Name: _____ Class: _____ Date: _____

Chapter 00: The Analytical Process

1. _____ chemical analysis is the measurement of how much of a chemical substance is present. _____ chemical analysis is the determination of what is present in a sample.
   a. Quantitative; Qualitative
   b. Stoichiometric; Qualitative
   c. Qualitative; Quantitative
   d. Stoichiometric; Identification
   e. Quantitative; Identification

ANSWER: a

2. Which of the following analyses is NOT quantitative?
   a. A home pregnancy test.
   b. A chocolate bar contains 33% fat.
   c. The density of water is determined to be 1.0 g/mL at 4ºC.
   d. A tap water sample was found to contain 13 200 ppb Pb^{2+}.
   e. A driver had 0.12% alcohol in his bloodstream.

ANSWER: a

3. *Chemical Abstract* is the most comprehensive source for locating articles published in chemistry journals. _____ is software that accesses *Chemical Abstract*.
   a. Google Scholar
   b. SciFinder
   c. Web of Science
   d. Wikipedia
   e. Microsoft Office

ANSWER: b

4. Sampling is the process in which
   a. general questions are translated into specific questions to be answered through chemical measurements.
   b. the chemical literature is searched to find appropriate procedures or, if necessary, devise new procedures to make the required measurements.
   c. a representative material is selected to analyze.
   d. a representative sample is converted into a form suitable for analysis.
   e. the concentration of analyte is measured in several identical portions.

ANSWER: c

5. A sample with a uniform chemical composition is a _____ sample.
   a. homologous
   b. homogeneous
   c. uniform

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d. consistent
e. heterogeneous

ANSWER: b

6. A(n) _____ sample is a sample in which the chemical composition differs from place to place.
a. variable
b. homogeneous
c. random
d. inconsistent
e. heterogeneous

ANSWER: e

7. When extracting a sample with a liquid, the liquid is _____ from the sample.
a. transferred
b. drained
c. decanted
d. effused
e. dispensed

ANSWER: c

8. A(n) _____ is used to grind solids into smaller particles.
a. orbital shaker
b. vortexer
c. mixer
d. mortar and pestle
e. centrifuge

ANSWER: d

9. _____ is the substance being measured during a chemical analysis.
a. Bulk
b. Lot
c. Sample
d. Analyte
e. Aliquot

ANSWER: d

10. The liquid above the packed solid following a centrifugation is the _____.
a. solvonatant
b. analyte
c. serum

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d. decanted
e. supernatant

ANSWER: e

11. A(n) _____ is a suspension of a solid in a liquid.
a. slurry
b. colloid
c. gel
d. supernatant
e. allotrope

ANSWER: a

12. _____ is the series of procedures applied to a sample prior to analysis.
a. Preanalysis clean up
b. Sample preparation
c. Filler elimination
d. Matrix removal
e. Lot cleaning

ANSWER: b

13. An aliquot is
a. a portion of a larger whole, especially a sample taken for chemical analysis or other treatment.
b. the substance being measured.
c. a suspension of a solid in a liquid.
d. the decanted liquid following a centrifugation.
e. the liquid above the packed solid following a centrifugation.

ANSWER: a

14. For separations performed using a chromatography column, the plot of detector response versus time is a(n) _____, and the area under the peak is _____ to the quantity of compound passing through the detector.
a. column plot; proportional
b. column plot; inversely proportional
c. chromatogram; proportional
d. chromatogram; inversely proportional
e. absorbance spectrum; proportional

ANSWER: c

15. A(n) _____ is a plot of detector response as a function of analyte concentration. The curve is constructed using _____ containing known concentrations of the analyte of interest.

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a. analyte curve; response solutions
b. response curve; standard solutions
c. analyte curve; analyte solutions
d. calibration curve; standard solutions
e. response curve; response solutions

ANSWER: d

16. _____ is the process of procuring a representative sample to analyze.
a. Inspection
b. Examination
c. Representation
d. Sampling
e. Partaking

ANSWER: d

17. Solid-phase extraction is a sample preparation technique. Which statement(s) is/are NOT true for an aqueous solid-phase extraction?

I. Solid-phase extraction separates analyte from the sample matrix using a chromatography stationary phase.
II. An aliquot of the aqueous sample is applied to the solid-phase extraction tube. It is washed with additional sample and then a water wash.
III. The analyte sticks to the column, and the water wash removes all species that do not adhere to the column.
IV. An organic solvent is used to wash the analyte from the column.
V. The organic phase containing the analyte is evaporated to dryness, and the solid is dissolved in water, ready for analysis.

a. III
b. I
c. II and III
d. IV
e. II

ANSWER: e

18. Which is NOT a general step in the analytical process?
a. sample preparation
b. selecting an analytical procedure
c. making policy
d. reporting and interpretation
e. analysis

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ANSWER: c

19. The purpose of replicate measurements is to assess the _____ in the analysis and to guard against _____ in the analysis of a single aliquot.
   a. error; uncertainty
   b. variability; gross error
   c. uncertainty; precision
   d. error; accuracy
   e. accuracy; error

ANSWER: b

20. _____ are repeated measurements to assess variability in an analysis and to guard against gross error in the analysis of a single aliquot.
   a. Replicate measurements
   b. Aliquots
   c. Sampling
   d. Analysis
   e. Error measurements

ANSWER: a

21. Which statement is NOT true?
   a. For a random heterogeneous material, differences in composition are random and on a fine scale.
   b. A representative random sample is collected from randomly selected portions of the sample for a given number of times.
   c. Segregated heterogeneous material has large regions with obviously different compositions.
   d. A representative composite sample is collected from a segregated material by taking portions from each region, where the number of collected portions are proportional to the area of the region.
   e. All are true statements.

ANSWER: e

22. _____ occurs when a species other than analyte increases or decreases the analytical signal and makes it appear that the concentration is greater or less than the real concentration.
   a. Interference
   b. Masking
   c. Aliquots
   d. Disruption
   e. Intervention

ANSWER: a

23. _____ is the transformation of an interfering species into a form that is not detected.
   a. Interference

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b. Masking
c. Obscurance
d. Cloaking
e. Camouflaging

ANSWER: b

24. Ca^{2+} in lake water can be measured with a reagent called EDTA. However, the presence of Al^{3+} will provide a false signal because it reacts with EDTA as well. The method of adding excess F^- to minimize the effects of Al^{3+} on the Ca^{2+} determination is called

a. interference.
b. masking.
c. obscurance.
d. cloaking.
e. camouflaging.

ANSWER: b

25. Chemists use the term _____ to refer any chemical of interest.

a. analyte
b. species
c. replicate
d. aliquot
e. bulk

ANSWER: b

26. A calibration curve for the determination of aspirin is constructed from known concentration aspirin solutions (mg/mL) and the HPLC peak areas for each standard. If the equation of the best-fit line is $y = 12.565x - 0.71$, what is the concentration for an unknown that has a peak area of 83.5?

ANSWER: 6.70 mg/mL; Substitute $y = 83.5$ into $y = 12.565x - 0.71$ and solve for x.

27. The allicin concentration in a garlic extract sample was determined using HPLC. A calibration curve prepared using allicin standards of known concentration (M) has an equation of the best-fit line of $y = 24\,376x + 8.4$. What is the molar concentration of allicin in the garlic extract sample if it has a signal of 88.9?

ANSWER: 0.003 30 M; Substitute $y = 88.9$ into $y = 24\,376x + 8.4$ and solve for x.

28. The spectrophotometric analysis of a series of permanganate standards (mM) at 525 nm gave a calibration equation of $y = 2.492\,5x + 0.091$. If an unknown sample has an absorbance reading of 0.654, what is the millimolar concentration of permanganate in the unknown solution?

ANSWER: 0.226 mM; Substitute $y = 0.654$ into $y = 2.492\,5x + 0.091$ and solve for x.

29. The fluorescence quantum yield measurement results of quinine sulfate in 0.1 M H_2SO_4 solution showed that there was a linear relationship between the integrated photoluminescence intensity and absorbance of

quinine sulfate. The relationship is described by the equation $y = 1.28 \times 10^8 x - 780\ 102$, where y is the integrated photoluminescence intensity and x is the absorbance of quinine sulfate. If the sample has an absorbance of 0.045, what is its photoluminescence intensity?

ANSWER: 4.98×10^6; Substitute $x = 0.045$ into $y = 1.28 \times 10^8 x - 780\ 102$ and solve for y.

30. Inorganic anions can be analyzed by capillary electrophoresis with conductivity detection. A calibration curve for nitrate was constructed by plotting the signal (μV) as a function of nitration concentration (μM), resulting in an equation of $y = 498x + 3.28$. If a sample contains 62.5 μM nitrate ions, what would be the signal of nitrate in the sample?

ANSWER: 3.11×10^4 μV or 31.1 mV; Substitute $x = 62.5$ into $y = 498x + 3.28$ and solve for y.