Homework Questions:

1. Which of the following are reasons that you would want to use a quantum sensor? Select all are true:
    a. The sample is being damaged at the currently available optical powers that allow the signal to be seen, so lower optical powers are desired.
    b. The signal can be seen with high power without damaging the sample, and thus even higher powers are wanted in future measurements.
    c. Signal is not currently observable, thus improved sensitivity is required for the sensor to operate.
    d. The integration times are very long, and it would improve measurements to have a reduced integration time.

ANSWERS: a, c, and d are correct

2. Which of these statements are true, about the minimum uncertainty states of light?
    a. The coherent state of light is a special case in which the uncertainty is evenly distributed between the two quadratures.
    b. For the squeezed state of light, the uncertainty in one quadrature can be reduced at the expense of the uncertainty in the second quadrature being increased.
    c. For the squeezed state of light, one quadrature can be arbitrarily small without consequence, and thus the system can break the Heisenberg uncertainty principle.
    d. Both a and b are true.

ANSWER: d is correct

3. What is an unwanted component of a squeezed light source?
    a. A low-noise laser
    b. Lossy optical components
    c. A nonlinear medium
    d. High quantum efficiency photodiodes

ANSWER: b is correct