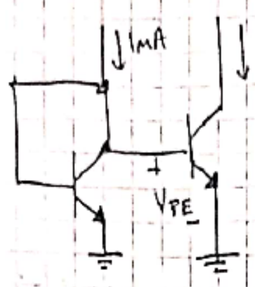
11.)



$I_{ES} = 10fA = 10^{-14}A$

$\beta = 100$ Find V_{BE} and I_{C2}

$1mA = I_{B2} + I_{B1} + I_{C1} \rightarrow 1mA = I_{B2} + I_{B1} + 100 I_{B1}$

$100 = \frac{i_C}{i_B} \rightarrow i_C = 100 i_{B1}$

$1mA = I_{B2} + I_{B1} + 100 I_{B1}$ $\quad I_{B1} = I_{B2}$

$1mA = 102 I_{B1} \rightarrow I_{B1} = \frac{1mA}{102} = 9.8\mu A$ ✓

$i_{C1} = 100 i_{B1} = 100(9.8) = 980\mu A = .98mA = i_{C2}$ ✓

$i_C = \alpha I_{ES}\left[\exp\left(\frac{V_{BE}}{V_T}\right) - 1\right]$ $\quad \alpha = \frac{\beta}{\beta+1} = \frac{100}{100+1} \approx .99$ ✓

$i_C \approx I_S \exp\left(\frac{V_{BE}}{V_T}\right)$ $\quad I_S = \alpha I_{ES}$

$9.8\mu A = \alpha \cdot 10^{-14} \exp\left(\frac{V_{BE}}{26mV}\right)$

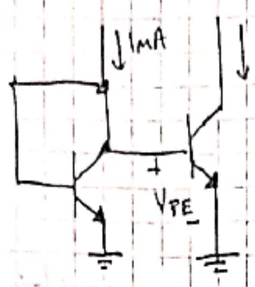
$9.9E-15$

$\ln\left(\frac{9.8e-6}{.99 \cdot E-14}(+1)\right) = \frac{V_{BE}}{26mV}$

solve for

$V_{BE} \approx .5385 Volts$

11.)



$I_{ES} = 10fA = 10^{-14}A$

$\beta = 100$ Find V_{BE} and I_{C2}

$1mA = I_{B2} + I_{B1} + I_{C1} \rightarrow 1mA = I_{B2} + I_{B1} + 100 I_{B1}$

$100 = \frac{i_C}{i_B} \rightarrow i_{C1} = 100 i_{B1}$

$1mA = I_{B2} + I_{B1} + 100 I_{B1}$ $\quad I_{B1} = I_{B2}$

$1mA = 102 I_{B1} \rightarrow I_{B1} = \frac{1mA}{102} = 9.8\mu A$ ✓

$i_{C1} = 100 i_{B1} = 100(9.8) = 980\mu A = .98mA = i_{C2}$ ✓

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$9.9E-15$

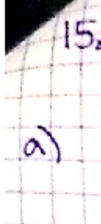
$\ln\left(\frac{9.8e-6}{.99 \cdot E-14}(+1)\right) = \frac{V_{BE}}{26mV}$

scientific calculator

$V_{BE} \approx .5385 Volts$

Solve the I and V of the circuits.
Assume ideal diodes.

15.) a)



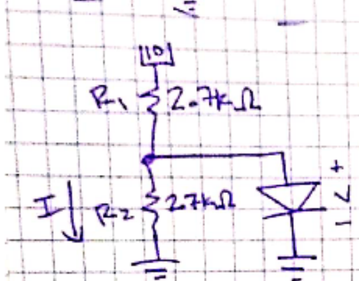
$V = IR \quad I = \frac{V}{R} = \frac{10 \text{ volts}}{2.7k\Omega} \approx \frac{1}{270} \approx .0037 = 3.7\text{mA}$

No voltage drop over ideal diode. $V = 0$ volts

b)

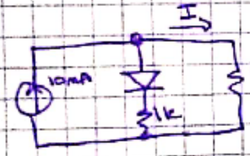
ideal diodes are just opencircuits with reverse bias, so no current will flow. This does however put $V_D = 10$ volts.

c)



ideal diodes close circuit with forward bias so "all" the current will go through the diode instead of R_2. That makes this circuit identical to circuit a

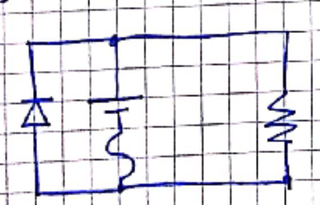
$I_D \cong 3.7\text{mA} \quad I = 0\text{ mA} \quad V = 0$ Volts



Forward bias so diode closes. Circuit is 2 1kΩ resistors in parallel. Current will split so $I = 5\text{mA}$ and $V = IR$ so

$V = .005(1000) = 5$ Volts

19. Build battery protection circuit to avoid reverse polarity causing damage. Use diode(s) and a fuse.



A fuse in series with the battery and a diode in parallel should protect the circuit.

When the battery is placed correctly, the diode is reverse biased and open circuits. The circuit acts as expected, powering the load.

When the battery is placed backwards, the diode is forward biased, conducts electricity, short circuiting the battery and burns out the fuse, which would then need to be replaced.

Thursday Sep 12th?

CS375 Programming Assignment

In Java, write a program to sum the following sequence.

Use the appropriate Java data type to get 32 bit *floating point.*

1.0/1.0 + 1.0/2.0 + 1.0/3.0 + 1.0/4.0 + 1.0/5.0 + ... + 1.0/x where x = 150,000,000.0

Compute the sum twice. Once in a loop starting with the first term i.e., 1.0/1.0 +1.0/2.0+...

The second time, sum the loop from 1.0/x back towards 1.0/1.0.

i.e., 1.0/150000000.0+1.0/149999999.0+...

In a separate attached typed document compare and explain your results.

Did you get the same sum when processing the sequence in both directions?

If not, why not?

If your sums are not the same, which of your two sums is the most accurate?

If one is more accurate than the other, why is it more accurate?

Turn in your Java program, the program's output (a screen shot is ok) and the typed explanation.