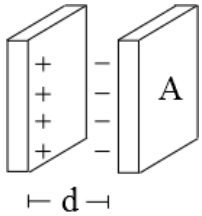
Name: _____ **Problems Solved __/ 8**

A capacitor is formed from two parallel plates. The plates are separated by a distance d and each have a surface area of A and hold a charge of + q and – q respectively. Calculate the missing values in the table.

The electric field should be in terms of σ and ε_o.
The potential across the gap should be in terms of q, A, d, and ε_o.
The capacitance should be in terms of A, d, and ε_o.

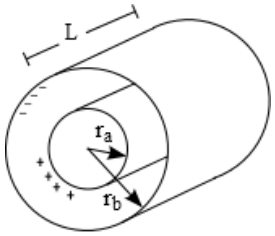
Be sure to show the details of your calculations and any assumptions you make.

System	Geometry	E-field in gap	ΔV across gap	$C = \frac{\lvert q \rvert}{\lvert \Delta V \rvert}$
Parallel Plate Capacitor		a)	b)	c)

A capacitor is formed from two concentric cylinders. The smaller cylinder has a radius of r_a and the larger cylinder has a radius of r_b. A positive charge of q is on the inner cylinder and a negative charge of q is on the outer cylinder. Calculate the missing values in the table.

The electric field should be in terms of q, π, ε_o, L and r.
The potential across the gap should be in terms of q, π, ε_o, L, r_a, and r_b.
The capacitance should be in terms of π, ε_o, L, r_a, and r_b.

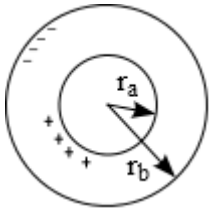
Be sure to show the details of your calculations and any assumptions you make.

System	Geometry	E-field in gap	ΔV across gap	$C = \frac{\lvert q \rvert}{\lvert \Delta V \rvert}$
Cylindrical Capacitor		a)	b)	c)

A capacitor is formed from two concentric spheres. The smaller sphere has a radius of r_a and the larger sphere has a radius of r_b. A positive charge of q is on the inner sphere and a negative charge of q is on the outer sphere. Calculate the missing values in the table. By sure to show the details of your calculations and any assumptions you make.

The electric field should be in terms of q, π, ε_o and r.
The potential across the gap should be in terms of q, π, ε_o, r_a, and r_b.
The capacitance should be in terms of π, ε_o, r_a, and r_b.

Be sure to show the details of your calculations and any assumptions you make.

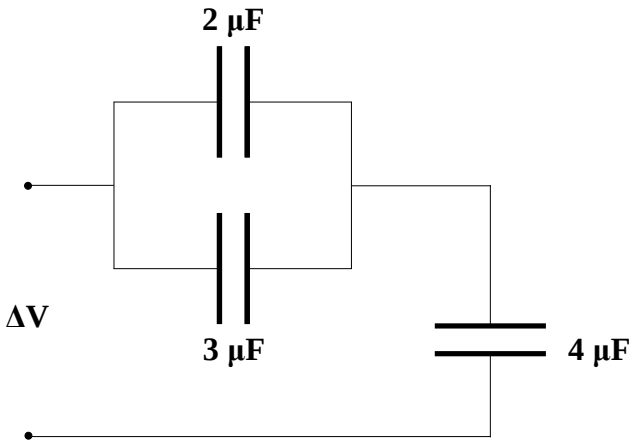
System	Geometry	E-field in gap	ΔV across gap	$C = \frac{\lvert q \rvert}{\lvert \Delta V \rvert}$
Spherical Capacitor		a)	b)	c)

For the capacitor network shown in the figure:

a) Find the equivalent capacitance of the network of three capacitors.

b) If $\Delta V = 10$ V, find the charge on each capacitor and the voltage across each capacitor.

c) Find the total electric potential energy stored in this system.



Consider a spherical capacitor whose concentric conductors have radii equal to 38.0 mm and 40.0 mm.

a) Calculate the system's capacitance by first finding the electric field and then the potential between the spheres. (Do so algebraically before plugging in numbers.)

b) Find the electric-field energy stored in this capacitor if the magnitude of charge on each sphere is 5.5 nC.

c) Consider a parallel plate capacitor with the same capacitance and same separation between plates as the spherical capacitor. What must be the area of each plate in the parallel plate capacitor for this condition to be met? How much electric-field energy is stored between the plates if the magnitude of charge on each plate is 5.5 nC?

A long straight wire with a 1.0 mm radius has a uniform linear charge density of $\lambda = -5.0 \times 10^{-8}$ C/m. The wire is surrounded by a cylindrical conducting shell with an inner radius of 5.0 mm.
If an electron at rest is released at the inner wire, what is its speed when it reaches the shell?

$m_{electron} = 9.11 \times 10^{-31}$ kg
$e = 1.60 \times 10^{-19}$ C
$k = 1/(4\pi\varepsilon_o) = 8.99 \times 10^{9}$ Nm^2/C^2
$\varepsilon_o = 8.85 \times 10^{-12}$ C^2/Nm^2

(Show all steps.)

Wolfson, Volume II, 2nd Edition, 23.18

Wolfson, Volume II, 2nd Edition, 23.48

Recall that average power = (change in energy)/(change in time).