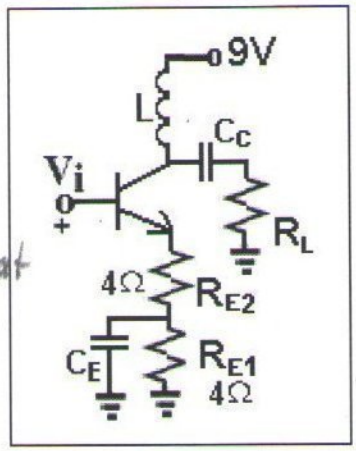
For the transistor, VCEsat=0.3V and ICmax=200mA are given.
Find RLopt.



$I_{CQ} = \frac{I_{CMAX}}{2} = 100mA$ //

$V_{CQ} = 9V$ $V_{CMIN} = I_{CQ} \cdot R_{E1} + 2I_{CQ}R_{E2} + V_{CEsat}$

$\downarrow \cong 0,4 + 0,8 + 0,3$

$\downarrow \cong 1,5V$ //

$V_{RLmax} = V_{CQ} - V_{CMIN}$

$\downarrow \cong 9 - 1,5 = 7,5$ → $R_{Lopt} = \frac{7,5V}{100mA} = 75\Omega$

$I_{RLmax} = I_{CQ} = 100mA$

Find VCEmax.

9V IRLmax xRLopt

$V_{CMAX} = V_{CQ} + V_{RLmax} = 16,5V$

$I_C = 0 \rightarrow V_C = V_{CMAX} \rightarrow V_E = I_{CQ} R_{E1} = 0,4V$ //

$V_{CEmax} = 16,5V - 0,4V = 16,1V$ //

Find maximum efficiency.

$P_{DC} = V_{CC} \cdot I_{CQ} = 9 \times 0,1A = 0,9W$

$P_{RLmax} = I_{RLmax} \times V_{RLmax} = 100mA \times 7,5V \times \frac{1}{2} = 0,375W$

$\eta_{max} = 0,375 / 0,9 \cong \%42$

Find the maximum power dissipated on the transistor

$P_{Trmax} \cong P_{DC} = 0,9W$ **(Vi=0, VL=0)**

Detailed calculation; $V_{CEQ} = 9V - I_{CQ} \cdot 8\Omega = 8,2V$ $I_{CQ} = 100mA$

$P_{Trmax} = 8,2V \times 0,1A = 0,82W$ //

For the transistor, the maximum junction temperature is given as 180 oC
The maximum air temperature is 50 oC.
What should "the thermal resistance from the junction to air" be?

$R_{Th_{Total}} \leq \frac{T_J - T_A}{P_{Trmax}} = \frac{180 - 50}{0,82W} \cong 158\ ^\circ C/W$