Figures of Merit & Calibration Methods

15 Advanced Multiple-Choice Questions

No calculation-based questions

Instructions
Circle the single best answer for each question. Read every option carefully before selecting your answer.

Based on: Introduction to Instrumental Analysis - Figures of Merit

Questions

Circle the correct answer.

1. Which statement most accurately distinguishes qualitative from quantitative instrumental analysis?

(A) Qualitative analysis measures analyte concentration, whereas quantitative analysis identifies the analyte.

(B) Qualitative analysis identifies the presence of an analyte, whereas quantitative analysis relates the magnitude of a measured property to analyte concentration.

(C) Qualitative analysis always uses classical methods, whereas quantitative analysis always uses instrumental methods.

(D) Qualitative analysis requires calibration, whereas quantitative analysis does not.

2. In a spectrophotometric measurement, which sequence correctly represents the transformation of analytical information?

(A) Electrical current -> monochromatic light -> absorption -> meter scale

(B) Monochromatic light -> analyte absorption -> photocell current -> processed readout

(C) Analyte concentration -> meter scale -> photocell -> light absorption

(D) Photocell current -> analyte absorption -> monochromatic light -> numerical result

3. Which description best differentiates a transducer from a general detector?

(A) A detector always generates an electrical signal, whereas a transducer only indicates environmental changes.

(B) A transducer converts non-electrical information into electrical data, whereas a detector broadly indicates a change in the environment.

(C) A detector measures only chemical properties, whereas a transducer measures physical properties.

(D) A transducer displays the final result, whereas a detector processes the electrical signal.

4. A calibration curve produces a very high R-squared value, but repeated measurements of the same sample are widely scattered. Which interpretation is most appropriate?

(A) The method has excellent precision but poor linearity.

(B) The method has excellent linearity but poor precision.

(C) The method has high accuracy because R-squared is high.

(D) The method has high selectivity but low sensitivity.

5. A set of replicate measurements forms a tight cluster that is consistently displaced from the accepted value. This result represents:

(A) High accuracy and low precision

(B) Low accuracy and high precision

(C) High accuracy and high precision

(D) Low accuracy and low precision

6. Which type of error is most directly associated with poor precision?

(A) Determinate error caused by an incorrect calibration standard

(B) Systematic error caused by an improperly zeroed instrument

(C) Indeterminate or random error affecting replicate measurements

(D) Constant bias caused by an operator technique

7. Which statement regarding analytical sensitivity is correct?

(A) It depends exclusively on the correlation coefficient of the calibration curve.

(B) It increases when the calibration slope increases and measurement variability decreases.

(C) It is equivalent to the lowest concentration that can be detected.

(D) It decreases when the instrument response changes strongly with concentration.

8. Two analytical methods have identical calibration slopes, but Method X has a smaller standard deviation of measurement than Method Y. Which conclusion is correct?

(A) Method Y has greater analytical sensitivity.

(B) Both methods have identical analytical sensitivity.

(C) Method X has greater analytical sensitivity.

(D) Analytical sensitivity cannot be compared without knowing the intercept.

9. At the limit of detection, which conclusion can generally be made?

(A) The analyte concentration can be quantified with high reliability.

(B) The analyte is confidently distinguishable from blank noise, but reliable quantification may not be possible.

(C) The analytical response is no longer proportional to concentration.

(D) The analyte signal is completely free from random noise.

10. Which statement best distinguishes the limit of quantification from the limit of detection?

(A) LOQ is normally lower than LOD because quantification requires less signal.

(B) LOD defines the upper end of the calibration curve, whereas LOQ defines the lower end.

(C) LOQ represents the lowest concentration that can be measured quantitatively with acceptable reliability.

(D) LOD and LOQ are interchangeable when the calibration curve is linear.

11. The upper boundary of the dynamic range is reached when:

(A) The analyte signal becomes distinguishable from the blank signal.

(B) The standard deviation of the blank becomes zero.

(C) The instrumental response is no longer adequately proportional to analyte concentration.

(D) The signal reaches the limit of quantification.

12. Which calibration technique is generally most appropriate for routinely analysing a large number of similar samples with minimal matrix differences?

(A) Standard addition method

(B) Internal standard method

(C) External calibration curve method

(D) Single-point standard addition method

13. Why is the standard addition method especially useful for samples with complicated matrices?

(A) It completely eliminates the need for standard solutions.

(B) It compensates for matrix effects by introducing known analyte increments directly into aliquots of the sample.

(C) It ensures that the calibration curve always passes through the origin.

(D) It removes all instrumental noise by averaging the sample signals.

14. Which condition is an essential assumption of the standard addition method as presented in the lecture?

(A) The analytical response must be non-linear over the studied concentration range.

(B) The standard and sample aliquots may be diluted to different final volumes.

(C) The response must remain linear, and the corresponding calibration curve is assumed to have a zero y-intercept.

(D) The matrix must be identical to pure solvent.

15. In the internal standard method, why is the ratio of analyte signal to internal-standard signal used?

(A) To increase the analyte concentration before analysis

(B) To correct for variations affecting both signals, such as sample size, position, matrix or certain instrumental fluctuations

(C) To force the calibration curve to pass through the origin

(D) To prevent the analyte and internal standard from producing separate signals

Model Answer Key

Check your responses only after completing all questions.

1 B	2 B	3 B	4 B	5 B
6 C	7 B	8 C	9 B	10 C
11 C	12 C	13 B	14 C	15 B

End of Quiz