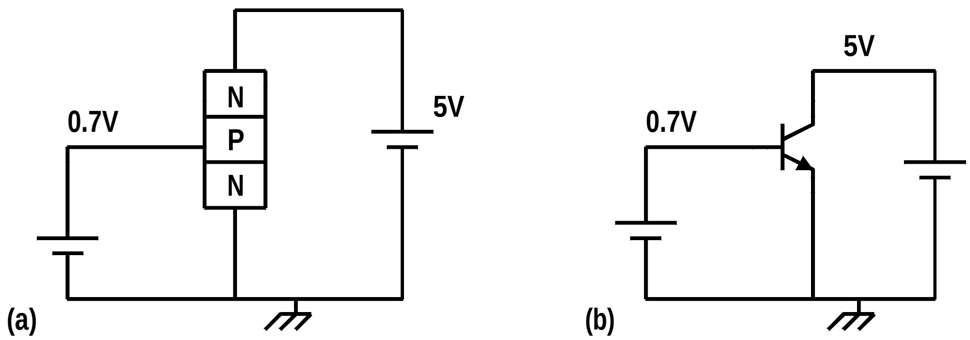


The function of a transistor bias circuit is to maintain

- a forward bias on the emitter–base junction
- a reverse bias on the base–collector junction.

In transistor bias circuits
Currents and voltages can
usually be determined by using:—

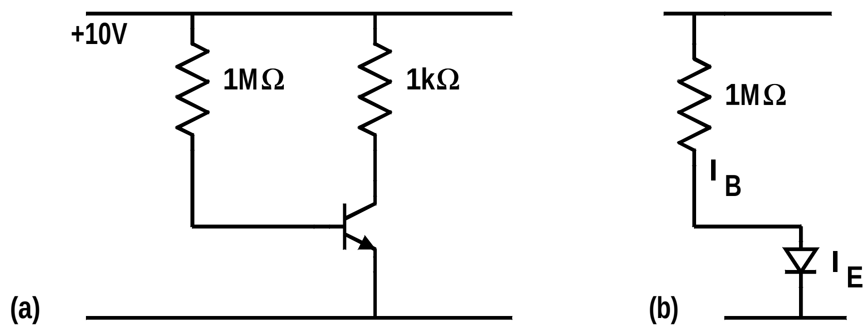
$$
\begin{aligned}
I_C &= \beta \times I_B \\
I_C &\approx I_E \\
V_{BE} &\approx 0.7
\end{aligned}
$$

The basic equation for calculatng the currents in transistor bias circuits is determined along a path such that:–

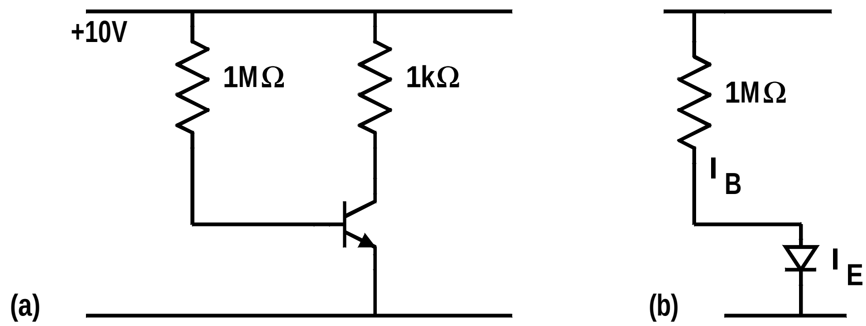
$$\text{Voltage supply} = \text{Sum of voltage drops}$$

A transistor must be biased so that
the emitter–base junction is forward biased
the base–collector junction is reverse biased.

Only a small number of circuits used to bias transistors and place the transistor in the middle of its operating range.

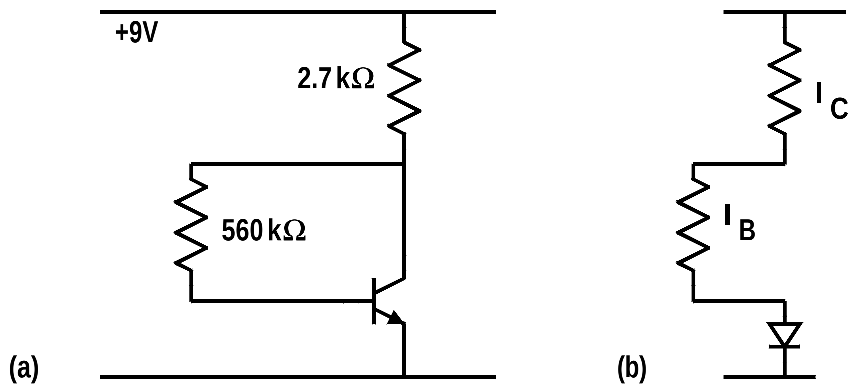


Calculate the emitter, base and collector voltages and currents for this circuit. $\beta = 250$.

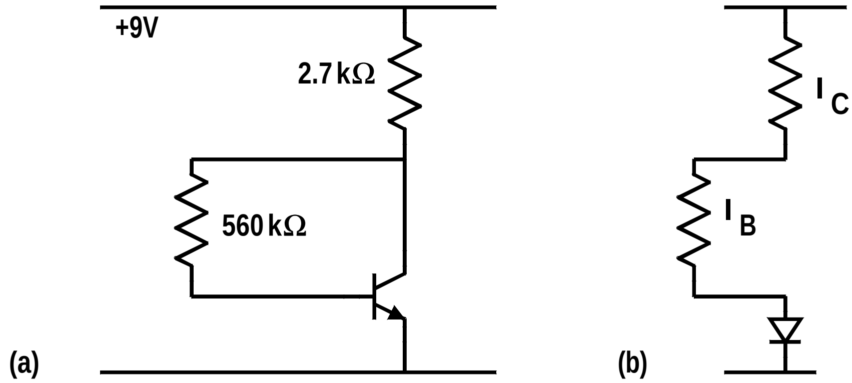


$$V_E = 0 \qquad V_B = 0.7$$

$$\begin{aligned}
\text{Basic equation } 10V &= I_B \times R_B + 0.7 \\
\text{which gives } \quad 10V &= I_B \times 10^6 + 0.7 \\
\text{and then } \quad I_B &= \frac{10 - 0.7}{10^6} = 9.3\mu A \\
I_C &= \beta \times I_B = 250 \times 9.3\mu A \\
&= 2.3mA \\
\text{This gives } \quad V_C &= 10 - I_C \times R_C \\
&= 10 - 2.3mA \times 1k\Omega \\
&= 7.7V
\end{aligned}$$

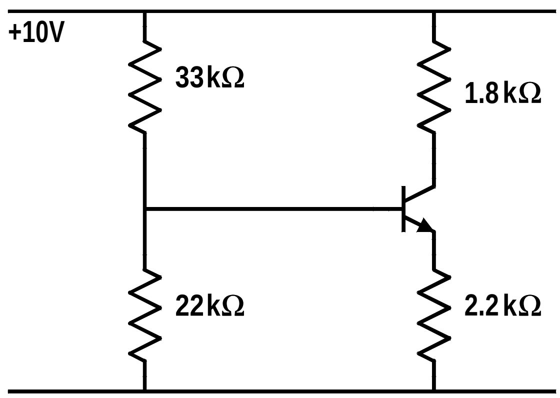


Calculate the emitter, base and collector voltages and currents for the circuit. $\beta = 300$.

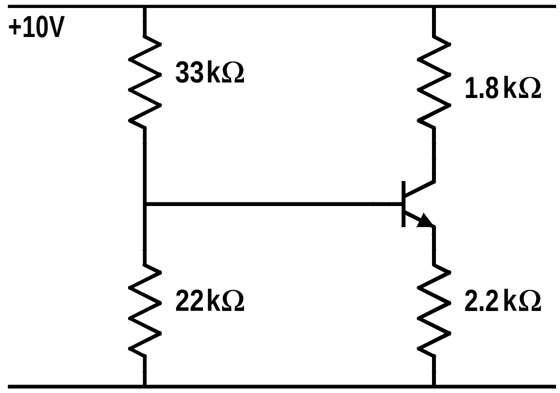


$$V_E = 0 \quad \text{and} \quad V_B = 0.7$$

$$\begin{aligned}
\text{(B.E.) } 9V &= I_C \times R_C + I_B \times R_B + 0.7 \\
\text{Use} \quad I_C &= \beta \times I_B \\
\text{to get} \quad 9 &= \beta \times I_B \times R_C + I_B \times R_B + 0.7 \\
\text{Solve } I_B &= \frac{9 - 0.7}{\beta \times R_C + R_B} \\
&= \frac{8.3}{300 \times 2.7 \times 10^3 + 560 \times 10^3} \\
&= 6.06 \mu A \\
\text{Then} \quad I_C &= \beta \times I_B = 1.82 mA \\
V_C &= 9V - 1.82 mA \times 2.7 k\Omega \\
&= 9 - 4.91 = 4.09V
\end{aligned}$$



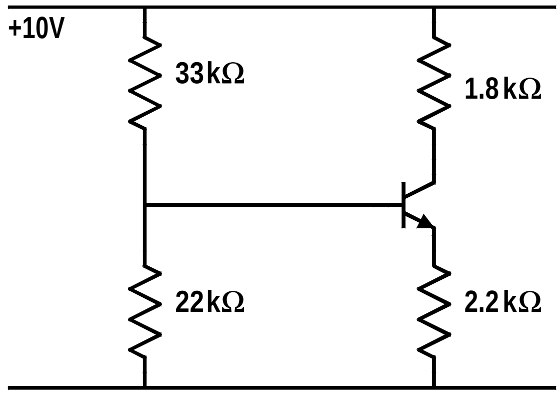
Calculate the emitter, base and collector voltages and currents for this circuit



Basic equation along a path through the potential divider
Current into base is less than 10% of divider current.

$$\text{Potential divider current} = \frac{10V}{33k\Omega + 22k\Omega} = 182\mu A$$

$$\text{Then } V_B = \frac{22}{33+22}\times 10V = 180\mu A \times 22k\Omega = 4V$$



The base–emitter voltage is 0.7V and therefore:—

$$\begin{aligned} V_E &= V_B - 0.7 = 4.0 - 0.7 = 3.3V \\ \text{Then} \quad I_E &= \frac{3.3V}{2.2k\Omega} = 1.5mA \\ I_C &= 1.5mA \\ V_C &= 10V - 1.8k\Omega \times 1.5mA \\ &= 10 - 2.7 = 7.3V \end{aligned}$$

Current gain β not used.
Good designs accomodates component tolerances.
β varies from batch to batch