1. A silicon sample at room temperature has an intrinsic carrier concentration of $n_i = 5\times10^{9}$ cm^{-3}. It is doped with $N_D = 6.1\times10^{16}$ arsenic atoms/cm^3 and $N_A = 6\times10^{12}$ boron atoms/cm^3. The electron mobility is measured as $\mu_n = 1600$ cm^2/V·s and the hole mobility is $\mu_p = 480$ cm^2/V·s.?

Is this material p or n-type? ___b_____

(a) p-type (b) n-type

What is the hole concentration? ____a_____

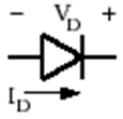
(a) p =4.1x10^2 /cm^3 (b) p =6x10^{12} /cm^3 (c) p =6.1x10^{16} /cm^3

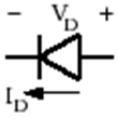
(d) p =2.5x10^{19} /cm^3

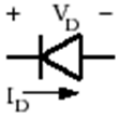
If an external electrical field of E =90V/cm is applied across this silicon sample, what is the electron current density in this material? _____b_____

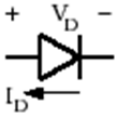
(a) jn =2.8x10^{-12} A/cm^2 (b) jn =1404 A/cm^2 (c) jn =15.6 A/cm^2

(d) jn =3.2x10^{-14} A/cm^2

a) 

b) 

c) 

d) 

e) None of these

2. Which figure above shows the correct sign convention for both positive diode voltage and positive diode current? _____b_____

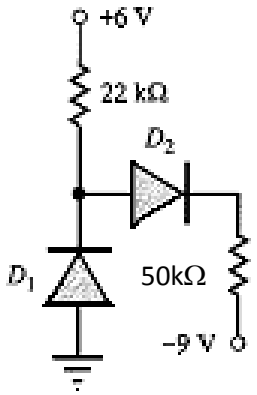
3. A diode has $I_S = 10^{-10}$A and the nonideality factor, n = 2. What is the diode voltage if the diode current is 40A? $V_T = 0.025$V for room temperature. _____c_____

(a) V_D =3.2V (b) V_D =-5.1V (c) V_D =1.34V (d) V_D =0V

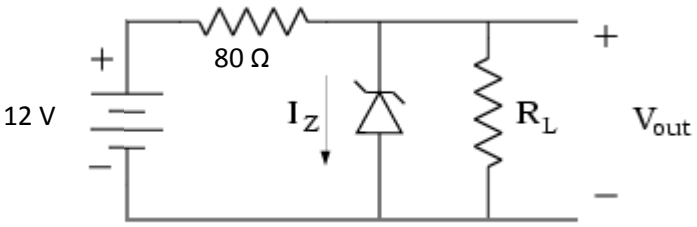
4. Find the current in each diode in the circuit shown below using the constant voltage drop model with V_{on} = 0.70 V. _____d_____

(a) I_{D1} =0A, I_{D2} =0A (b) I_{D1} =0.199mA, I_{D2} =0A

(c) I_{D1} =0A, I_{D2} =0.3mA (d) I_{D1} =0A, I_{D2} =0.199mA



5. In the circuit below, the Zener diode has a breakdown voltage $V_{Z0} = |V_{BR}| = 8.0$ V and a measurement has shown that $V_Z = 8.6$ V when $I_Z = 30$ mA. What is the value of V_{out} when R_L becomes infinitely large? _____c_____

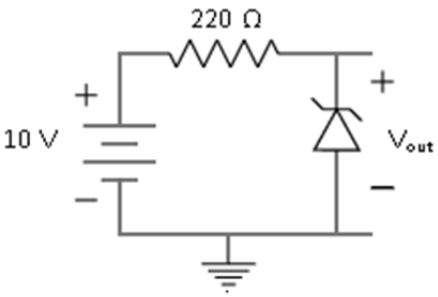


(a) V_{out} = 0 V **(b)** V_{out} = 8.2 V **(c)** V_{out} = 8.8 V **(d)** V_{out} = 8.4 V

6. The Zener diode in the circuit has an equivalent resistance $R_Z = 10\ \Omega$. From the diode data sheet we find that if the voltage across the Zener diode is 6.4 V at $I_Z = 20$ mA. Determine the output voltage V_{out} ____c_____

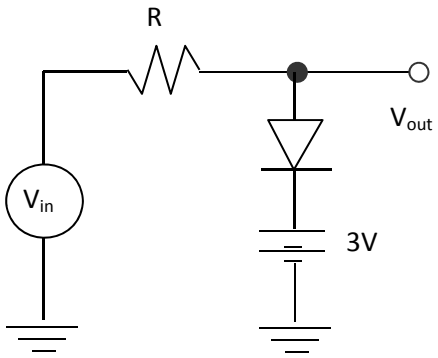
(a) V_{out} =6.4V (b) V_{out} =6.2V

(c) V_{out} =6.365V (d) V_{out} =10V

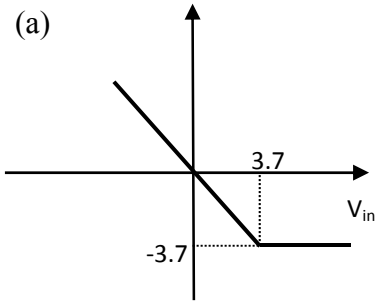


7. Which one of the curves shown below represents the transfer characteristics (v_{in}-v_{out}) for the Clipper Circuit? (Assume constant voltage drop model with V_{on} = 0.7V)

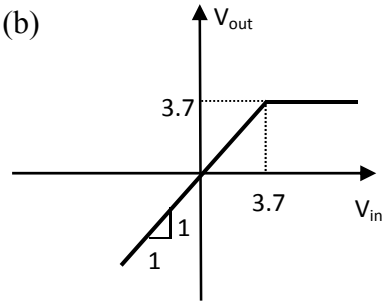
Answer: _____b_____



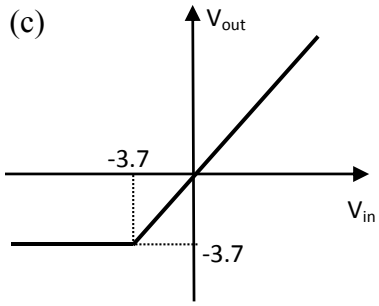
(a)



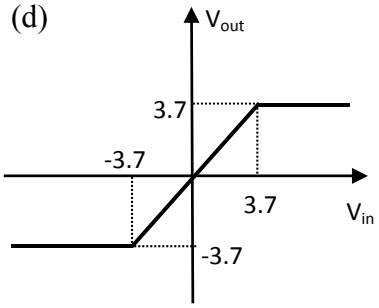
(b)



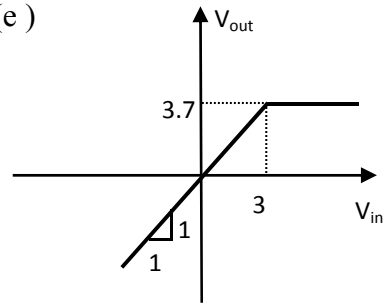
(c)



(d)



(e)

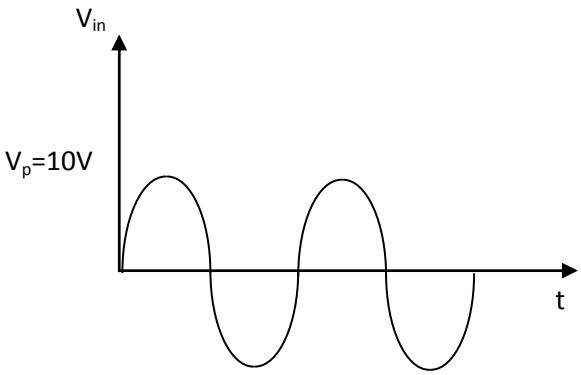


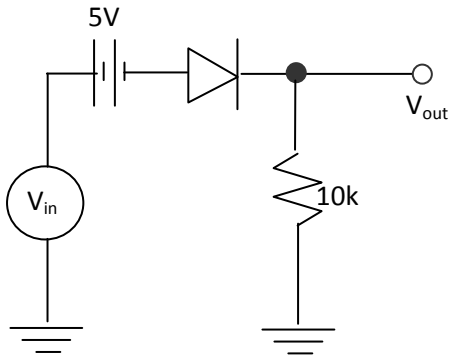
(f)

None of these

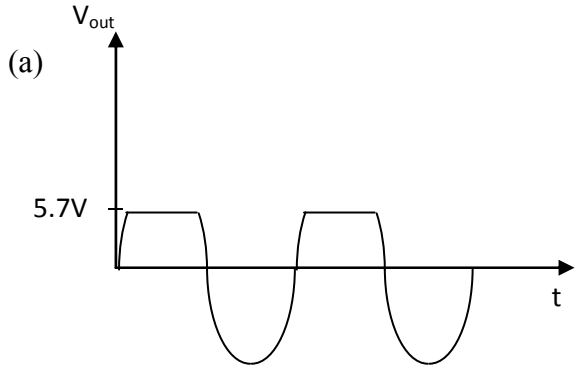
8. For the circuit shown below, if a sinusoidal wave is applied to the input, which one of the curves is the output voltage? (Assume V_{on}=0.7V)

Answer: _____e_____

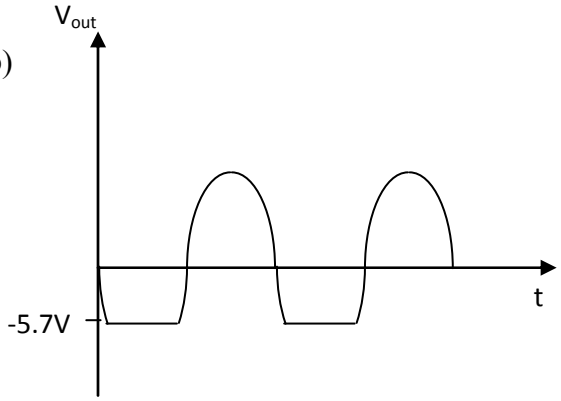




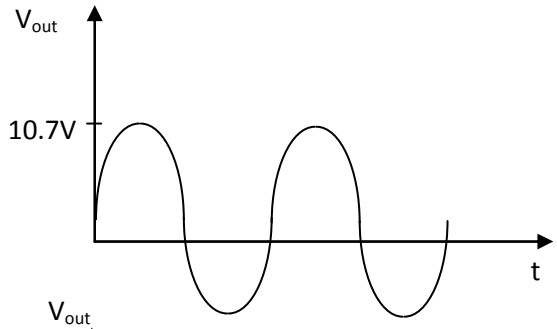
(a)



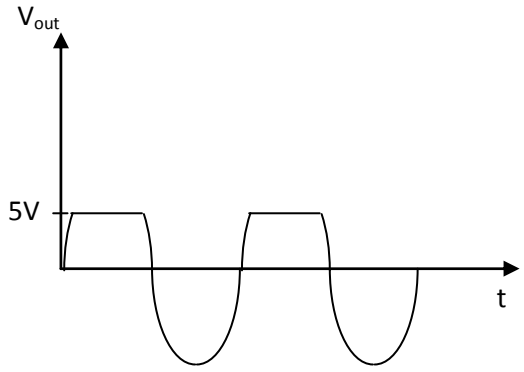
(b)



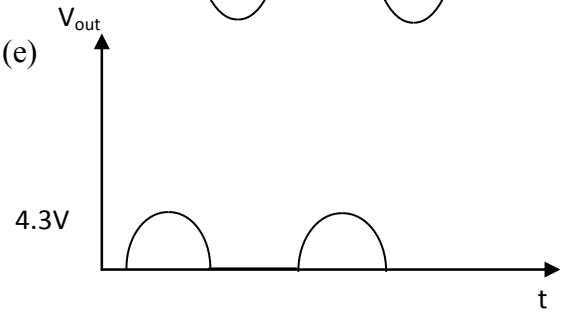
(c)



(d)

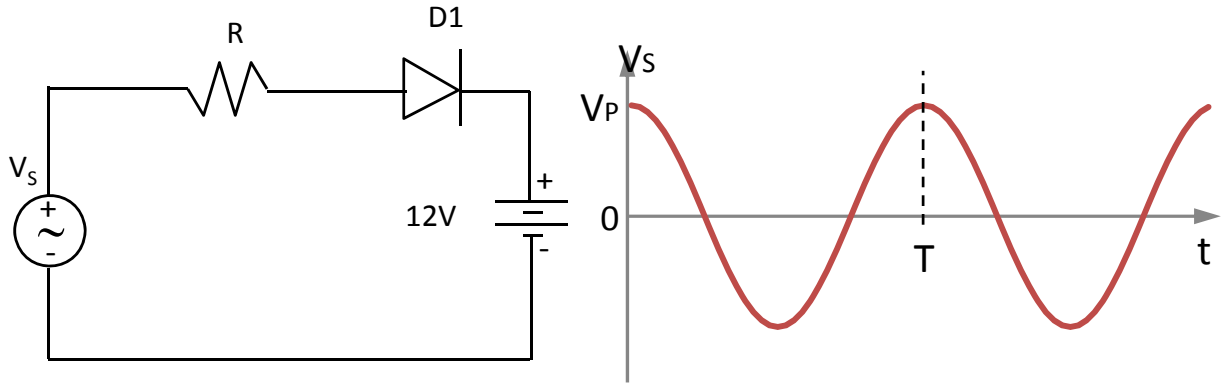


(e)



(f) None of these

9. You are asked to design an automotive battery charger using a 60 Hertz sinusoidal voltage source described by, $V_S = V_P \cos(\omega t) = V_P \cos(2\pi 60 t)$. In order to prevent the battery from overheating, the charging cycle must be kept to 1/3 of a cycle (i.e. charging only occurs for 1/3 of the 60 Hertz cycle). Using the ideal diode model, determine the proper value of V_P to achieve the design goal. ____b_____



(a) $V_p = 12\sqrt{2}V$ (b) $V_p = 24V$ (c) $V_p = 36V$ (d) $V_p = 28V$