

# Laboratory Quality Control, Statistics, and Measurement Uncertainty Post Assessment

1. Which of the following is an element in a quality assurance plan?
  - a. control charts
  - b. quality control plan
  - c. human resource directives
  - d. data quality objectives
  
2. The laboratory mission statement defines the \_\_\_\_\_ for the laboratory.
  - a. location and destination
  - b. safety and quality objectives
  - c. purpose and place
  - d. responsibilities and opportunities
  
3. Laboratory safety is incorporated into the quality assurance plan by \_\_\_\_\_.
  - a. a specific section that describes all the safety measures
  - b. providing the general rules for laboratory safety
  - c. completely deferring to another program
  - d. making an overall statement of the safety objectives
  
4. A laboratory quality control program ensure data is accurate, consistent, and \_\_\_\_\_.
  - a. reliable
  - b. within strict guidelines
  - c. releasable
  - d. true
  
5. A laboratory quality control program is made of \_\_\_\_\_ and processes.
  - a. analyses
  - b. data
  - c. procedures
  - d. programs

6. Standards used in a laboratory quality control program are \_\_\_\_\_.
- calibrated by external sources
  - used for duplicate analysis
  - error free
  - certified when purchased
7. One method used as part of a laboratory quality control program is \_\_\_\_\_.
- Data manipulation
  - trained personnel
  - multiple repeats
  - internal assessments
8. Quality Control samples are \_\_\_\_\_.
- analyzed separately
  - included with every batch of samples
  - analyzed with greater care
  - reviewed and approved by an external team
9. The mean value for a data set is also called the \_\_\_\_\_ value.
- average
  - centerline
  - zero sigma
  - neutral
10. The mean for the following set of data is?  
21.2, 24.6, 18.7, 20.3, 26.8, 19.5, 21.5, 18.5
- 19.9
  - 21.9
  - 20.8
  - 21.4

11. The standard deviation of a data set determines its \_\_\_\_\_.
- average
  - reproducibility
  - precision
  - accuracy
12. Standard deviation is calculated for \_\_\_\_\_.
- method blanks
  - QC samples
  - Duplicate samples
  - Matrix spike samples
13. What is the standard deviation for the following set of data?  
125.3, 139.6, 132.7, 127.6, 142.3, 138.1, 129.6, 134.5, 131.4
- 5.69
  - 4.94
  - 5.13
  - 5.26
14. Which of the following can cause inconsistent results?
- human error
  - instrument malfunctions
  - procedure issues
  - all the above
15. The confidence levels of a data set are calculated directly from the \_\_\_\_\_.
- mean
  - percent spike recovery
  - standard deviation
  - relative percent deviation

16. In a normal distribution, \_\_\_\_\_ of all data is expected to fall within the  $3\sigma$  limit.
- 99.7%
  - 95%
  - 99.9%
  - 86%
17. \_\_\_\_\_ is when samples are analyzed together.
- Grouping
  - Batching
  - Linking
  - None of the above
18. Method blanks are used to check for \_\_\_\_\_.
- procedure compliance
  - analysis accuracy
  - reagent quality
  - cross-contamination
19. The relative percent deviation (% RPD) is used to determine \_\_\_\_\_.
- cross-contamination
  - reagent quality
  - procedure compliance
  - precision
20. If two analyses return results of 86.4 and 95.3, what is the relative percent deviation (% RPD)?
- 0.095
  - 9.5
  - 0.098
  - 9.8

21. In a matrix spike, a \_\_\_\_\_ has a known amount of analyte added to it.

- a. sample
- b. method blank
- c. duplicate
- d. QC sample

22. A low matrix spike recovery may be indicative of \_\_\_\_\_.

- a. chemistry problems
- b. poor technique
- c. instrument malfunction
- d. all the above

23. What is the percent spike recovery for the following set of data?

Original Sample Result – 164.4 ug/g

Spike Sample Result – 193.5 ug/g

Spike Amount Added – 30 ug/g

- a. 0.97
- b. 1.03
- c. 1.00
- d. 0.0

24. Which of the following are plotted and tracked on quality control charts?

- a. Original Sample
- b. Duplicate sample
- c. QC sample
- d. Standard deviation

25. Which of the following error types is expected?

- a. trend
- b. systematic
- c. shift
- d. random

26. Any error outside of \_\_\_\_\_ is unacceptable.
- $2\sigma$
  - $3\sigma$
  - 10%
  - 5%
27. Two consecutive points of data between \_\_\_\_\_ and \_\_\_\_\_ place analytical method "out of control".
- the mean,  $2\sigma$
  - $1\sigma$ ,  $2\sigma$
  - the mean,  $1\sigma$
  - $2\sigma$ ,  $3\sigma$
28. Systematic error is \_\_\_\_\_.
- predictable
  - impossible to eliminate
  - not constant
  - none of the above
29. Trends are usually \_\_\_\_\_.
- subtle
  - downward
  - abrupt
  - upward
30. Trends are defined as data that moves in the same direction for \_\_\_\_\_ or more points.
- 3
  - 5
  - 7
  - 9

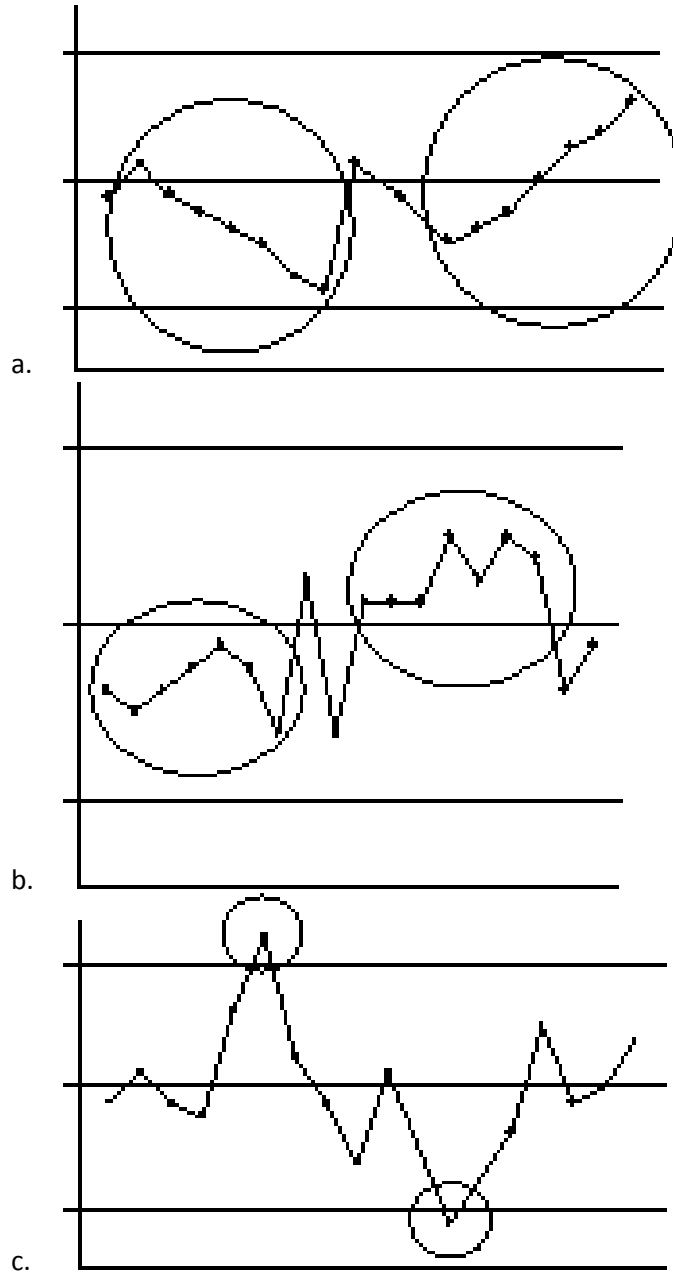
31. A shift in data is also known as.

- a. adjustment
- b. bias
- c. change
- d. none of the above

32. A shift in data usually occurs \_\_\_\_\_.

- a. over time
- b. regularly
- c. after procedure changes
- d. abruptly

33. Which of the following charts represents a shift?





34. Training for laboratory technicians should include:
- Classroom and on-the-job training
  - Classroom and practice time
  - Required reading and practice time
  - On-the-job training only
35. On-the-job training for laboratory technicians should include:
- Guided completion
  - Independent performance
  - Observation
  - All the above
36. Scientists and chemists can use laboratory technicians for \_\_\_\_\_.
- method validation
  - research
  - reagent selection
  - results calculation
37. Measurement uncertainty for radiochemistry analysis is calculated differently because \_\_\_\_\_.
- laboratory technicians are usually not proficient
  - procedures do not always work
  - reagents are changed frequently
  - samples are not consistent
38. Which of the following is NOT included in a radiochemistry error calculation?
- Instrument error
  - Counting error
  - Radioactive half-life
  - Equipment malfunction

39. \_\_\_\_\_ can contribute greatly to a radiochemistry uncertainty calculation.
- Short count times
  - High energy coefficients
  - Low instrument efficiencies
  - High sample count rates
40. Radiochemistry counting instruments have inherent errors from \_\_\_\_\_.
- operator error
  - radioactive decay uncertainties
  - shielding
  - radioactive decay particles
41. In what area can a laboratory focus to improve uncertainty values?
- Reducing background levels
  - Increasing sample activity
  - Limiting human performance errors
  - Change customer requirements to suit lab needs.