Ch 10 (3, 5, 15, 43, 47)

10.3

GIVEN: a 50nF CAPACITOR IS CHARGED TO 14×10^{-3} C

READ: POTENTIAL DIFFERENCE

SOLN:

$$V = \frac{Q}{C} = \frac{10 \times 10^{-3}\,C}{50 \times 10^{-6}\,F} = \boxed{200\,V = V}$$

10.5

GIVEN: 5nF CAPACITOR @ 150V. CHARGE IS REDUCED UNTIL 84V.

READ: FINAL CHARGE ON CAPACITOR

SOLN:

$$Q = VC = 84V\,(5 \times 10^{-6}\,F) = \boxed{420\,\mu C = Q}$$

10.15

GIVEN: AN AIR-DIELECTRIC CAP w/ $d = 1.5$ mm

READ: MAX VOLTAGE BEFORE BREAKDOWN

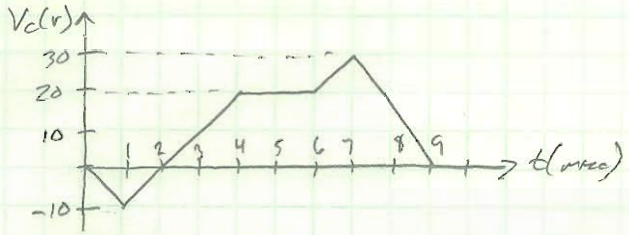
SOLN:

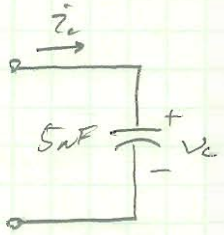
dielectric strength of air $k = 3\ kV/mm$

$$B.V. = kd = \left(3\frac{kV}{mm}\right) 1.5\,mm = \boxed{4500\,V = V_{bv}}$$

10.43

GIVEN





READ i_c GRAPH

SOLN $i_c = C\frac{\Delta V}{\Delta t}$

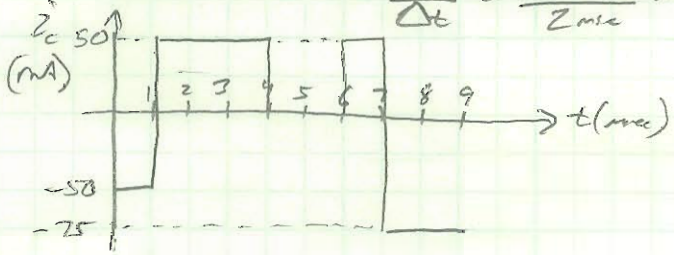
TIME 0→1 $\Rightarrow \frac{\Delta V}{\Delta t} = \left(\frac{-10-0\ V}{1\ msec}\right) = -10\ kV/sec \rightarrow i_c = 5nF\left(-10\frac{kV}{sec}\right) = -50\ mA$

TIME 1→4 $\Rightarrow \frac{\Delta V}{\Delta t} = \frac{20-(-10)}{3\ msec} = +10\ kV/sec \rightarrow i_c = 5nF\left(+10\frac{kV}{sec}\right) = +50\ mA$

TIME 4-6 $\Rightarrow \frac{\Delta V}{\Delta t} = 0 \rightarrow i_c = 0$

TIME 6-7 $\Rightarrow \frac{\Delta V}{\Delta t} = \frac{30-20V}{1\ msec} = +10\ kV/sec \rightarrow i_c = 5nF\left(+10\frac{kV}{sec}\right) = +50\ mA$

TIME 7-9 $\Rightarrow \frac{\Delta V}{\Delta t} = \frac{0-30V}{2\ msec} = -15\ kV/sec \rightarrow i_c = 5nF\left(-15\frac{kV}{sec}\right) = -75\ mA$



10-47

READ: ENERGY STORED IN CAPACITOR OF 10-47

SOLN @ 1 msec → $W = \frac{1}{2}Cv^2 = \frac{1}{2}(5nF)(-10V)^2 = 250\ nJ$

@ 4 msec → $W = \frac{1}{2}Cv^2 = \frac{1}{2}(5nF)(20V)^2 = 1000\ nJ$

@ 5 msec → $W = \frac{1}{2}Cv^2 = \frac{1}{2}(5nF)(20V)^2 = 1000\ nJ$

@ 7 msec → $W = \frac{1}{2}Cv^2 = \frac{1}{2}(5nF)(30V)^2 = 2250\ nJ$

@ 9 msec → $W = \frac{1}{2}Cv^2 = \frac{1}{2}(5nF)(0V)^2 = 0\ nJ$