

Name: _____

Please give me a word or number to post your grade _____

1. (30 pts) Please choose T (True) or F (False) to the following questions.

- 1) Gauss' law is only valid in problems with symmetry. T F
- 2) A charged particle is moving from point A to point B in an electric field. The potential energy of the charged particle is increased if the work is done by the electric force. T F
- 3) A charged particle is moving from point A to point B in an electric field. The work done either by electric force or external force will dependent on the path. T F
- 4) The potential on a conducting object is the same everywhere, i.e. the conducting object is an equal potential object. T F
- 5) The capacitance of a capacitor depends on the geometry of the capacitor and is independent of the applied voltage. T F
- 6) If electric field is zero everywhere on an object, the potential must be zero object. T F
- 7) A neutral object carries no charges. T F
- 8) Superposition principle is valid in calculating electric static forces, electric fields, and potentials. T F
- 9) The point closer to a negatively charged object has a higher potential than that closer to a positively charged object. T F
- 10) A charge neutral object can produce an electric field when it is polarized. T F

The following question does not earn any credit.

- 11) Dr. Xiao is taller than 6.3". T F

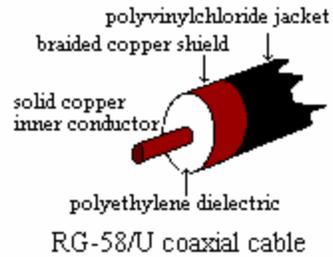
2. (30pts) Coaxial cable is typically used to make high-speed circuit connections between electronic test instruments. It consists of an inner wire of diameter a , a concentric conducting braid of diameter b , separated by an insulating material. This is a capacitor geometry for which you may calculate its capacitance using Gauss's law.

- a. Use Gauss's law to determine the electric field at a point between long coaxial conductors when oppositely charged with a linear charge density λ (C/m). Sketch the field and gaussian surface; say a few words about the symmetry of the field and the selection of gaussian surface.

(The region between the conductors may be assumed to be empty here.)

- b. Use the resulting electric field to find the potential difference between two conductors *(The region between the conductors may be assumed to be empty here.)*

- c. Evaluate the capacitance per meter length of RG58/U cable, which has an inner wire of diameter 0.81 mm, an outer conductive braid of diameter 2.9 mm *(The region between the conductors may be assumed to be empty here.)*. (The real capacitance of a RG58/U cable is 2.25 times larger since the dielectric constant for polyethylene insulating materials is 2.25).



3. (40 pts) An electron (circle) is accelerated from still by a potential difference of 100V, which does not affect the electron after it escapes from the hole on the second plate. The electron enters a uniform field of 10V/m generated by another two parallel plates. (Assuming E becomes zero outside and no edge effect). The separation of two plates is 2.0 cm. Calculate (a) the velocity of the electron before it enters E field; (b) the acceleration of the electron inside E, (c) the position of the electron (with respect to its original path) after it exits E field, and (d) the final velocity of the electron. ($e=1.6 \times 10^{-19}$ C, $m_e=9.1 \times 10^{-31}$ kg).

