

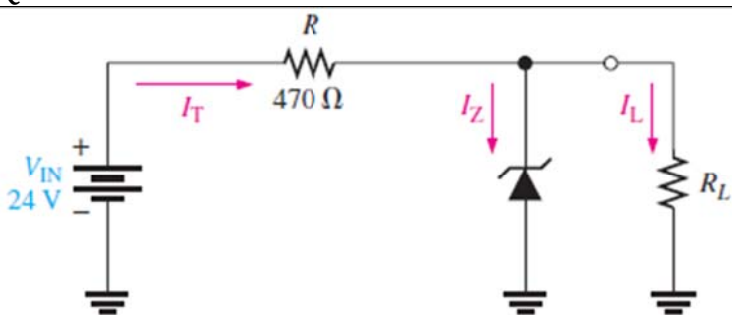
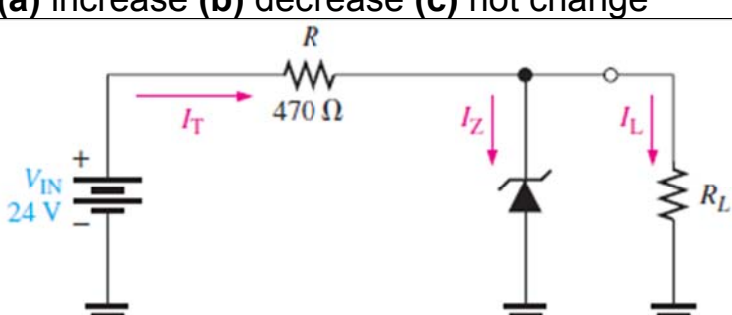
# Electronic Circuits - Tutorial 06

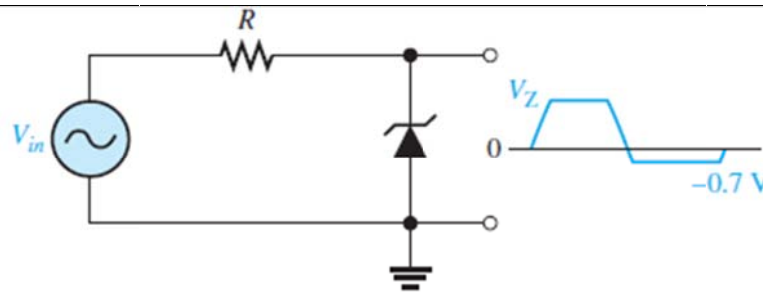
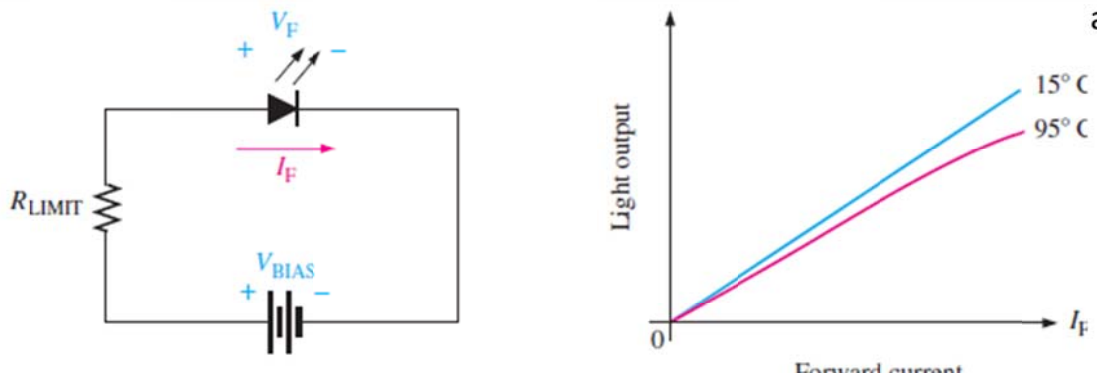
## Special Purpose Diodes

True/False

#	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

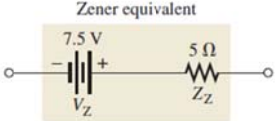
MCQ

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

3	 <p>If the input voltage amplitude in Figure is increased, the positive output voltage will</p> <p>(a) increase (b) decrease (c) not change</p>	c
4	<p>The cathode of a zener diode in a voltage regulator is normally</p> <p>(a) more positive than the anode (b) more negative than the anode</p> <p>(c) at +0.7 V (d) grounded</p>	a
5	<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</p> <p>(a) 1 <math>\Omega</math> (b) 100 <math>\Omega</math> (c) 10 <math>\Omega</math> (d) 0.1 <math>\Omega</math></p>	c
6	 <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</p> <p>(a) increase (b) decrease (c) not change</p>	a

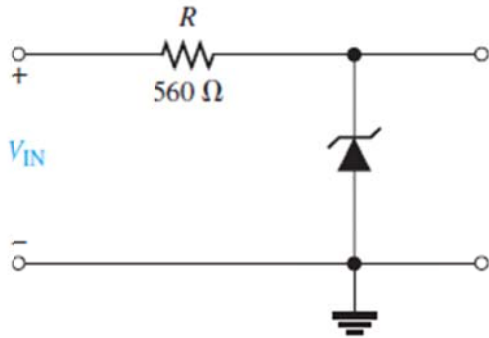
7	A no-load condition means that <b>(a)</b> the load has infinite resistance <b>(b)</b> the load has zero resistance <b>(c)</b> the output terminals are open <b>(d)</b> answers(a) and (c)	d
8	An LED <b>(a)</b> emits light when reverse-biased <b>(b)</b> senses light when reverse-biased <b>(c)</b> emits light when forward-biased <b>(d)</b> acts as a variable resistance	c
9	Compared to incandescent bulbs, high-intensity LEDs <b>(a)</b> are brighter <b>(b)</b> have a much longer life <b>(c)</b> use less power <b>(d)</b> all of the above	d
10	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 <b>(a)</b> not change <b>(b)</b> decrease <b>(c)</b> increase <b>(d)</b> fluctuate	b
11	A laser diode produces <b>(a)</b> incoherent light <b>(b)</b> coherent light <b>(c)</b> monochromatic light <b>(d)</b> both (b) and (c)	d
12	In order for a system to function properly, the various types of circuits that make up the system must be <b>(a)</b> properly biased <b>(b)</b> properly connected <b>(c)</b> properly interfaced <b>(d)</b> all of the above <b>(e)</b> answers(a) and (b)	d

Problems:

1	<p>A certain zener diode has a <math>V_Z = 7.5 \text{ V}</math> and an <math>Z_Z = 5 \Omega</math> at a certain current. Draw the equivalent circuit.</p>
1	<p>..... See Figure ANS-7. ....</p> <p>.....</p> <div style="text-align: center;">  <p>Zener equivalent</p> </div> <p>.....</p>
2	<p>When the reverse current in a particular zener diode increases from 20 mA to 30 mA, the zener voltage changes from 5.6 V to 5.65 V. What is the impedance of this device?</p>
2	<p>.....</p> <p>..... <math>5 \Omega</math> .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
3	<p>A certain zener diode has the following specifications: <math>V_Z = 6.8 \text{ V}</math> at <math>25^\circ\text{C}</math> and <math>TC = +0.04\%/^\circ\text{C}</math>. Determine the zener voltage at <math>70^\circ\text{C}</math>.</p>
3	<p>.....</p> <p>..... <math>6.92 \text{ V}</math> .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

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Repeat Problem 6 with  $Z_Z = 20 \Omega$  and  $V_Z = 14 \text{ V}$  at  $30 \text{ mA}$ .

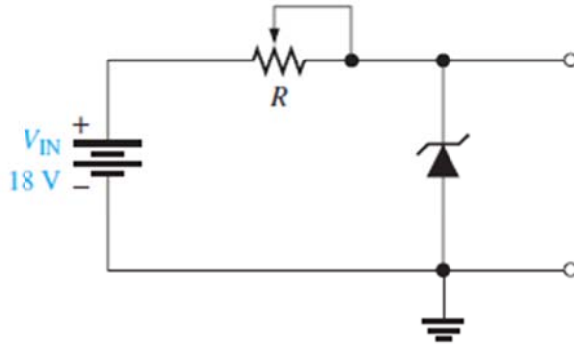


4

.....  
 ..... 14.3 V .....  
 .....  
 .....

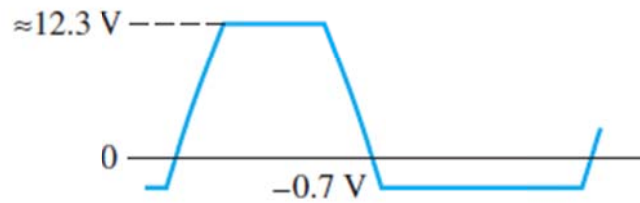
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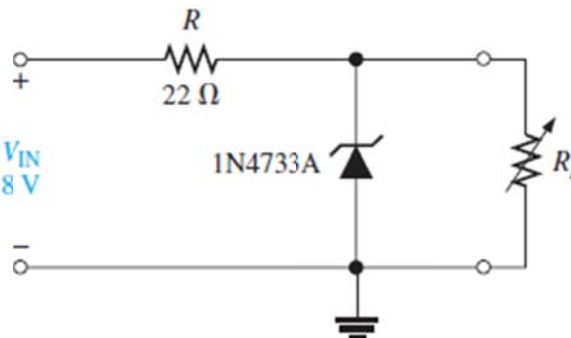
A 20 V peak sinusoidal voltage is applied to the circuit in Figure 3-69 in place of the dc source. Draw the output waveform. Use the parameter values established in Problem 8.



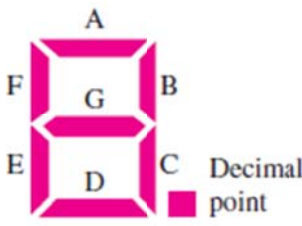
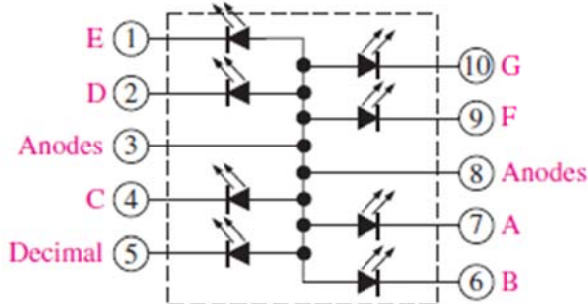
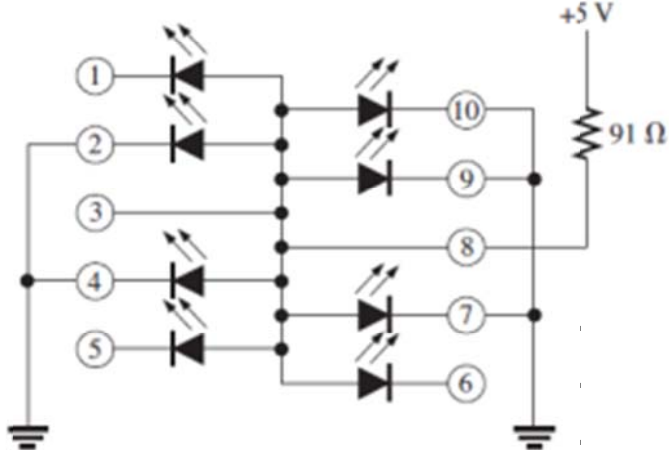
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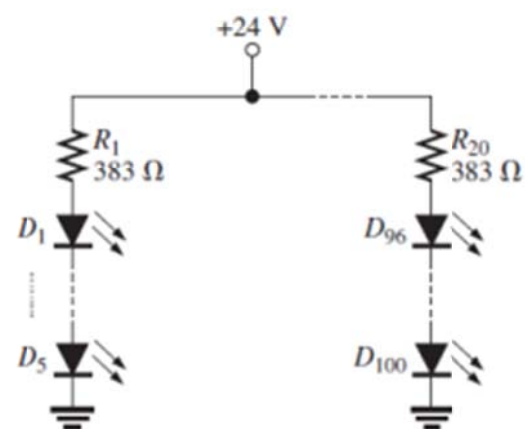
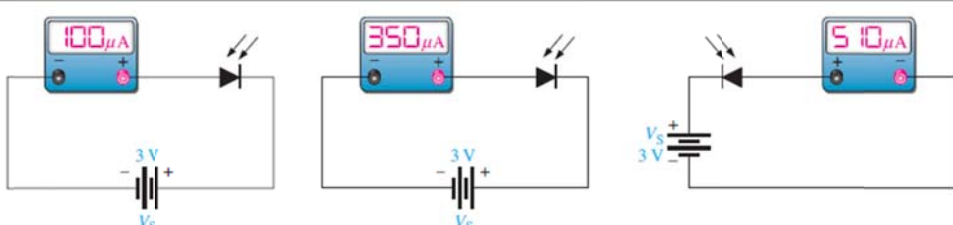
See Figure ANS-8.



6	<p>Find the load regulation expressed as a percentage in Problem 10.</p> 
6	<p>.....</p> <p>..... 10.3% .....</p> <p>.....</p> <p>.....</p> <p>.....</p>
7	<p>The no-load output voltage of a certain zener regulator is 8.23 V, and the full-load output is 7.98 V. Calculate the load regulation expressed as a percentage. Refer to Chapter 2, Equation 2-15.</p>
7	<p>.....</p> <p>..... 3.13% .....</p> <p>.....</p> <p>.....</p> <p>.....</p>
8	<p>The output voltage of a zener regulator is 3.6 V at no load and 3.4 V at full load. Determine the load regulation expressed as a percentage. Refer to Chapter 2, Equation 2-15.</p>
8	<p>.....</p> <p>..... 5.88% .....</p> <p>.....</p> <p>.....</p> <p>.....</p>



<p>9</p>	<p>Determine how to connect the seven-segment display in Figure 3-74 to display "5." The maximum continuous forward current for each LED is 30 mA and a +5 V dc source is to be used.</p>  
<p>9</p>	<p>.....          .....          ..... See Figure ANS-9. ....          .....   <p>.....          .....          .....          .....          .....          .....          .....</p> </p>

10	<p>Develop a yellow LED traffic-light array using a minimum number of limiting resistors that operates from a 24 V supply and consists of 100 LEDs with <math>I_F = 30 \text{ mA}</math> and an equal number of LEDs in each parallel branch. Show the circuit and the resistor values.</p>
10	<p>..... 23. See Figure ANS-10. ....</p>  <p>.....</p>
11	 <p>What is the resistance of each photodiode in Figure 3-75?</p>
11	<p>..... (a) <math>30 \text{ k}\Omega</math>    (b) <math>8.57 \text{ k}\Omega</math>    (c) <math>5.88 \text{ k}\Omega</math> .....</p> <p>.....</p>