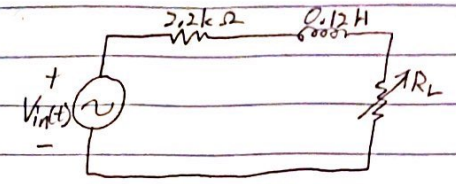
Prelab 9

A.



p-p value: 8Volts & frequency: 10kHz

Solution: $\omega = 2\pi f = 62831.85$ rad/sec

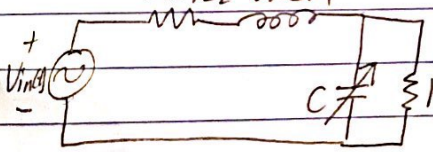
$$P_L = \frac{|V_{in}|^2 R_L}{2((R_L+R_S)^2+(\omega L)^2)} = \frac{64R_L}{2((R_L+2200)^2+56848915.79)}$$

when $\frac{dP_L}{dR_L}=0$, P_L is at maximum. Let R_L be x.

$$\frac{dP_L}{dR_L} = \frac{-3200(100x^2-61688915.79)}{(100x^2+440000x+61688915.79)^2} = 0 \Rightarrow R_L = 7854.229165$$

Plug R_L to P_L: $P_L = 1.5914\times10^{-3}$ W

B.

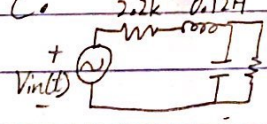


$$P_L = \frac{|V_{in}|^2 R_L}{2((R_L+R_S-\omega^2 R_L LC)^2+(\omega(L+R_L R_S C))^2)}$$

when $\frac{dP_L}{dC}=0$, $R_L = \frac{14800\sqrt{1862232368325709354}}{1570845833\sqrt{2247290762055281963862711 49}} \approx 2.71216\times10^{-9}$

Plug C to P_L: $P_L = 0.002486$ w, which higher than part A

C.



frequency = 10k Hz $V_{in} = 8/2 = 4$ V $\omega = 2\pi f = 2\times10^4\pi = 62831.85$

$$P_L = \frac{|V_L|^2}{2R_L} = \frac{|V_{in}|^2 R_L}{2((R_L+R_S-\omega^2 R_L LC)^2+(\omega(L+R_L R_S C))^2)} \overset{\text{Plug}}{=} \frac{141^2 R_L}{2((R_L+2200-62831.85^2 R_L 0.12C)^2+(2\times10^4\pi(0.12+R_L 2200C))^2)}$$

By wolfram Alphag $P_{max} = 0.000921221$ with $C = 1.9496e-9$F & $R_L = 28040.4\,\Omega$