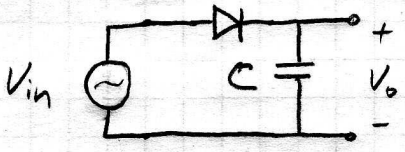
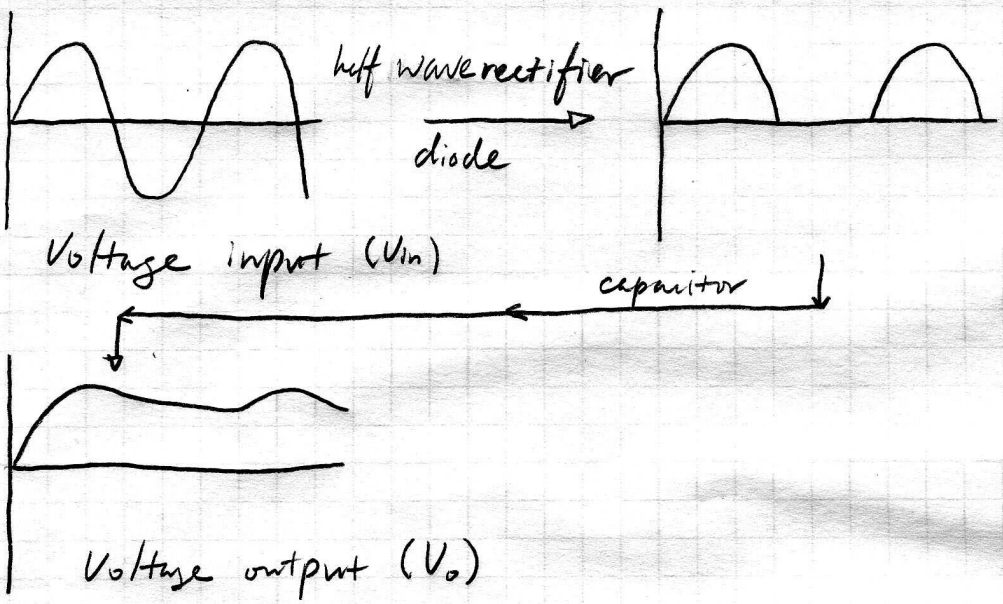
PLEASE READ: The purpose of this document is to provide examples of pre-lab tasks. The designs, calculations, values, and any other technical aspects of this document will not be suitable for your design.

- Important – rectifier design
  1. Current handling of the diode
  2. Peak inverse voltage (PIV)
  - "select a diode that has a reverse breakdown voltage at least 50% greater than expected PIV."

- Design #1 – half wave rectifier



How it operates:



half wave rectifier ripple is given by:

$$V_r = \frac{V_p}{f C R_L}$$

V_r = ripple voltage
V_p = peak voltage
f = frequency
C = Capacitance

Given design spec:

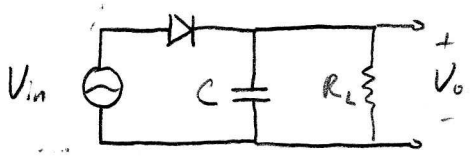
$V_r < 5$ volts

$V_p = 120$ volts

$f = 60$ Hz

$C = ?$

$R_L = ?$



Small ripple is desired: $V_r \to 0$

Worst case: $V_r = 5$ volts

$V_r = \frac{V_p}{f C R_L}$, assuming $R_L = 10\,k\Omega$

↳ prototyping only!

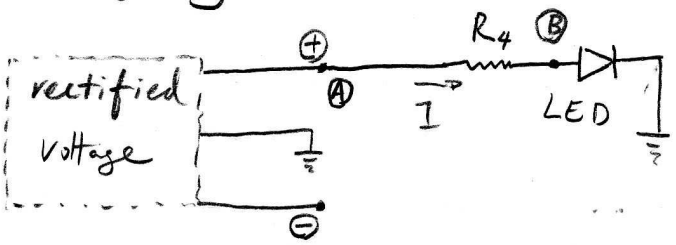
$$5 = \frac{120}{60(C)(10000)}$$

$C = 0.00004\ F = 40\ \mu F$

※ increase C will result in smaller ripple

Design #2 — Full wave rectifier

Designing Power LED:



- The rectified positive voltage is 52 volts, this means node A is 52 volts → $V_A = 52$ volts
- From data sheet, under normal operation, the LED has a voltage drop of 3.7 volts, and continous current of 10.28×10^3 mA.

calculating of R_4:

$$\frac{V_A - V_B}{R_4} = I$$

$V_A = 52$ volts

$V_B = 3.7$ volts

$I = 10.28 \times 10^3$ mA

$$\frac{52 - 3.7}{R_4} = 10.28 \times 10^3 \text{ mA}$$

$R_4 = 4.7\ \Omega$

※ A 4.7 Ω resistor should be able to keep the power LED from damaging.