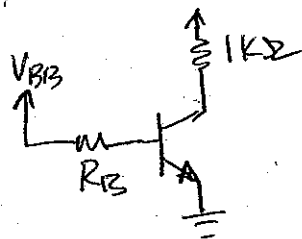
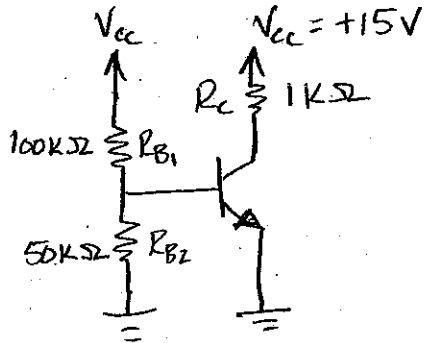


Assume that the manufacturer of the transistor in the following circuit specifies that $50 < \beta < 300$. Will the transistor be in its active mode for this range of β values? If not, what sub-range of β values will ensure that the transistor remains in its active mode? (Be sure to identify what criteria you use to determine that a BJT transistor is in active mode.)



$$V_{BB} = \frac{R_{B2}}{R_{B1} + R_{B2}} \cdot V_{cc}$$

$$= \frac{50k\Omega}{150k\Omega} \cdot 15V = 5V$$

$$R_B = R_{B1} \parallel R_{B2}$$

$$= \frac{100 \cdot 50}{150} = 33.3k\Omega$$

$$i_B = \frac{V_{BB} - V_{BE}}{R_B} = 0.129mA$$

$$i_C = \beta i_B$$

active mode when $V_{CE} > 0.2$ volts ($V_{BE} > 0.5V$)

$$V_{CE} = V_{cc} - i_C R_C = V_{cc} - \beta i_B R_C > 0.2 \text{ volts}$$

$$\beta < \frac{-0.2 + V_{cc}}{i_B R_C}$$

$$\beta < \frac{15 - 0.2V}{0.129mA \cdot 1k\Omega} = \frac{14.8V}{0.129A} = 115$$

so:

$$50 < \beta < 115$$

Should be collector-base potential