Lab 2 Computer tutorial Name_____

Answer the following questions to verify your progress.

1. **Ordinary calibration**. You may notice that the band between the trumpets is not equally narrow everywhere. You get the best result around the center of gravity of your calibration points.
Question: What happens when you move to higher or lower concentration values, i.e. away from the center?

A. The resulting uncertainty gets larger because the vertical distance between the two outer trumpets gets larger

B. The resulting uncertainty gets smaller because the horizontal distance between the two outer trumpets gets larger

C. The resulting uncertainty gets larger because the vertical distance between the two inner trumpets gets larger

D. The resulting uncertainty gets larger because the horizontal distance between the two outer trumpets gets larger

2. **Ordinary calibration.** You may notice that the band between the trumpets is not equally narrow everywhere. You get the best result around the center of gravity of your calibration points.
Question: What happens to the *systematic component*, i.e. the *calibration error* when you are far away from the center?

A. The widening of the outer trumpets indicates that the calibration error becomes less significant

B. The systematic component, indicated by the inner trumpets becomes the dominant contribution so that the calibration error dominates any random contribution

C. The outer trumpets become wider but this is the result of random errors in the measurement of the unknown

D. The systematic component of the error is constant for all values of the calibration line

3. **Standard addition. Question:** What should we use to find the confidence limits of the final measurement?

A. Because we measure the same unknown multiple times we cannot use either of the trumpets because we need to construct an outer trumpet for more than one replicate

B. We are measuring the same one unknown sample over and over, we should use the outer trumpets

C. We are using all the data at once to find the intercept of the calibration line with the Xaxis. The inner trumpets determines where we expect the line to be

D. We should use the standard errors of the slope and the intercept and do error propagation

4. One requirement for Least Squares regression to be successful is that the matrix ($\mathbf{X^TX}$) has an inverse. This depends on:

A. The software you are using

B. The quality of the data set

C. Whether or not the data are homoschedastic

D. The design of the data set, i.e. your choice of independent variables

E. Whether or not the data set contains outliers

F. Whether the equipment is properly calibrated or not

5. In matrix notation a set of data points can be written as
**Y** = **X.β** + **ε**
However this equation reduces to
**Y** = **X.β**

A. when the parameters ε are chosen such that the sum of the squared residuals is minimal

B. when the parameters are chosen such that the sum of residuals is minimal

C. when the calibration is applied

D. when the parameters β are chosen such that the sum of the squared residuals is minimal

E. when the parameters are chosen such that the squared residuals are minimal

6. In matrix notation a set of data points can be written as
**Y** = **X.β** + **ε**
The symbol **ε**

A. Stands for the random error component; it is assumed to be normally distributed as N(0,σ2)

B. Stands for the estimated parameters

C. Stands for the bias due to the calibration error

D. Stands for the random error component and can have any symmetrical distribution

Answers

1._____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____