Capacitors and Dielectrics

Name:_____ Date: _____

Instructor: Emma Stover :)

Teammates

1.- _____ 2.- _____

3.- _____ 4.- _____

Instructions: Follow the steps on this worksheet, using your lab manual as a guide, unless directed to do otherwise by your lab instructor. Show at least one sample calculation for each step. Box final mathematical results. Do not forget the units.

1 Data

1.1 Effective Capacitance

1. Select two different fixed value capacitors that vary in capacitance by less than a factor of ten. Measure and record their individual capacitances using the digital capacitance meter.

$C_1 = 10.434\ nF$

$C_2 = 101.38\ nF$

2. Connect the two capacitors in series, then measure and record their effective capacitance.

$C_{eff} = 9.461\ nF$

3. Connect the two capacitors in parallel, then measure and record their effective capacitance.

$C_{eff} = 111.82\ nF$

1.2 Parallel Plate Capacitor

1. Insert an acrylic sheet between the movable plates of the parallel plate capacitor and close the plates. Measure and record the capacitance. **Carefully**, remove the acrylic without changing the distance between the two cylindrical plates. Measure and record the capacitance with only air in between the two plates.

2. Repeat the last procedure 4 times, inserting an additional acrylic sheet each time. On your last trial, you should have 5 acrylic sheets stacked between the parallel plates. Make a table of your data.

Plates	Sep. Dist. [m]	Capacitance-Acrylic [pF]	Capacitance-Air [pF]
1	0.0120	154.66	61.42
2	0.0165	91.55	38.60
3	0.0192	73.18	30.09
4	0.0236	57.68	24.34
5	0.0269	50.32	21.70

1.3 Cylindrical Capacitor

1. Measure and record the inner diameter of the capacitor, the outer diameter of the capacitor, and the length of the capacitor.

inner (b): $d_i = 0.0129\,m$

outer (a): $d_o = 0.0257\,m$

$L = 1.22\,m$

2. Measure and record the capacitance of the cylindrical capacitor.

$C_{cyl} = 138.11\,pF$

2 Analysis

2.1 Effective Capacitance

1. Calculate and record your theoretical effective series capacitance and the theoretical effective parallel capacitance for the capacitors used.

Series: $\frac{1}{C_{eff}} = \frac{1}{C_1} + \frac{1}{C_2}$

Parallel: $C_{eff} = C_1 + C_2$

2. Compare your experimental values to your theoretical values and obtain the percentage difference between both.