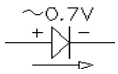
Folder:____ Name:_____ ECE 2210 hw # DO1

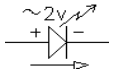
Fill in the blanks in the following circuits. For some of the simple calculations, you may simply write down the answer without showing work.

A.Stolp rev b

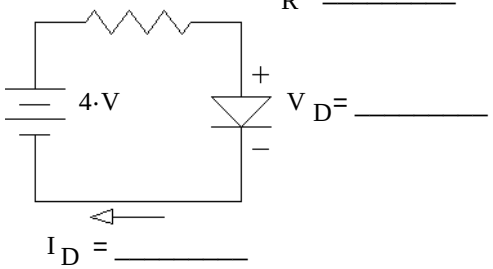
Assume the diodes are silicon with a $0.7V$ forward voltage drop:



Assume the LEDs have a $2V$ forward voltage drop:



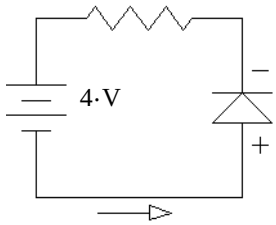
1. $R := 330 \cdot \Omega$ $V_R =$ _____



$V_D =$ _____

$I_D =$ _____

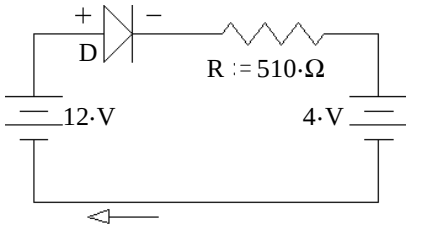
2. $R := 330 \cdot \Omega$ $V_R =$ _____



$V_D =$ _____

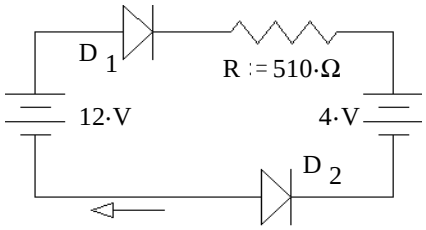
$I_D =$ _____

3. $V_D =$ _____ $V_R =$ _____



$I =$ _____

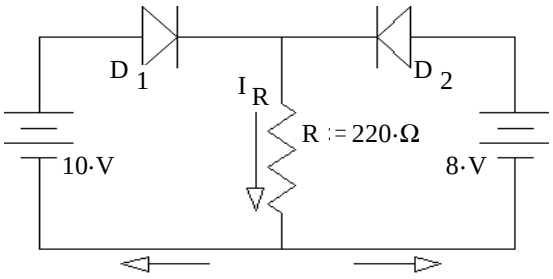
4. $V_{D1} =$ _____ $V_R =$ _____



$I =$ _____ $V_{D2} =$ _____

Note: In problems 5 and 6 you'll have to make some assumptions about which diode(s) is/are conducting. Work the problem with those assumptions and see if you arrive at impossible answers. If so, change your assumptions and try again.

5. $V_{D1} =$ _____ $V_{D2} =$ _____



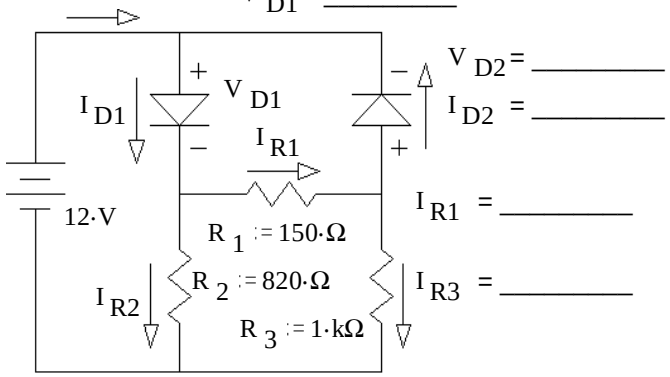
$I_1 =$ _____ $I_2 =$ _____

There are four possible assumptions.

1. Neither diode conducts.
2. Only D_1 conducts.
3. Only D_2 conducts.
4. Both diodes conduct.

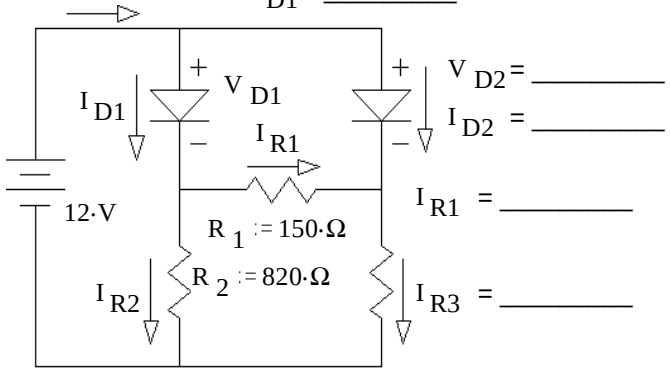
NOTE: You don't have to try all four possibilities. As soon as you find one that works, that's the answer. So make your best guess first.

6. I_T = _____ V_{D1} = _____



I_{R2} = _____

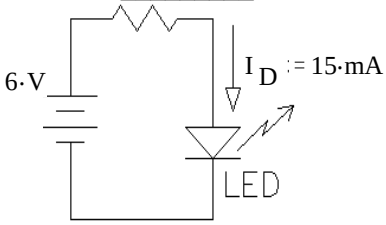
7. I_T = _____ V_{D1} = _____



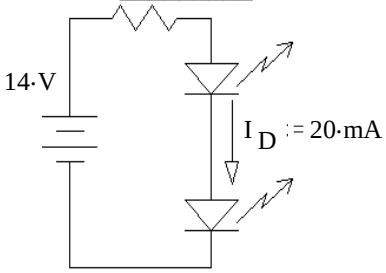
I_{R2} = _____

8. V_R = _____

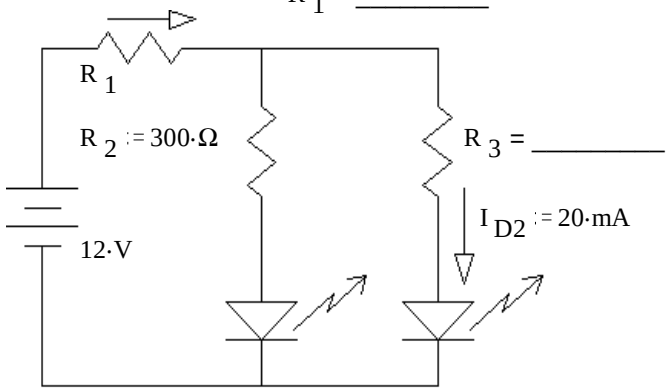
R = _____



9. R = _____

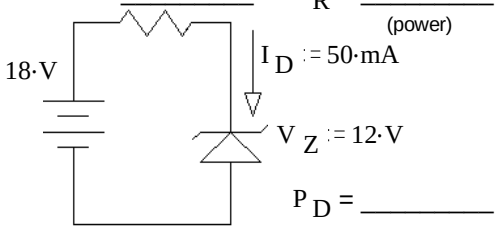


10. I_{R1} := 30·mA R_1 = _____

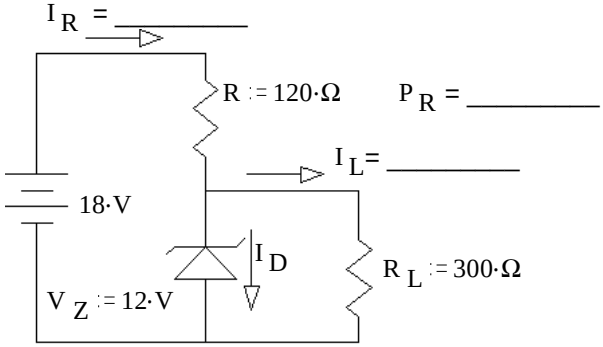


11. V_R = _____

R = _____ P_R = _____ (power)

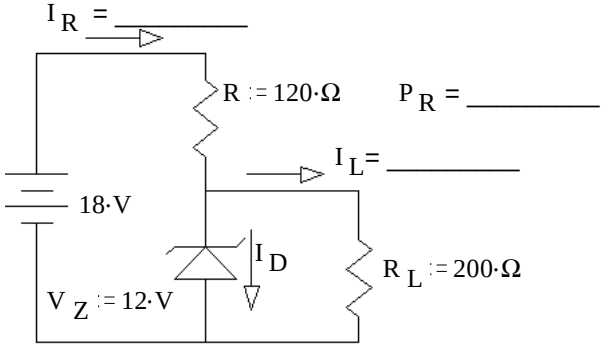


12. I_R = _____



I_D = _____ P_D = _____

13. I_R = _____



I_D = _____ P_D = _____

Warning: If I_D turns out negative, it is actually 0 and you must recalculate everything else.

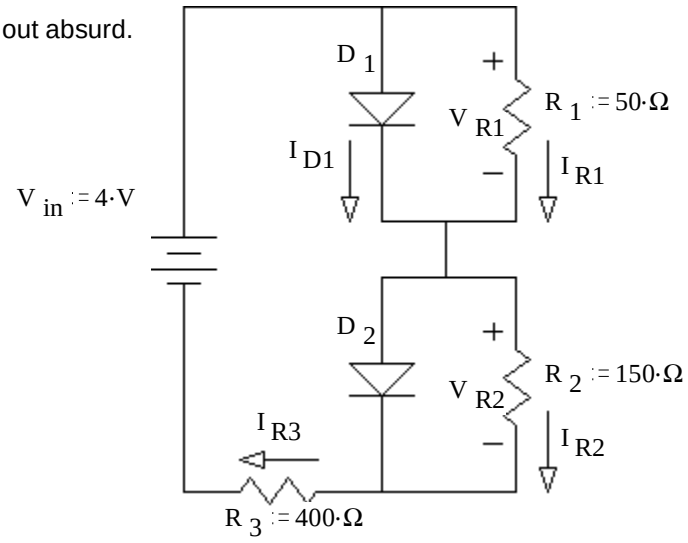
You will need more paper for the next two problems, add a sheet or two.

14. Assume that diode D_1 does conduct. Assume that diode D_2 does NOT conduct.

a) Find V_{R1}, I_{R1}, I_{R3}, I_{D1}, V_{R2} based on these assumptions.
Stick with these assumptions even if your answers come out absurd.

V_{R1} = ? I_{R1} = ? I_{R3} = ? I_{D1} = ?

V_{R2} = ?



b) Was the assumption about D_1 correct? yes or no

How do you know? (Specifically show a value which is or is not within a correct range.)

c) Was the assumption about D_2 correct? yes or no

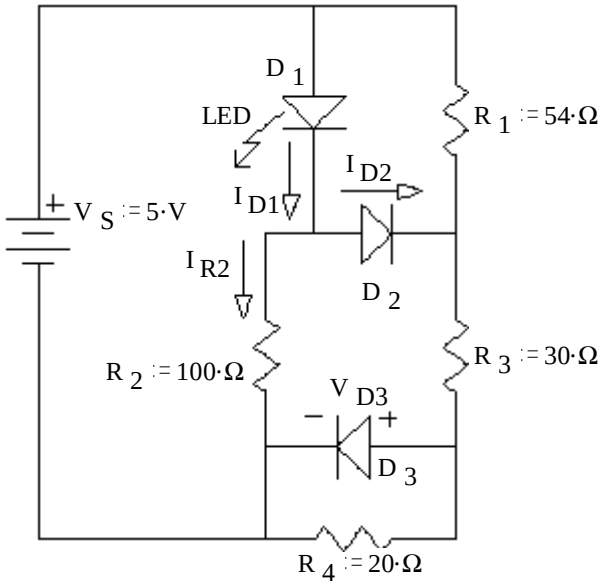
How do you know?

15. Assume that diodes D_1 and D_2 **DO** conduct.

Assume that diode D_3 does **NOT** conduct.

a) Find I_{R2}, I_{D2}, I_{D1}, & V_{D3} based on these assumptions. Stick with these assumptions even if your answers come out absurd.

I_{R2} = ? I_{D2} = ? I_{D1} = ? V_{D3} = ?



b) Based on the numbers above, was the assumption about D_1 correct? yes no
How do you know? (Show a value & range.)

c) Was the assumption about D_2 correct? yes no
How do you know? (Show a value & range.)

d) Was the assumption about D_3 correct? yes no
How do you know? (Show a value & range.)

e) Based on your answers to parts b), c) & e):

i) The ***real*** $I_{R2} < I_{R2}$ calculated in part a.

ii) The ***real*** $I_{R2} = I_{R2}$ calculated in part a.

iii) The ***real*** $I_{R2} > I_{R2}$ calculated in part a.

You do not need to justify your answer.

Answers

1 $V_D := 0.7·V$ $V_R := 3.3·V$ $I_D := 10·mA$

2. $I_D := 0·mA$ $V_D := -4·V$ $V_R := 0·V$

3. $V_D := 0.7·V$ $V_R := 7.3·V$ $I := 14.3·mA$

4. $I := 0·mA$ $V_{D2} := -8·V$ $V_{D1} := 0·V$ $V_R := 0·V$

5. $V_{D1} := 0.7·V$ $V_{D2} := -1.3·V$ $I_1 := 42.3·mA$ $I_2 := 0·mA$

6. $I_{D2} := 0·mA$ $V_{D1} := 0.7·V$ $I_{R2} := 13.8·mA$ $I_{R1} = I_{R3} := 9.83·mA$ $V_{D2} := -2.17·V$ $I_{D1} = I_T := 23.6·mA$

7. $V_{D1} := 0.7·V$ $V_{D2} := 0.7·V$ $I_{R1} := 0·mA$ $I_{R2} := 13.8·mA = I_{D1}$ $I_{R3} := 11.3·mA = I_{D2}$ $I_T := 25.1·mA$

8. $V_R := 4·V$ $R := 267·Ω$

9. $R := 500·Ω$

10. $R_1 := 233·Ω$ $R_3 := 150·Ω$

11. $V_R := 6·V$ $I_D := 50·mA$ $R := 120·Ω$ $P_R := 0.3·W$ $P_D := 0.6·W$

12. $I_L := 40·mA$ $I_R := 50·mA$ $I_D := 10·mA$ $P_R := 0.3·W$ $P_D := 0.12·W$

13. $I_D := 0·mA$ $I_L = I_R := 56.3·mA$ $V_L := 11.3·V$ $P_R := 0.38·W$ $P_D := 0·W$

14. a) $V_{R1} := 0.7·V$ $I_{R1} := 14·mA$ $I_{R3} := 6·mA$ $I_{D1} := -8·mA$ $V_{R2} := 0.9·V$ b) no $I_{D1} = -8·mA < 0$

c) no $V_{D2} = V_{R2} = 0.9·V > 0.7V$

15. a) $I_{R2} := 30·mA$ $I_{D2} := -4·mA$ $I_{D1} := 26·mA$ $V_{D3} := 0.92·V$

_/ b) yes $I_{D1} := 26·mA > 0$

c) no $I_{D2} := -4·mA < 0$

d) no $V_{D3} := 0.92·V > 0.7V$ e) ii)