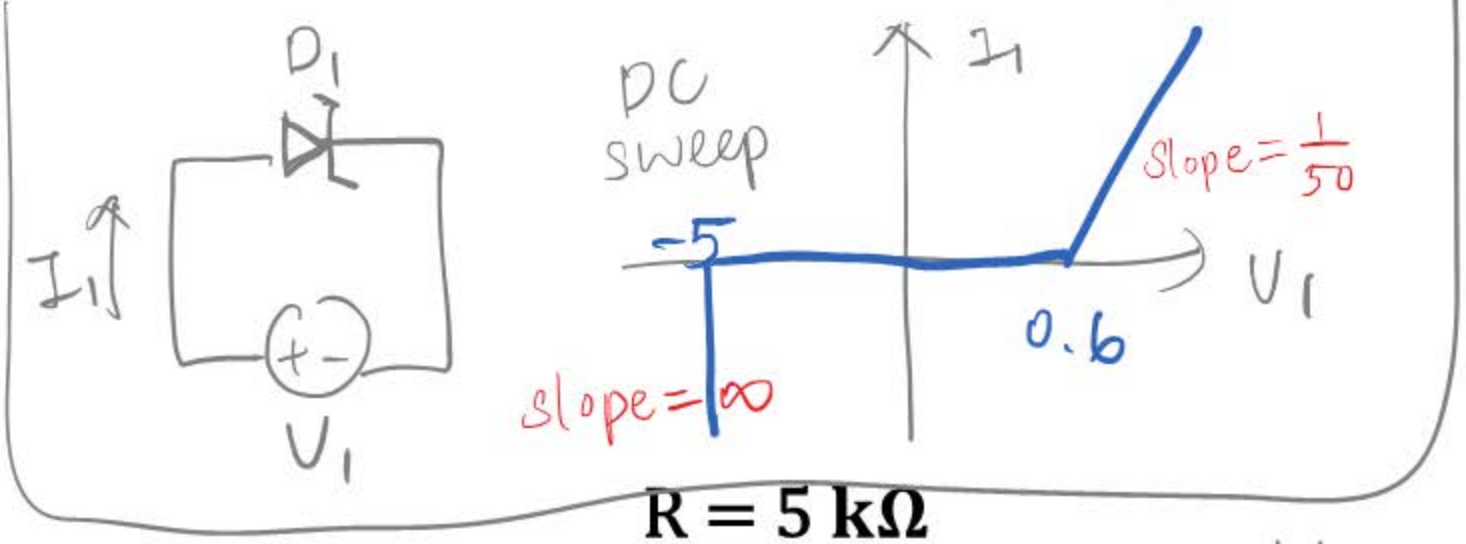
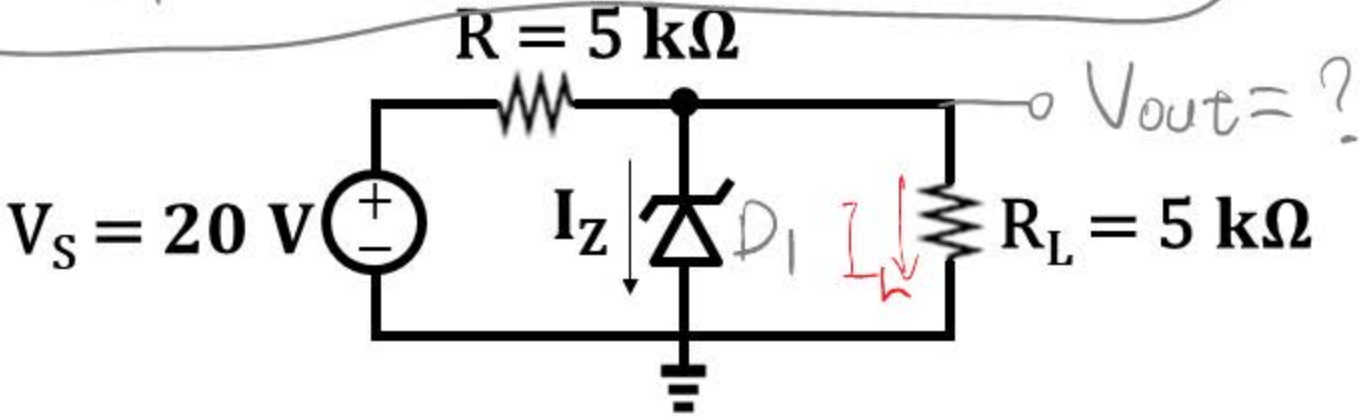
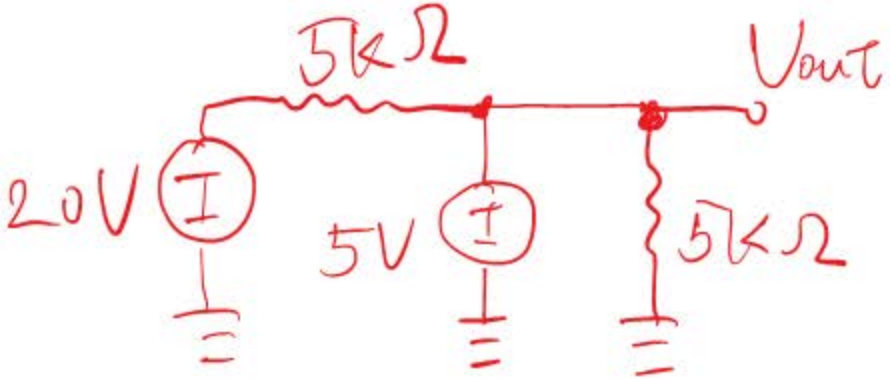


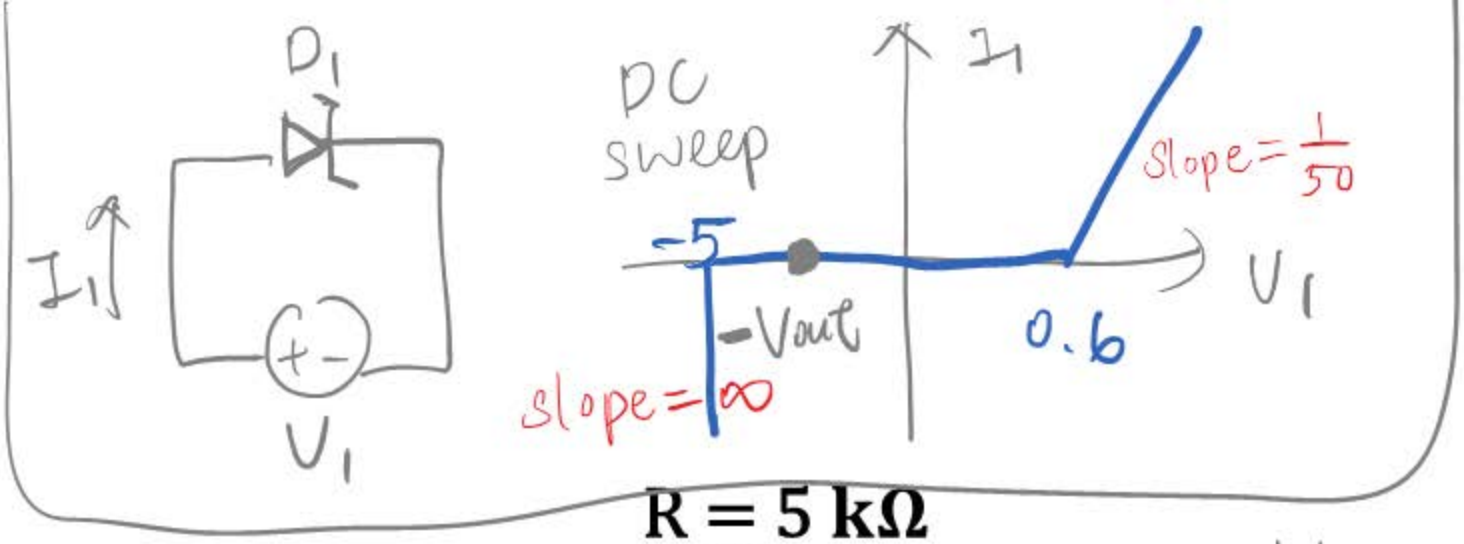


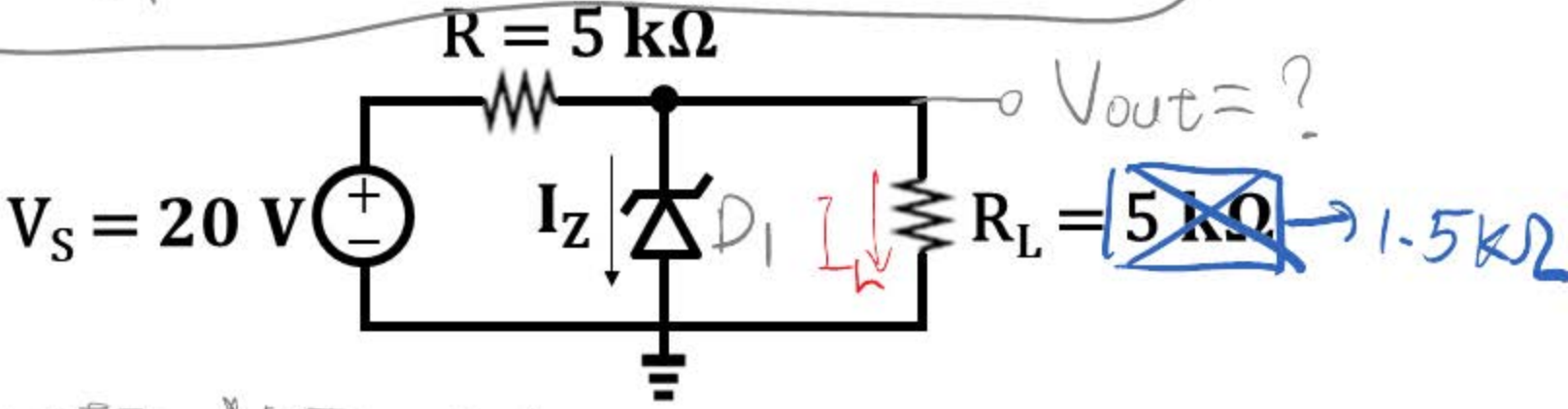


$V_{out} = 5\ V$

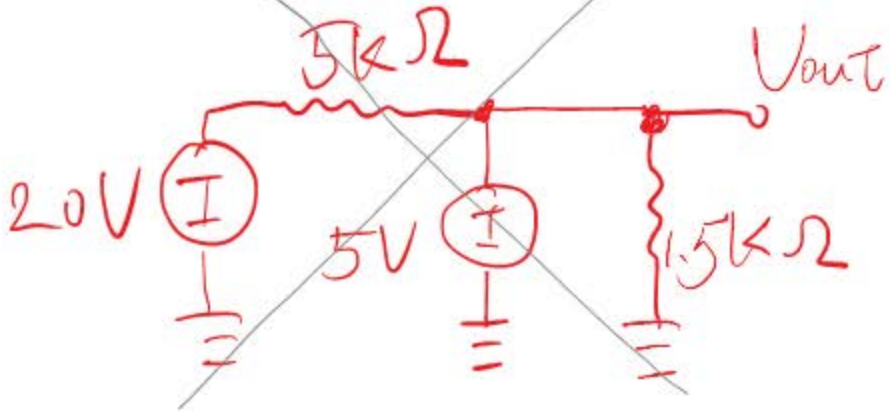
$\frac{20-5}{5k} - I_L = I_8$

$\frac{5}{5k} = I_L$





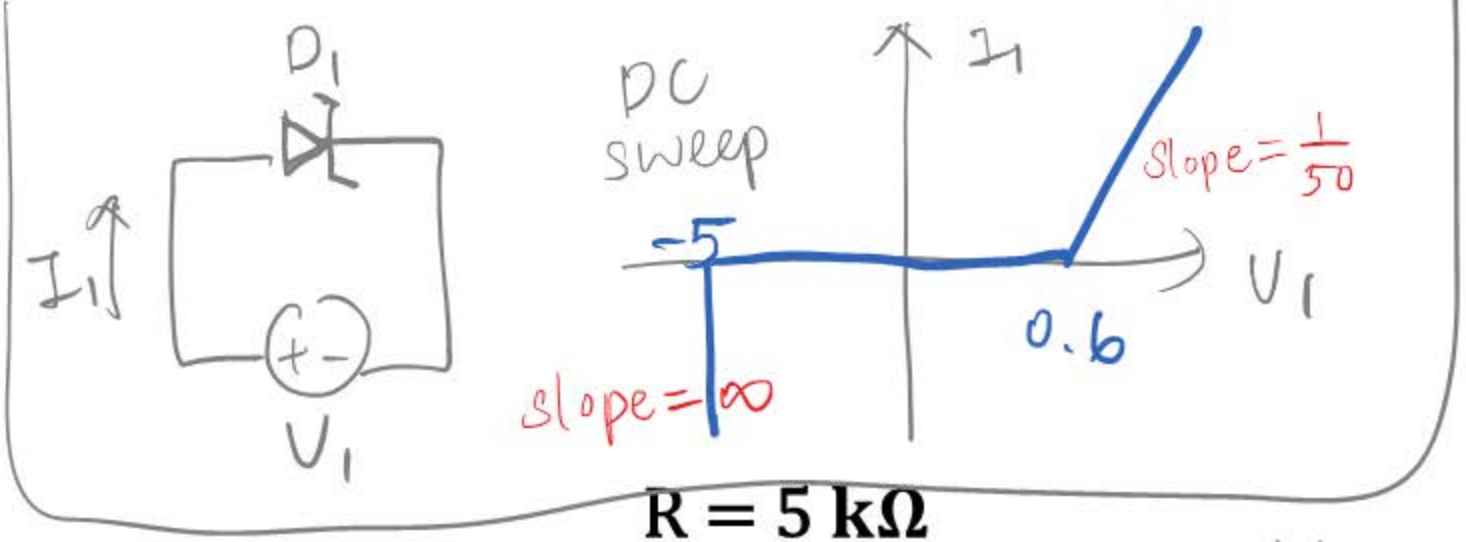
Assumption NOT valid

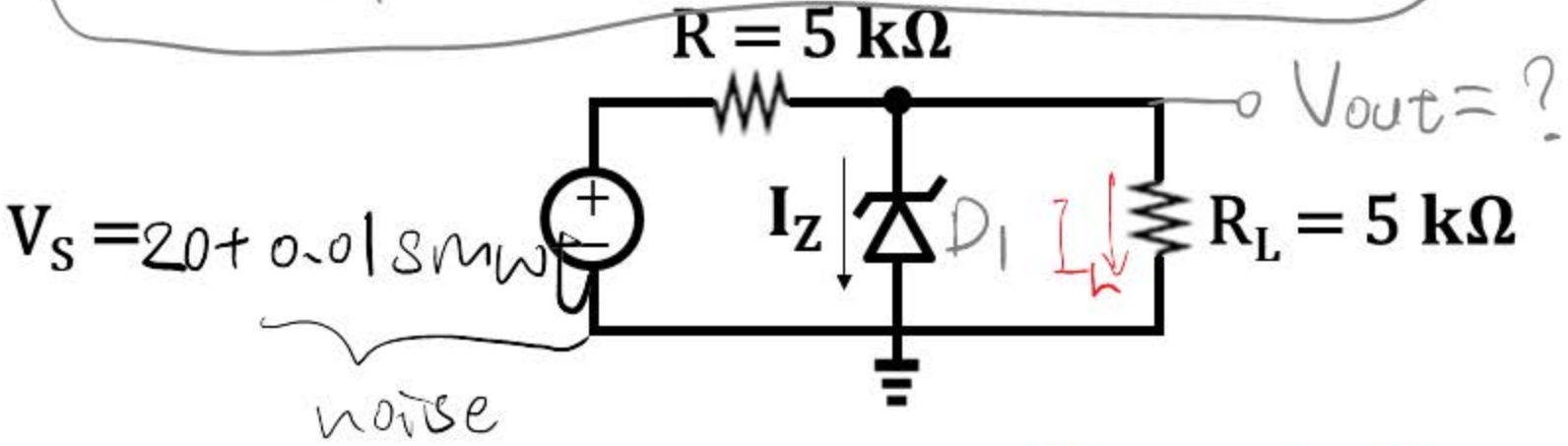


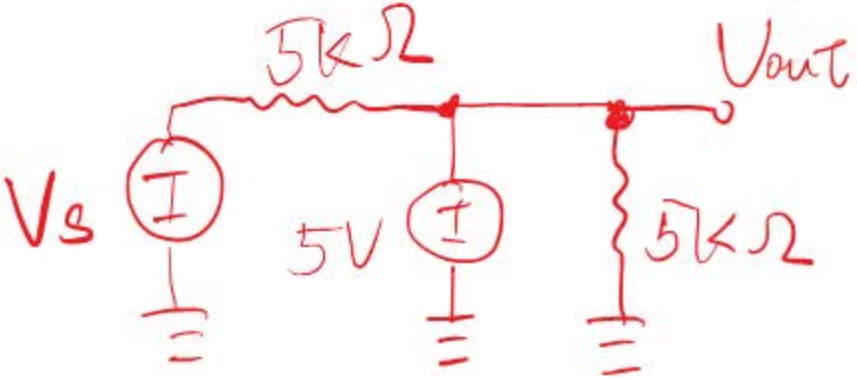
$$20 \cdot \frac{1.5k}{1.5k+5k} = Vout$$

check:

$$\frac{5}{1.5k} = I_L > \frac{20-5}{5k}$$



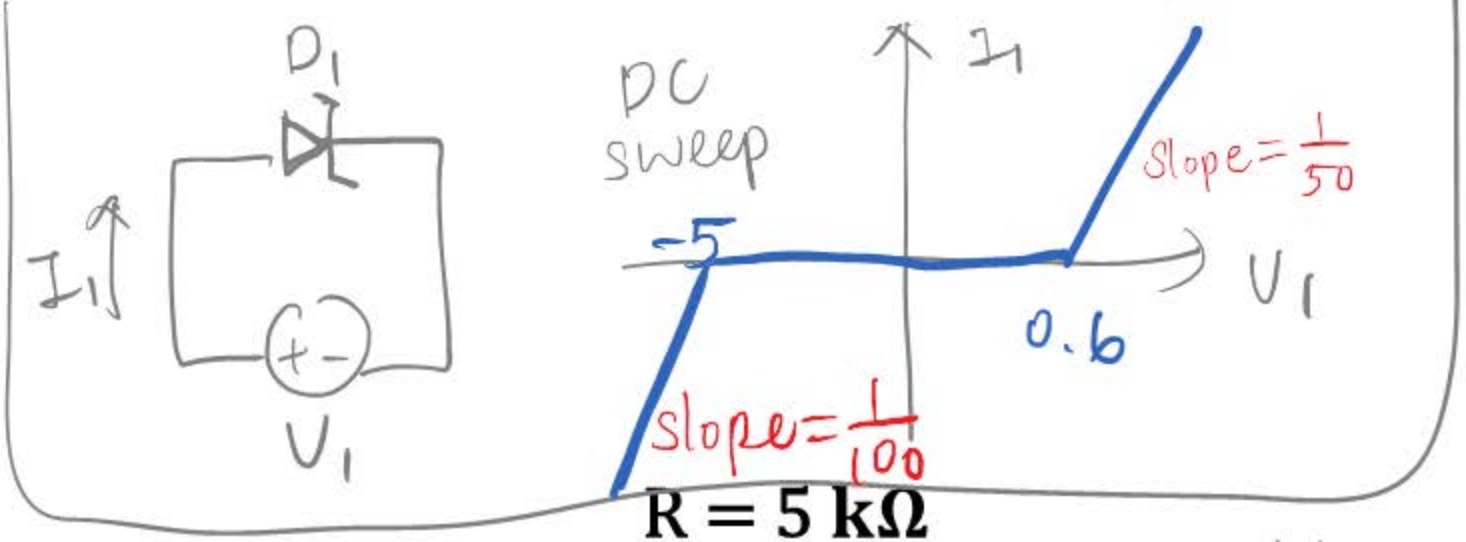


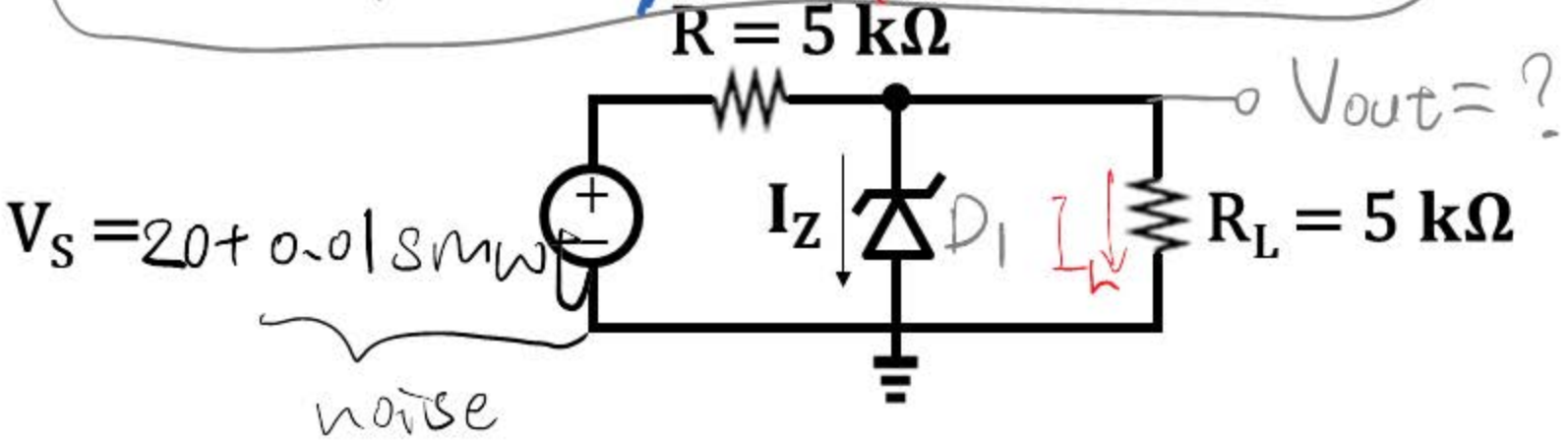


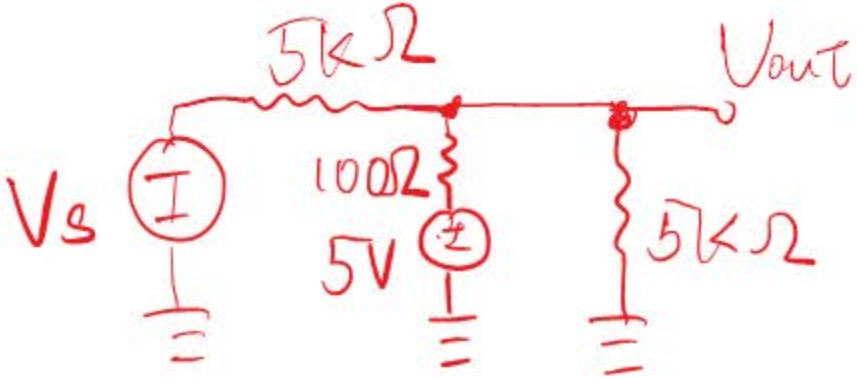
$V_{out} = 5\ V$

$$\frac{V_S - 5}{5k} - I_L = I_8$$

$$\frac{5}{5k} = I_L$$

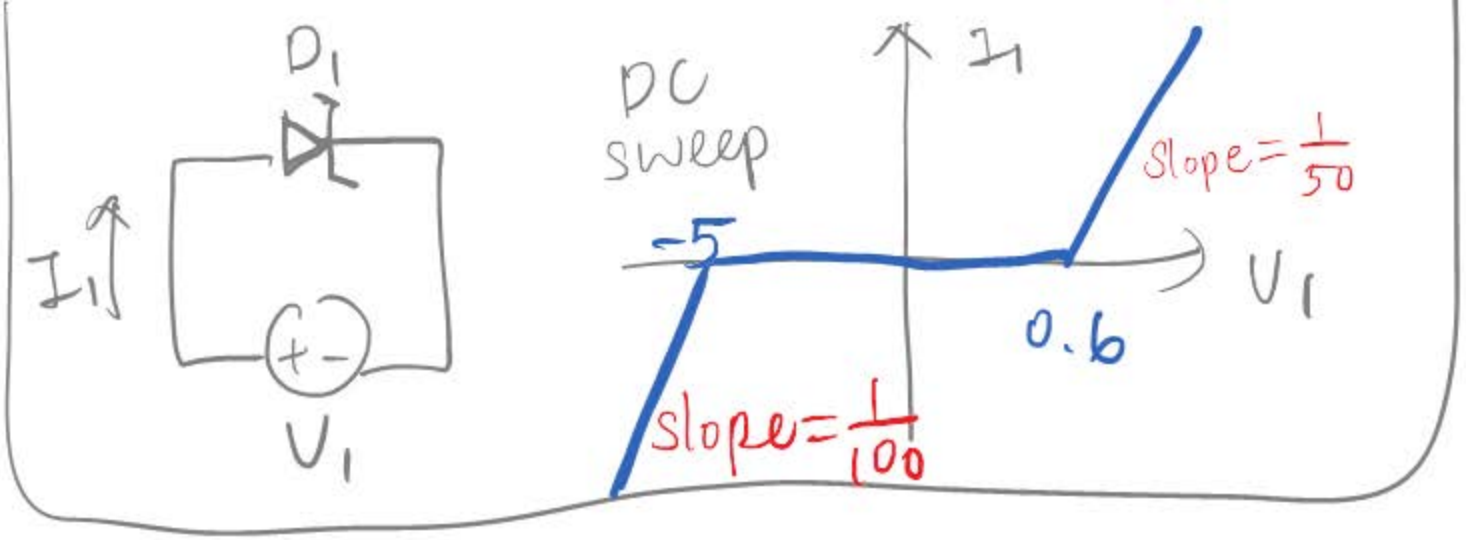


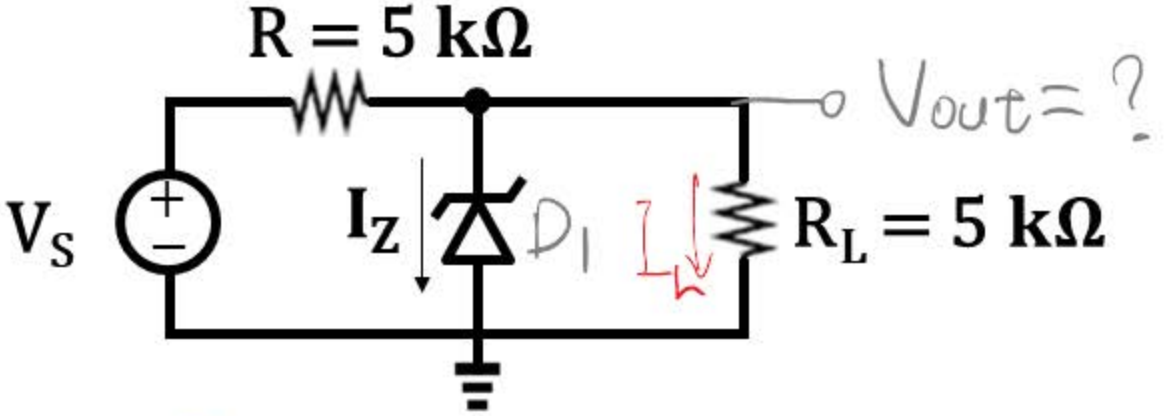




$$\frac{V_s - V_{out}}{5K} = \frac{V_{out}}{5K} + \frac{V_{out} - 5}{100}$$

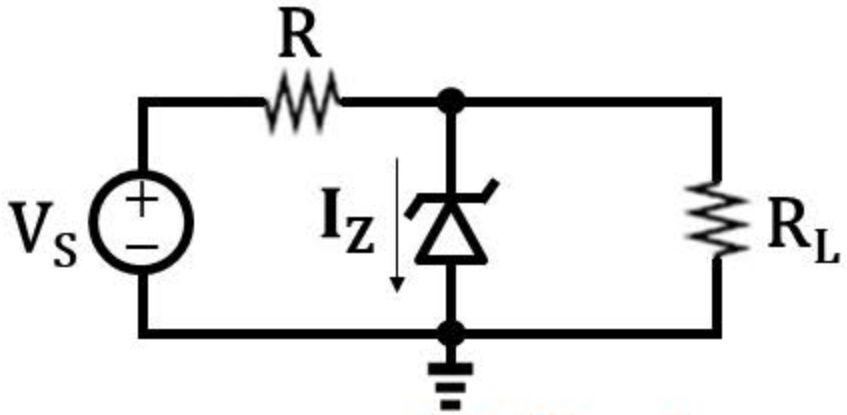
$$V_{out} = \boxed{DC} + \boxed{AC}$$



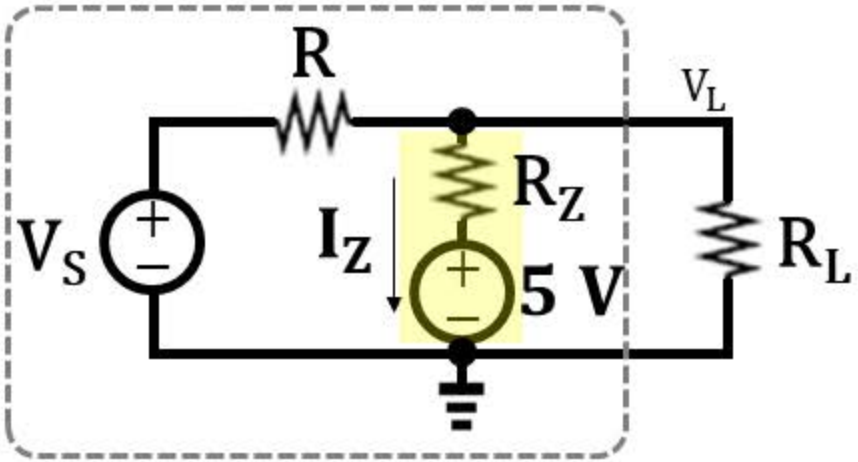


* We want R_Z to be as small as possible.
* If R too large, not enough supply current.
  If R too small, not enough voltage regulation.

Line Regulation and Load Regulation



If $I_Z > 0$



- **Line Regulation:** how sensitive the output voltage (V_L) is to input voltage (V_S) changes, when $R_L = \infty$.

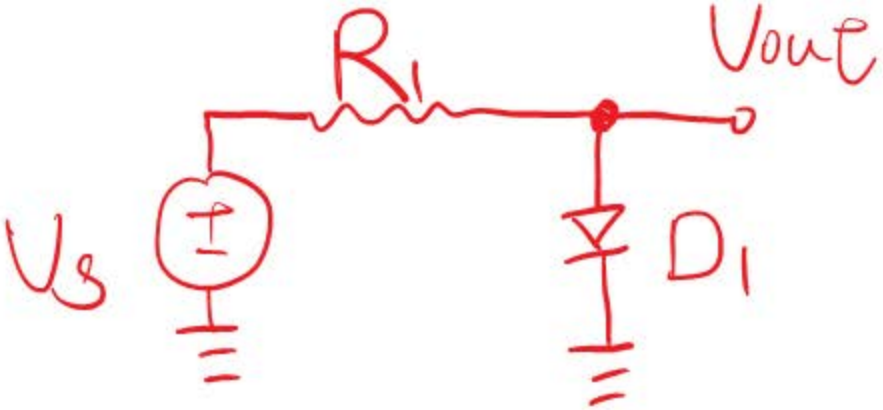
$$\text{Line Regulation} = \frac{dV_L}{dV_S} = \frac{R_Z}{R + R_Z}$$

The smaller, the better

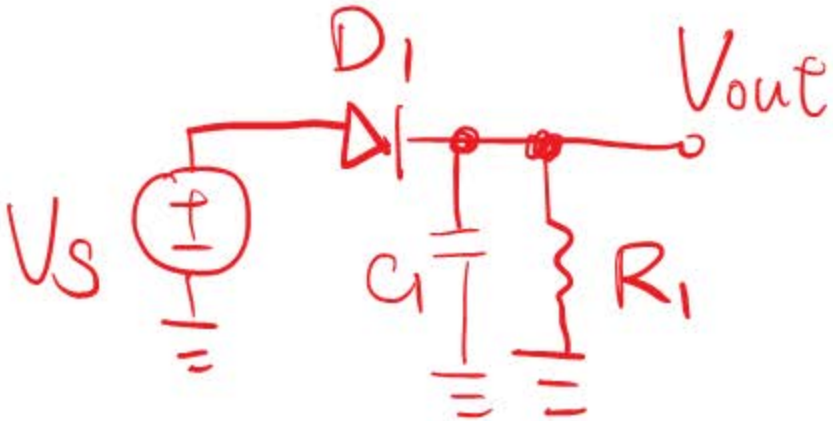
- **Load Regulation:** output impedance of the voltage regulator.

$$\text{Load Regulation} = \frac{dV_L}{dI_L} = R \parallel R_Z$$

The smaller, the better.



Regulators.



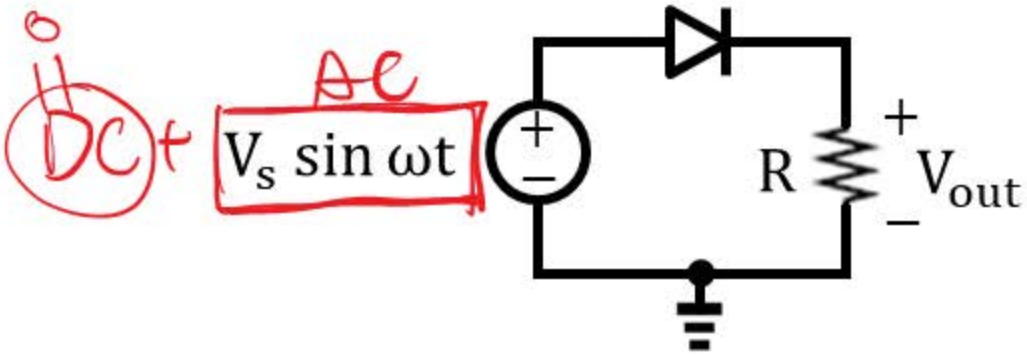
Rectifiers.

(AC → DC)

220 V
60 Hz

5 V DC

Half-Wave Rectifier with Resistive Load

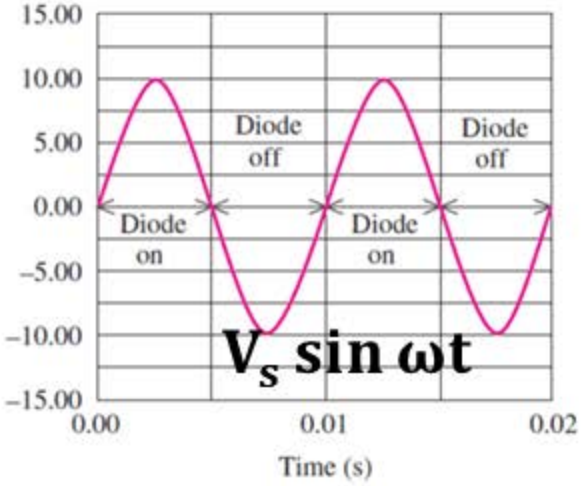


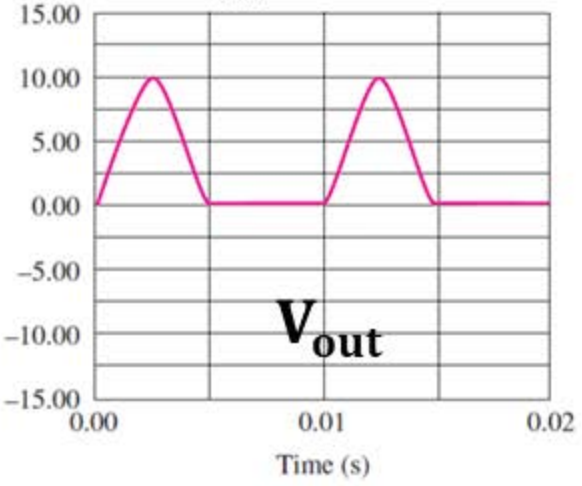
$V_s = 10$ V

$\omega = 2\pi f = 2\pi \frac{1}{0.01} = 200\pi$ (rad/sec)

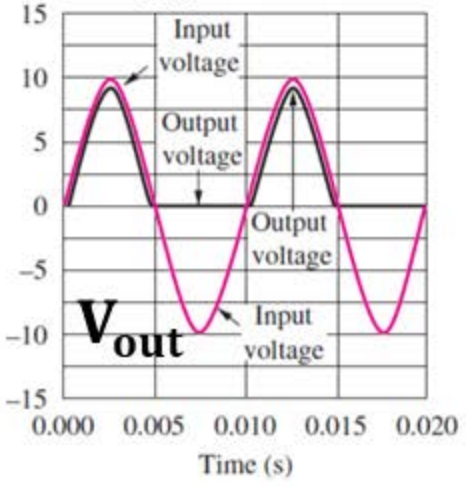
V_{out} is not DC.

$V_{on} = 0$ V

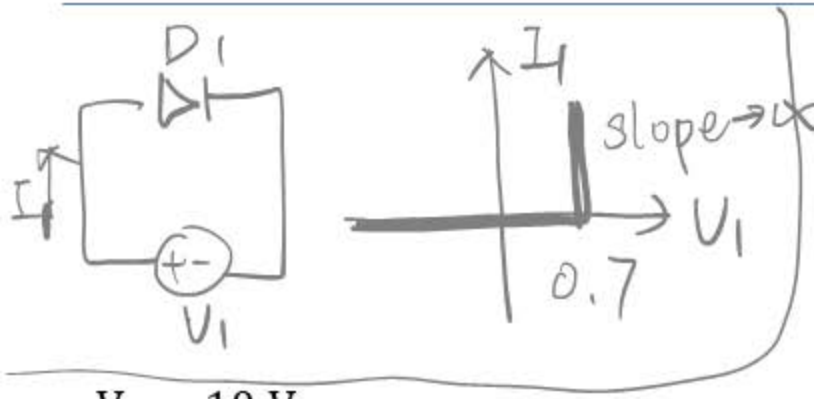


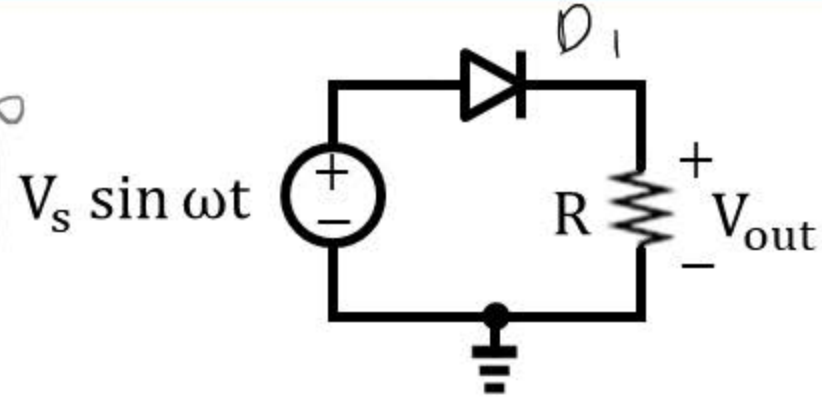


$V_{on} = 0.7$ V



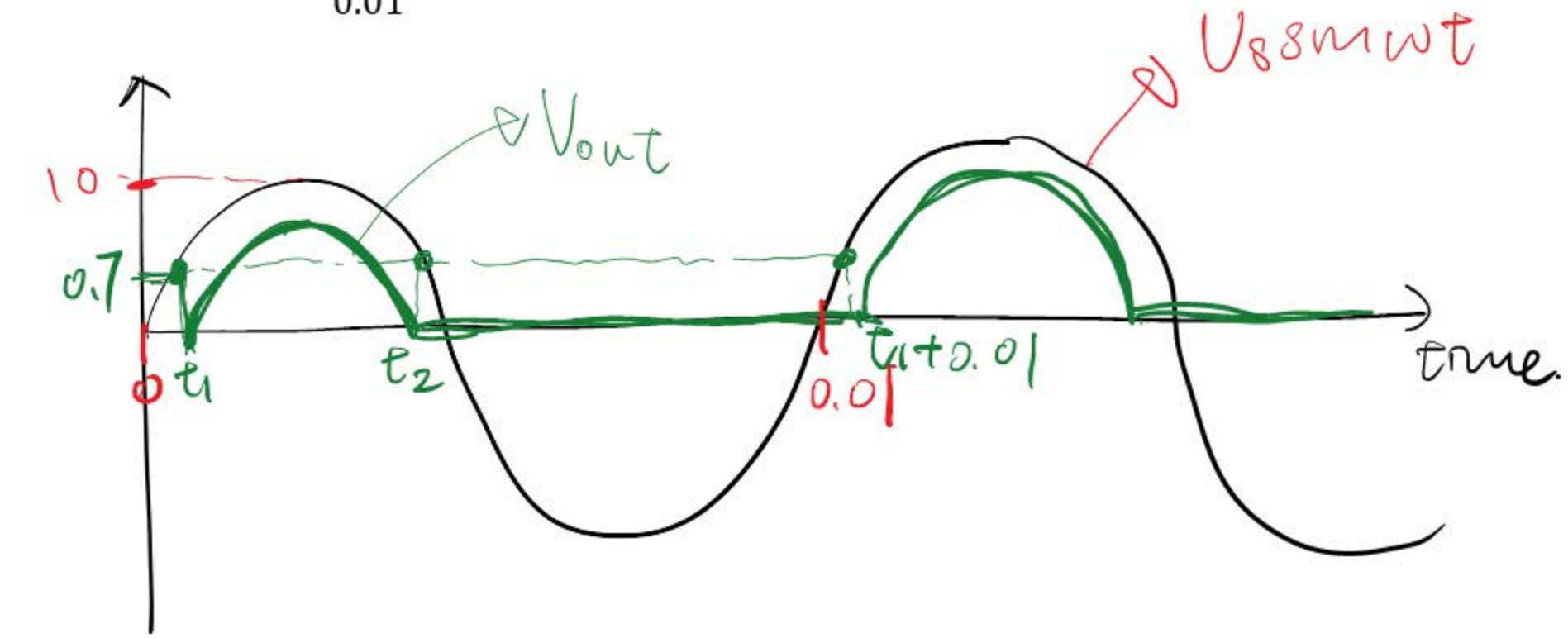
Half-Wave Rectifier with Resistive Load



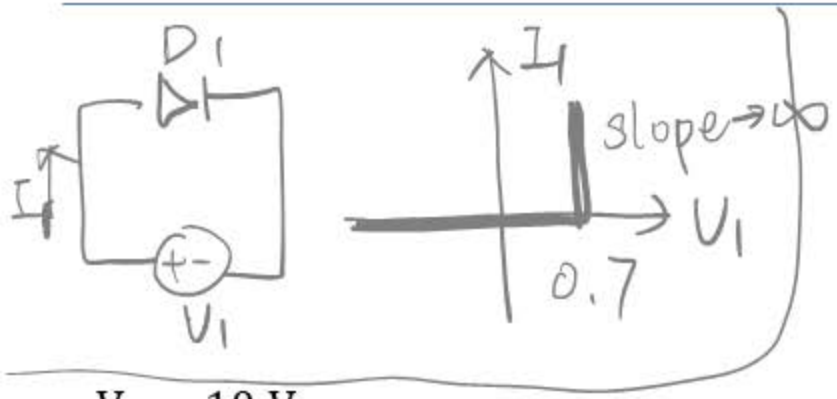


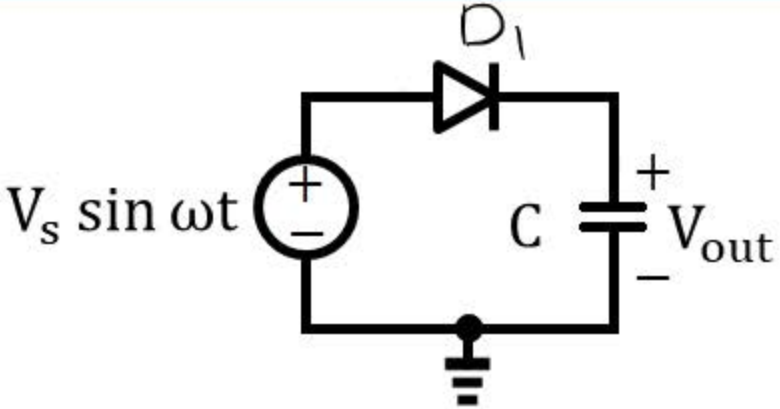
$V_s = 10\ V$

$\omega = 2\pi f = 2\pi \frac{1}{0.01} = 200\pi\ (rad/sec)$



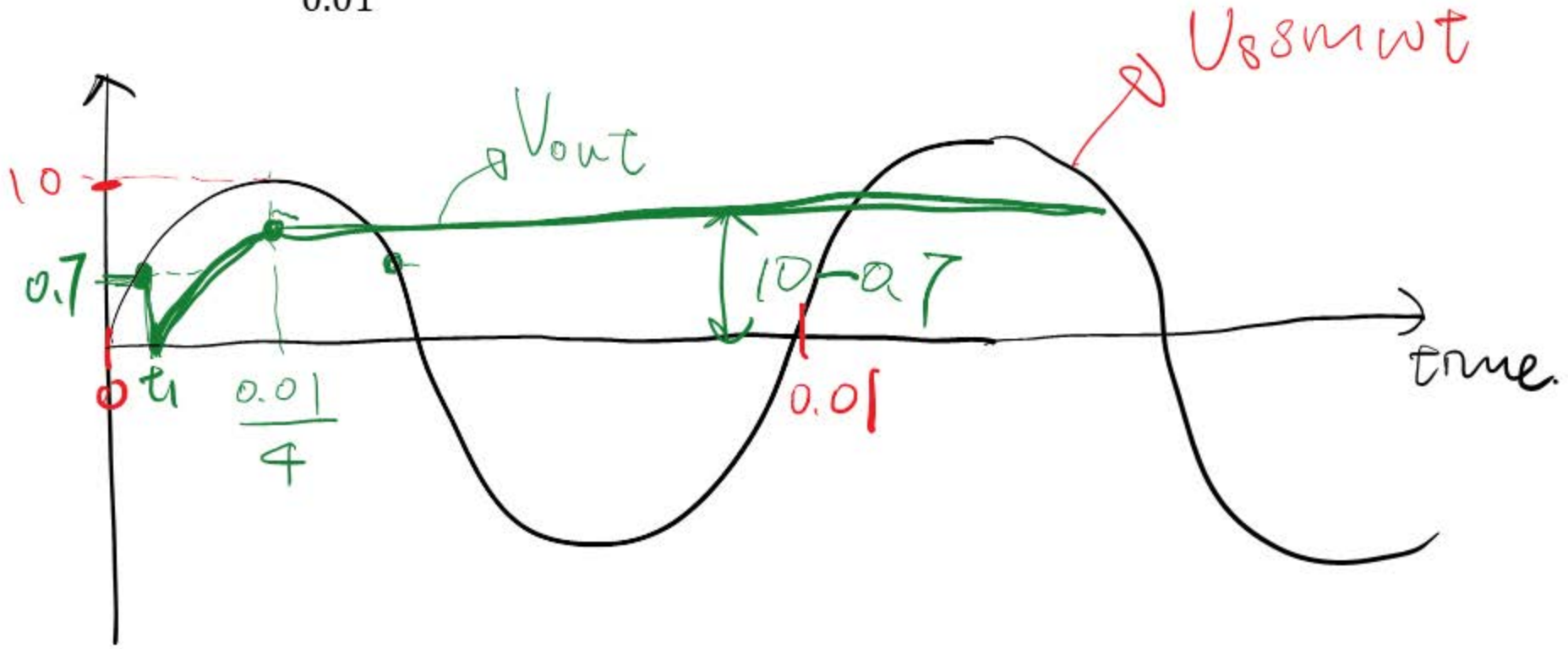
Half-Wave Rectifier with Resistive Load

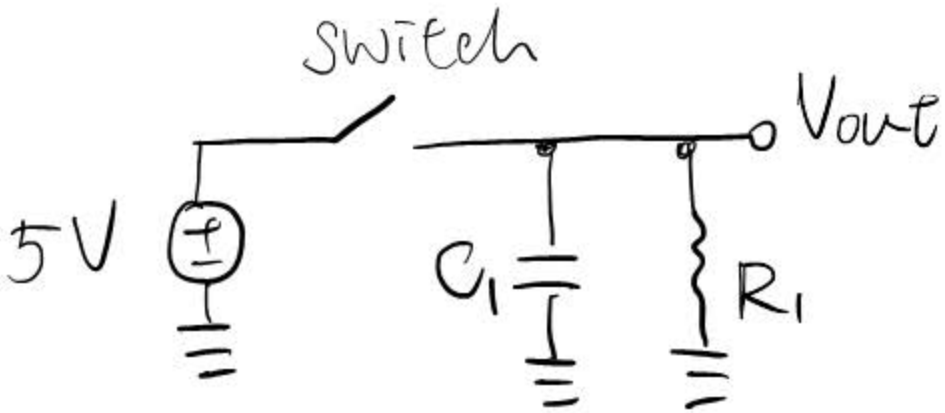




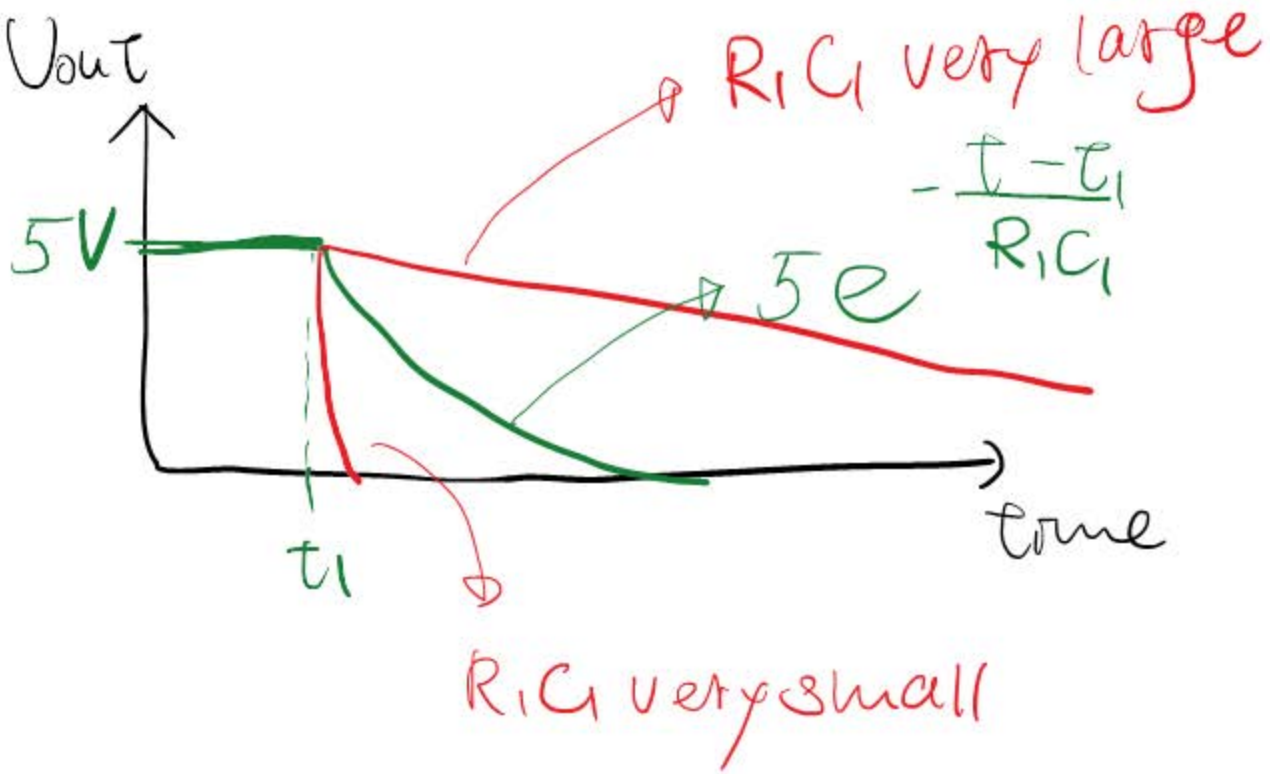
$V_s = 10\ V$

$\omega = 2\pi f = 2\pi \frac{1}{0.01} = 200\pi\ (rad/sec)$

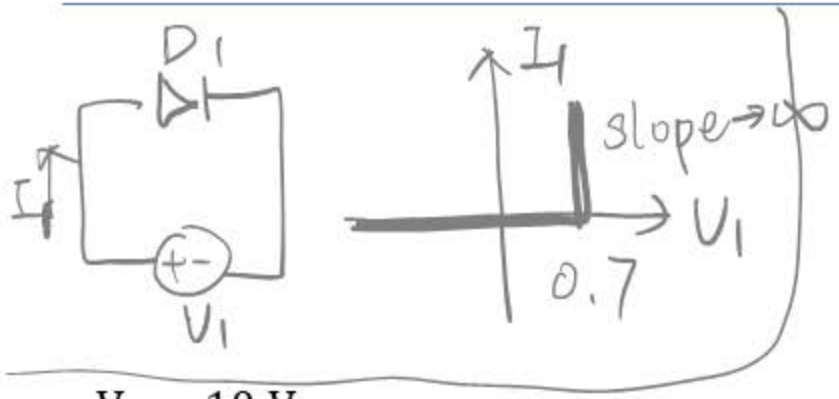


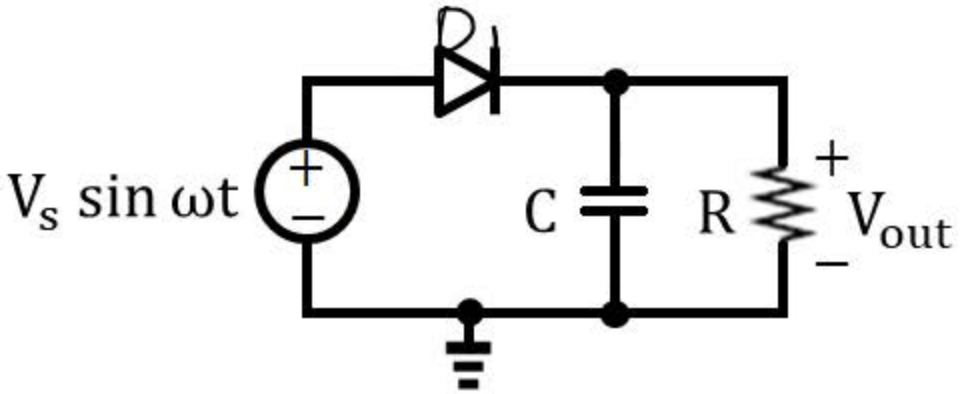


The switch is closed until t_1.



Half-Wave Rectifier with Resistive Load





$V_s = 10\ V$

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