

## Block C: Diode

### Q1. Problem P9.7 (modified)

Consider the circuit of Figure P9.7. Determine whether the diode is conducting or not. Assume that the diode is an ideal diode.

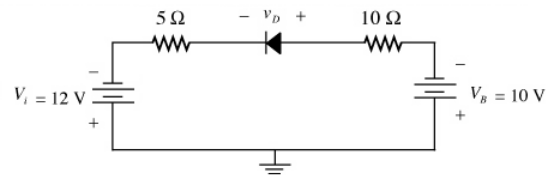


Figure P9.7

**Answer: it is conducting**

### Q2. Problem P9.14

For the circuit of Figure P9.14, find the range of  $V_{in}$  for which  $D_1$  is forward-biased. Assume an ideal diode.

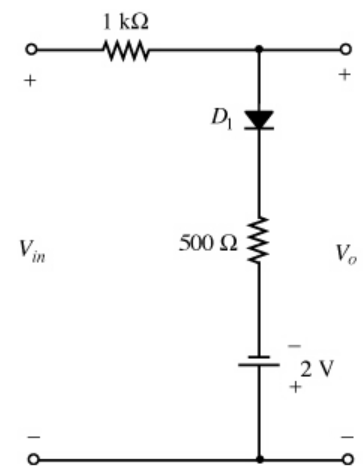


Figure P9.14

### Q3. Problem P9.16

Find voltage  $v_L$  in the circuit of Figure P9.16 where  $D$  is an ideal diode, for positive and negative values of  $v_S$ . Sketch a plot of  $v_L$  versus  $v_S$ .

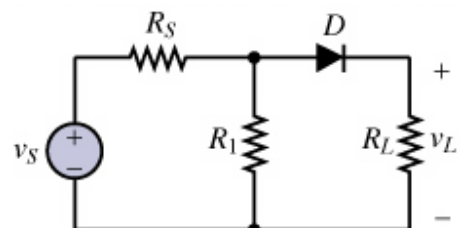


Figure P9.16

**Answer:**

For  $v_S < 0$ ,  $v_L = 0$ .

For  $v_S \geq 0$ ,  $v_L = v_S \left( \frac{R_L \parallel R_1}{R_S + R_L \parallel R_1} \right)$ .

**Q4. Problem P9.19 (modified)**

Assume that the diode in Figure P9.19 requires a minimum current of 1 mA to be above the knee of its  $i$ - $v$  characteristic. Use  $V_\gamma = 0.7$  V.

- What should be the value of  $R$  to establish 10 mA in the circuit?
- With the value of  $R$  determined in part a, what is the minimum value to which the voltage  $E$  could be reduced and still maintain diode current above the knee?

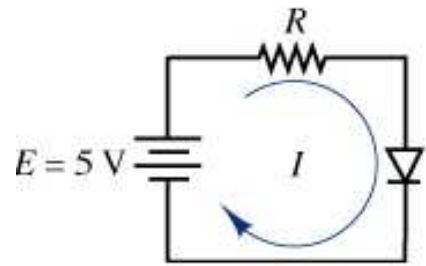


Figure P9.19

**Answer:**

- 430  $\Omega$
- 1.13 V

**Q5. Problem P9.20**

In Figure P9.20, a sinusoidal source of 50 V rms drives the circuit. Use the offset diode model for a silicon diode.

- What is the maximum forward current?
- What is the peak inverse voltage across the diode?

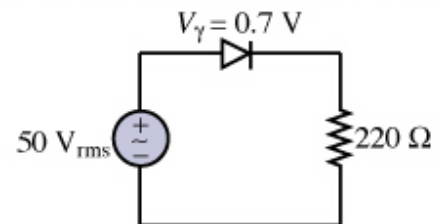


Figure P9.20

**Answer:**

- 318 mA
- 70.7 V

**Q6. Problem P9.22**

In the circuit of Figure P9.22, find the range of  $V_{in}$  for which  $D_1$  is forward-biased. Assume ideal diodes.

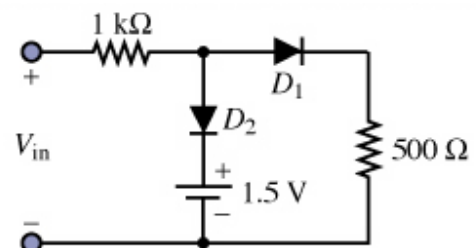


Figure P9.22

**Answer:**  $V_{in} > 0$

**Q7. Problem P9.25**

Sketch the output waveform and the voltage transfer characteristic for the circuit of Figure P9.25. Assume offset diode model with  $V_\gamma = 0.6\text{ V}$ ,  $v_S(t) = 10 \sin(2,000\pi t)$ .

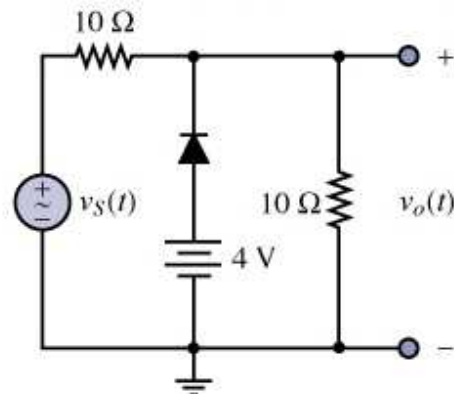


Figure P9.25

**Q8. Problem P9.33**

Find the average value of the output voltage for the circuit of Figure P9.33 if the input voltage is sinusoidal with an amplitude of 5 V. Let  $V_\gamma = 0.7\text{ V}$ .

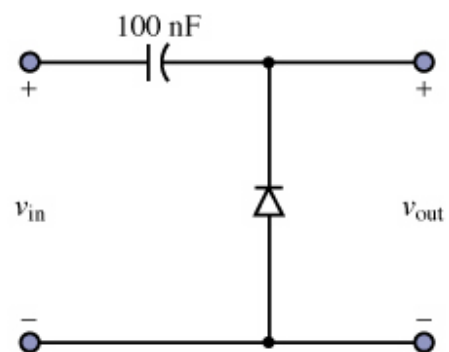


Figure P9.33

**Answer:** 4.3V

**Q9. Problem P9.34**

In the rectifier circuit shown in Figure P9.34,  $v(t) = A \sin(2\pi 100)t$  V. Assume a forward voltage drop of 0.7 V across the diode when it is conducting. If conduction must begin during each positive half-cycle at an angle no greater than  $5^\circ$ , what is the minimum peak value  $A$  that the AC source must produce?

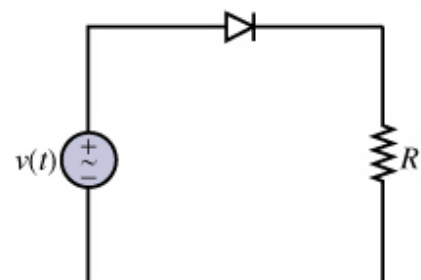


Figure P9.34

**Answer:** 8.03V

**Q10. Problem P9.35**

A half-wave rectifier is to provide an average voltage of 50 V at its output.

- Draw a schematic diagram of the circuit.
- Sketch the output voltage waveshape.
- Determine the peak value of the output voltage.
- Sketch the input voltage waveshape.
- What is the rms voltage at the input?

Answer:

- 157.2V
- 111.2V

**Q11. Problem P9.42**

The diodes in the full-wave DC power supply shown in Figure P9.42 are silicon. If  $I_L = 5 \text{ mA}$ ,  $V_L = 10 \text{ V}$ ,  $V_r = 20\%$ ,  $v_{line} = 170 \cos(\omega t) \text{ V}$ ,  $\omega = 377 \frac{\text{rad}}{\text{s}}$ .

Determine the

- Turns ratio  $n = V_{line}/V_{S1}$ .
- The values of the capacitor C.

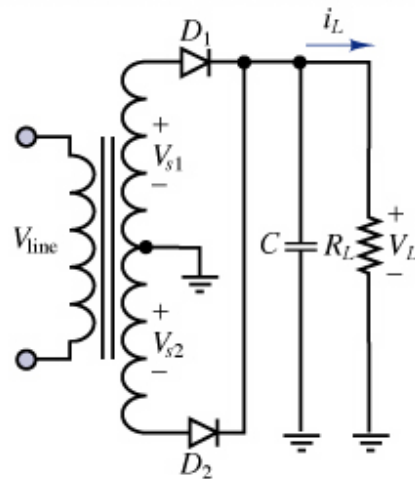


Figure P9.42

Answer:

- 14.53
- 16.84  $\mu\text{F}$