Numerical Problems

1. In a certain circuit, the transistor has a collector current of 10 mA and a base current of 40μA. What is the current gain of the transistor?

Given: Collector current $I_c = 10mA = 10 \times 10^{-3}$

A Base current $I_B = 40\mu A = 40 \times 10^{-6}$ A

To Find:

Current gain β =?

Solution:

The current gain 'β' of transistor is

$$\beta = \frac{I_C}{I_B}$$

Putting Values

$$\beta = \frac{10 \times 10^{-3} A}{40 \times 10^{-6} A}$$

$$\boxed{\beta = 0.250 \times 10^{3} = 250}$$

2. The current flowing into the base of a transistor is 100μA. Find its collector current I_C its emitter current Iε, and the ratio I_c/I_E if the value of current gain β is 100.

Given:

Base current $I_B = 100\ \mu A = 100 \times 10^{-6} A$

Current gain $\beta = 100$

To Find:

Collector current I_c =?

Emitter current I_E = ?

$\frac{I_C}{I_E} = ?$

Solution:

The current gain 'β' of transistor is

$\beta = \frac{I_C}{I_E}$

$I_C = \beta I_B$

Putting values

$I_C = 100 \times 10^{-6} A$

$\boxed{I_C = 10 \times 10^{-3} A = 10 mA}$

The emitter current I_E is the sum of base current I_B and the collector current I_C.

Therefore $I_E = I_B + I_C$

putting values $I_E = 100 \times 10^{-6} A + 10 \times 10^{-3} A$

$I_E = 10.1 \times 10^{-3} A = 10.1 mA$

The ratio $\frac{I_C}{I_E}$ is

$\frac{I_C}{I_E} = \frac{10 \times 10^{-3} A}{10.1 \times 10^{-3} A}$

$\boxed{\frac{I_C}{I_E} = 0.99}$

3.A transistor is connected in CE configuration. The voltage drop across the load resistance (R_c) 3 k Ω is 6 V. Find the base current. The current gain β of the transistor is 0.97.

Given: Load resistance $R_c = 3k\Omega = 3 \times 10^3 \Omega$

Voltage drop at load $V_c = 6V$

Current gain $\beta = 0.97$

To Find: Base current I_B = ?

Solution:

The current gain β of transistor is $\beta \frac{I_C}{I_B}$ or $IB = \frac{I_C}{\beta}$ (i)

The collector current I_C can be calculated by using Ohm's law $I_C = \frac{V_C}{R_C}$

Putting values: $I_C = \frac{6V}{3\times10^{3}\Omega}$

$I_C = 2 \times 10^{-3}A$

Putting values in equation (i)

$$I_B = \frac{2\times10^{-3}A}{0.97}$$

$$\boxed{I_B = 2.06 \times 10^{-3}A}$$