At right are two configurations for using an *npn* BJT to deliver power to a load (the coil of relay, a DC motor, a light bulb, an LED, etc): one with the load connected to the emitter and one with the load connected to the collector.

Assume that the control voltage, $v_i$ , is either 0 or 5 V, (something like the output from an Arduino-type micro-controller).  Of course, if $v_i = 0$ in either circuit, the BJT is off and no current flows.  For the case of $v_i = 5$ V for each circuit, calculate the load current current and voltage, $i_{RL}$ and $v_{RL}$. Calculate the power delivered to the load.  The calculate the power being delivered by the supplies: $P_S = V_{CC} \cdot i_c + v_i \cdot i_b$. How much current is being dissipated in the transistor of the left circuit? How much power is being dissipated in the combination of the transistor and $R_B$ in the right circuit?  What is the power delivery efficiency $\eta = P_{RL}/P_S$ in each case?
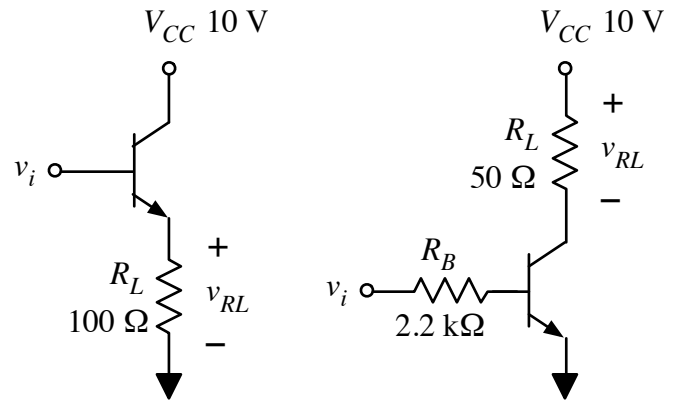
For the transistors, $\beta_F = 100$.

$i_{RL} =$ _____          $i_{RL} =$ _____

$v_{RL} =$ _____          $v_{RL} =$ _____

$P_{RL} =$ _____          $P_{RL} =$ _____

$P_S =$ _____          $P_S =$ _____

$P_{bjt} =$ _____          $P_{bjt+RB} =$ _____

$\eta =$ _____          $\eta =$ _____

*Put your answers — and whatever work will fit — on this sheet.  Staple any sheets with additional work behind.*