Selected Answers to HW #4

Include explanatory text and intermediate calculations in your solutions. You will not receive credit for merely repeating an answer given here without supporting work.

If an answer is not provided below, it is because either the solution is trivial or disclosure of the answer would give away too much of the solution.

Although some effort has been made to ensure that there are no errors in the answers below, some might nevertheless appear because of the rush to post them. Please let me know as soon as possible if you discover an apparent error.

1. $R_{REF} = 560 \ \Omega$; [total no. of LEDs is between 2 and 7; exact number not given]

2. $(I_{REF}/I_L)|_{max} = 55$

3.   a. $R_{REF} = 9.6 \ k\Omega$; $R_E = 4.4 \ k\Omega$
             b. $V_{BE1} = 0.70$ V; $V_{BE2} = 0.59$ V (Note that $i_C = \beta I_{SB} e^{v_{BE}/\eta V_T}$; I_{SB} is the scale current
             applicable to the base-emitter junction only, so $i_B = I_{SB} e^{v_{BE}/\eta V_T}$)
             c. $R_{EE} = 11 \ M\Omega$
             d. compliance voltage: $V_{comp} = 0.31$ V

4. $I_O < 1.8$ mA

5. $v_{in} = -15$ mV

6.   a. $W_1 = 8.4 \ \mu m$; $W_2 = 8.4 \ \mu m$; $W_3 = 1.1 \ \mu m$; $V_{GS2} = 1.2$ V
             b. compliance limit: $V_{comp} = 0.50$ V
             c. output resistance $= 25 \ k\Omega$
             d. $\Delta I_L = 20 \ \mu A$ [magnitude of the change is sufficient]