Prelab: Capacitors in Series and Parallel and the Time Constant

Print Name _____

Lab Section _____ **Date**_____**TA**_____

This prelab contains two parts. To answer part A, you need to watch the videos that are in the "Capacitors" folder. To answer part B, you need to read the lab handout.

PART A:

1. Considering the general form of a linear equation y=mx+b, which variable does time (t) correspond to in part 1 of the experiment?
2. What is the time scale (ms/div) used in the calculation?
3. In the demo, which configuration of capacitors has a steeper discharge curve displayed on the oscilloscope, two capacitors in series or two capacitors in parallel?
4. What setting was changed in the oscilloscope to allow for more precise measurements?

PART B:
Give answers to four decimal places.

1) Two 0.10 μF capacitors are first connected in series and then in parallel. Calculate the equivalent capacitance of both. Enter your results in units of micro-Farads, μF. (1.00 μF = 1.00 x 10^{-6} F)

C_{series} =_____ μF $C_{parallel}$ =_____ μF

2) The time required for a capacitor to decay to half its maximum value of V_o is called the half-life, $t_{1/2}$, where: [$t_{1/2}$ = (ln2)(RC)]. If $t_{1/2}$ = 2.30 ms and R = 32.5 kΩ, calculate the capacitance of the capacitor. Enter your answer in units of μF.

C =_____ μF

3) For an initial voltage, V_0= 8V, the times, *t*, for a voltage, V_C, across a capacitor as it discharges is recorded and analyzed in the table

Note, this question uses *t* vs *ln(V_0/V_c)*. In the experiment we will plot *L* vs *ln(V_0/V_c)*:

What is the properly rounded best estimate for the time constant (time constant is R*C) of this circuit?

V_c	t	LN(V_0/V_c)	t	N
(V)	(ms)		(ms)	8
8	0	0.000	0	**slope**
7	0.48	0.134	0.48	**(ms)**
6	0.97	0.288	0.97	3.2186499
5	1.55	0.470	1.55	**intercept**

4	2.24	0.693	2.24	**(ms)**
3	3.17	0.981	3.17	0.0273187
2	4.50	1.386	4.5	**R^2**
1	6.72	2.079	6.72	0.9999359
				S_t
				(ms)
				0.0195859
				S_{slope}
				(ms)
				0.0105243
				$S_{inter\ cept}$
				(ms)
				0.0105308

RC =_____ **ms**