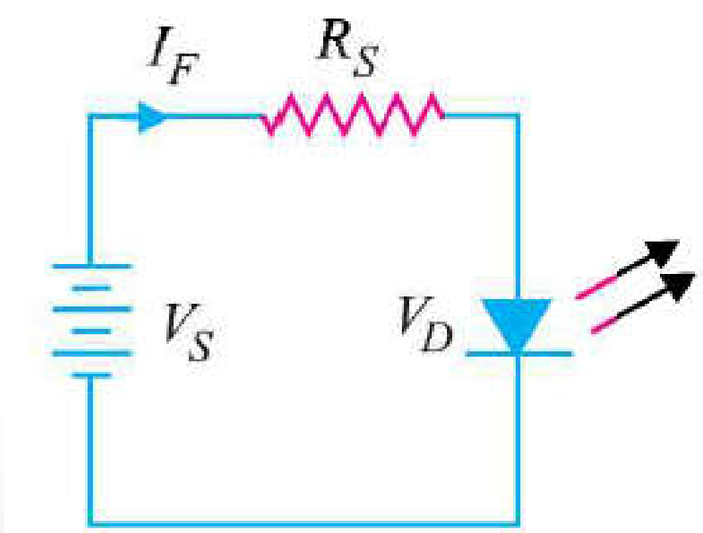
DELD – Tutorial 1

ECED SVNIT

Question

- What value of series resistor is required to limit the current through a LED to a 20 mA with a forward drop of 1.6 V when connected to a 10 V Supply?



Solution

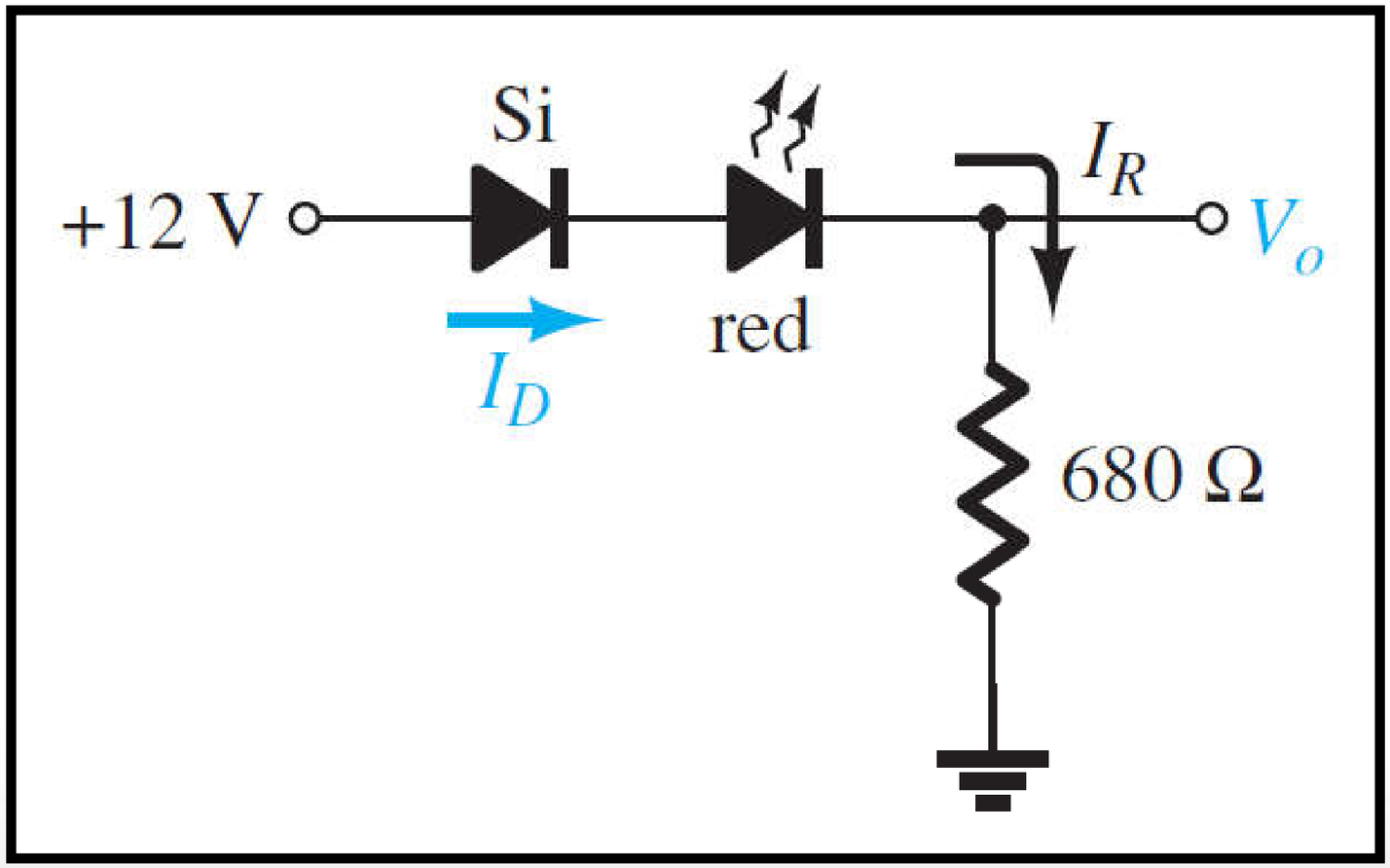
$$V_S = 10\ \text{V}; \quad V_D = 1.6\ \text{V}; \quad I_F = 20\ \text{mA} = 20 \times 10^{-3}\ \text{A}$$

$$R_S = \frac{V_S - V_D}{I_F}$$

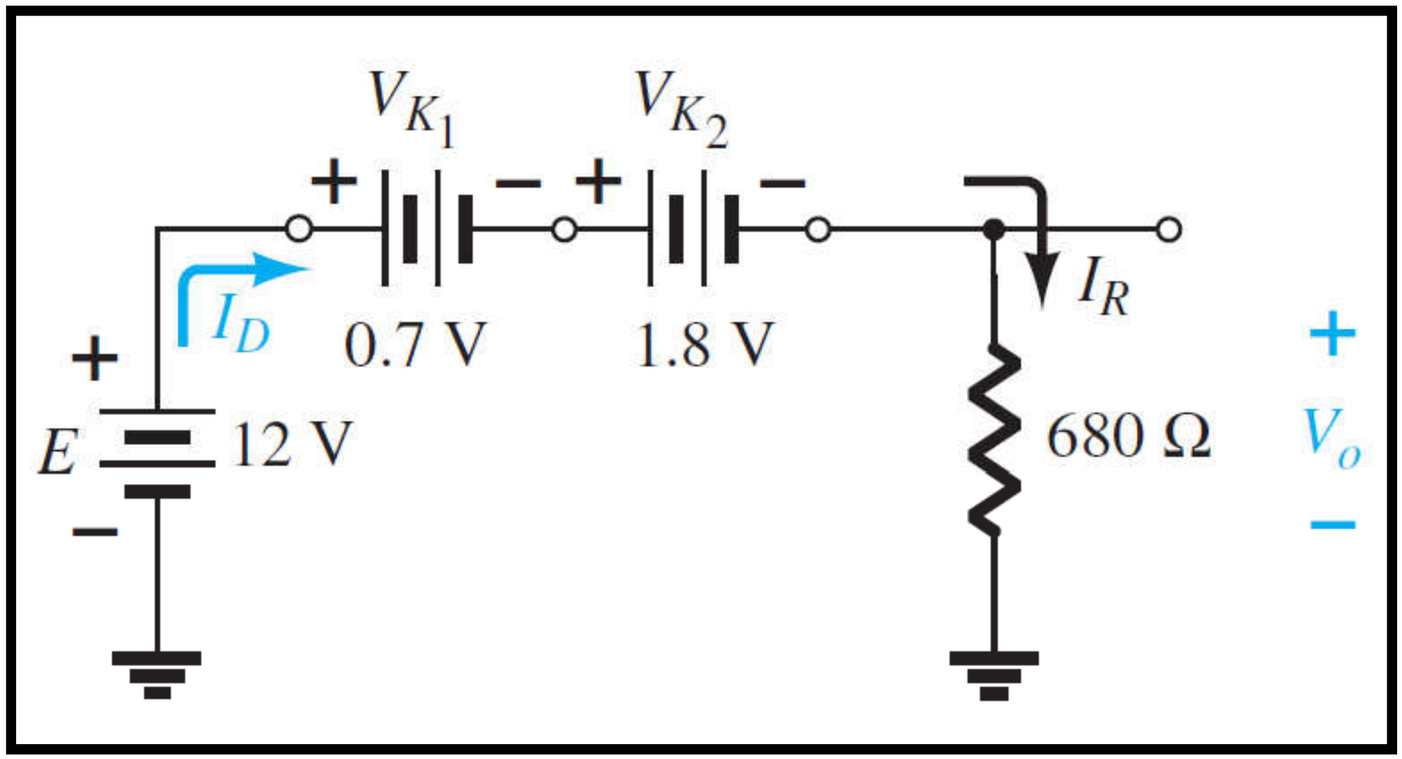
$$R_S = \frac{10 - 1.6}{20 \times 10^{-3}} = \mathbf{420\ \Omega}$$

Question

- Determine Vo and the series current/Diode current Id. Assume the forward drop across LED to be 1.8 Volts.



Solution

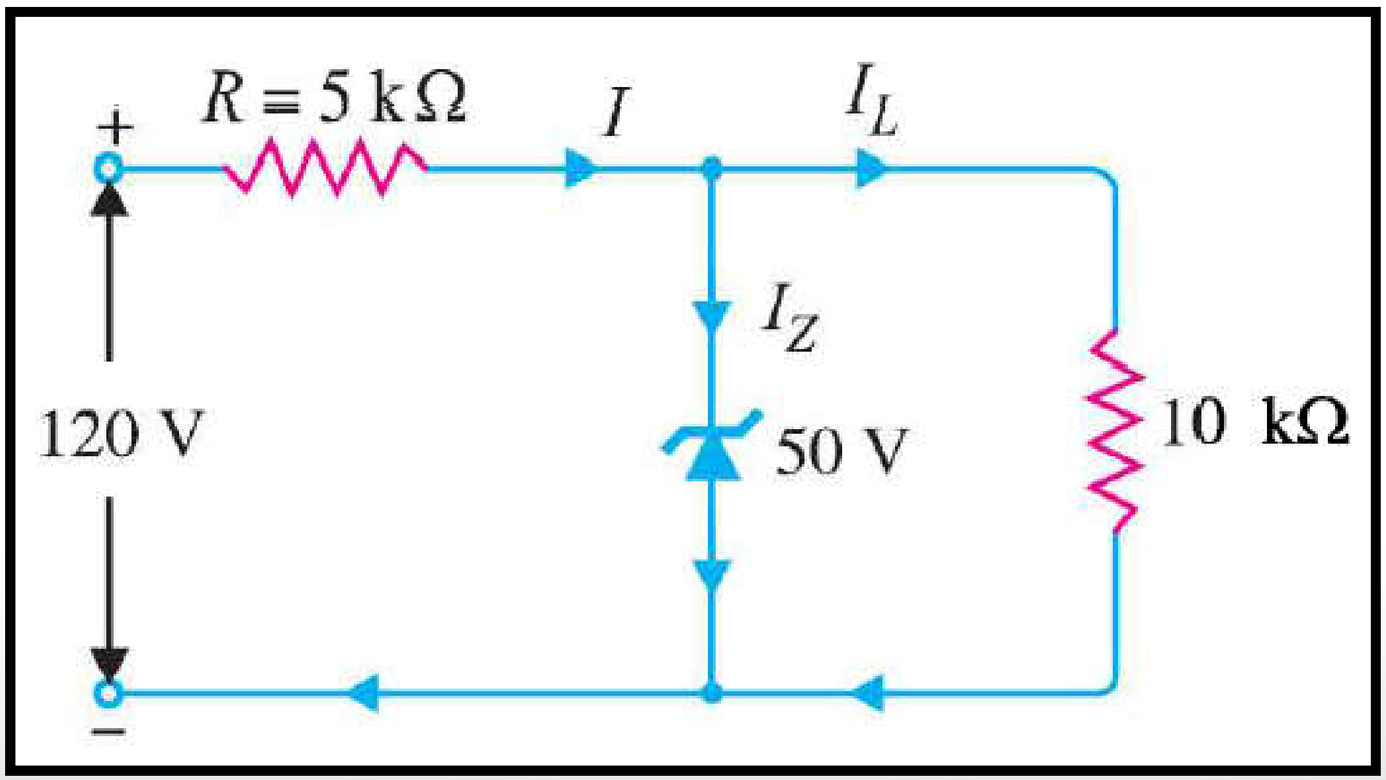


$$V_o = E - V_{K_1} - V_{K_2} = 12\text{ V} - 2.5\text{ V} = \mathbf{9.5\text{ V}}$$

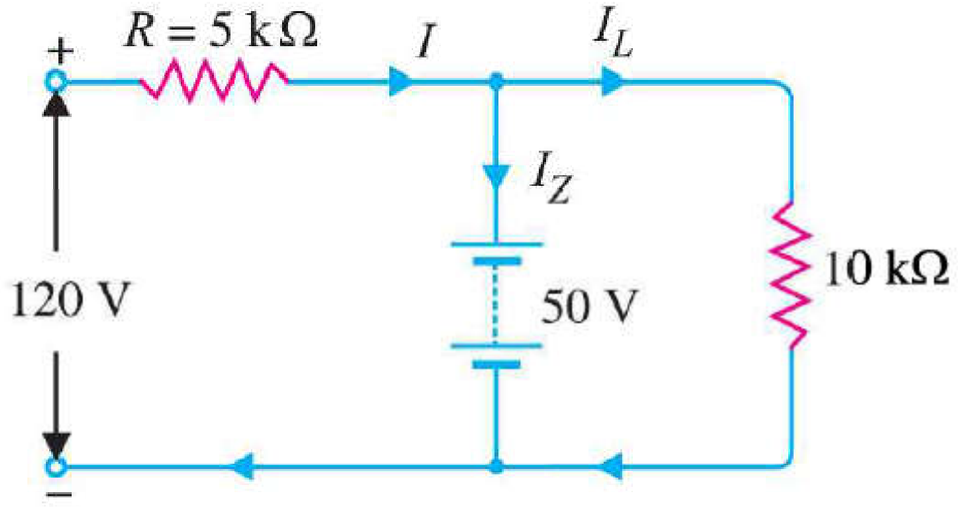
$$I_D = I_R = \frac{V_R}{R} = \frac{V_o}{R} = \frac{9.5\text{ V}}{680\ \Omega} = \mathbf{13.97\text{ mA}}$$

Question

- Find 1) Output Voltage 2) Voltage drop a cross series resistance 3) The current thro ugh Zener Diode



Solution



$$V = \frac{R_L E_i}{R + R_L} = \frac{10 \times 120}{5 + 10} = 80 \text{ V} \qquad \text{Output voltage} = V_Z = \mathbf{50\ V}$$

Voltage drop across R = Input voltage $- V_Z = 120 - 50 = \mathbf{70\ V}$

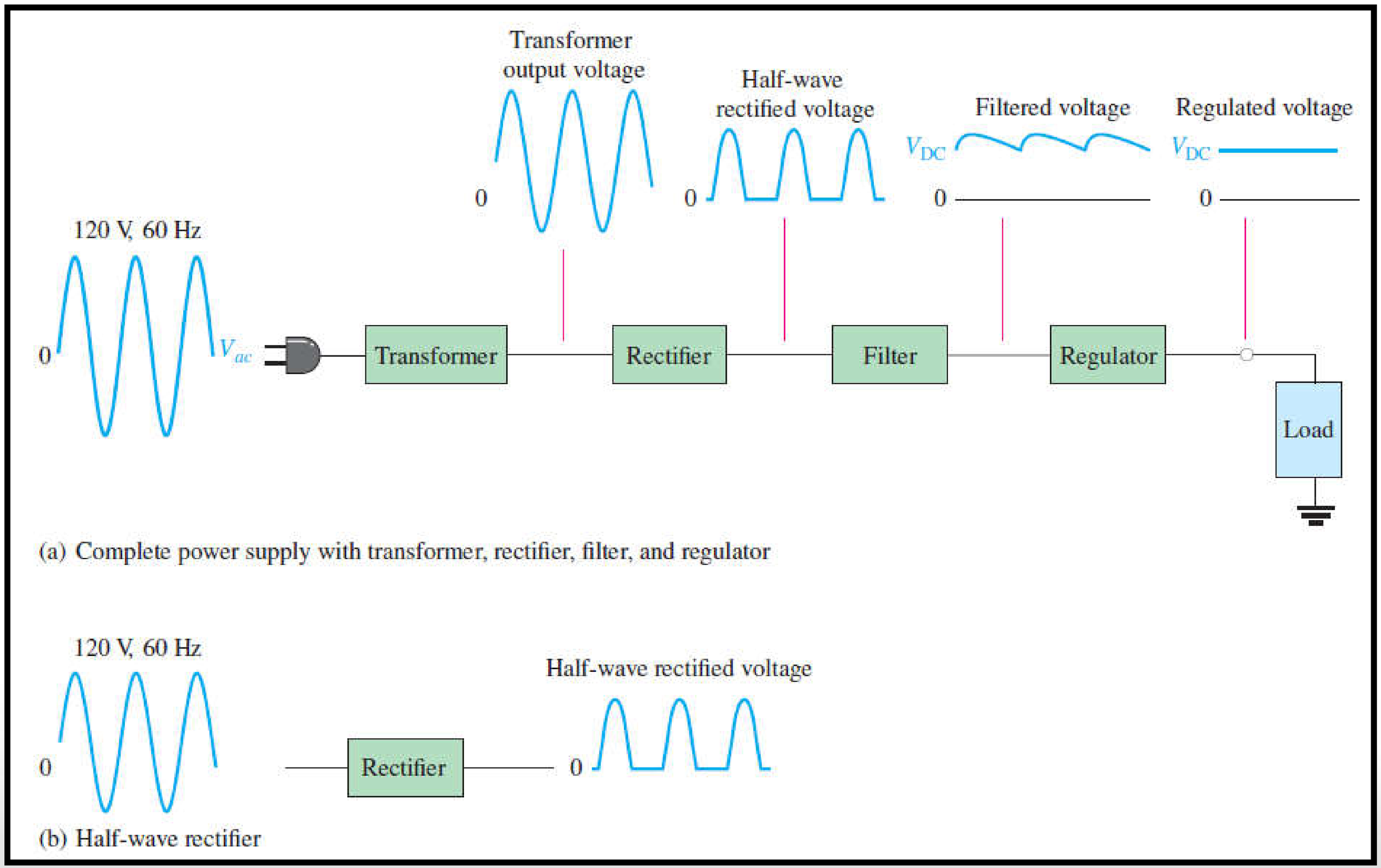
Load current, $I_L \equiv V_Z/R_L \equiv 50 \text{ V}/10 \text{ k}\Omega \equiv 5 \text{ mA}$

Current through R, $I = \dfrac{70 \text{ V}}{5 \text{ k}\Omega} = 14 \text{ mA}$

Applying Kirchhoff's first law, $I = I_L + I_Z$

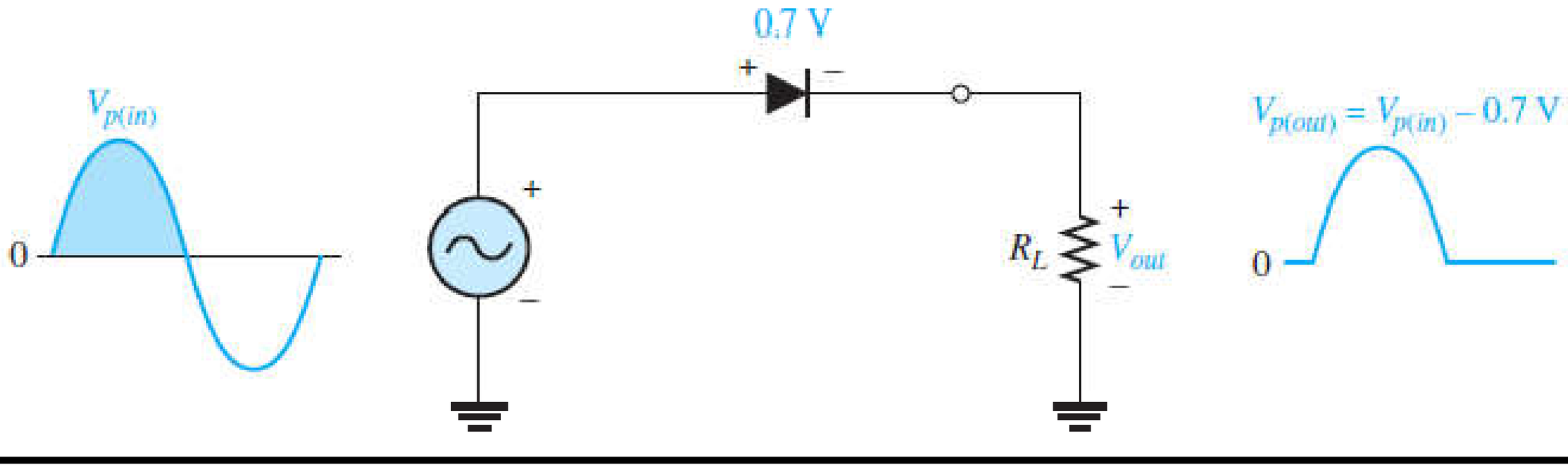
$\therefore$ Zener current, $I_Z = I - I_L = 14 - 5 = \mathbf{9\ mA}$

Concept of Rectification

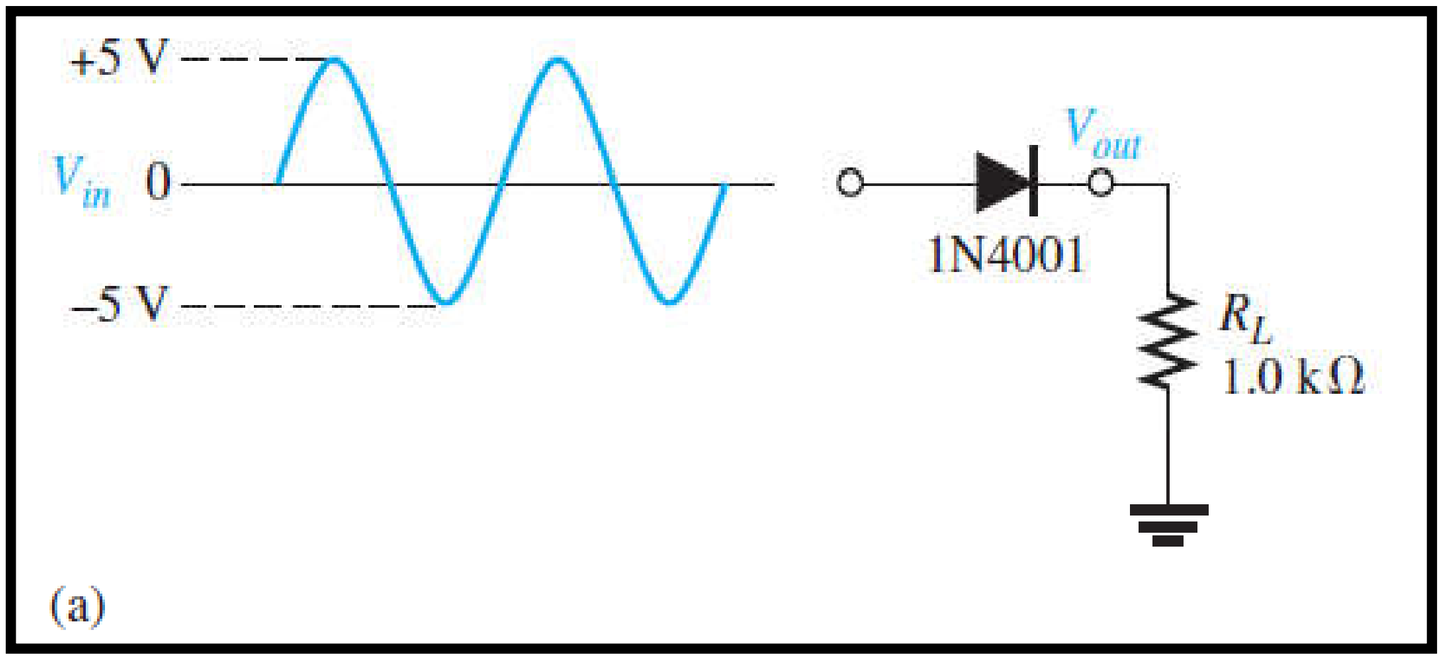


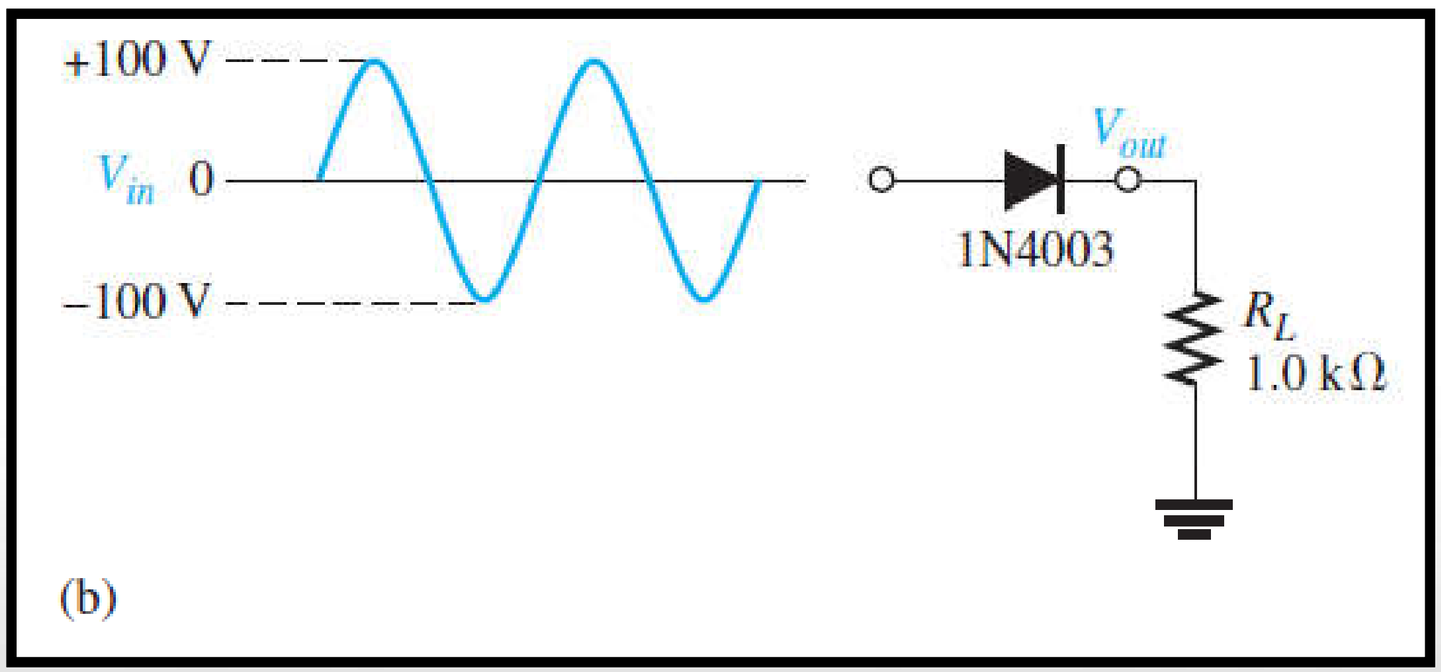
Effect of Barrier Potential on HWR

$$V_{p(out)} = V_{p(in)} - 0.7\ \text{V}$$

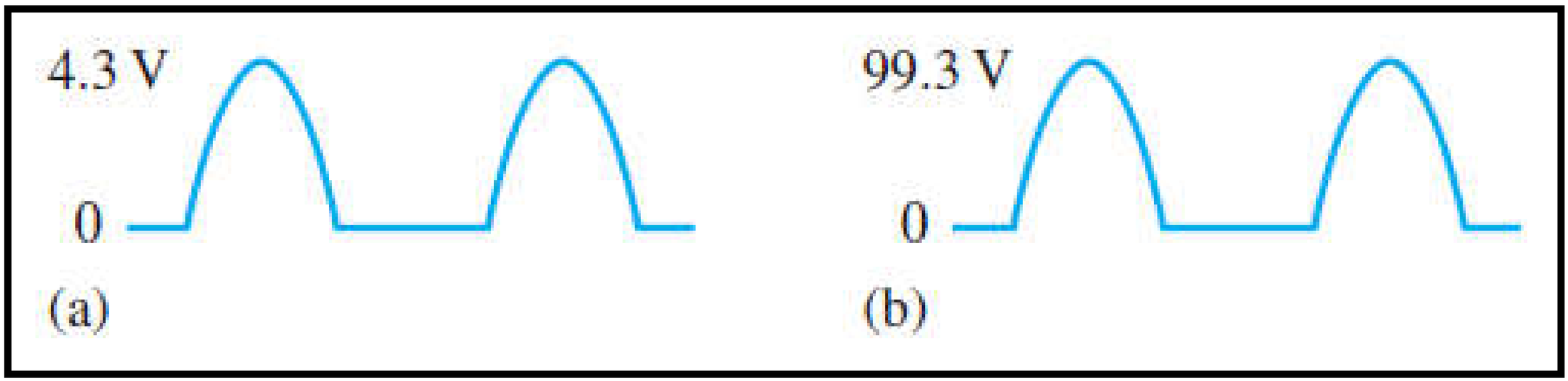


Question


+5 V
V_{in} 0
–5 V
V_{out}
1N4001
R_L
1.0 kΩ
(a)

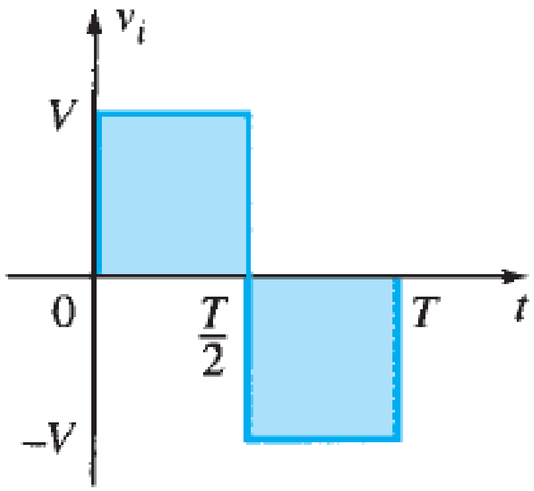

+100 V
V_{in} 0
–100 V
V_{out}
1N4003
R_L
1.0 kΩ
(b)

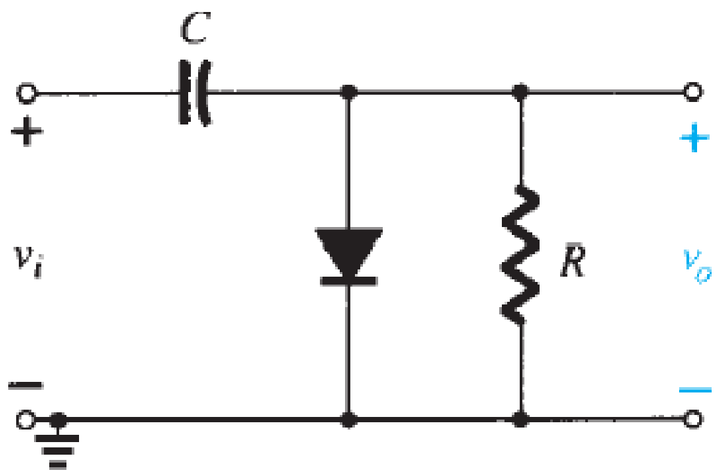
Solutions



Clamper Circuits

- **A clamper is a network constructed of a diode, a resistor, and a capacitor that shifts a waveform to a different dc level without changing the appearance of the applied signal.**





Steps

Step 1: Start the analysis by examining the response of the portion of the input signal that will forward bias the diode.

Step 2: During the period that the diode is in the "on" state, assume that the capacitor will charge up instantaneously to a voltage level determined by the surrounding network.

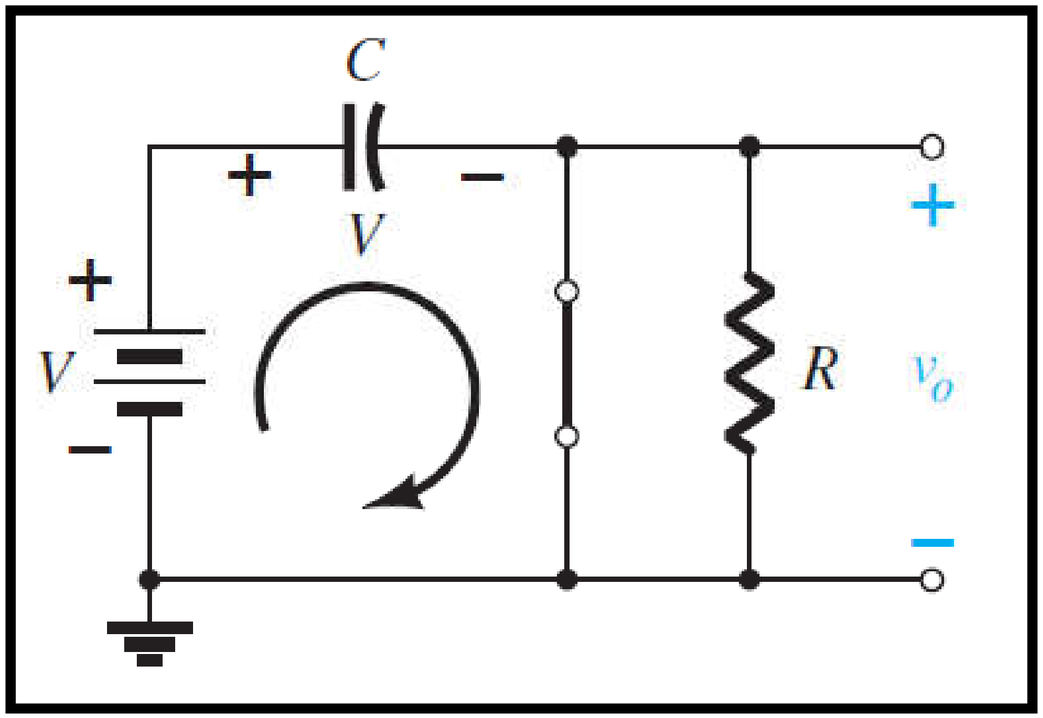
Step 3: Assume that during the period when the diode is in the "off" state the capacitor holds on to its established voltage level.

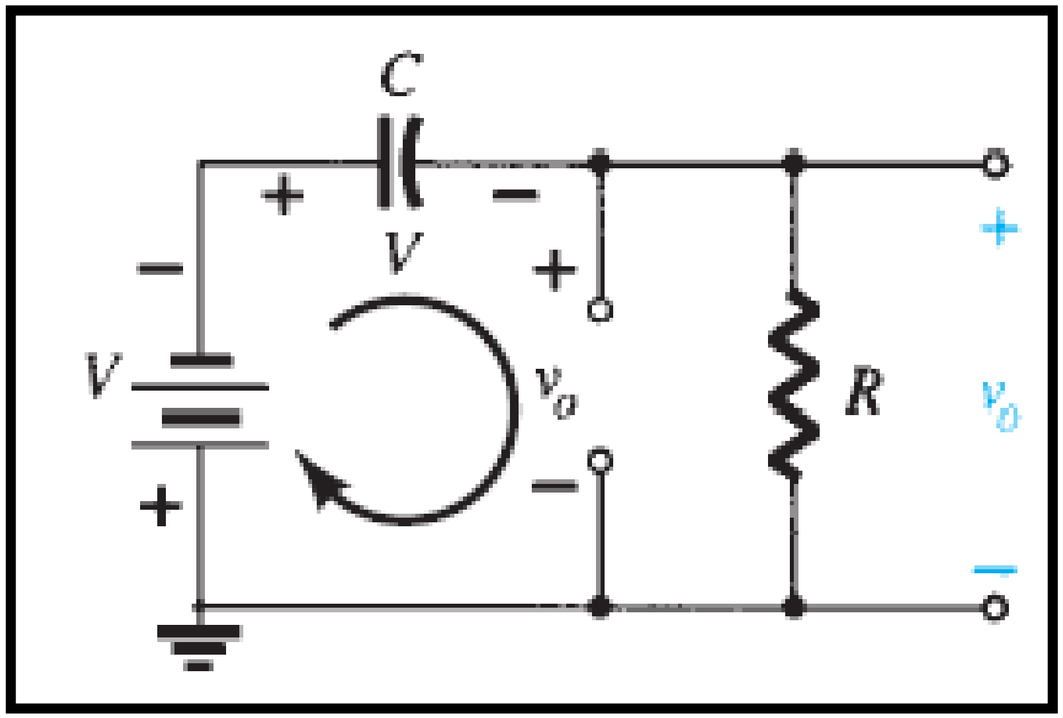
Step 4: Throughout the analysis, maintain a continual awareness of the location and defined polarity for v_o to ensure that the proper levels are obtained.

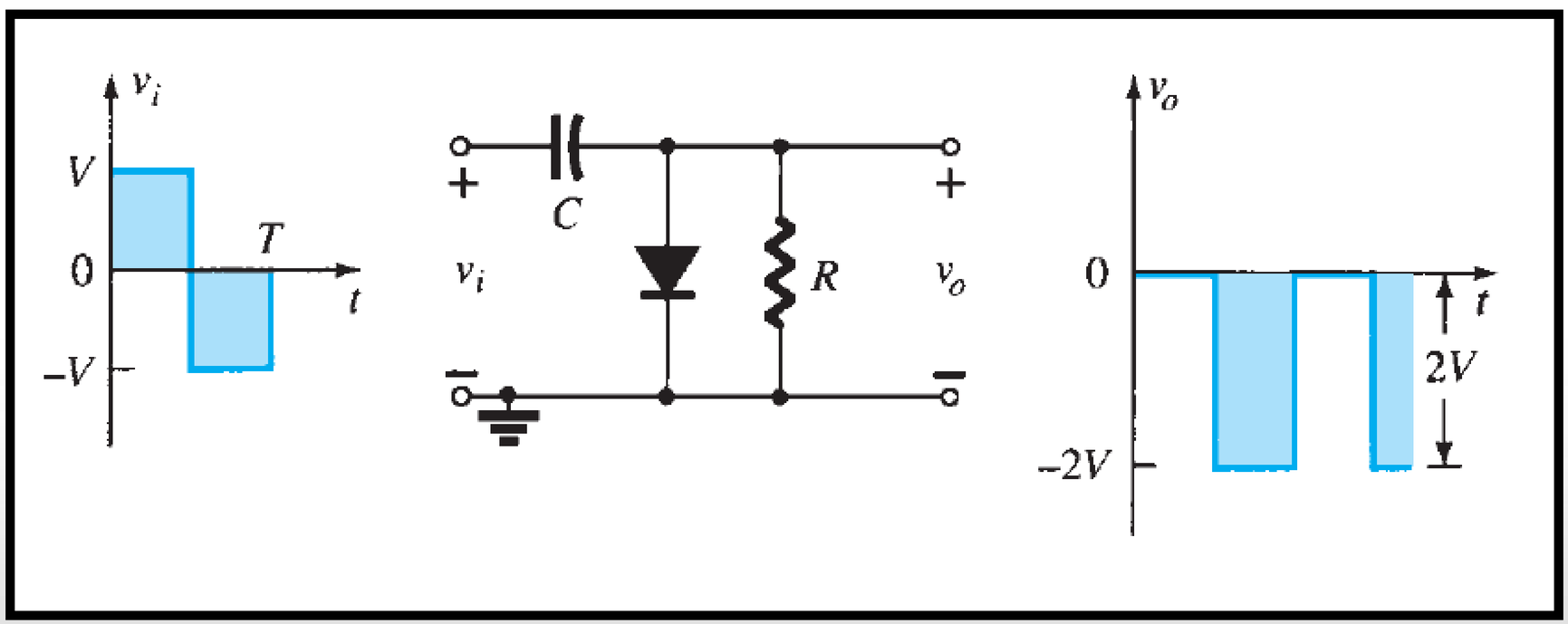
Step 5: Check that the total swing of the output matches that of the input.

This is a property that applies for all clamping networks, giving an excellent check on the results obtained.

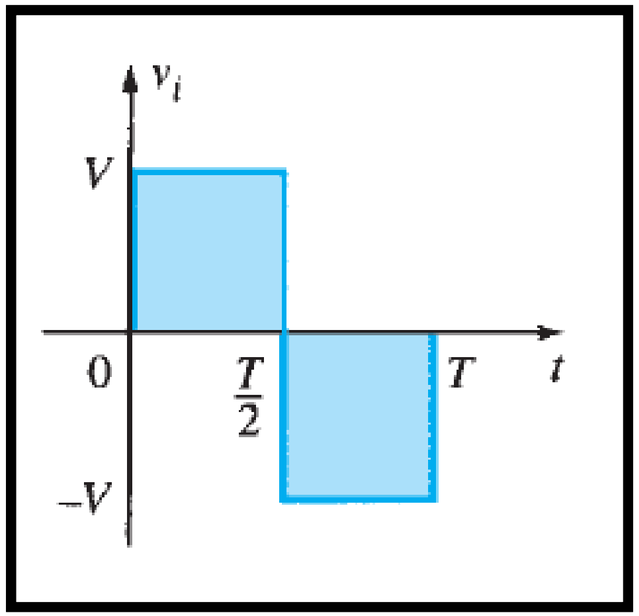
Clamper - Working

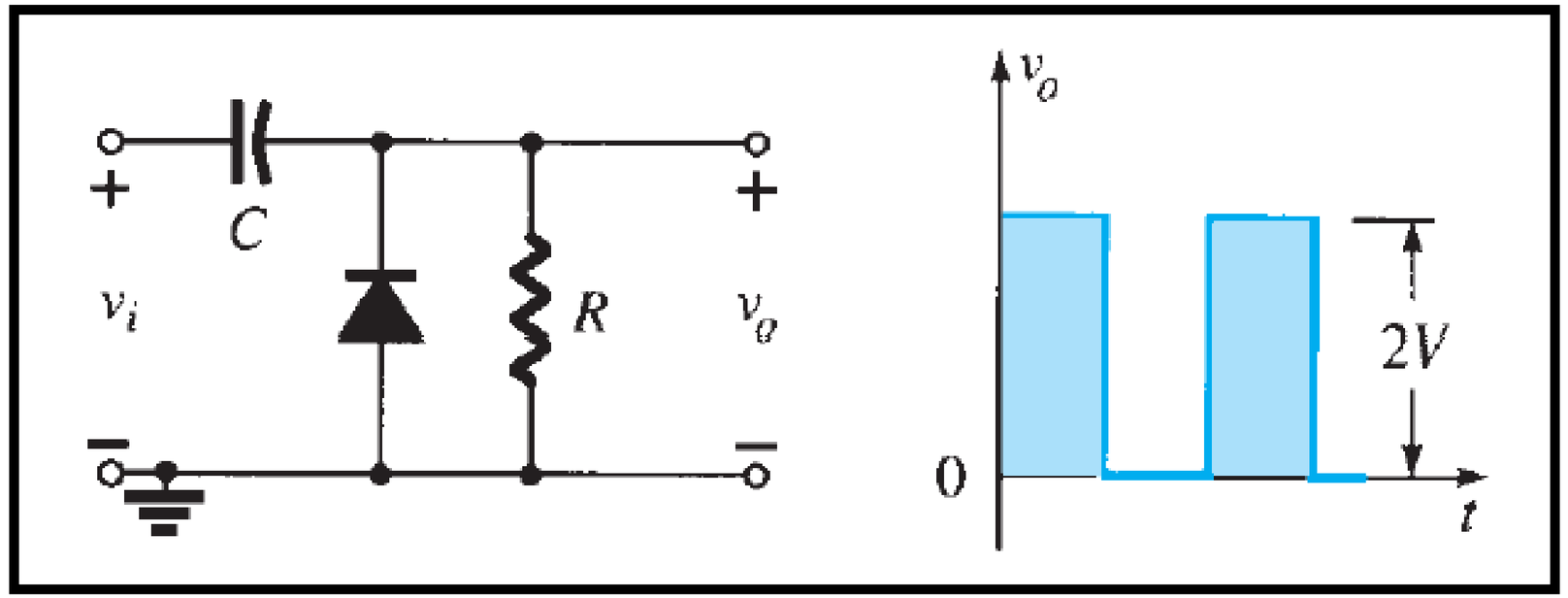




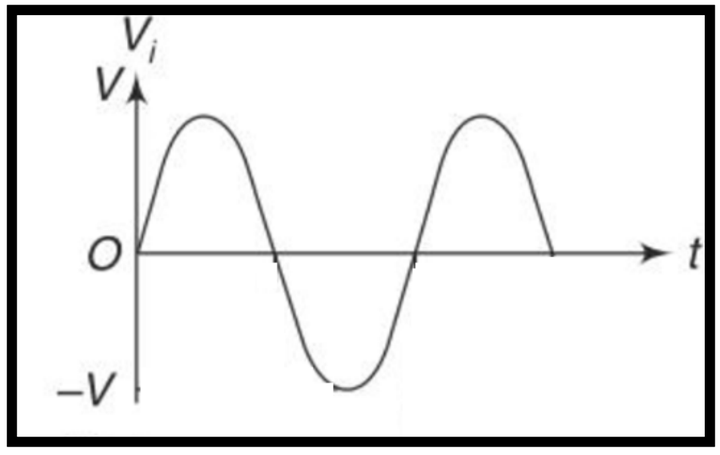


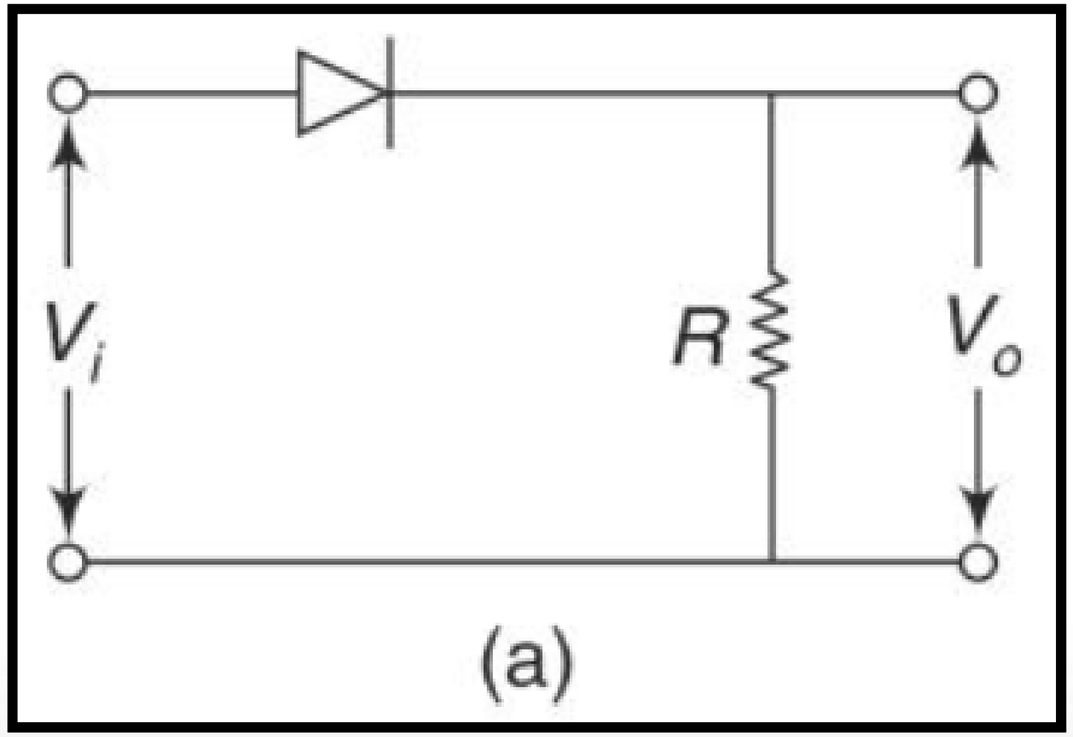
Clamper - Working

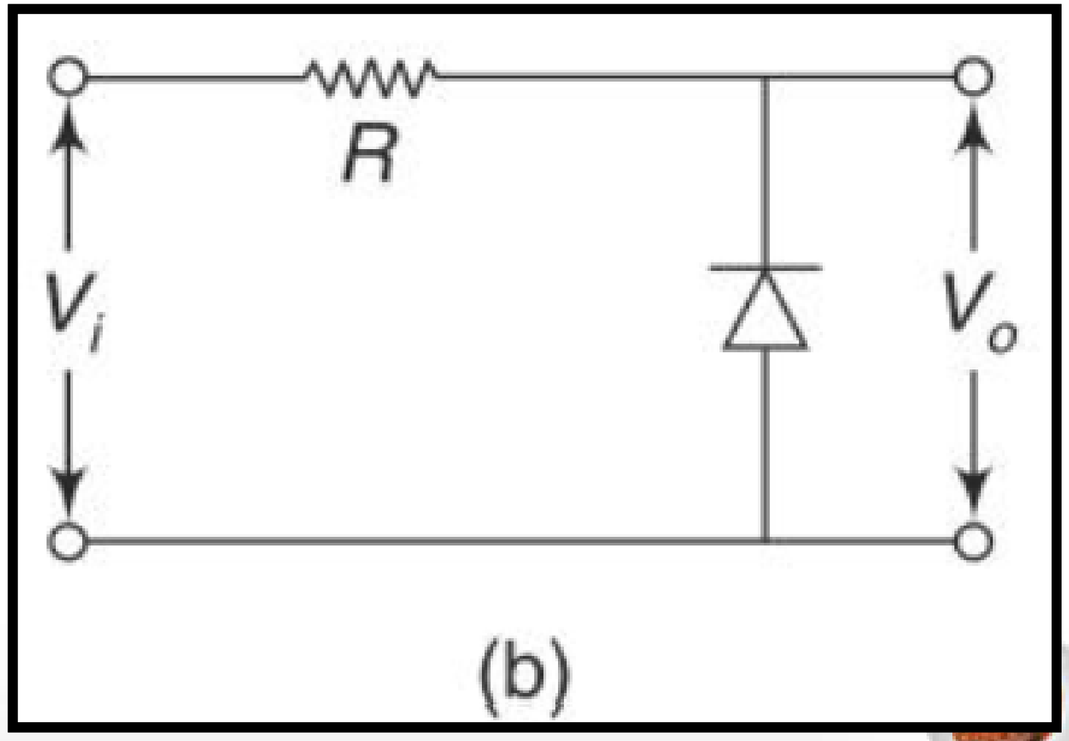




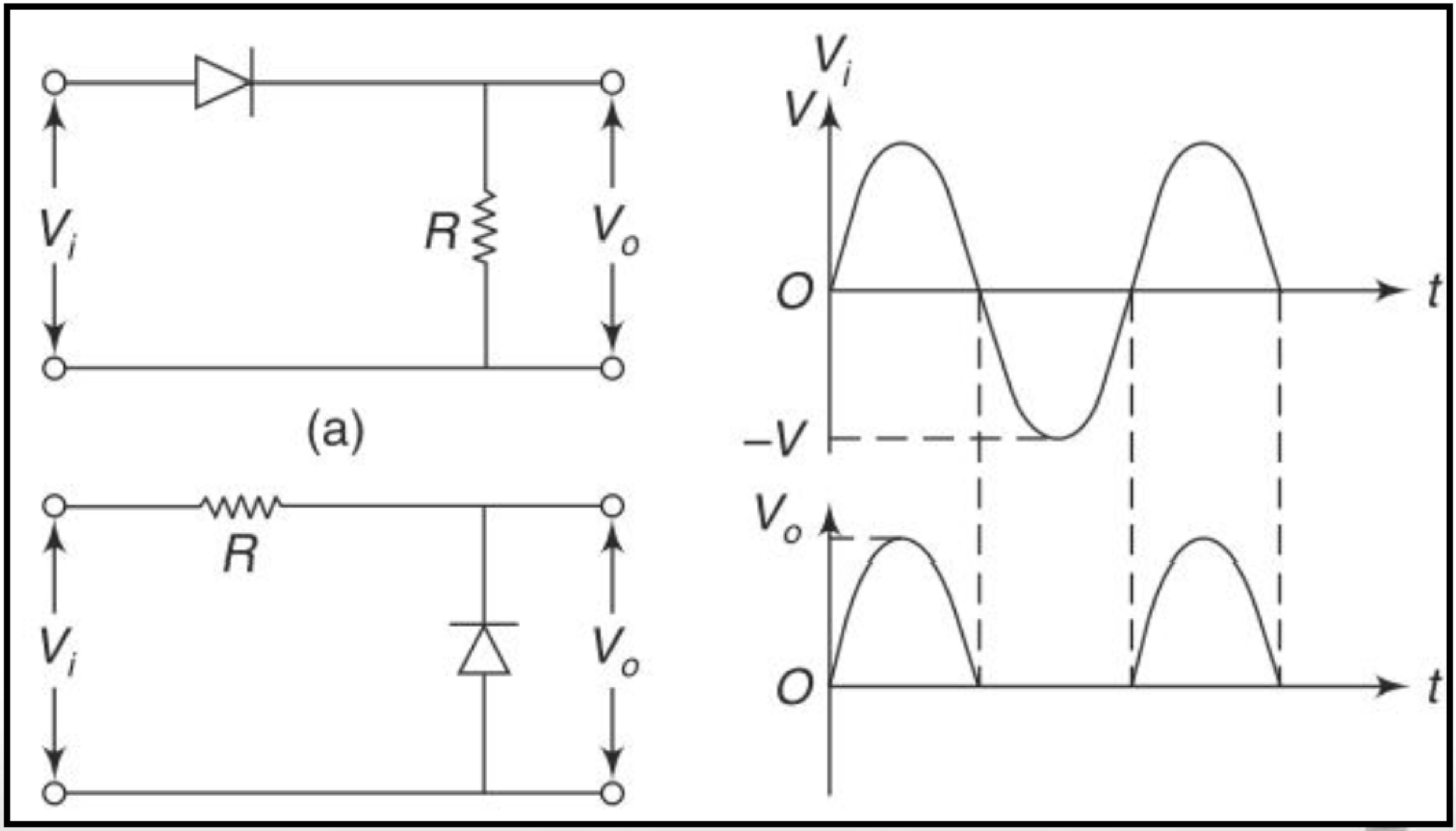
Concept Check



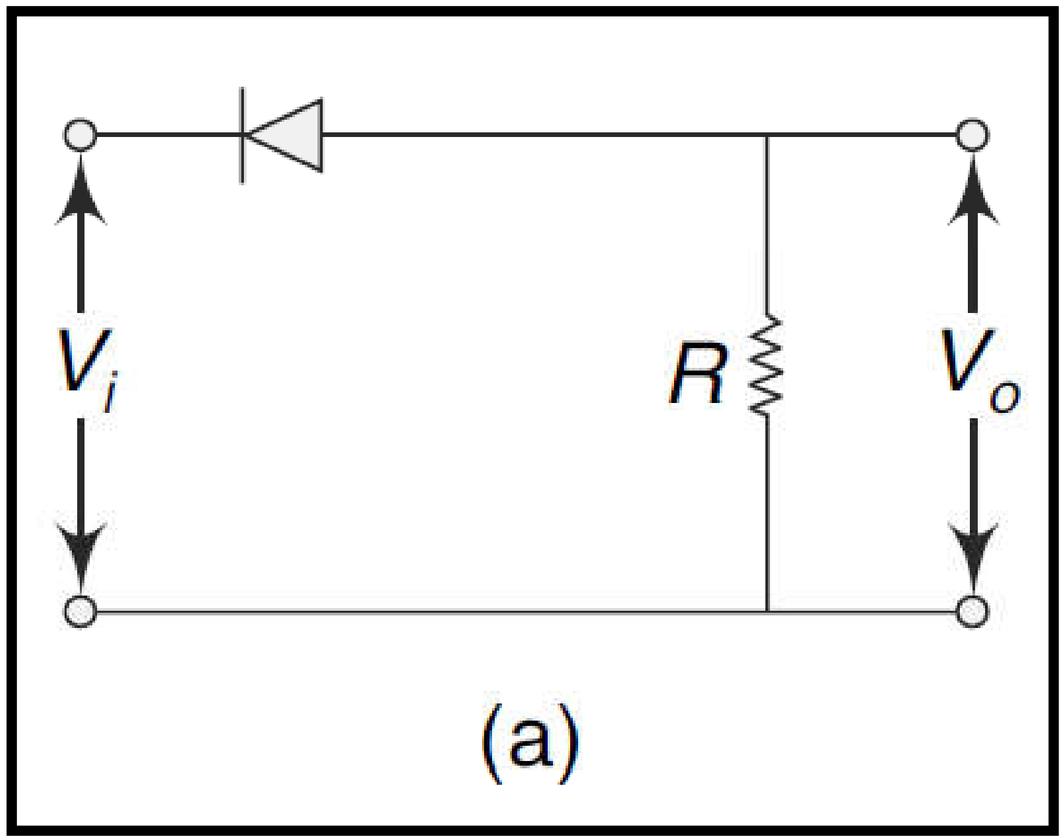


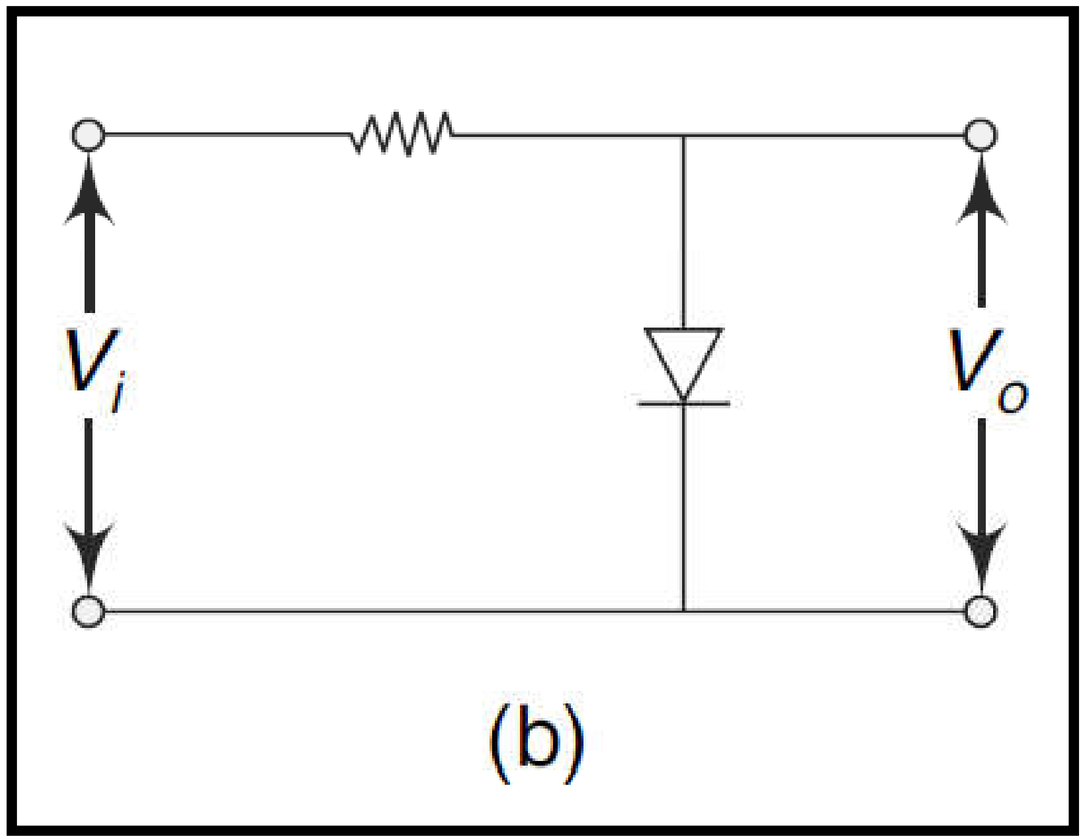


Solution

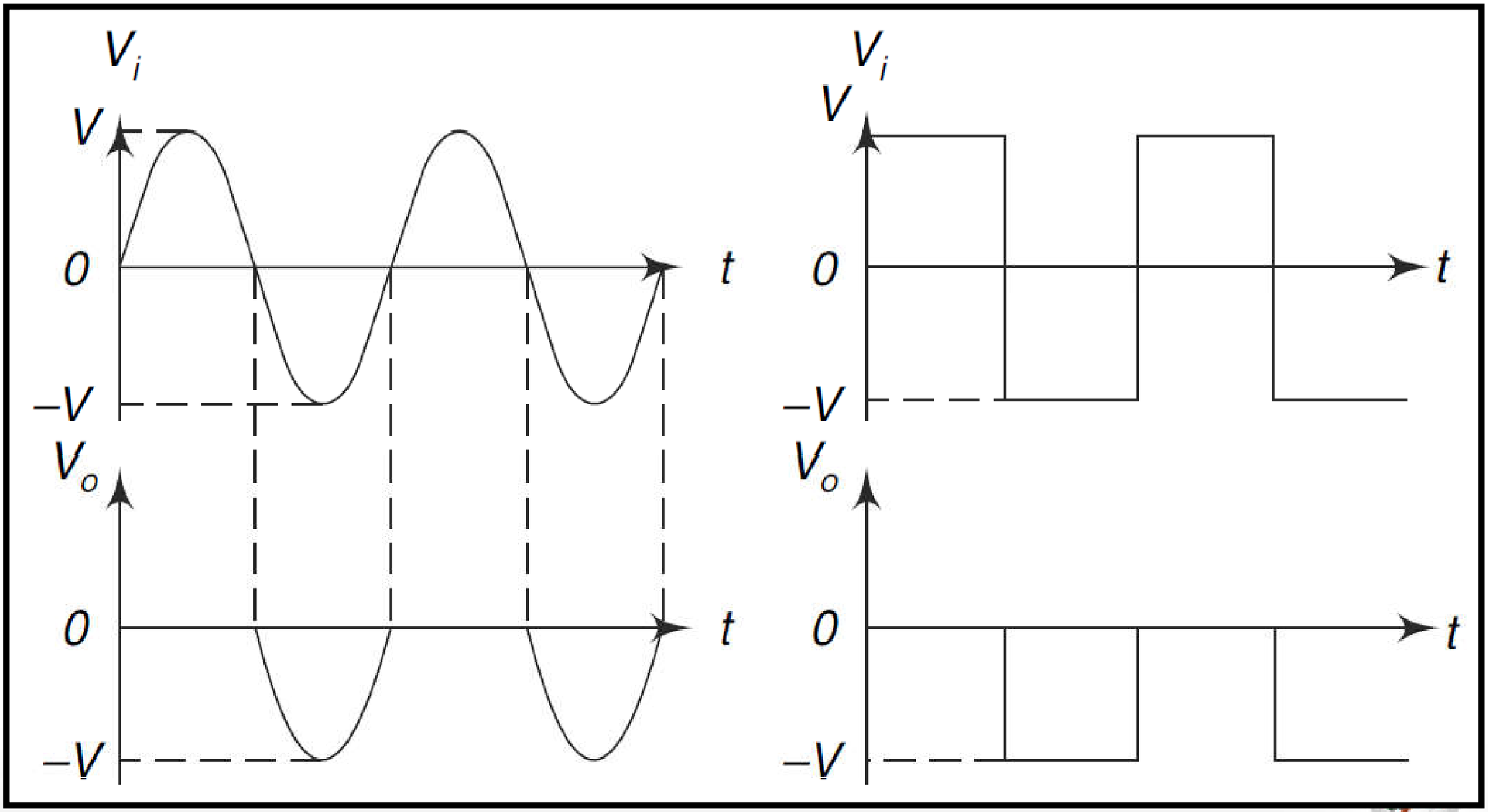


Concept Check

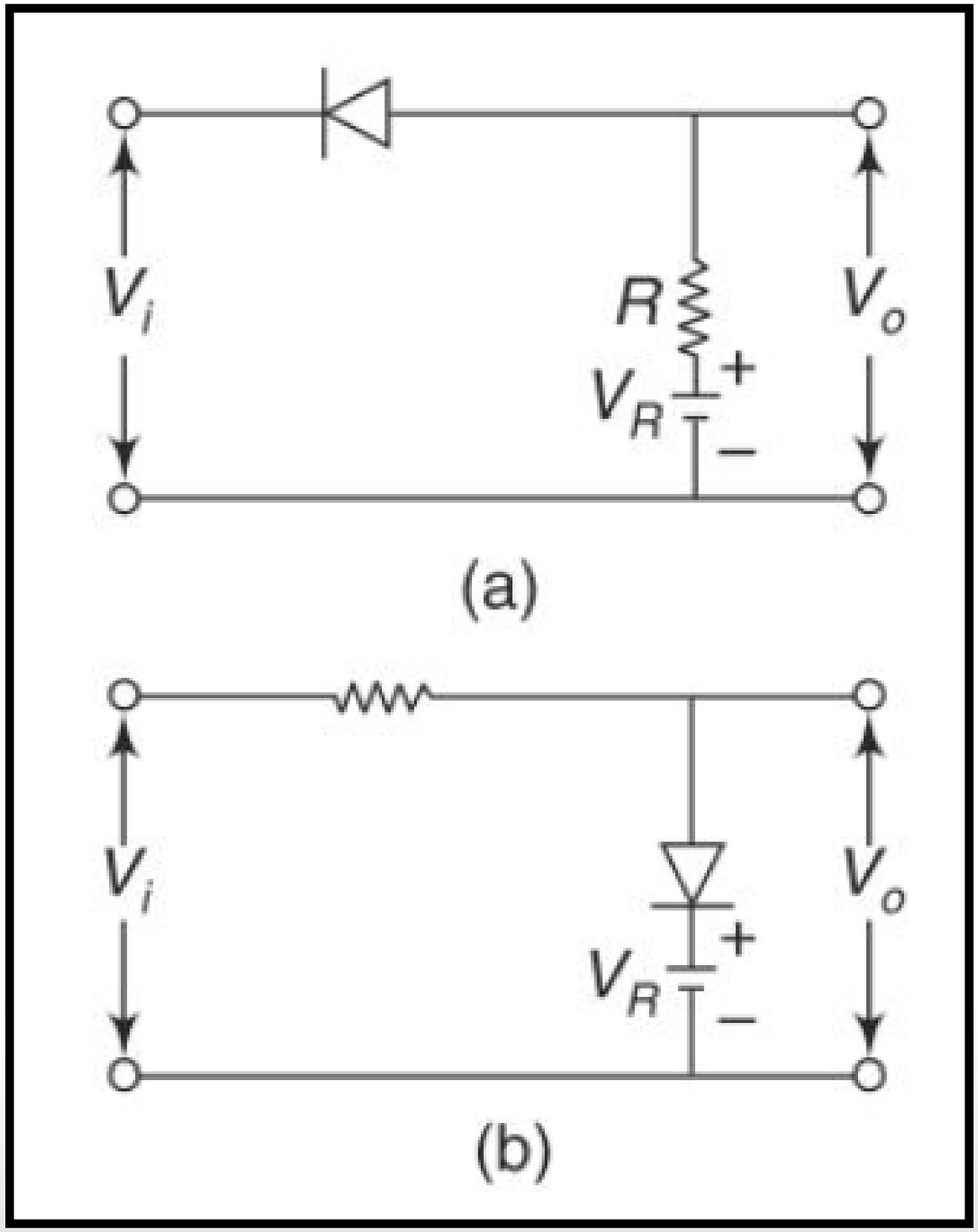




Solution



Question



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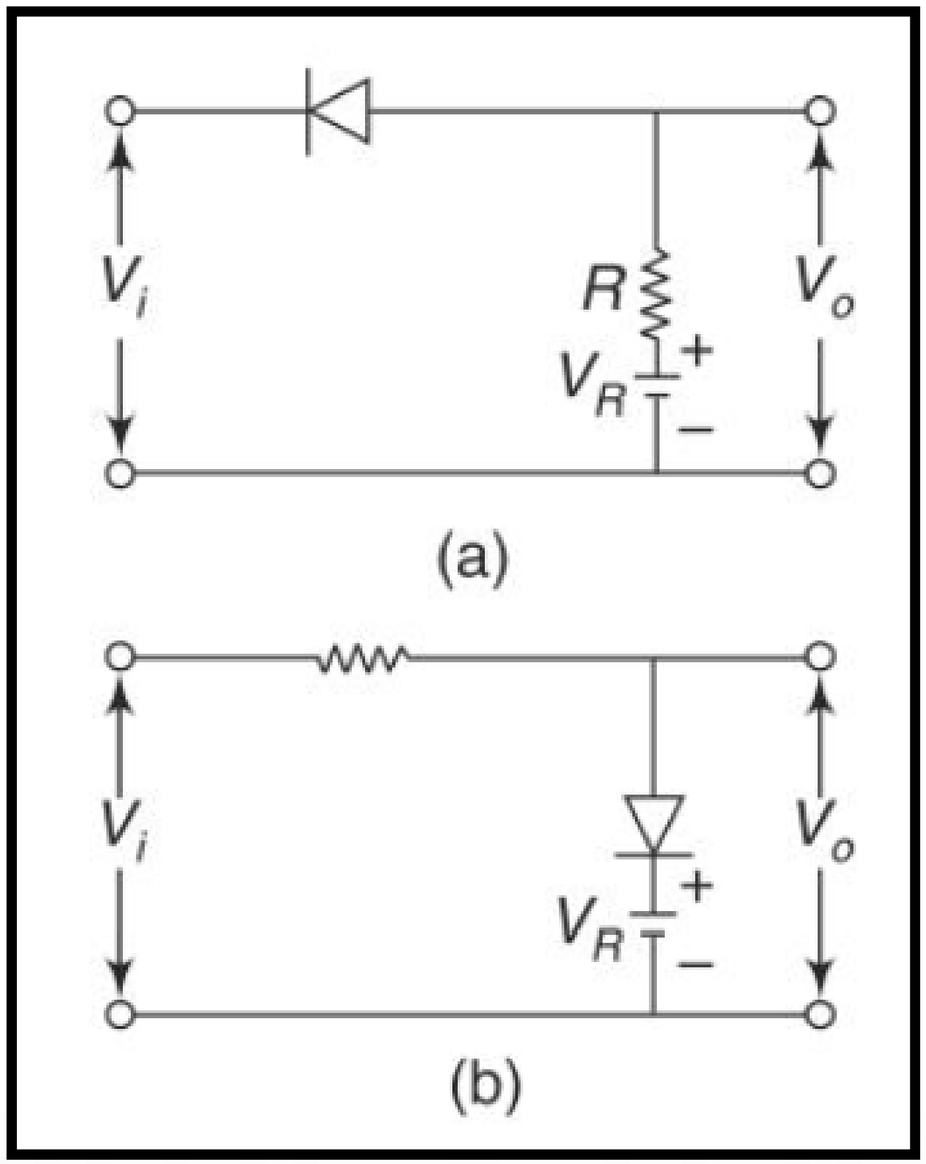

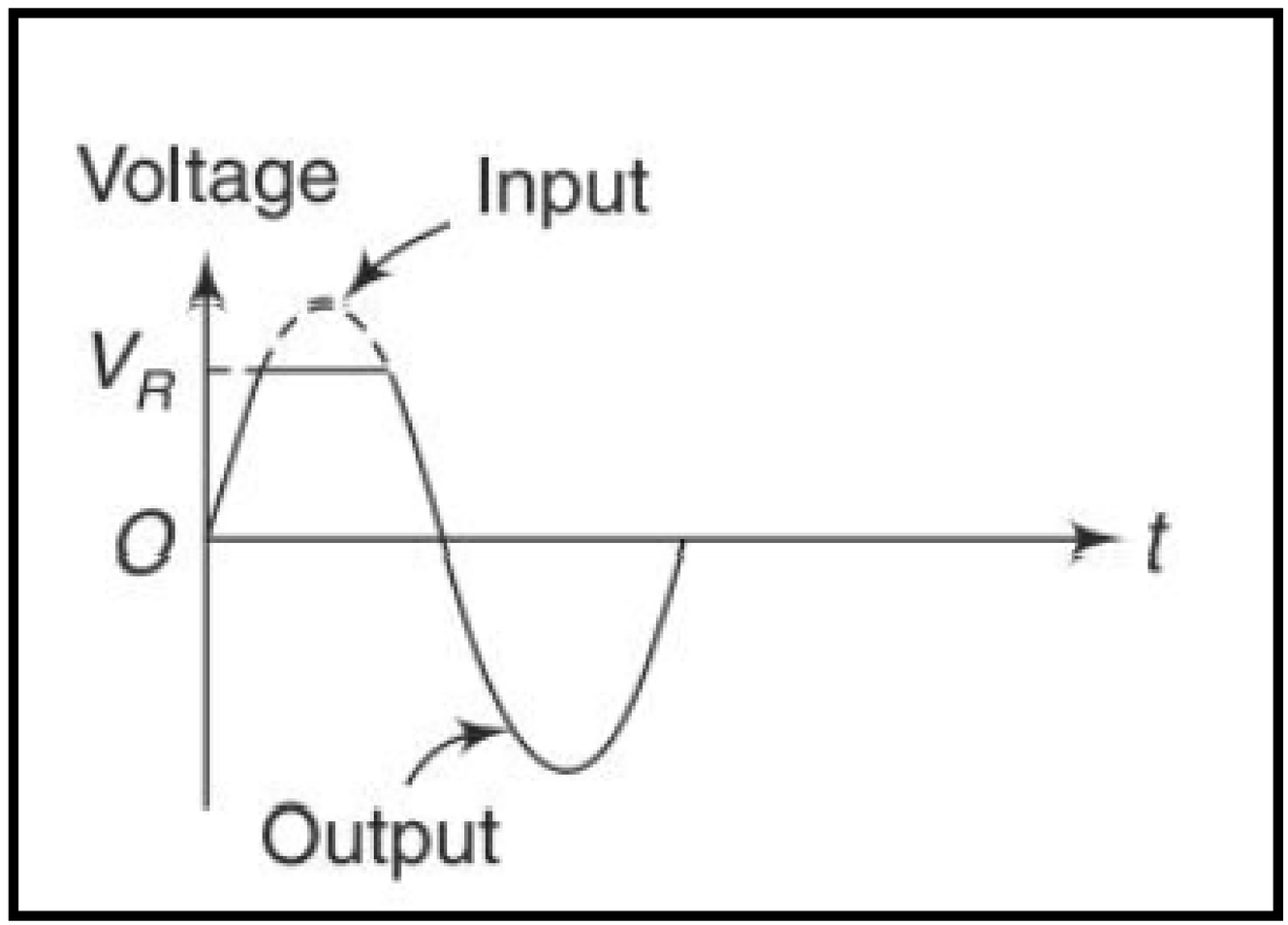

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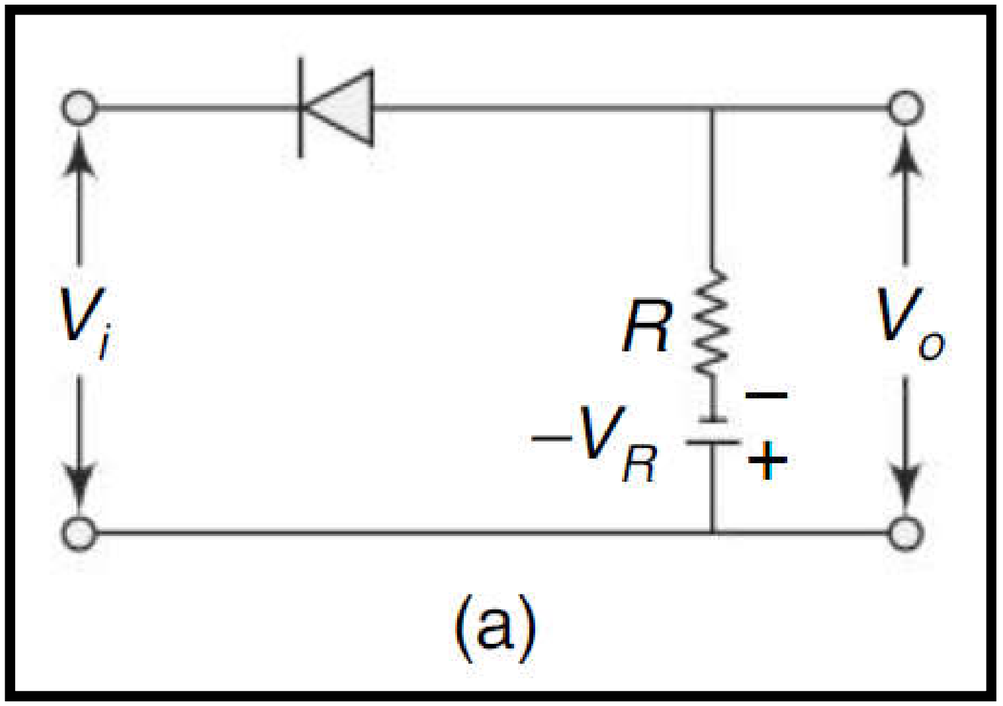
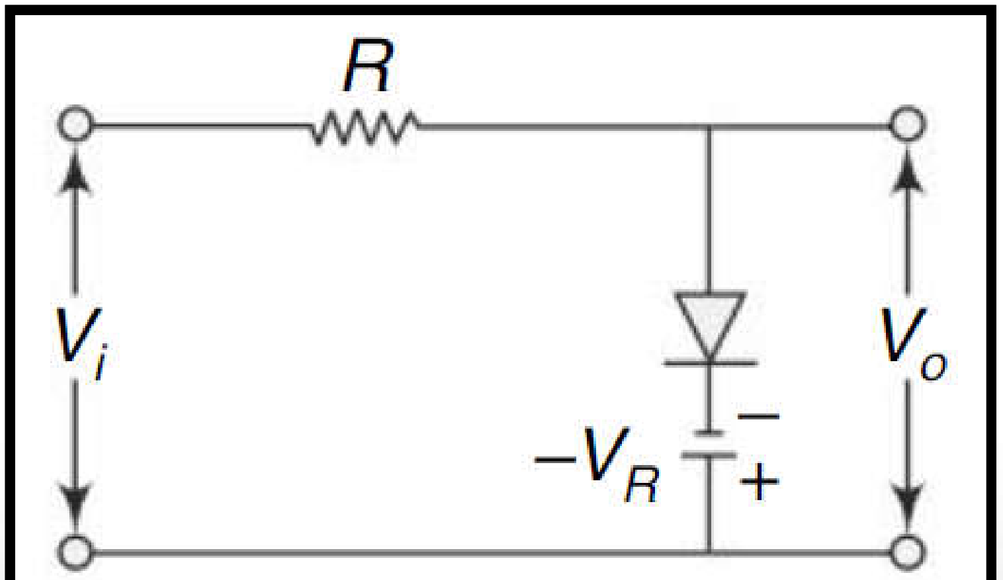
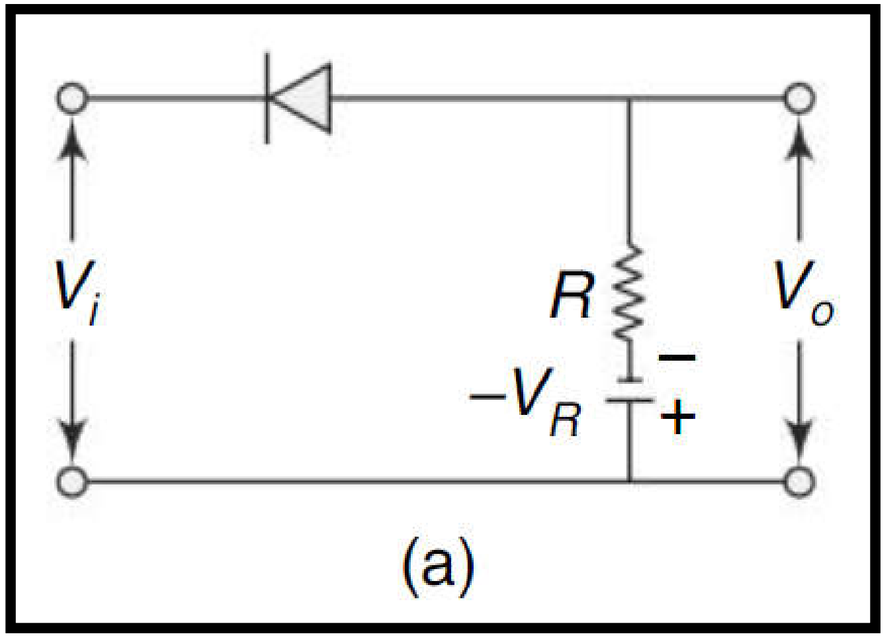


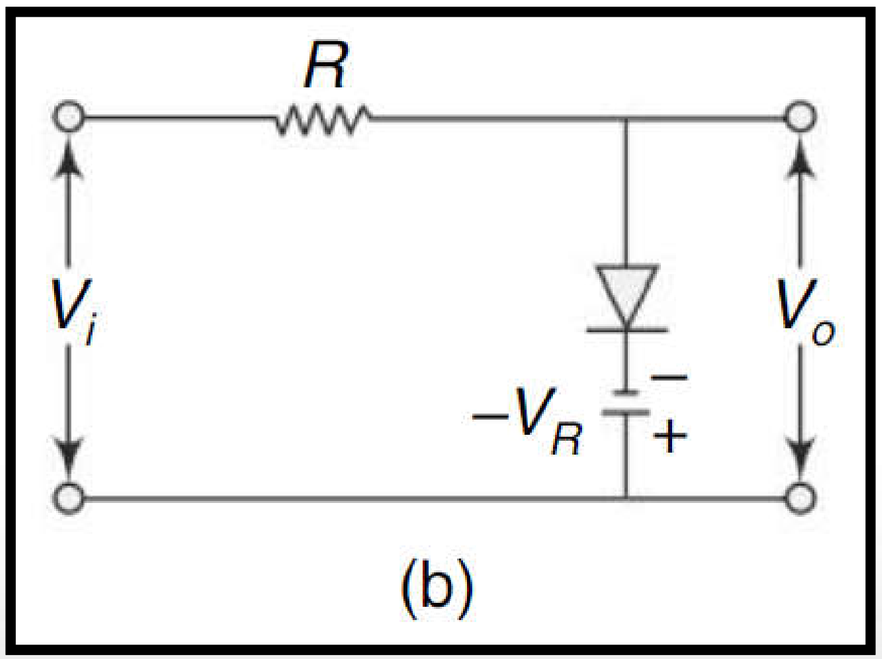
(a)

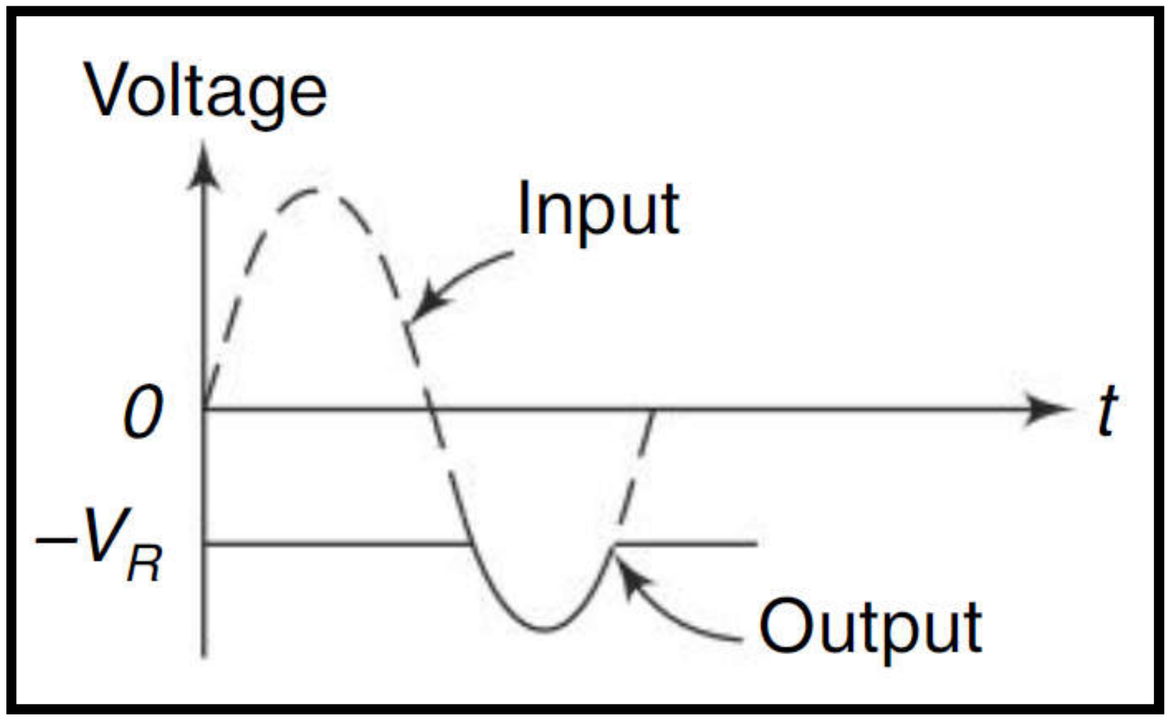


(b)

Solution







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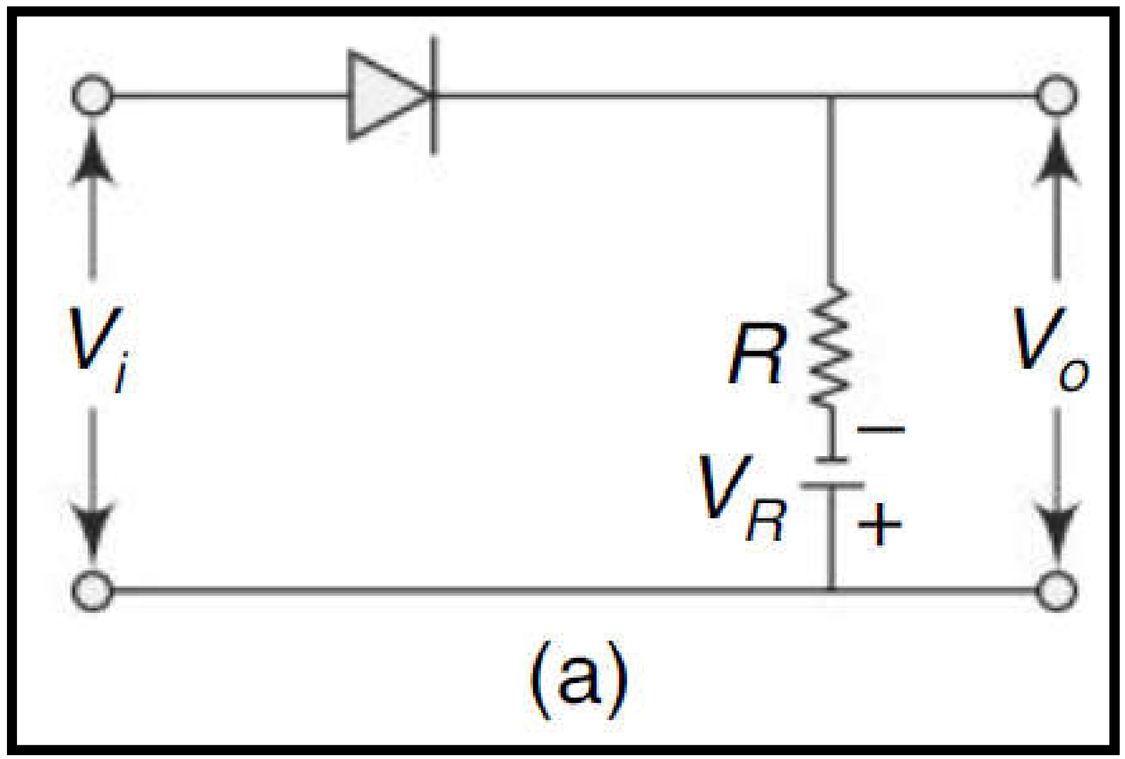
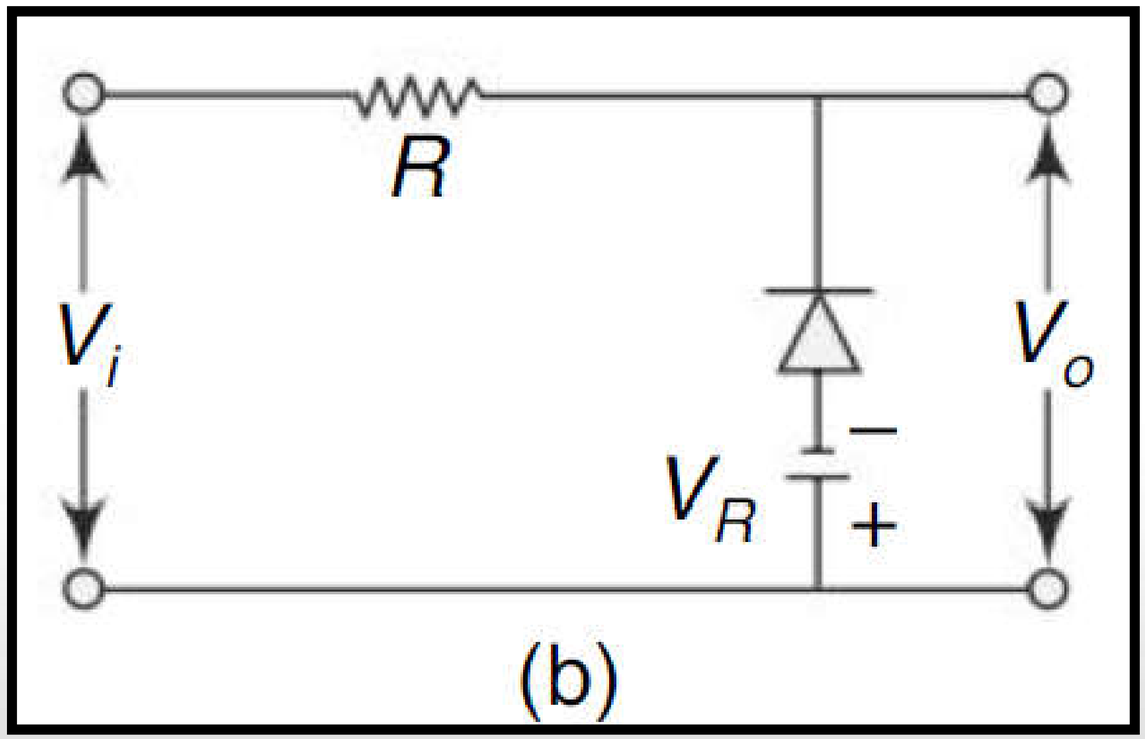
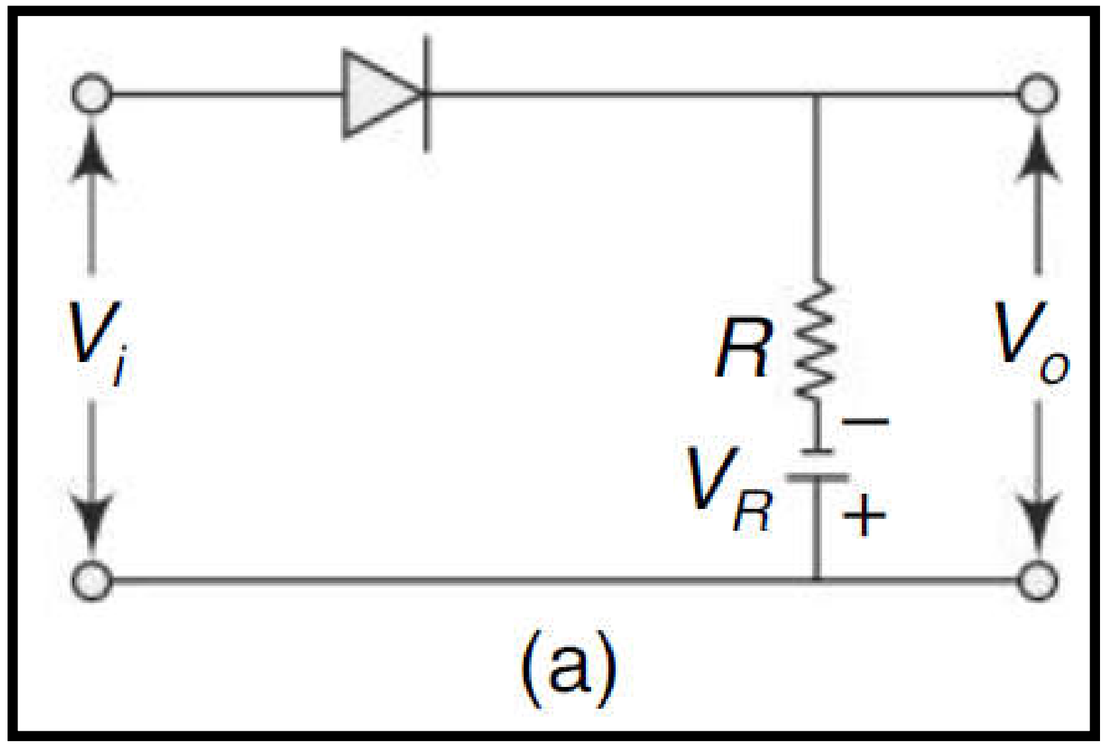
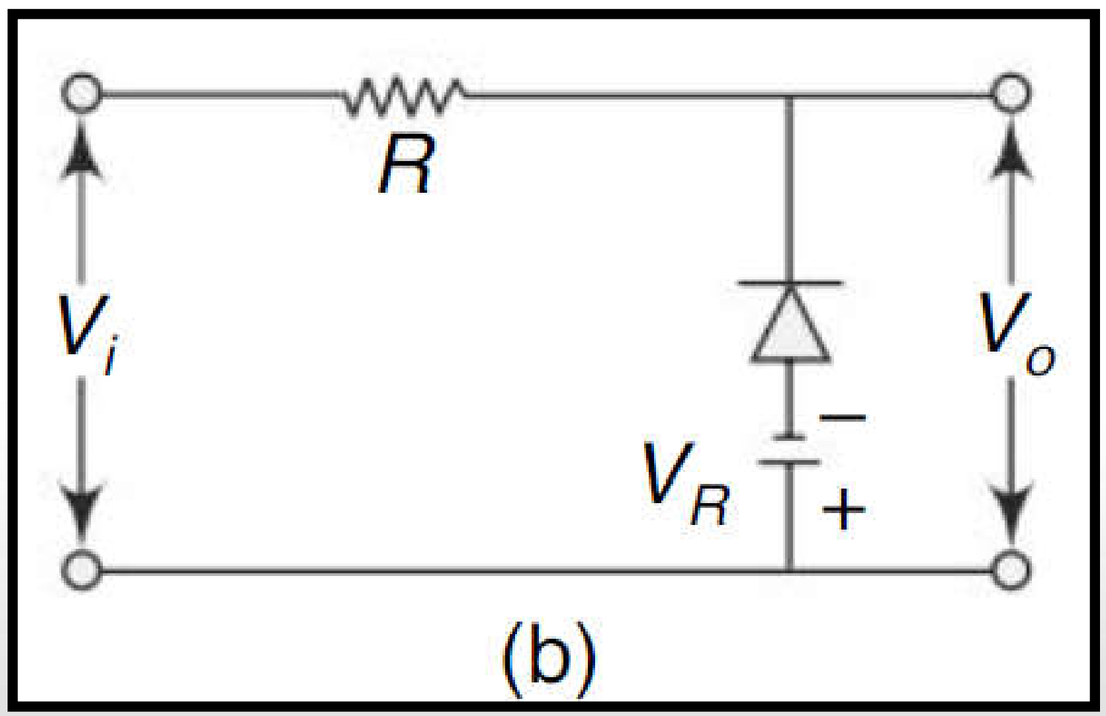




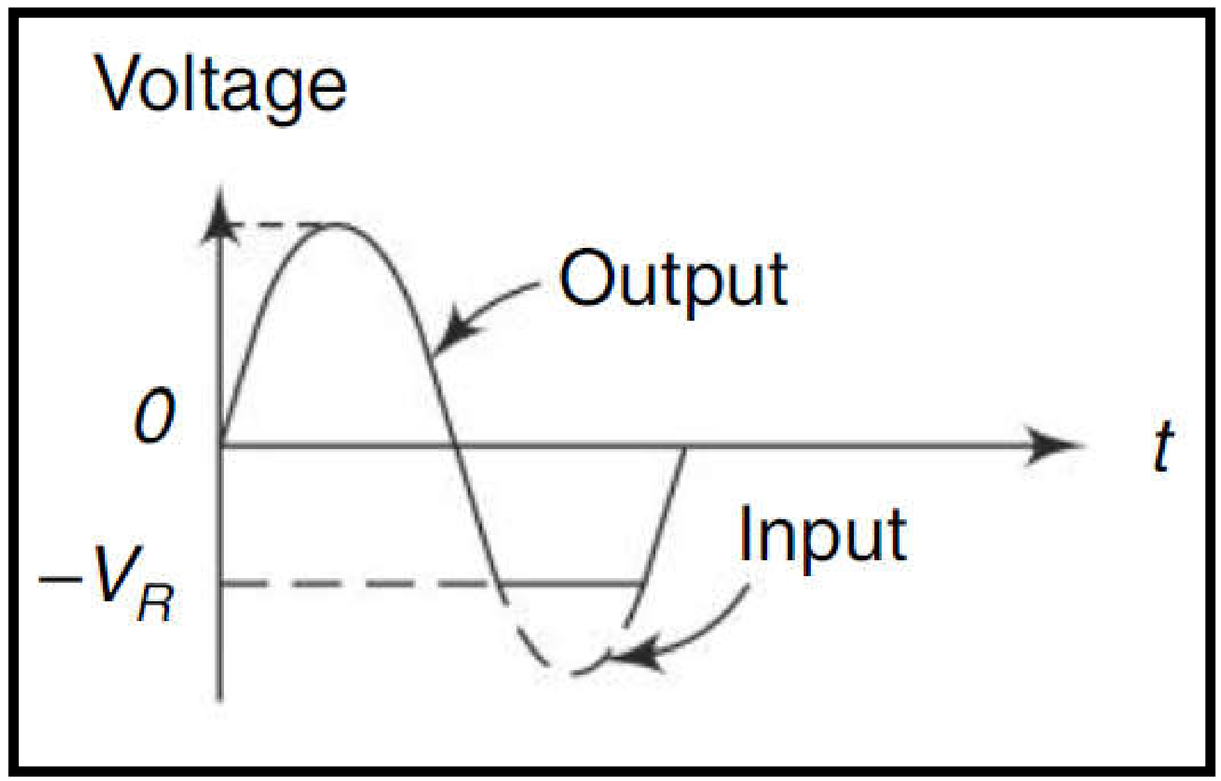
Solution



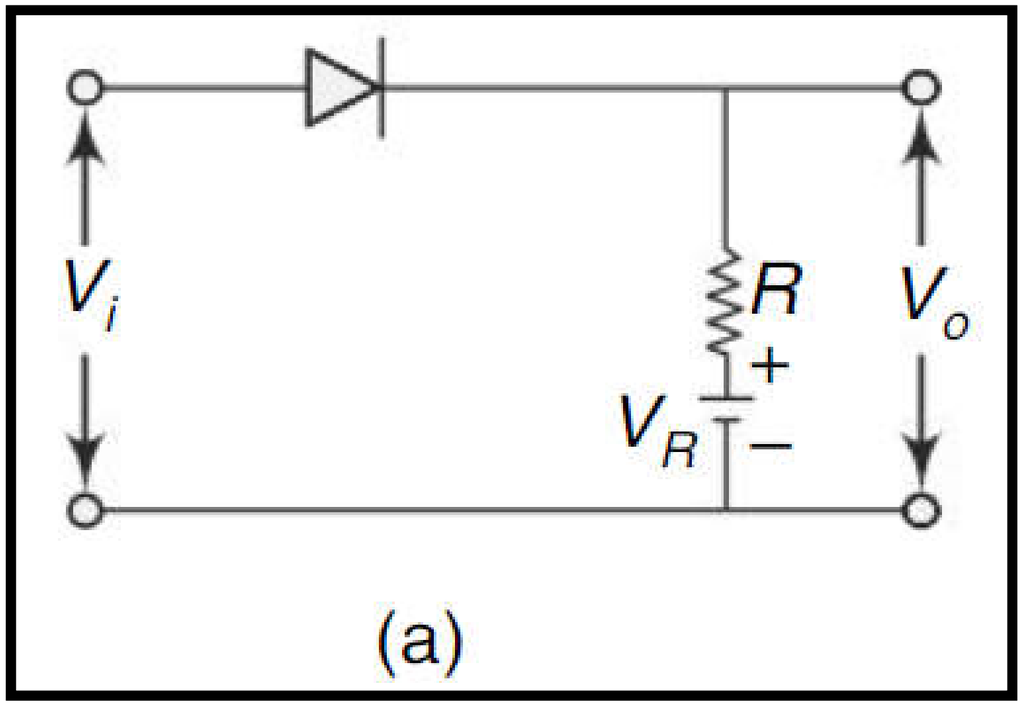
(a)



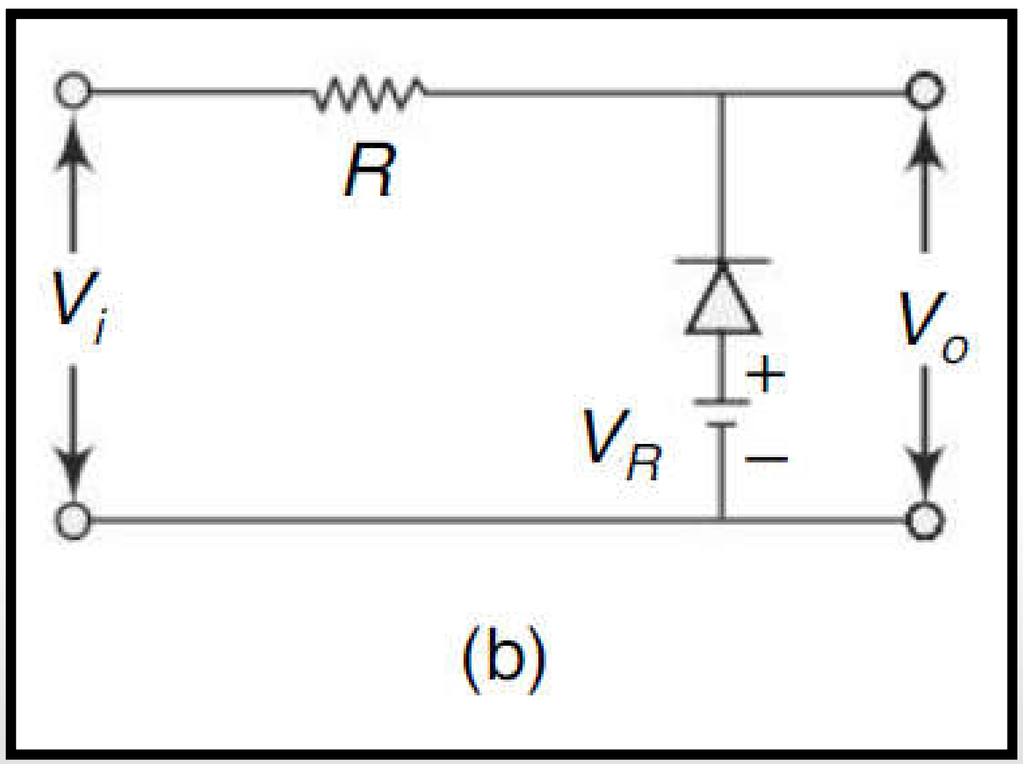
(b)



Question

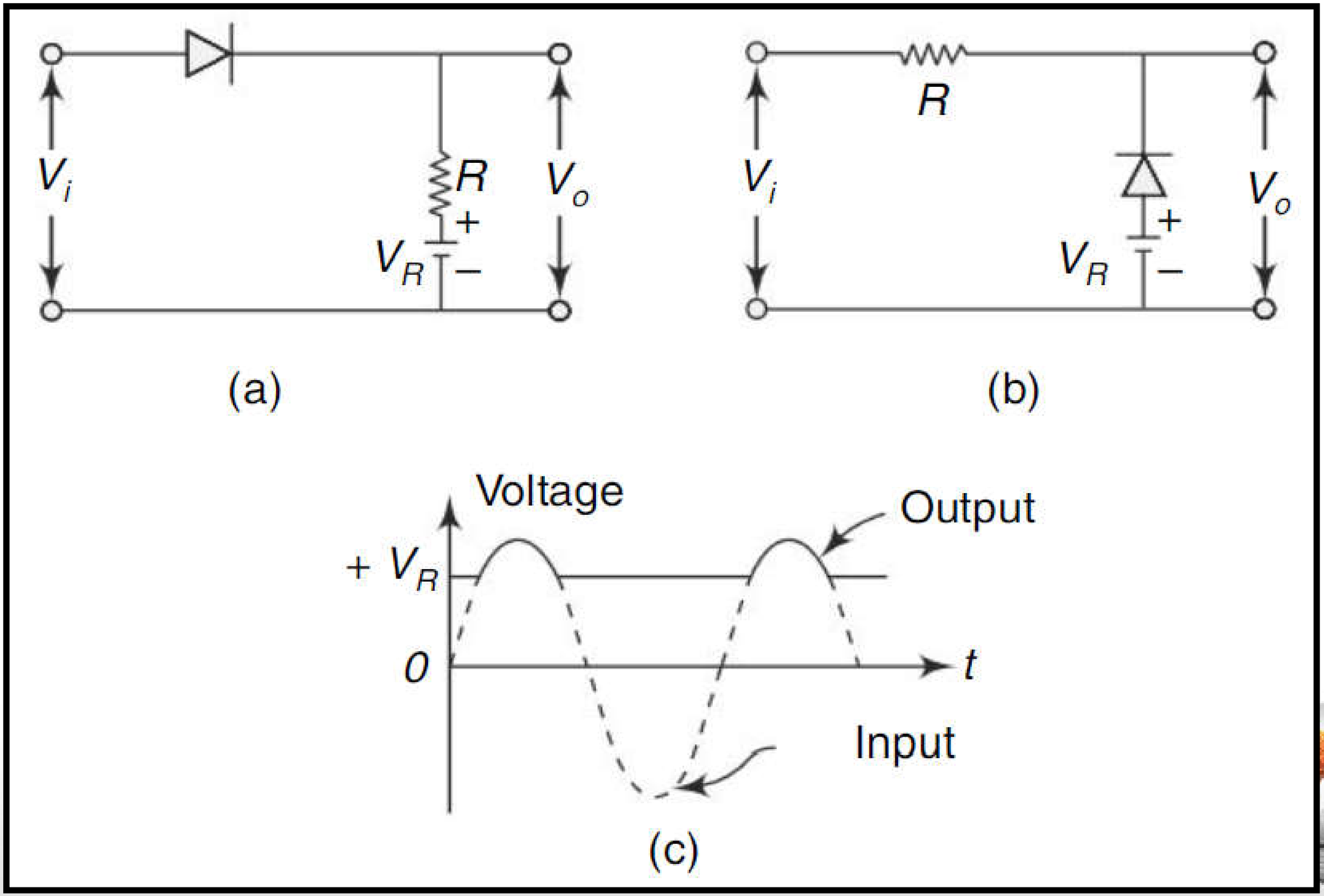


(a)

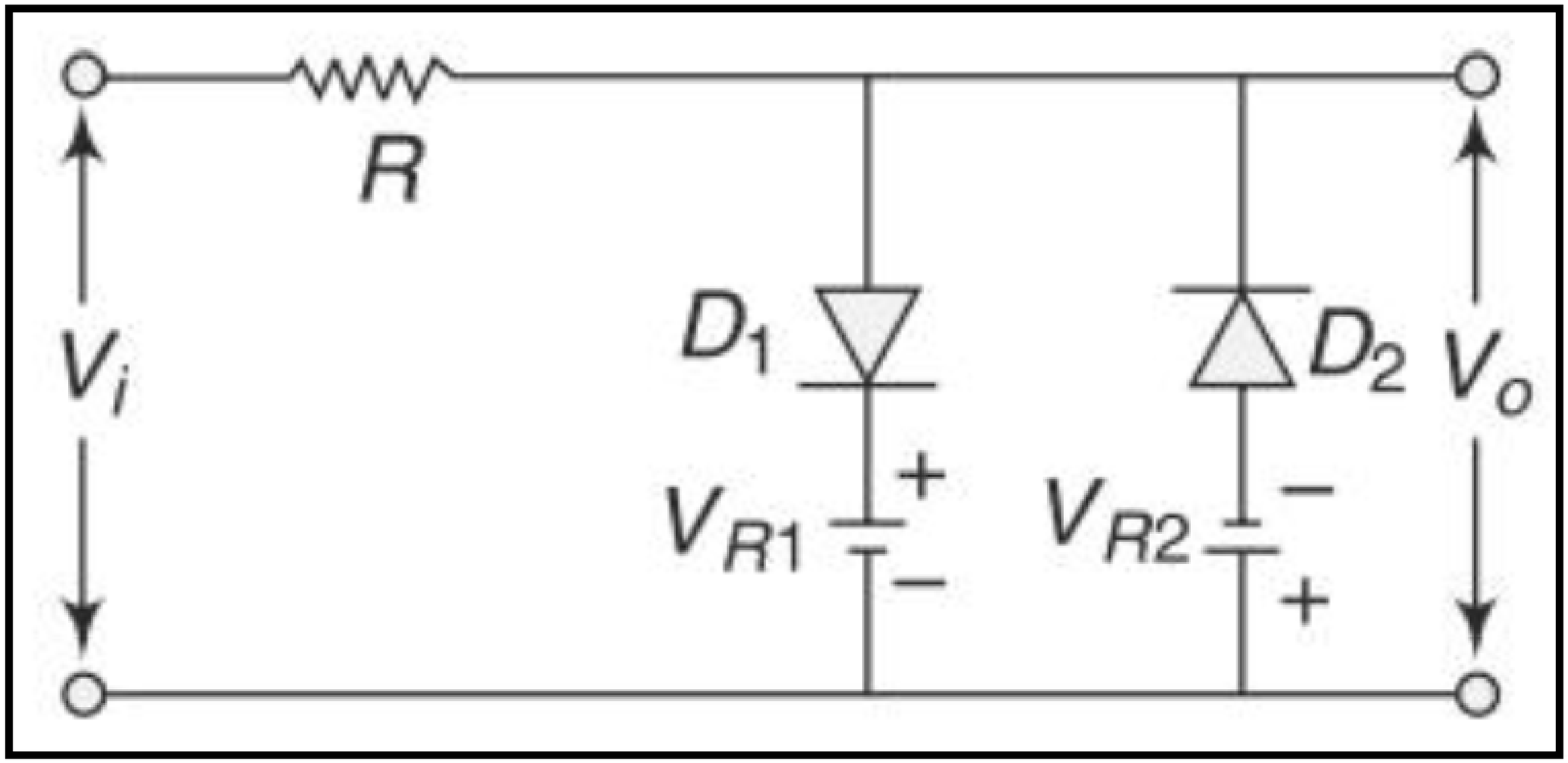


(b)

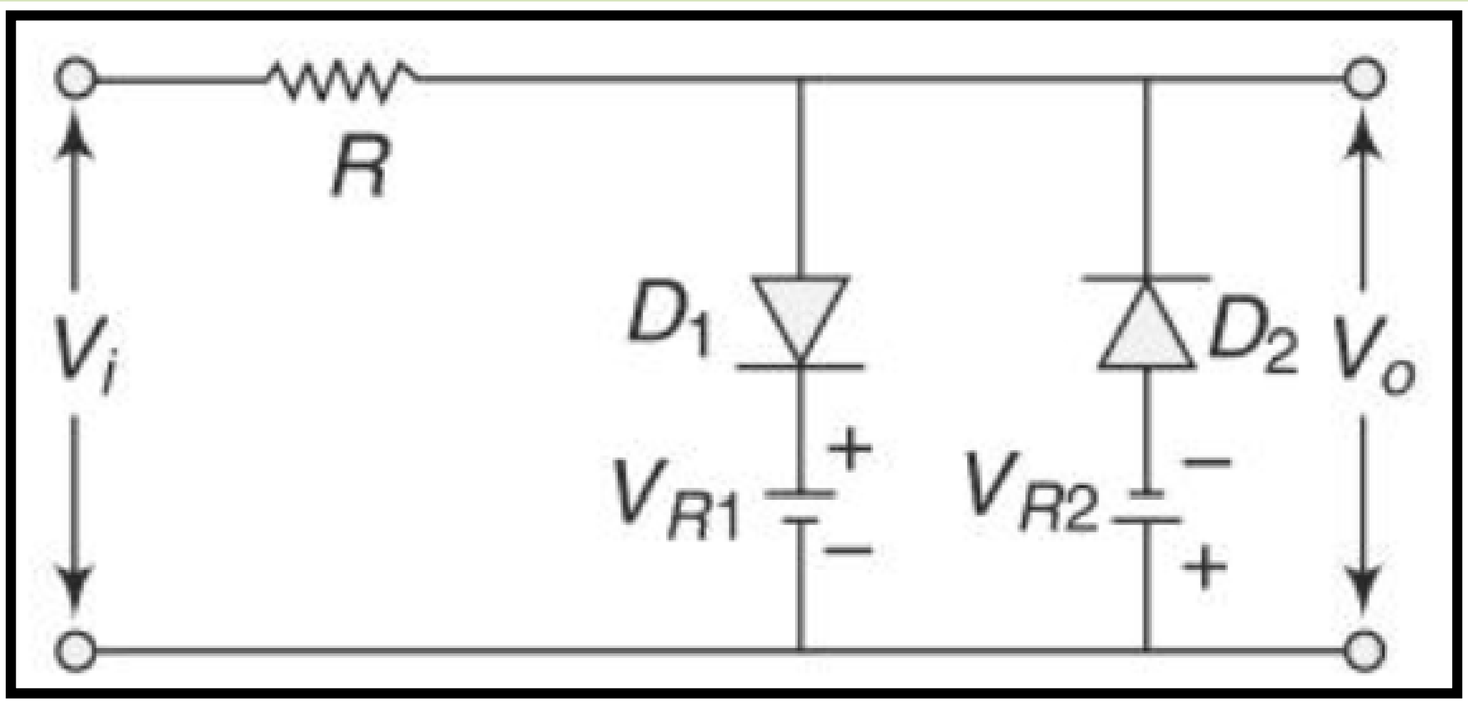
Solution

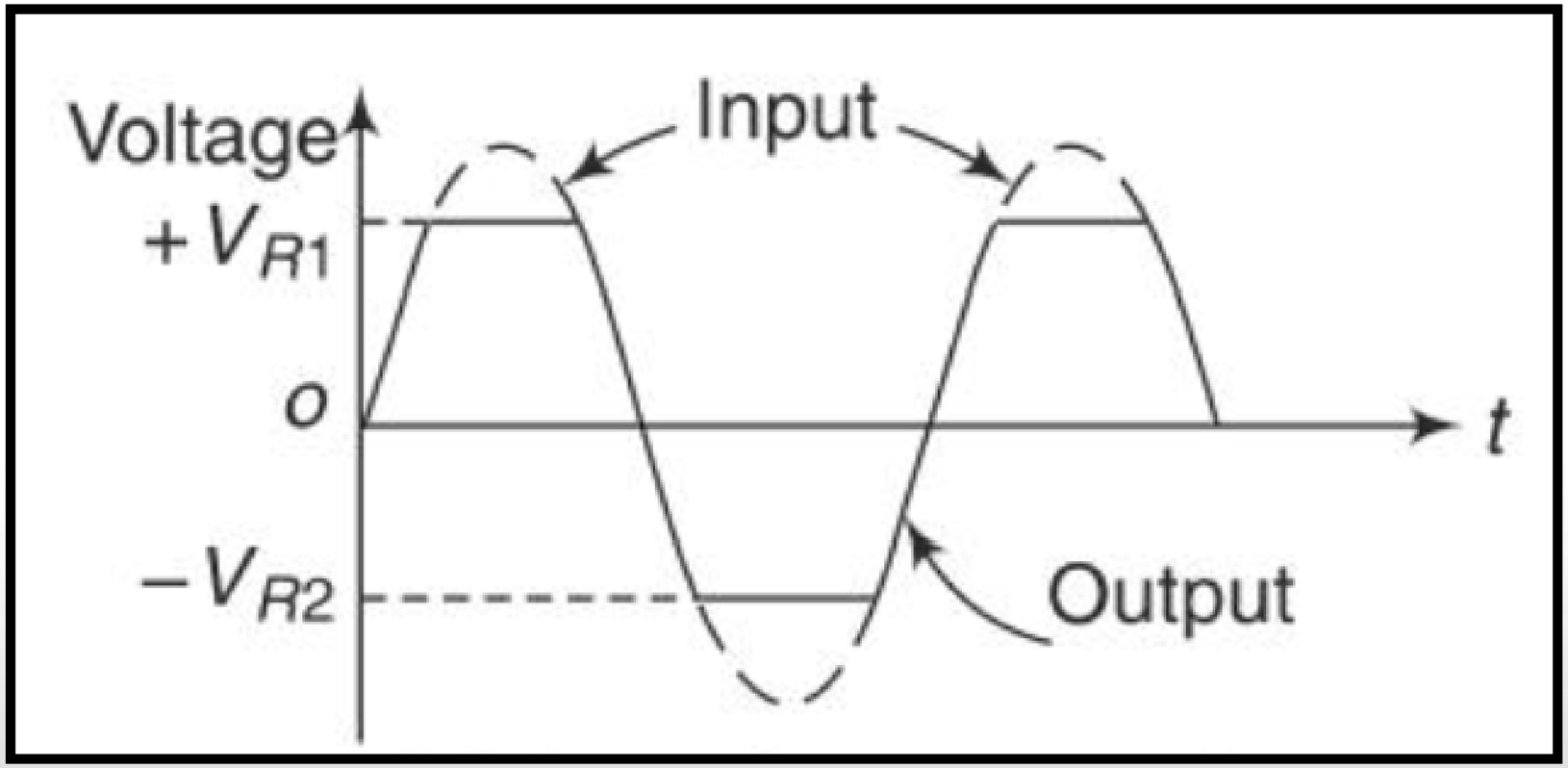


Two Level Clipper Circuit



Solution





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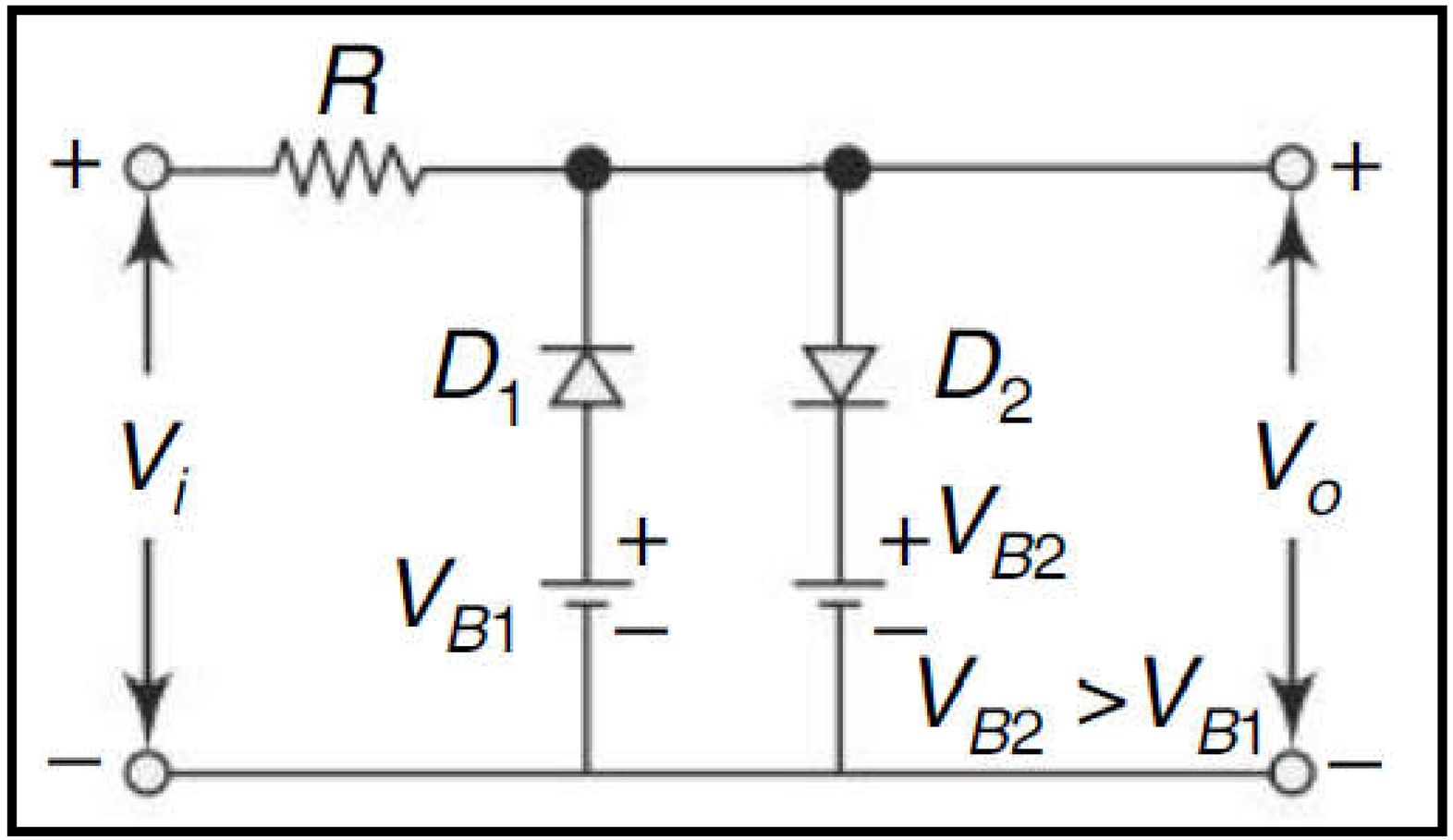
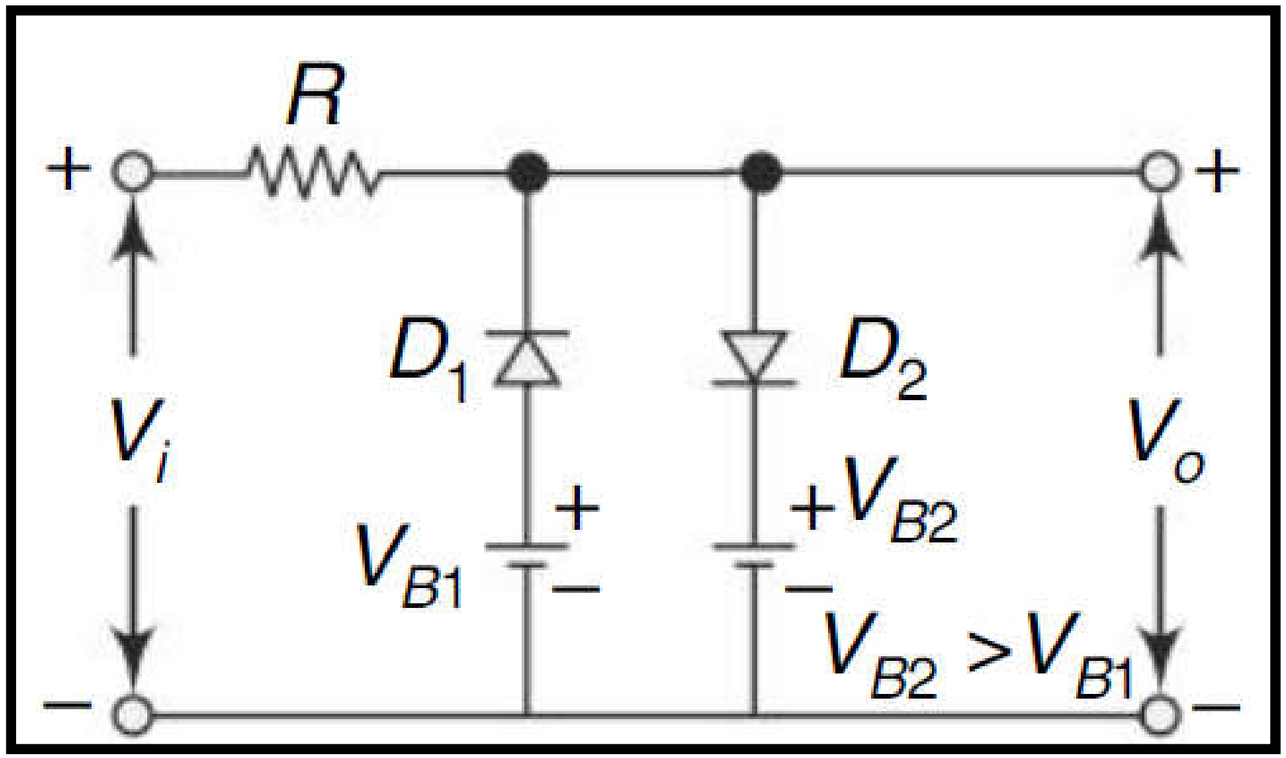
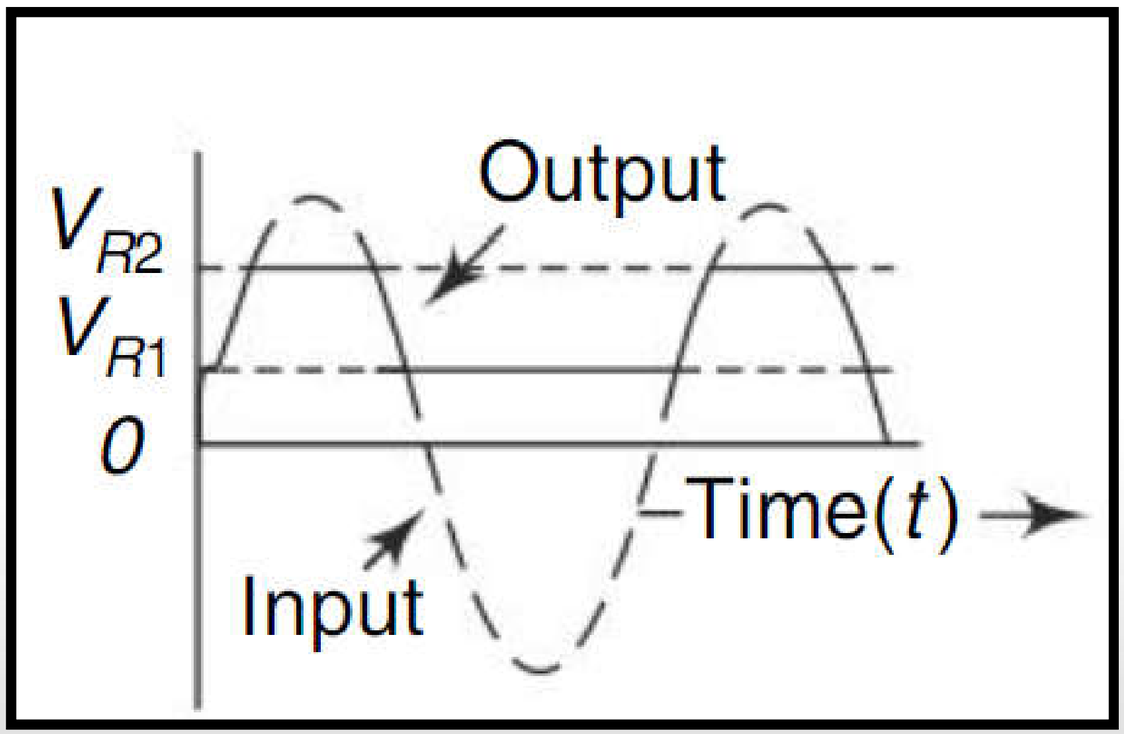
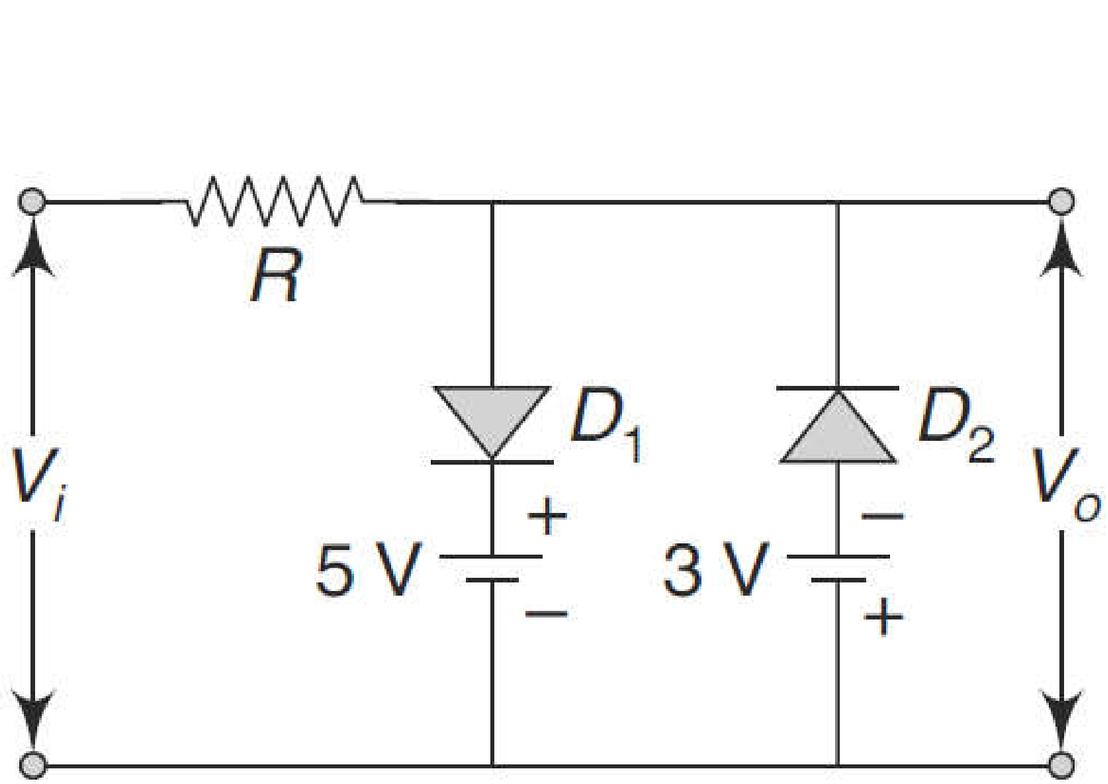


Solution





Determine Output assuming Ideal Diodes



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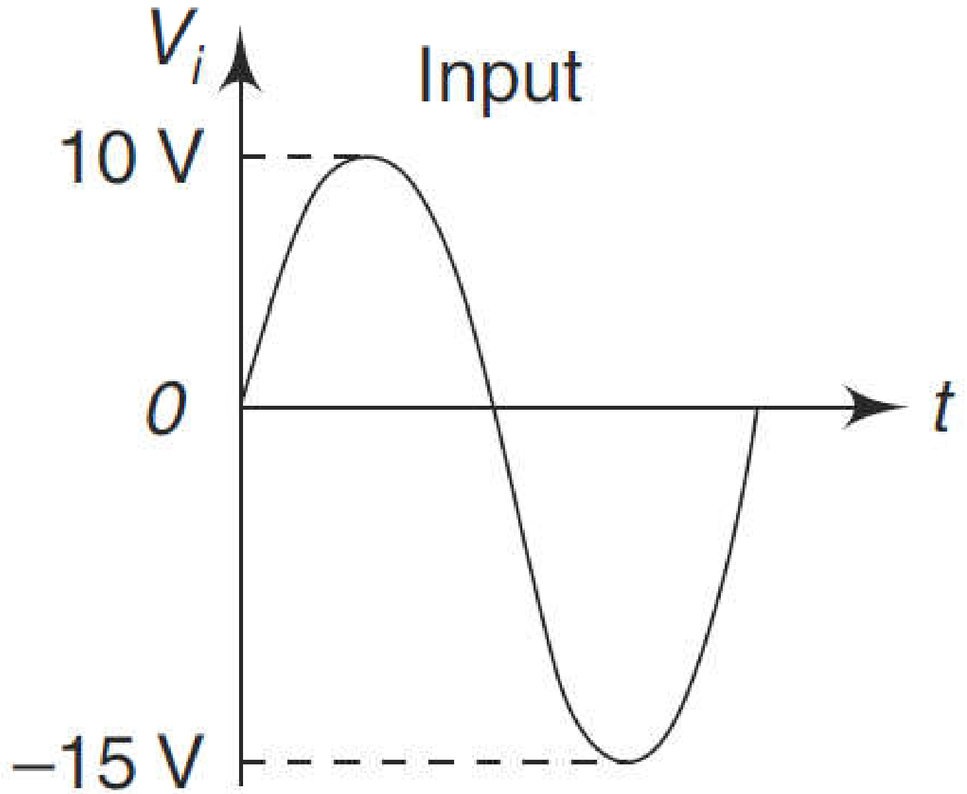

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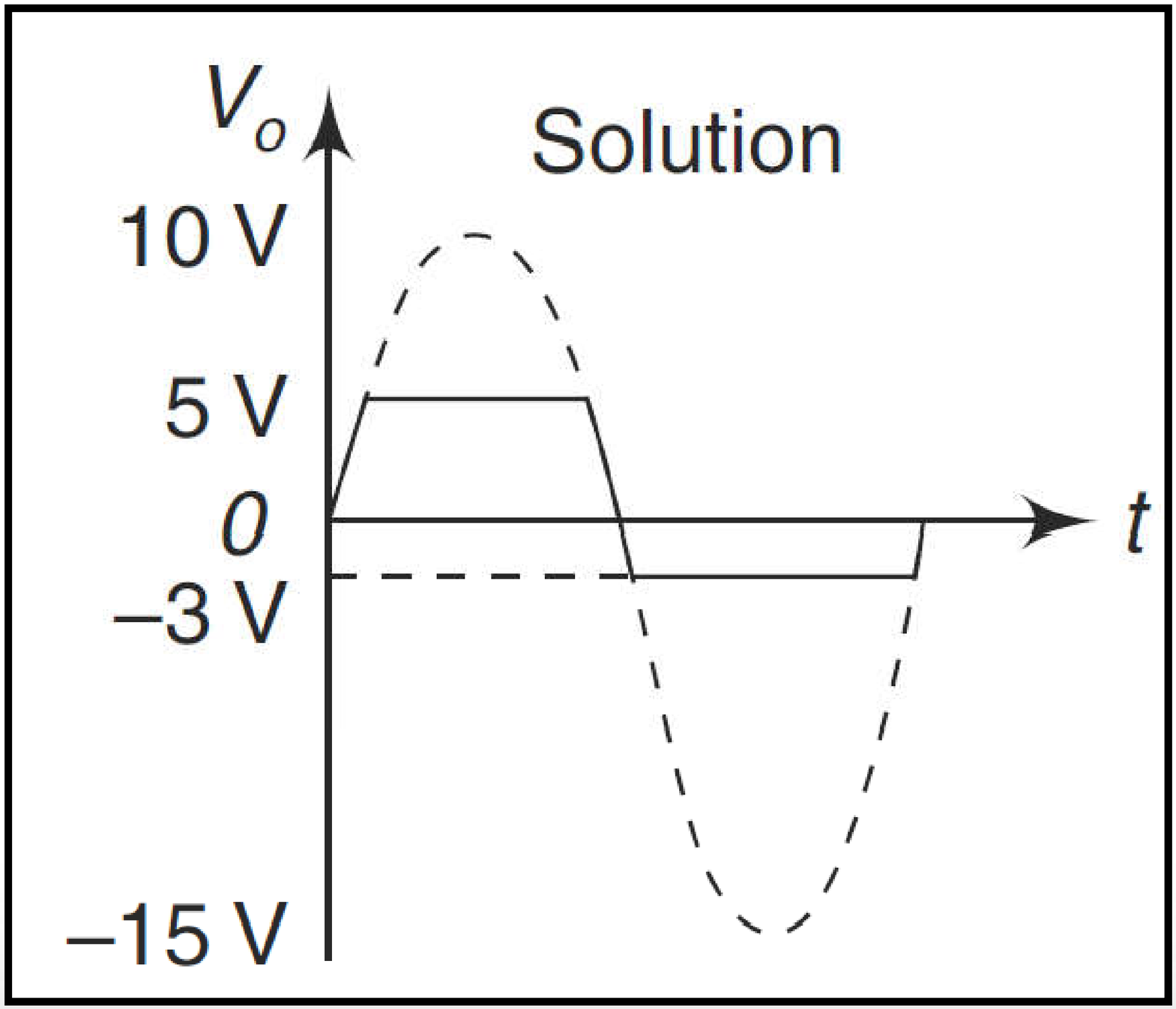
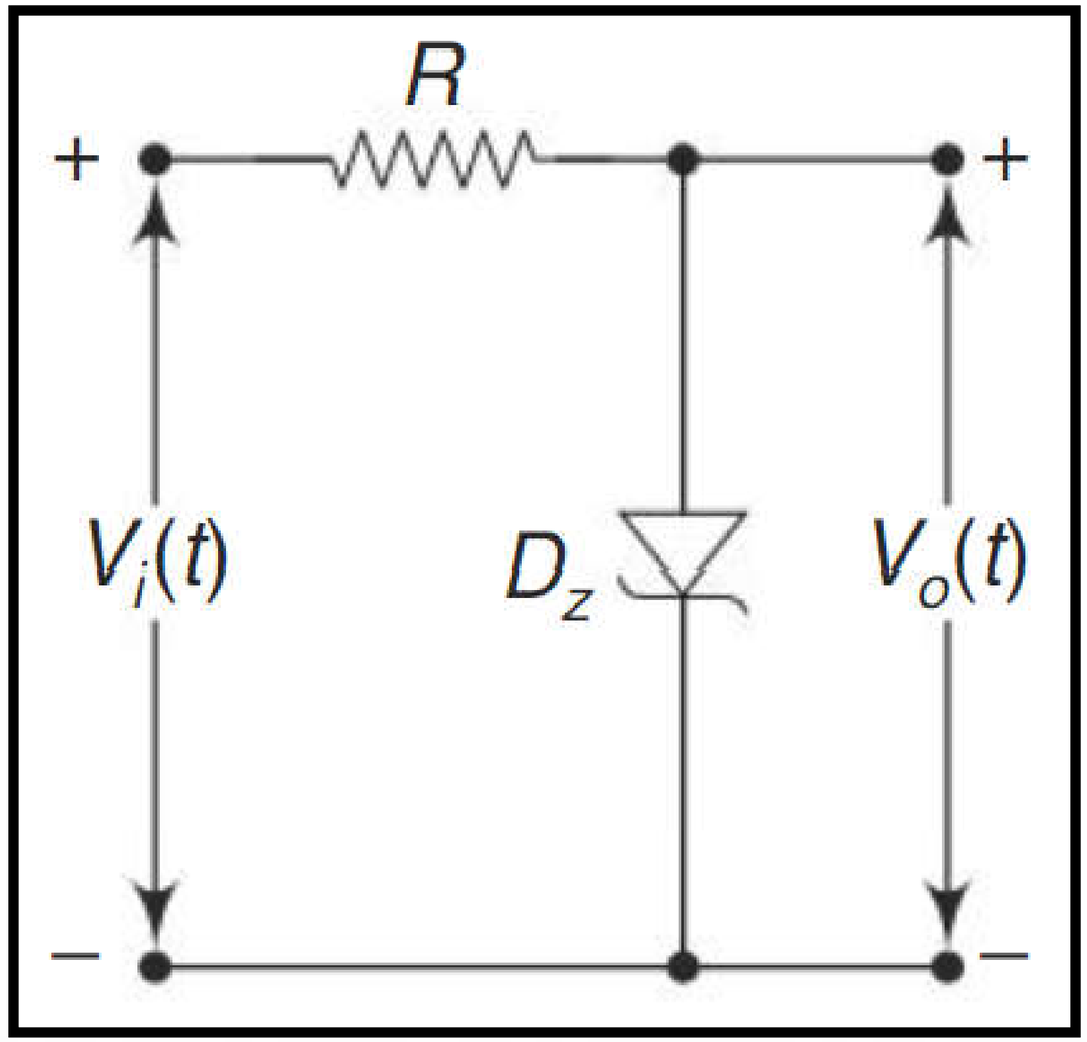
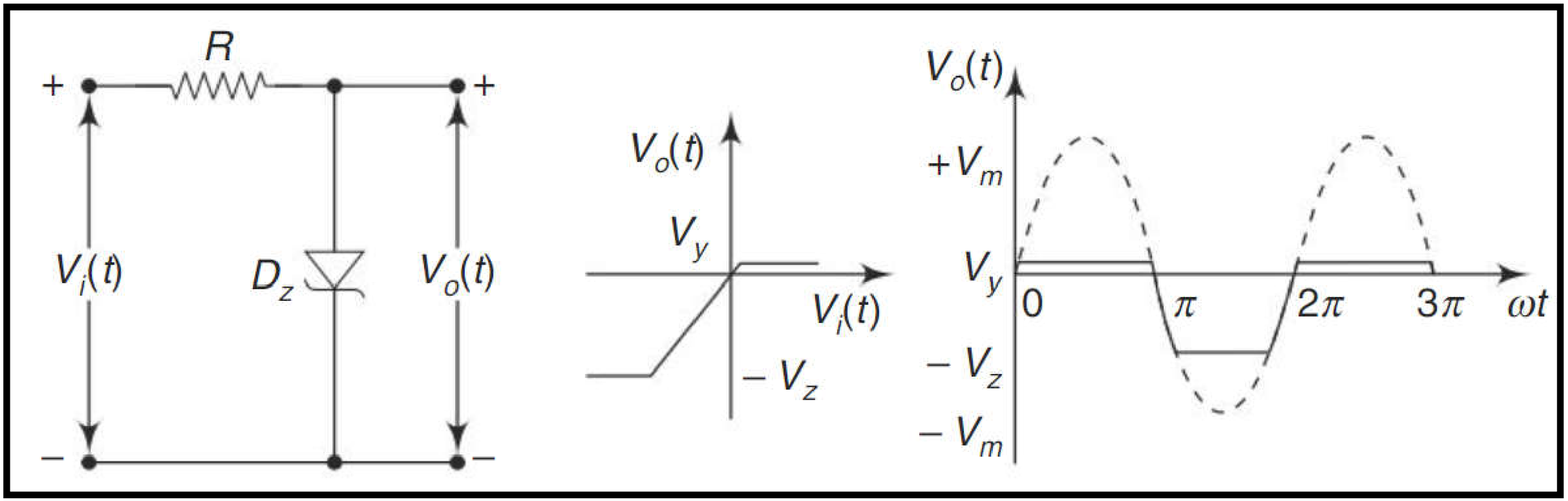
Solution



Zener Diode Clipper Circuits



Solution



To Be Continued...