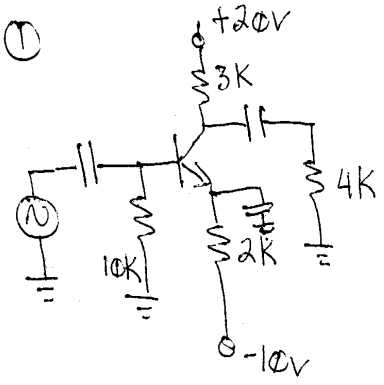
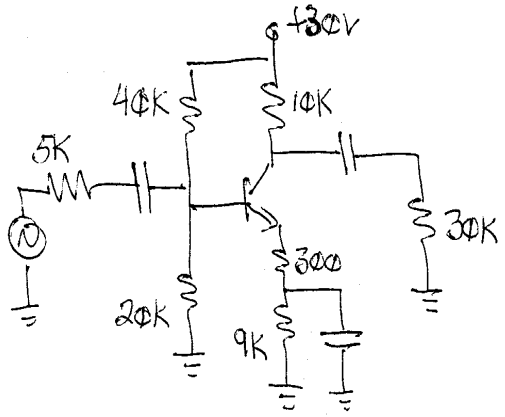
# Linear Electronics "Fun for Free"

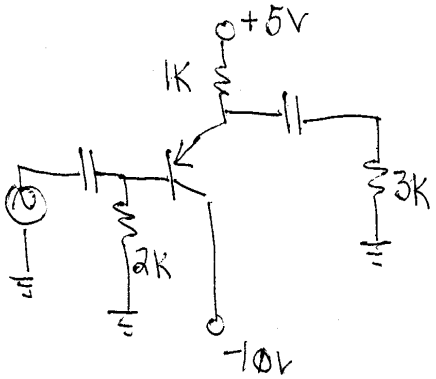
AC small signal home work sheet. Assume $\beta = 100$ for all.

① 


Find $Z_{in}$ and $A_V$.

② 


Find $V_{LOAD}$ if $V_{in} = 50mV$

③ 


Find $Z_{in}$ and $A_V$.

Answers

① using approx. Technique: $V_B \approx 0V$, $V_E \approx -.7V$, $I_E \approx \frac{9.3V}{2K} = 4.65mA$

$$r'_e = \frac{26mV}{I_E} = \frac{26mV}{4.65mA} = 5.6\Omega$$

$Z_{in(base)} = \beta \cdot r'_e = 100 \cdot 5.6 = 560\Omega$

$Z_{in} = 10K // 560 = \underline{530\Omega}$

$$A_V = -\frac{r_c}{r'_e} = -\frac{3K // 4K}{5.6\Omega} = \underline{-306}$$

② $V_B = 10VDC$, $V_E = 9.3vDC$, $I_E = \frac{9.3V}{9.3K\Omega} = 1mA$, $r'_e = \frac{26mV}{1mA} = 26\Omega$

$Z_{in(base)} = \beta(r'_e + r_E) = 100(26 + 300) = 32.6K$

$Z_{in} = 40K // 20K // 32.6K = 9.46K$

source mismatch $= \frac{9.46K}{9.46K + 5K} = .654$

$$A_V = -\frac{r_c}{r'_e + r_E} = \frac{-10K // 3K}{26 + 300} = -23$$

$A_{net} = -23 \cdot .654 = -15$, so $V_{out} = 50mV \cdot (-15) = \underline{.752 \text{ volts}}$

③ $I_E = 4.3mA$, $r'_e = 6\Omega$

$Z_{in(base)} = \beta(r'_e + r_E) = 100(6 + 1K // 3K) = 75.6K\Omega$

$Z_{in} = 2K // 75.6K = \underline{1.95K\Omega}$

$$A_V = \frac{r_E}{r'_e + r_E} = \frac{1K // 3K}{6 + 1K // 3K} = .992$$

(no source impedance to bother with).