(2) $R_1 = R_2 = 10\,k\Omega$, $C_1 = C_2 = 1\,nF$, $Q = 1$

$$\Rightarrow Q = \frac{1}{3-K} = 1 \Rightarrow K = 2 \Rightarrow 1 + \frac{R_f}{R} = 2 \Rightarrow \frac{R_f}{R} = 1$$

Hence, we can chose $R = R_f = 1\,k\Omega$.

$$\Rightarrow f_0 = \frac{1}{2\pi\sqrt{C_1R_1C_2R_2}}\,Hz = \frac{1}{2\pi \times 10^4 \times 10^{-9}}\,Hz = \frac{10^5}{2\pi}\,Hz = 15915\,Hz$$

Experimentally the peak in gain is obtained around 11.3 kHz. The peak is not very sharp though owing to the low Q-factor. The transition is not very sharp.

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(4) $R_1 = R_2 = 10\,k\Omega$, $C_1 = C_2 = 1\,nF$, $Q = 2.5$

$$\Rightarrow Q = \frac{1}{3-K} = \frac{5}{2} \Rightarrow K = \frac{13}{5} \Rightarrow 1 + \frac{R_f}{R} = \frac{13}{5} \Rightarrow \frac{R_f}{R} = \frac{8}{5}$$

Hence we can choose $R_f = 2\,k\Omega$ and $R = 1.25\,k\Omega$

$$\Rightarrow f_0 = \frac{1}{2\pi\sqrt{R_1C_1R_2C_2}}\,Hz = \frac{1}{2\pi RC}\,Hz = \frac{10^8}{2\pi}\,Hz = 15915\,kHz$$

Experimentally the gain starts to drop around 150 kHz and reaches −3dB value near 300kHz. The huge difference between theoretical and experimental value stems from the fact that the op-amp used (OP-777) has a finite bandwidth. (non ideal) Moreover this bandwidth is much lesser (for the OP-AMP used) than 15915 kHz. Due to this the OP-AMP deviates from its ideal behaviour. It can be observed by using a different OP-AMP such as LT-1226 the roll-off occurs near the expected value.