1. vacuum: $\varepsilon_r = 1$

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

$$C_{nom} = \frac{(8.854)(1)(1\times10^{-3})^2}{2\times10^{-6}} = 4.427\,pF$$

$$C_{max} = \frac{(8.854)(1)(1\times10^{-3})^2}{1\times10^{-6}} = 8.854\,pF$$

$$C_{min} = \frac{(8.854)(1)(1\times10^{-3})^2}{3\times10^{-6}} = 2.951\,pF$$

2. $V_{0_{cnom}} = -\frac{10(3p)}{10p} = -3V$

$V_{0_{cmax}} = -\frac{10(5p)}{10p} = -5V$

$V_{0_{cmin}} = -\frac{10(2p)}{10p} = -2V$

3. $f = \frac{0.455}{RC}$

$$f_{Cnom} = \frac{0.455}{(3\times10^{-12})(100{,}000)} = 1.517\,MHz$$

$$f_{Cmax} = \frac{0.455}{(5\times10^{-12})(100{,}000)} = 910\,KHz$$

$$f_{Cmin} = \frac{0.455}{(2\times10^{-12})(100{,}000)} = 2.275\,MHz$$

4. $\overline{V_{in}} = 10V$

Case 1: $C_1 = C_2 = 3pF$

$$\overline{V_0} = \frac{10C_1}{C_1+C_2} = \frac{10(3)}{3+3} = 5V$$

Case 2: $C_1 = 2pF$, $C_2 = 5pF$

$$\overline{V_0} = \frac{10C_1}{C_1+C_2} = \frac{10(2)}{2+5} = 2.86V$$

Case 3: $C_1 = 5pF$, $C_2 = 2pF$

$$V_0 = \frac{10 C_1}{C_1 + C_2} = \frac{10(5)}{5+2} = 7.14V$$

5. $R_{eq} = \frac{1}{fC}$

$C_{min} = 2pF \rightarrow R_{eq} = \frac{1}{(250{,}000)(2\times10^{-12})} = 2M\Omega$

$C_{nom} = 3pF \rightarrow R_{eq} = \frac{1}{(250{,}000)(3\times10^{-12})} = 1.33M\Omega$

$C_{max} = 5pF \rightarrow R_{eq} = \frac{1}{(250{,}000)(5\times10^{-12})} = 800K\Omega$

6. $\tau = 0.693RC$

$\tau_{Cmin} = 0.693(250{,}000)(2\times10^{-12}) = 0.347\,\mu s$

$\tau_{Cnom} = 0.693(250{,}000)(3\times10^{-12}) = 0.520\,\mu s$

$\tau_{Cmax} = 0.693(250{,}000)(5\times10^{-12}) = 0.866\,\mu s$