Example 5.1 A bipolar transistor with an emitter current of 1 mA has an emitter efficiency of 0.99, a base transport factor of 0.995 and a depletion layer recombination factor of 0.998. Calculate the base current, the collector current, the transport factor and the current gain of the transistor.

Solution The transport factor and current gain are:

$$a = g_E a_T d_r = 0.99 \times 0.995 \times 0.998 = 0.983$$

and

$$b = \frac{a}{1-a} = 58.1$$

The collector current then equals

$$I_C = a\ I_E = 0.983\ \text{mA}$$

And the base current is obtained from:

$$I_B = I_E - I_C = 17\ \mu\text{A}$$