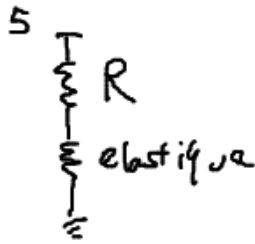


2.7 V	Quand on inspire	3k
2.3 V	Quand on expire	2k



$$\text{inspire : } 5 \cdot \frac{3k}{3k + R} = 2.7$$

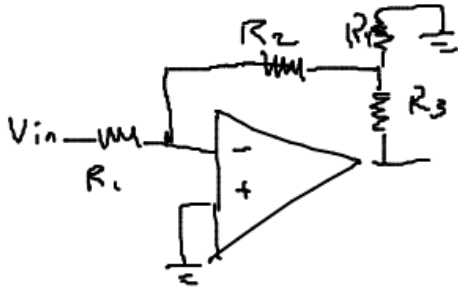
$$15k = 8.1k + 2.7R$$

$$\frac{6.9k}{2.7} = R = 2555 \Omega \text{ (ou moins)}$$

$$\text{expire : } 5 \cdot \frac{2k}{2k + R} = 2.3$$

$$10k = 4.6k + 2.3R$$

$$\frac{5.4k}{2.3} = R = 2348 \Omega \text{ (ou plus)}$$



$$\frac{V_{in}}{R_1} = \frac{0 - V_A}{R_2} = \frac{-V_A}{R_2} \Rightarrow V_A = -V_{in} \frac{R_2}{R_1}$$

$$-\frac{V_A}{R_2} = \frac{V_A}{R_4} + \frac{V_A - V_{out}}{R_3}$$

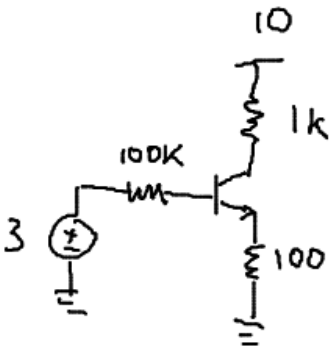
$$\frac{-\left(-V_{in} \frac{R_2}{R_1}\right)}{R_2} = \frac{\left(-V_{in} \frac{R_2}{R_1}\right)}{R_4} + \frac{\left(-V_{in} \frac{R_2}{R_1}\right) - V_{out}}{R_3}$$

$$\frac{V_{in}}{R_1} = -\frac{V_{in} R_2}{R_1 R_4} - \frac{V_{in} R_2}{R_1 R_3} - \frac{V_{out}}{R_3}$$

$$V_{in} \left( \frac{1}{R_1} + \frac{R_2}{R_1 R_4} + \frac{R_2}{R_1 R_3} \right) = -\frac{V_{out}}{R_3}$$

$$V_{in} \left( \frac{R_3}{R_1} + \frac{R_2 R_3}{R_1 R_4} + \frac{R_2 R_3}{R_1 R_3} \right) = -V_{out}$$

$$-\left( \frac{R_3 R_4 + R_2 R_3 + R_2 R_4}{R_1 R_4} \right) = \frac{V_{out}}{V_{in}}$$



Active  

$$I_B = \frac{3 - V_B}{100k}$$

$$V_B = V_E + 0.7$$

$$V_B = I_E \cdot 100 + 0.7$$

$$V_B = (\beta + 1) I_B \cdot 100 + 0.7$$

$$I_B = \frac{3 - (\beta + 1) I_B \cdot 100 + 0.7}{100k}$$

$$I_B \cdot 100k = 2.3 - 10.1k I_B$$

$$I_B \cdot 110.1k = 2.3$$

$$I_B = \frac{2.3}{110.1k} = 20.9 \mu A$$

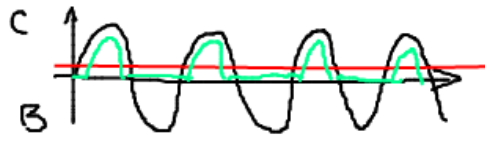
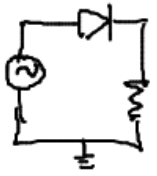
$$I_C = 2.09 \text{ mA}$$

$$V_C = 7.9 \text{ V}$$

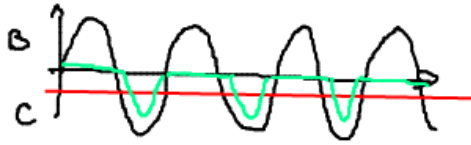
$$I_E = I_C + I_B$$

$$= 2.119 \text{ mA}$$

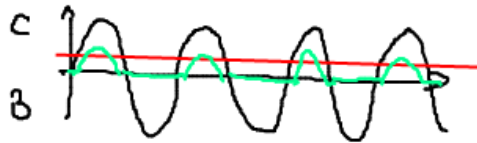
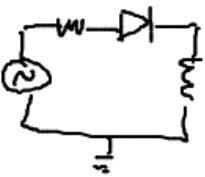
$$V_E = 0.2119 \text{ V}$$



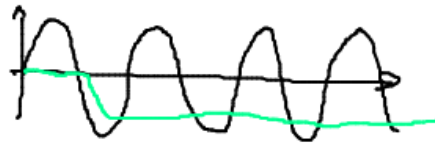
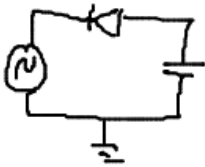
C:  $V_{out} = V_{in} - 0.7$   
 B:  $V_{out} = 0$



C:  $V_{out} = V_{in} + 0.7$   
 B:  $V_{out} = 0$



C:  $V_{out} = \frac{V_{in} - 0.7}{2}$   
 B:  $V_{out} = 0$



C:  $V_{out} =$   
 B:  $V_{out} =$