This print-out should have 14 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points
Two conductors insulated from each other are charged by transferring electrons from one conductor to the other. After $9.905 \times 10^{13}$ have been transferred, the potential difference between the conductors is $16.6$ V.

The charge on an electron is $-1.60218 \times 10^{-19}$ C.

What is the capacitance of the system? Answer in units of F.

002 (part 1 of 4) 10.0 points
An air-filled capacitor consists of two parallel plates, each with an area of 2 cm$^2$, separated by a distance 2.2 mm. A 24 V potential difference is applied to these plates.

The permittivity of a vacuum is $8.85419 \times 10^{-12}$ C$^2$/N$ \cdot$ m$^2$. 1 pF is equal to $10^{-12}$ F.

The magnitude of the electric field between the plates is

1. $E = \frac{1}{V \cdot d}$.

2. $E = \left( \frac{V}{d} \right)^2$.

3. $E = \frac{1}{(V \cdot d)^2}$.

4. $E = \frac{d}{V}$.

5. None of these

6. $E = (V \cdot d)^2$.

7. $E = \left( \frac{d}{V} \right)^2$.

8. $E = \frac{V}{d}$.

9. $E = V \cdot d$.

003 (part 2 of 4) 10.0 points
The magnitude of the surface charge density on each plate is

1. $\sigma = \frac{\varepsilon_0}{(V \cdot d)^2}$.

2. $\sigma = \frac{\varepsilon_0}{V \cdot d}$.

3. $\sigma = \frac{\varepsilon_0 \cdot V}{d}$.

4. $\sigma = \varepsilon_0 \cdot V \cdot d$.

5. $\sigma = \frac{\varepsilon_0 \cdot d}{V}$.

6. $\sigma = \varepsilon_0 \left( \frac{V}{d} \right)^2$.

7. $\sigma = \varepsilon_0 \left( \frac{d}{V} \right)^2$.

8. None of these

9. $\sigma = \varepsilon_0 \left( V \cdot d \right)^2$.

004 (part 3 of 4) 10.0 points
Calculate the capacitance. Answer in units of pF.

005 (part 4 of 4) 10.0 points
Calculate plate charge; i.e., the magnitude of the charge on each plate. Answer in units of pC.

006 (part 1 of 2) 10.0 points
An air-filled spherical capacitor is constructed with inner and outer shell radii of 9 cm and 15.9 cm, respectively.

The Coulomb constant is \( 8.98755 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2 \).

Calculate the capacitance of the device. Answer in units of pF.

**007** (part 2 of 2) 10.0 points
What potential difference between the spheres results in a charge of 56.6 \( \mu \text{C} \) on the capacitor? Answer in units of kV.

**008** (part 1 of 5) 10.0 points
Consider the group of capacitors shown in the figure.

Find the equivalent capacitance of the circuit. Answer in units of \( \mu \text{F} \).

**009** (part 2 of 5) 10.0 points
Determine the charge on 8.18 \( \mu \text{F} \) capacitor on the left. Answer in units of \( \mu \text{C} \).

**010** (part 3 of 5) 10.0 points
Determine the charge on 1.75 \( \mu \text{F} \) capacitor on the top. Answer in units of \( \mu \text{C} \).

**011** (part 4 of 5) 10.0 points
Determine the charge on 5.37 \( \mu \text{F} \) capacitor on the bottom. Answer in units of \( \mu \text{C} \).

**012** (part 5 of 5) 10.0 points
Determine the charge on 7.12 \( \mu \text{F} \) capacitor on the left. Answer in units of \( \mu \text{C} \).

**013** 10.0 points
When the switch is in position \( a \), an isolated capacitor of unknown capacitance has been charged to a potential difference of 146 V.

When the switch is moved to position \( b \), this charged capacitor is then connected parallel to the uncharged 12.3 \( \mu \text{F} \) capacitor. The voltage across the combination becomes 15 V.

Calculate the unknown capacitance. Answer in units of \( \mu \text{F} \).

**014** 10.0 points
Calculate the energy stored in a(n) 17.8 \( \mu \text{F} \) capacitor when it is charged to a potential of 132 V. Answer in units of mJ.