$$R_T = \frac{(6.8\ \text{k}\Omega)(15\ \text{k}\Omega)}{(6.8\ \text{k}\Omega + 15\ \text{k}\Omega)} = 4.68\ \text{k}\Omega$$

and

$$I_C = \frac{10\ \text{V} - 0.7\ \text{V} - 6.88\ \text{V}}{680 + (4.68\ \text{k}\Omega/150)} = 3.4\ \text{mA} \quad \text{using equation 5.16}$$

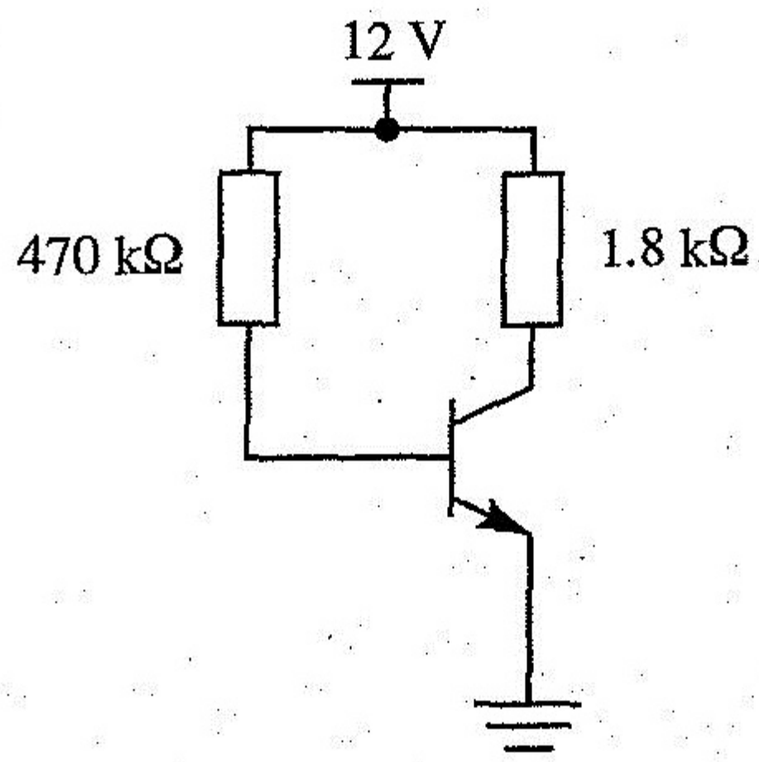
The collector–emitter voltage is obtained by applying KVL to the collector–emitter branch of the circuit. Then:

$$V_{CE} = 10\ \text{V} - (3.4\ \text{mA})(680\ \Omega + 1.8\ \text{k}\Omega) = 1.56\ \text{V}$$

PROBLEMS

5.1 For the base-bias circuit shown assume that $\beta = 150$ and $V_{BE} = 0.7$ V and determine I_C and V_{CE}.

[3.6 mA, 5.5 V]



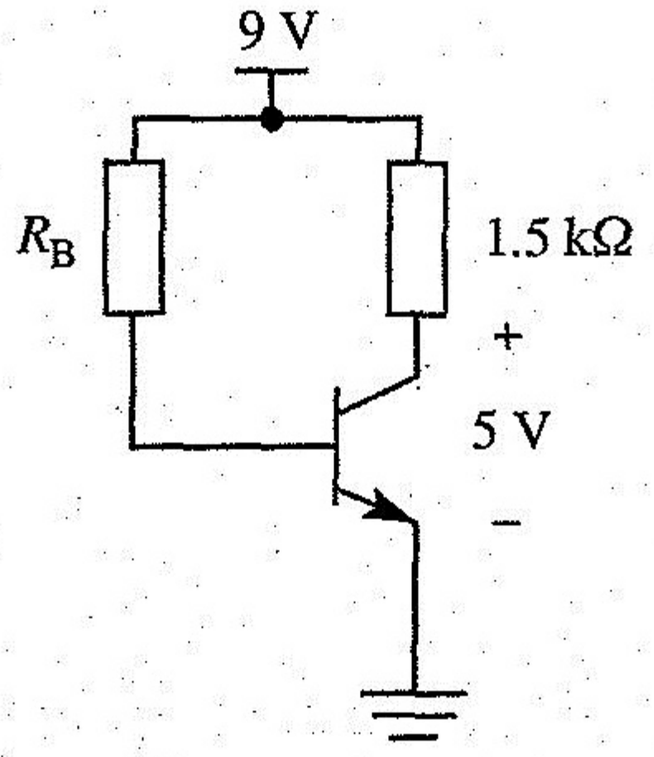
5.2 Repeat Problem 5.1 for $\beta = 350$ and comment on the result.

5.3 Determine I_C and V_{CE} for the circuit shown if $\beta = 120$ and $V_{BE} = 0.7$ V.

[2.2 mA, 3.47 V]

5.4 Determine a suitable value for R_B to provide a V_{CE} of 5 V for the circuit shown if $\beta = 180$ and $V_{BE} = 0.7$ V.

[560 kΩ]

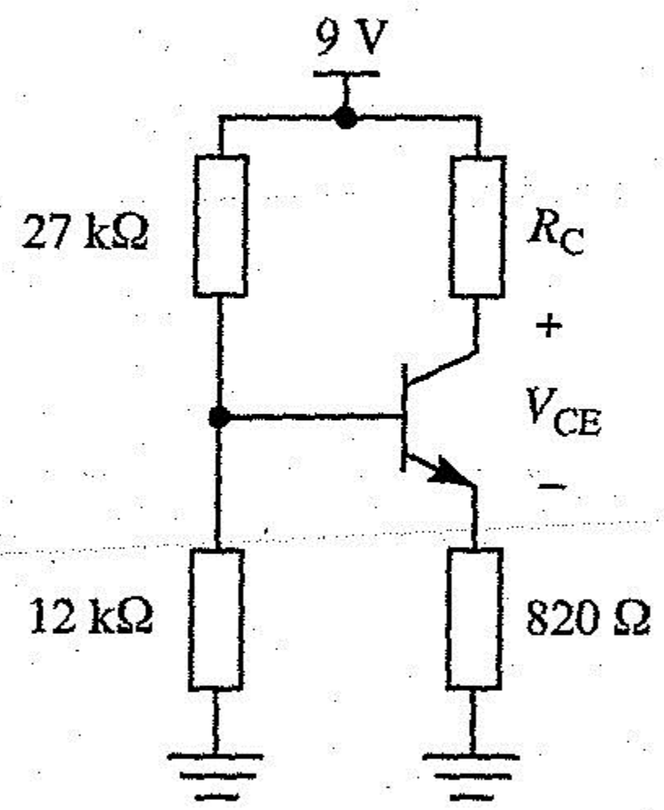


5.5 Determine I_C and V_{CE} for the circuit shown if $\beta = 200$ and $V_{BE} = 0.7$ V.

[6.4 mA, 3.4 V]

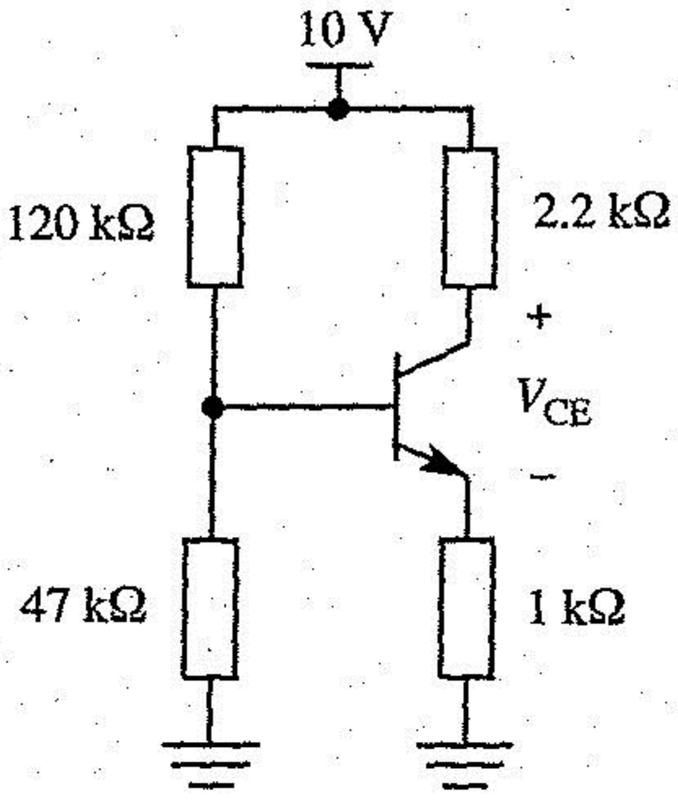
5.6 Determine the value of R_C to ensure that $V_{CE} \geq 3$ V if β varies from 80 to 240. Assume that $V_{BE} = 0.7$ V.

[1.65 kΩ]



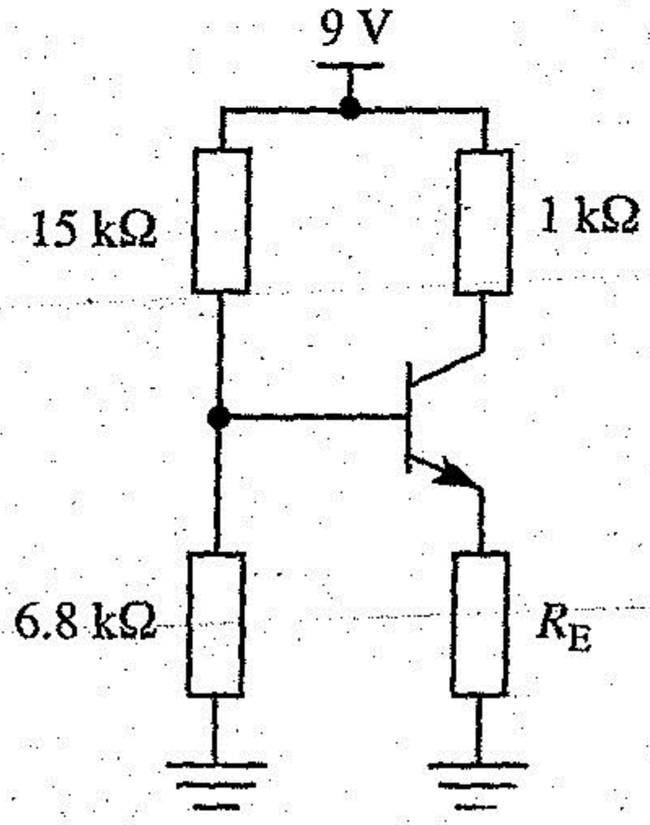
5.7 Determine the change in V_{CE} if β varies from 120 to 420. Assume that $V_{BE} = 0.7$ V.

[4.72 V to 3.76 V]



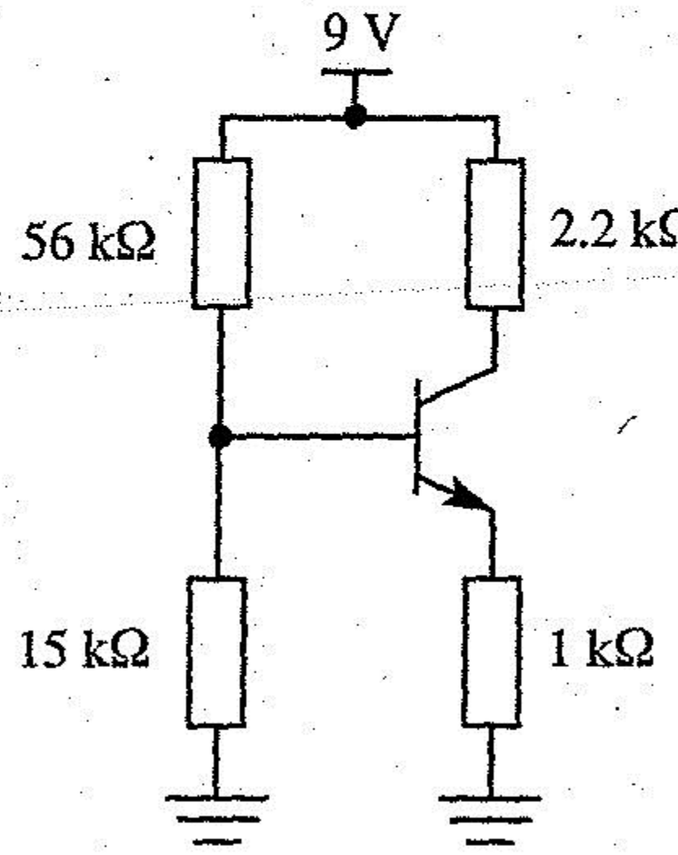
5.8 Select a suitable value for R_E to provide a collector current of 2 mA if $\beta = 150$ and $V_{BE} = 0.7$ V.

[1018 Ω]



5.9 For the circuit shown $\beta = 120$ and $V_{BE} = 0.7$ V. Verify that the collector current is 1.1 mA and determine the value of R_E which is required to provide a collector current of 2 mA.

[500 Ω]

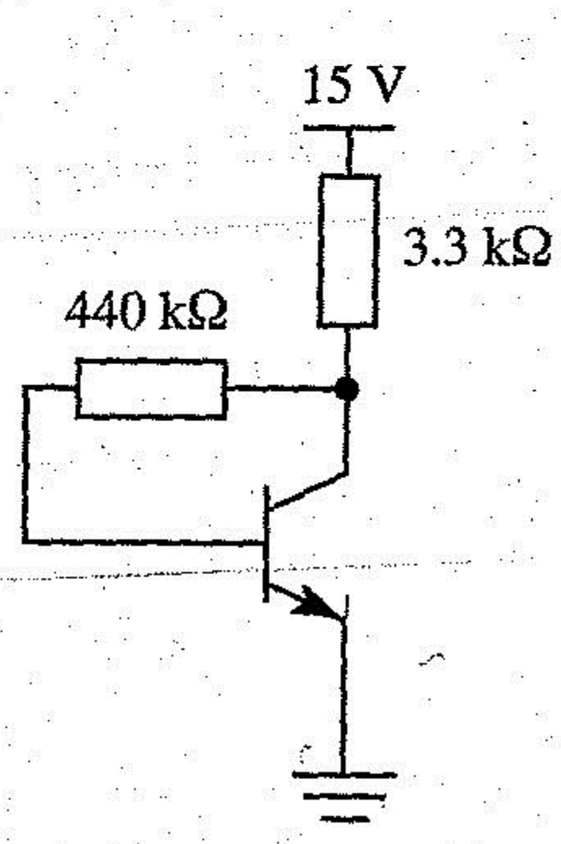


5.10 Design a base potential divider bias circuit to provide a collector current of 3 mA from a supply of 12 V for an npn transistor where the minimum and maximum values of β are specified as 120 and 320 respectively. Determine values for R_1, R_2, R_E and R_C.

[30.3 kΩ, 5.7 kΩ, 400 Ω, 1.6 kΩ]

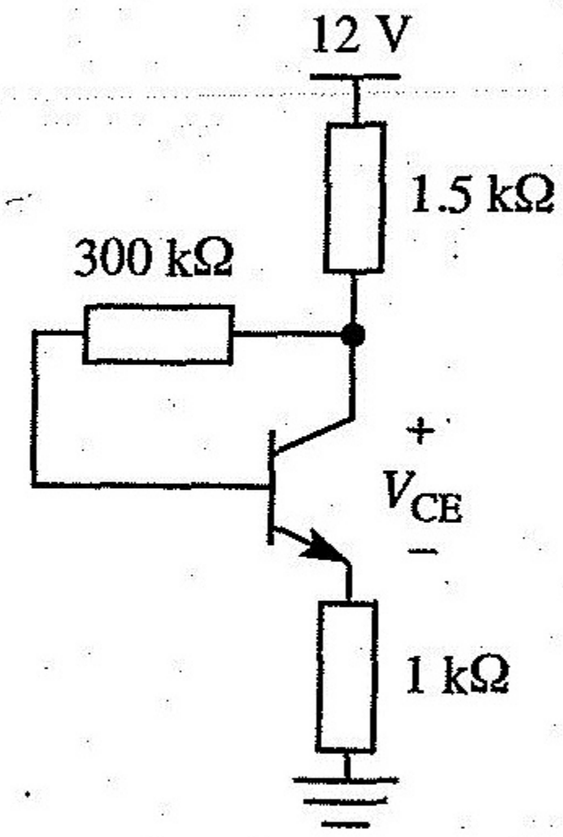
5.11 Determine I_C and V_{CE} if $\beta = 200$ and $V_{BE} = 0.7$ V for the collector-bias circuit shown.

[2.64 mA, 6.4 V]



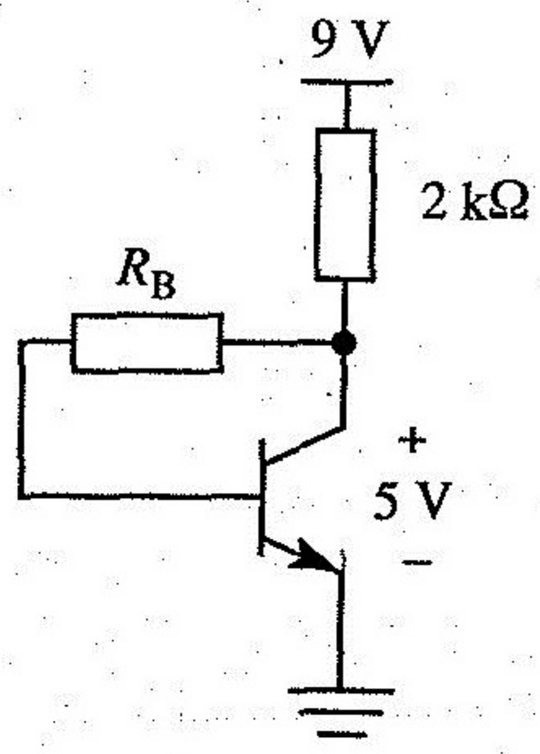
5.12 For the circuit shown determine V_{CE} for $\beta = 120$ and 350 if $V_{BE} = 0.7$ V.

[6.35 V, 3.6 V]



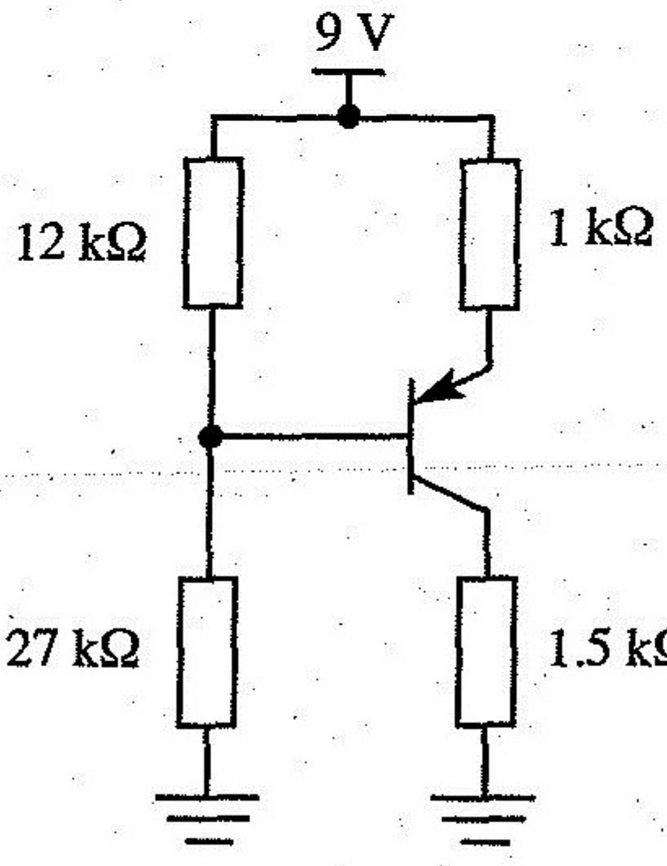
5.13 If $V_{CE} = 5$ V, $\beta = 250$ and $V_{BE} = 0.7$ V, determine R_B.

[537 kΩ]



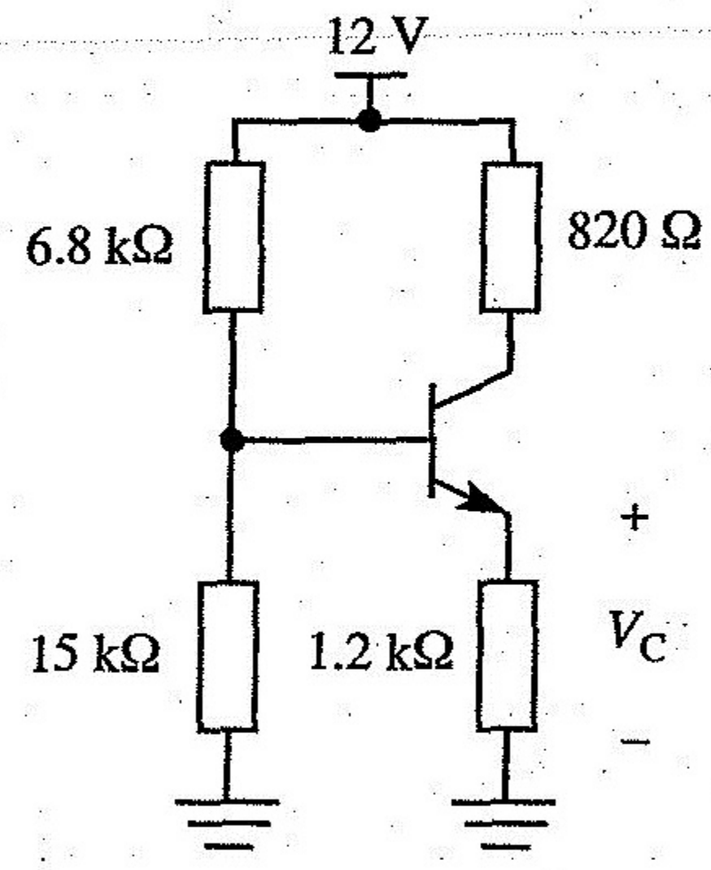
5.14 Determine the collector current for the pnp emitter-biased circuit if $\beta = 120$ and $V_{BE} = 0.7$ V.

[1.94 mA]



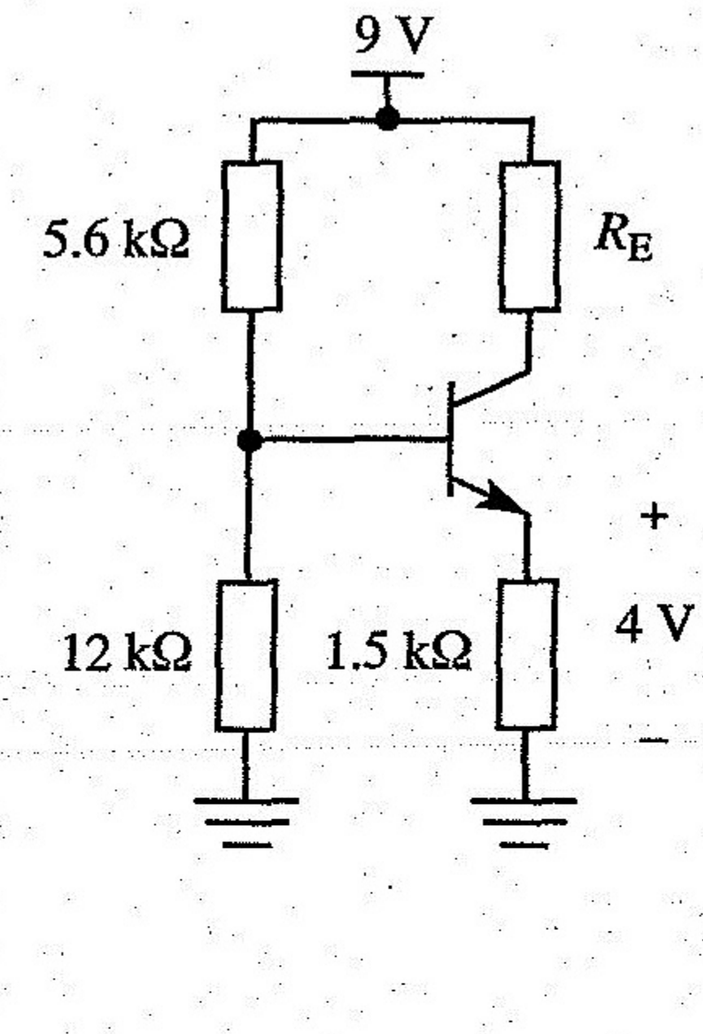
5.15 Determine V_C if $\beta = 150$ and $V_{BE} = 0.65$ V.

[4.4 V]



5.16 For the circuit shown $V_C = 4$ V. Determine the value of R_E if $\beta = 200$ and $V_{BE} = 0.7$ V.

[790 Ω]



5.17 For Problem 5.10 the nearest preferred values for the resistors are:

$R_1 = 33$ kΩ, $R_2 = 5.6$ kΩ,
$R_E = 390$ Ω and $R_C = 1.5$ kΩ

Use PSpice to observe the value of the collector current for the two extremes of β, that is 120 and 320, with $V_{CC} = 12$ V.

[2.19 mA, 2.33 mA]

5.18 Use PSpice to verify the parameters in Problems 5.3, 5.7, 5.12 and 5.15.

[P5.3 $I_C = 2.18$ mA, $V_{CE} = 3.52$ V]

[P5.7 $V_{CE} = 4.95$ V and 4.01 V]

[P5.12 $V_{CE} = 6.37$ V and 3.66 V]

[P5.15 $V_C = 4.11$ V]