1. The potential energy function between two gaseous Neon atoms is given as a function of distance by the 12-6 Lennard-Jones potential as shown in the following equation.

\[
E = 4\varepsilon \left( \frac{\sigma}{r} \right)^{12} - \left( \frac{\sigma}{r} \right)^{6}
\]

a) Develop a relationship to describe the attractive, repulsive, and total force between two atoms (assume three way or greater interactions never happen).

2. Aluminum containing 1.55 wt% Magnesium is to be altered by increasing the Mg content of the surface by exposing it to a gas containing 5.0 wt% Mg. A treatment of 8 hours at 1000 °C creates a good surface finish to a depth of 3 mm. Estimate the Mg content at this depth.

3. Find the minimum inside diameter needed in an o-ring that just fits around a 10 cm outside diameter titanium rod. The rod will support a load of 3 x 10^8 N.

4. Sketch the following. Be sure to label your axis and origin.

A [101], B [123], C [120], D (121), E (113), F (120).

5. A bar of alloy steel (see figure 6.217th ed or 6.24 6th edition) having a square cross section of 15 mm x 15 mm and length of 600 mm has a load of 400,000 N applied in tension. Find the amount of plastic and elastic strain. Next, find the final length of the bar upon removal of the load.

6. How many grams of platinum need to be added to 8.00 g of gold in order to create a material containing 1.57 x 10^{22} atoms of platinum / cm³?