CSE2209: Digital Electronics and Pulse Techniques

Course Conducted By:

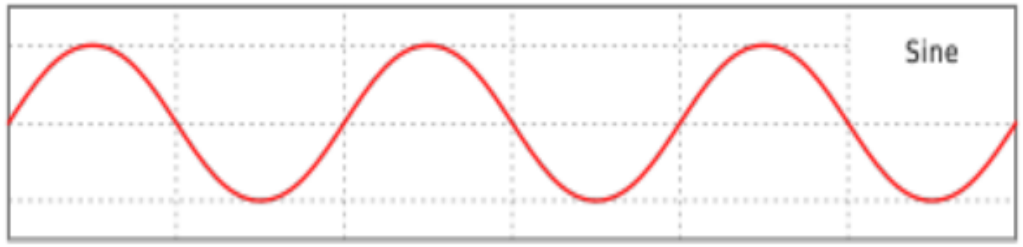
Nowshin Nawar Arony

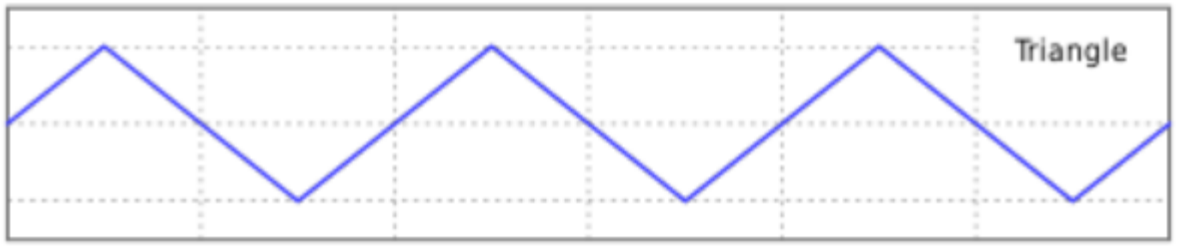
Lecturer, Dept of CSE, AUST

Chapter 2

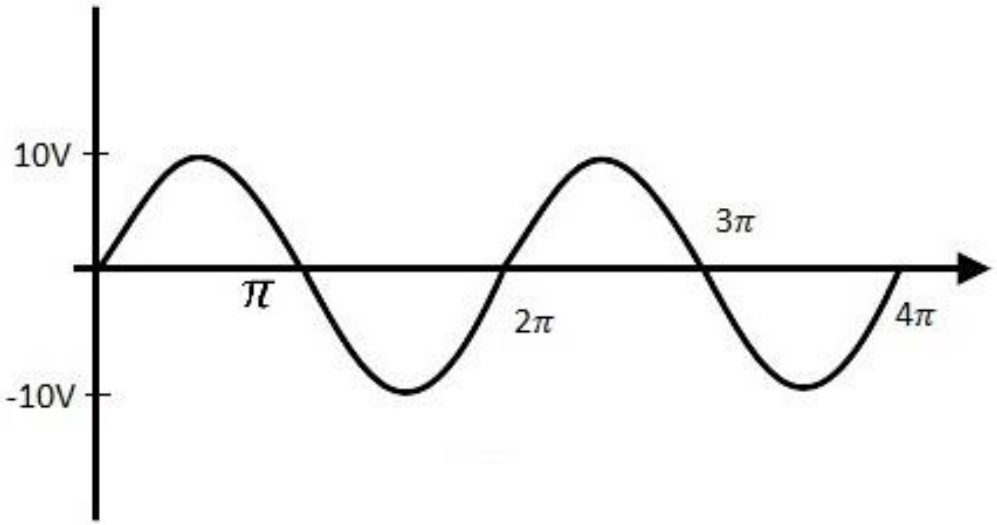
Clipper Circuit

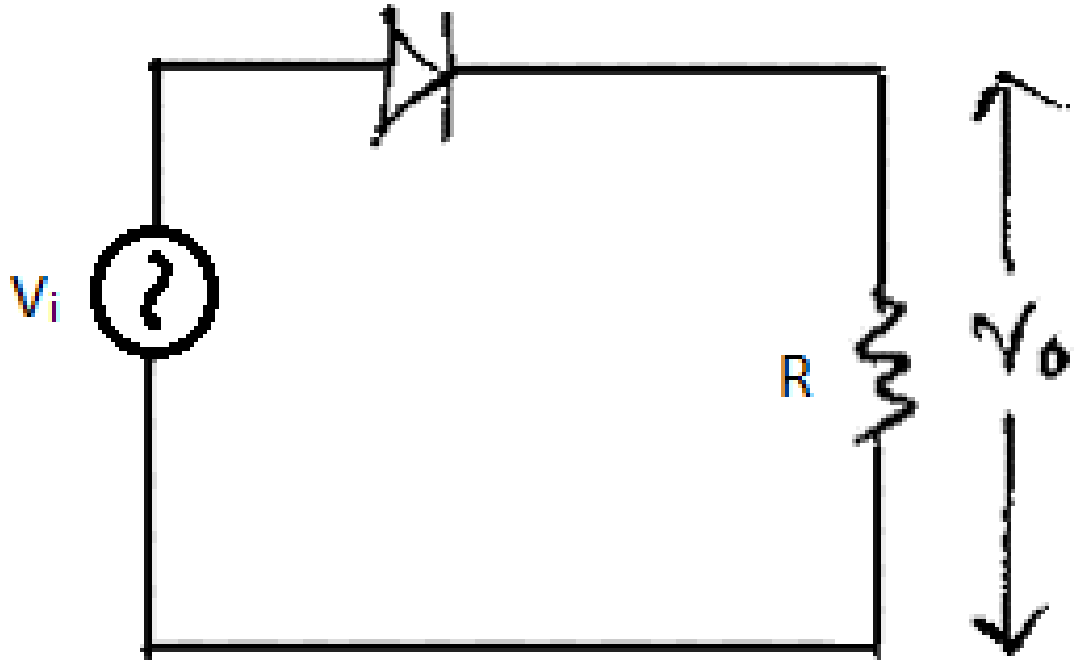
- A clipper circuit passes that part of an input signal which lies above or below some reference voltage.





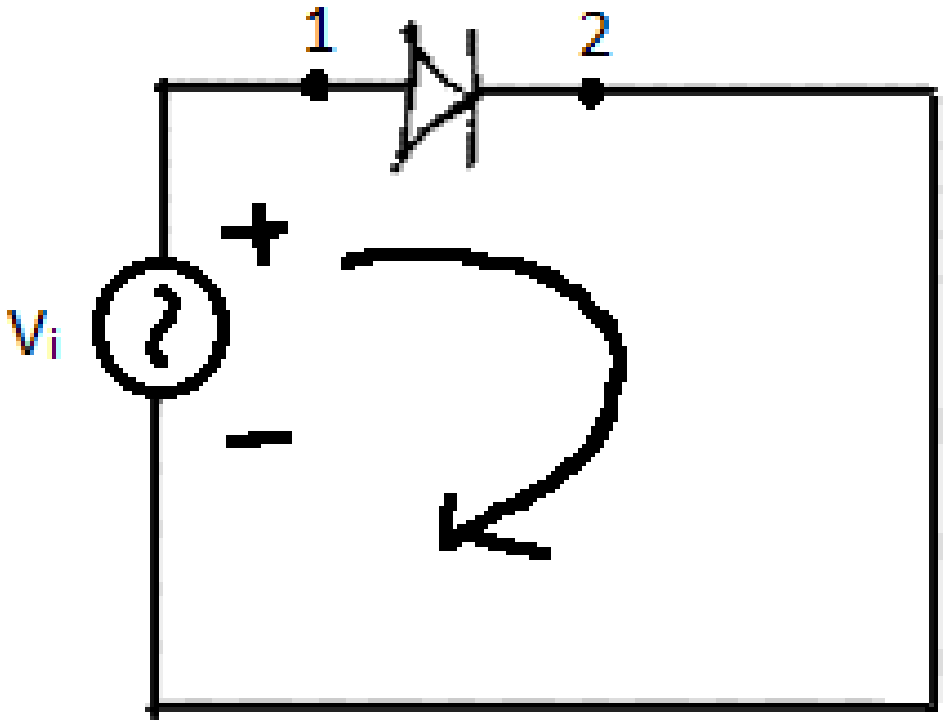
Circuit 1





Step 1: Find conditions for diode on and off. Draw circuit ignoring resistance

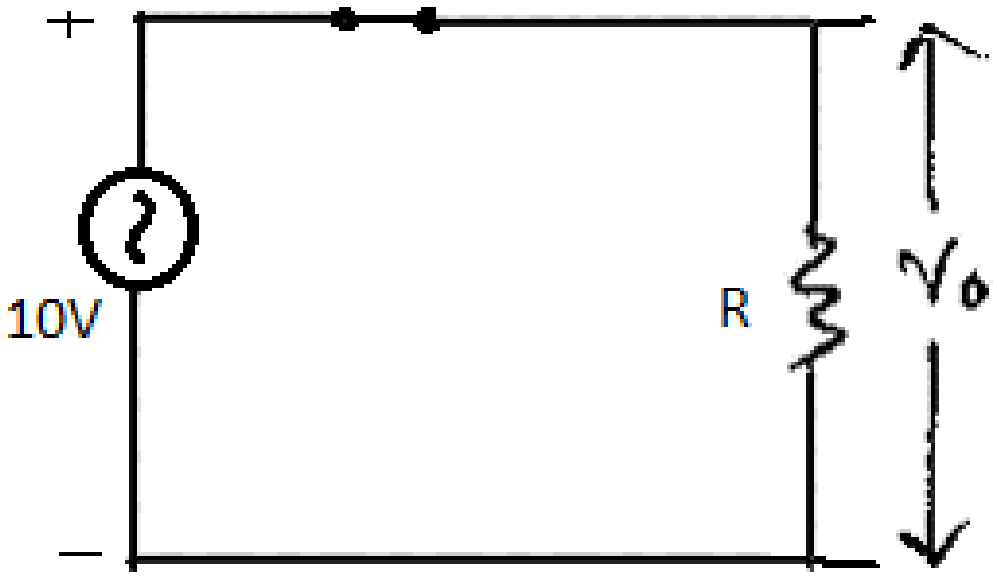
No need to consider $V_\gamma = 0.6$ for forward bias.



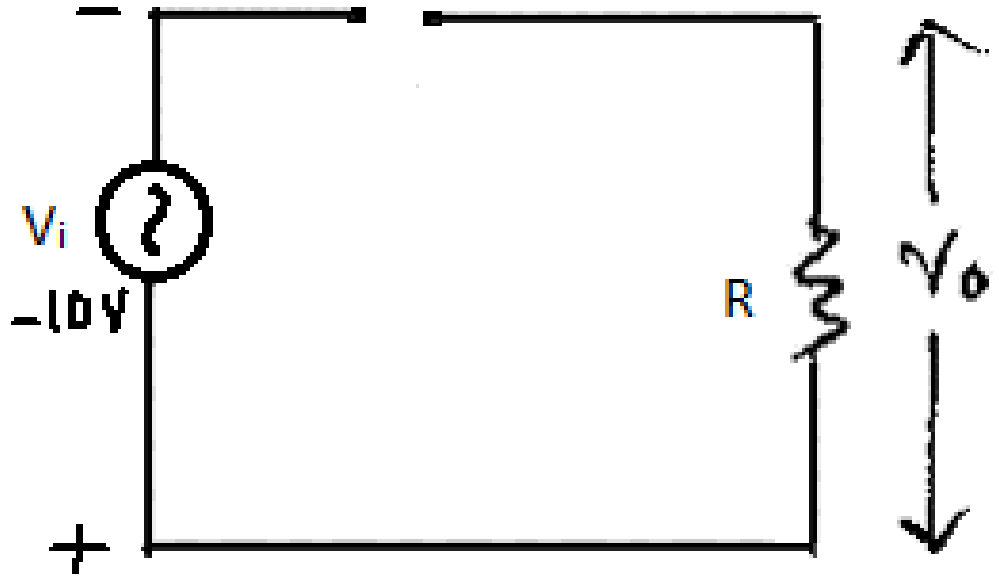
Diode ON	Diode Off
$V_{12} > 0$ $V_i > 0$	$V_{12} < 0$ $V_i < 0$

Step 2: Draw circuit and waveform for diode On and Off conditions

Diode ON

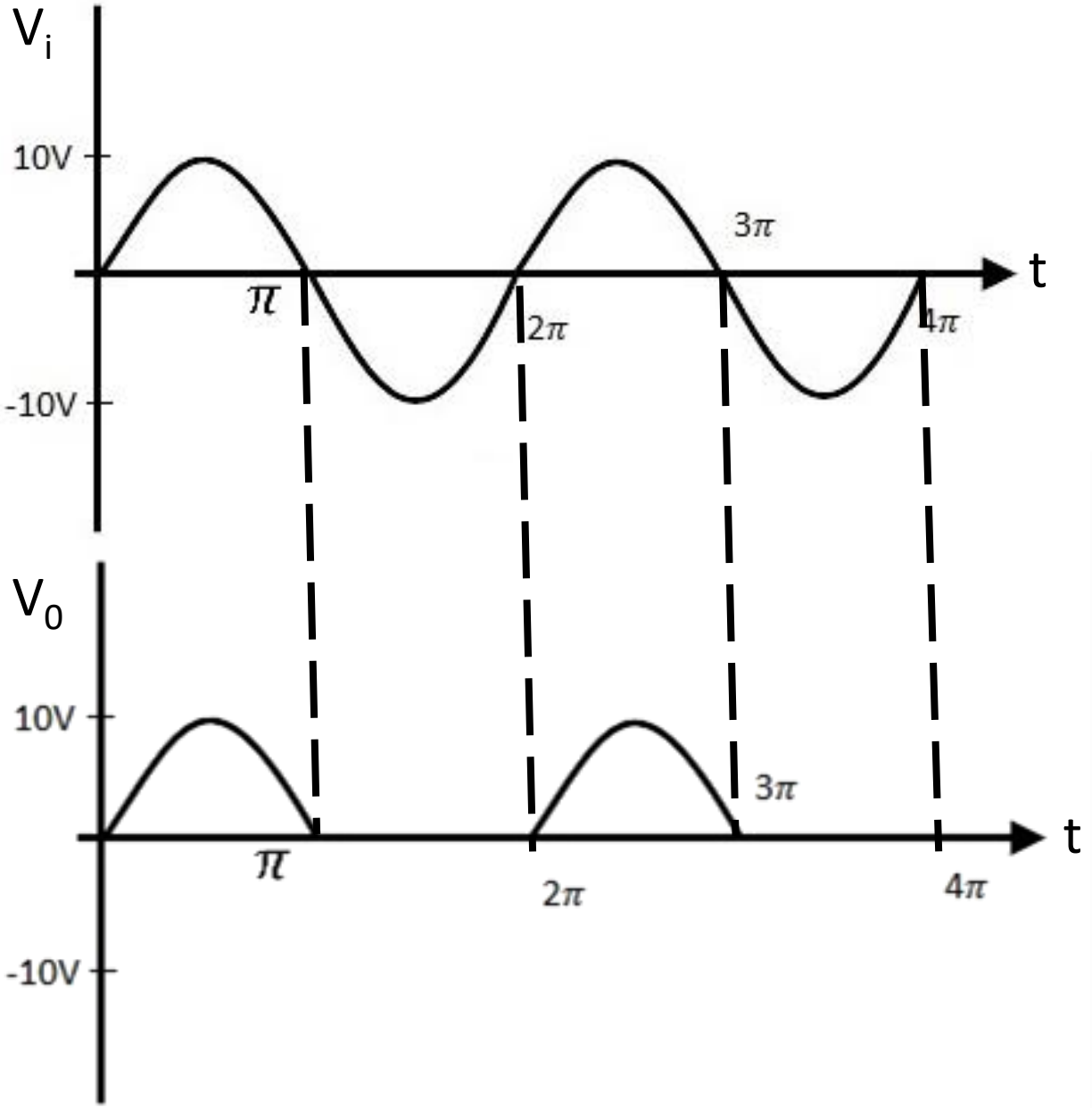


Diode Off

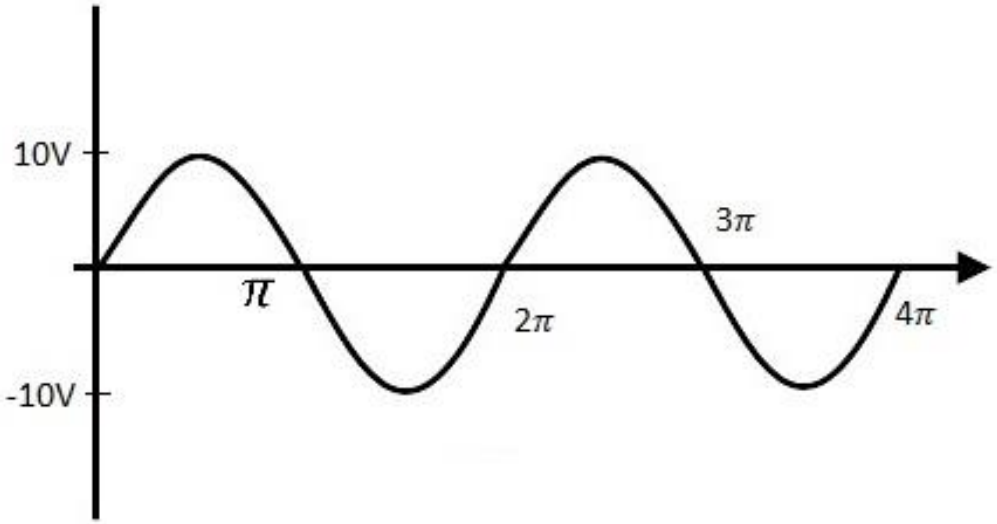


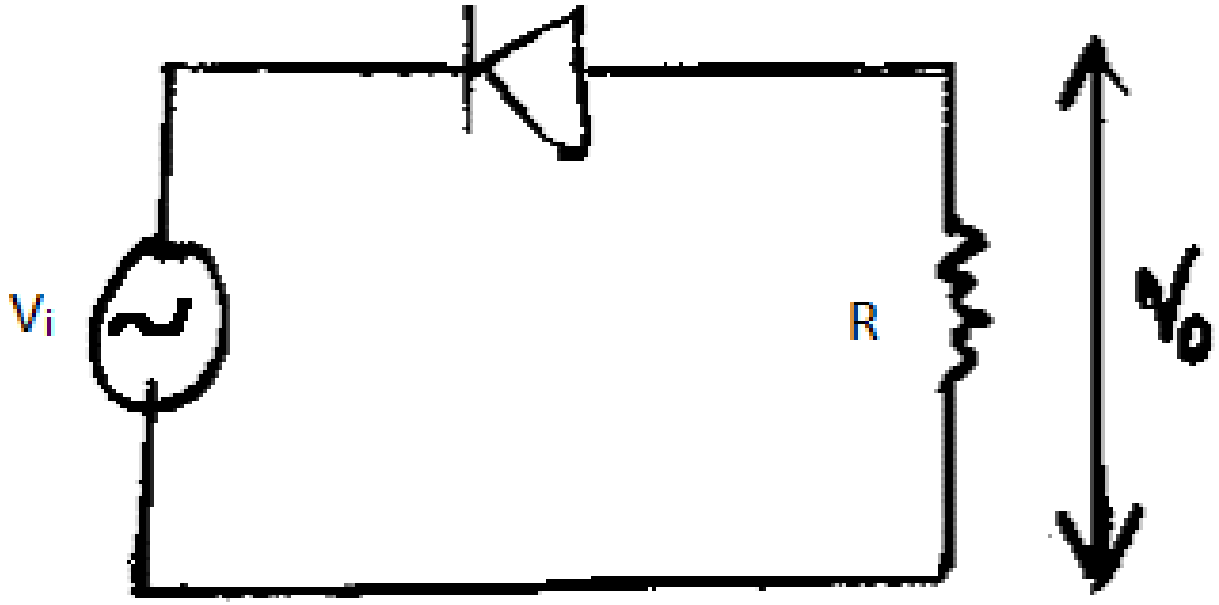
Input Wave

Output Wave

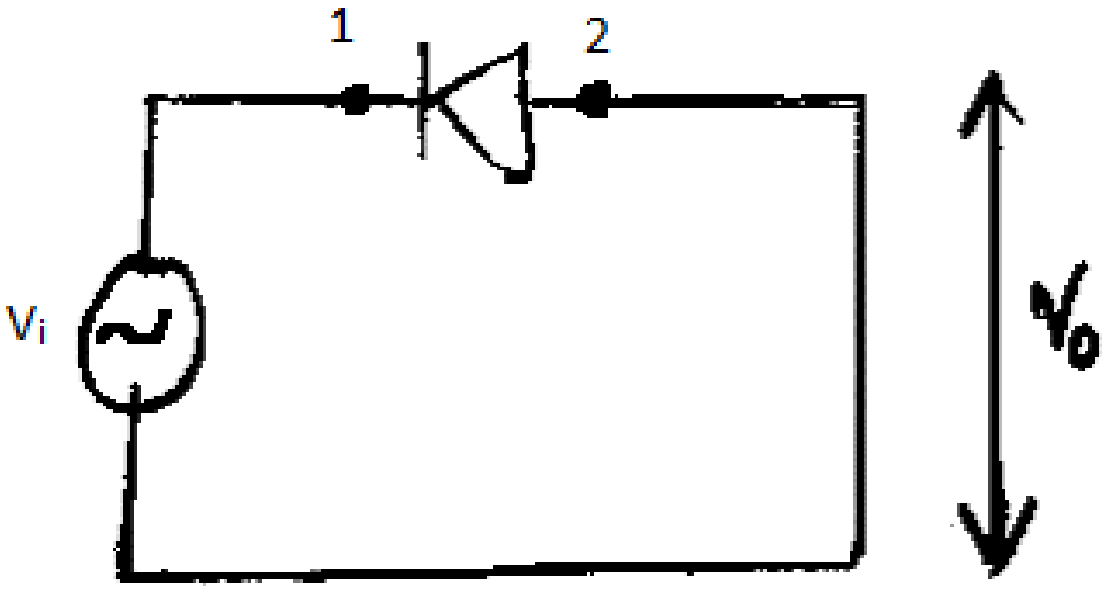


Circuit 2





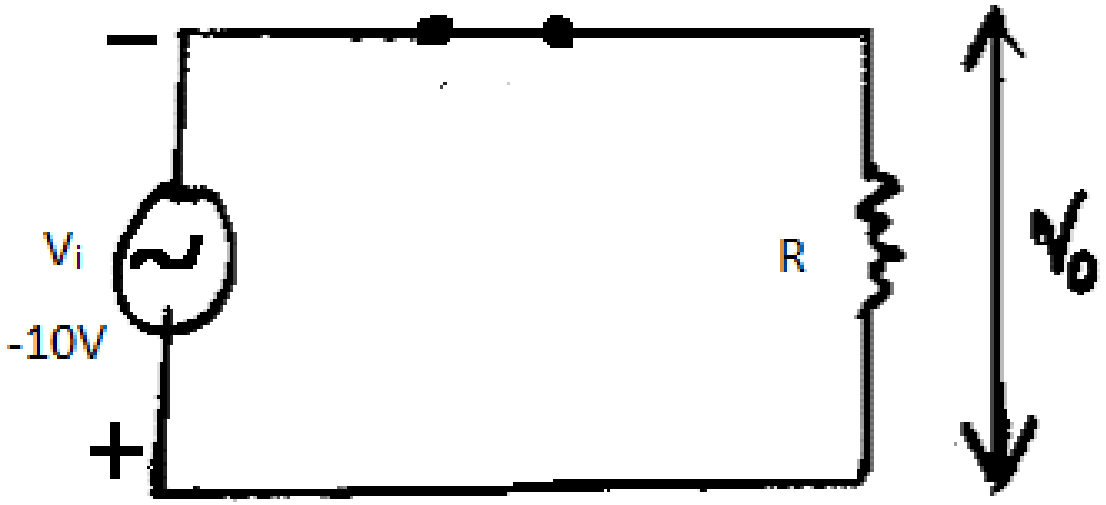
Step 1:



Diode ON	Diode Off
$V_{21} > 0$ $-V_{12} > 0$ $\Rightarrow V_{12} < 0$ $V_i < 0$	$V_{21} < 0$ $-V_{12} < 0$ $\Rightarrow V_{12} > 0$ $V_i > 0$

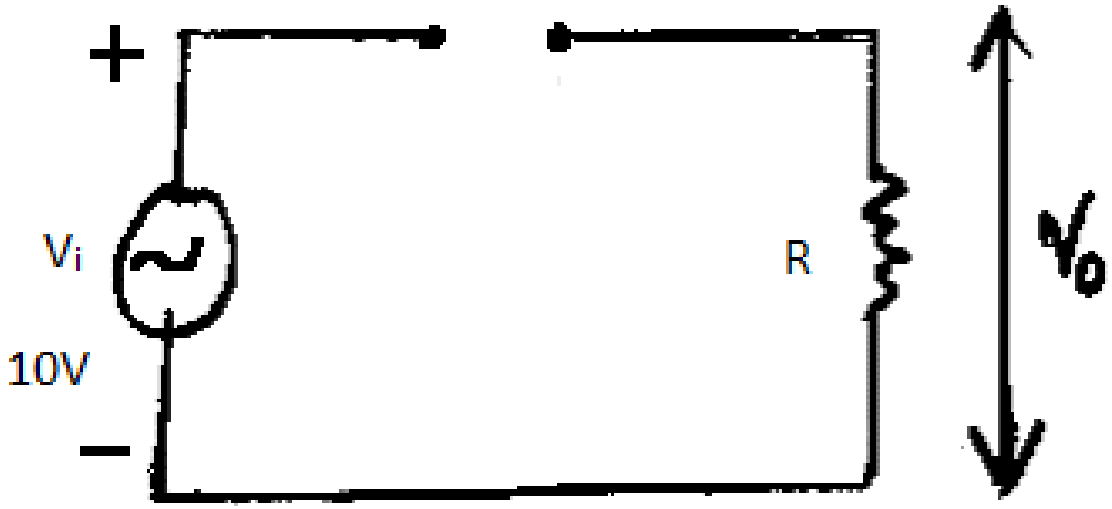
Step 2:

Diode ON



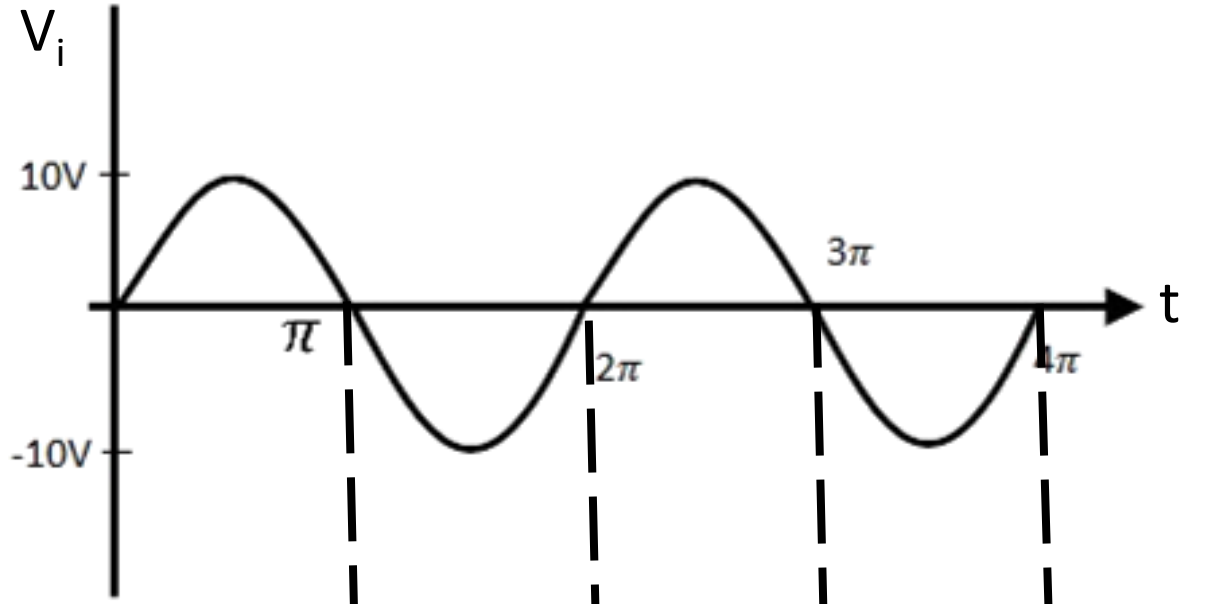
When $V_i < 0$, $V_0 = V_i$

Diode Off

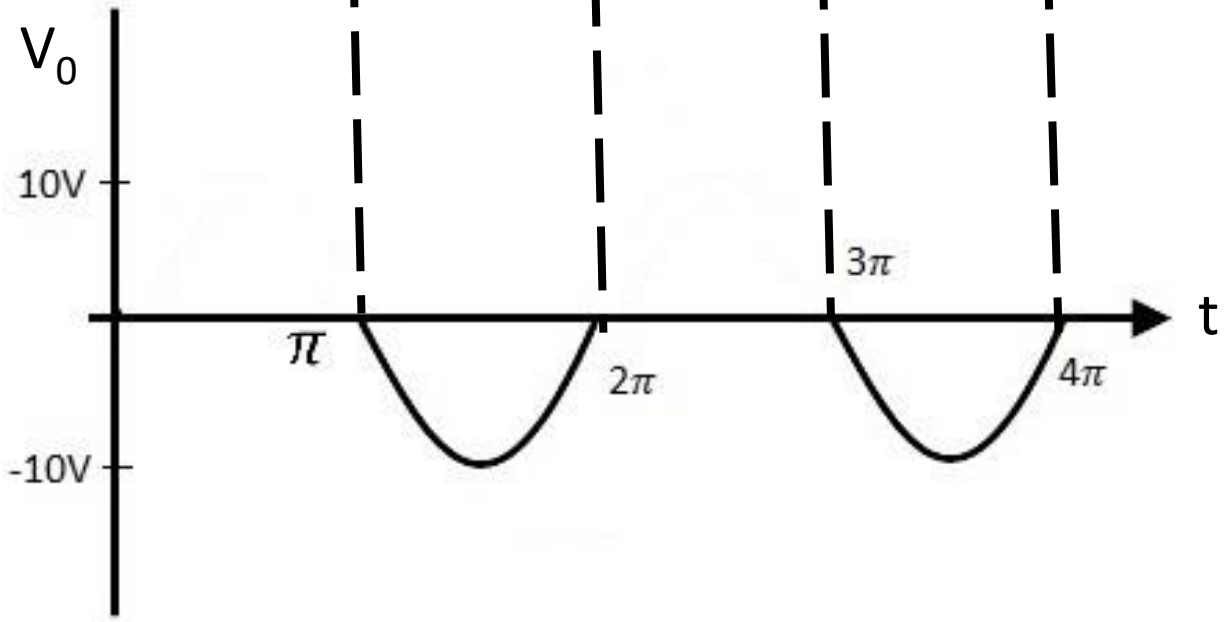


When $V_i > 0$, $V_0 = 0V$

Input Wave



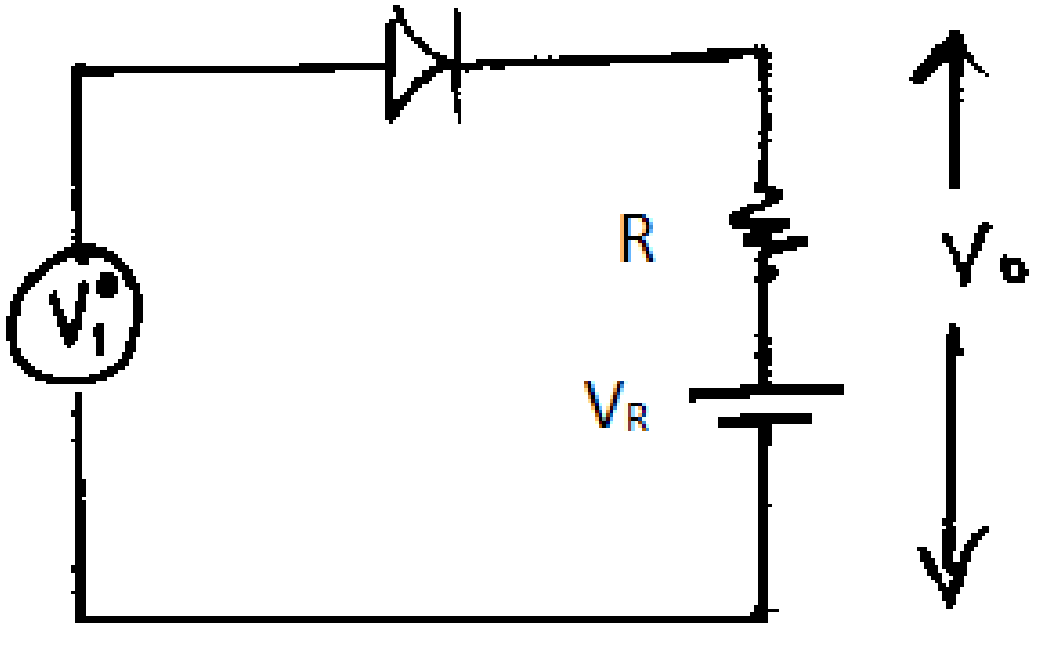
Output Wave

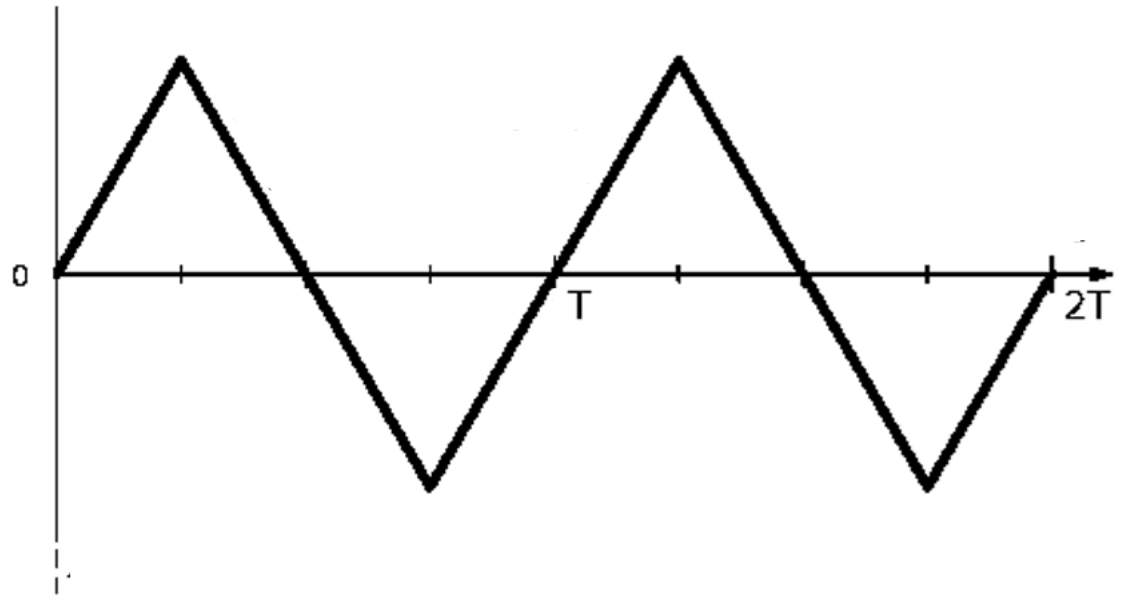


Output Voltage

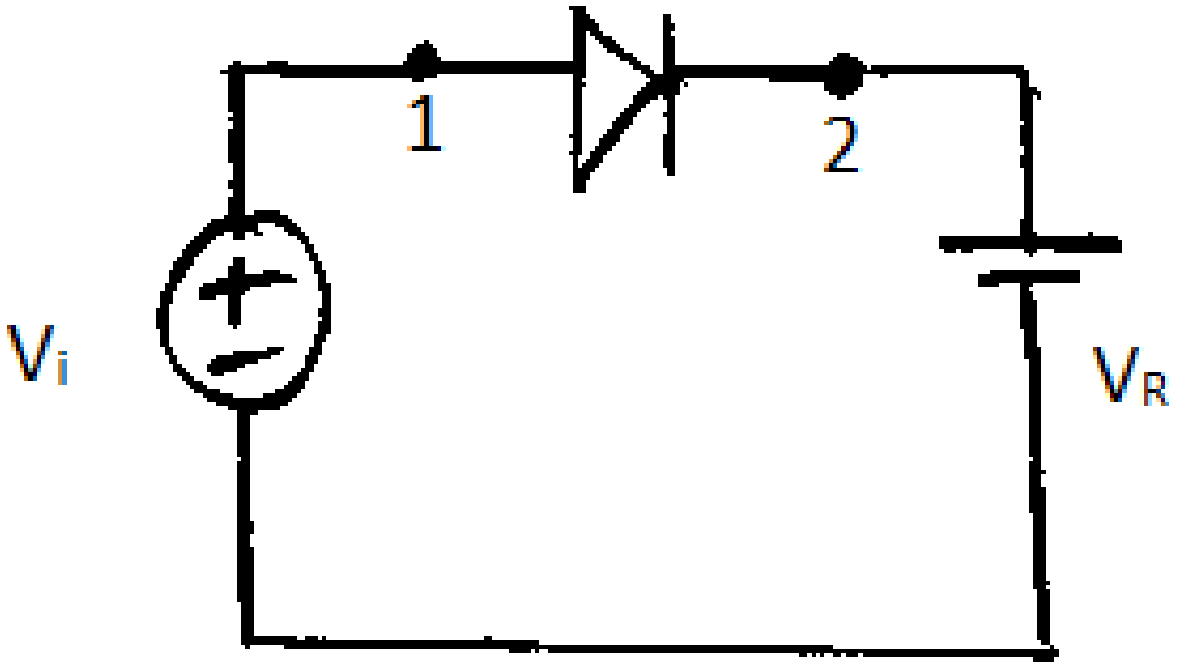
$V_i < 0$	$V_i > 0$
$V_0 = V_i$	$V_0 = 0$ V

Circuit 3





Step 1:



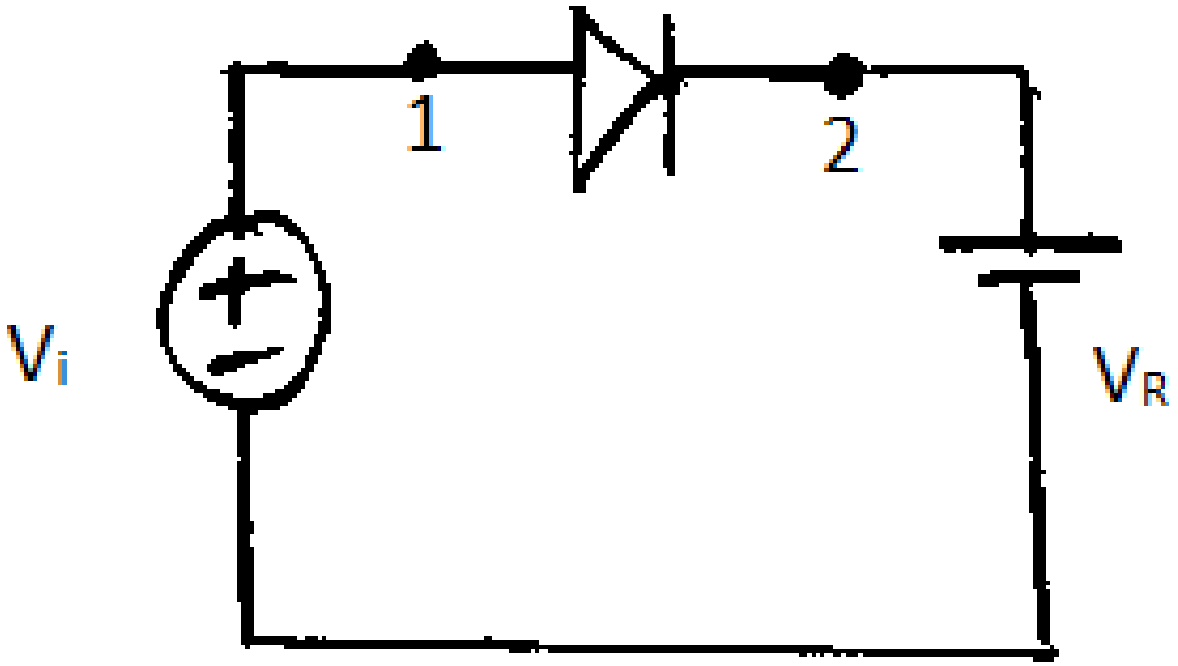
Output Equation,

Applying KVL,

$-V_i + V_{12} + V_R = 0$

$V_{12} = V_i - V_R$

Step 1:



Diode ON

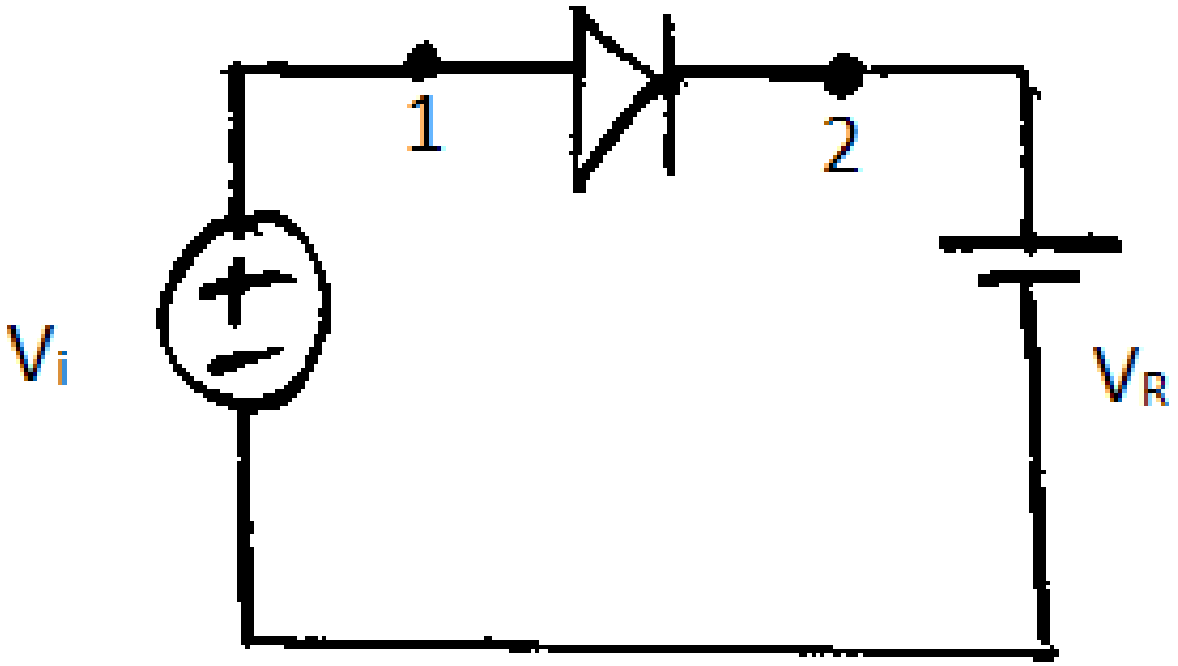
When $V_{12} > 0$

So,

$V_i - V_R > 0$

$V_i > V_R$

Step 1:



Diode OFF

When $V_{12} < 0$

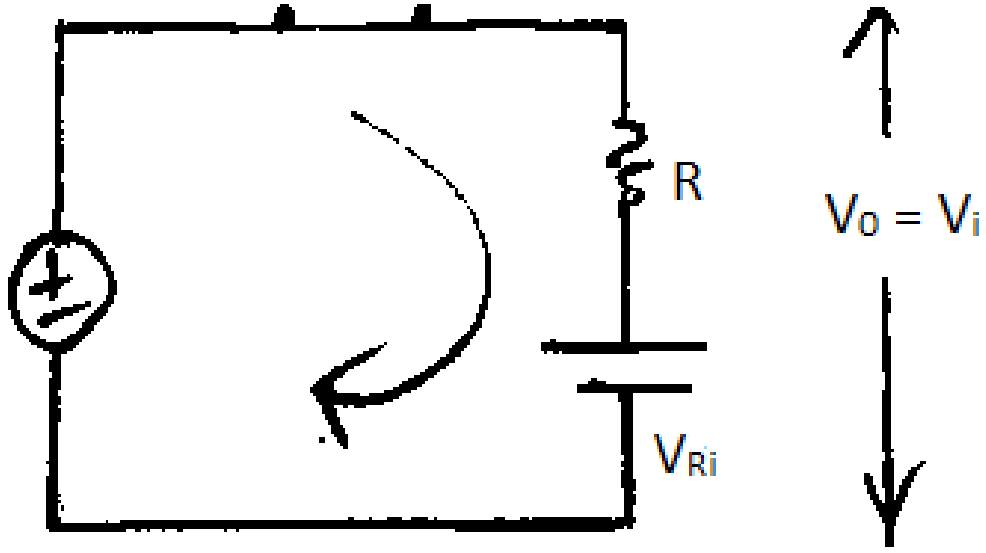
So,

$V_i - V_R < 0$

$V_i < V_R$

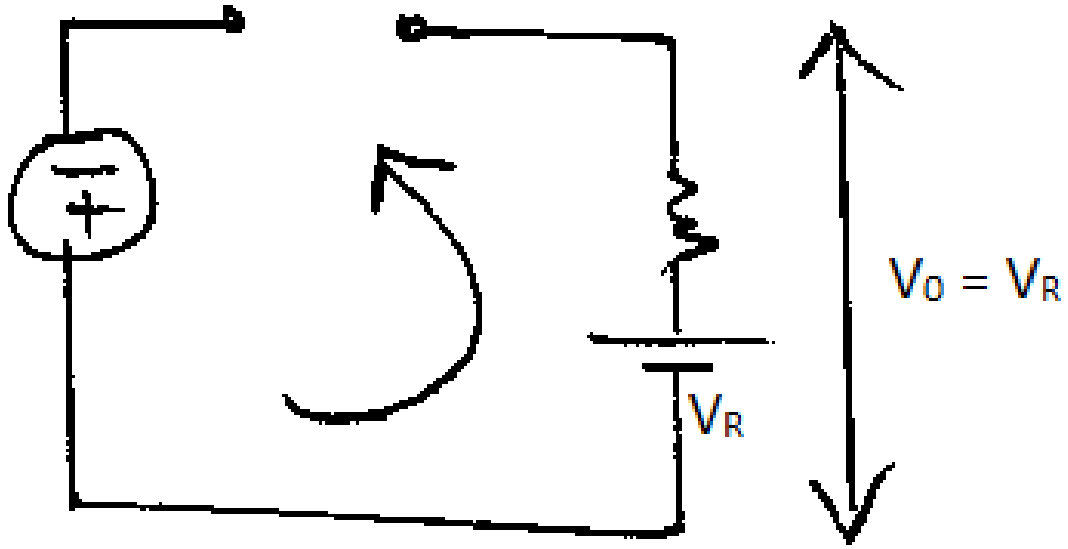
Step 2:

Diode ON



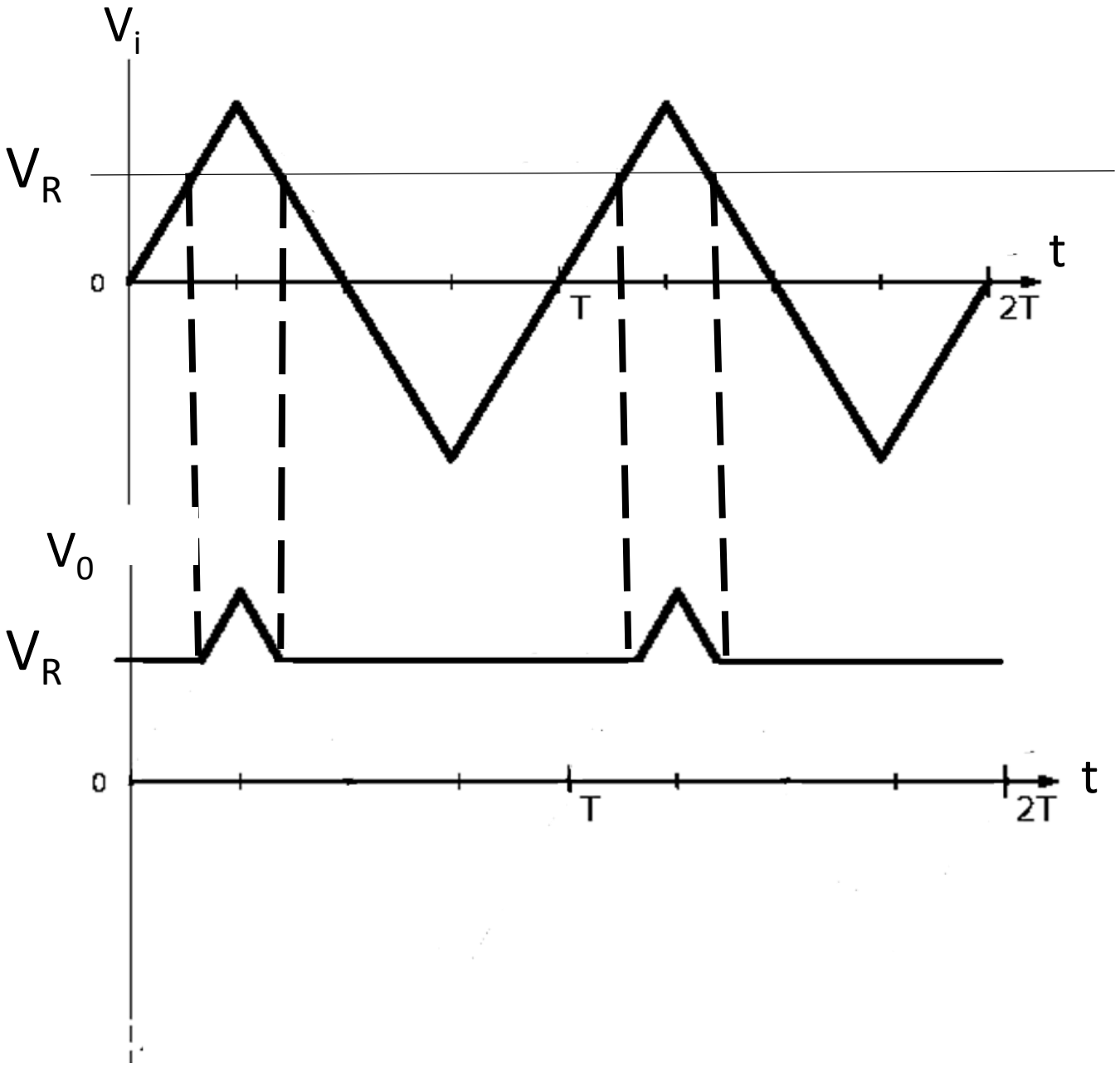
When $V_i > V_R$, $V_0 = V_i$

Diode Off



When $V_i < V_R$, $V_0 = V_R$

Input Wave

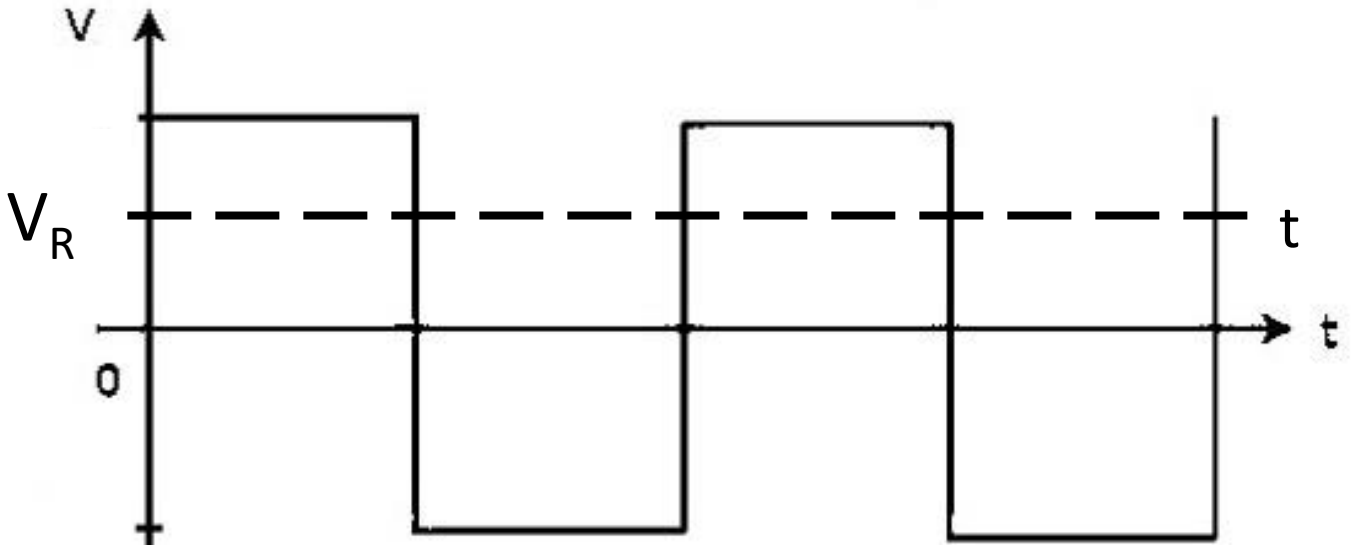


Output Wave

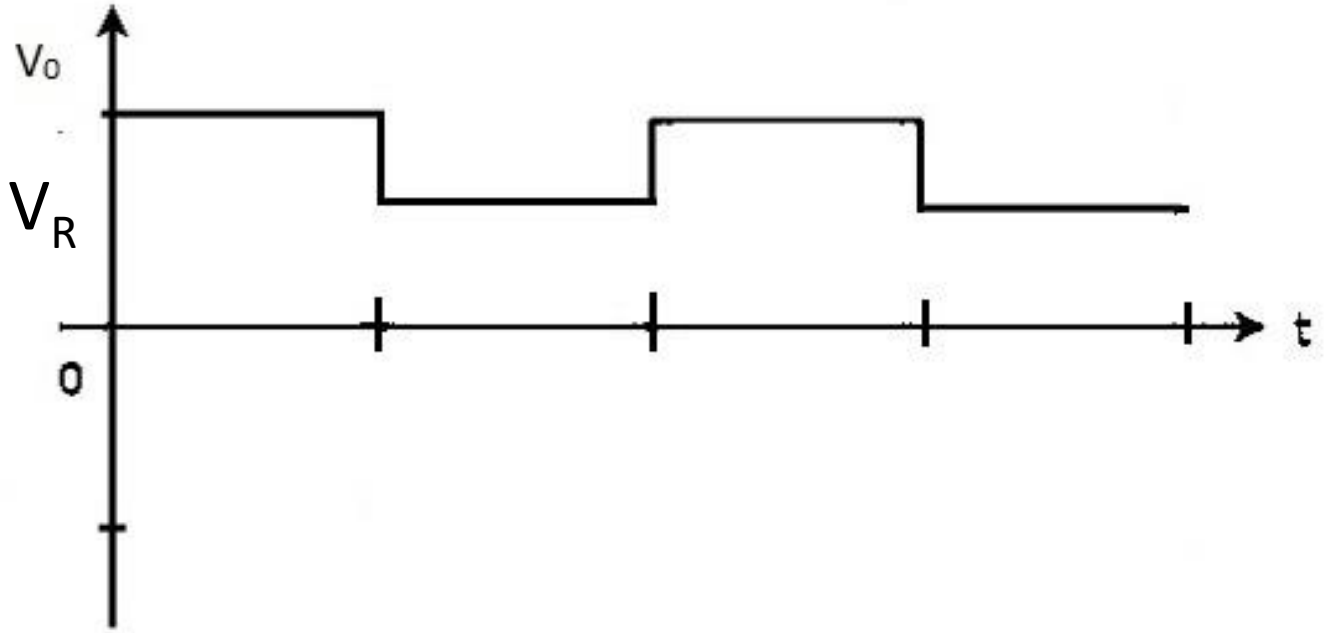
Output Voltage

$V_i < V_R$	$V_i > V_R$
$V_0 = V_R$	$V_0 = V_i$

Input Wave



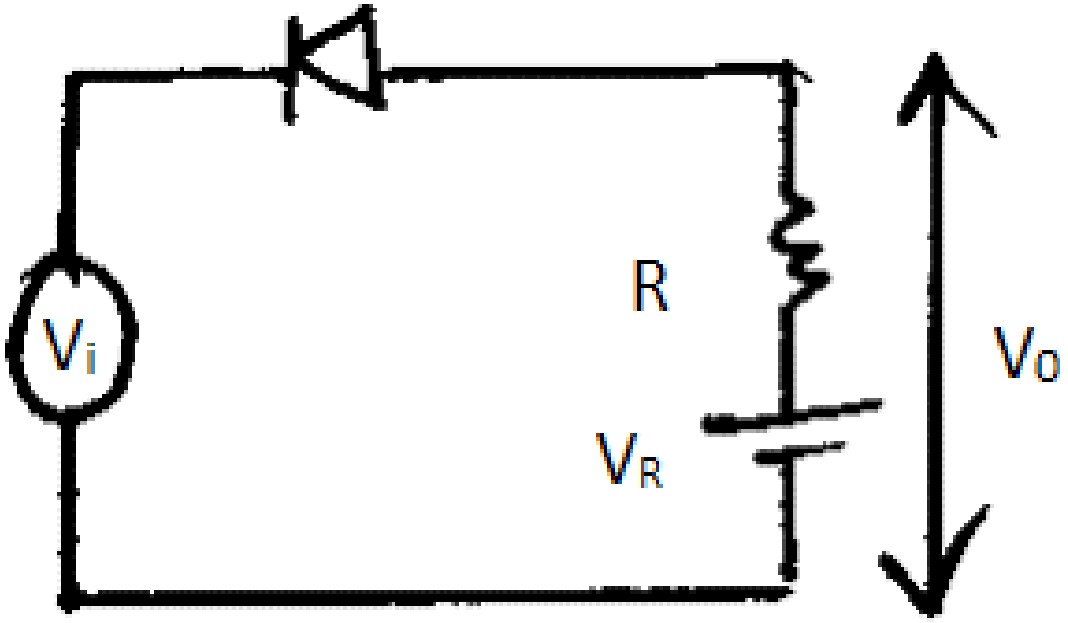
Output Wave

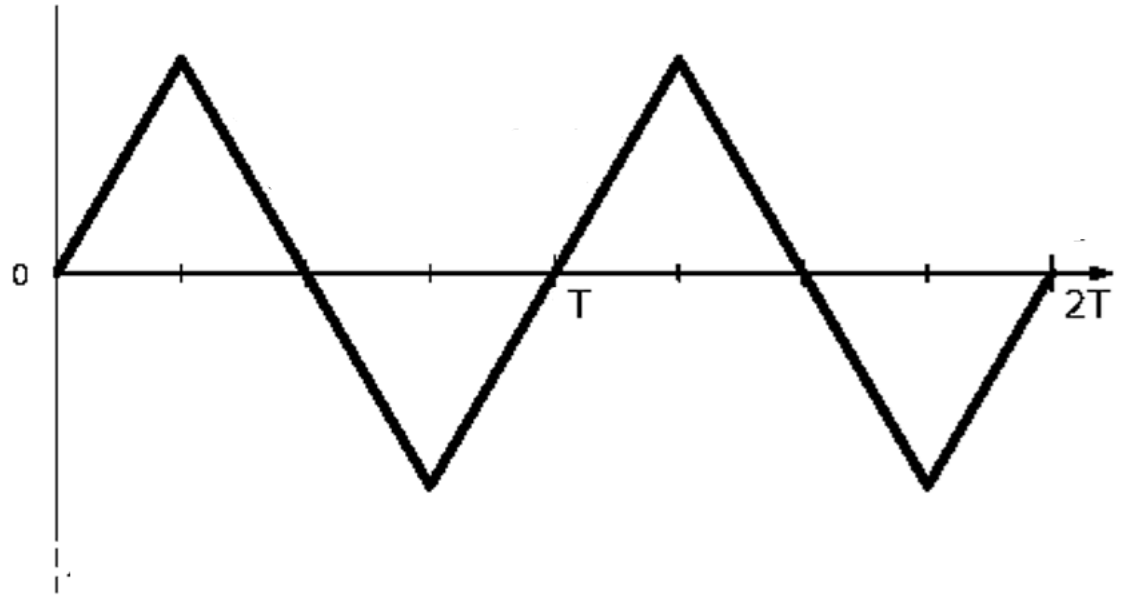


Output Voltage

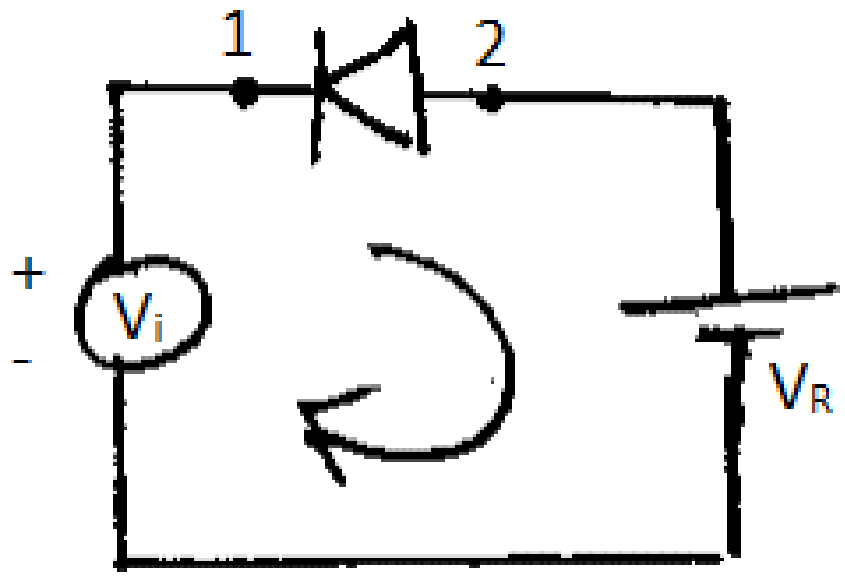
$V_i < V_R$	$V_i > V_R$
$V_0 = V_R$	$V_0 = V_i$

Circuit 4





Step 1:



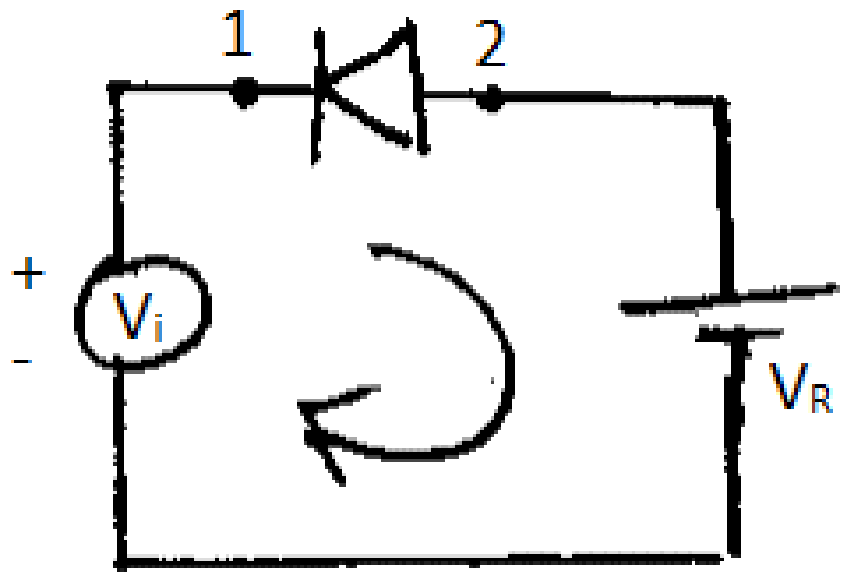
Output Equation,

Applying KVL,

$-V_i - V_{12} + V_R = 0$

$-V_{12} = V_i - V_R$

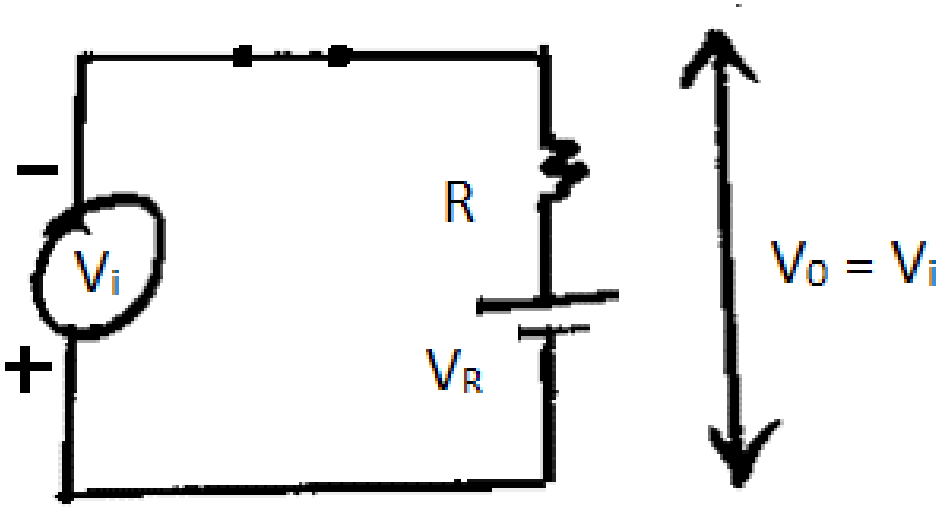
$\Rightarrow V_{21} = V_i - V_R$



Diode ON	Diode Off
$V_{12} < 0$ $V_{21} > 0$ => $V_{21} > 0$ $V_i - V_R > 0$ $V_i > V_R$	$V_{12} > 0$ $V_{21} < 0$ => $V_{21} < 0$ $V_i - V_R < 0$ $V_i < V_R$

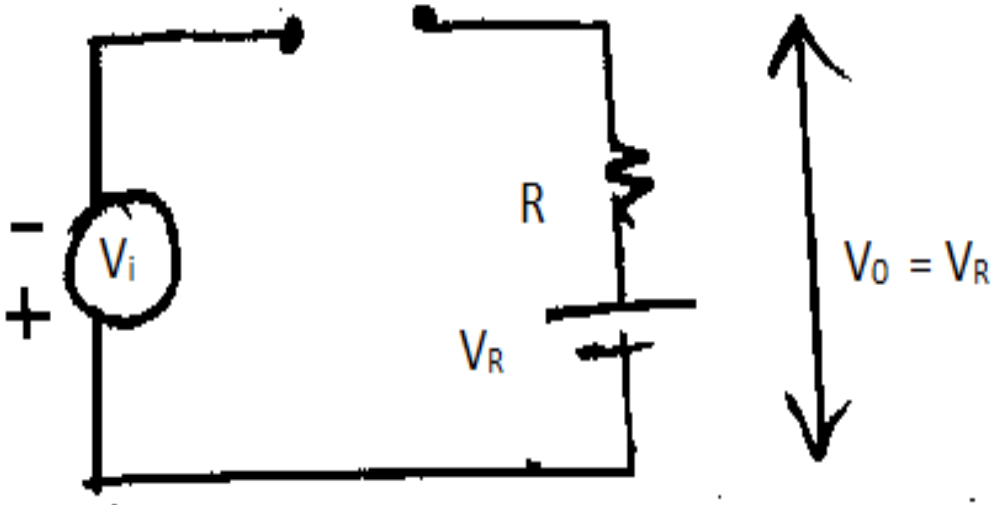
Step 2:

Diode ON



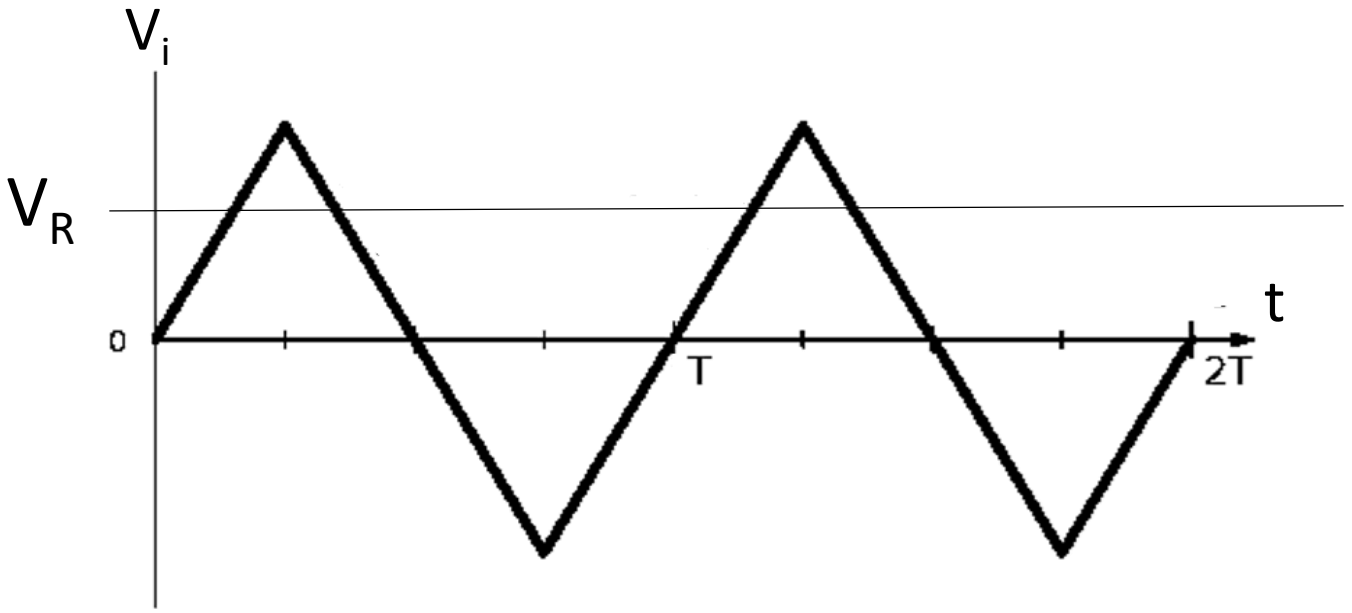
When $V_i < V_R$, $V_0 = V_i$

Diode Off

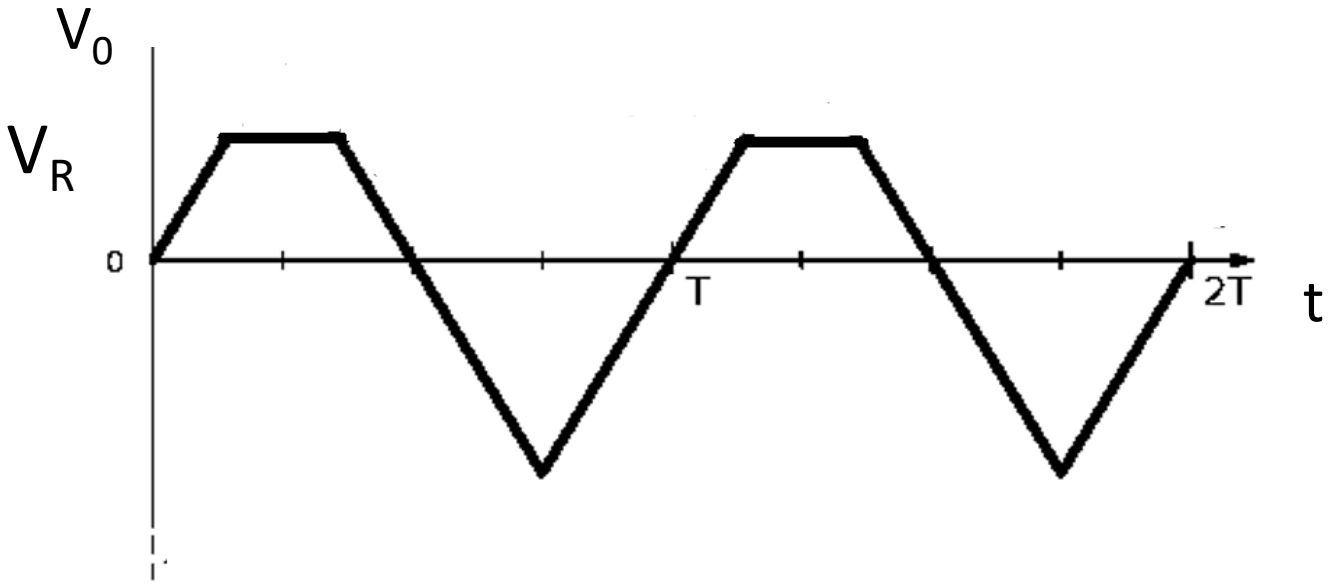


When $V_i > V_R$, $V_0 = V_R$

Input Wave



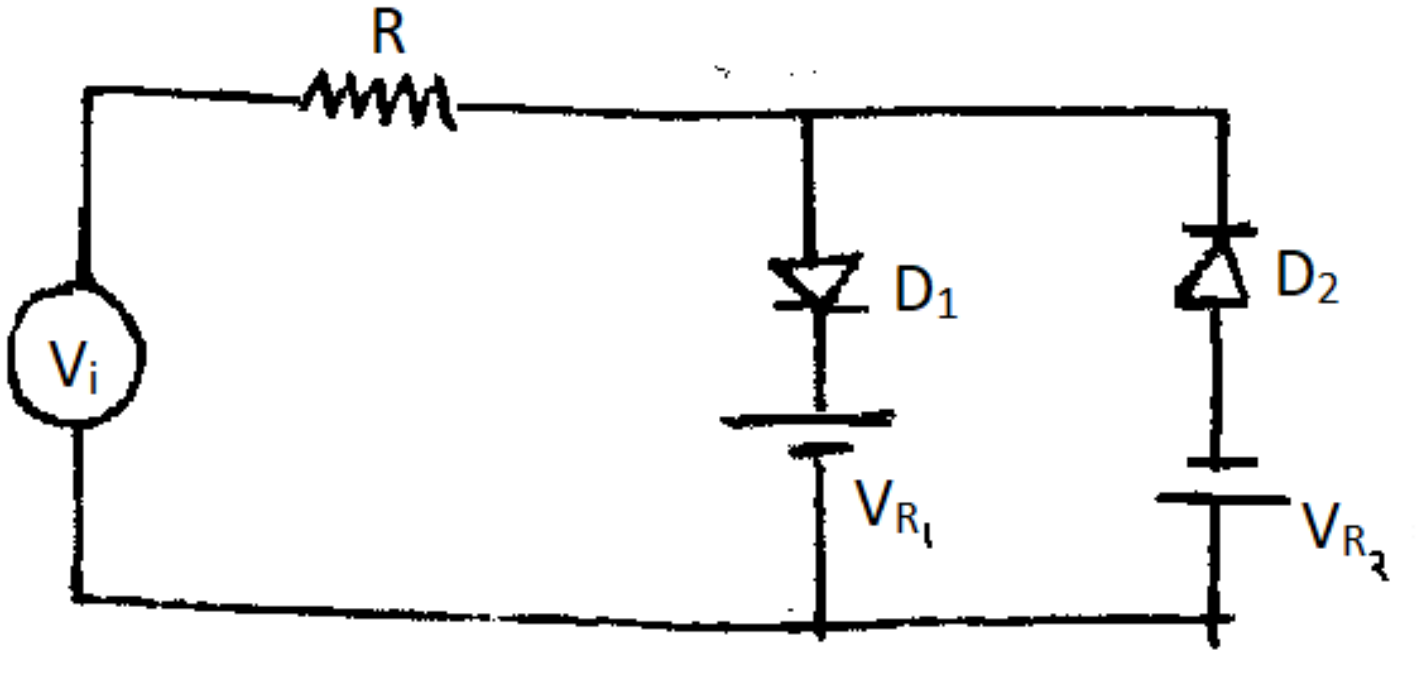
Output Wave

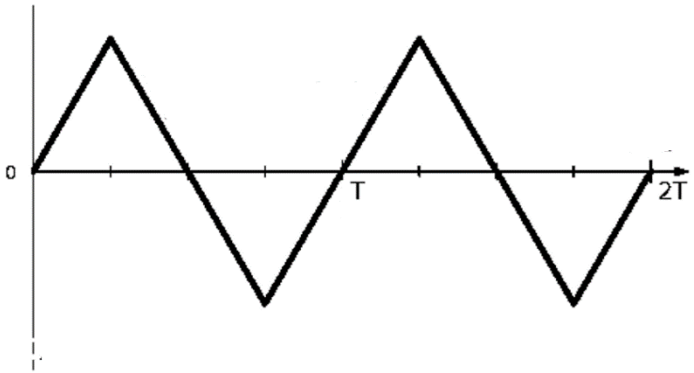


Output Voltage

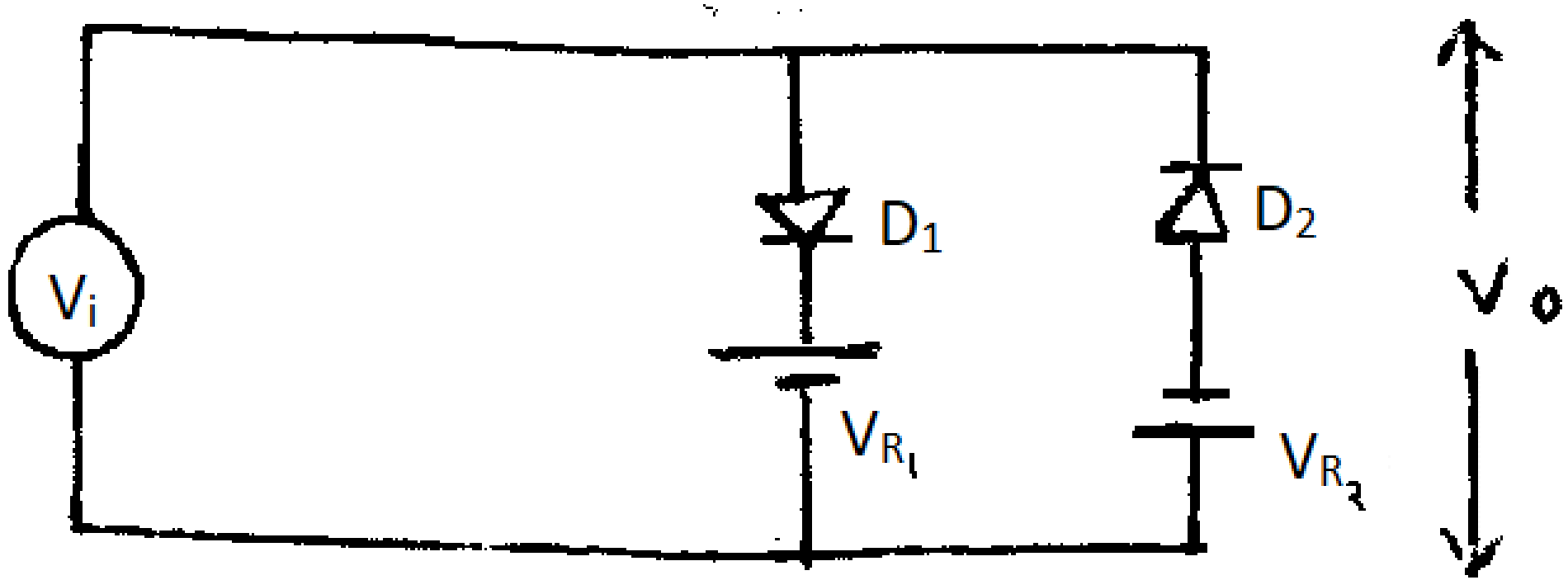
$V_i > V_R$	$V_i < V_R$
$V_0 = V_R$	$V_0 = V_i$

Circuit 5



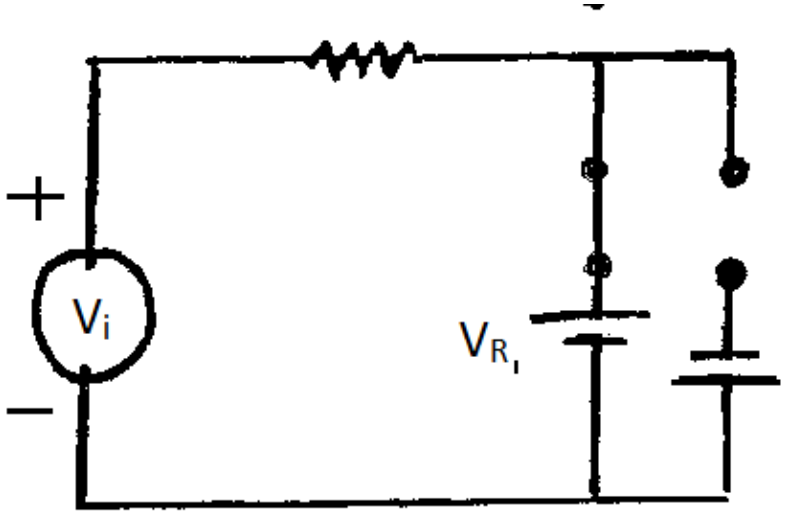


Step 1:



Step 2: Draw circuit and waveform for diode On and Off conditions

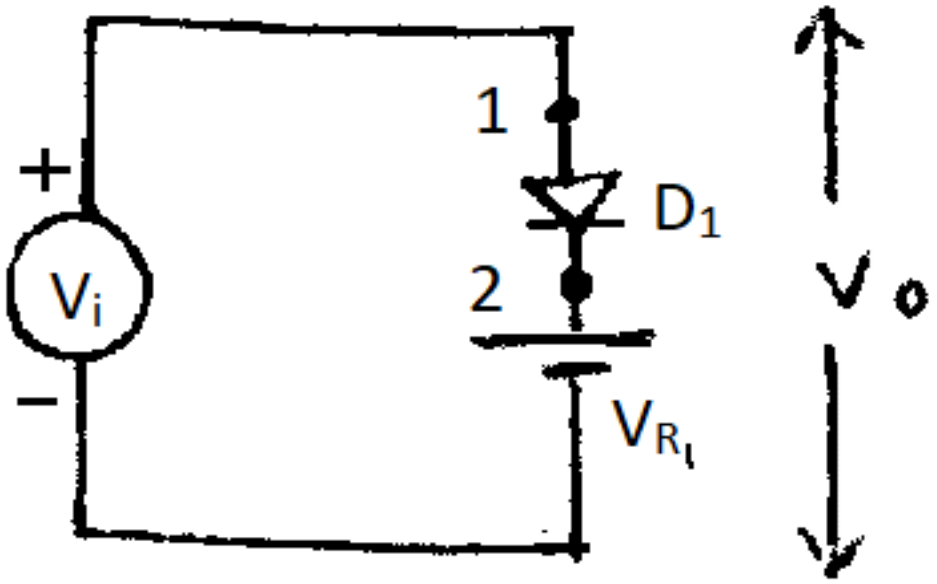
For D_1



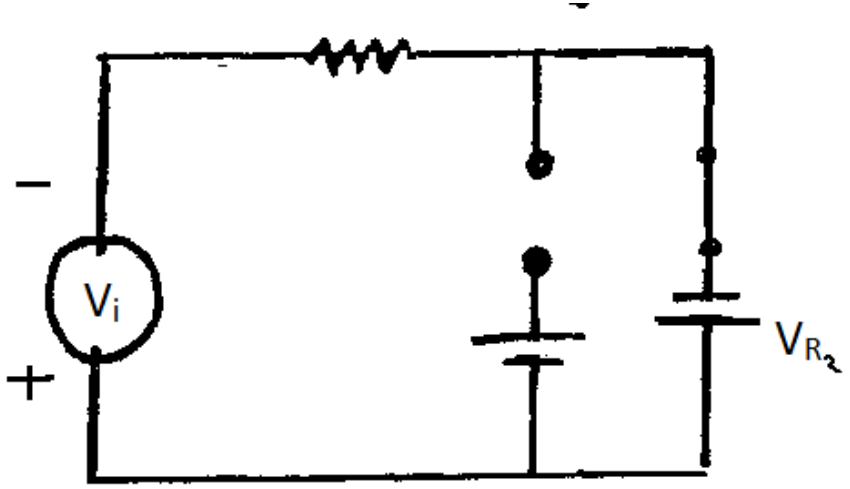
Applying KVL,

$-V_i + V_{12} + V_{R1} = 0$

$V_{12} = V_i - V_{R1}$



Diode ON	Diode Off
$V_{12} > 0$ $V_i - V_{R1} > 0$ $V_i > V_{R1}$	$V_{12} < 0$ $V_i - V_{R1} < 0$ $V_i < V_{R1}$



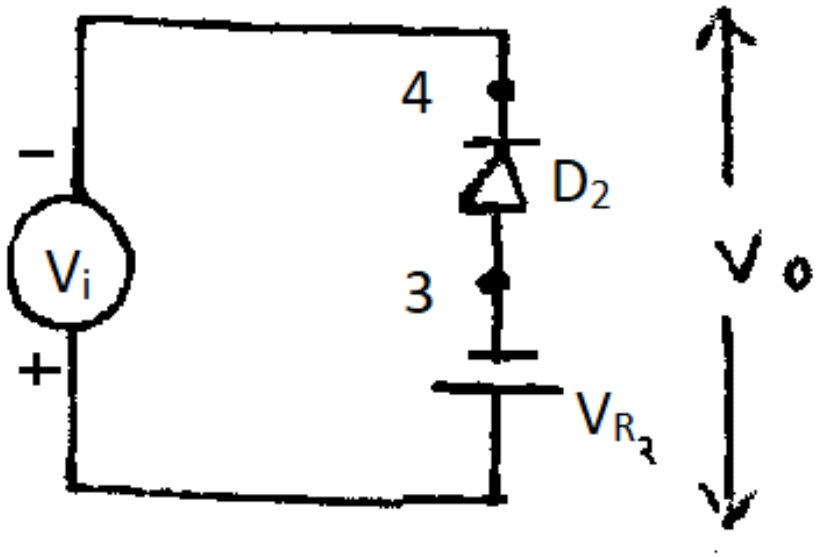
For D_2

Applying KVL,

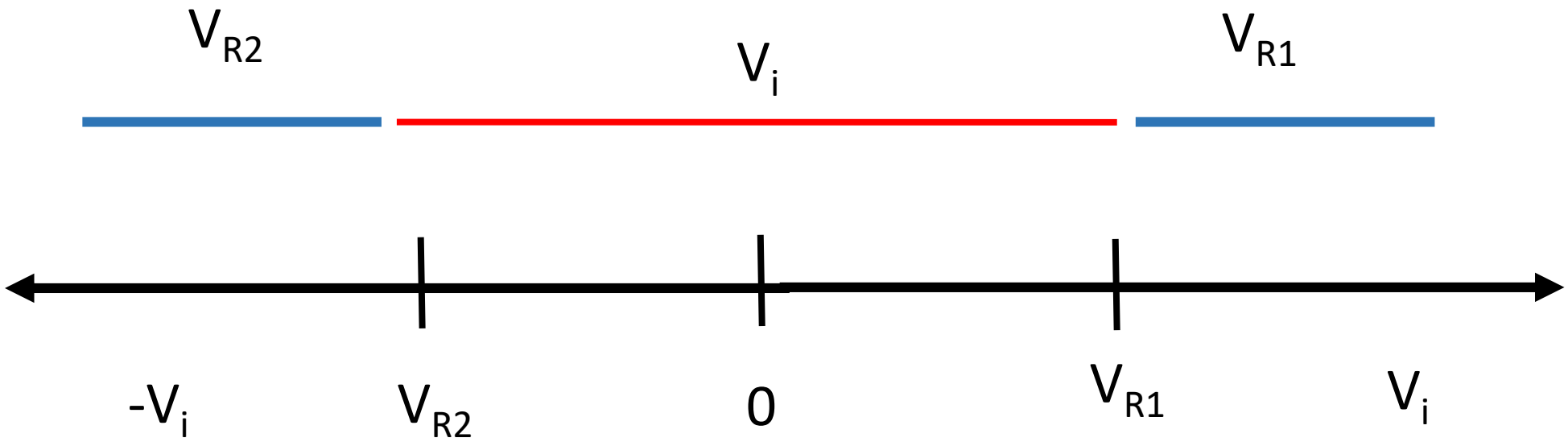
$-V_i - V_{34} + V_{R2} = 0$

$V_{34} = -V_i + V_{R2}$

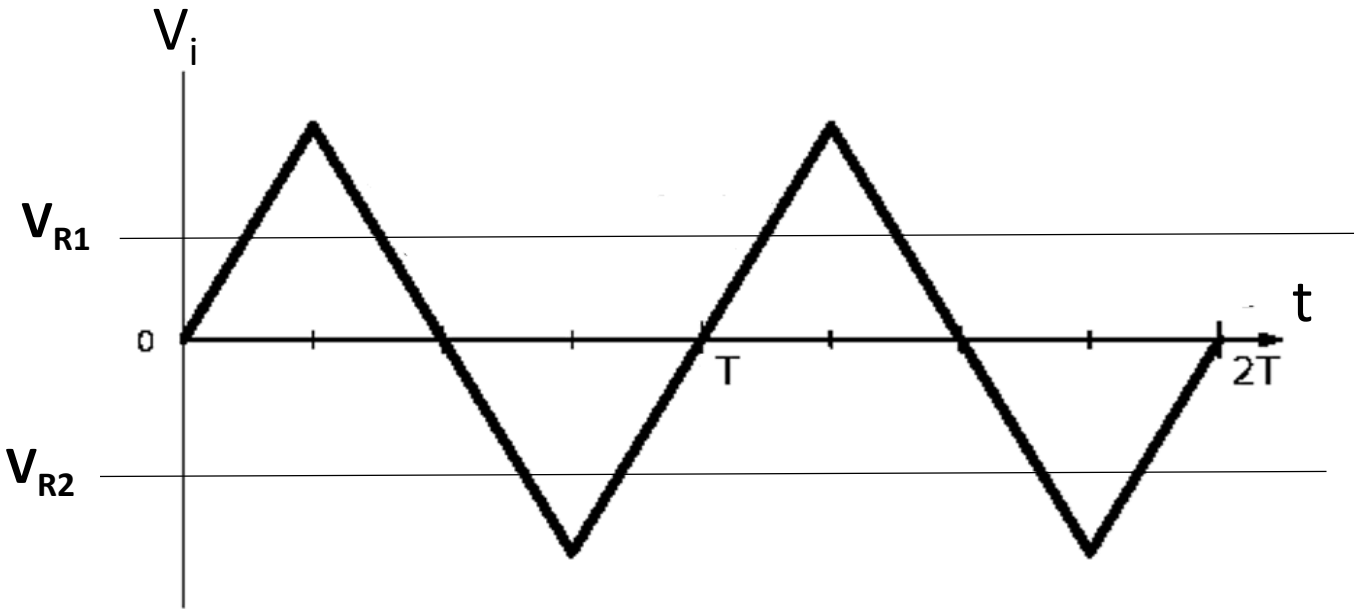
D_2 is ON



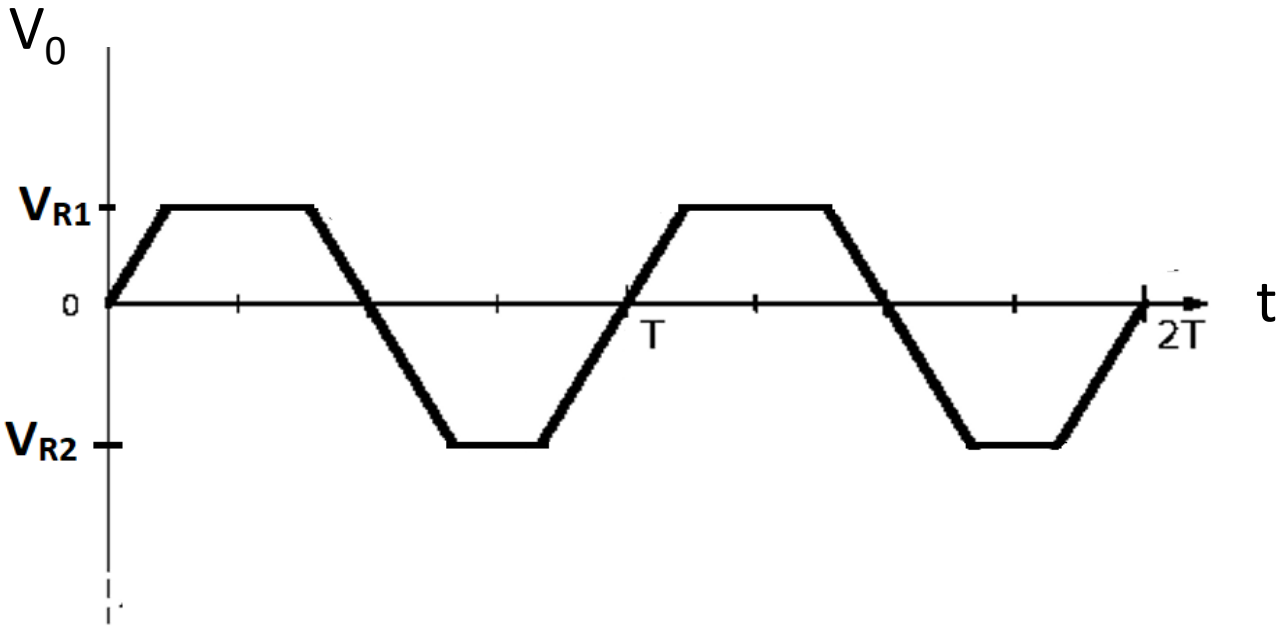
Diode ON	Diode Off
$V_{34} > 0$ $-V_i + V_{R2} > 0$ $V_i < V_{R2}$	$V_{34} < 0$ $-V_i + V_{R2} < 0$ $V_i > V_{R2}$


V_{R2}
V_i
V_{R1}
$-V_i$
V_{R2}
0
V_{R1}
V_i

Input Wave



Output Wave



Output Voltage

When $V_i < V_{R2}$ $V_0 = V_{R2}$
When $V_{R2} < V_i < V_{R1}$ Then, $V_0 = V_i$
When $V_i > V_{R1}$ $V_0 = V_{R1}$

Try yourself