

**Physics 221A**  
**Fall 2017**  
**Homework 9**  
**Due Friday, October 27, 2017 at 6pm**

**Reading Assignment:** Notes 16, Secs. 10-11; Notes 17, entire; Notes 18, Secs. 1–12. Supplementary reading: Commins covers some aspects of diatomic molecules in Sec. 13.1, but not in as much detail as in our notes; he covers hydrogen in Sec. 8.5, including the  $SO(4)$  symmetry in Secs. 8.6–8.7; and the coupling of angular momenta in Sec. 7.8.

If you look at the movie “Cool It,” you will see red and blue atoms forming diatomic molecules which vibrate and rotate. These form and break up under collisions. You will also see triatomic and polyatomic molecules forming, as well as clusters, that grow bigger and eventually turn into a liquid as the temperature is lowered. The movie is a simulation based on classical mechanics. The potential between red and blue atoms is repulsive at short distances and attractive at larger distances, as with real atoms. The potential between two red or two blue atoms is repulsive at all distances.

Please do problems 16.2, 17.1, 17.2, 18.2.