1. (20%) What is the toluene concentration in workplace if the analytical result from the laboratory is "non detected" (ND), and the volume of air collected is 0.159 liter? Will it exceed TLV-TWA for toluene? Why? The lab follows NIOSH method 1500 (9) for analyzing toluene. NIOSH 1500 (9) gives the following information on toluene:

   Range studied: 548–2190 mg/m^3; or 1.13–4.51 mg/sample

   Estimated LOD: 53 μg/sample

   Air sampling flow rate: ≤0.2 lpm

   Air sampling media: 100 mg/50 mg coconut shell charcoal

   TLV-TWA: 188 mg/m^3

2. (20%) Calculate the upper and lower 95% confidence limits (UCL and LCL) for a measured air concentration of toluene (125 mg/m^3). The TLV-TWA is 188 mg/m^3, and NIOSH list the standard deviation (S_r) as 0.052. Will this concentration exceed TLV-TWA for toluene? Why?

3. (20%) An industrial hygienist is planning for conducting samplings for assessing free silica exposures to casting workers. Please describe the sampling train to be used in this work. Please explain the reasons for your selections.

4. (20%) Please describe the way to measure the sound power level for an operating machine.

5. (20%) Please describe the employee exposure determination and measurement strategy recommended by NIOSH in 1977. What are the advantages and disadvantages of the above method?