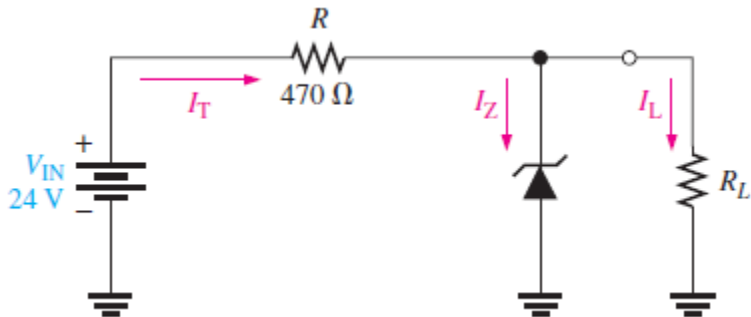
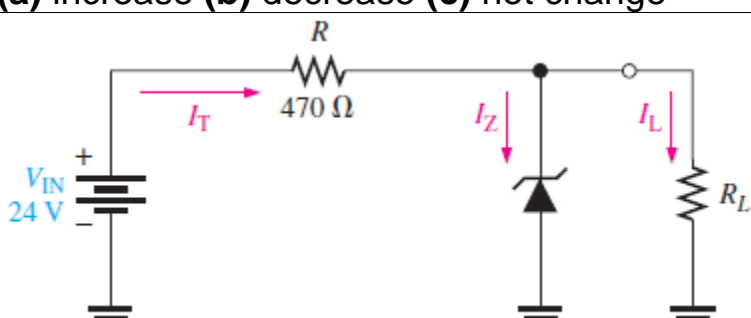
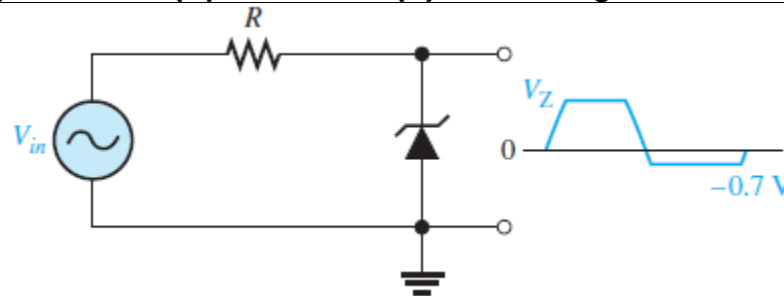


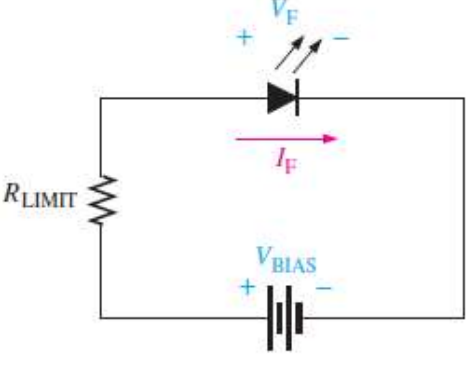
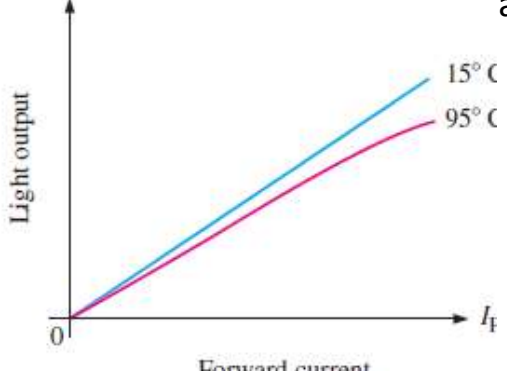
Electronic Circuits - Tutorial 04

Special Purpose Diodes

T & F

#	Question	
1	A zener diode can be used as a voltage regulator.	T
2	The varactor diode normally operates in forward bias.	F
3	The capacitance of a varactor varies directly with reverse voltage.	F
4	The LED is normally operated in forward bias.	T
5	The photodiode operates in reverse bias.	T
6	The light emitted by a laser diode is monochromatic.	T

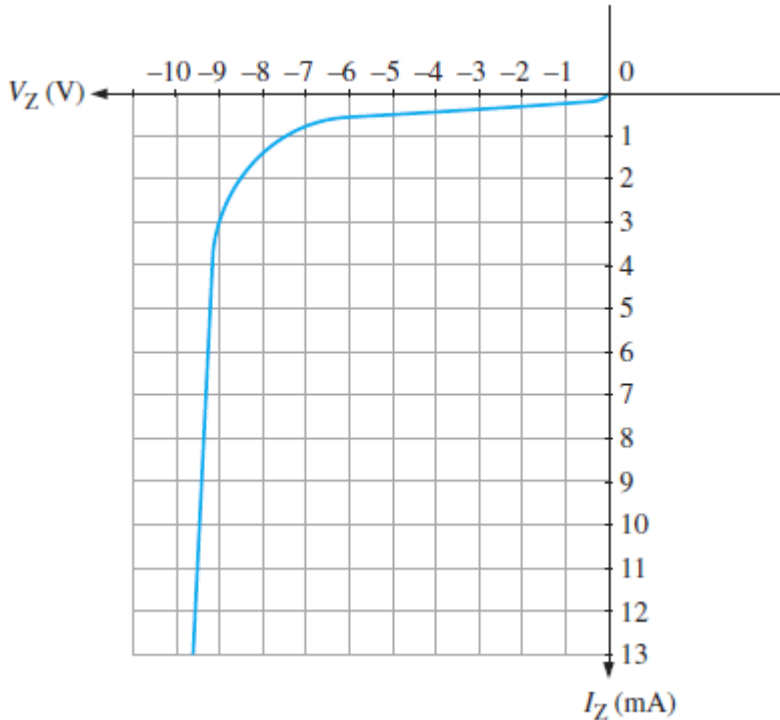
#	Question	
1	 <p>If the input voltage in Figure 3–14 is reduced by 2 V, the zener current will (a) increase (b) decrease (c) not change</p>	b
2	 <p>If the zener opens in Figure 3–14, the output voltage will (a) increase (b) decrease (c) not change</p>	a
3	 <p>If the input voltage amplitude in Figure 3–18(a) is increased, the positive output voltage will (a) increase (b) decrease (c) not change</p>	c

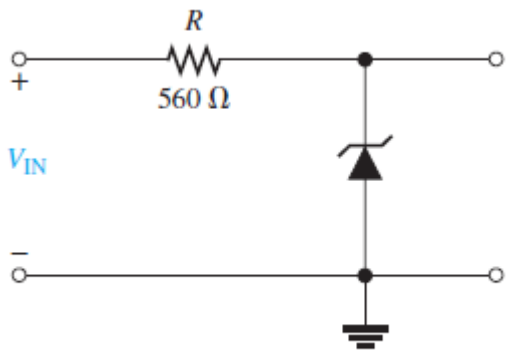
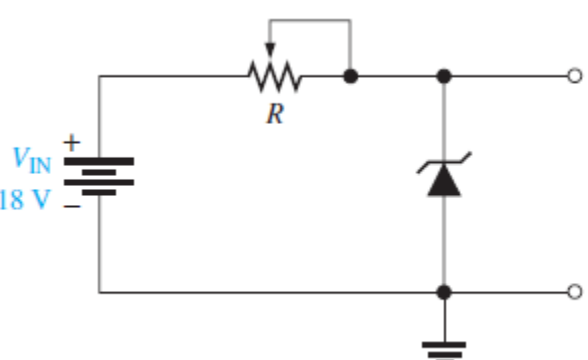
4	 <p>(a) Forward-biased operation</p>  <p>(b) General light output versus forward current for two temperatures</p> <p>If the bias voltage in Figure 3–30 is increased, the light output of the LED will (a) increase (b) decrease (c) not change</p>	a
5	<p>The cathode of a zener diode in a voltage regulator is normally (a) more positive than the anode (b) more negative than the anode (c) at +0.7 V (d) grounded</p>	a
6	<p>For a certain 12 V zener diode, a 10 mA change in zener current produces a 0.1 V change in zener voltage. The zener impedance for this current range is (a) 1 Ω (b) 100 Ω (c) 10 Ω (d) 0.1 Ω</p>	c
7	<p>A no-load condition means that (a) the load has infinite resistance (b) the load has zero resistance (c) the output terminals are open (d) answers(a) and (c)</p>	d
8	<p>An LED (a) emits light when reverse-biased (b) senses light when reverse-biased (c) emits light when forward-biased (d) acts as a variable resistance</p>	c
9	<p>Compared to incandescent bulbs, high-intensity LEDs (a) are brighter (b) have a much longer life (c) use less power (d) all of the above</p>	d
10	<p>An infrared LED is optically coupled to a photodiode. When the LED is turned off, the reading on an ammeter in series with the reverse-biased photodiode will (a) not change (b) decrease (c) increase (d) fluctuate</p>	b

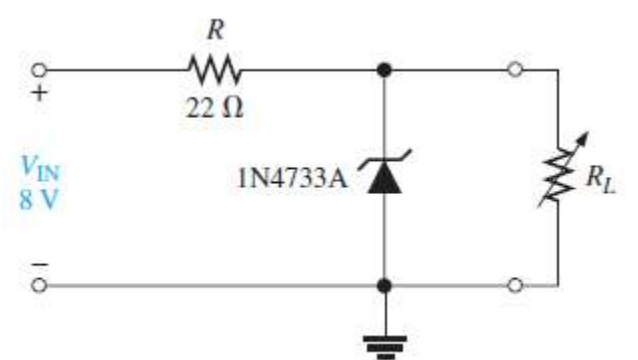
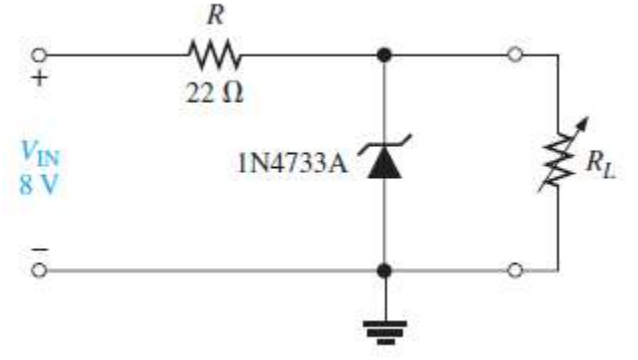


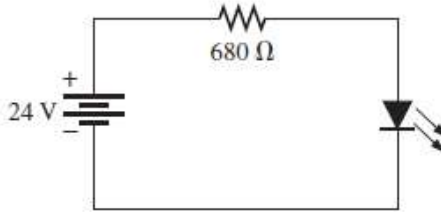
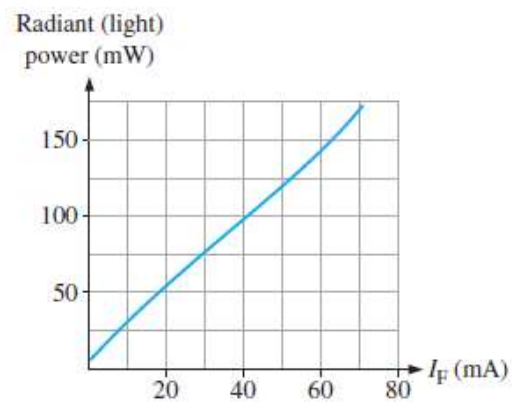
1	A laser diode produces	d
1	(a) incoherent light (b) coherent light (c) monochromatic light (d) both (b) and (c)	
1	In order for a system to function properly, the various types of	d
2	circuits that make up the system must be (a) properly biased (b) properly connected (c) properly interfaced (d) all of the above (e) answers(a) and (b)	

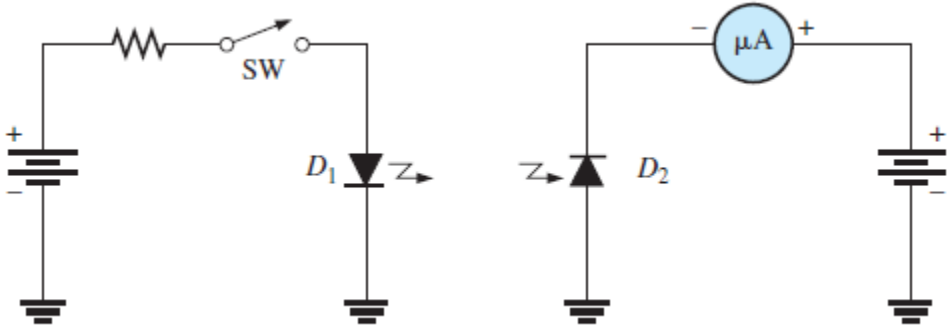
Problems:

Q1	A certain zener diode has a $V_Z = 7.5 \text{ V}$ and an $Z_Z = 5 \Omega$ at a certain current. Draw the equivalent circuit.
Q2	<p>From the characteristic curve in Figure 3-67, what is the approximate minimum zener current (I_{ZK}) and the approximate zener voltage at I_{ZK}?</p>  <p>The graph shows the characteristic curve of a zener diode. The vertical axis is labeled V_Z (V) and ranges from 0 to -13 with major grid lines every 1 unit. The horizontal axis is labeled I_Z (mA) and ranges from 0 to -10 with major grid lines every 1 unit. The curve starts at a very low current for $V_Z = 0$, rises sharply to a point where $V_Z \approx -9.5 \text{ V}$ and $I_Z \approx -1 \text{ mA}$, then continues to rise more gradually, reaching a point where $V_Z \approx -7.5 \text{ V}$ and $I_Z \approx -5 \text{ mA}$. From $I_Z = -5 \text{ mA}$ onwards, the curve becomes nearly horizontal, indicating a constant zener voltage of approximately -7.5 V.</p>
Sol 2	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Q4	A zener has an impedance of 15Ω . What is its terminal voltage at 50 mA if $V_Z = 4.7 \text{ V}$ at $I_Z = 25 \text{ mA}$?
Sol 4	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

<p>Q6</p>	<p>Determine the minimum input voltage required for regulation to be established in Figure 3–68. Assume an ideal zener diode with $I_{ZK} = 1.5 \text{ mA}$ and $V_Z = 14 \text{ V}$.</p> 
<p>Sol 6</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>Q8</p>	<p>To what value must R be adjusted in Figure 3–69 to make $I_Z = 40 \text{ mA}$? Assume $V_Z = 12 \text{ V}$ at 30 mA and $Z_Z = 30 \Omega$.</p> 
<p>Sol 8</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

<p>Q1 0</p>	<p>A loaded zener regulator is shown in Figure 3–70. $V_Z = 5.1 \text{ V}$ at $I_Z = 49 \text{ mA}$, $I_{ZK} = 1 \text{ mA}$, $Z_Z = 7 \Omega$, and $I_{ZM} = 70 \text{ mA}$. Determine the minimum and maximum permissible load currents.</p> 
<p>Sol 10</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>Q1 2</p>	<p>Analyze the circuit in Figure 3–70 for percent line regulation using an input voltage from 6 V to 12 V with no load. Refer to Chapter 2, Equation 2–14.</p> 
<p>Sol 12</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

Q1 4	In a certain zener regulator, the output voltage changes 0.2 V when the input voltage goes from 5 V to 10 V. What is the input regulation expressed as a percentage? Refer to Chapter 2, Equation 2-14.
Sol 14
20	<p>The LED in Figure 3-73(a) has a light-producing characteristic as shown in part (b). Neglecting the forward voltage drop of the LED, determine the amount of radiant (light) power produced in mW.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div>  <p>(a)</p> </div> <div>  <p>(b)</p> </div> </div>
20
22	Specify the number of limiting resistors and their value for a series-parallel array of 48 red LEDs using a 9 V dc source for a forward current of 20 mA.
22

24	For a certain photodiode at a given irradiance, the reverse resistance is $200\text{ k}\Omega$ and the reverse voltage is 10 V . What is the current through the device?
24	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
26	<p>When the switch in Figure 3-76 is closed, will the microammeter reading increase or decrease? Assume D_1 and D_2 are optically coupled.</p> 
	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>