Homework 3 Solutions

Posted Monday, October 3rd, 2016

Each homework problem is worth 10 points unless otherwise stated.

2.24

(a) $I_L = 0$

$$I_Z = \frac{10-5.6}{50+3} \Rightarrow 83.0\text{ mA}$$

$$V_Z = 5.6 + (0.083)(3) = 5.85\text{ V} = V_L$$

$$P_Z = I_Z V_Z = (0.083)(5.85) = 0.486\text{ W}$$

(b) $$\frac{10-V_L}{50} = \frac{V_L - 5.6}{3} + \frac{V_L}{200}$$

$$0.20 + 1.867 = V_L(0.02 + 0.3333 + 0.005)$$

So $V_L = 5.769\text{ V}$

Then $$I_L = \frac{5.769}{0.2} = 28.84\text{ mA}$$

$$I_I = \frac{10-5.769}{0.050} = 84.62\text{ mA}$$

And $I_Z = I_I - I_L = 55.8\text{ mA}$

$$P_Z = (0.0558)(5.769) = 0.322\text{ W}$$

(c) $I_L = 0$

$$I_Z = \frac{12-5.6}{50+3} \Rightarrow 120.8\text{ mA}$$

$$V_Z = V_L = 5.6 + (0.1208)(3) = 5.962\text{ V}$$

$$P_Z = (0.1208)(5.962) = 0.72\text{ W}$$

(d) $$\frac{12-V_L}{50} = \frac{V_L - 5.6}{3} + \frac{V_L}{200}$$

$$0.24 + 1.867 = V_L(0.02 + 0.333 + 0.005)$$

So $V_L = 5.88\text{ V}$

Then $$I_L = \frac{5.88}{0.20} = 29.4\text{ mA};\quad I_I = \frac{12-5.88}{0.05} = 122.4\text{ mA}$$

$$I_Z = 122.4 - 29.4 = 93\text{ mA}$$

$$P_Z = (0.093)(5.88) = 0.547\text{ W}$$

2.30

For $-6.3 \le \upsilon_I \le 3\text{ V}$, $\upsilon_O = \upsilon_I$

For $\upsilon_I > 3\text{ V}$, $I = \dfrac{\upsilon_I - 3}{1.5}$ and $\upsilon_O = \upsilon_I - I(0.5)$

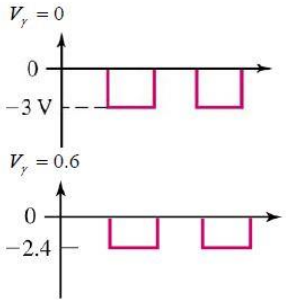
$$\upsilon_O = \upsilon_I - (0.5)\left(\frac{\upsilon_I - 3}{1.5}\right) = 0.667\upsilon_I + 1.0$$

For $\upsilon_I < -6.3\text{ V}$, $I = \dfrac{\upsilon_I + 6.3}{2.5}$ and $\upsilon_O = \upsilon_I - I(0.5)$

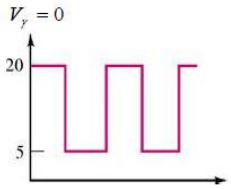
$$\upsilon_O = \upsilon_I - (0.5)\left(\frac{\upsilon_I + 6.3}{2.5}\right) = 0.8\upsilon_I - 1.26$$

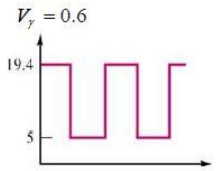
2.36

a.

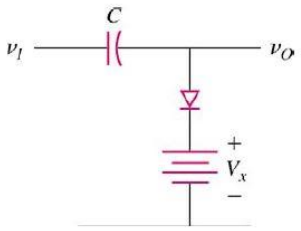


b.





2.40



a. For $V_\gamma = 0 \Rightarrow V_x = 2.7$ V

b. For $V_\gamma = 0.7\,\text{V} \Rightarrow V_x = 2.0$ V