

**Homework #2: Due 9-30-2025****PHYSICS 561 - Fall 2025**

1. Problems 4.2, 5.1, 6.1, 6.2, 6.5, 7.2

2. Extra Problem:

The dispersion for a particle in the Jellium model is given by

$$\epsilon(p) = \epsilon_F^0 [x^2 - 0.663r_s F(x)], \quad (1)$$

where  $x = p/p_F$  and  $\epsilon_F^0 = p_F^2/2m$ . Given that  $F(x=0) = 1$ , the dispersion is largely negative for  $0 < x < 1$ . You are to determine what is the significance of the negative energy region. What physically does it mean? Plotted in Fig. 6.1b is the dispersion for  $r_s = 3$ . What is the significance of  $r_s = 3$ ? What happens for  $r_s < 3$  and  $r_s > 3$ ? What does this tell you about the physical state of the system for  $r_s > 3$ ?