In all sciences, when we model data describing physical phenomena, we should always be aware of the units the values have.

When we use functions in our models like sin( ), cos( ), $e^{(\ )}$, ln( ), we will want to remember that what ends up in the ( ) doesn't have units.

In modeling RC decay, we found that the potential difference across the discharging capacitor, as a function of time, is given by

$$\Delta V_C = \Delta V_0 e^{(-t/RC)}$$

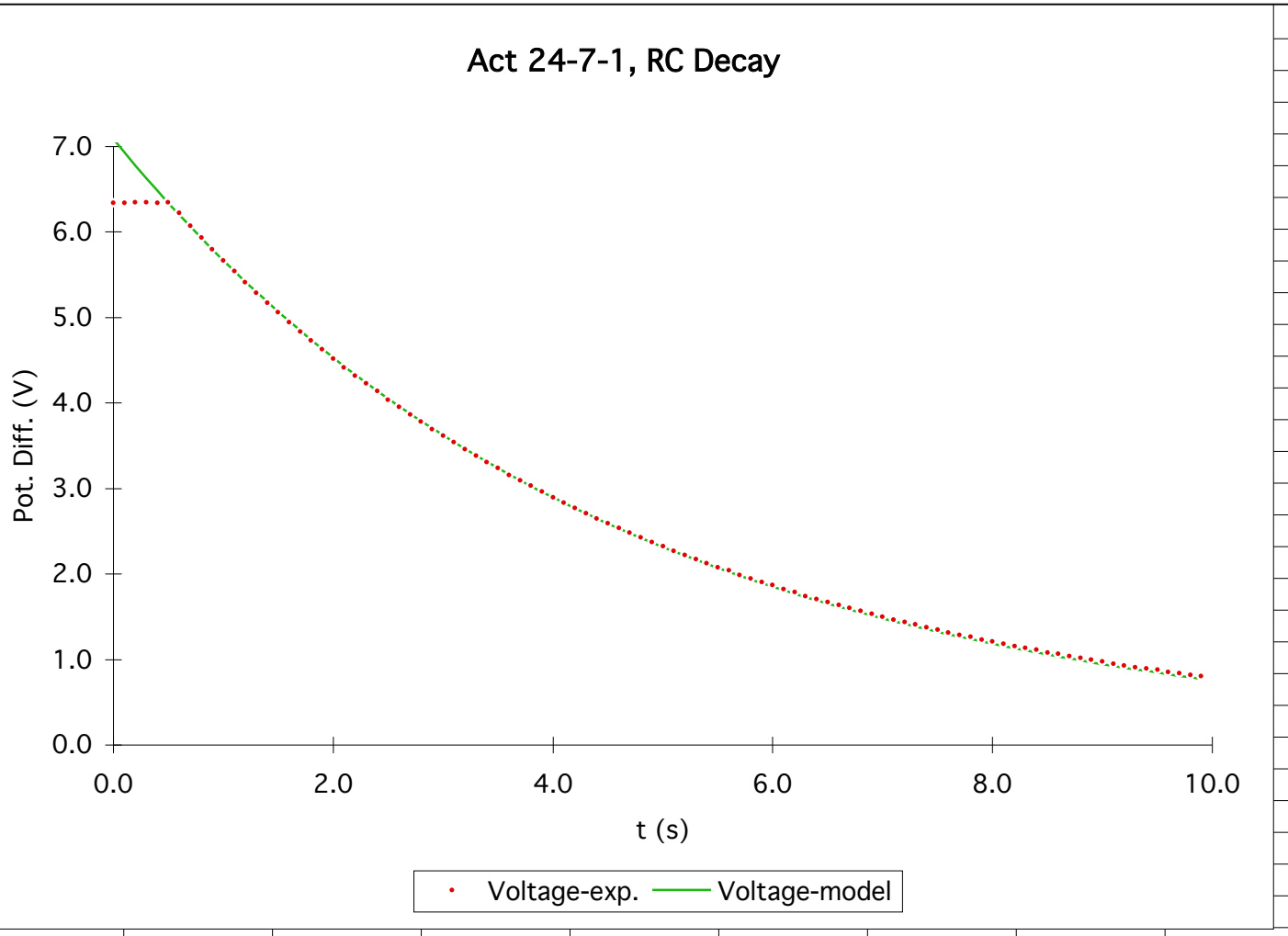
t is in seconds, and since (t/RC) doesn't have units, the product RC must also be in seconds: [Ω] [F] = [s]

We use this information to characterize and compare different RC circuits.

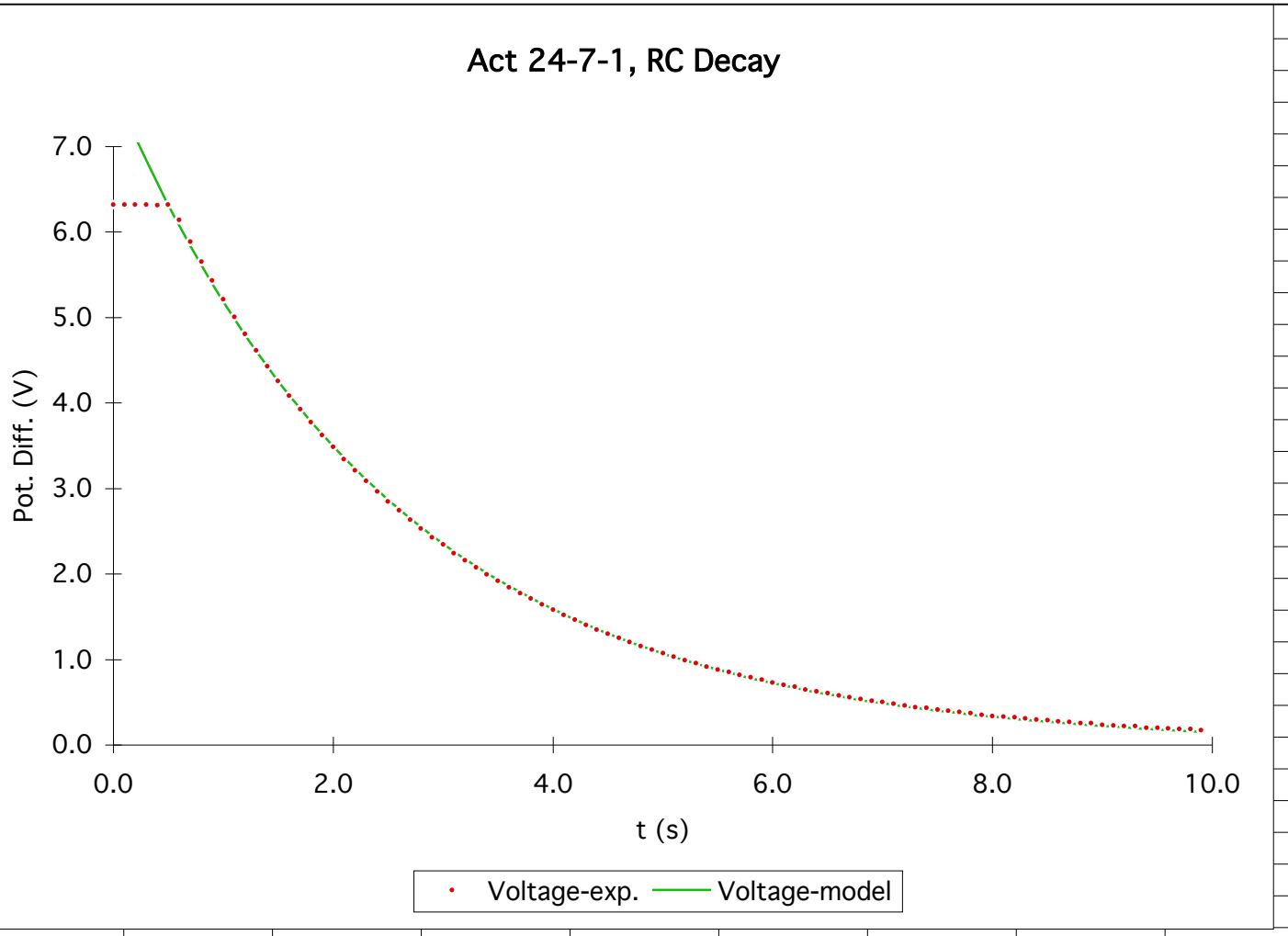
1) "RC time constant": $\tau = RC$.

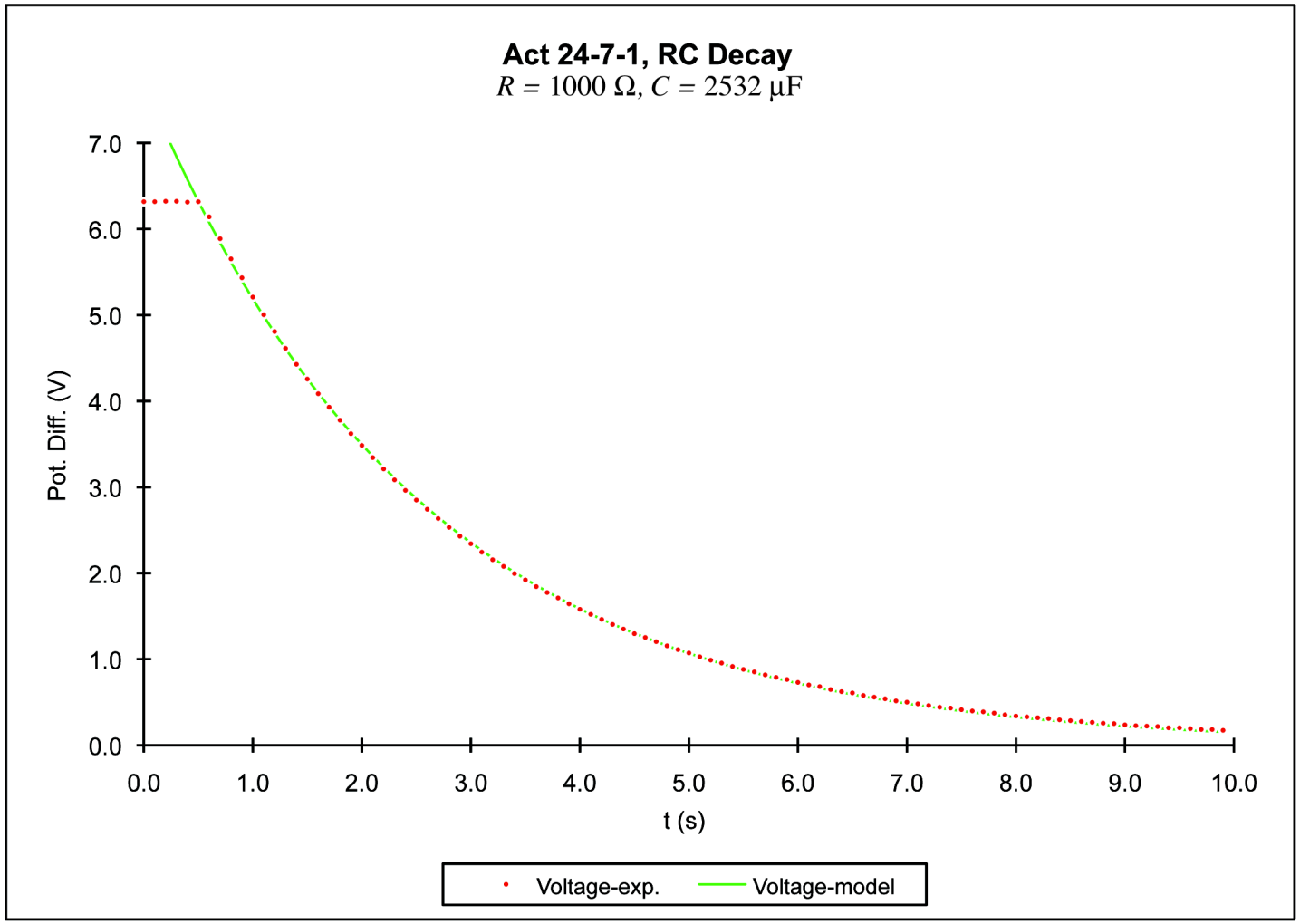
2) "*Half-life,* $t_{1/2}$": the time it takes for ΔV_C to decay from ΔV_0 to $\Delta V_0/2$.

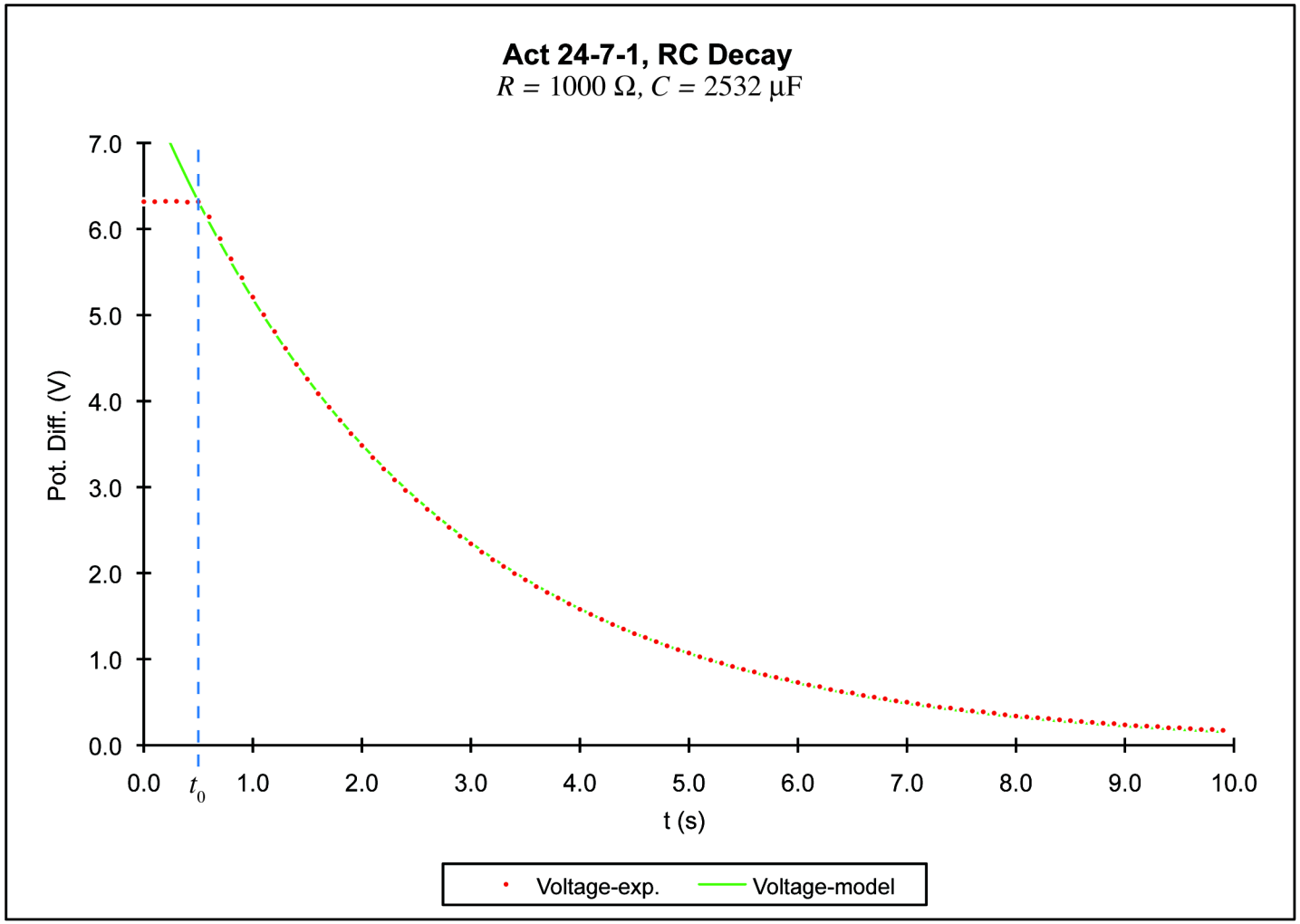
ΔV =	6.34	
R =	980	
C =	4.56E-03	
Act 24-7-1, RC Decay		
Pot. Diff. (V)		
t (s)	Voltage-exp	Voltage-mo
0.0	6.342	7.091
0.1	6.342	6.934
0.2	6.347	6.781
0.3	6.347	6.631
0.4	6.342	6.484
0.5	6.347	6.340
0.6	6.220	6.200
0.7	6.068	6.062
0.8	5.937	5.928
0.9	5.800	5.797
1.0	5.668	5.668
1.1	5.541	5.543
1.2	5.414	5.420
1.3	5.287	5.300
1.4	5.170	5.182
1.5	5.062	5.068
1.6	4.945	4.955
1.7	4.833	4.846
1.8	4.730	4.738
1.9	4.628	4.633
2.0	4.520	4.531
2.1	4.418	4.430
2.2	4.320	4.332

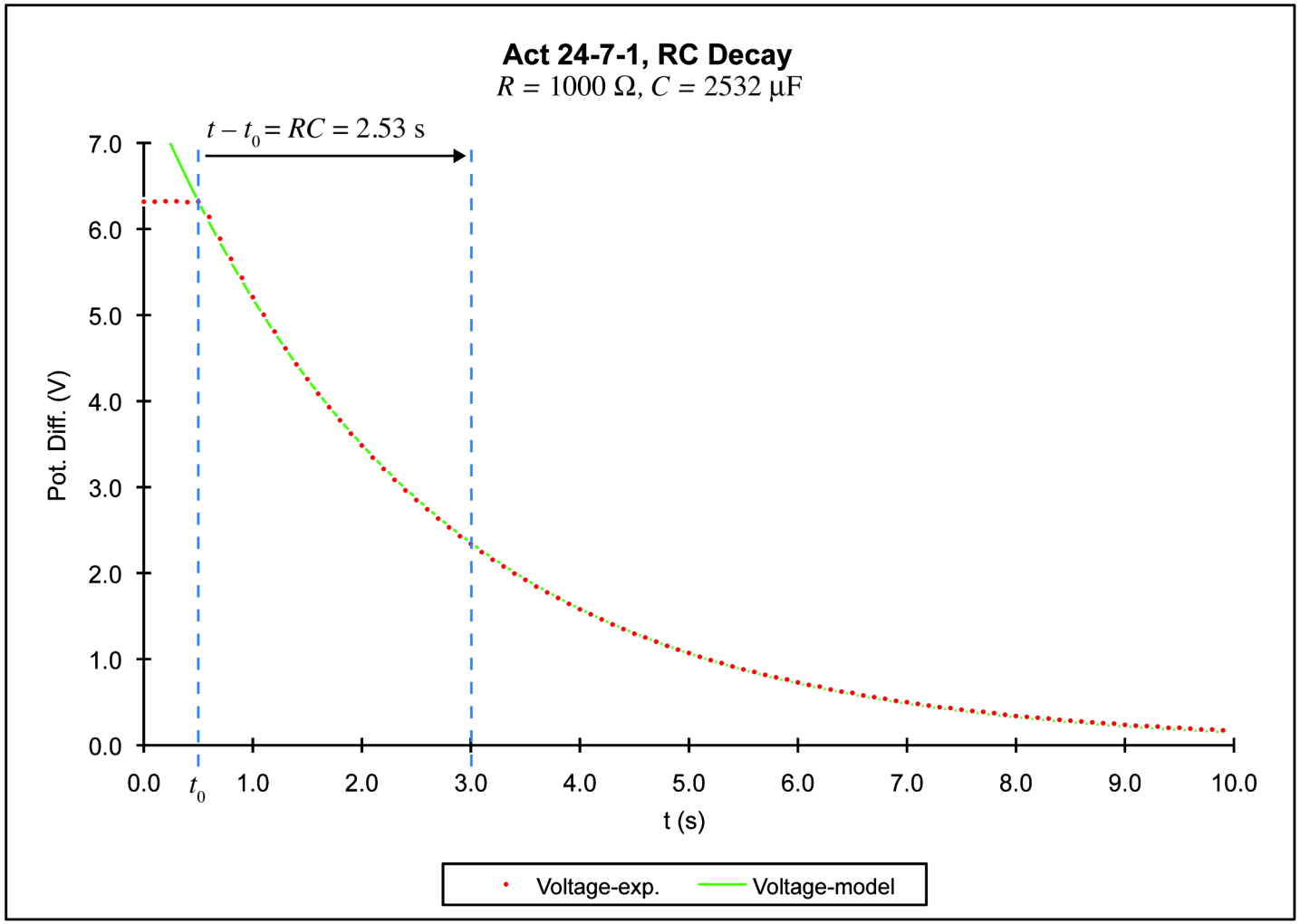


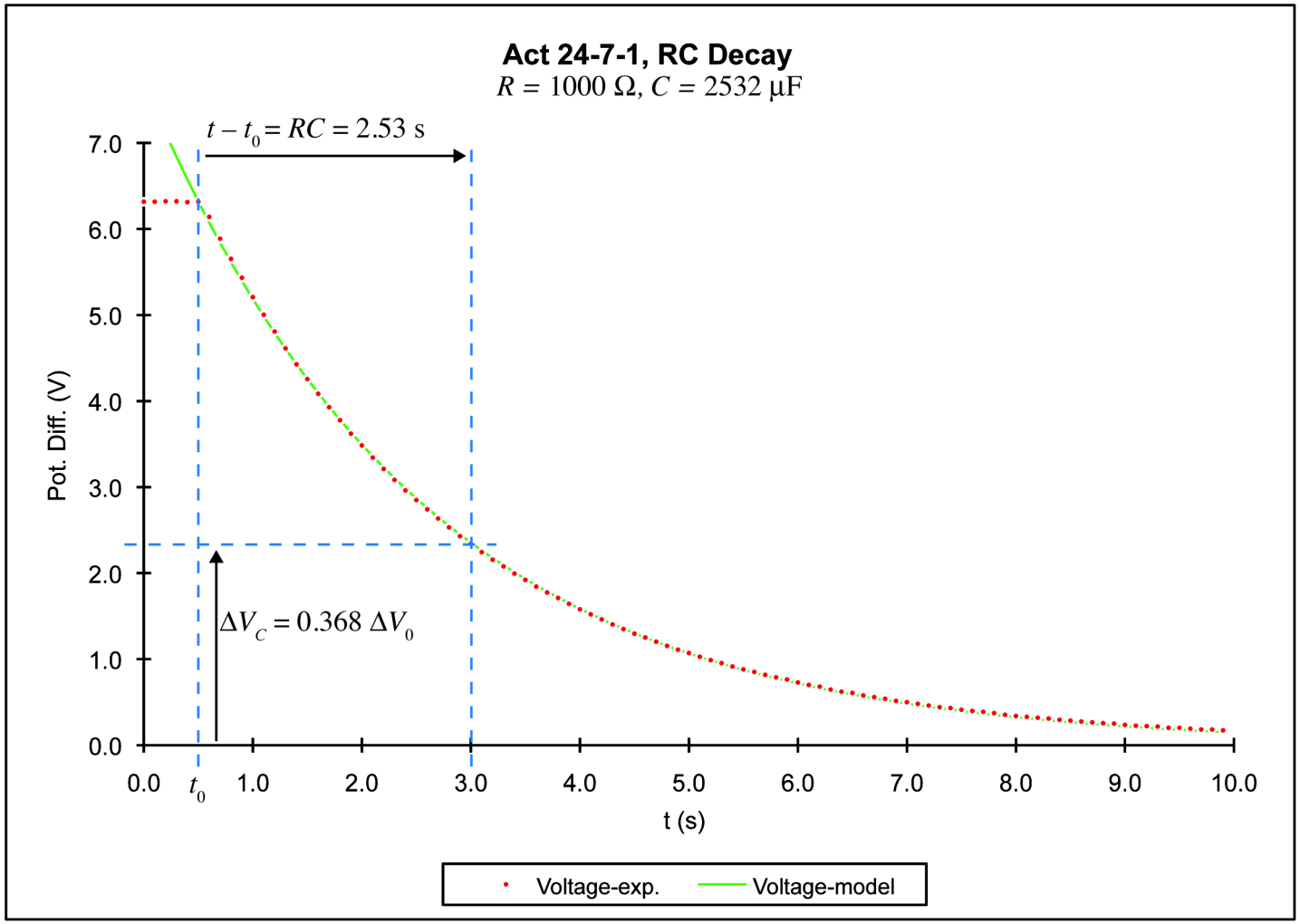
ΔV =	6.32	
R =	1000	
C =	2.53E-03	
Act 24-7-1, RC Decay		
Pot. Diff. (V)		
t (s)	Voltage-exp	Voltage-mo
0.0	6.317	7.700
0.1	6.317	7.402
0.2	6.322	7.115
0.3	6.322	6.839
0.4	6.313	6.575
0.5	6.317	6.320
0.6	6.142	6.075
0.7	5.888	5.840
0.8	5.653	5.614
0.9	5.433	5.396
1.0	5.209	5.187
1.1	5.004	4.987
1.2	4.808	4.793
1.3	4.613	4.608
1.4	4.427	4.429
1.5	4.256	4.258
1.6	4.085	4.093
1.7	3.929	3.935
1.8	3.778	3.782
1.9	3.621	3.636
2.0	3.485	3.495
2.1	3.343	3.360
2.2	3.211	3.229

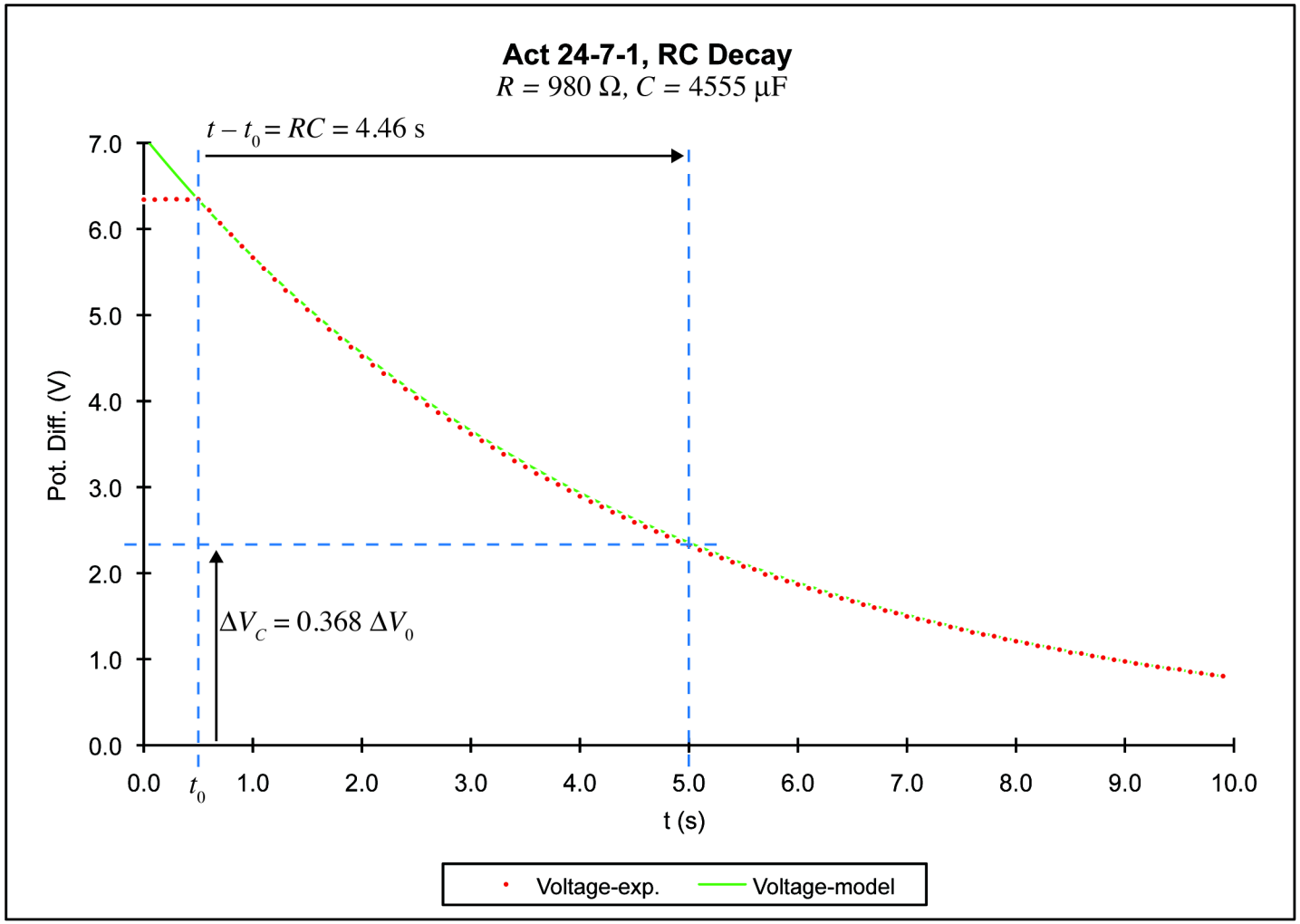


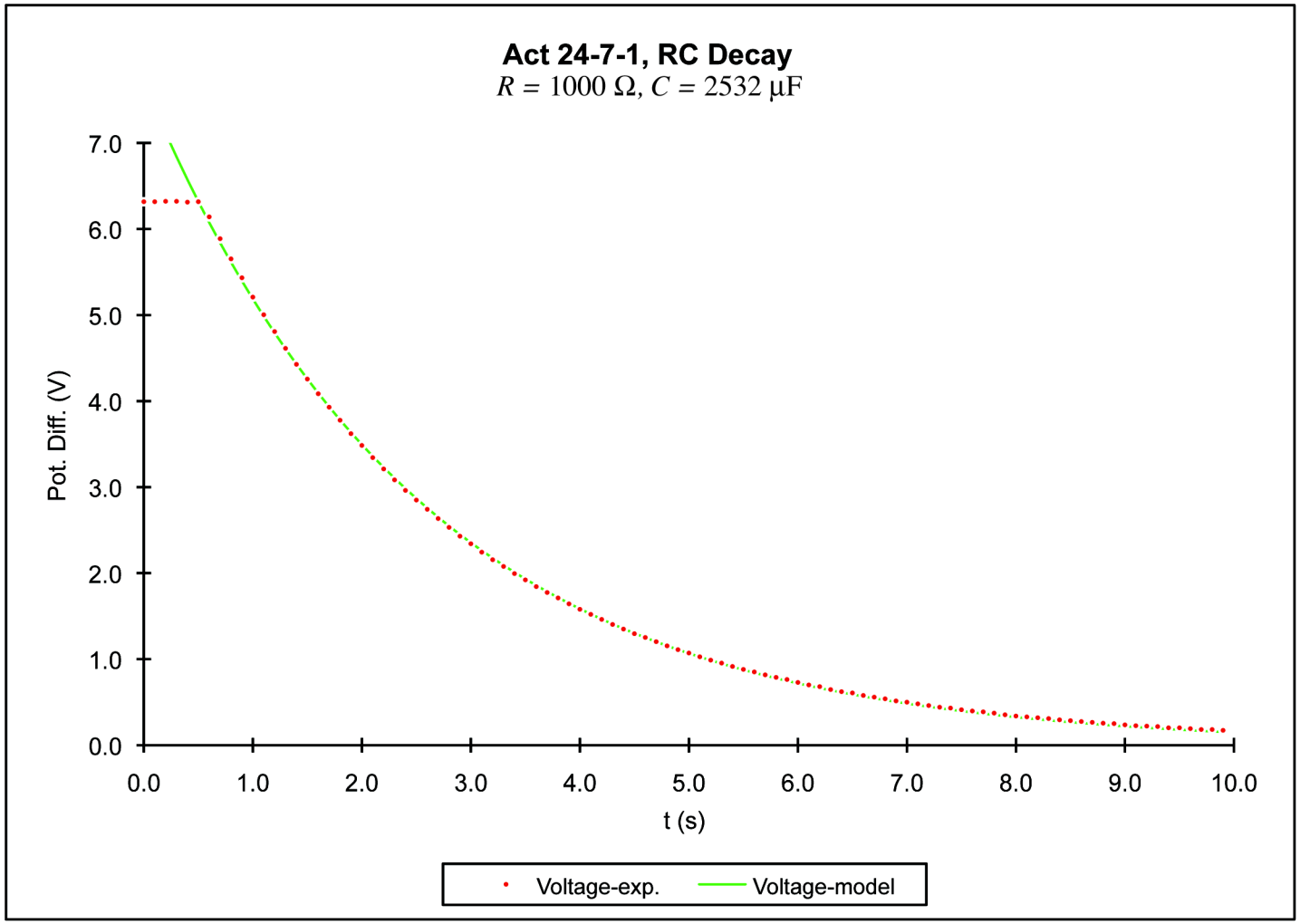

Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model

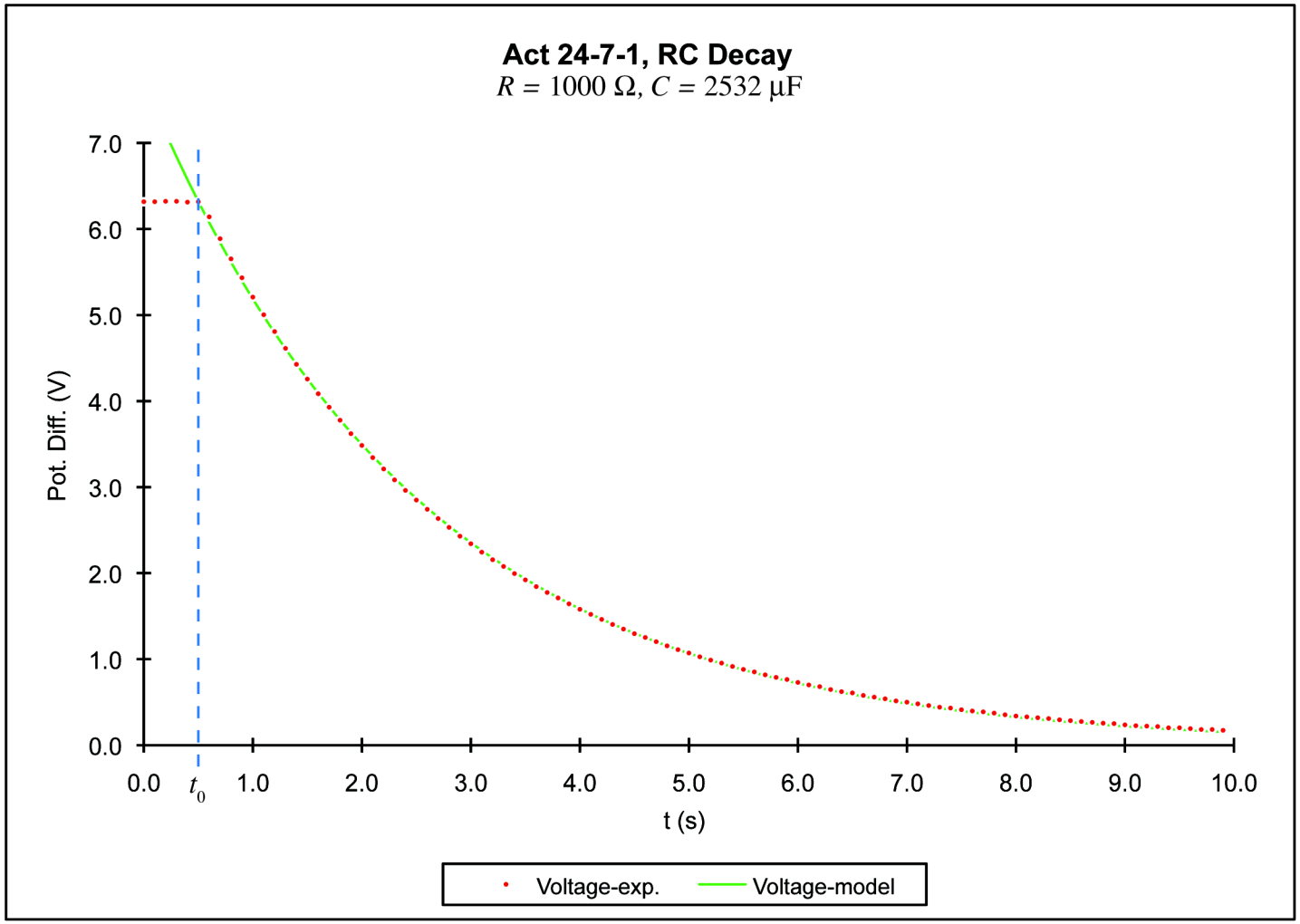

Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model

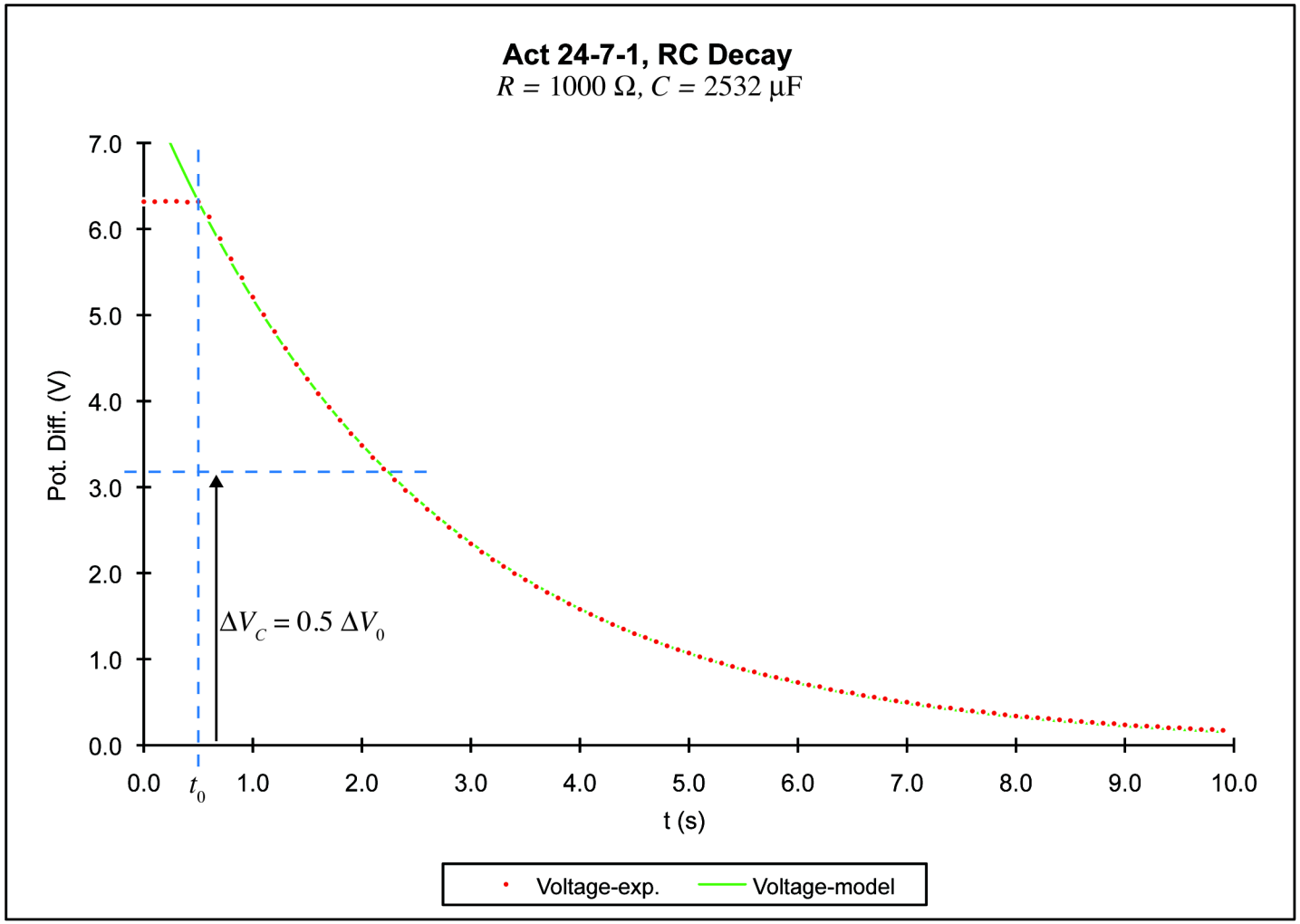

Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
t – t0 = RC = 2.53 s
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model

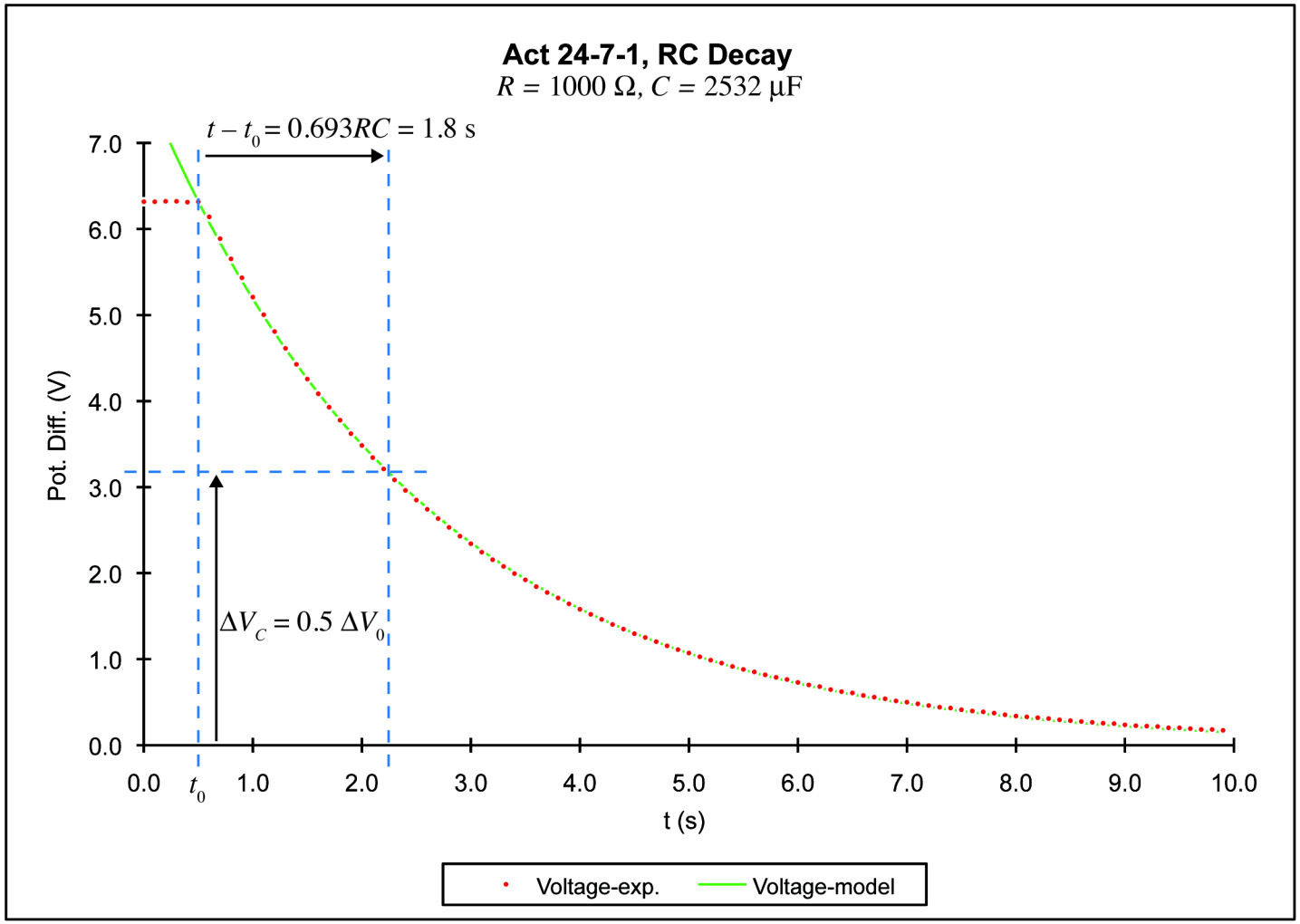

Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
t – t0 = RC = 2.53 s
ΔVC = 0.368 ΔV0
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model

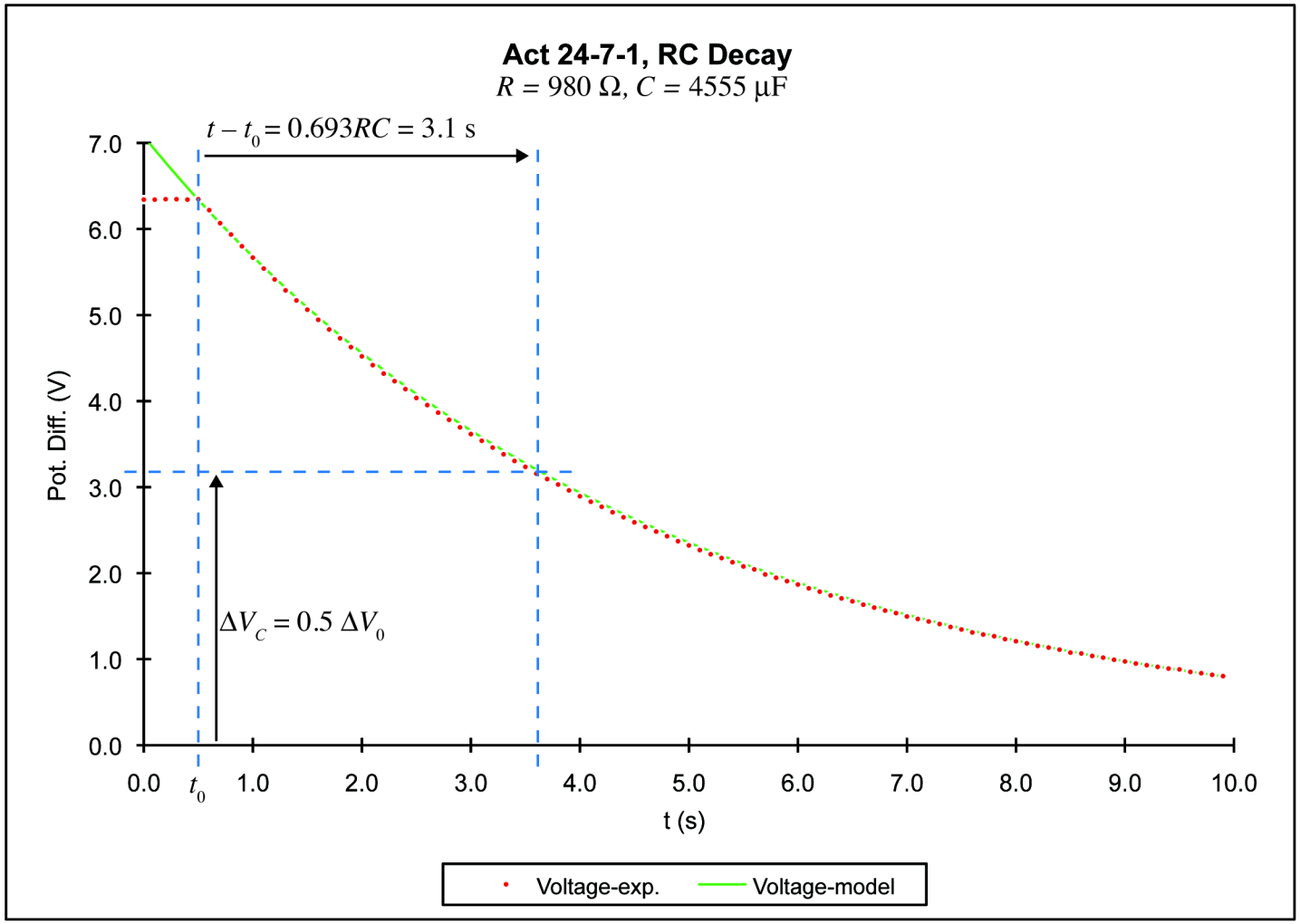

Act 24-7-1, RC Decay
R = 980 Ω, C = 4555 µF
t – t0 = RC = 4.46 s
ΔVC = 0.368 ΔV0
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model


Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model


Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model


Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
Pot. Diff. (V)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
ΔV_C = 0.5 ΔV_0
0.0
t_0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
t (s)
Voltage-exp.
Voltage-model


Act 24-7-1, RC Decay
R = 1000 Ω, C = 2532 μF
t – t0 = 0.693RC = 1.8 s
ΔVC = 0.5 ΔV0
Pot. Diff. (V)
t (s)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Voltage-exp.
Voltage-model


Act 24-7-1, RC Decay
R = 980 Ω, C = 4555 μF
t – t0 = 0.693RC = 3.1 s
ΔVC = 0.5 ΔV0
Pot. Diff. (V)
t (s)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
t0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Voltage-exp.
Voltage-model