AP PHYSICS 2 LAB: CAPACITANCE	NAME:

- Google: “Phet capacitor lab”

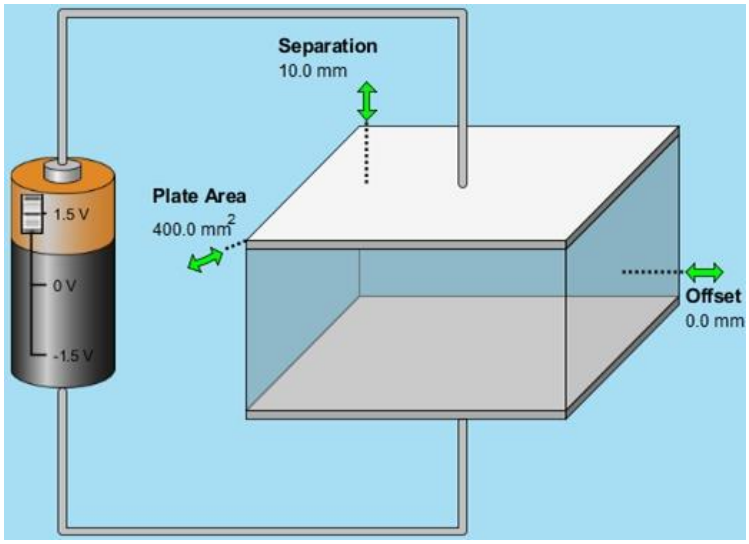
PART I – CAPACITOR

- Go to the tab “Dielectric”
- Increase the plate area to 400.0 mm^2.
- Make sure the offset of the dielectric is 0.0 mm.
- Make sure the distance separation between plates is 10.0 mm.

- Check mark the views: Plate charges , and Electric field lines
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 1. Draw the distribution of charges an electric field lines when:

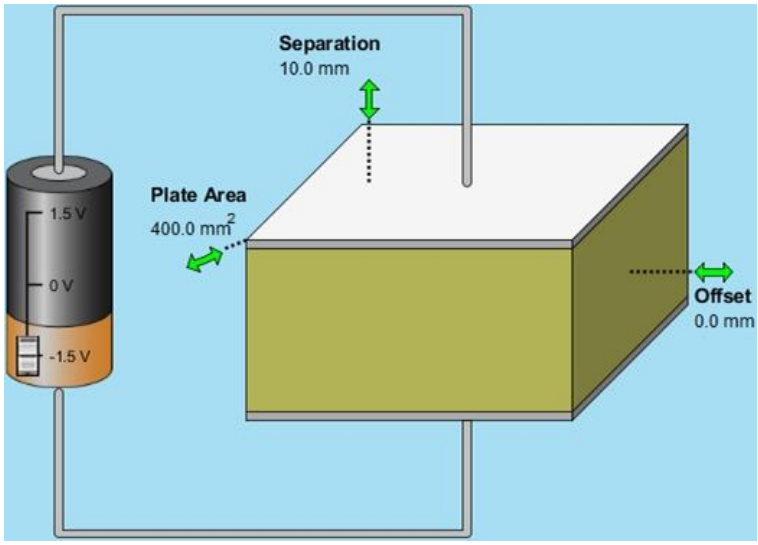
BATTERY IS TURNED ON TO +1.5 V.



READINGS FROM THE METERS

Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

BATTERY IS TURNED ON TO -1.5 V.



READINGS FROM THE METERS

Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 2. How do the measurements from the meters change, when the electric potential difference of the battery is +1.5v and -1.5v?

Q 3. With your own words describe a capacitor.

CAPACITANCE

$$C = \frac{\kappa \cdot \varepsilon_0 \cdot A}{d}$$

ELECTRIC CHARGE

$$q = C|\Delta V|$$

ELECTRIC POTENTIAL ENERGY

$$\Delta U_q = \frac{q \cdot \Delta V}{2}$$

VACUUM PERMITTIVITY

$$\varepsilon_0 = 8.85 \times 10^{-12} \ \frac{N \cdot m^2}{C^2}$$

ELECTRIC FIELD

$$E = \left|\frac{\Delta V}{d}\right|$$

CONVERSIONs:

- From mm to m, divide the amount of mm by 1000 mm
- From mm^2 to m^2, divide the amount of mm^2 by $(1000\ mm)^2$

PART II – CAPACITANCE

- Click on reset all
- Make sure the offset of the dielectric is 0.0 mm.
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 4. Complete the chart below:

SETTING OF YOUR CAPACITOR	
kappa	$\kappa = 3$
Distance separation	d = 10.0 mm
Plate Area	A = 100.0 mm^2
Electric Potential difference	ΔV = 1.5 v

READINGS FROM THE METERS	
Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 5. Show your work to calculate physical quantities:

- Capacitance
- Electric charge
- Electric potential energy
- Electric Field

PART III – EFFECT OF THE DIELECTRIC CONSTANT ON THE CAPACITANCE OF THE CAPACITOR

- Click on reset all
- Make sure the offset of the dielectric is 0.0 mm.
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 6. Complete the chart below:

SETTING OF YOUR CAPACITOR	
kappa	$\kappa = 5$
Distance separation	d = 10.0 mm
Plate Area	A = 100.0 mm^2
Electric Potential difference	$\Delta V = 1.5$ v

READINGS FROM THE METERS	
Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 7. How does the dielectric constant affect the capacitance of the capacitor? (increase or decrease)

WHEN κ INCREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

WHEN κ DECREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

PART IV – EFFECT OF THE DISTANCE SEPARATION ON THE CAPACITANCE OF THE CAPACITOR

- Click on reset all
- Make sure the offset of the dielectric is 0.0 mm.
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 8. Complete the chart below:

SETTING OF YOUR CAPACITOR	
kappa	$\kappa = 3$
Distance separation	d = 5.0 mm
Plate Area	A = 100.0 mm^2
Electric Potential difference	$\Delta V = 1.5$ v

READINGS FROM THE METERS	
Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 9. How does the distance separation affect the capacitance of the capacitor? (increase or decrease)

WHEN d INCREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

WHEN d DECREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

PART V – EFFECT OF THE PLATE AREA ON THE CAPACITANCE OF THE CAPACITOR

- Click on reset all
- Make sure the offset of the dielectric is 0.0 mm.
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 10. Complete the chart below:

SETTING OF YOUR CAPACITOR	
kappa	$\kappa = 3$
Distance separation	d = 10.0 mm
Plate Area	A = 400.0 mm^2
Electric Potential difference	ΔV = 1.5 v

READINGS FROM THE METERS	
Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 11. How does the plate area affect the capacitance of the capacitor? (increase or decrease)

WHEN A INCREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

WHEN A DECREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

PART VI – EFFECT OF THE ELECTRIC POTENTIAL DIFFERENCE ON THE CAPACITANCE OF THE CAPACITOR

- Click on reset all
- Make sure the offset of the dielectric is 0.0 mm.
- Check mark the meters: Capacitance, Plate charge, Stored Energy, and Electric Field Detector

Q 12. Complete the chart below:

SETTING OF YOUR CAPACITOR	
kappa	$\kappa = 3$
Distance separation	d = 10.0 mm
Plate Area	A = 100.0 mm^2
Electric Potential difference	ΔV = 1.0 v

READINGS FROM THE METERS	
Capacitance	**C =**
Electric charge	**q =**
Electric Potential Energy	**ΔUq =**
Electric Field	**E =**

Q 13. How does the electric potential difference affect the capacitance of the capacitor? (increase or decrease)

WHEN ΔV INCREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

WHEN ΔV DECREASES
Capacitance
Electric charge
Electric Potential Energy
Electric Field

PART VII – THE REAL CAPACITOR

You will need:

- Wires
- 1 resistor
- 1 capacitor
- cellphones or digital cameras
- Stopwatch
- Batteries

Q 14. Look at all the electric components of the circuit:

DRAW THE ELECTRIC CIRUIT	**DRAW THE CIRUIT DIAGRAM (USE SYMBOLS)**

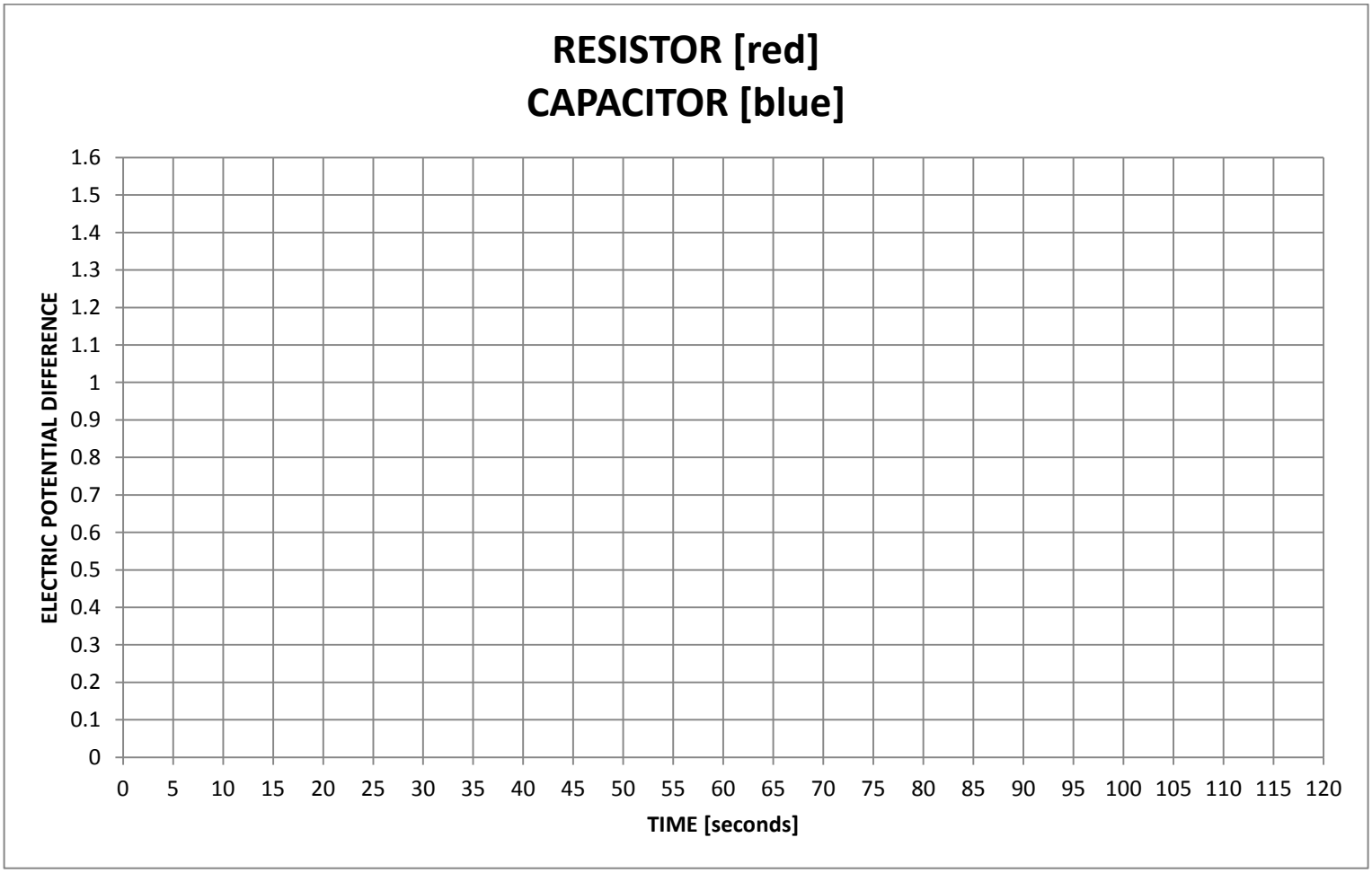
- Place a running stop watch (could be your phone) next to the two voltmeters.
- Connect the wires to the battery.
- Make a video that focus on the two voltmeters and the stop watch.

Q 15. With your own words describe what happens (voltmeters).

Q 16. Complete the chart below (every 5 seconds):

TIME (STOP WATCH)	**CLOCK READING (SET YOUR ZERO)**	**ELECTRIC POTENTIAL DIFFERENCE ACROSS THE RESISTOR**	**ELECTRIC POTENTIAL DIFFERENCE ACROSS THE CAPACITOR**
	0		

Q 17. Graphs



Q 18. What type of relationships are observed for the resistor and the capacitor [ask your teacher for some help]

Q 19. What quantities affect the capacitance of a capacitor?

Q 20. What happen to the charges in the capacitor (initially charged) when you click on disconnect battery? Explain why.