Electronic Circuits – Assignment 05

BJT Transistor

#	Student ID	Student Name	Grade (10)
-			

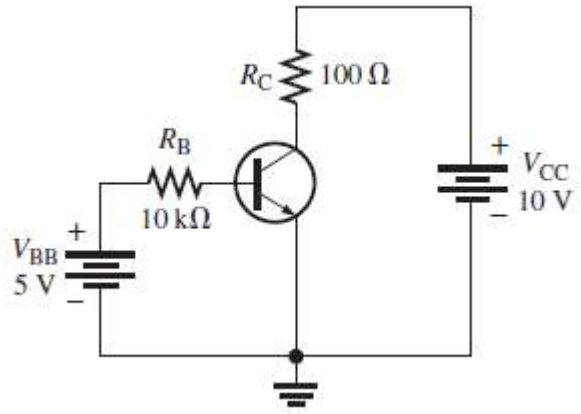
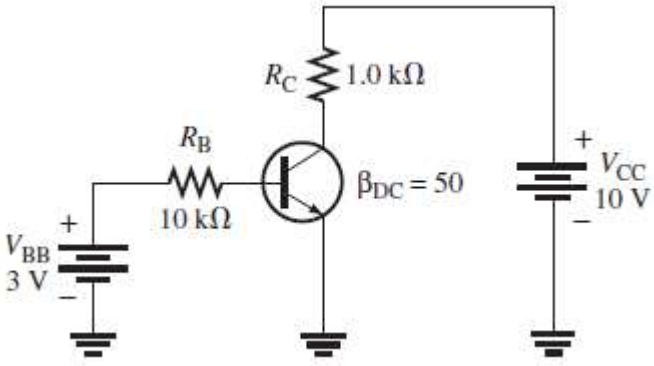
Delivery Date	

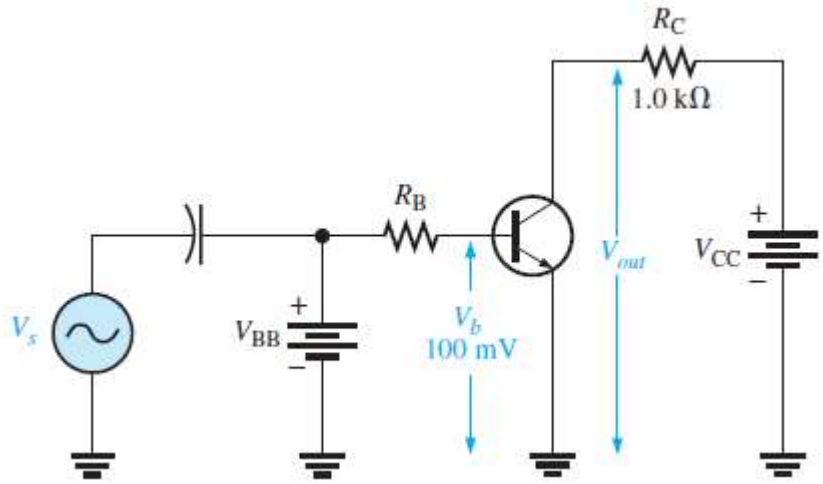
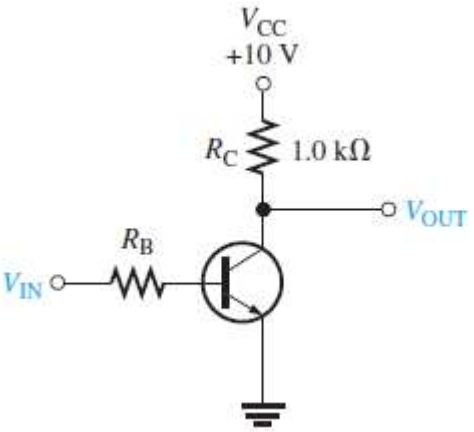
١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير
٢. يتم التسليم لمعيد المقرر مباشرة
٣. تتم أجابه التمرين في نفس ورق الأسئلة

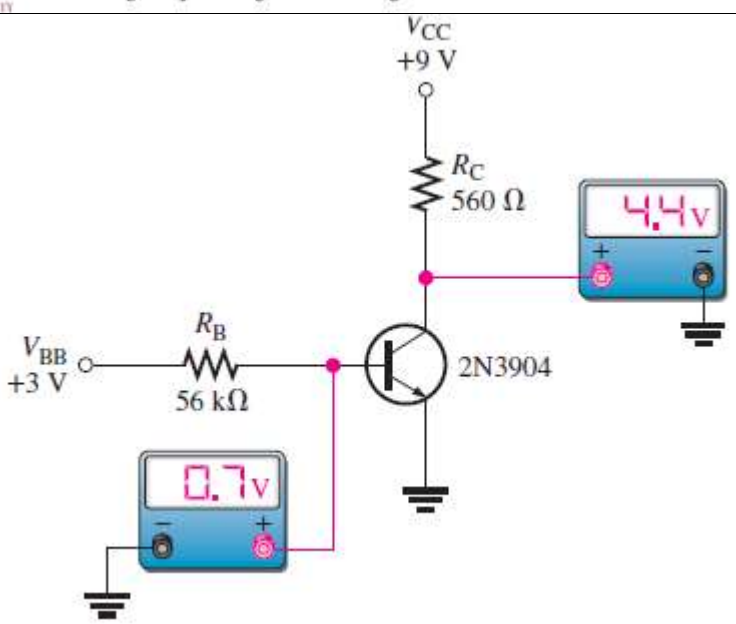
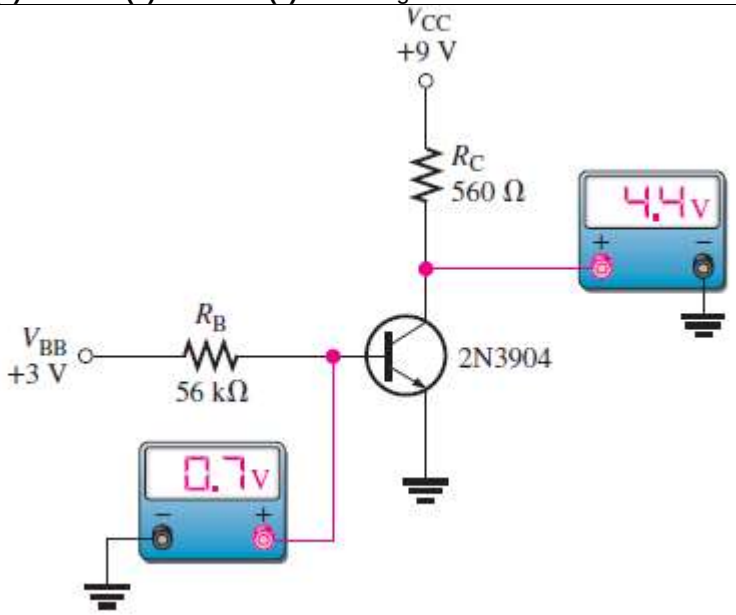
T & F

#	TRUE/FALSE QUIZ	
1	The three regions of a BJT are base, emitter, and cathode.	
2	Two types of BJT are npn and pnp.	
3	The dc voltage gain of a transistor is designated bDC.	
4	When a transistor is saturated, the collector current is maximum.	
5	Voltage gain of a transistor amplifier depends on the collector resistor and the internal acresistance.	
6	A transistor in cutoff acts as an open switch.	

MCQ1

#	MCQ 1	
1	 If a transistor with a higher β_{DC} is used in Figure, the emitter current will **(a)** increase **(b)** decrease **(c)** not change	
2	 If V_{BB} is reduced in Figure, the collector current will **(a)** increase **(b)** decrease **(c)** not change	

3	 If the amplitude of *Vin* in Figure is decreased, the ac output voltage amplitude will **(a)** increase **(b)** decrease **(c)** not change	
4	 *R*C in Figure is reduced in value, the value of *I*C(sat) will **(a)** increase **(b)** decrease **(c)** not change	

5	 If the transistor in Figure is open from collector to emitter, the collector voltage will **(a)** increase **(b)** decrease **(c)** not change	
6	 If the emitter in Figure becomes disconnected from ground, the collector voltage will **(a)** increase **(b)** decrease **(c)** not change	

MCQ 2

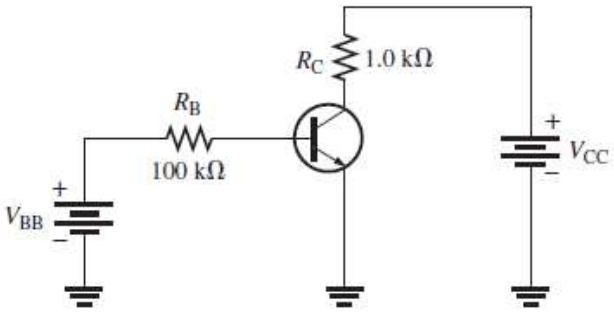
#	MCQ 2	
1	In a *pnp* transistor, the *p* regions are **(a)** base and emitter **(b)** base and collector **(c)** emitter and collector	
2	The emitter current is always **(a)** greater than the base current **(b)** less than the collector current **(c)** greater than the collector current **(d)** answers (a) and (c)	
3	If I_C is 50 times larger than I_B, then is βdc **(a)** 0.02 **(b)** 100 **(c)** 50 **(d)** 500	
4	The bias condition for a transistor to be used as a linear amplifier is called **(a)** forward-reverse **(b)** forward-forward **(c)** reverse-reverse **(d)** collector bias	
5	When a lowercase is used in relation to a transistor, it refers to **(a)** a low resistance **(b)** a wire resistance **(c)** an internal ac resistance **(d)** a source resistance	
6	When operated in cutoff and saturation, the transistor acts like a **(a)** linear amplifier **(b)** switch **(c)** variable capacitor **(d)** variable resistor	
7	In saturation, V_{CE} is **(a)** 0.7 V **(b)** equal to V_{CC} **(c)** minimum **(d)** maximum	
8	Once in saturation, a further increase in base current will **(a)** cause the collector current to increase **(b)** not affect the collector current **(c)** cause the collector current to decrease **(d)** turn the transistor off	
9	The relationship between the collector current and a light-generated base current is (a) $I_C = \beta_{DC} I_\lambda$ (b) $I_C = \alpha_{DC} I_\lambda$ (c) $I_C = \lambda I_\lambda$ (d) $I_C = \beta_{DC}^2 I_\lambda$	
10	In a transistor amplifier, if the base-emitter junction is open, the collector voltage is **(a)** V_{CC} **(b)** 0 V **(c)** floating **(d)** 0.2 V	

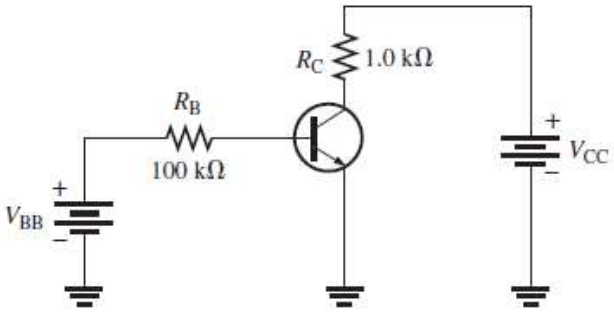
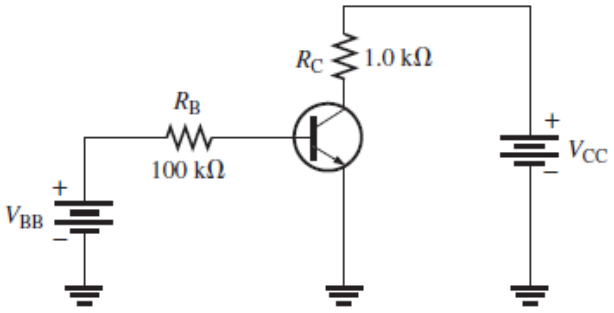
Problems

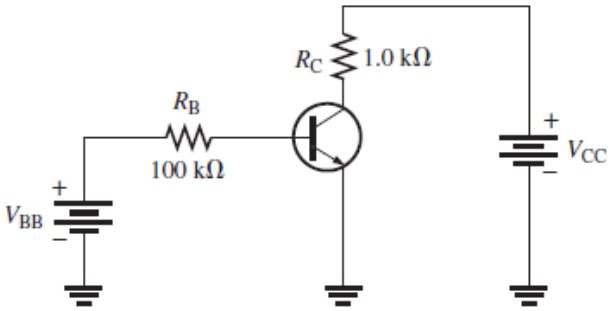
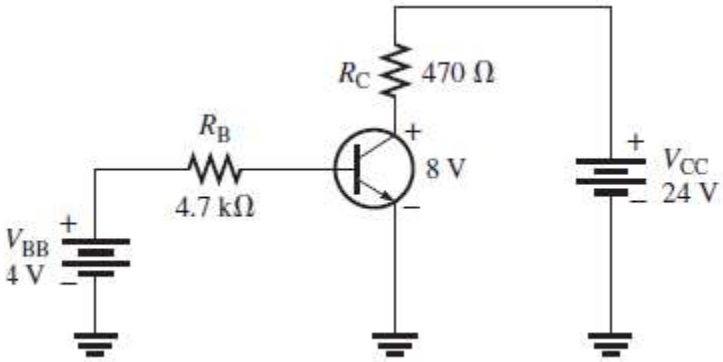
Q1	What are the majority carriers in the base region of an *npn* transistor called?
Sol 1	…… …… …… ……
Q2	Explain the purpose of a thin, lightly doped base region.
Sol 2	…… …… …… …… ……

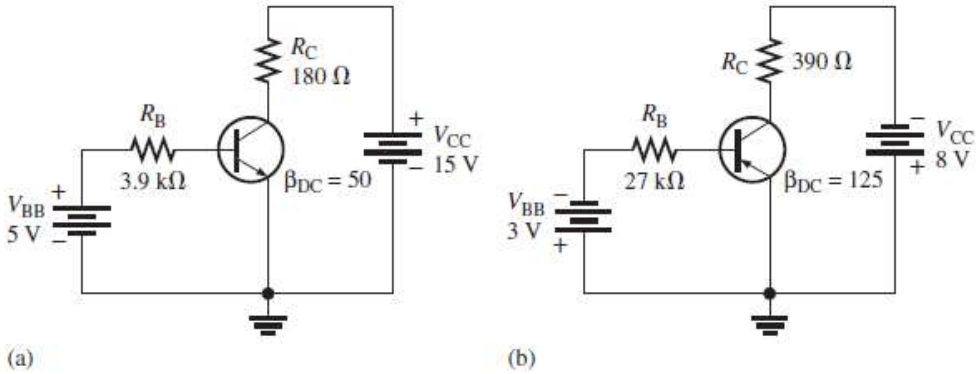
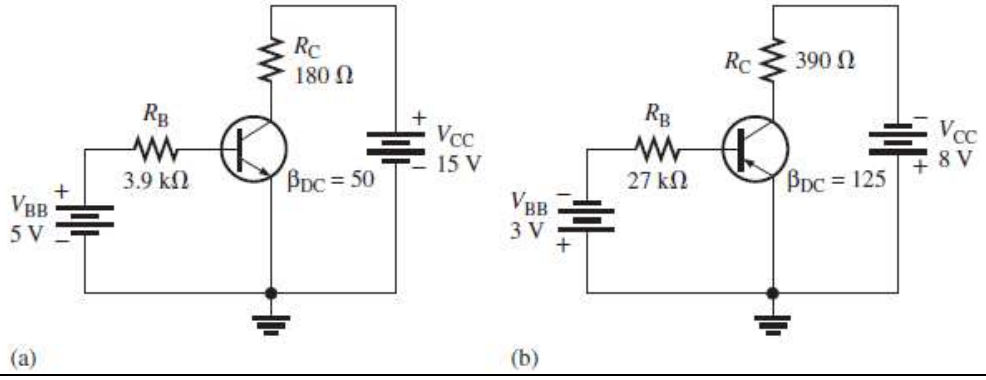
Q3	Why is the base current in a transistor so much less than the collector current?
Sol 3	…… …… …… …… …… …… ……
Q4	In a certain transistor circuit, the base current is 2 percent of the 30 mA emitter current. Determine the collector current
Sol 4	…… …… …… ……
Q5	For normal operation of a *pnp* transistor, the base must be (+ or −) with respect to the emitter, and (+ or −) with respect to the collector.
Sol 5	…… …… …… …… …… ……
Q6	What is the value of I_C for $I_E = 5.34$ mA and $I_B = 475\ \mu$A?
Sol 6	…… …… …… …… ……

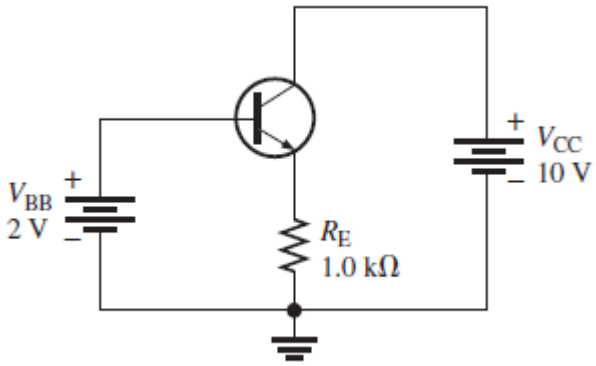
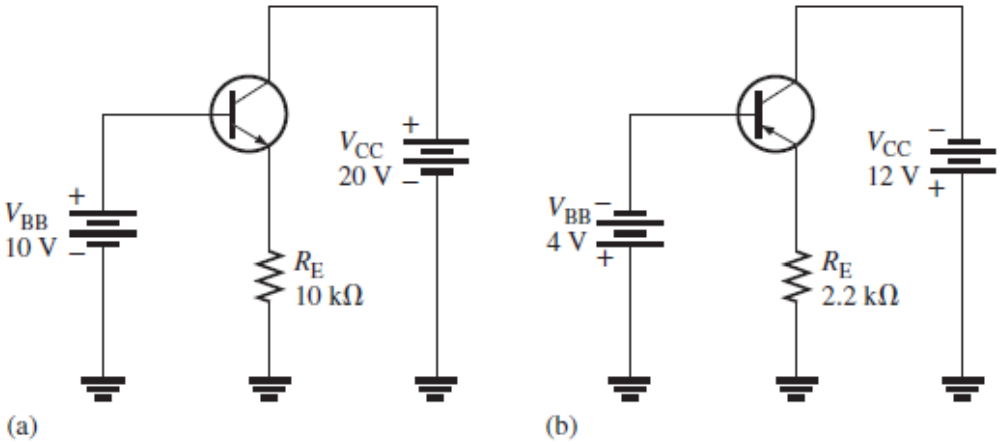
Q7	What is the α_{DC} when $I_C = 8.23$ mA and $I_E = 8.69$ mA?
Sol 7	…… …… …… ……
Q8	A certain transistor has an $I_C = 25$ mA and an $I_B = 200\ \mu$A. Determine the β_{DC}.
Sol 8	…… …… …… ……
Q9	What is the β_{DC} of a transistor if $I_C = 20.3$ mA and $I_E = 20.5$ mA?
Sol 9	…… …… …… …… …… …… …… …… …… …… …… …… …… …… …… ……

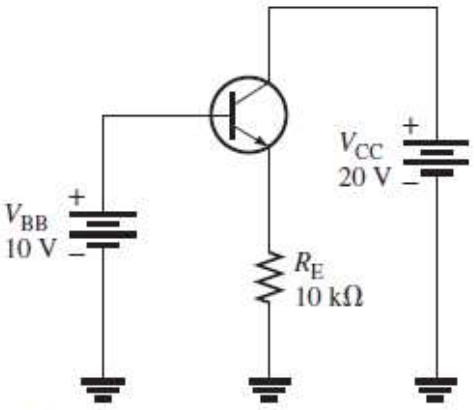
Q10	What is the α_{DC} if $I_C = 5.35$ mA and $I_B = 50\ \mu$A?
Sol 10	…… …… …… ……
Q11	A certain transistor exhibits an α_{DC} of 0.96. Determine I_C when $I_E = 9.35$ mA.
Sol 11	…… …… …… …… ……
Q12	A base current of 50 μA is applied to the transistor in Figure 4–53, and a voltage of 5 V is dropped across R_C. Determine the β_{DC} of the transistor. GURE 4–53 
Sol 12	…… …… …… …… …… …… ……

Q13	Calculate α_{DC} for the transistor in A base current of 50 μA is applied to the transistor in Figure 4–53, and a voltage of 5 V is dropped across R_C. Determine the β_{DC} of the transistor. GURE 4–53 
Sol 13	…… …… …… ……
Q14	Assume that the transistor in the circuit of Figure 4–53 is replaced with one having a β_{dc} of 200. Determine I_B, I_C, I_E, and V_{CE} given that V_{CC} = 10 V and V_{BB} = 3 V. GURE 4–53 
Sol 14	…… …… …… …… …… …… ……

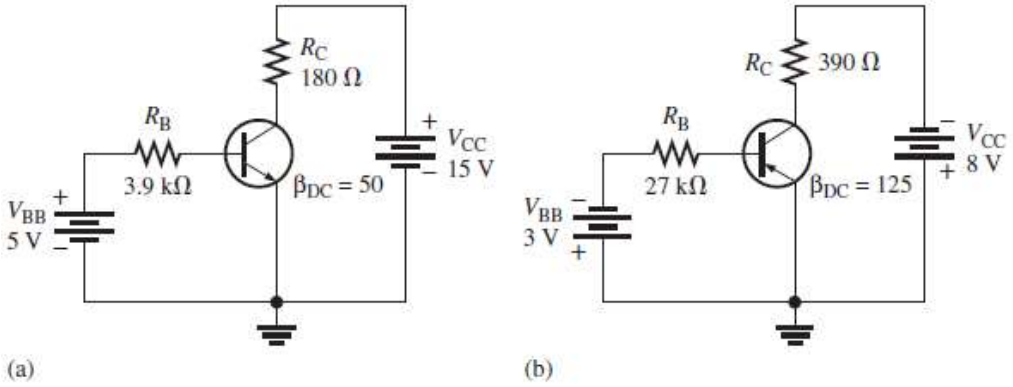
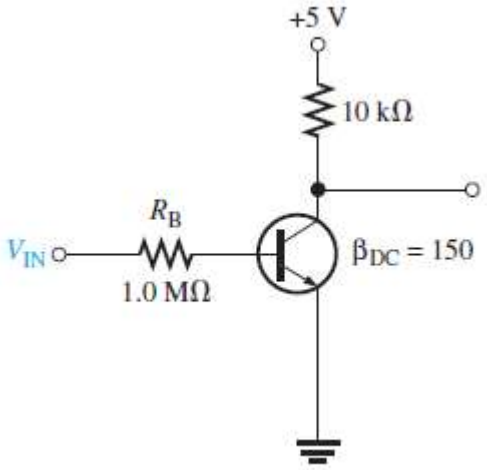
Q15	If V_{CC} is increased to 15 V in Figure 4–53, how much do the currents and V_{CE} change? GURE 4–53 
Sol 15	…… …… …… ……
Q16	Determine each current in Figure 4–54. What is the β_{DC}? 
Sol 16	…… …… …… …… …… …… …… ……

Q17	Find V_{CE}, V_{BE}, and V_{CB} in both circuits of Figure 4–55. 
Sol 17	…… …… …… ……
Q18	Determine whether or not the transistors in Figure 4–55 are saturated. 
Sol 18	…… …… …… …… …… …… ……

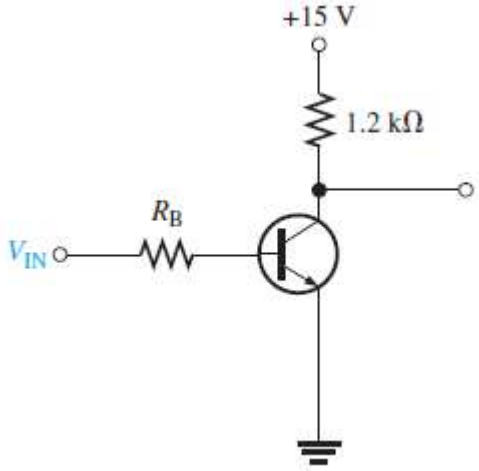
19	Find I_B, I_E, and I_C in Figure 4–56. $\alpha_{DC} = 0.98$. 
19	…… …… …… ……
20	Determine the terminal voltages of each transistor with respect to ground for each circuit in Figure 4–57. Also determine V_{CE}, V_{BE}, and V_{CB}. 
20	…… …… …… ……

21	If the β_{DC} in Figure 4–57(a) changes from 100 to 150 due to a temperature increase, the change in collector current?  (a)
21	…… …… …… ……
22	A certain transistor is to be operated at a collector current of 50 mA. How high can V_{CE} go without exceeding a $P_{D(max)}$ of 1.2 W?
22	…… …… …… ……
23	The power dissipation derating factor for a certain transistor is 1 mW/° C. The $P_{D(max)}$ is 0.5 W at 25° C. What is $P_{D(max)}$ at 100° C?
23	…… …… …… …… …… …… …… ……

24	A transistor amplifier has a voltage gain of 50. What is the output voltage when the input voltage is 100 mV?
24	…… …… …… ……
25	To achieve an output of 10 V with an input of 300 mV, what voltage gain is required?
25	…… …… …… ……
26	A 50 mV signal is applied to the base of a properly biased transistor with $r'_e = 10\ \Omega$ and $R_C = 560\ \Omega$. Determine the signal voltage at the collector.
	…… …… …… ……
27	Determine the value of the collector resistor in an *npn* transistor amplifier with $\beta_{DC} = 250$, $V_{BB} = 2.5$ V, $V_{CC} = 9$ V, $V_{CE} = 4$ V, and $R_B = 100\ k\Omega$.
	…… …… …… …… …… …… …… …… …… ……

28	What is the dc current gain of each circuit in Figure 4–55? 
	…… …… …… ……
29	Determine $I_{C(sat)}$ for the transistor in Figure 4–58. What is the value of I_B necessary to produce saturation? What minimum value of V_{IN} is necessary for saturation? Assume $V_{CE(sat)} = 0$ V. 
	…… …… …… ……

30 The transistor in Figure 4–59 has a β_{DC} of 50. Determine the value of R_B required to ensure saturation when V_{IN} is 5 V. What must V_{IN} be to cut off the transistor? Assume $V_{CE(sat)} = 0$ V.



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31 A certain phototransistor in a circuit has a $\beta_{DC} = 200$. If $I_\lambda = 100\ \mu$A, what is the collector current?

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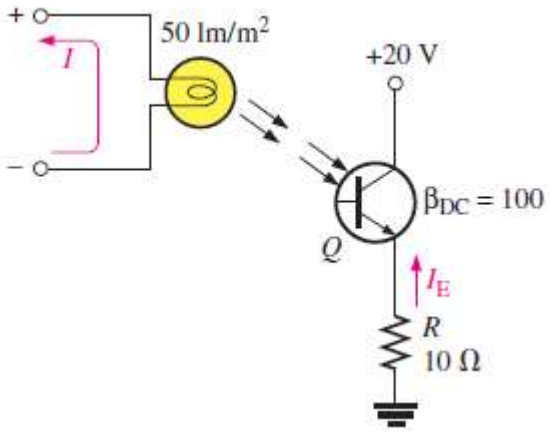
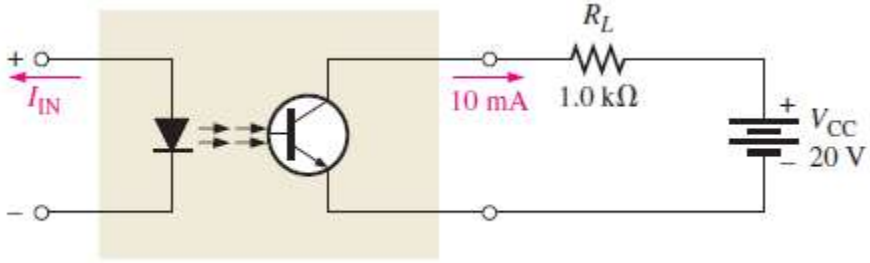
32	Determine the emitter current in the phototransistor circuit in Figure 4–60 if, for each lm/m^2 of light intensity, 1 μA of base current is produced in the phototransistor. 
	…… …… …… ……
33	A particular optical coupler has a current transfer ratio of 30 percent. If the input current is 100 mA, what is the output current?
	…… …… …… ……
34	The optical coupler shown in Figure 4–61 is required to deliver at least 10 mA to the external load. If the current transfer ratio is 60 percent, how much current must be supplied to the input? 
	…… …… ……