital**





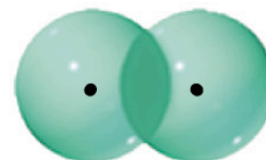
**H·**

1s atomic  
orbital



**·H**

1s atomic  
orbital

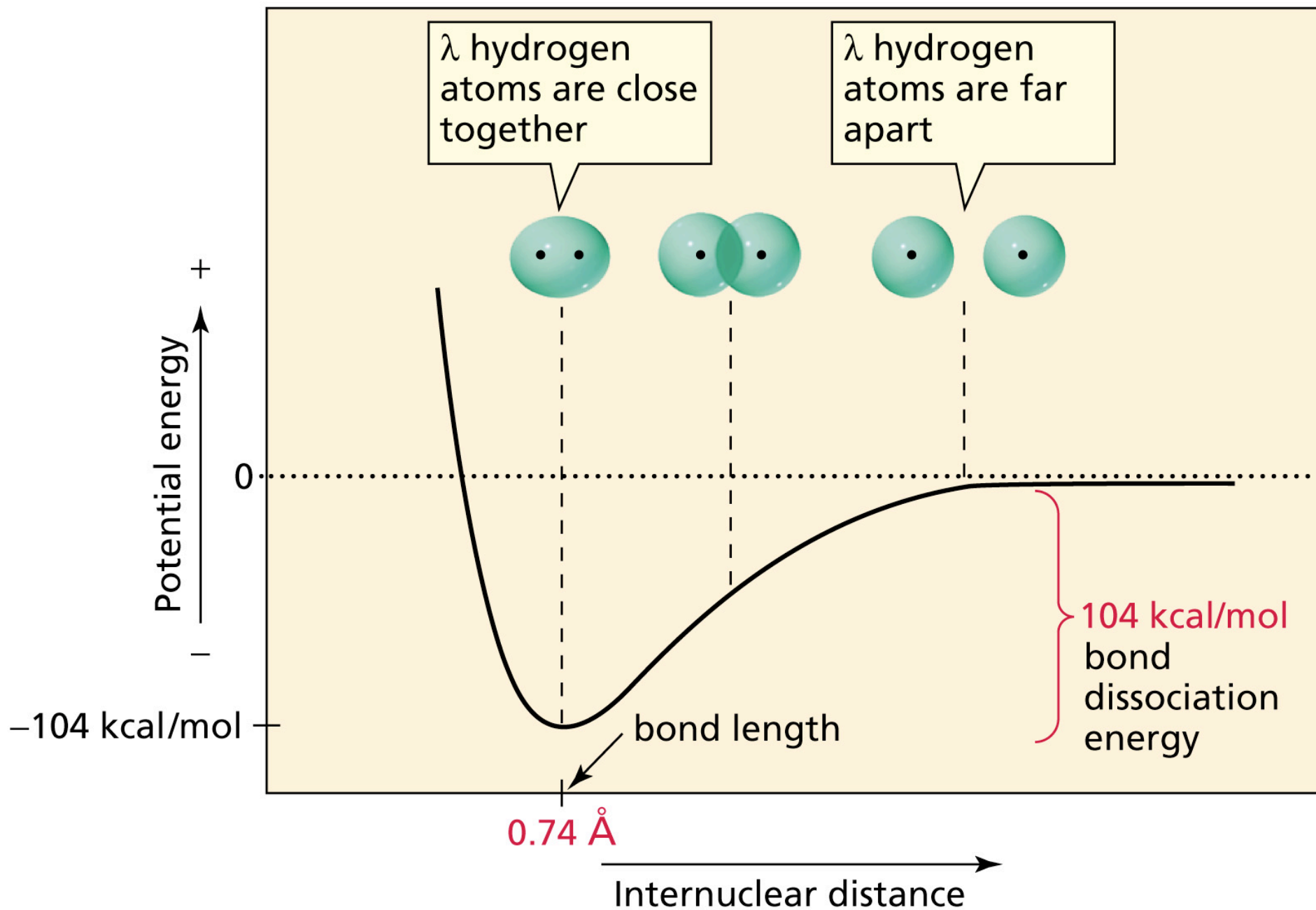


**H : H**



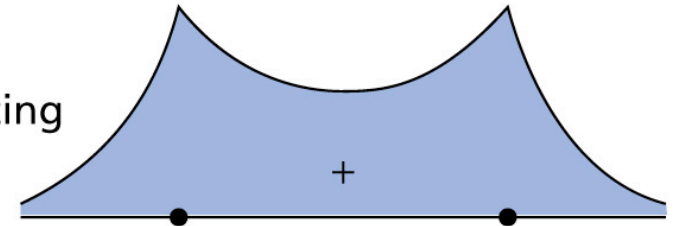
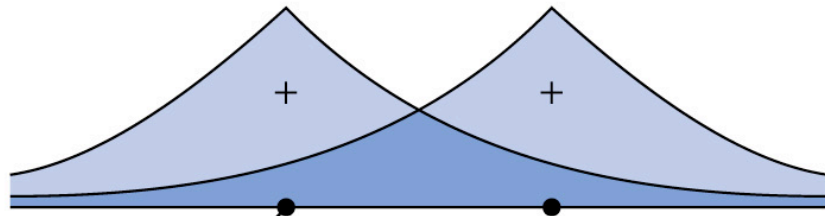
**H : H**

molecular orbital



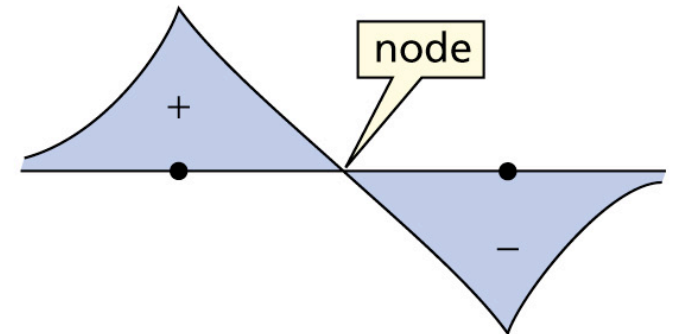
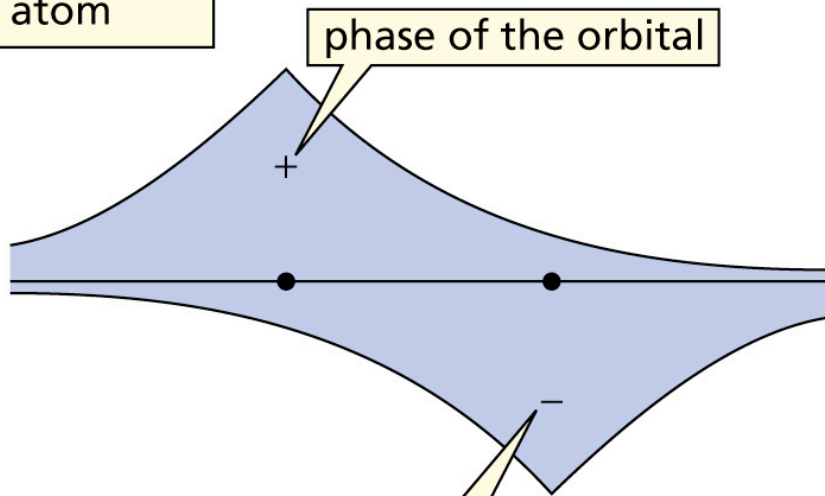
### constructive combination

waves reinforce each other, resulting in bonding



### destructive combination

waves cancel each other, and no bond forms

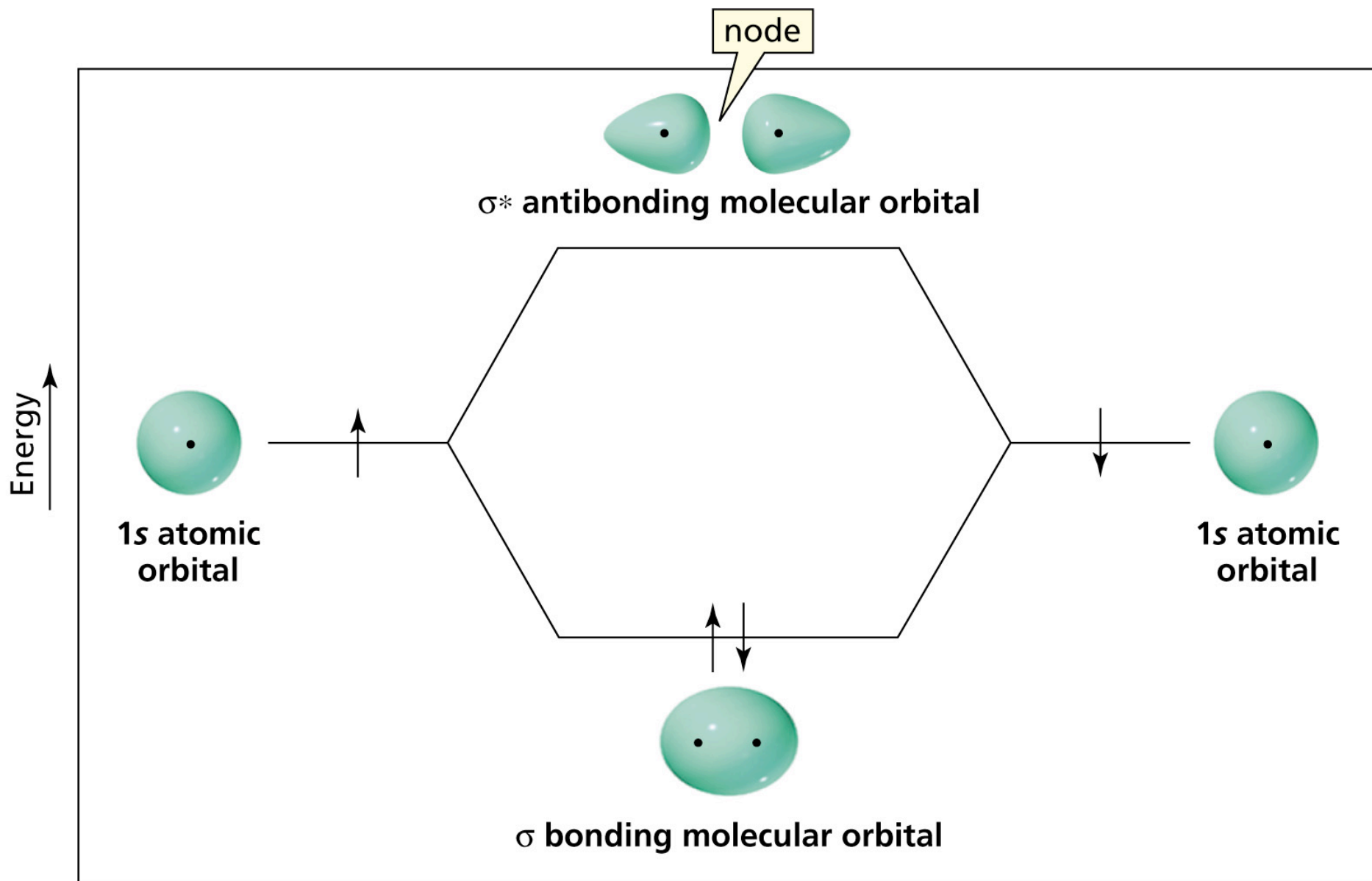


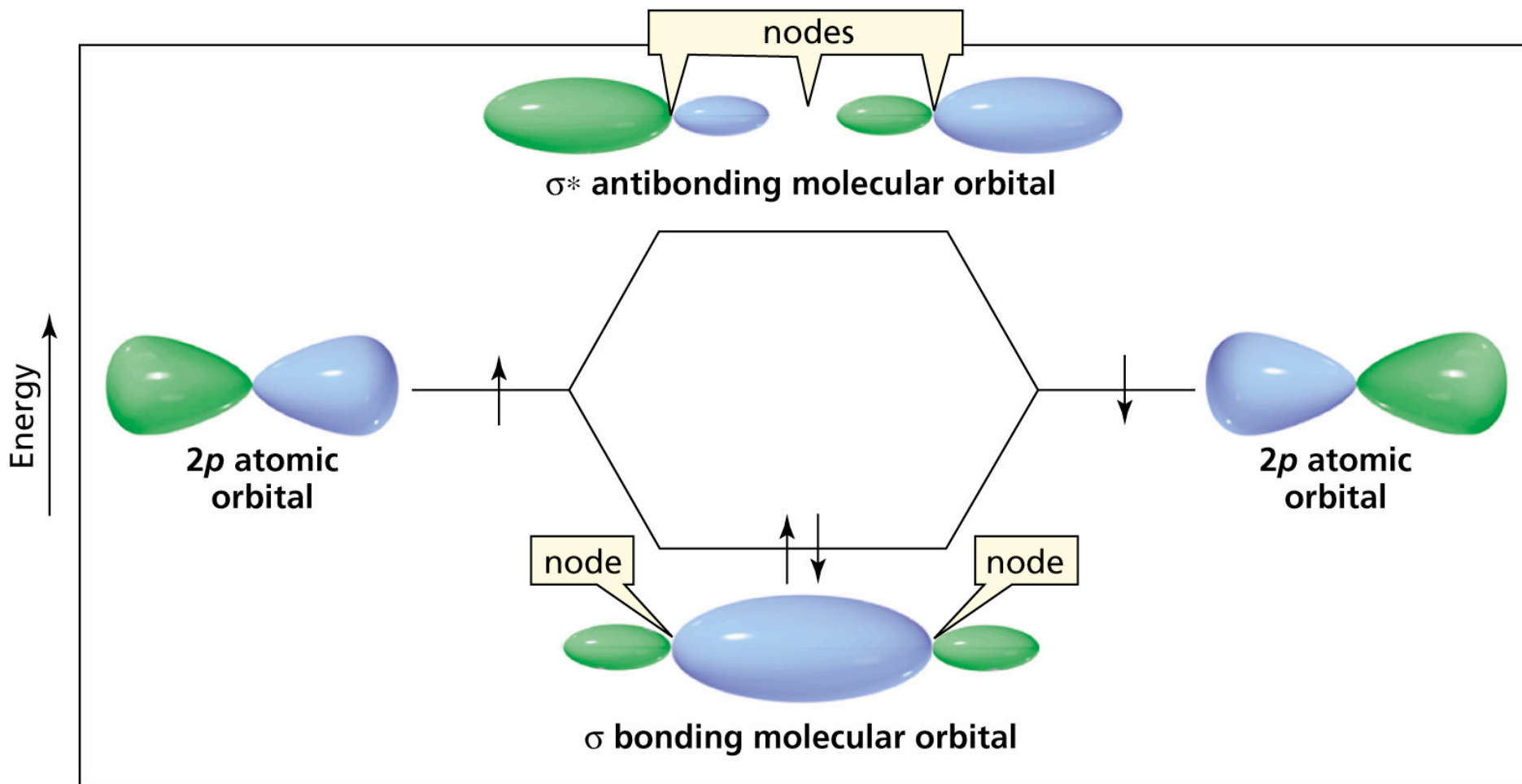
nucleus of the hydrogen atom

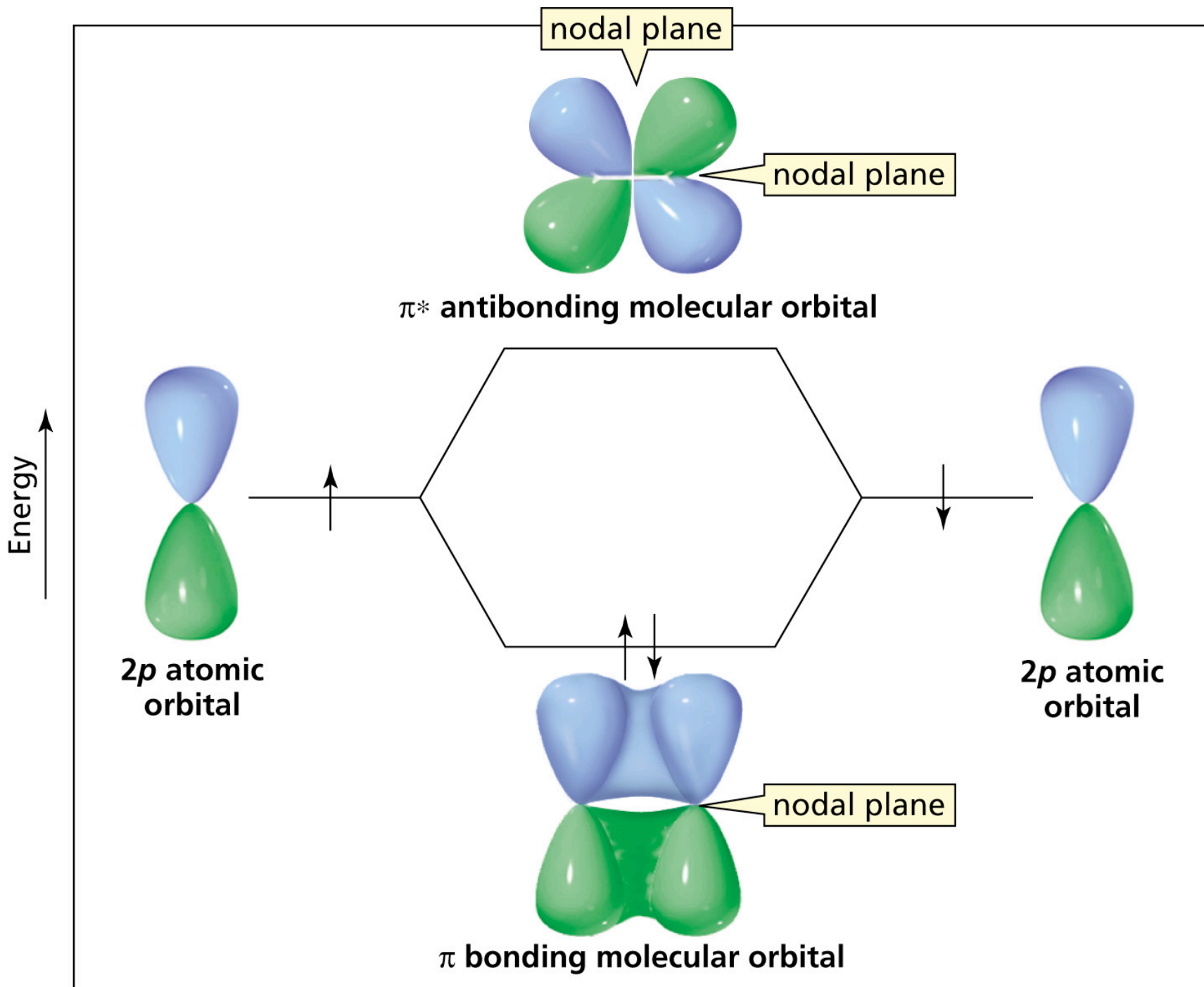
phase of the orbital

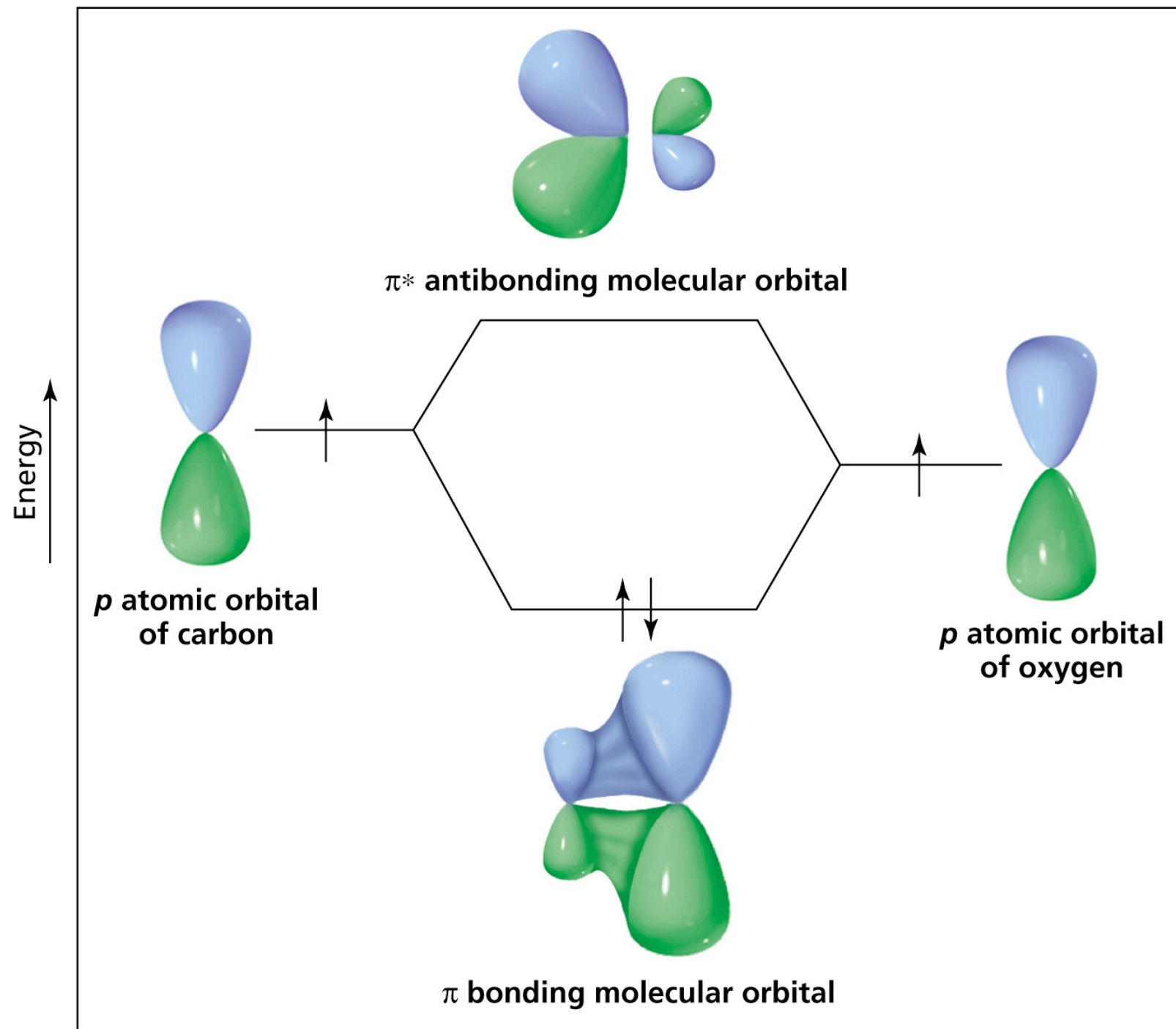
phase of the orbital

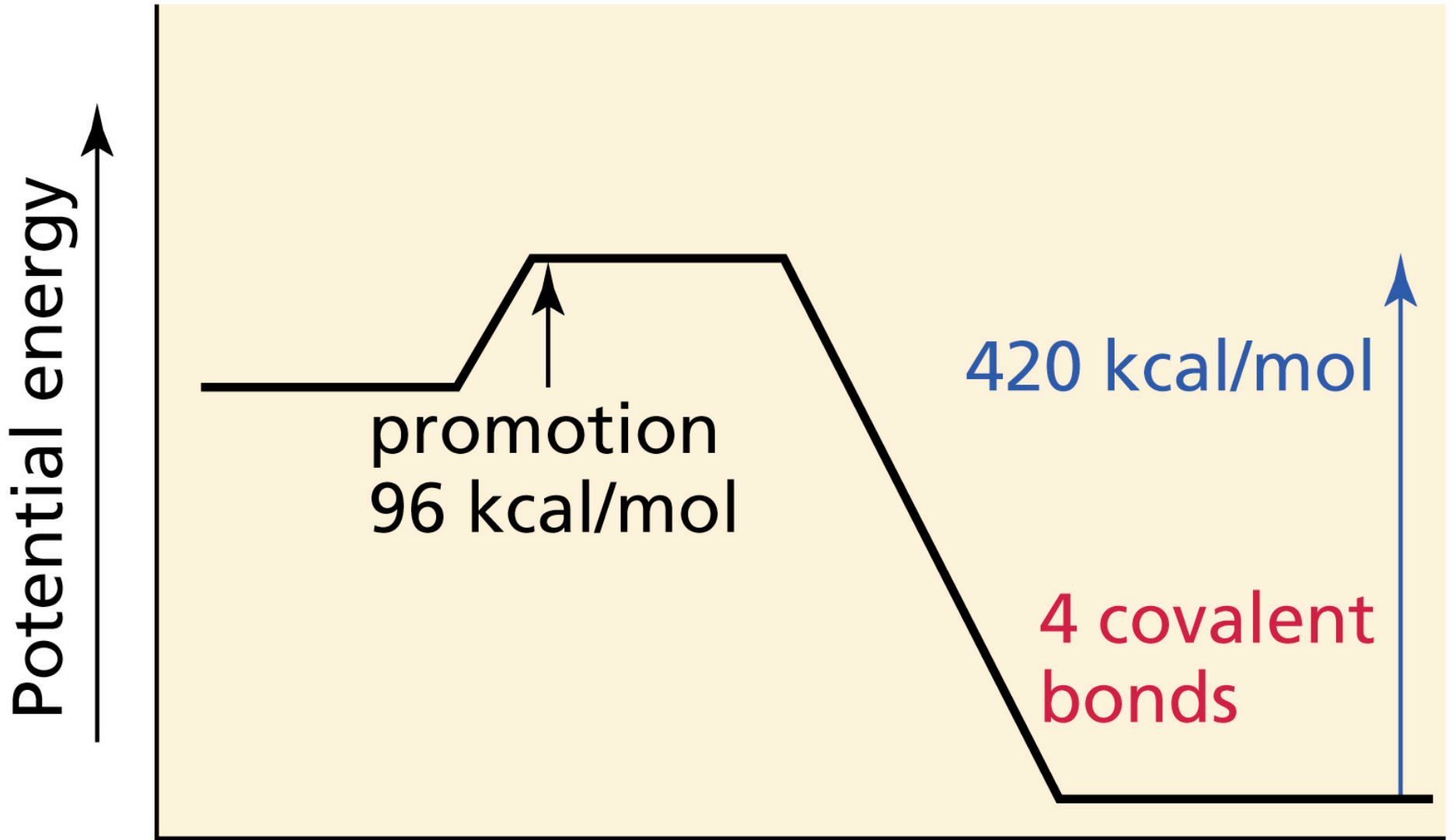
node



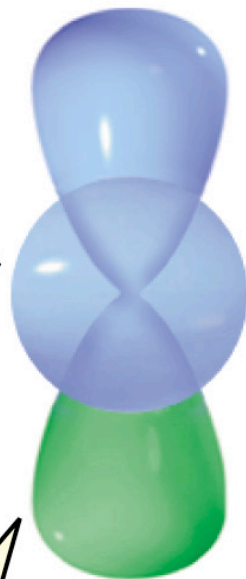








s orbital

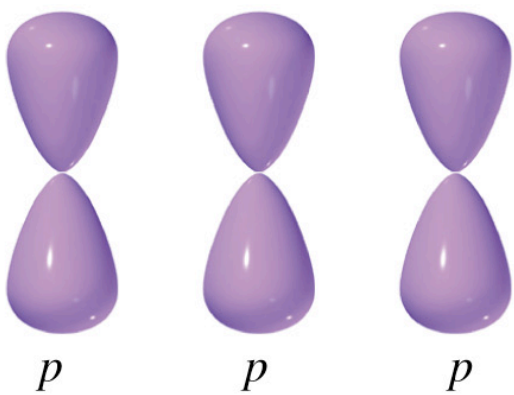


p orbital

the s orbital adds to the lobe of the p orbital



the s orbital subtracts from the lobe of the p orbital



*p*

*p*

*p*

hybridization  
→



*sp*<sup>3</sup>



*sp*<sup>3</sup>

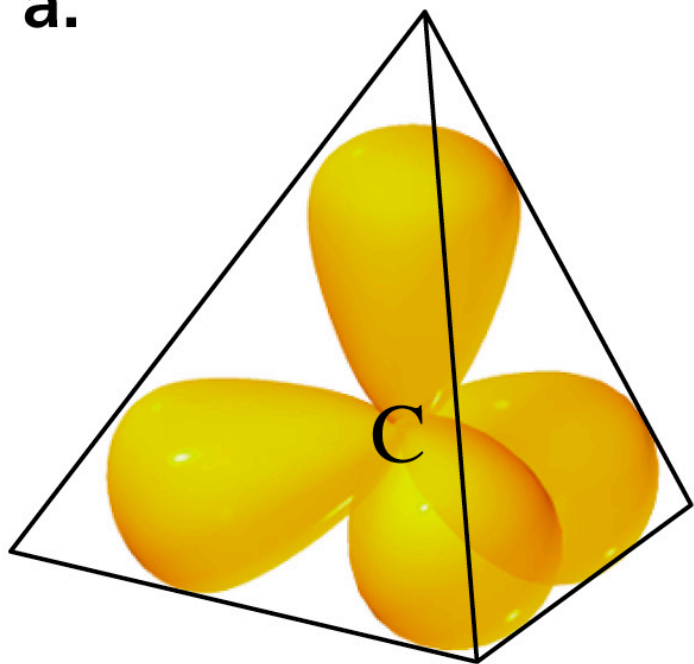


*sp*<sup>3</sup>

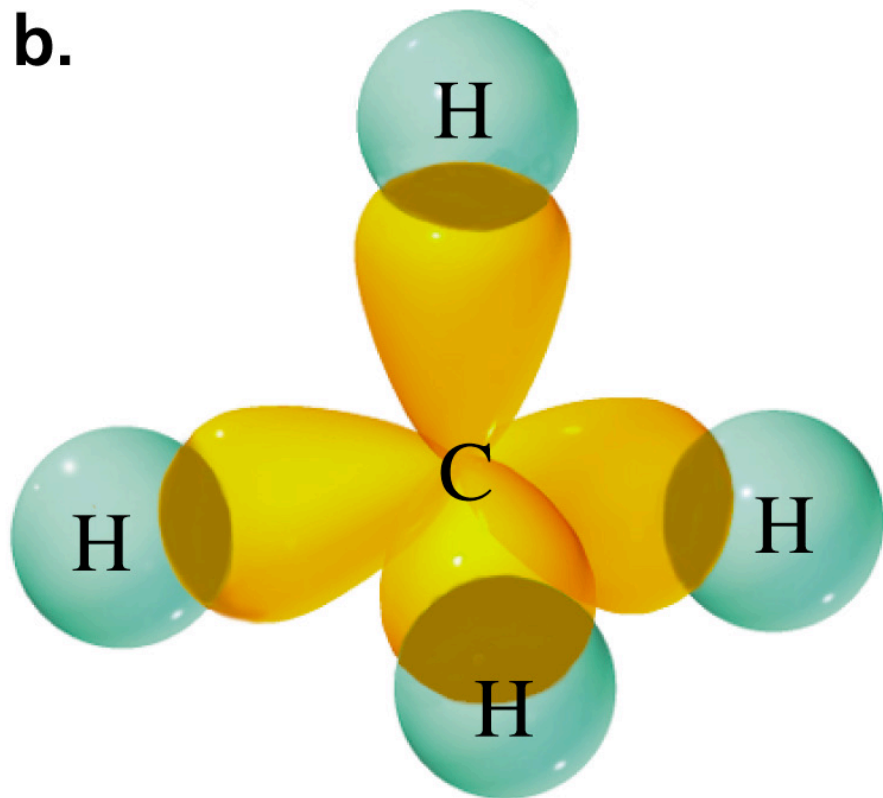


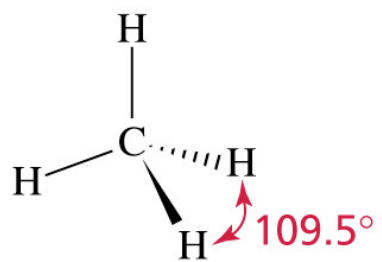
*sp*<sup>3</sup>

**a.**

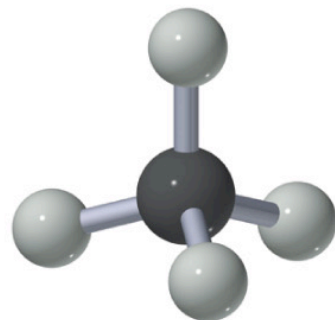


**b.**

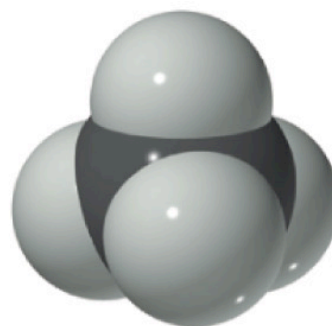




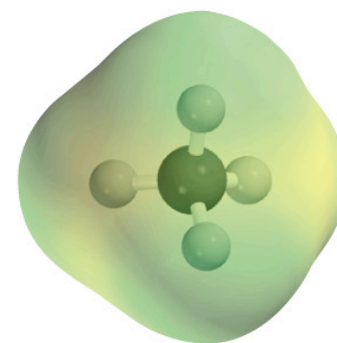
perspective formula  
of methane



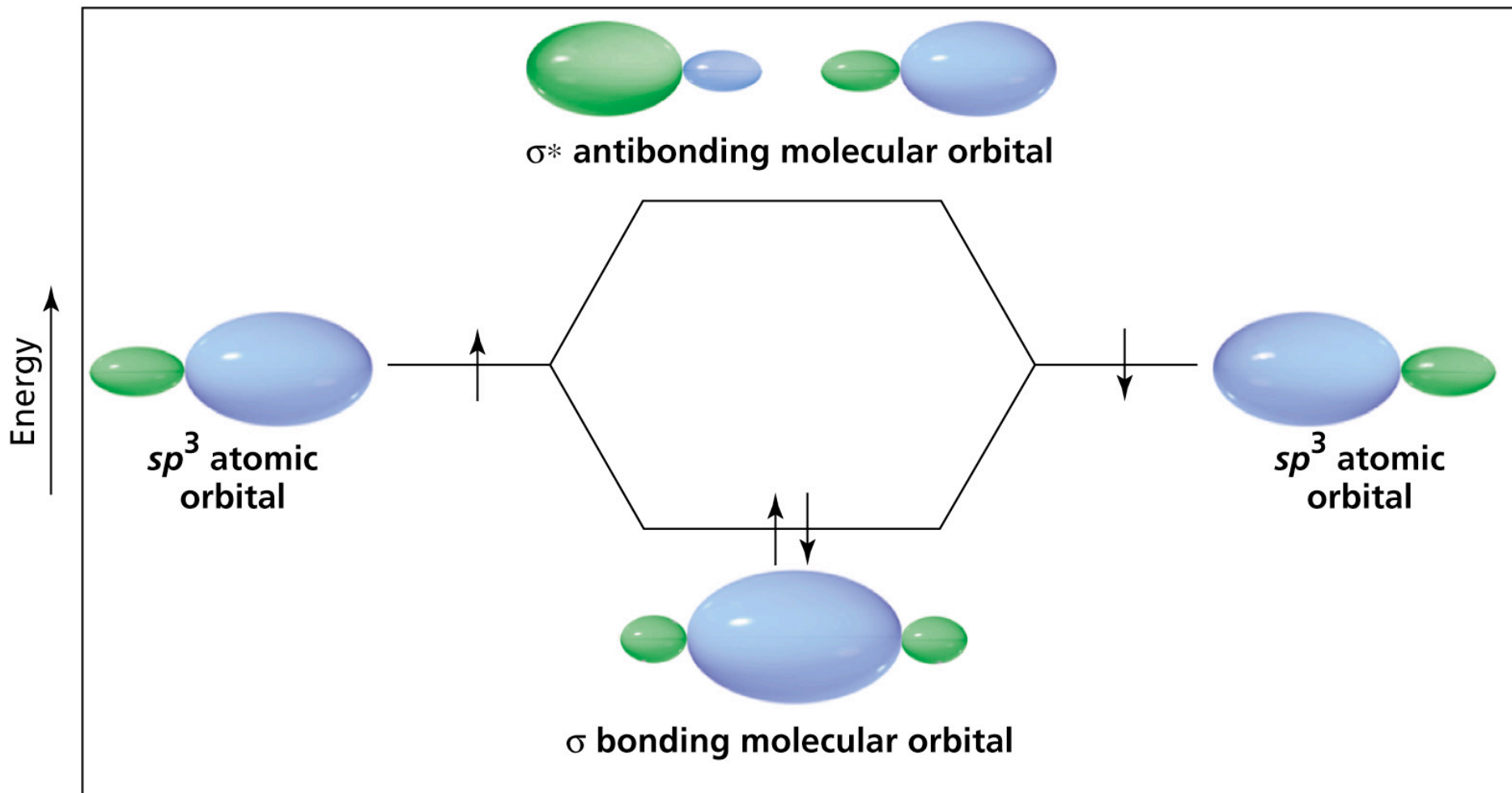
ball-and-stick model  
of methane

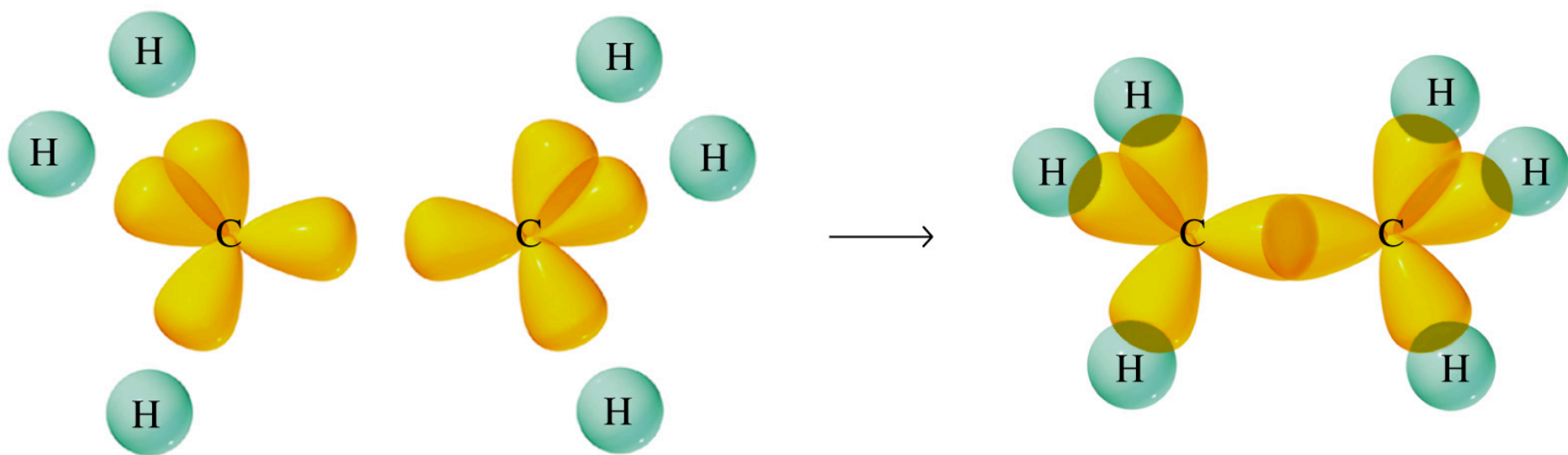


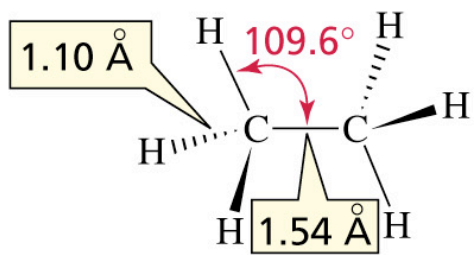
space-filling model  
of methane



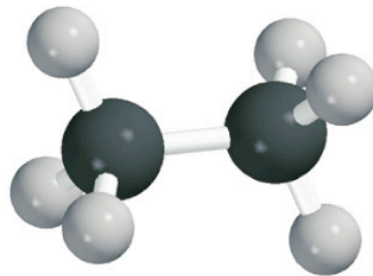
electrostatic potential  
map for methane







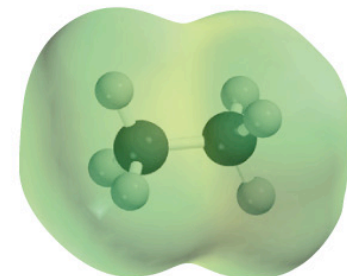
perspective formula  
of ethane



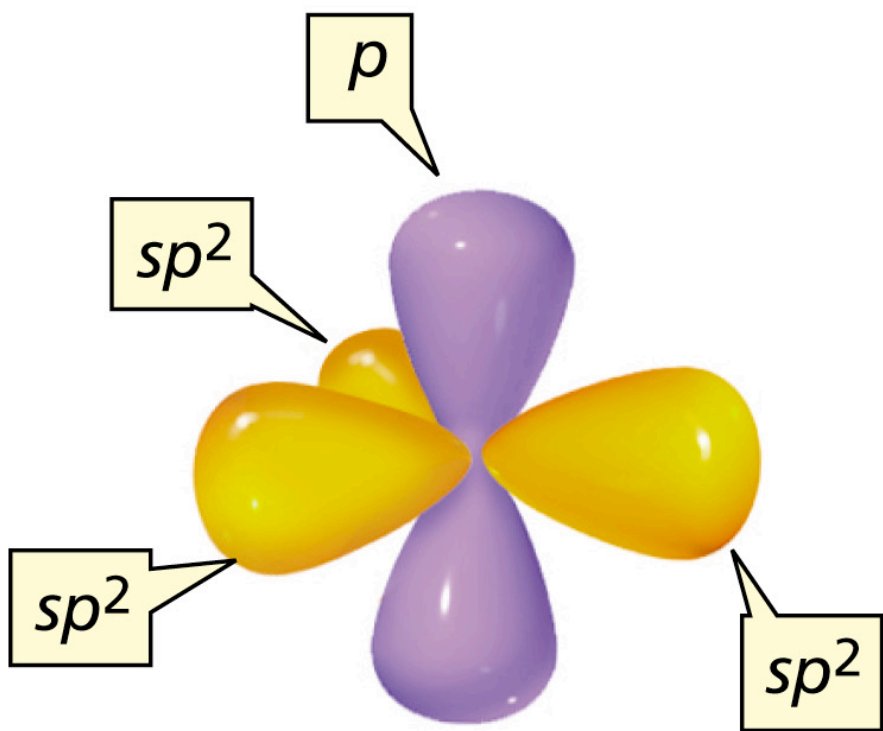
ball-and-stick model  
of ethane



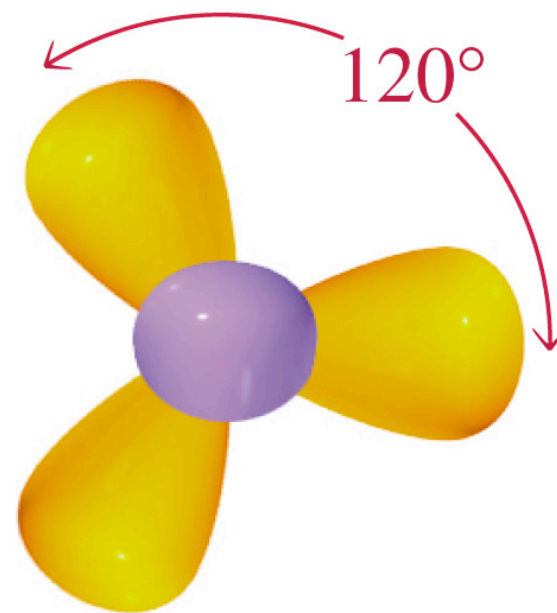
space-filling model  
of ethane



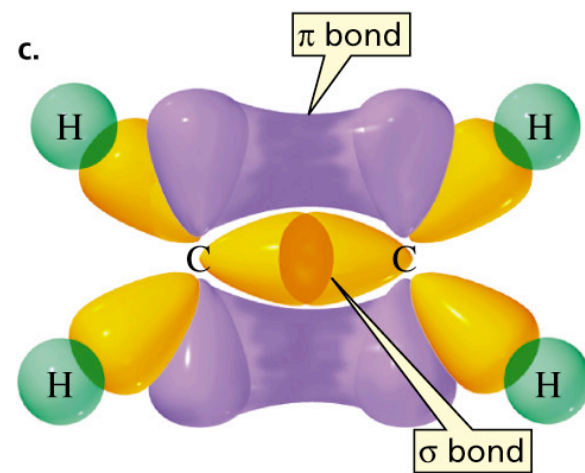
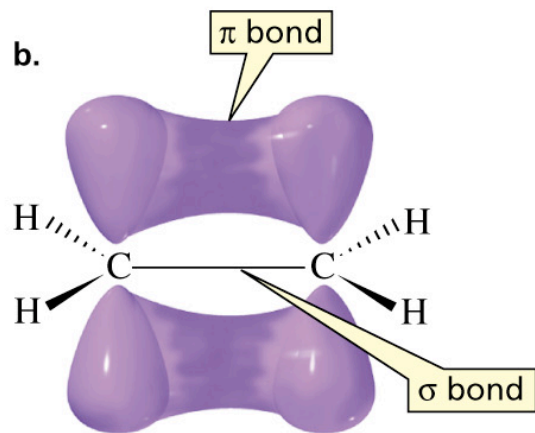
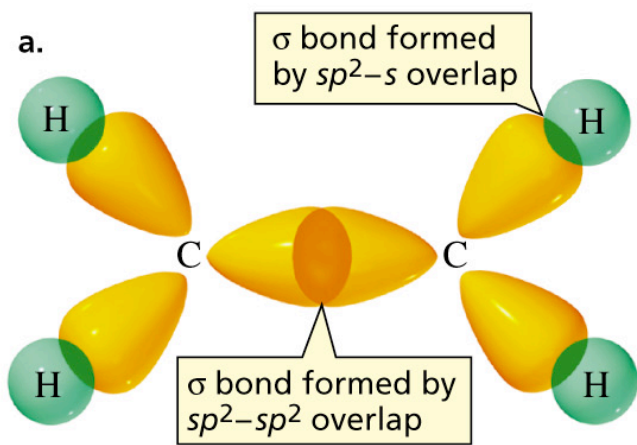
electrostatic potential  
map for ethane

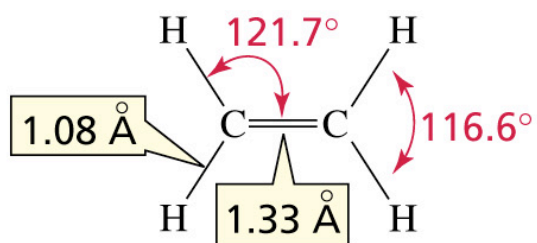


side view

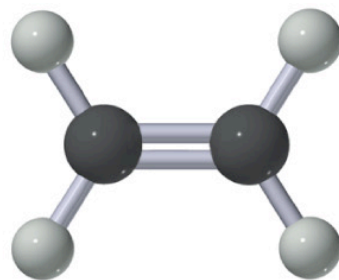


top view

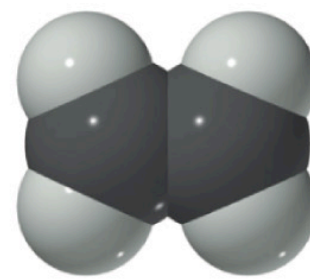




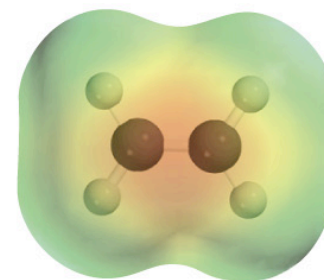
a double bond consists of one  $\sigma$  bond and one  $\pi$  bond



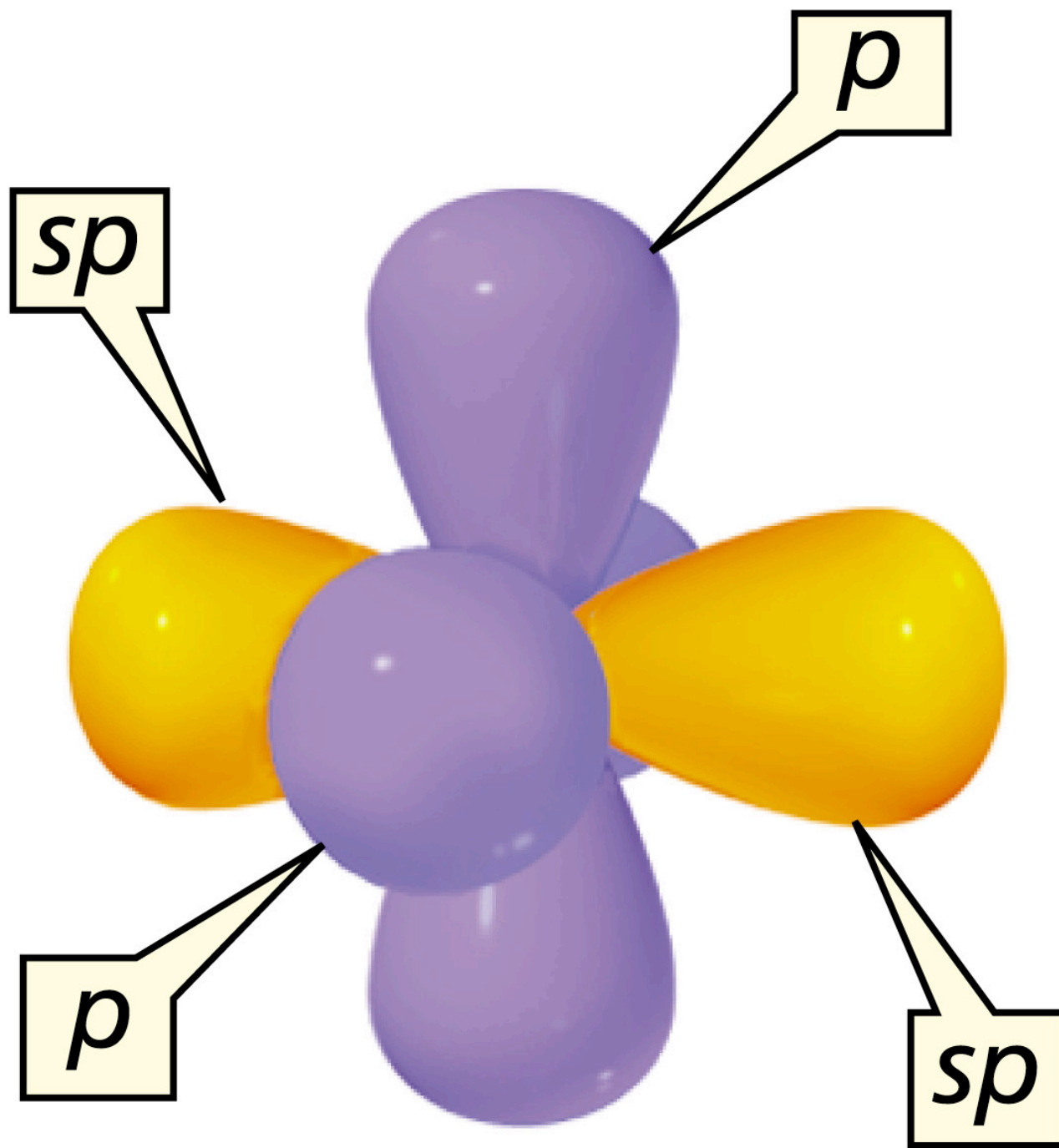
ball-and-stick model of ethene

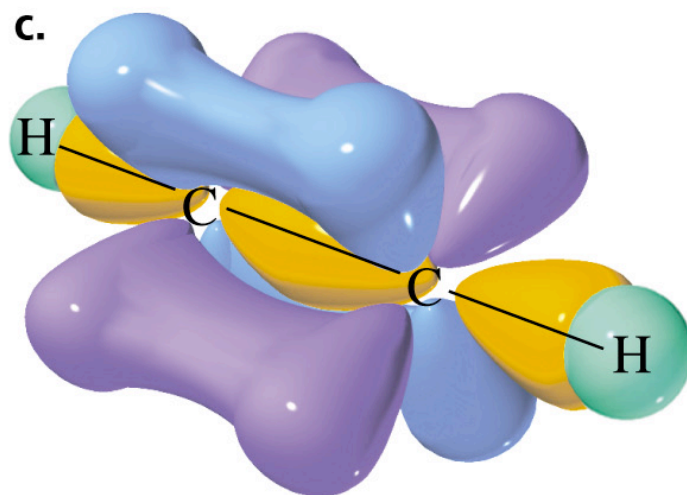
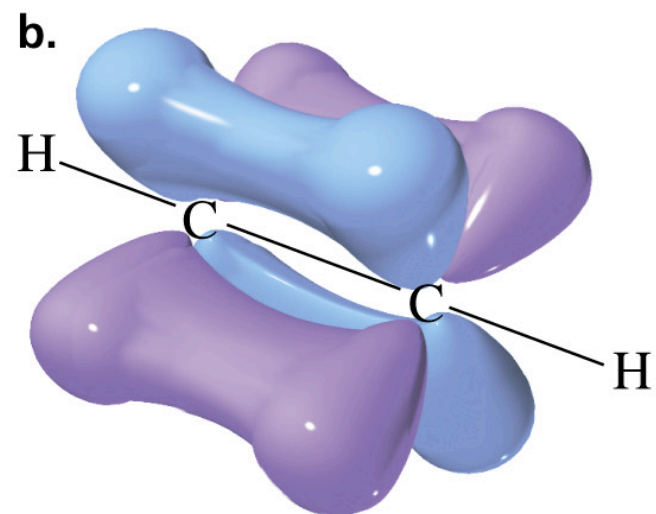
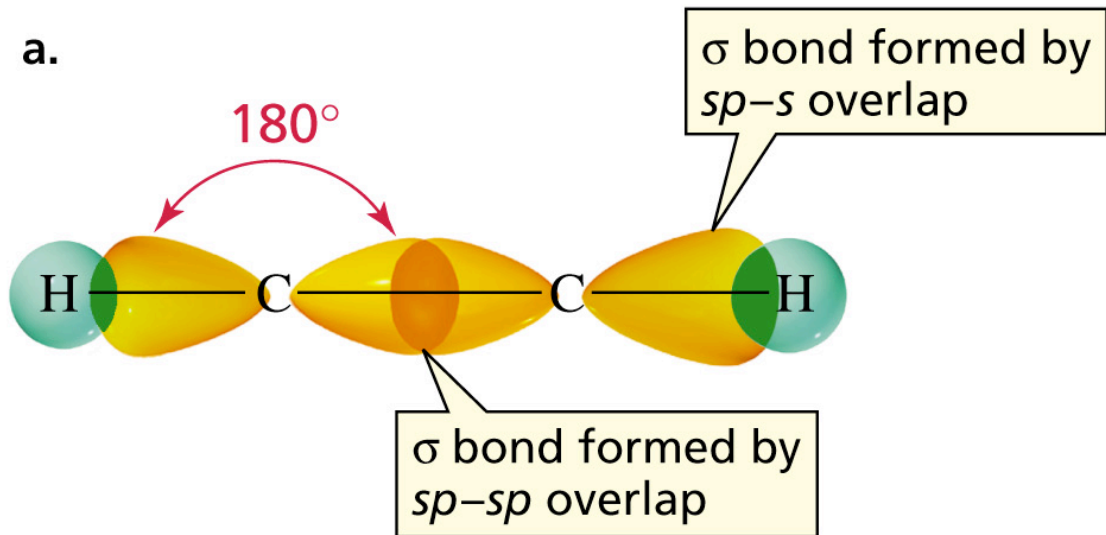


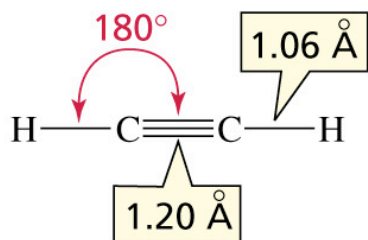
space-filling model of ethene



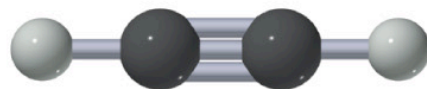
electrostatic potential map for ethene







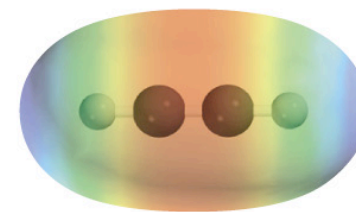
a triple bond consists of one  $\sigma$  bond and two  $\pi$  bonds



ball-and-stick model  
of ethyne



space-filling model  
of ethyne



electrostatic potential map  
for ethyne