**PHYS 202 … Practice Problems … Electric Potential Part B**

**Electric Potential and Potential Energy … “Thinking” problems**

**Part 1** … Charged conducting objects

1. A solid conducting sphere has a radius of 4.23 cm and a net electric change of 3.92 C. The charges are stationary.
   1. What is the electric field (as a function of “r”) outside of the sphere?
   2. Taking location “b” to be infinitely far from the sphere’s center and the potential at “b” to be zero, what is the electric potential at location “a” (as a function of “r”) outside the sphere? {integrate the function above}
   3. What is the electric potential at the surface of the conducting sphere?
   4. What is the electric field (as a function of “r”) inside the sphere?
   5. Taking location “b” to be at the surface of the sphere (potential at “b” you just found) what is the electric potential at location “a” (as a function of “r”) inside the sphere? {integrate the function above}
   6. What is the electric potential at the center of the conducting sphere?
2. A solid conducting sphere has a radius of 5.39 cm. The electric potential 2.83 cm form the sphere’s center is measured to be 45.3 V higher than at infinity. What is the net charge of the sphere?
3. A solid conducting sphere has a radius of 5.39 cm. The electric potential 8.32 cm form the sphere’s center is measured to be 45.3 V higher than at infinity. What is the net charge of the sphere?
4. A solid conducting sphere has a radius of 2.83 cm. The electric potential 5.39 cm form the sphere’s center is measured to be 45.3 V lower than at infinity. What is the net charge of the sphere?
5. A solid conducting sphere has a radius of 8.32 cm. The electric potential 5.39 cm form the sphere’s center is measured to be 45.3 V lower than at infinity. What is the net charge of the sphere?

**Part 2** … Conservation of energy

1. A proton is shot directly toward a large conducting sphere that has a net charge of 2.84 nC and a radius of 1.92 mm (very large compared to the proton). The proton is initially 35.9 cm from the sphere and has 582 eV of kinetic energy.
   1. Will the proton collide with the sphere?
   2. If the proton collides with the sphere, what is its kinetic energy at the moment of impact.
   3. If the proton does not collide with the sphere, what is the closes the proton gets to the sphere’s surface?
2. An electron is shot directly toward a large conducting sphere that has a net charge of 6.47 C and a radius of 3.45 mm (very large compared to the electron). The electron is initially 24.1 cm from the sphere and has 39.2 eV of kinetic energy.
   1. Will the electron collide with the sphere?
   2. If the electron collides with the sphere, what is its kinetic energy at the moment of impact.
   3. If the electron does not collide with the sphere, what is the closes the electron gets to the sphere’s surface?
3. An infinitely long conducting cylinder has a radius of 0.359 cm and a linear charge density of 4.58 x 10 – 7 C/m. A proton is placed 5.63 cm from the center of the cylinder (perpendicular distance) and released from rest.

Assume nothing else acts on the cylinder.

* 1. Will the proton move toward the cylinder, away from the cylinder, parallel to the cylinder, or remain at rest?
  2. What is the kinetic energy of the proton once it’s moved a distance of 2.59 cm?
  3. What are your answers to (a) and (b) if the proton is exchanged for an electron?