Chapter 5

1. frequency dependent: flicker and environmental noise
   frequency independent: thermal and shot noise

2. a) thermal noise
   b) certain types of environmental noise
   c) thermal and shot noise

3. 10^4 to 10^5 and 10^6 to 10^7 Hz. Environmental noise is at a minimum in these regions.

5. a) High-pass filters are used to remove low frequency flicker noise from high frequency analytical signals.
   b) Low-pass filters are used to remove high frequency noise from dc analytical signals.

8. a) The mean of the data is $\bar{x} = 1.43_8 \text{ mV}$.
   The standard deviation is $s = 0.27_1 \text{ mV}$.
   Thus, $S/N = 1.435/0.271 = 5.3$
   b) By averaging $n$ measurements, the signal-to-noise ratio improves by $\sqrt{n}$ (see equation 5.11). To improve $S/N$ from 5.3 (for 8 measurements) to $S/N = 10$ requires:

   $$n = \left( \frac{10}{5.3} \right)^2 \times 8 \text{ measurements} = 28.16 = 29 \text{ measurements}$$