UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATION, NOV/DEC 2017

COURSE NO: ES 273

COURSE NAME: **SAMPLING AND ANALYSIS**

CLASS: **ES II** TIME: 3 HOURS

Name**:** _____ Index Number: _____

SECTION A

Answer all questions in this section

1. The first and in many instances most important step in every determination in analytical chemistry is……
   A. Weighing
   B. Sampling.
   C. Filtration
   D. Drying

2. Under "anaerobic" conditions, iron is found predominantly in the oxidation state of
   A. -3
   B. -2
   C. +2
   D. +3

3. Material taken from the bulk quantity in a single sampling procedure is referred to as……
   A. spot sample.
   B. Bulk sample
   C. Grab sample
   D. Test sample

4. With solid matter, the size of the sample is determined by the ……..of the material and the homogeneity of distribution of the element that is to be analyzed.
   A. Moisture content
   B. grain size

C. Porosity

D. Permeability

5. The homogeneity of a sample always plays a role when the material under investigation is……..

   A. not mixed thoroughly,

   B. composed of mixed crystals

   C. contained in large containers

   D. already mixed thoroughly.

6. Contaminations can occur, through the following influences except;

   A. Air

   B. Losses

   C. Furniture

   D. Reagents

   E. Humans

7. Which of the following is NOT a method of avoiding contamination when carrying out analysis.

   A. Wearing gloves

   B. Working in clean environment

   C. Working with trained and qualified personnel

   D. Working with clean old standard solutions

8. Losses can occur in samples because of ;

   A. Evaporation and Adsorption

   B. Precipitation and dilution

   C. Evaporation and metamorphoses

   D. Condensation and Adsorption

9. Standard solutions stored in plastic bottles alter their concentrations by about 1% per year, since the solvent, water……..through the receptacle walls.

   A. Condense

   B. Occlude

   C. Evaporate

   D. Sublime

E. Coalesce

10. Filtration is important in sample storage and preservation because it prevents;
    A. Reaction of particles with dissolved components.
    B. Precipitation of analyte.
    C. Formation of unwanted complexes
    D. Excessive dilution of the sample
11. UV-radiations are used sample storage and preservation for……, in order to avoid formation of larger complexes.
    A. Minimizing evaporation and condensation of solvent
    B. Destruction of biological and organic components
    C. Destruction of both bacteria and virus
    D. Destruction of both inorganic and organic components
12. …….. is a system of management activities involving planning, implementation, assessment and reporting to make sure that the end product is of the type and quality needed to meet the needs of the user.
    A. Quality control
    B. Quality Procedure
    C. Quality Assurance
    D. Quality Technique
13. Which of the following is NOT a cause of blunder.
    A. Transcription error
    B. Calibrating instrument before use
    C. Misreading a scale, signal or display
    D. Giving result in the wrong unit
14. Random error occurs when the analytical results fall on ……..of the true value.
    A. both sides
    B. top
    C. left side
    D. right side
15. All the following are causes of systematic errors except;
    A. Interferences

B. Biased calibration
C. Different reaction times
D. Biased blank

16. Action taken to eliminate the cause of a potential non-conformity or either potentially undesirable situation is known as ……..
    A. Corrective action
    B. Preventive action
    C. Occupation action
    D. Destructive action
17. Which of the following is NOT a corrective action procedure.
    A. Accurately define the existing problem
    B. Investigate the most probable cause
    C. Determine inaccurate corrective action
    D. Implement corrective action
18. Which of the following can be used to transform a bad (non-representative) sample into a good one;
    A. statistical transformation of data,
    B. application of sophisticated analytical methods,
    C. imposition of quality assurance and quality control measures
    D. None of the above
19. Quantitative assessments of the quality of water are made based on the following criteria ***except;***
    A. temperature,
    B. dissolved oxygen level,
    C. work index
    D. Concentration of various organic and inorganic compounds.

20. A major disadvantage of ***bottom grab sampler*** when conducting stream sediment sampling is that;
    A. Finely divided particulates may be carried away by outflowing water from the sampler

B. Coarse materials are obtained but not representative of the bulk.
C. Extremely small area of bottom are encountered
D. Waters in contact with the fines are entrapped and cannot carry the fines away.

21. ***A core sampler*** is preferred over ***bottom grab sampler,*** in that,
    A. Finely divided particulates may be carried away by outflowing water from the sampler
    B. Coarse materials are obtained but not representative of the bulk.
    C. Extremely small area of bottom are encountered
    D. Waters in contact with the fines are entrapped and cannot carry the fines away

22. A general rule in sediment sampling to provide sufficient and valid analytical data is that,
    A. more grab samples of a bottom are required than bottom core samples
    B. more core samples of a bottom are required than bottom grab samples
    C. Few grab samples of bottom are required than bottom core samples
    D. Few core samples of bottom are required than bottom grab samples

23. A ……sampler gives the most nearly representative sample of water or wastewater flow where the pumping rate is proportional to stream flow.
    A. Continuous Automatic
    B. Manual Grab
    C. Core
    D. Grab automatic

24. The choice of sample type depends upon the following except;
    A. The intent of the sampling campaign,
    B. The regulatory prescriptions,
    C. The Maximum Contaminant Limits (MCL) of analyte
    D. The nature of the sampled stream

25. The primary objectives for monitoring the quality of water include the following except;
    A. It helps in setting realistic environmental policies.
    B. In developing achievable pollution prevention and remediation programs.
    C. To evaluate the impact of a pollutant
    D. It helps enforcement agencies in ensuring compliance with environmental regulations and permits.

26. ……..is one of the most important criteria in determining the quality of natural water, as oxygen is required for most aquatic life.
    A. Biochemical Oxygen Demand (BOD)
    B. Dissolved Oxygen (DO)
    C. Chemical Oxygen Demand (COD)
    D. Theoretical Oxygen Demand (ThOD)

27. The major nutrients in water are substances rich in;
    A. Nitrogen and Phosphorus
    B. Potassium and Calcium
    C. Nitrogen and Calcium
    D. Phosphorus and Potassium

28. Which of the following substances may cause water to requires increased amounts of soap for bathing or washing clothes, and forms a scale on piping, cooking vessels, boilers, and heat exchangers.
    A. $CuSO_4$
    B. $Ca(OH)_2$
    C. $CaCO_3$
    D. NaOH

29. ……. is used to describe the ability to exactly determine from the documentation that which reagents and standards were used in the analysis and where they came from.
    A. Traceability
    B. Documentation
    C. Custody or Control
    D. Quality Assurance

30. …….refers to the subjective selection of sampling locations based on professional judgment using prior information on the sampling site, visual inspection (e.g., leaks and discoloration), or personal knowledge and experience.
    A. Judgmental sampling
    B. Simple random sampling

C. Stratified Random sampling
D. Systematic Sampling

31. …….are observations that appear to be inconsistent with the remainder of the collected data.
    A. Analytical Errors
    B. Outliers
    C. Mistaken values
    D. Estimated values

32. Groundwater is stored in an …….....h typically is soil or rock that has a high porosity and permeability.
    A. Bedrock
    B. Aquifer
    C. Limestone
    D. Dolomite

33. The ……..dictates where and how fast water and contaminant will flow.
    A. Fractures
    B. Fissures
    C. Grain size
    D. Aquifer

34. ……..is the ratio of the volume of voids to the total volume, which determines the amount of groundwater or the storage capacity of an aquifer.
    A. Porosity
    B. Permeability
    C. Hydraulic Conductivity
    D. Vadose Zone

35. The ……. is the measure of an aquifers ability to transmit water, hence the flow rate of groundwater.

A. Porosity
B. Permeability or hydraulic conductivity
C. Infiltration
D. Permeability

36. …….is a special small diameter, non-pumping well used to measure the elevation of water table or potentiometric surface.
A. A Vadose
B. A piezometer
C. Bailer
D. Well

37. ……..is used for the analysis of suspended solids in water, or the analysis of dissolved phase contaminant after the removal of suspended solids.
A. Fractionation
B. Vacuum pump
C. Filtration
D. Distillation

38. Macromolecules such as protein and nucleic acids can be separated by the use of ……..device.
A. Centrifuge
B. Filter press
C. Vacuum pump
D. Distillation

39. A …… distillation is used for separating compounds if the compounds will decompose at atmospheric pressure before its boiling point is reached.
A. Filter press
B. Vacuum
C. Capillary

D. High pressure

40. A ……..allows a reaction mixture to be heated for an extended period of time without a loss of water or solvent.
    A. reflux apparatus
    B. Vacuum apparatus
    C. Capillary apparatus
    D. Distillation apparatus

41. Aqua regia for digestion of soils and sediments composed of a mixture of…….and nitric acid.
    A. Sulphuric acid
    B. Weak carbonic acid
    C. Sodium hydroxide
    D. Hydrochloric acid
42. ……..are the analytes-free reagents (water or solvent) inserted in the analytical run, normally injected between high concentration and low concentration samples
    A. Instrument blanks
    B. Reagent blanks
    C. Statistical blank
    D. Water Spikes
43. …….are aliquot of the same sample that are prepared and analysed at the same time, but submitted and analysed as separate samples.
    A. Working Standards
    B. Water Spikes
    C. Reagent blanks
    D. Laboratory Duplicates

44. …….are the standard solutions used to obtain calibration curves, including a calibration blank and a series of several concentrations.

A. Calibration Standards.

B. Laboratory Duplicates
C. Water Spikes
D. Reference Materials

45. The amount of dissolved oxygen in water …….with ……. water temperature.

A. Increases, increasing

B. Decreases, increasing

C. Remains constant, decreasing

D. Decreases, constant

46. Dissolved solids in potable water include the following **except;**

A. pH

B. chlorides,

C. nitrates and nitrites

D. Phosphates or sulphates of sodium, calcium, magnesium, iron and manganese.

47. QA/QC programs are implemented not only to minimize errors from both sampling and analysis, but many are designed to …….the errors in the measurement.

A. Explain

B. Eliminate

C. Quantify

D. Elevate

48. Which of the following is not true about suspended solids.

A. serve as food for many aquatic organisms.

B. interfere with self-purification of water

C. reduce photosynthetic activity

D. deposited as silt over food for aquatic organisms

49. Dust or particulate matter (PM) can be mitigated in the environment by one of the following methods ***except.***

A. watering of haul roads

B. use of agglomerating or binding materials on road surfaces

C. Use of wobblers to spray water at crushing sites and quarries

D. Use of Gravicon VC25 to measure dust concentrations in quarries

50. A cyclical nutrient flow by the activities of ……and……which convert dead organic tissues back to inorganic nutrients for the chain to continue.

A. Herbivores, omnivores

B. scavenging organisms, micro organisms

C. Phytoplankton, Zooplankton

D. Viruses, bacteria

SECTION B

Answer question One and any other Two

Question One

a) How many millilitres of 20% HCl solution of specific gravity 1.098 should be taken for preparation or 5 litres of 0.1 N solution? **(2 marks)**

b) What is the difference between gravimetric and volumetric analysis? **(2 marks)**

c) What is spectrophotometry? **(1 mark)**

d) Distinguish between absorbance and transmittance. **(2 marks)**

e) Calculate the mole fraction, molarity and molality of NH_3 if it is in a solution composed of 30.6 g NH_3 in 81.3 g of water. The density of the solution is 0.982 g/mL and the density of water is 1.00 g/mL. **(3 marks)**

f) An organic reagent forms a 1:1 coloured complex with lead (II) when complexed with excess reagent, a solution containing 2.07 mg of lead (II) per litre has an absorbance of 0.63 (vs. a water blank) in a 1-cm cell at 440 nm. Calculate the molar absorptivity of the lead (II) complex. **(4 marks)**

Question Two

a) List four (4) things that would make data scientifically objective. **(2 marks)**

b) Explain what a legally defensible data is. **(1 mark)**

c) What is judgmental sampling? **(1 mark)**

d) What are the components of a legally defendable data? **(2 marks)**

e) Explain what is meant by Data Indicators (QDI) in sampling and analysis. **(1 mark)**

f) State four (4) sources of data acquisition. **(2 marks)**

g) List the six (6) soil horizons in order. **(3 marks)**

Question Three

a) List three (3) importance of the sampling plan. **(1.5 marks)**

b) List five (5) steps of management system that is employed to ensure quality assurance/ control. **(2.5 mark)**

c) Explain sampling error and list the four groups of sampling error. **(3 marks)**

d) Name the three (3) groups of static water and indicate how each group is sampled. **(3 marks)**

e) What are the components of the soil profile? **(2 marks)**

Question Four

a) Differentiate using definitions between corrective and preventive action and state the relevance of each under ISO 17025. **(2 marks)**

b) State two (2) factors that determine the correctness or reliability of tests performed by a lab under ISO 17025. **(2 marks)**

c) In the case of subcontracting tests and calibrations, name two (2) things the lab should do or ensure. **(2 marks)**

d) Qualitative laboratory error that are usually made due to negligence or lack of information may arise from four actions. State and explain these actions **(2 marks)**

e) What is the relevance of the knowledge of the soil profile in soil sampling? **(2 marks)**

f) ISO/ TC 190 identifies four (4) general objectives for soil sampling. **(2 marks)**

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