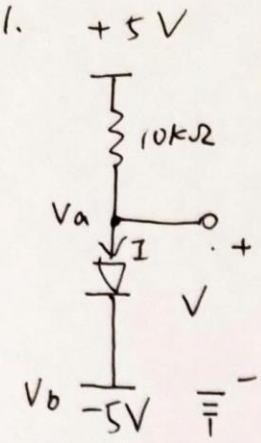
1. 

If diode is ~~off~~, $V_a = 5V$ $V_a > V_b(-5V)$

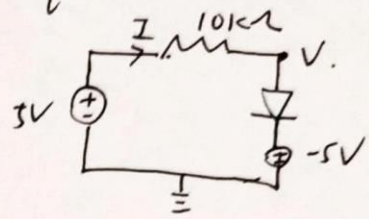
wrong assumption So, diode is on.

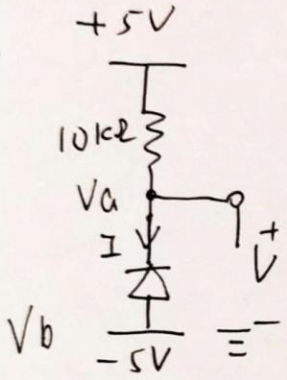
If diode is on,

$$I = \frac{5-(-5V)}{10k\Omega} = 1mA$$

$V = V_a = V_b = -5V$.

Equivalent circuit

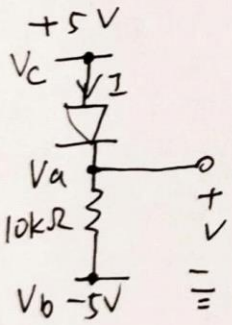


2. 

If diode is ~~off~~ $V_a = 5V$ $V_a > V_b$, so assumption holds.

Since diode is ~~off~~, $I = 0$

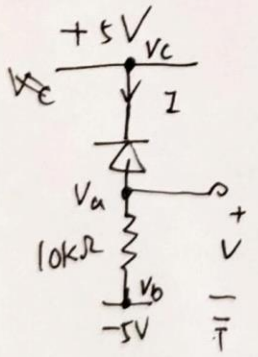
$V_a = V = 5V$.

3. 

If diode is ~~off~~, $V_a = -5V$ $V_c > V_a$, assumption Invalid.

So diode is on.

$$I = \frac{5V-(-5V)}{10k\Omega} = 1mA \quad V = V_a = 5V.$$

4. 

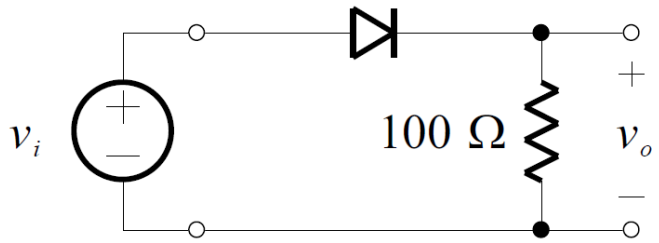
If diode is off, $V_a = -5V$ $V_a < V_c$ so, assumption holds.

$I = 0$

$V_a = -5V$.

5.

A symmetrical square wave of 6-V peak-to-peak amplitude and zero average is applied to the circuit below, which has an ideal diode:



(a) What is the peak output voltage that results?

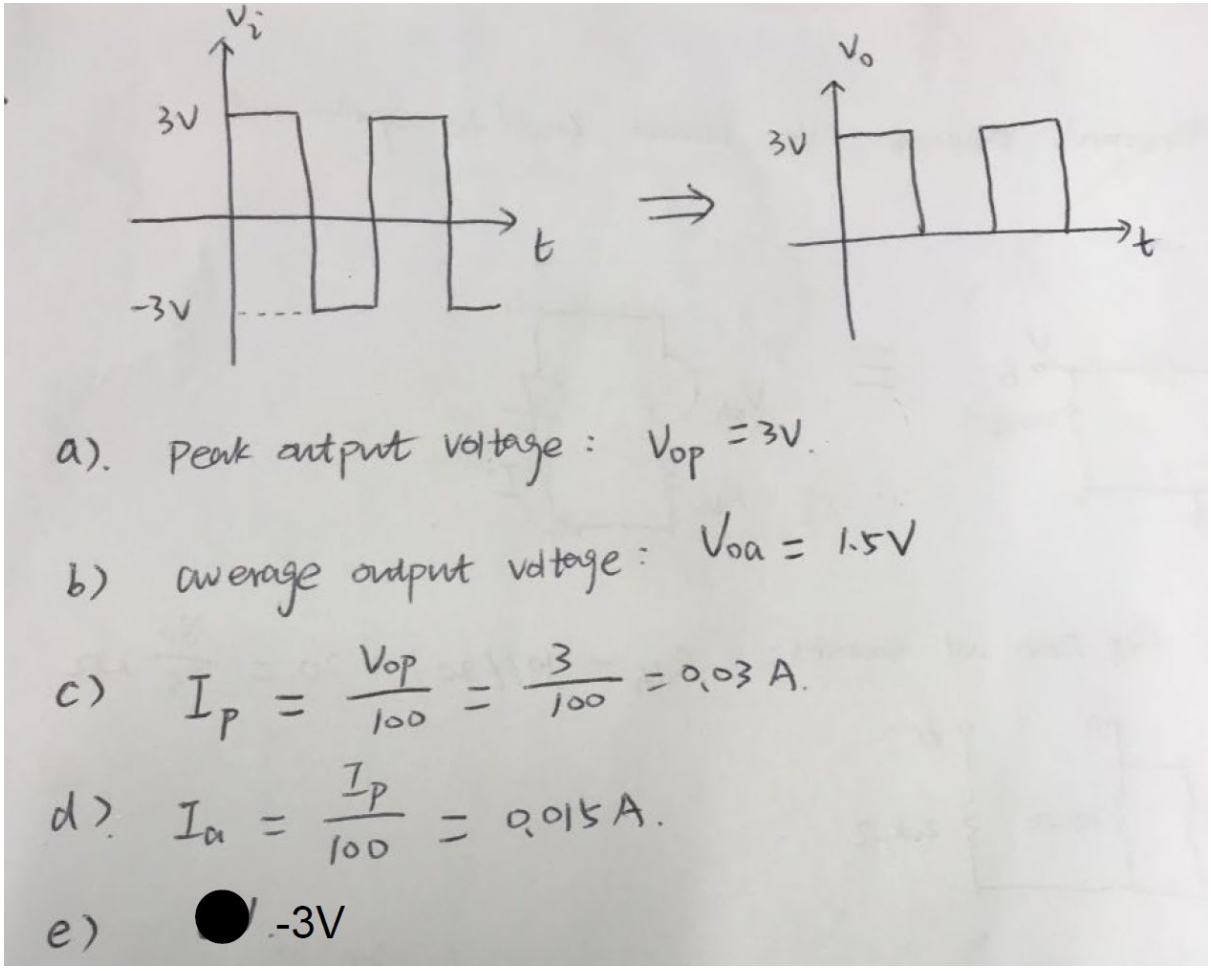
(b) What is the average output voltage that results?

(c) What is the peak diode current?

(d) What is the average diode current?

(e) What is the maximum reverse voltage across the diode?

Solutions:



a). Peak output voltage : $V_{op} = 3V$.

b) average output voltage : $V_{oa} = 1.5V$

c) $I_p = \frac{V_{op}}{100} = \frac{3}{100} = 0,03\ A.$

d) $I_a = \frac{I_p}{100} = 0,015\ A.$

e) -3V

6.

The diode shown in Figure 1a can be represented by the model of Figure 1b, with $V_f = 0.7V$.

Assuming that the diode operates as a 0.7V voltage source, and solve for the node voltages v_1 and v_2. Find diode current I_D. Are the results consistent with the model? Provide your reasoning?

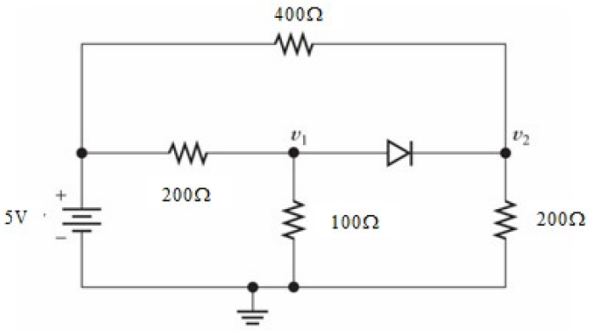


Figure 1a

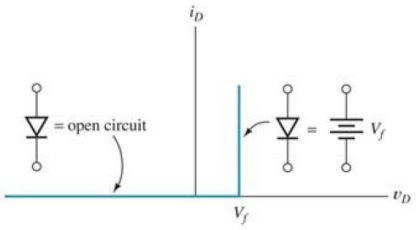


Figure 1b

Solutions:

Answer:

$$v_1 - v_2 = V_f = 0.7 \; --- (1)$$

The supernode enclosing the V_f:

$$\frac{v_1 - 5}{200} + \frac{v_1}{100} + \frac{v_2 - 5}{400} + \frac{v_2}{200} = 0 \; --- (2)$$

Solve (1)&(2),

v_1=1.9V & v_2=1.2V

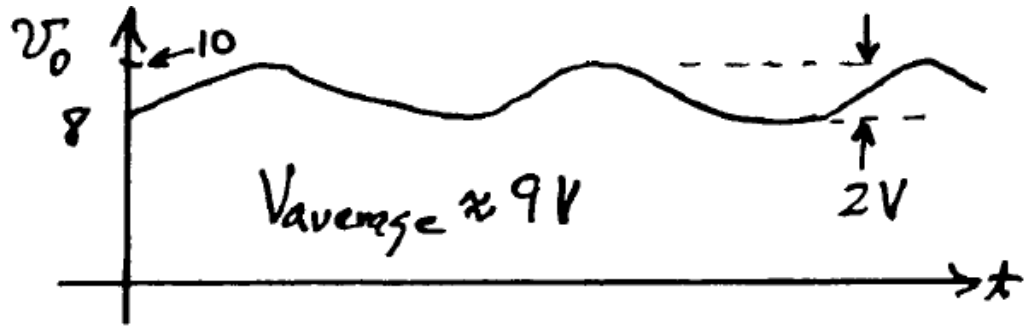
$$i_D = \frac{5 - v_1}{200} - \frac{v_1}{100} = -3.5mA$$

As i_D is negative, the diode operation is inconsistent with the mode.

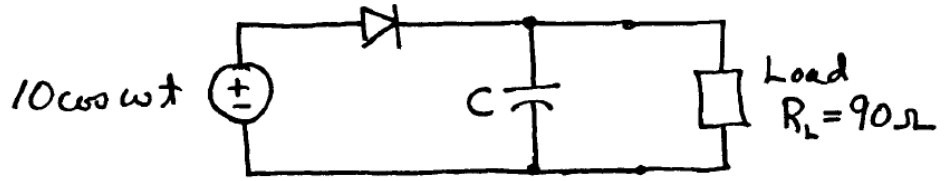
7.

Design a half-wave rectifier power supply to deliver an average voltage of 9V with a peak-to-peak ripple of 2 V to a load. The average load current is 100mA. Assume that ideal diodes and 60 Hz ac voltage sources of any amplitudes needed are available. Draw the circuit diagram for your design. Specify the values of all components used.

The output voltage waveform is:



The peak voltage is approximately 10 V. Assuming an ideal diode, the ac source must have a peak voltage of 10 V. The circuit is:



where $R_L = V_{ave}/I_L = 9/0.1 = 90\Omega$

The capacitance required is $C = \frac{I_L T}{V_r}$

$$C = \frac{0.1(1/60)}{2} = 833\mu\text{F}$$