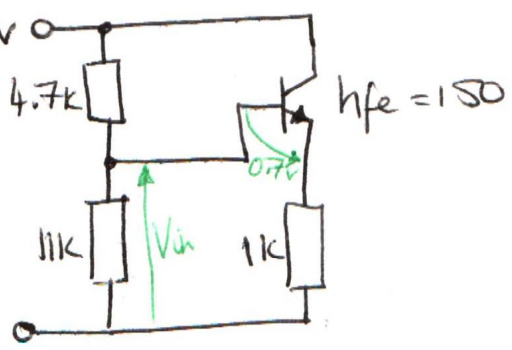
Homework 1.11

(1)



a) $V = I \times R$

$I = \frac{V}{R}$

$I = \frac{12}{15700}$

$I = 7.64 \times 10^{-4} A$

$V = I \times R$

$V = (7.64 \times 10^{-4}) \times 11000$

$V = 8.4V$

$Ve = Vin - Vbe$

$Ve = 8.4 - 0.7$

$Ve = 7.7v$

b) $Ve = Ie \times Re$

$Ie = \frac{Ve}{Re}$

$Ie = \frac{7.7}{1000}$

$Ie = 7.7mA$

c) $Ib = ?$

$Ic = Ie$

$Ic = 7.7mA$

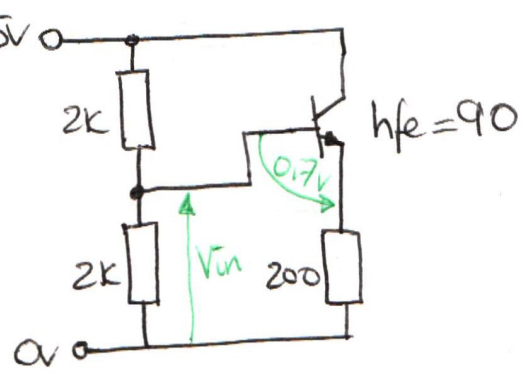
$hfe = \frac{Ic}{Ib}$

$150 = \frac{(7.7 \times 10^{-3})}{Ib}$

$Ib = \frac{(7.7 \times 10^{-3})}{150}$

$Ib = 5.13 \times 10^{-5} A$

(ii)



a) $V = I \times R$

$I = \frac{V}{R}$

$I = \frac{5}{4000}$

$I = 1.25\,mA$

$V = I \times R$

$V = (1.25 \times 10^{-3}) \times 2000$

$V = 2.5v$

$Ve = Vin - Vbe$

$Ve = 2.5 - 0.7$

$Ve = 1.8v$

b) $Ve = Ie \times Re$

$Ie = \frac{Ve}{Re}$

$Ie = \frac{1.8}{200}$

$Ie = 9\,mA$

c) $Ic = Ie$

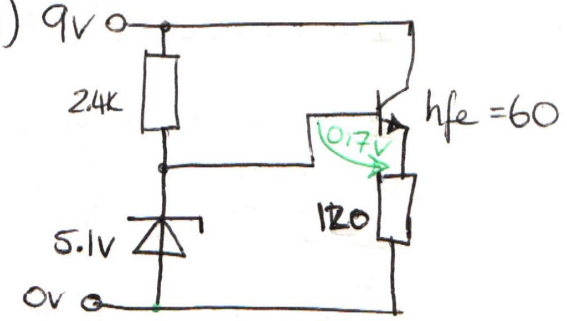
$hfe = \frac{Ic}{Ib}$

$90 = \frac{(9 \times 10^{-3})}{Ib}$

$Ib = \frac{(9 \times 10^{-3})}{90}$

$Ib = 1 \times 10^{-4} A$

(iii)



a) ~~[illegible]~~

$V_{in} = 5.1V$

$V_e = V_{in} - V_{be}$

$V_e = 5.1 - 0.7$

$V_e = 4.4V$

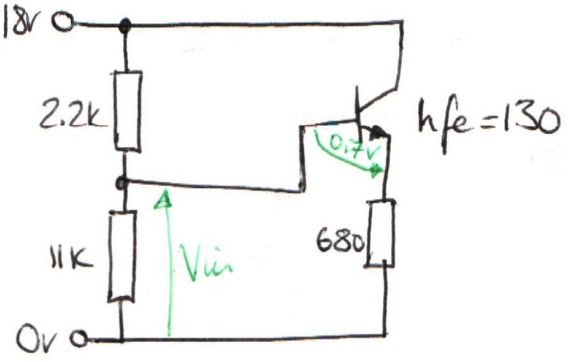
b) $V_e = I_e \times R_e$

$I_e = \frac{V_e}{R_e}$

$I_e = \frac{4.4}{120}$

$I_e = 0.037$

(iv)



a) $V = I \times R$

$I = \frac{V}{R}$

$I = \frac{18}{13200}$

$I = 1.36\,mA$

$V = I \times R$

$V = (1.36 \times 10^{-3}) \times 11000$

$V = 14.96v$

$V_e = V_{in} - V_{be}$

$V_e = 14.96 - 0.7$

$V_e = 14.26V$

b) $V_e = I_e \times R_e$

$I_e = \frac{V_e}{R_e}$

$I_e = \frac{14.26}{680}$

$I_e = 0.02A$

c) $I_c = I_e$

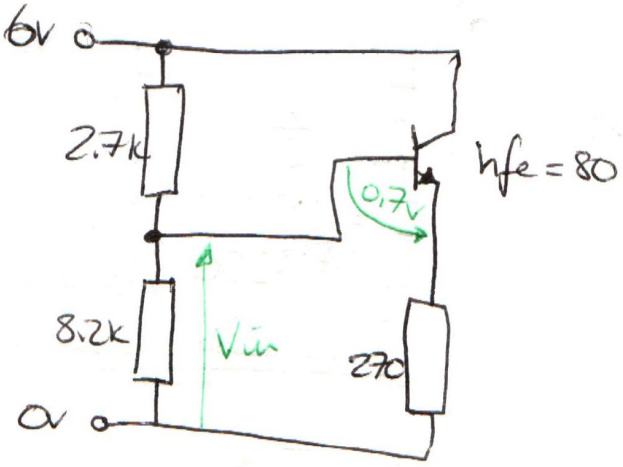
$h_{fe} = \frac{I_c}{I_b}$

$130 = \frac{0.02}{I_b}$

$I_b = \frac{0.02}{130}$

$I_b = 1.54 \times 10^{-4} A$

(v)



a) $V = I \times R$

$I = \frac{V}{R}$

$I = \frac{6}{10900}$

$I = 5.5 \times 10^{-4} A$

$V = I \times R$

$V = (5.5 \times 10^{-4}) \times 820$

$V = 4.51V$

$Ve = Vin - Vbe$

$Ve = 4.51 - 0.7$

$Ve = 3.81V$

b) $Ve = Ie \times Re$

$Ie = \frac{Ve}{Re}$

$Ie = \frac{3.81}{270}$

$Ie = 0.01A$

c) $Ic = Ie$

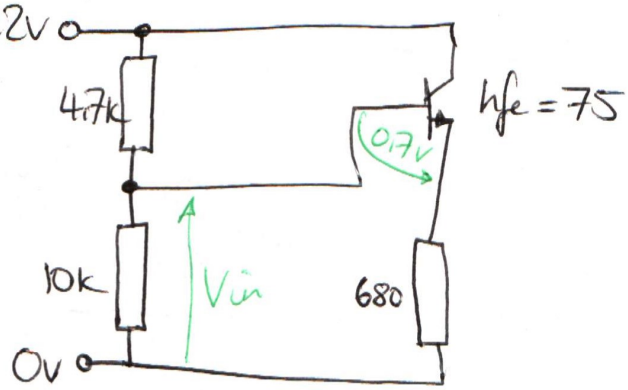
$hfe = \frac{Ic}{Ib}$

$80 = \frac{0.01}{Ib}$

$Ib = \frac{0.01}{80}$

$Ib = 1.25 \times 10^{-4} A$

(vi)



a) $V = I \times R$

$I = \frac{V}{R}$

$I = \frac{12}{14700}$

$I = 8.16 \times 10^{-4} A$

$V_e = V_{in} - V_{be}$

$V_e = 8.16 - 0.7$

$V_e = 7.46v$

$V = I \times R$

$V = (8.16 \times 10^{-4}) \times 10000$

$V = 8.16v$

b) $V_e = I_e \times R_e$

$I_e = \frac{V_e}{R_e}$

$I_e = \frac{7.46}{680}$

$I_e = 0.01A$

c) $I_c = I_e$

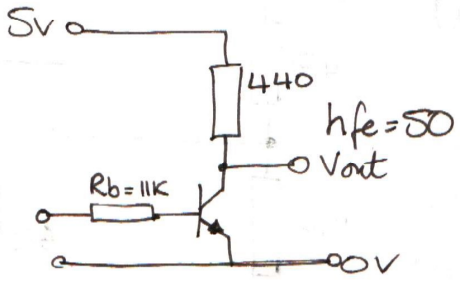
$h_{fe} = \frac{I_c}{I_b}$

$75 = \frac{0.01}{I_b}$

$I_b = \frac{0.01}{75}$

$I_b = 1.33 \times 10^{-4} A$

Homework 1.12.



(i) $I_b = ?$

$h_{fe} = \frac{I_c}{I_b}$

$50 = \frac{0.01}{I_b}$

$I_b = \frac{0.01}{50}$

$I_b = 0.2mA \ (2 \times 10^{-4} A)$

(ii) $V = I \times R$

$5 = I_c \times 440$

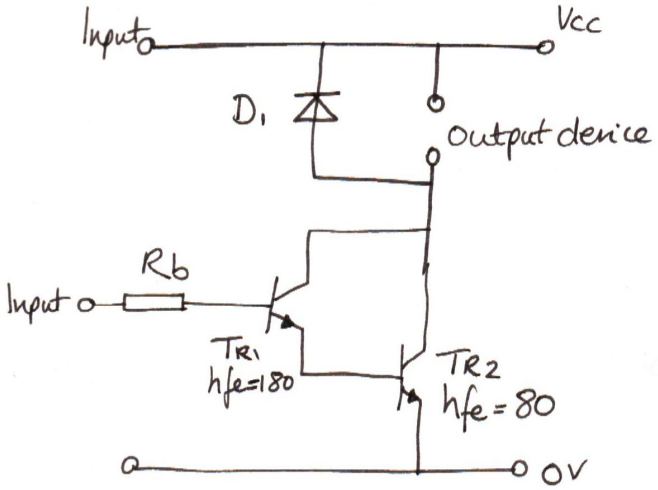
$I_c = \frac{5}{440}$

$I_c = 0.01A$

(iii)

Homework 1.13

a)(i) Darlington pair.
Increased gain and power output compared to only one transistor.



(ii) $h_{fe} = 180 \times 80$

$h_{fe} = 14400$.

b) To protect the transistors from back E.M.F.

c)(i) Thermostat for the aquarium.

Input → thermistor  Output → heater/lamp. 

(ii) A rain detector to automatically close skylights.

Input → moisture sensor Output → motor/Piston 

(iii) A window "open" alarm.

Input → Switch/ reed switch.  Output → Buzzer 

(iv) Automatic window shades for bright sunlight.

Input → LDR  Output → motor