**PhyzSim: ’Lectronic Plates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**UNIFORM ELECTRIC FIELDS name per date**

SETUP

1. Launch the PhET Sim: Capacitor Lab. For this activity, remain in the Introduction tab.

2. From the Control Panel View section, activate the Plate Charges option.

3. From the Control Panel View section, Electric Field Lines ***can*** be activated or not: your call.

4. Click the on-screen button to Disconnect Battery.

5. Use the on-screen arrow control to set the Plate Area to approximately 200 mm2 (between 195 mm2 and 205 mm2).

Record the actual value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Use the on-screen arrow control to set the Separation to 7.5 mm (7.4 mm—7.6 mm).

Record the actual value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. From the Control Panel Meters section, activate the Electric Field Detector. Make sure the “Show Values” option is activated. The detector’s sensor should appear between the parallel plates.

8. Using the on-screen Plate Charge slider, increase the charge until the electric field between the plates is nearly 1450 V/m (1400 V/m—1500 V/m). Use the detector’s display zoom controls as needed.

Record the actual value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Activate the Plate Charge display.

Record the plate charge value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

VARY THE VARIABLES

1. What relationship—if any—is there between the plate charge and the resulting electric field? Describe your evidence.

2. What relationship—if any—is there between the plate area and the resulting electric field? Describe your ***quantitative*** evidence.

3. What relationship—if any—is there between the separation distance and the resulting electric field? Why do you suppose this surprises some people?

CHARGE DENSITY

4. A student suggests that the strength of the electric field is constant for a given ***charge density***. That is, the plate charge can be varied and the plate area can be varied, but as the electric field value will remain constant as long as the ***ratio*** between the two is constant.

a. The symbol for charge density is s (lowercase sigma). What are the units of charge density?

b. Cite ***numerical evidence*** from sim experimentation to accept or reject the student’s claim.

STRONGEST FIELD

5. What is the strongest electric field you can create in the sim?

a. Record the value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Comment on each parameter in the configuration, indicating whether it should be at a maximum, minimum, or if it’s irrelevant: plate charge (*Q*), plate area (*A*), and separation (*d*).

c. How can you maximize charge density? Discuss in terms of plate charge, area, and separation.

THE BATTERY

Click the on-screen button to Connect Battery.

6. What is the strongest electric field you can create in the sim with the battery connected?

a. Record the value:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Comment on each parameter in the configuration, indicating whether it should be at a maximum, minimum, or if it’s irrelevant: battery voltage (*V*), plate area (*A*), and separation (*d*).

c. How can you maximize charge density? Discuss in terms of battery voltage charge, plate area, and separation.