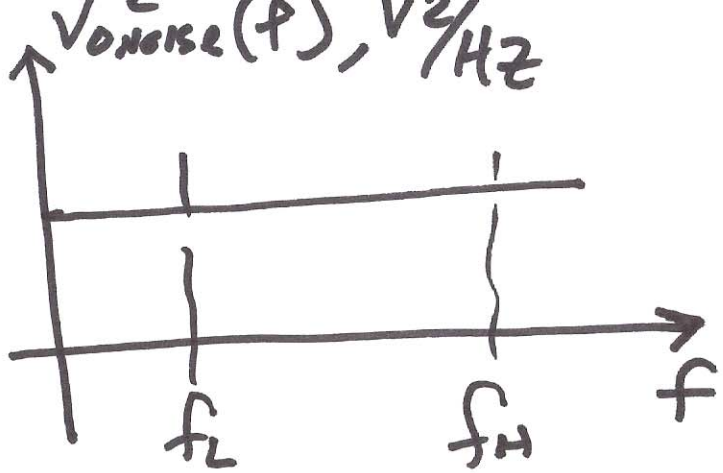
$$\bar{v}^2 = V_{Rms}^2 = \int_{f_L}^{f_H} V_{ONOISE}^2(f) \cdot df$$

$V_{ONOISE}^2 \Rightarrow \frac{V^2}{Hz}$



$$P_{AVG} = \frac{V_{Rms}^2}{R}$$

$$P(f) = \frac{\frac{V^2}{Hz}}{R} = \frac{V^2}{R \cdot Hz} \quad \text{Joules} = \frac{V \cdot V}{R \cdot Hz} = V \cdot Amps \cdot s$$

$Amps = Coulombs/s$

$P(f) = V \cdot Coulombs$

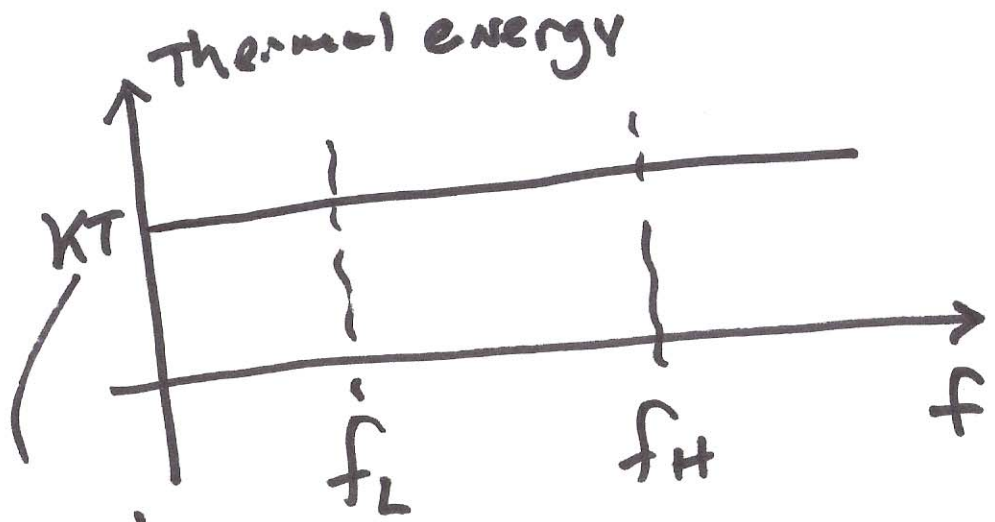
Sec. 8.2.2

Joules $\Rightarrow$ V · Coulombs

Ex. 8.4

$$P_{AVG} = \int_{f_L}^{f_H} P(f) \cdot df$$

1)

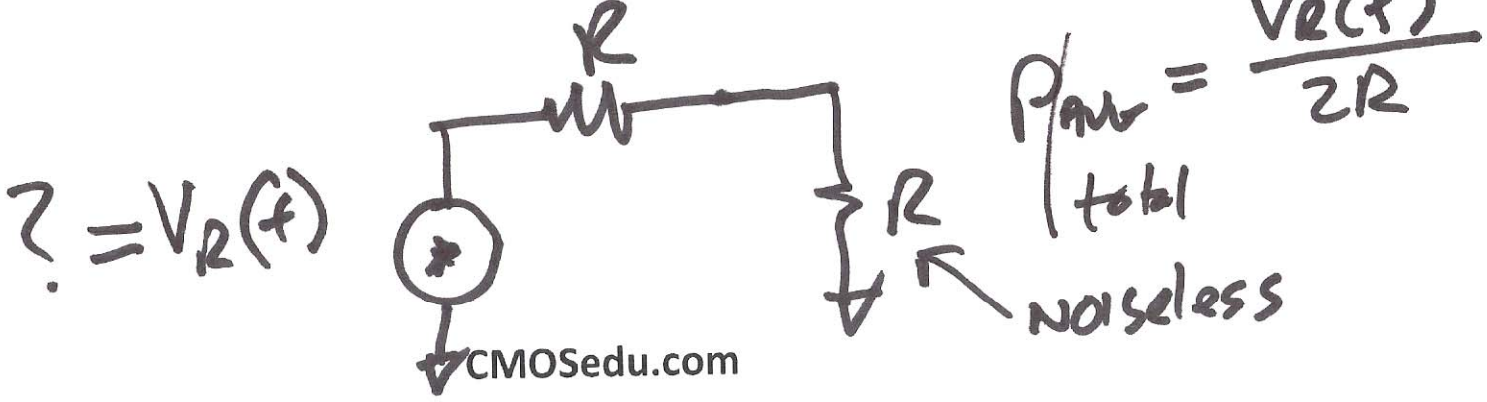


thermal energy

K = Boltzmann's $= 13.8 \times 10^{-24} \frac{W \cdot s}{K^\circ} \rightarrow J/K^\circ$

T = Kelvin

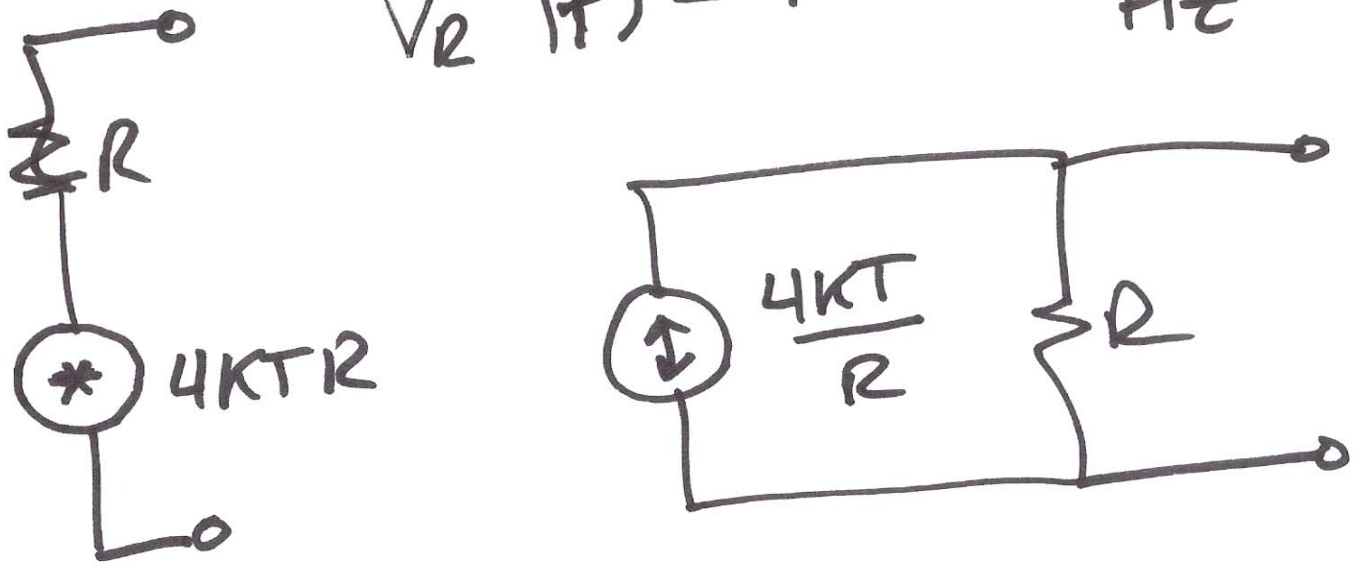
$$P_{AVG} = KT \cdot (f_H - f_L) = KT \cdot B \rightarrow f_H - f_L$$



$$P_{AVG}\Big|_{\text{delivered to load}} = \frac{V_R^2(f)}{4R} \cdot \underbrace{(f_H - f_L)}_{=B}$$

$$\frac{V_R^2(f)}{4R} = KT$$

$$V_R^2(f) = 4KTR \quad \frac{V^2}{Hz}$$



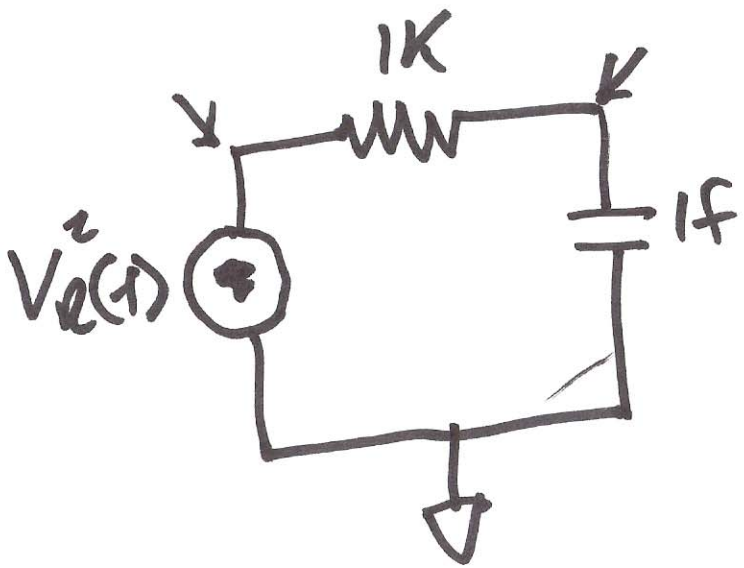
3)

$KT\big|_{@300K} = 4.14 \times 10^{-21}\ J$

1 sec

$4.14 \times 10^{-21}\ W$

$P = 3600 \cdot 4.14 \times 10^{-21}\ W = 14.9 \times 10^{-18}$ Joules



$4KTR =$

$4.300 \cdot 10^{3} \cdot 13.8 \times 10^{-24}$

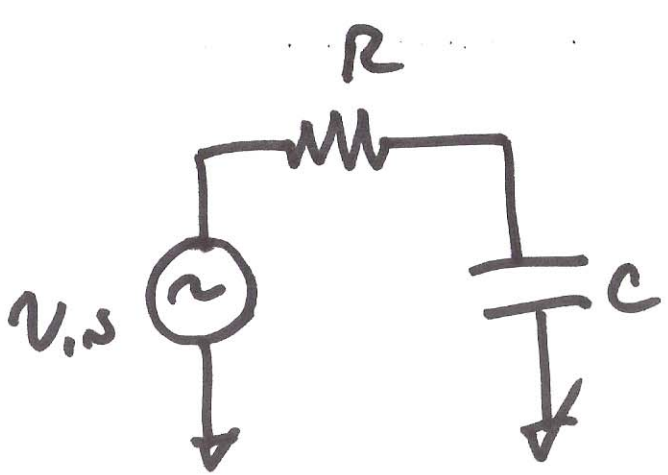
$= \left(4.1 \times 10^{-18}\ \frac{V^2}{\sqrt{Hz}}\right)^2$

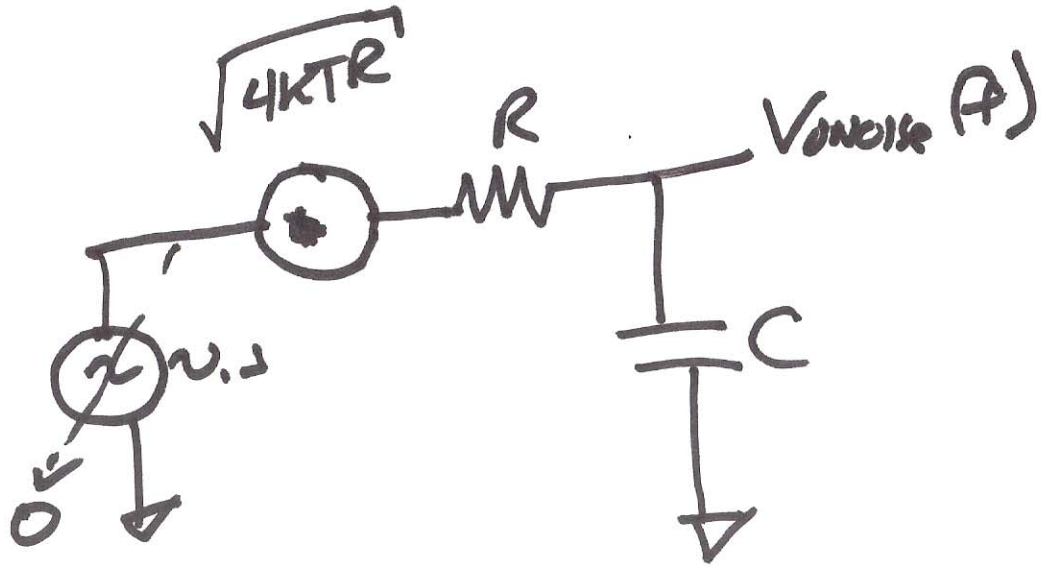
$= 16.8 \times 10^{-18}\ \frac{V^2}{Hz}$

see sim!

4)

$$NEB = \frac{\pi}{2} \cdot f_{3dB}$$





$$f_{3dB} = \frac{1}{2\pi RC}$$

$$V_{ONOISE}(f) = \sqrt{4KTR} \cdot \frac{\frac{1}{j\omega C}}{\frac{1}{j\omega C} + R}$$

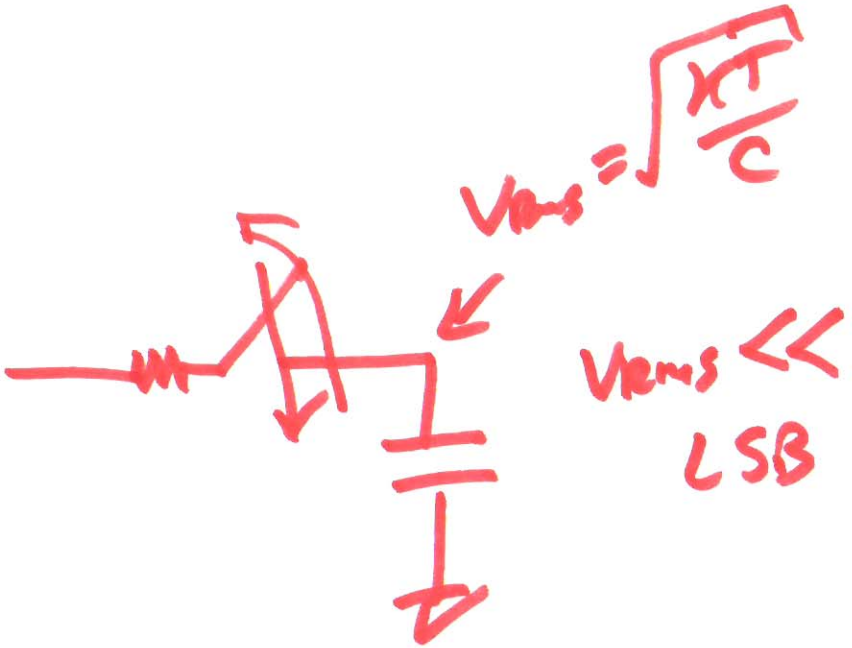
$$= \sqrt{4KTR} \cdot \frac{1}{1+j\omega RC}$$

$$V_{rms}^2 = \int_0^\infty |V_{onoise}^2(f)|\, df = \int_0^\infty 4kTR \cdot \frac{1}{1+(2\pi f RC)^2}\, df$$

$$= 4kTR \cdot \frac{\pi}{2} \cdot \frac{1}{2\pi RC}$$

$$\bar{V}^2 = V_{rms}^2 = \frac{kT}{C}$$

$$V_{rms} = \sqrt{\frac{kT}{C}}$$



$$\boxed{V_{rms} = \sqrt{\frac{kT}{C}}}$$

1 pF

$$V_{rms} = \underline{\underline{64\mu V}}$$