1 (2 pts). What types of noise are frequency dependent? Independent?

- Flicker & environmental (freq. dependent)
- Thermal & shot (freq. independent)

2 (2 pts). The following data were obtained with repetitive weighings of a 1.004 g standard: 1.003, 1.004, 1.001, 1.000, 1.006 and 1.007. Assuming the variation is random, calculate the signal-to-noise ratio. How many measurements would have to be averaged to obtain a S/N= 500. \( \frac{S}{N} = \frac{\text{mean}}{\text{std. dev.}} = \frac{1.003}{0.0027} = 366 \) \( \frac{3.7 \times 10^2}{(0.5)^2} \) \( \frac{366}{3.7 \times 10^2} = 3.37 \) \( n = 11 \) measurements

3 (4 pts). Explain the basic principles of SPME and SPE. What steps are involved and what are the advantages of each?

- **SPME** = headspace or liquid extraction
  - Preconcentration possible.
  - Especially useful for low volumes.
  - Rapid - fewer steps.
  - Extraction conditions must be very precisely controlled.
  - More limited chemistries of solid phase - must thus be chosen.

- **SPE** = liquid extraction method
  - Precipitation possible.
  - Need prior sample volume at minimum.
  - Slow and organic solvent is extraction from solid phase.
  - More steps than SPME.
  - Greater variety of stationary phases chemistry available.
4 (2 pts). Assume a SPME experiment was performed in solution using 0.01 L of 0.0045 M analyte. The percent recovery of the analyte was found to be 75%. If the adsorbed analyte was desorbed into a 10 x 10^{-6} L injector volume, what is the preconcentration factor, if any?

\[
(0.014) (0.0045 \text{ M}) = (4.15 \times 10^{-5} \text{ Mole}) (4.02 \times 10^{23} \text{ Molecules per Mole}) = 2.71 \times 10^{19} \text{ Molecules}
\]

75\% \text{ Recovery} \Rightarrow (2.71 \times 10^{19} \text{ Molecules}) \cdot (0.75) = 2.53 \times 10^{18} \text{ Molecules}

\[
(2.53 \times 10^{18} \text{ Molecules}) \cdot \left(\frac{1 \text{ Mole}}{6.02 \times 10^{23} \text{ Molecules}}\right) = 3.38 \times 10^{-5} \text{ Molecules}
\]

New conc. = \[
\frac{3.38 \times 10^{-5} \text{ Molecules}}{10 \times 10^{-6} \text{ L}} = 3.38 \text{ M}
\]

Preconcentration \Rightarrow \frac{3.38}{0.0045} = 750 \times