Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class period:\_\_\_\_\_

**Interactive: PhET Simulation Capacitor Lab**

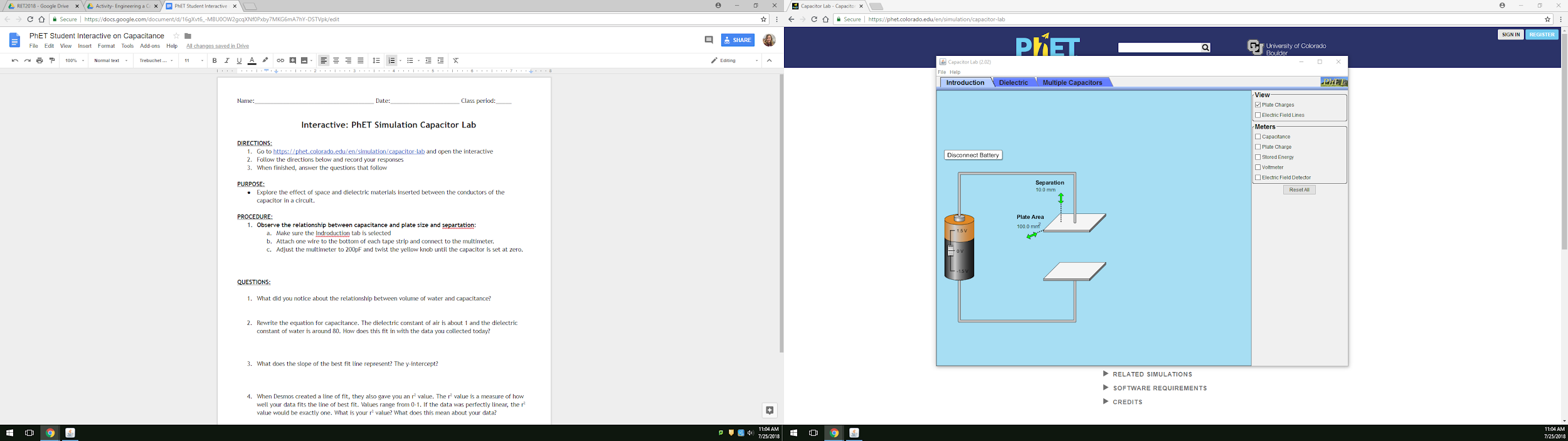
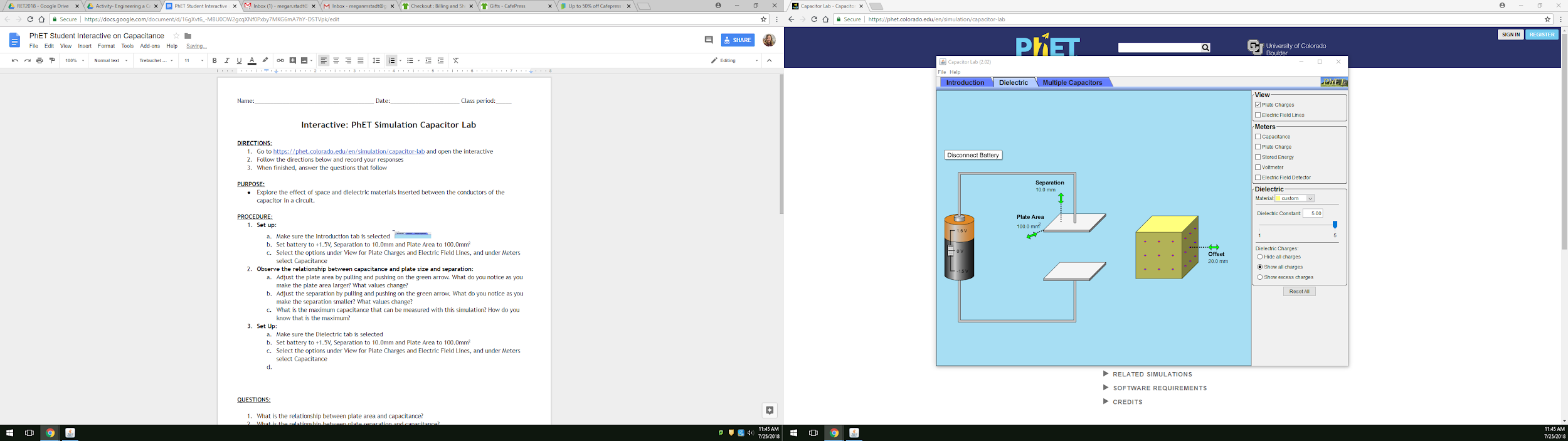
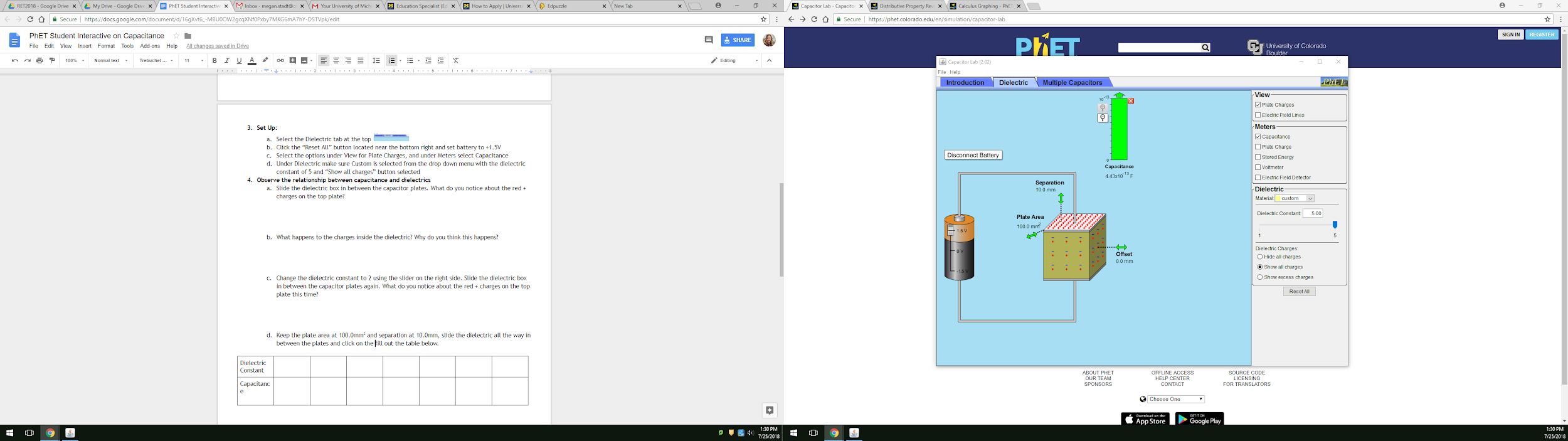
**DIRECTIONS:**

1. Go to <https://phet.colorado.edu/en/simulation/capacitor-lab> and open the interactive
2. Follow the directions below and record your responses
3. When finished, answer the questions that follow

**PURPOSE:**

Explore the effect of space and dielectric materials inserted between the conductors of the capacitor in a circuit.

**PROCEDURE:**

1. **Set up:**
   1. Make sure the Introduction tab is selected 
   2. Set battery to +1.5V, Separation to 10.0mm and Plate Area to 100.0mm2
   3. Select the options under View for Plate Charges and Electric Field Lines, and under Meters select Capacitance
2. **Observe the relationship between capacitance and plate size and separation:**
   1. Adjust the plate area by pulling and pushing on the green arrow. What do you notice as you make the plate area larger? What values change?
   2. Adjust the separation by pulling and pushing on the green arrow. What do you notice as you make the separation smaller? What values change?
   3. What is the maximum capacitance that can be measured with this simulation? How do you know that is the maximum?
3. **Set Up:**
   1. Select the Dielectric tab at the top 
   2. Click the “Reset All” button located near the bottom right and set battery to +1.5V
   3. Select the options under View for Plate Charges, and under Meters select Capacitance
   4. Under Dielectric make sure Custom is selected from the drop down menu with the dielectric constant of 5 and “Show all charges” button selected
4. **Observe the relationship between capacitance and dielectrics**
   1. Slide the dielectric box in between the capacitor plates. What do you notice about the red + charges on the top plate?
   2. What happens to the charges inside the dielectric? Why do you think this happens?
   3. Change the dielectric constant to 2 using the slider on the right side. Slide the dielectric box in between the capacitor plates again. What do you notice about the red + charges on the top plate this time?
   4. Keep the plate area at 100.0mm2 and separation at 10.0mm, slide the dielectric all the way in between the plates and click on the  next to the capacitance meter. Fill out the table below for the various insulators.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Dielectric Constant** | **5** | **Glass**  **(4.7)** | **4** | **Paper (3.5)** | **3** | **Teflon (2.1)** | **1** |
| Capacitance  (pF = x 10-12) |  |  |  |  |  |  |  |

* 1. Describe the pattern you found.

**QUESTIONS:**

1. What is the relationship between plate area and capacitance?
2. What is the relationship between plate separation and capacitance?
3. What does the dielectric object do in a capacitor?
4. Room temperature water has a dielectric constant of 80. How could you use the data you collected to predict the capacitance at such a large value?