Chapter 10, Solution 91.

(a)   Let $V_2 =$ voltage at the noninverting terminal of the op amp

$V_o =$ output voltage of the op amp

$Z_p = 10 \ k\Omega = R_o$

$Z_s = R + j\omega L + \dfrac{1}{j\omega C}$

As in Section 10.9,

$$\frac{V_2}{V_o} = \frac{Z_p}{Z_s + Z_p} = \frac{R_o}{R + R_o + j\omega L - \dfrac{j}{\omega C}}$$

$$\frac{V_2}{V_o} = \frac{\omega C R_o}{\omega C (R + R_o) + j (\omega^2 LC - 1)}$$

For this to be purely real,

$$\omega_o^2 LC - 1 = 0 \quad \rightarrow \quad \omega_o = \frac{1}{\sqrt{LC}}$$

$$f_o = \frac{1}{2\pi \sqrt{LC}} = \frac{1}{2\pi \sqrt{(0.4 \times 10^{-3})(2 \times 10^{-9})}}$$

$$f_o = \textbf{180 kHz}$$

(b)   At oscillation,

$$\frac{V_2}{V_o} = \frac{\omega_o C R_o}{\omega_o C (R + R_o)} = \frac{R_o}{R + R_o}$$

This must be compensated for by

$$A_v = \frac{V_o}{V_2} = 1 + \frac{80}{20} = 5$$

$$\frac{R_o}{R + R_o} = \frac{1}{5} \quad \rightarrow \quad R = 4 R_o = \textbf{40 k}\Omega$$