ECE 2100 homework # 15 Due: Wed, 3/12/03

A.Stolp
3/17/02,
2/27/03

Microelectronic Circuits, 4th Ed. Ch. 4
prob. 4.2 (ans: β = 368,122,24.2), Ex. 4.1 - 4.7

Assume thermal voltage: $V_T = 25mV$

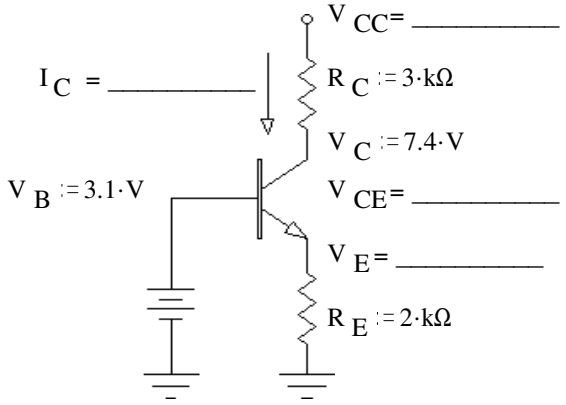
Note for Fig. 4.8: i_B should flow out of transistor.

ECE 2100 homework # 16 Due: Fri, 3/14/03 Name:_____

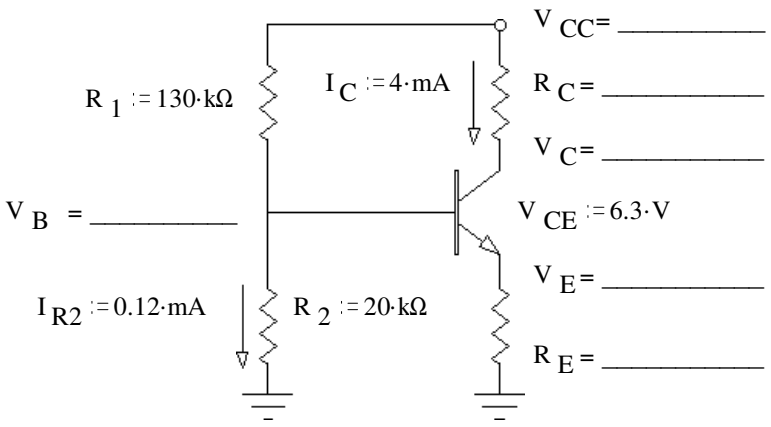
On separate paper, do: Microelectronic Circuits, 4th Ed. Ch. 4 Ex. 4.8 - 4.9, prob. 4.21, 4.22 (ans: 28k, 28.3k)

1. Fill in the blanks in the circuit below. You may neglect the base bias current (I_B).

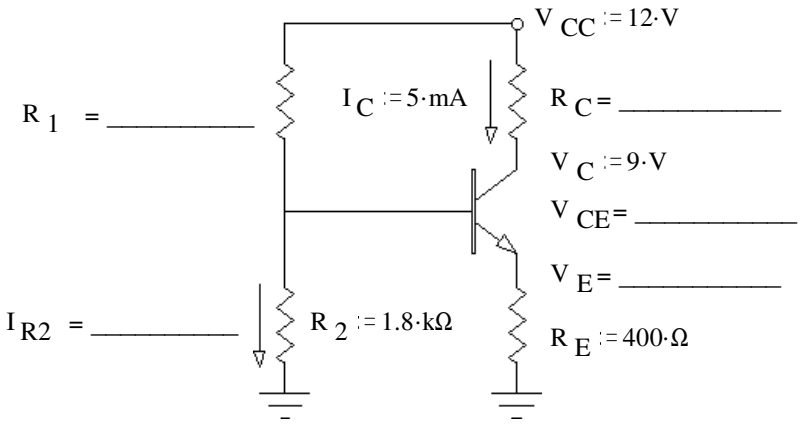
a)



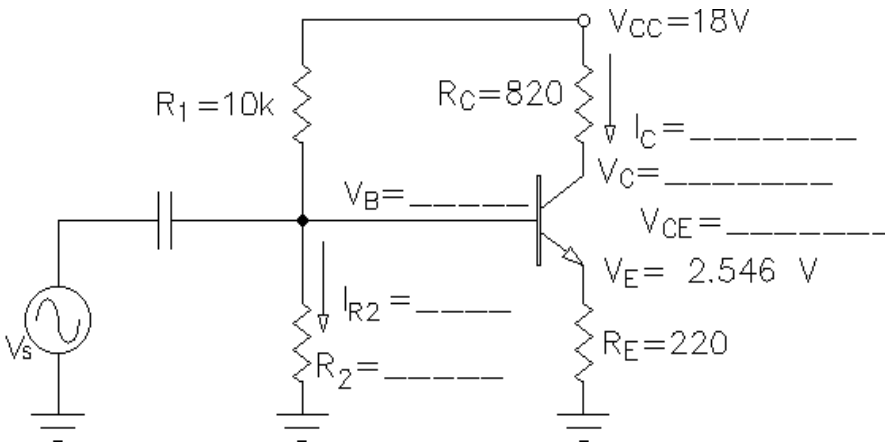
b)



c)



2. a) Fill in the blanks in the circuit. Neglect I_B.



Note: You'll probably want to add a sheet of paper in order to work out the rest of this problem.

b) Is the transistor operating in the active region? Show your evidence. Yes No

c) If $\beta = 150$, how big is that I_B that we neglected?

d) Compare this value to I_{R2}. Was it reasonable to neglect I_B? (is I_B < 10% of I_{R2})

e) If we actually built this circuit, what effect would the actual I_B have on I_C? That is would I_C be lower, higher or the same as you found earlier? Hint: would V_B be higher or lower? Would V_E be higher or lower? Would I_E be higher or lower?

IC would be: lower higher same
(circle one)

f) Considering only I_C and V_{CE}, how much power does this transistor dissipate or contribute?

g) Does it dissipate or contribute power? dissipate contribute (circle one)

h) If the v_s signal were applied at the base, an AC signal would also appear at the collector. How much larger would it be. (Voltage gain).

Answers

1 a) V_E = 2.4 V, V_{CE} = 5 V, I_C = 1.2 mA, and V_{CC} = 11 V b) V_B = 2.4 V, V_{CC} = 18 V, V_E = 1.7 V, R_E = 425, V_C = 8 V, R_C = 2.5 k c) V_E = 2.0 V, V_{CE} = 7 V, R_C = 600 , and V_B = 2.7 V, I_{R2} = 1.5 mA, R_1 = 6.2 k

2. a) $I_E := 11.57 \cdot mA$ $V_C := 8.51 \cdot V$ $V_{CE} := 5.96 \cdot V$ $V_B := 3.246 \cdot V$ $I_{R2} := 1.475 \cdot mA$ $R_2 := 2.2 \cdot k\Omega$

b) Yes, V_{CE} > 0.2V c) $I_B := 0.077 \cdot mA$ d) OK to neglect e) lower f) $69 \cdot mW$ g) dissipate h) 3.73