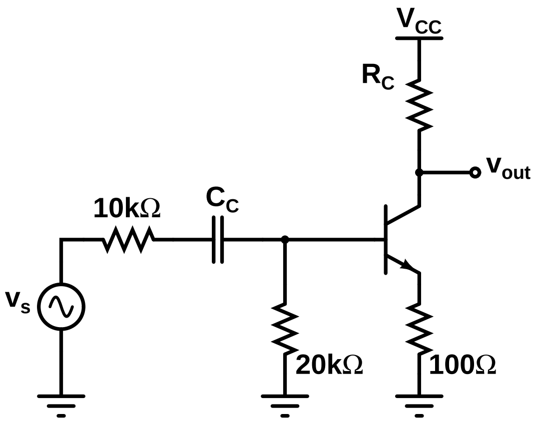
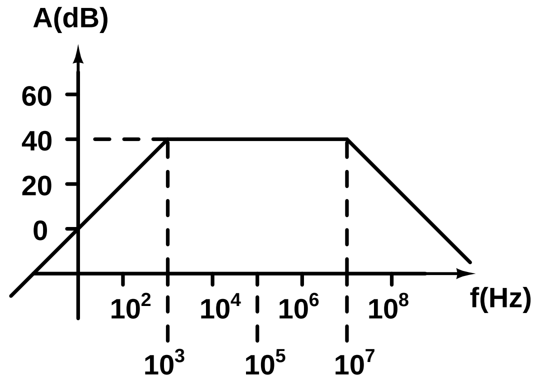




1. R_C.

   ANSWER: From the bode plot, the midband gain magnitude is $40dB = 100$. This must be equal to the common-emitter gain times the input loading factor, so

$$100 = \frac{\beta R_C}{r_\pi + (\beta+1)R_e} \times \frac{20k\Omega \,||\, [r_\pi + (\beta+1)R_e]}{20k\Omega \,||\, [r_\pi + (\beta+1)R_e] + 10k\Omega}$$

   Using $R_e = 100\Omega$, $r_\pi = \beta V_T/i_C = 75 \times 25mV/0.5mA = 3750\Omega$, and solving for R_C yields

$$\boxed{R_C = 36k\Omega}$$

2. C_C.

   ANSWER:

   From the bode plot, the low-frequency pole is at $1000Hz = 6280rps$. Since the coupling capacitor C_c "sees" a resistance

$$R_{eq} = 10k\Omega + 20k\Omega \,||\, [r_\pi + (\beta+1)R_e] = 10k\Omega + 7.24k\Omega = 17.24k\Omega$$

   Thus,

$$C_c = \frac{1}{R_{eq}\omega_L} = \frac{1}{6280 \times 17.24k\Omega} = \boxed{9pF}$$

3. C_μ if Miller's Theorem can be applied and the output capacitor can be neglected. Use $R_C = 2k\Omega$, not the value you found in part 1.

   ANSWER:

   Miller's gain would be

$$K = v_c/v_b = \frac{\beta R_C}{r_\pi + (\beta+1)R_e} = \frac{-75 \times 2k\Omega}{3.75k\Omega + 76 \times 100\Omega} = -13.3V/V$$

   Thus applying Miller's theorem would yield a capacitor $C_{IN} = 14.3 \times C_\mu$ from base to ground. Such capacitor would "see" an equivalent resistance

$$R_{eq} = 10k\Omega \,||\, 20k\Omega \,||\, [r_\pi + (\beta+1)R_e] = 4.2k\Omega$$

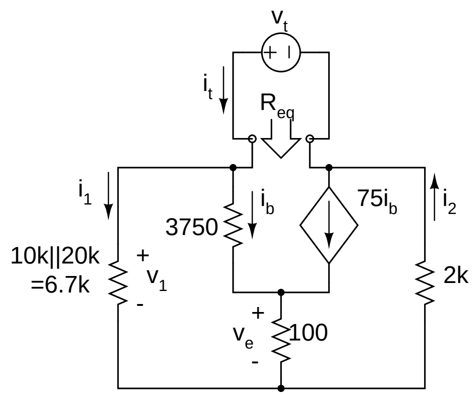
   Since this capacitor will cause the high-frequency pole at $10^7Hz = 62.8Mrps$,

$$C_{mu} = \frac{1}{(1-K)R_{eq}\omega_H} = \boxed{0.27pF}$$

4. C_μ without applying Miller's Theorem, and by replacing the transistor with its model and analyzing the resulting circuit to find out the resistance seen by C_μ. Use $R_C = 2k\Omega$, not the value you found in part 1.

ANSWER:

The high-frequency pole at $\omega_H = 62.8Mrps$ is associated with C_μ and thus $C_\mu = \frac{1}{R_{eq}\omega_H}$. After replacing the transistor with its model and placing a test source in place of C_μ to find R_{eq}, the following diagram results



A KVL in the left loop yields

$$v_1 = i_b(3750 + 76 \times 100) = 11350\Omega \times i_b$$

Thus

$$i_1 = \frac{v_1}{6.7k\Omega} = 1.69 i_b$$

A KCL on the top-left node gives

$$i_t = i_1 + i_b = 2.69 i_b$$

A KCL on the bottom node yields,

$$i_2 = i_e + i_1 = 76 i_b + 1.69 i_b = 77.69 i_b = 28.9 i_t$$

Finally, a KCL in the outer loop give

$$v_t = v_1 + 2k \times i_2 = (\frac{11350\Omega}{2.69} + 2000\Omega \times 28.9) i_t$$

and

$$R_{eq} = \frac{v_t}{i_t} = 62k\Omega$$

$$C_\mu = \frac{1}{62 \times 10^3\Omega \times 6.28 \times 10^7} = \boxed{0.26pF}$$