A grounded emitter transistor amplifier circuit using the 2N222A BJT is shown. A graphical analysis of the transistor shows that $\beta_{DC} = \beta_{AC} = 175$ and $r_{oc} = 40 \, k\Omega$. Also, tests show that $V_{BE(on)} = 0.7 \, V$ and $V_{CE(sat)} = 0.2 \, V$. The amplifier design characteristics are $V_{CC} = 12 \, V$, $R_B = 390 \, k\Omega$, $R_C = 1.2 \, k\Omega$, $R_L = 2.4 \, k\Omega$, and $C_1 = C_2 = 2.0 \, \mu F$. Analyze the circuit following the steps given below.

1. Identify the transistor operating point (Q point).
   
   $V_{CEQ} =$ __________
   $I_{CQ} =$ __________
   $I_{BQ} =$ __________

2. Calculate the transistor small signal input resistance $r_\pi$ assuming the operating temperature is $27^\circ C$.
   
   $r_\pi =$ __________

3. Find the small signal voltage amplifier circuit parameters $r_i$, $r_o$, and $a_{vo}$ ($a_{vo} = v_o/v_{in}$ with $R_L = \infty$) and draw the equivalent circuit on the back of this sheet. Include on the equivalent circuit diagram the voltage source ($v_s$ and $R_s$), the load resistance ($R_L$), as well as $r_i$, $r_o$, and $a_{vo}$. Assume $X_{C1} = X_{C2} = 0$.
   
   $r_i =$ __________
   $r_o =$ __________
   $a_{vo} =$ __________

4. Using the small signal voltage amplifier equivalent circuit diagram, find the small signal voltage gain ($a_v = v_o/v_{in}$) with $R_L = 2.4 \, k\Omega$ for the circuit at a midrange frequency of 40 kHz.
   
   $a_v =$ __________

5. Using the small signal voltage amplifier equivalent circuit diagram, find the overall small signal voltage gain ($A_v = v_o/v_s$) with $R_L = 2.4 \, k\Omega$ for the circuit at a midrange frequency of 40 kHz assuming $R_S = 50 \, \Omega$.
   
   $A_v =$ __________