Physics 2020 Assignment 7

1. Explain why a conductor is an equipotential surface.

2. Units and Conversion

Quantity	cgs	mks
Potential	1 statvolt = erg/esu	1 volt = 1 Joule/Coulomb
Capacitance	1 cm	1 farad = 1 Coulomb/volt

   a) What is the relation between esu and coulombs?

   b) Show 1 statvolt = 300 volts.

   c) Show 1 farad = 9×10^{11} cm.

3. What is the capacitance C of a capacitor that consists of two concentric spherical metal shells? The inner radius of the outer shell is a while the outer radius of the inner shell is b. Check your result by considering the limiting case with the gap between the conductors, a-b, much smaller than b. In that limit the formula for the capacitance of the flat parallel palate capacitor ought to be applicable.

4. A 100 pF capacitor is charged to 100 volts. After the charging battery is disconnected, the capacitor is connected in parallel to another capacitor.

   a) If the final voltage is 30 volts, what is the capacitance of the second capacitor?

   b) How much energy was lost and what happened to it?

5. Two aluminized optical flats 15 cm in diameter are separated by a gap of 0.04 mm, forming a capacitor. What is the capacitance in pF?

6. Two coaxial aluminum tubes are 30 cm long. The outer diameter of the inner tube is 3 cm and the inner diameter of the outer tube is 4 cm. When these are connected to a 45 volt battery, how much energy is stored in the electric field between the tubes?