

Questions & Answers

CBSE > Physics > Grade 12 > Current Gains



The relationship between current gain α in Common Base

CB mode and current gain β in Common Emitter CE mode is

A. $\beta = \alpha + 1$

B. $\beta = \frac{\alpha}{1 - \alpha}$

C. $\beta = \frac{\alpha}{1 + \alpha}$

D. $\beta = 1 - \alpha$

Answer ✓ Verified

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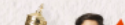


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Hint: Use the formulae for the current gain in Common Base mode and current gain in Common Emitter mode. Also use the relation between the emitter current, collector current and base current. Substitute the values of the current gains in Common Base mode and Common Emitter mode in this relation and solve it.

Formulae used:

The current gain α in Common Base CB mode is given by

$$\alpha = \frac{I_c}{I_e} \dots\dots (1)$$

Here, I_c is the current from the collector and I_e is the current from emitter.

The current gain β in Common Emitter CE mode is given by

$$\beta = \frac{I_c}{I_b} \dots\dots (2)$$

Here, I_c is the current from the collector and I_b is the current from base.

Complete step by step answer:

We have asked to determine the relationship between the current gain α



in Common Base CB mode and the current gain β in Common Emitter

CE mode. From equation (1). We can write

$$\frac{1}{\alpha} = \frac{I_e}{I_c}$$

From equation (2). We can write

$$\frac{1}{\beta} = \frac{I_b}{I_c}$$

We know that in a transistor the sum of the current from the collector and the current from base is equal to the current from the emitter.

$$I_e = I_c + I_b$$

Multiply both sides of the above equation by the collector current I_c .

$$\frac{I_e}{I_c} = 1 + \frac{I_b}{I_c}$$

Substitute $\frac{1}{\alpha}$ for $\frac{I_e}{I_c}$ and $\frac{1}{\beta}$ for $\frac{I_b}{I_c}$ in the above equation.

$$\begin{aligned}\frac{1}{\alpha} &= 1 + \frac{1}{\beta} \\ \Rightarrow \frac{1}{\beta} &= \frac{1}{\alpha} - 1 \\ \Rightarrow \frac{1}{\beta} &= \frac{1 - \alpha}{\alpha}\end{aligned}$$

$$\therefore \beta = \frac{\alpha}{1 - \alpha}$$

Therefore, the relationship between the current gain α in Common Base

CB mode and the current gain β in Common Emitter CE mode is

$$\beta = \frac{\alpha}{1 - \alpha}.$$

Hence, the correct option is B.

Note: The students should be careful while using the formulae for the current gain in Common Base mode and Common Emitter mode. If the ratio of the currents in these formulae is taken incorrectly then we will also end with the incorrect relation between the current gain in Common Base and Common Emitter mode.

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Related Questions

The base current in a transistor circuit changes from $45\mu A$ to $140\mu A$.

Accordingly, the collector current changes from $0.2mA$ to $4.00mA$. The gain in current is:

- A) 9.5
 - B) 1
 - C) 40
 - D) 20
-

In a transistor amplifier $\beta = 62, R_L = 5000\Omega$ and internal resistance of the transistor is 500Ω . Its power amplification will be

- A) 25580
- B) 33760
- C) 38440
- D) 55760

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