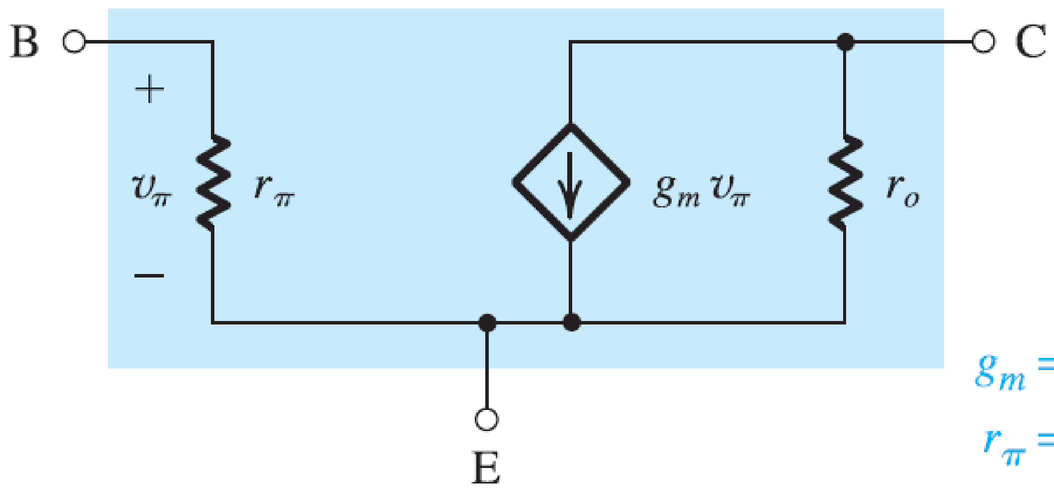
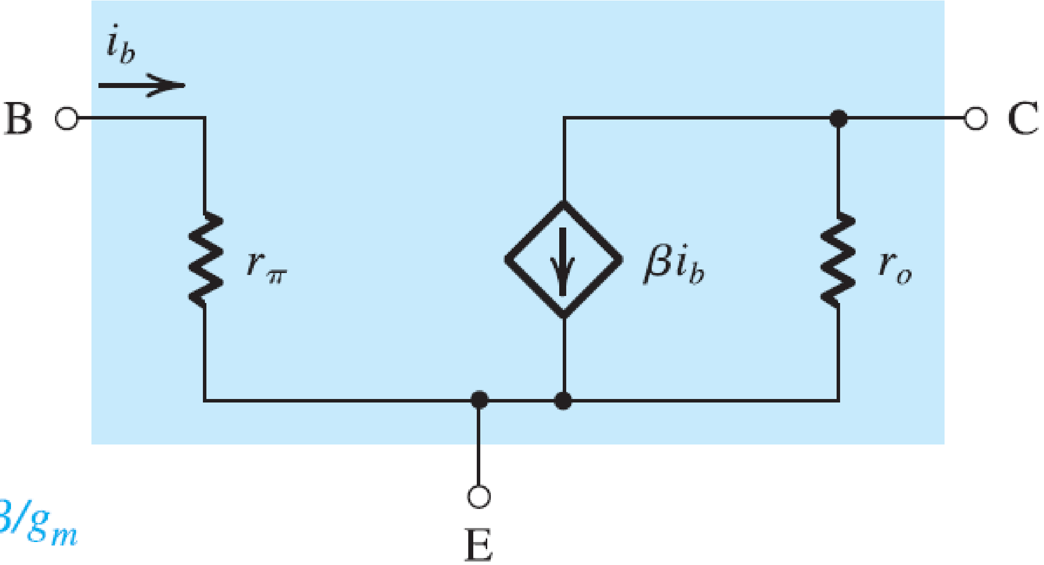
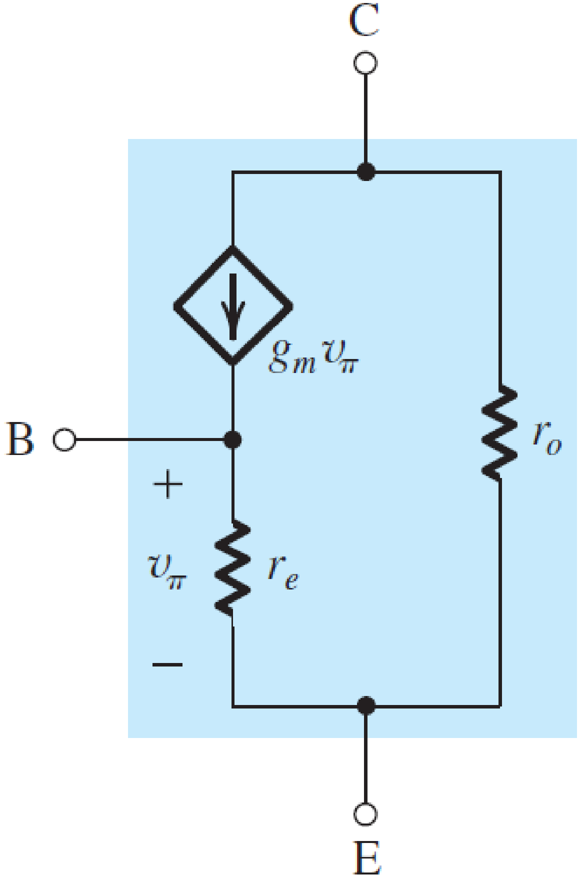
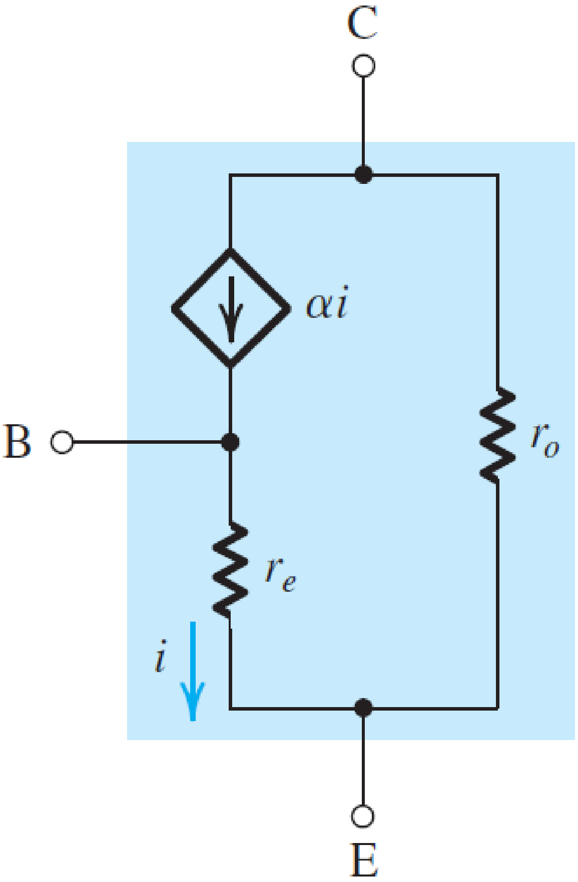
7.43 A BJT is biased to operate in the active mode at a dc collector current of 1 mA. It has a β of 100 and V_A of 100 V. Give the four small-signal models (Figs. 7.25 and 7.27) of the BJT complete with the values of their parameters.


B
C
E
+
v_π
−
r_π
$g_m v_\pi$
r_o
$g_m =$
$r_\pi =$



β/g_m


C
$g_m v_\pi$
B
r_o
+
v_π
r_e
−
E


C
αi
B
r_o
r_e
i
E

***7.58** The transistor in the circuit shown in Fig. P7.58 is biased to operate in the active mode. Assuming that β is very large, find the collector bias current I_C. Replace the transistor with the small-signal equivalent-circuit model of Fig. 7.26(b) (remember to replace the dc power supply with a short circuit). Analyze the resulting amplifier equivalent circuit to show that

$$\frac{v_{o1}}{v_i} = \frac{R_E}{R_E + r_e}$$

$$\frac{v_{o2}}{v_i} = \frac{-\alpha R_C}{R_E + r_e}$$

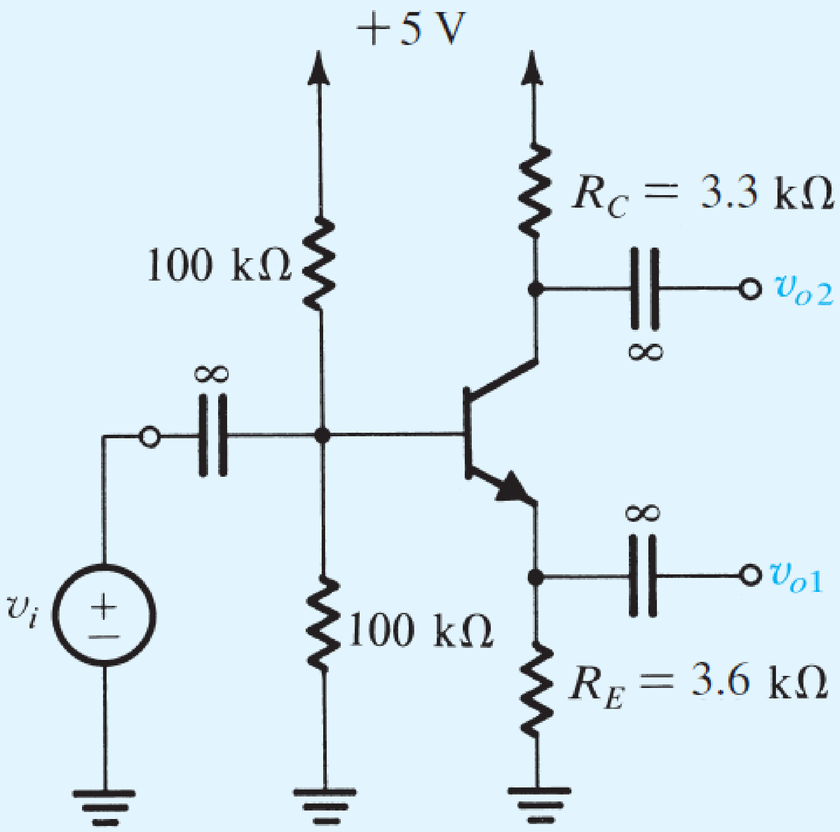


Figure P7.58

Find the values of these voltage gains (for $\alpha \simeq 1$). Now, if the terminal labeled v_{o1} is connected to ground, what does the voltage gain v_{o2}/v_i become?

10.21 Measurement of h_{fe} of an *npn* transistor at 50 MHz shows that $|h_{fe}| = 10$ at $I_C = 0.2$ mA and 12 at $I_C = 1.0$ mA. Furthermore, C_μ was measured and found to be 0.1 pF. Find f_T at each of the two collector currents used. What must τ_F and C_{je} be?

10.22 A particular small-geometry BJT has f_T of 10 GHz and $C_\mu = 0.1$ pF when operated at $I_C = 1.0$ mA. What is C_π in this situation? Also, find g_m. For $\beta = 120$, find r_π and f_β.

***10.25** Complete the table entries on the previous page for transistors (a) through (g), under the conditions indicated. Neglect r_x.

Transistor	I_E(mA)	r_e(Ω)	g_m(mA/V)	r_π (kΩ)	β_0	f_T (MHz)	C_μ (pF)	C_π (pF)	f_β (MHz)
(a)	2				100	500	2		
(b)		25					2	10.7	4
(c)				2.5	100	500		10.7	
(d)	10				100	500	2		
(e)	0.1				100	150	2		
(f)	1				10	500	2		
(g)						800	1	9	80