1 Water Properties & Sources

1. Which one of the following best defines the term aquifer?

   (a) A low lying area where water pools

   (b) Water-bearing stratum of rock, sand, or gravel

   (c) Impervious stratum near the ground surface

   (d) Treated water leaving the water system

2. The height to which water will rise in wells located in an artesian aquifer is called the

   (a) Pumping water level

   (b) Water table

   (c) Piezometric surface

   (d) Drawdown

   (e) Radius of influence

3. What percentage of all the earth's water is readily available as a potential drinking water supply in the form of lakes, rivers, and near-surface groundwater?

   (a) 97

   (b) 50

   (c) 2

   (d) 1

   (e) 0.34

4. To prevent the entry of surface contamination into a well is the purpose of

   (a) The well casing

   (b) The water table

   (c) The louvers or slots

   (d) Well development

   (e) The annular grout seal

5. An aquifer that is located underneath an aquiclude is called

   (a) An unconfined aquifer

   (b) A confined aquifer

   (c) A water table

   (d) Unreachable groundwater

   (e) An Artesian spring

6. The process by which water changes from the gas to the liquid phase is termed

   (a) Condensation ·

   (b) Evaporation

   (c) Percolation

   (d) Precipitation

   (e) Runoff

7. The free surface of the water in an unconfined aquifer is known as the

   (a) Pumping water level

   (b) Artesian spring

   (c) Water table

   (d) Drawdown

   (e) Percolation

8. The transfer of liquid water from plants and animals on the surface of the earth into water vapor in the atmosphere is called

   (a) Transpiration

   (b) Evaporation

   (c) Condensation

   (d) Runoff

   (e) Percolation

9. The elevation of water in the casing of an operating well is called the

   (a) Piezometric surface

   (b) Water table

   (c) Pumping water level

   (d) Drawdown

   (e) Radius of influence

10. An aquifer under pressure is often termed

    (a) Unconfined

    (b) Pacific

    (c) Artesian

    (d) Alluvial

    (e) Elevated

11. An aquifer is usually composed of

    (a) Sand and gravel

    (b) Clays and silts

    (c) Bedrock

    (d) Large voids in the soil, resembling underground lakes

    (e) None of the above

12. Which of the following best defines the term specific capacity?

    (a) Amount of water a given volume of saturated rock or sediment will yield to gravity

    (b) Amount of water a given volume of saturated rock or sediment will yield to pumping

    (c) Rate at which water would flow in an aquifer if the aquifer were an open conduit

    (d) Amount of water a well will produce for each foot of drawdown

13. The most common type of well used for public water supply systems is a

    (a) Jetted well

    (b) Driven well

    (c) Drilled well

    (d) Bored well

14. Which of the following best defines the term static water level?

    (a) Water level in a well after a pump has operated for a period of time

    (b) Water level in a well when the well is not in operation

    (c) Water level in a well measured from the ground surface to the drawdown water level

    (d) Waterlevel in a well measured from the natural water level to the drawdown water level

15. The residual drawdown of a well is defined as

    (a) Water level in a well after a pump has operated over a period of time

    (b) Measured distance from the ground to the pumping level

    (c) Water level below the normal level that persists after a well pump has been off for a period of time

    (d) Measured distance between the water level and the top of the screen

16. A well is located in an aquifer with a water table elevation 20 feet below the ground surface. After operating for three hours, the water level in the well stabilizes at 50 feet below the ground surface. The pumping water level is:

    (a) 20 feet

(b) 30 feet

(c) 50 feet

(d) 70 feet

(e) 100 feet

17. What percentage of all the earth's water is readily available as a potential drinking water supply in the form of lakes, rivers, and near-surface groundwater?

(a) 97%

(b) 50%

(c) 2%

(d) 1%

(e) 0.34%

18. To prevent the entry of surface contamination into a well is the purpose of

(a) The well casing

(b) The water table

(c) The louvers or slots

(d) Well development

(e) The annular grout seal

19. The process by which water changes from the gas to the liquid phase is termed

(a) Condensation ·

(b) Evaporation

(c) Percolation

(d) Precipitation

(e) Runoff

20. The free surface of the water in an unconfined aquifer is known as the

(a) Pumping water level

(b) Artesian spring

(c) Water table

(d) Drawdown

(e) Percolation

21. The transfer of liquid water from plants and animals on the surface of the earth into water vapor in the atmosphere is called

(a) Transpiration

(b) Evaporation

(c) Condensation

(d) Runoff

(e) Percolation

22. The term for the combined processes which transfer liquid water on the earth's surface into water in the gas phase in the atmosphere is

(a) Percolation

(b) Evapotranspiration

(c) Sublimation

(d) Overdraft

(e) Precipitation

23. A primary advantage of using surface water as a water source includes:

(a) Usually higher in turbidity

(b) Generally softer than groundwater

(c) Easily contaminated with microorganisms

(d) Can be variable in quality

24. Which source of water has the greatest natural protection from bacterial contamination?

(a) Shallow well

(b) Deep well

(c) Surface water

(d) Spring

25. A water-bearing formation in the soil is referred to as

(a) An aquitard or aquiclude

(b) An aquifer

(c) An aqueduct

(d) The drawdown

(e) The static water level

26. An operating well will drain the water from a volume of soil around the well during pumping. This volume is referred to as the

(a) Pumping water level

(b) Radius of influence

(c) Drawdown

(d) Cone of depression

(e) Recharge zone

27. One acre is 43,560 square feet. If this acre is covered with one foot of water, it contains

(a) 1 acre-foot

(b) 43,560 cubic feet

(c) 325,829 gallons

(d) All of the above

(e) None of the above

28. The safe yield of an aquifer is

(a) Determined by the Department of Health Services

(b) Variable, depending on rainfall

(c) The average amount of water that can be withdrawn each year without causing a long-term drop in the water table

(d) The difference between the static water level and the pumping water level

(e) All of the above

29. The movement of water from the surface of the earth into the soil is called

(a) Condensation

(b) Evaporation

(c) Evapotranspiration

(d) Runoff

(e) None of the above

30. The freezing point of water is

(a) $0^\circ F$

(b) $32^\circ C$

(c) $32^\circ F$

(d) $0^\circ C$

(e) $100^\circ F$

31. The movement of water from the atmosphere to the surface of the earth is called

(a) Condensation

(b) Evaporation

(c) Evapotranspiration

(d) Runoff

(e) Precipitation

32. The movement of water on the surface of the earth is called

(a) Percolation

(b) Evaporation

(c) Evapotranspiration

(d) Runoff

(e) Infiltration

33. A formation in the soil that resists water movement (such as a clay layer) is called

(a) An aquitard or aquiclude

(b) An aquifer

(c) An aqueduct

(d) The drawdown

34. Another term for the percolation that transports water from the surface into an aquifer is

(a) Artesian springs

(b) Recharge

(c) Extraction

(d) Overdraft

(e) Runoff

35. Water that is safe to drink is called _____ water.

(a) Potable

(b) Palatable

(c) Good

(d) Clear

36. Groundwaters generally have consistent water quality that include

(a) having a higher total dissolved solids content than surface water*

(b) having a lower mineral content than surface waters

(c) having lower pH values than surface waters

(d) having a higher amount of bacteria than surface waters

37. What is the middle layer of a stratified lake called?

    (a) Thermocline

    (b) Benthic Zone

    (c) Epilimnion

    (d) Hypolimnion

38. What is the conversion of liquid water to gaseous water known as?

    (a) Advection

    (b) Condensation

    (c) Precipitation

    (d) Evaporation

39. Water weighs

    (a) 7.48lbs/gal

    (b) 8.34lbs/gal

    (c) 62.4lbs/ft^3

    (d) Both B. and C.

40. What is the static level of an unconfined aquifer also known as?

    (a) Drawdown

    (b) Water Table

    (c) Pumping Water Level

    (d) Aquitard

41. A water bearing geologic formation that accumulates water due to its porousness

    (a) Aquifer

    (b) Lake

    (c) Aquiclude

    (d) Well

42. What kind of stream flows continuously throughout the year?

    (a) Ephemeral

    (b) Perennial

    (c) Intermittent

    (d) Stratified

43. The surface to atmosphere movement of water is known as

    (a) Precipitation

    (b) Percolation

    (c) Stratification

    (d) Evapotranspiration

44. An aquifer that is underneath a layer of low permeability is known as

    (a) Confined aquifer

    (b) Water Table aquifer

    (c) Unconfined aquifer

    (d) Unreachable groundwater

45. What is the middle layer of a stratified lake known as?

    (a) Hypolimnion

    (b) Benthic Zone

    (c) Thermocline

    (d) Epilimnion

46. The amount of water that can be pulled from a aquifer without depleting

    (a) Drawdown

    (b) Safe yield

    (c) Overdraft

    (d) Subsidence

47. The primary origin of coliforms in water supplies is
    a. Natural algae growth
    b. Industrial solvents
    c. Fecal contamination by warm-blooded animals
    d. Acid raid

48. A primary source of volatile organic chemical (VOC) contamination of water supplies is
    a. Agricultural pesticides
    b.Industrial solvents
    c. Acid rain
    d. Agricultural fertilizers

49. The term "surface runoff" refers to
    a. Rainwater that soaks into the ground
    b. Rain that returns to the atmosphere from the earth's surface
    c. Surface water that overflows the banks of rivers
    d. Water that flows into rivers after a rainfall

50. The most important factor to consider in locating a well site from the health point of view is
    a. Anticipated yield
    b. Availability of electric power
    c. Distance from other wells
    d. Vulnerability

51. A disease that can be transferred by water is
    a. Gonorrhea
    b. Malaria
    c. Mumps
    d. Typhoid

52. Final determination of vulnerability is made by
    a. Private contractor/consultants
    b. The primacy agency
    c. The water supplier
    d. All of the above

53. To prevent the entry of surface contamination into a well is the purpose of
    a. The well casing
    b. The water table
    c. The louvers or slots
    d. Well development
    e. The annular grout seal

54. Potable water may be defined as
    a. Water high in organic content
    b. Any water that occasionally may be polluted from another source
    c. Any water that, according to recognized standards, is safe for consumption
    d. Water that indicates a septic condition
    e. Water that has been transported from outside the service area

55. An operating well will drain the water from a volume of soil around the well during pumping. This volume is referred to as the
    a. Pumping water level
    b. Radius of influence
    c. Drawdown
    d. Cone of depression

e. Recharge zone

56. A well screen must be installed in
    a. deep wells
    b. consolidated materials
    c. shallow wells
    d. unconsolidated materials

57. A well is acidified in order to
    a disinfect
    b. increase yield
    c. remove objectionable gases
    d. remove disinfection by-products

58. The amount of water that a well will produce for each foot of drawdown is called:
    a. specific head
    b. static yield
    c. yield/feet
    d. specific capacity

59. Surging a well to loosen scale deposits on the screen refers to:
    a. turning the pumps on and off as fast as possible to cause a water hammer
    b. pumping the water in and out of a well
    c. sending shock waves through the aquifer to cause a surge of water
    d. using a water jet to surge around the well casing.

60. A well is acidized in order to
    a. Disinfect the water
    b. Increase yield
    c. Remove objectionable gasses
    d. Remove disinfection by-products

61. To prevent the entry of surface contamination into a well is the purpose of
    a, The well casing
    b. The water table
    c. The louvers or slots
    d. Well development
    e. The annular grout seal

62. The variation in water demand during the course of a day is termed
    a. Seasonal variation
    b. Fire flow requirements
    c. Emergency storage variation
    d. The straight line equalization method
    e. Diurnal variation

63. The maximum momentary load placed on a water supply system is known as
    a. Average daily flow
    b. Average daily demand
    c. Rated capacity
    d. A System float
    e. Peak demand

64. The term aquifer refers to:
    a. A special type of aqueduct.
    b. A natural source of water.
    c. A potable water.
    d. Water bearing strata.

65. The use of a well supply as a source normally results in:
    a. Water that is high in nitrates
    b. Water of consistent quality
    c. Water very high in mineral content
    d. Water that is considered "soft".

66. Maximum Safe Yield of a water source is defined as:
    a) Where the state health department has approved the source of use.
    b) The quantity of water that can be taken from a source of supply over a period of years without depleting the source permanently - beyond it's ability to replenish in wet years.
    c) Water that is free of bacteria.
    d) Quantity of water that may be treated in the plant.

67. Movement of water through the ground is called:
    a) Hydraulic subsidence
    b) Runoff
    c. Percolation
    d. Infiltration

Laboratory

1. Which of the following is an indicator organism?
   (a) Giardia
   (b) Cryptosporidium
   (c) Hepatitis
   (d) E. Coli
2. What is the primary origin of coliform bacteria in water supplies?
   (a) Natural algae growth
   (b) Industrial solvents
   (c) Animal or human feces
   (d) Acid rain
3. What ls the term for water samples collected at regular intervals and combined in equal volume with each other?
   (a) Time grab samples
   (b) Timo flow samples
   (c) Proportional time composite samples
4. What is the basis for the number of samples that must be collected for utilities monitoring for lead and copper that are in compliance or have installed corrosion control'?
   (a) Size of distribution system
   (b) Population
   (c) Amount of water produced
   (d) Number of raw water sources
5. Where should bacteriological samples be collected in the distribution system?
   (a) Uniformly distributed throughout the system based on area
   (b) At locations that are representative of conditions within the system
   (c) Always from extreme locations in the system but occasionally at other locations
   (d) Uniformly throughout the system based on population density
6. The quantity of oxygen. that can remain dissolved in water is related to
   (a) Temperature
   (b) pH
   (c) Turbidity

(d) Alkalinity

7. In coliform analysis using the presence-absence test, a sample should be incubated for

   (a) 24 hours at 25°C

   (b) 36 hours at 35°C

   (c) 24 and 36 hours at 25°0

   (d) 24 and 48 hours at 35°C

8. A major source of error when obtaining water quality information is improper:

   (a) Sampling

   (b) Preservation

   (c) Tests of samples

   (d) Reporting of data

9. What is commonly used as an indicator of potential contamination in drinking water samples?

   (a) Viruses

   (b) Coliform bacteria

   (c) Intestinal parasites

   (d) Pathogenic organisms

10. The type of organisms that can cause disease are said to be _____ microorganisms.

    (a) Bad

    (b) Pathogenic

    (c) Undesirable

    (d) Sick

11. Four types of aesthetic contaminants in water include the following:

    (a) Odor, turbidity, color, hydrogen sulfide gas

    (b) Pathogens, microorganisms, arsenic, disinfection by-products

    (c) Odor, color, turbidity, hardness

    (d) Color, pathogens, metals, organics

12. What is the purpose of adding fluoride to drinking water?

    (a) Increase tooth decay

    (b) Reduce tooth decay

    (c) Make teeth white

    (d) Government conspiracy

13. The test used to determine the effectiveness of disinfection is called the:

    (a) Coliform bacteria test

    (b) Color test

    (c) Turbidity test

    (d) Particle test

14. Turbidity is measured as:

    (a) mg/L

    (b) mL

    (c) gpm

    (d) NTU

15. Giardia and cryptosporidium are a type of:

    (a) Mineral

    (b) Organism

    (c) Color

    (d) Bird

16. Chronic contaminants are those that can cause sickness after:

    (a) Prolonged exposure

    (b) Low levels or low exposure

17. A positive total coliform test indicates that:

    (a) Disease-causing organisms may be present in the water supply

    (b) The water is safe to consume

    (c) The water supply has high iron levels

    (d) There is nothing to be concerned about

18. What is the purpose of the bacteriological site sampling plan?

    (a) To have a map showing where BacT samples are drawn

    (b) In case of a positive Bac T sample, the operator will know where to take the four repeat samples

    (c) The state will know where you are taking your repeat samples

    (d) All of the above

19. To ensure that the water supplied by a public water system meets state requirements, the water system operator must regularly collect samples and:

(a) Have water analyzed at an approved water testing laboratory

(b) Determine a sampling schedule based on state requirements

(c) Send all analyses results to the state

(d) All of the above

20. Samples taken for routine bacteriological testing should be preserved by:

(a) Freezing

(b) Boiling

(c) DPD preservative

(d) Refrigeration

21. How many coliform samples are required per month for a water system serving a population between 25 and 100?

(a) 1

(b) 2

(c) 3

(d) 4

22. Before taking a bacteriological (BacT) water sample from a faucet, you should:

(a) Wash hands thoroughly

(b) Remove the faucet aerator

(c) Flush water until you're sure water is from the main, not the service line

(d) All of the above

23. Monthly BacT samples should be taken from:

(a) The well pump house

(b) The distribution system

(c) The treatment plant

(d) An outside hose spigot

24. If your BacT sample test is positive, how long do you have to collect four repeat samples and deliver them to the lab?

(a) 12 hours

(b) 24 hours

(c) 48 hours

(d) 72 hours

25. _____is a measure of the capacity of water to neutralize acids.

    (a) Concentration

    (b) Alkalinity

    (c) pH

    (d) Conductivity

26. The DPD method is used to determine the _____ of a water sample.

    (a) Dissolved oxygen content

    (b) Conductivity

    (c) pH

    (d) Free chlorine residual

27. What color does N,N-diethyl-p-phenylenediamine (DPD) turn in the presence of chlorine?

    (a) Brown

    (b) Green

    (c) Blue

    (d) Pink

28. The presence-absence (P-A) test used for microbiological testing is also commonly referred to as

    (a) Multiple Tube Fermentation

    (b) Membrane Filtration

    (c) Confirmed Test

    (d) Colilert

29. When testing for coliform bacteria with the multiple tube fermentation (MFT) method what is the best indicator for a positive test?

    (a) Color change

    (b) Gas bubble formation

    (c) Formation of a cyst

    (d) Formation of turbidity

30. Coliform bacteria share many characteristics with pathogenic organisms. Which of the following is not true?

    (a) They survive longer in water

    (b) They grow in the intestines

    (c) There are less coliform than pathogenic organisms

(d) They are still present in water without fecal contamination

31. What is the second step in the multiple tube fermentation test?

(a) Presumptive test

(b) Negative test

(c) Completed

(d) Confirmed

32. What is the removal and deactivation requirement for Giardia?

(a) 2log

(b) 3log

(c) 4log

(d) There is no requirement

33. The multiple barrier approach to water treatment includes removal through which method?

(a) Filtration

(b) Coagulation

(c) Disinfection

(d) a and c

34. A pH reading of 7 is considered

(a) Slightly acidic

(b) Acidic

(c) Basic

(d) Neutral

35. EDTA titration is used to determine the _____ of a water sample.

(a) Hardness

(b) Conductivity

(c) Alkalinity

(d) Free chlorine residual

36. A higher than normal turbidity reading could signify

(a) A change in water quality

(b) Nothing. Keep operating as normal

(c) Microbiological contamination

(d) Both A & C

37. What is the ingredient used during the second multiple tube fermentation test?

    (a) Colilert

    (b) MMO/MUG

    (c) Brilliant Green Bile

    (d) Chlorine

38. When collecting a distribution system sample for bacteriological testing, the person collecting the sample should allow the water to run before filling the sample bottle.

    (a) A minimum of five minutes.

    (b) 1 hr.

    (c) 30 min

    (d) only a few seconds

39. Black stains on plumbing fixtures might be attributed to

    (a) calcium.

    (b) copper.

    (c) magnesium.

    (d) manganese.

40. The multiple tube fermentation test consists of three distinct tests. These tests, in the order performed, are the:

    (a) preliminary, confirmed, and completed tests.

    (b) preliminary, presumptive and confirmed tests.

    (c) presumptive, confirmed, and completed tests.

    (d) prespumtive, preliminary, and completed tests.

41. What should the sample volume be when testing for total coliform bacteria?

    (a) l00mL

    (b) 250mL

    (c) 500mL

    (d) 1,000mL

42. pH is a measure of :
    a. conductivity
    b. water's ability to neutralize acid
    c. hydrogen ion activity
    d. dissolved solids

43. Sodium Thiosulfate is used to
    a. Buffer chlorine solutions
    b. Neutralize chlorine residuals
    c. Detect chlorine leaks
    d. Sterilize sample bottles

44. The presence of total coliforms in drinking water indicates
    a. The presence of pathogens.
    b. The absence of an adequate chlorine residual
    c. The existence of an urgent public health problem
    d. The potential presence of pathogens

45. A primary health risk associated with microorganisms in drinking water is
    a. Cancer
    b. Acute gastrointestinal diseases
    c. Birth defects
    d. Nervous system disorders

46. After 5 years use, a portion of cast iron pipe shows a white scale about 1/2 inch thick lining the inside. This means
    a. Red water will soon become a problem
    b. The water has been corrosive
    c. The water is chemically unstable and is depositing
    d. Water should flow easier since the lining is smooth

47. Hardness in water is caused by
    a. Dissolved minerals
    b. High pH.
    c. Low turbidity
    d. Alkalinity

48. The meniscus on calibrated glassware is read at the
    a. Bottom of curvature for mercury but the top for water
    b. Extreme point of contact between the liquid and glass, i.e., where gas, liquid, and air all meet at one point
    c. Mid-height of the curvature so that beginning and ending readings will results in zero error
    d. Top of curvature for mercury but at the bottom for most other liquids including water

49. An unknown substance is found on the bottom of the water within a drinking water reservoir. Which of the following statements is true of this substance?
    a. It has a specific gravity less than 1.0
    b. It has a specific gravity equal to 1.0
    c. It has a specific gravity greater than 1.0
    d. It has no specific gravity

e. None of the above

50. The term "Chain of Custody" refers to
    a. A large accessory to a come-along
    b. An attachment to a pipe-cutter
    c. Employee labor laws
    d. Procedures and documentation required for water quality sampling
    e. Procedures and documentation required for chemical application

51. Water samples to be analyzed for taste and odor must be
    a. Analyzed in the field
    b. Collected in glass sample containers
    c. Dechlorinated with sodium thiosulfate
    d. Preserved with dilute hydrochloric acid
    e. None of the above

52. Bacteriological samples for a distribution system must be collected in accordance with
    a. The Surface Water Treatment Rule
    b. OSHA requirements
    c. An approved sample siting plan
    d. FLSA requirements
    e. ANSI/NSF Standard 61

53. Trihalomethanes are classified as
    a. Metals
    b. Inorganic constituents
    c. Secondary drinking water standards
    d. Radiological contaminants
    e. Volatile organic compounds

54. The multiple tube fermentation analysis consists of
    a. Positive, negative, and neutral tests
    b. Presumptive, confirmed, and completed tests
    c. Preliminary, presumptive, and confirmed tests
    d. Preliminary, confirmed, and completed tests
    e. Presence or absence testing

55. Which of the following is NOT a characteristic of coliform organisms?
    a. Intestinal origin
    b. Will produce carbon dioxide from lactose
    c. Heartier in a water environment than pathogenic organisms
    d. Far less numerous than pathogenic organisms
    e. Able to survive with or without oxygen

56. A bacteriological test that measures only the presence or absence of coliforms is
    a. ColiLert (MMO/MUG)
    b. Multiple tube fermentation
    c. Most probable number (MPN)
    d. Membrane filtration
    e. Presumptive test

57. After collection, if stored at 4°C, bacteriological samples must be processed within
    a. 1 hour
    b. 6 hours
    c. 24 hours
    d. 48 hours
    e. 72 hours

58. Sample bottles which are furnished by a certified laboratory for collection of bacteriological samples
    a. Should be rinsed with the water to be sampled before use
    b. Should be placed in boiling water for at least 10 minutes before use
    c. Should be rinsed with a chlorine solution before use
    d. Should be rinsed with distilled water before use
    e. Are ready to use

59. The standard indicator of potential fecal contamination of a water supply is
    a. Cryptosporidium
    b. pH
    c. Alkalinity
    d. Hardness
    e. Coliform presence/absence

60. Where should bacteriological samples be collected?
    a. At different locations on each sampling cycle, to make sure the entire system is sampled
    b. Only from public locations, such as drinking fountains and restrooms
    c. Only from locations owned by consumers
    d. Only from specially constructed sampling stations
    e. From several sampling locations around the entire distribution system, in accordance with a DHS-approved sample siting plan

61. Storage of bacteriological samples during transport to a laboratory is best accomplished using
    a. A clean storage box specifically designed to hold sample containers
    b. An ice chest packed with ice
    c. An insulated storage box with "blue ice".
    d. An insulated storage box with "dry ice"
    e. No particular sample storage requirements apply, as long as the samples can be delivered to a laboratory prior to the end of the work day

62. Sodium thiosulfate is added in the laboratory to bacteriological sample bottles to:
    a. Thoroughly disinfect the sample bottle
    b. -Complete the cleaning and sterilization process
    c. Neutralize any residual chlorine present in the sample at the time of collection
    d. Counteract the effects of sunlight on the water sample
    e. Prevent further growth of bacteria in water samples following collection

63. Radiological contaminant concentrations in drinking water are measured in
    a. Milligrams per liter
    b. Micrograms per liter
    c. Nanograms per liter
    d. Picograms per liter
    e. None of the above

64. Which of the following is NOT a characteristic of coliform organisms?
    a. Intestinal origin
    b. Will produce carbon dioxide from lactose
    c. Heartier in a water environment than pathogenic organisms
    d. Far less numerous than pathogenic organisms
    e. Able to survive with or without oxygen

65. A water supply is found to have a calcium carbonate concentration of 50 mg/L. This water would be considered
    a. soft water
    b. hard water
    c. potable water
    d. non-potable water

66. Cathodic protection refers to protection against
    a. contamination
    b. corrosion
    c. hardness
    d. alkalinity

67. An operator uses _____ to test for residual chlorine
    a. DPD
    b. Cresol red
    c. Methyl orange
    d. Sulfuric acid

68. The meniscus on calibrated glassware is read at the:
    a. Bottom of curvature for mercury but the top for water
    b. Extreme point of contact between the liquid and glass, i.e., where gas, liquid, and air all meet at one point

c. Mid-height of the curvature so that beginning and ending readings will results in zero error
d. Top of curvature for mercury but at the bottom for most other liquids including water

69. The type of corrosion caused by the use of dissimilar metal in a water system is
a. Caustic corrosion
b. Galvanic corrosion
c. Oxygen corrosion
d. Tubercular corrosion

70. Which of the following can cause tastes and odors in a water supply?
a. Dissolved zinc
b. Algae
c. High pH
d. Low pH

Regulations

1. What does the acronym MCL stand for?

   (a) Minimum contaminant level

   (b) Micron contaminant level

   (c) Maximum contaminant Level

   (d) Milligrams counted last

2. How long do sanitary surveys have to be retained for records?

   (a) 3 years

   (b) 5 years

   (c) 7 years

   (d) 10 years

3. The most severe water system violation that requires the fastest public notification

   (a) Tier I

   (b) Tier II

   (c) Tier III

   (d) Tier IV

4. The primacy agency may grant a variance or exemption as long as

   (a) The agency is using the Best Available Technology

   (b) There is no threat to public health

   (c) There is never a scenario for a variance or exemption

   (d) Both A. and B.

5. A public water system that serves at least 25 people six months out of the year

   (a) Nontransient noncommunity

   (b) Transient noncommunity

   (c) Community public water system

   (d) None of the above

6. Regulations based on the aesthetic quality of drinking water

   (a) Primary Standards

   (b) Secondary Standards

(c) Microbiological Standards

(d) Radiological Standards

7. The lowest reportable limit for a water sample

(a) 0.5mg/L

(b) Zero

(c) Public health goal

(d) Detection Level for reporting

8. Primary Standards are based on

(a) Color and Taste

(b) Aesthetic quality

(c) Public Health

(d) Odor

9. A disease causing microorganism

(a) Pathogen

(b) Colilert

(c) Pathological

(d) Turbidity

10. According to Surface Water Treatment Rule, what is the combined inactivation and removal for Giardia?

(a) 1.0 Logs

(b) 2.0 Logs

(c) 3.0 Logs

(d) 4.0 Logs

11. What is the equivalency expressed as a percentage for the SWTR inactivation and removal of viruses?

(a) 99.9%

(b) 99.99%

(c) 99.0%

(d) 99.999%

12. A water agency that takes more than 40 coliform samples must fall under what percentile?

(a) 10%

(b) 7%

(c) 5%

(d) No positive samples allowable

13. The National Primary Drinking Water Regulations apply to drinking water contaminantR that may have adverse effects on
    a. Water color
    b. Water taste
    c. Water odor
    d. Human health

14. Which of the following is considered an acute risk to health?
    a. Two Tier 2 violations
    b. One Tier 2 violation
    c. Two Tier 1 violations
    d. One Tier 1 violation

15. Records on turbidity analyses should be kept for a minimum of
    a. 5years
    b. 7 years
    c. l0 years
    d. 25 years

16. Records on bacteriological analyses should be kept for a minimum of
    a. 5 years
    b. 7 years
    c. 10 years
    d. 25 years

17. Differecne between primary and secondary standard substances:
    a. Primary standards refer to substances that are carcinogenic, secondary standards do not
    b. Primary standards refer to substances that are thought to pose a threat to human health, secondary standards do not
    c. Primary standards refer to substances that, if not.put in check, will eventually kill humans, secondary standards do not ·
    d. Secondary qualities are aesthetic qualities and will only make some people sick, while primary standards refer to substances that will make everyone sick and may possibly cause death

18. The SDWA defines a public water system that supplies piped water for human consumption as one that has
    a. 10 service connection or serves 20 or more people for 60 or more days per year
    b. 15 service connections or serves 20 or more people for 90 or more days per year
    c. 10 service connections or serves 25 or more people for 30 or more days per year
    d- 15 service connections 01' serves 25 or more people for 60 or more days per year

19. According to the USEPA regulations, the owner or operator of a public water system that fails to comply with applicable
monitoring requirements shall give notice to the public within
a. 1 week of the violation in a letter hand-delivered to customers
b. 45 days of the violation by posting a notice at the town hall
c. 3 months of the violation in a daily newspaper in the area
d. served by the system 1 year of.the violation by including the notice with the water- bill ·

20. What US agency establishes drinking water standards?
a. AWWA
b. USEPA
c. NIOSH
d. NSF

21. If a water supply exceeds the MCL, whose responsibility is it to notify the consumer?
a. the testing lab
b. the supplier
c. the DOH
d. the USEPA

22. According to the Lead and Copper Rule. the action for the 90thpercentile lead level is:
a. 0. 005 mg/1
b. 0. 015 mg/l
c. 0. 030 mg/l
d. 0.050 mg/l

23. The term "maximum contaminant level goal (MCLG)" means the:
a. Maximum allowable level of a given contaminant in drinking water
b. Level of a contaminant .in drinking water below which there are no known or suspected adverse health effects with a margin of safety
c. Level of a contaminant in drinking water that will trigger a Tier 1 violation
d. Minimum detectable level of a given contaminant

24. The maximum contaminant level goal (MCLG) of known or probable carcinogens is:
a. Set by the state
b. The same number as the maximum contaminant level (MCL)
c. Zero
d. The minimum detectable level of a given contaminant

25. The difference between Tier 1 and Tier 2 violations is: a. Tier 1 violations·potentially impose·direct and adverse health effects;-Tier 2 violations do not pose a a direct threat to public health. b. Tier 1 violations require public notification; Tier 2 violations do not require public notification c. Tier 1 violations are acute; Tier 2 violations are not acute d. Tier 1 violations have legal consequences; Tier 2 violations do not

26. The Safe Drinking Water Act requires _____ to develop a comprehensive coliform monitoring plan
    a. Large public water systems (serving >50,000 people)
    b. Large and medium public water systems (serving >3,300 people)
    c. Small and medium public water systems (serving >25 and <3,300 people)
    d. All public water systems

27. Final determination of vulnerability is made by: a. Private contractor/consultants
    b. The primacy agency
    c. The water supplier
    d. All of the above

28. The most important factor to consider in locating a well site from the health point of view is
    a. Anticipated yield
    b. Availability of electric power
    c. Distance from other wells
    d. Vulnerability

29. Trihalomethanes are classified as a. Metals
    b. Inorganic constituents
    c. Secondary drinking water standards
    d. Radiological contaminants
    e. Volatile organic compounds

Treatment

1. What is the recommended loading rate for copper sulfate for algae control at an alkalinity greater than 50 mg/L?

   (a) 0.9 lb of copper sulfate per acre of surface area

   (b) 1.9 lb of copper sulfate per acre of surface area

   (c) 2-4 lb of copper sulfate per acre of surface area

   (d) .4 lb of copper sulfate per acre of surface area

   If ammonia vapor is passed over a chlorine leak in a cylinder valve, the presence of the leak is indicated by a

   (a) Yellow cloud

   (b) White cloud

   (c) Gray cloud

   (d) Brown cloud

2. What is the recommended minimum contact time water mains with the chlorine slug method?

   (a) 3 hours

   (b) 6hours

   (c) 10 hours

   (d) . 12 hours·

3. The basic goal for water treatment is to _____.

   (a) Protect public health

   (b) Make it clear

   (c) Make it taste good

   (d) Get stuff out

4. Greensand can be operated in either _____ regeneration or _____ regeneration modes.

   (a) Continuous or intermittent

   (b) Fast or slow

   (c) Hot or cold

   (d) Constant or unusual

5. The two most common types of chlorine disinfection by-products include:

   (a) TTHM and HAA5

   (b) TTHA of HMM5

(c) Turbidity and color

(d) Chloride and fluoride

6. GAC contactors are used to reduce the amount of _____ contaminants in water.

(a) Inorganic

(b) Turbidity

(c) Particle

(d) Organic

7. List the five types of surface water filtration systems.

(a) Bag filtration, cartridge filtration, fine filtration, coarse filtration, media filtration

(b) Conventional treatment, direct filtration, slow sand filtration, diatomaceous earth filtration, membrane filtration

(c) Turbidity filtration, color filtration, bag filtration, fine filtration, media filtration

(d) None of the above

8. Describe two primary methods used to control taste and odor?

(a) Oxidation and adsorption

(b) Filtration and sedimentation

(c) Mixing and coagulation

(d) Sedimentation and clarification

9. The adsorption process is used to remove:

(a) Organics or inorganics

(b) Bugs or salts

(c) Organisms or dirt

(d) Color or particles

10. The solid that adsorbs a contaminant is called the:

(a) Adsorbent

(b) Adsorbate

(c) Sorbet

(d) Rock

11. What is a method of reducing hardness?

(a) Softening

(b) Hardening

(c) Lightning

(d) Flashing

12. Bag and cartridge filters are used to remove which two pathogenic microorganisms?

(a) Viruses and giardia

(b) Giardia and cryptosporidium

(c) Viruses and bacteria

(d) None of the above

13. The process of cleaning a filter by pumping water up through the filter media is called _____ the filter.

(a) Backwashing

(b) Rewashing

(c) Purging

(d) Lifting

14. In a typical water treatment plant, alum would be added into the _____ mixer.

(a) Speed

(b) Large

(c) Slow

(d) Flash

15. When comparing conventional treatment with direct filtration, what process unit is in the conventional treatment plant that is not in the direct filtration plant?

(a) Filter

(b) Clarifier

(c) Mixer

(d) Detention

16. List the basic processes, in the proper order, for a conventional treatment plant.

(a) Coagulation, flocculation, sedimentation, filtration

(b) Flocculation, coagulation, sedimentation, filtration

(c) Filtration, coagulation, flocculation, sedimentation

(d) Coagulation, sedimentation, flocculation, filtration

17. The four most common oxidants include:

(a) Chlorine, potassium permanganate, ozone, chlorine dioxide

(b) Chlorides, soap, air, coagulants

(c) Air, chemicals, sodium, chloride

(d) Flocculants, coagulants, sediments, granules

18. When operating a filter, one of the operational concerns is the difference between the pressure or head on top of the filter and the pressure or head at the bottom of the filter. This difference is called _____ pressure.

(a) Different

(b) Differential

(c) High

(d) Low

19. What type of polymer is used to improve the efficiency of the sedimentation process?

(a) Cationic

(b) Nonionic

(c) Anionic

(d) All of the above

20. A(n) _____ polymer is commonly used as a coagulant.

(a) Anionic

(b) Cationic

(c) Nonionic

(d) Ionic

21. A(n) _____ polymer is used to enhance flocculation.

(a) Anionic

(b) Cationic

(c) Nonionic

(d) Ionic

22. Al2(SO4)3 • 18H20 is the chemical formula for:

(a) Alum

(b) Iron

(c) Manganese

(d) Lead

23. Particles that are less than 1 μm in size and will not settle easily and are called:

(a) Light particles

(b) Colloidal particles

(c) Colored particles

(d) Flat particles

24. The sedimentation portion of water treatment is also called a(n):

(a) Clarifier

(b) Filter

(c) Adsorber

(d) Water treater

25. Slowly agitating coagulated materials is the process of:

(a) Flocculation

(b) Coagulation

(c) Sedimentation

(d) Filtration

26. The process of decreasing the stability of colloids in water is called:

(a) Flocculation

(b) Coagulation

(c) Sedimentation

(d) Clarification

27. The chemical oxidation process in water treatment is typically used to aid in the removal of :

(a) Organic contaminants

(b) Inorganic contaminants

(c) Large contaminants

(d) None of the above

28. Flocculation, sedimentation, filtration, and adsorption are _____ processes.

(a) Physical

(b) Chemical

(c) Biological

(d) Mechanical

29. Oxidation, coagulation, and disinfection are _____ processes.

(a) Physical

(b) Chemical

(c) Biological

(d) Mechanical

30. A precipitate can be formed after which one of the following processes:

(a) Oxidation

(b) Flocculation

(c) Filtration

(d) Adsorption

31. Water that is safe to drink is called _____ water.

(a) Potable

(b) Palatable

(c) Good

(d) Clear

32. The type of organisms that can cause disease are said to be _____ microorganisms.

(a) Bad

(b) Pathogenic

(c) Undesirable

(d) Sick

33. The basic goal for water treatment is to _____.

(a) Protect public health

(b) Make it clear

(c) Make it taste good

(d) Get stuff out

34. Four types of aesthetic contaminants in water include the following:

(a) Odor, turbidity, color, hydrogen sulfide gas

(b) Pathogens, microorganisms, arsenic, disinfection by-products

35. What does mg/L stand for?

(a) Microorganisms/Liter

(b) Milligrams/Loser

(c) Milligrams/Liter

(d) None of the above

36. Disinfection by-products are a product of:

    (a) Filtration

    (b) Disinfection

    (c) Sedimentation

    (d) Adsorption

37. Acute contaminants are those that can cause sickness after:

    (a) Prolonged exposure

    (b) Low levels or low exposure

38. Chronic contaminants are those that can cause sickness after:

    (a) Prolonged exposure

    (b) Low levels or low exposure

39. TTHMs and HAA5s can affect:

    (a) Health

    (b) Aesthetics

    (c) Color

    (d) Odor

40. Oxidation, coagulation, and disinfection are _____ processes.

    (a) Physical

    (b) Chemical

    (c) Biological

    (d) Mechanical

41. Flocculation, sedimentation, filtration, and adsorption are _____ processes.

    (a) Physical

    (b) Chemical

    (c) Biological

    (d) Mechanical

42. A precipitate can be formed after which one of the following processes:

    (a) Oxidation

    (b) Flocculation

    (c) Filtration

(d) Adsorption

43. Giardia and cryptosporidium are a type of:

(a) Mineral

(b) Organism

(c) Color

(d) Bird

14. The chemical oxidation process in water treatment is typically used to aid in the removal of :

(a) Organic contaminants

(b) Inorganic contaminants

(c) Large contaminants

(d) None of the above

44. The process of decreasing the stability of colloids in water is called:

(a) Flocculation

(b) Coagulation

(c) Sedimentation

(d) Clarification

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(a) Flocculation

(b) Coagulation

(c) Sedimentation

(d) Filtration

46. The sedimentation portion of water treatment is also called a(n):

(a) Clarifier

(b) Filter

(c) Adsorber

(d) Water treater

47. Particles that are less than 1 μm in size and will not settle easily and are called:

(a) Light particles

(b) Colloidal particles

(c) Colored particles

(d) Flat particles

48. One micrometer is also equal to:

    (a) 0.1 mm

    (b) 0.0001 mm

    (c) 0.001 mm

    (d) 1 m

49. Particles less than 0.45 μm in size are considered to be:

    (a) Dissolved

    (b) Really little

    (c) Colored particles

    (d) Flat particles

50. Turbidity is measured as:

    (a) Mg/L

    (b) mL

    (c) gpm

    (d) NTU

51. Al2(SO4)3 • 18H20 is the chemical formula for:

    (a) Alum

    (b) Iron

    (c) Manganese

    (d) Lead

52. A(n) _____ polymer is commonly used as a coagulant.

    (a) Anionic

    (b) Cationic

    (c) Nonionic

    (d) Ionic

53. A(n) _____ polymer is used to enhance flocculation.

    (a) Anionic

    (b) Cationic

    (c) Nonionic

    (d) Ionic

54. The concentration of a chemical added to the water is measured in:

(a) mL

(b) mg

(c) mg/L

(d) Liters

55. The quantity of chlorine remaining after primary disinfection is called a _____ residual.

(a) Chlorine

(b) Permaganate

(c) Hot

(d) Cold

56. Primary disinfectants are used to _____ microorganisms.

(a) Hurt

(b) Inactivate

(c) Burn up

(d) Evaporate

57. Secondary disinfectants are used to provide a _____ in the distribution system.

(a) Color

(b) Chemical

(c) Smell

(d) Residual

58. What type of polymer is used to improve the efficiency of the sedimentation process?

(a) Cationic

(b) Nonionic

(c) Anionic

(d) All of the above

59. When operating a filter, one of the operational concerns is the difference between the pressure or head on top of the filter and the pressure or head at the bottom of the filter. This difference is called _____ pressure.

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(b) Differential

(c) High

(d) Low

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    (a) Coagulation, flocculation, sedimentation, filtration

    (b) Flocculation, coagulation, sedimentation, filtration

    (c) Filtration, coagulation, flocculation, sedimentation

    (d) Coagulation, sedimentation, flocculation, filtration

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    (a) Chlorine, potassium permanganate, ozone, chlorine dioxide

    (b) Chlorides, soap, air, coagulants

    (c) Air, chemicals, sodium, chloride

    (d) Flocculants, coagulants, sediments, granules

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    (c) Mixer

    (d) Detention

63. In a typical water treatment plant, alum would be added into the _____ mixer.

    (a) Speed

    (b) Large

    (c) Slow

    (d) Flash

64. The process of cleaning a filter by pumping water up through the filter media is called _____ the filter.

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    (b) Rewashing

    (c) Purging

    (d) Lifting

65. Bag and cartridge filters are used to remove which two pathogenic microorganisms?

    (a) Viruses and giardia

    (b) Giardia and cryptosporidium

    (c) Viruses and bacteria

(d) None of the above

66. List the five types of membrane filtration processes commonly used in water treatment.

(a) MCF, MF, UF, NF, and RO

(b) MNF, MOF, UOF, NOF, and ROO

(c) CFM, FM, FU, FN, and OR

(d) None of the above

67. What is a method of reducing hardness?

(a) Softening

(b) Hardening

(c) Lightning

(d) Flashing

68. Adsorption of a substance involves its accumulation onto the surface of a:

(a) Solid

(b) Rock

(c) Pellet

(d) Snow ball

69. The solid that adsorbs a contaminant is called the:

(a) Adsorbent

(b) Adsorbate

(c) Sorbet

(d) Rock

70. The adsorption process is used to remove:

(a) Organics or inorganics

(b) Bugs or salts

(c) Organisms or dirt

(d) Color or particles

71. Describe two primary methods used to control taste and odor?

(a) Oxidation and adsorption

(b) Filtration and sedimentation

(c) Mixing and coagulation

(d) Sedimentation and clarification

72. List the five types of surface water filtration systems.

    (a) Bag filtration, cartridge filtration, fine filtration, coarse filtration, media filtration

    (b) Conventional treatment, direct filtration, slow sand filtration, diatomaceous earth filtration, membrane filtration

    (c) Turbidity filtration, color filtration, bag filtration, fine filtration, media filtration

    (d) None of the above

73. GAC contactors are used to reduce the amount of _____ contaminants in water.

    (a) Inorganic

    (b) Turbidity

    (c) Particle

    (d) Organic

74. Greensand can be operated in either _____ regeneration or _____ regeneration modes.

    (a) Continuous or intermittent

    (b) Fast or slow

    (c) Hot or cold

    (d) Constant or unusual

75. What is the cause of taste and odor problems in raw surface water?

    (a) Copper sulfate

    (b) Blue-green algae

    (c) Oxygen

    (d) Lake turnover

76. What chemical reduces blue-green algae growth?

    (a) Chlorine

    (b) Caustic Soda

    (c) Copper Sulfate

    (d) Alum

77. What is the purpose of adding fluoride to drinking water?

    (a) Increase tooth decay

    (b) Reduce tooth decay

    (c) Make teeth white

    (d) Government conspiracy

78. The optimal coagulant dose is determined by a

    (a) Chlorine Test
    (b) Flocculation test
    (c) Jar Test
    (d) Coagulation test

79. The most common primary coagulant is

    (a) Alum
    (b) Cationic polymer
    (c) Fluoride
    (d) Anionic polymer

80. Bacteria and Viruses belong to a particle size known as

    (a) Suspended
    (b) Dissolved
    (c) Strained
    (d) Colloidal

81. The purpose of coagulation is to

    (a) Increase filter run times
    (b) Increase sludge
    (c) Increase particle size
    (d) Destabilize colloidal particles

82. The purpose of flocculation

    (a) Destabilize colloidal particles
    (b) Increase particle size
    (c) Decrease sludge
    (d) Decrease filter run times

83. Primary coagulant aids used in treatment process are

    (a) Poly-aluminum chloride
    (b) Aluminum sulfate
    (c) Ferric chloride
    (d) All of the Above

84. How do water agencies monitor the effectiveness of their filtration process?

    (a) Alkalinity
    (b) Conductivity
    (c) Turbidity
    (d) pH

85. Flocculation is used to enhance

    (a) Number of particle collisions to increase floc
    (b) Charge neutralization
    (c) Dispersion of chemicals in water
    (d) Settling speed of floc

86. If there is a problem with floc formation, what would you consider changing?

    (a) Adjust coagulant dose
    (b) Stay the course
    (c) Adjust mixing intensity
    (d) Both A & C

87. Which step in the treatment process is the shortest?

    (a) Filtration
    (b) Sedimentation
    (c) Flocculation
    (d) Coagulation

88. To lower the pH for enhanced coagulation the operator will add

    (a) Chlorine
    (b) Sulfuric acid
    (c) Lime
    (d) Caustic Soda

89. The flocculation process lasts how long?

    (a) Seconds
    (b) 5-10 minutes
    (c) 15-45 minutes
    (d) Over an hour

90. The function of a flocculation basin is to

    (a) Settle colloidal particles
    (b) Destabilize colloidal particles
    (c) Mix chemicals
    (d) Allow suspended particles to grow

91. The treatment process that involves coagulation, flocculation, sedimentation, and filtration is known as

    (a) Direct filtration
    (b) Slow sand Filtration
    (c) Conventional treatment
    (d) Pressure filtration

92. Sedimentation produces waste known as

    (a) Backwash water
    (b) Sludge
    (c) Waste water
    (d) Mud

93. What kind of process is the sedimentation step?

    (a) Physical
    (b) Chemical
    (c) Biological
    (d) Direct

94. The weirs at the effluent of a sedimentation basin are also called

    (a) Effluent weirs
    (b) Baffling
    (c) Launders
    (d) Spokes

95. Sedimentation is used in water treatment plants to

    (a) Settle pathogenic material
    (b) Destabilize particles
    (c) Disinfect water

(d) Reduce loading on Filters

96. Scouring is a term that describes conditions in a sedimentation tank which

(a) Could impact the rest of treatment process

(b) Higher flow rates in the sludge zone

(c) Re-suspends settle sludge

(d) All of the above

The four zones in a Sedimentation basin include

(a) Inlet, sedimentation, sludge, outlet

(b) Inlet, filter, waste, outlet

(c) Inlet, top, bottom, outlet

(d) Surface, sedimentation, sludge, outlet

97. The removal and inactivation requirement for Giardia is?

(a) 99.9%

(b) 99.99%

(c) 99.00%

(d) 90%

98. Short circuiting in a sedimentation basin could be caused by

(a) Surface wind

(b) Ineffective weir placement, or weirs covered in algae

(c) Poor baffling in sedimentation inlet zone

(d) All of the Above

99. How much solids should be removed during sedimentation?

(a) 95% or more

(b) 80 – 95%

(c) 70 – 80%

(d) 60 – 70%

100. The type of basin that includes coagulation and flocculation is

(a) Rectangular

(b) Triangular

(c) Up-Flow

(d) None of the above

101. Recarbonation basins are used to stabilize water after

(a) Filtration

(b) Disinfection

(c) Softening

(d) Coagulation

102. Which of the following is an effective way for removing iron water?

(a) adding baffles

(b) adding sodium chloride

(c) aeration and filtration

(d) flash mixing

103. How can iron bacteria be controlled in a water distribution system?

a. by aeration

b. filtration

c. chlorination

d. precipitation

104. Which of the following is a hazard when handling hydrofluosilicic acid?

a. fire

b. explosion

c. corrosion

d. inhalation

105. Trihalomenthane may be partially removed from water by:

a. fluoridation

b. chlorination

c. oxidation

d. ultraviolet radiation

106. Which of the following forms of iron is most soluble in water?

a. Ferric (Fe^{+3})

b. Ferric hydroxide [$Fe(OH_3)$]

c) Ferrous (Fe^{+2})

d. Ferrous oxide (FeO)

107. Two fundamental treatment requirements for public water systems using surface sources are a. Coagalat1on and sedimentation b. Lime softening and disinfection c. Filtration and aeration d. Disinfection and filtration

108. A zeolite softening unit will replace calcium and magnesium ions with _____ ions.
    a. Fluoride
    b. Iron
    c. Sodium
    d. Sulfur

109. One use of polyphosphates is to:
    a. Control algae
    b. Improve taste
    c. Sequester iron and manganese
    d. Kill bacteria

110. An acceptable means of corrosion control for relatively small systems is
    a. Activated carbon
    b. Lime-soda ash softening
    c. pH control
    d. zeolite softening

Disinfection

1. Disinfection by-products are a product of:

   (a) Filtration

   (b) Disinfection

   (c) Sedimentation

   (d) Adsorption

2. Chloramine is most effective as a _____ disinfectant.

   (a) Primary

   (b) Secondary

   (c) Third

   (d) First

3. Name the two types of hypochlorites used to disinfect water.

   (a) Chloride and monochloride

   (b) Sodium and calcium

   (c) Ozone and hydroxide

   (d) Arsenic and manganese

4. Name two methods commonly used to disinfect drinking water other than chlorination.

   (a) Ozone and ultraviolet light

   (b) Soap and agitation

   (c) Filtration and adsorption

   (d) Salt and vinegar

5. In order to determine the effectiveness of disinfection, it is desirable to maintain a disinfectant residual of at least _____ mg/L entering the distribution system.

   (a) 0.10

   (b) 0.5

   (c) 0.3

   (d) 0.2

6. Secondary disinfectants are used to provide a _____ in the distribution system.

   (a) Color

   (b) Chemical

   (c) Smell

(d) Residual

7. Primary disinfectants are used to _____microorganisms.

   (a) Hurt

   (b) Inactivate

   (c) Burn up

   (d) Evaporate

8. The quantity of chlorine remaining after primary disinfection is called a _____ residual.

   (a) Chlorine

   (b) Permaganate

   (c) Hot

   (d) Cold

9. The two most common types of chlorine disinfection by-products include:

   (a) TTHM and HAA5

   (b) TTHA of HMM5

   (c) Turbidity and color

   (d) Chloride and fluoride

10. In order to determine the effectiveness of disinfection, it is desirable to maintain a disinfectant residual of at least _____ mg/L entering the distribution system.

    (a) 0.10

    (b) 0.5

    (c) 0.3

    (d) 0.2

11. A _____ residual of chlorine is required throughout the system.

    (a) Large

    (b) High

    (c) Trace

    (d) Hot

12. The test used to determine the effectiveness of disinfection is called the:

    (a) Coliform bacteria test

    (b) Color test

    (c) Turbidity test

(d) Particle test

13. Name two methods commonly used to disinfect drinking water other than chlorination.

    (a) Ozone and ultraviolet light

    (b) Soap and agitation

    (c) Filtration and adsorption

    (d) Salt and vinegar

14. Name the two types of hypochlorites used to disinfect water.

    (a) Chloride and monochloride

    (b) Sodium and calcium

    (c) Ozone and hydroxide

    (d) Arsenic and manganese

15. Free chlorine can only be obtained after _____ point chlorination has been achieved.

    (a) Breakpoint

    (b) Fastpoint

    (c) Softpoint

    (d) Onpoint

16. The meaning of the "C" and the "T" in the term CT stands for:

    (a) Concentration and time

    (b) Color and turbidity

    (c) Calcium and tortellini

    (d) Chlorine and turbidity

17. Chloramine is most affective as a _____ disinfectant.

    (a) Primary

    (b) Secondary

    (c) Third

    (d) First

18. TTHMs and HAA5s can affect:

    (a) Health

    (b) Aesthetics

    (c) Color

    (d) Odor

19. The multiple barrier treatment approach includes

    (a) Sterilization and filtration

    (b) Disinfection and filtration

    (c) Disinfection and sterilization

    (d) Infection and filtration

20. The maximum disinfectant residual allowed for chlorine in a water system is

    (a) .02mg/L

    (b) 2.0mg/L

    (c) 3.0mg/L

    (d) 4.0mg/L

21. What is the disinfectant byproduct caused by ozonation?

    (a) Trihalomethanes

    (b) Bromate

    (c) Chlorite

    (d) No DBP formation

22. Haloacitic Acids are also known as

    (a) TTHM

    (b) HOCL

    (c) Chlorite

    (d) HAA5

23. What is the MCL for trihalomethanes?

    (a) .10mg/L

    (b) .06mg/L

    (c) .08mg/L

    (d) .12mg/L

24. What is the MCL for Haloacitic Acids?

    (a) 100ppb

    (b) 60ppb

    (c) 80ppb

    (d) 120ppb

25. What is the MCL for bromate?

    (a) .010mg/L

    (b) .020mg/L

    (c) .030mg/L

    (d) .040mg/L

26. What is residual Chlorine?

    (a) Chlorine used to disinfect

    (b) The amount of chlorine after the demand has been satisfied

    (c) The amount of chlorine added before disinfection

    (d) Film left on DPD kit to measure residual

27. When Chlorine reacts with natural organic matter in water it can create

    (a) Disinfectant by-products

    (b) Coliform bacteria

    (c) Chloroform

    (d) Calcium

28. What are trihalomenthanes classified as

    (a) Salts

    (b) Inorganic compounds

    (c) Volatile organic compounds

    (d) Radio

29. What disinfectant is used for emergency purposes and not utilized in the water treatment industry?

    (a) Chlorine

    (b) Iodine

    (c) Ozone

    (d) Chlorine Dioxide

30. What is the disinfectant with the least killing power but that has the longest lasting residual?

    (a) Chlorine

    (b) Ozone

    (c) Chlorine Dioxide

    (d) Chloramines

31. The active ingredient in household bleach is

    (a) Calcium hypochlorite

    (b) Calcium hydroxide

    (c) Sodium hypochlorite

    (d) Sodium hydroxide

32. Cryptosporidium is not resistant to this chemical

    (a) Ozone

    (b) Chlorine Dioxide

    (c) Chlorine

    (d) Both A & B

33. If a coliform test is positive, how many repeat samples are required at a minimum?

    (a) None

    (b) 1

    (c) 3

    (d) Depends on the severity of the positive sample

34. Your water system takes 75 coliform tests per month. This month there were 6 positive samples. What is the percentage of samples which tested positive? Did your system violate regulations?

    (a) 3% Yes

    (b) 5%No

    (c) 8% Yes

    (d) 10% No

35. The form of Chlorine which is 100% available chlorine is?

    (a) Sodium Hypochlorite

    (b) Calcium Hypochlorite

    (c) Calcium Hydroxide

    (d) Gaseous Chlorine

36. What is the minimum amount of chlorine residual required in the distribution system?

    (a) There is no minimum

    (b) mg/L

    (c) 0.2mg/L

(d) mg/L

37. What is the approximate pH range of sodium hypochlorite?

(a) 4-5

(b) 6-7

(c) $9 - 11$

(d) $12 - 14$

38. What is the typical concentration of sodium hypochlorite utilized by water treatment professionals?

(a) 5%

(b) 65%

(c) 100%

(d) 12.5%

39. Chlorine demand refers to

(a) Chlorine in the system for a given time

(b) The difference between chlorine applied and chlorine residual-usually caused by inorganics, organics, bacteria, algae, ammonia, etc.

(c) Chlorine needed to produce a higher pH

(d) None of the above

40. What is the most effective chlorine disinfectant?

(a) Dichloramine

(b) Trichloramine

(c) Hypochlorite Ion

(d) Hypochlorous acid

41. What can form when chlorine reacts with natural organic matter in source water?

(a) Disinfectant by-products

(b) Sulfur

(c) Algae

(d) Coliform bacteria

42. What kind of solution is used to check for a gas chlorine leak?

(a) Sodium hydroxide

(b) Ozone

(c) Ammonia

(d) Calcium hypochlorite

43. Chlorine is

(a) Heavier than air

(b) Lighter than air

(c) Brown in color

(d) not harmful to your health

44. Chlorine demand may vary due to

(a) Chlorine demand always stays the same

(b) Temperature

(c) pH

(d) Both B and C

45. What effect does high turbidity have on disinfection?

(a) It can increase chlorine demand

(b) It has no effect

(c) It gives the water a milky appearance that will clear out after some time

(d) You must increase the temperature of the water

46. What is the target chlorine:ammonia ratio?

(a) 2 : 1

(b) 3 : 1

(c) 4 : 1

(d) 5 : 1

47. What is the MCL for Nitrates?

(a) 1ppm

(b) 10ppm

(c) 5ppm

(d) None of the above

48. What is the molecular weight of Chlorine?

(a) 70

(b) 14

(c) 65

(d) 20

49. What disinfectant has the longest lasting residual?

(a) Ozone

(b) Chlorine

(c) Chloramine

(d) Chlorine Dioxide

50. What are some of the early indicators of Nitrification?

(a) Lowering chlorine residual

(b) Excess ammonia in treated water

(c) Raise in bacterial heterotrophic plate counts

(d) All of the above

51. What are THMs classified as?

(a) Turbidity

(b) Radiological

(c) Volatile Organic Chemicals

(d) Salts

52. What method can operators employ to combat nitrification?

(a) Lower residual chlorine target

(b) Keep reservoir levels static

(c) Minimize free ammonia in treated water

(d) Increase water age

53. How many times stronger is Chlorine compared to monochloramine?

(a) 250 times

(b) 20 times

(c) 1500 times

(d) 5 times

54. What chemicals are formed when chlorine is mixed with water?

(a) Hydrogen sulfide and ammonia

(b) DPD and carbon dioxide

(c) Sodium hypochlorite and calcium hypochlorite

(d) Hypochlorous acid and hydrochloric acid

55. Chlorine residual is measured in the field using the
    a. Electroconductivity method
    b. EDTA titrimetric method
    c. Ortho-tolidine colorimetric method
    d. DPD colorimetric method
    e. Differential pH method

56. In nitrification, bacteria consume excess ammonia in the water and produce
    a. Chloramines
    b. Free chlorine
    c. Urine
    d. Nitrite
    e. Sodium thiosulfate

57. Which of the following is a form of free chlorine?
    a. Nitrite
    b. Hypochlorous acid
    c. Monochloramine
    d. Hydrochloric acid
    e. Trichloramine

58. A distribution system operator measures a total chlorine residual of 1.25mg/L. How many points on the chlorine breakpoint curve may display this residual?
    a. Zero
    b. One
    c. Two
    d. Three
    e. Four

59. What is the chlorine dosage that must be applied when disinfecting a pipeline using the slug method?
    a. 300mg/L
    b. 100mg/L
    c. 50mg/L
    d. 25mg/L
    e. 6mg/L

60. Which of the following is a form of combined chlorine?
    a. Hypochlorite ion

b. Hypochlorous acid
c. Monochloramine
d. Hydrochloric acid
e. Free ammonia

61. A distribution system operator measures a total chlorine residual of 1.25mg/L, and a free chlorine residual of 1.15mg/L : This indicates that
a. The system is operating with a chloramine residual
b. The chlorine demand is 0.10mg/L
c. The chlorine demand is 2.40mg/L
d. Chloramines are being destroyed by free chlorine
e. The system is operating to the right of the breakpoint on the chloramine curve

62. Which of the following is the most desirable form of combined residual chlorine?
a. Hypochlorite ion
b. Hypochlorous acid
c. Monochloramine
d. Dichloramine
e. Trichloramine

63. Of the following, which is the most effective disinfectant?
a. Hypochlorite ion
b. Hypochlorous acid
c. Monochloramine
d. Dichloramine
e. Trichloramine

64. A field chlorine residual measurement shows no reading at one minute, but 2.1mg/L after three minutes. This indicates that
a. The field DPD test kit needs to be returned to the laboratory for maintenance
b. There is no chlorine residual
c. There is no free chlorine residual, but there are 2.1mg/L of chloramines
d. There is no combined residual, but the free chlorine residual is 2.1mg/L
e. The analyst should wait an additional three minutes and re-test

65. When disinfecting a storage tank, one method calls for the bottom 6% of the tank volume to be chlorinated for at least 6 hours with an applied chlorine dosage of
a. 50mg/L
b. 25mg/L
c. 6mg/L
d. 4mg/L
e. 0.2mg/L

66. Residual chlorine refers to

a. The amount of chlorine in the chlorinated water after several minutes
b. The chlorine needed to disinfect the water supply
c. The chlorine needed to produce floc in the water
d. The sludge in the bottom of the chlorine solution tank
e. None of the above

67. While handling sodium hypochlorite, proper safety precautions include a. Avoiding situations that could splash hypochlorite solution b. Using a face shield and/or goggles to avoid eye contact c. Minimizing skin contact with rubber gloves and/or protective clothing d. All of the above e. None of the above are necessary

68. The fusible plug that is in all chlorine containers
a. Is not necessary
b. May be used as a tap for the chlorine source
c. Should be removed after the cylinders are empty
d. Should never be removed or tampered with
e. Should be removed prior to withdrawing chlorine from the container

69. Sodium hypochlorite is a a. Compound purchased in liquid solution used for disinfection
b. Dry neutralizing powder for treating chlorine burns
c. Gas delivered in 100-pound, 150-pound, or one-ton containers
d. Salt that is formed when hydrochloric acid is neutralized with caustic soda
e. None of the above

70. The chlorine demand abruptly jumps in your source water. This may indicate that a. The water source has been contaminated b. Flow rates in the distribution system have increased
c. The hypochlorite solution used for disinfection has deteriorated
d. The hypochlorite solution tank is empty
e. The hypochlorite ion has a higher concentration than hypochlorous acid

71. The chemical compound typically found in chlorination tablets and granules is
a. Sodium hypochlorite
b. Sodium hydroxide
c. Sodium chloride
d. Calcium hypochlorite
e. Calcium hydroxide

72. The maximum rate of withdrawal of gas from a 150-pound chlorine cylinder in 24-hours is
a. 20 pounds
b. 40 pounds
c. 100 pounds
d. 150 pounds
e. None of the above

73. The maximum rate of withdrawal of gas from a one-ton chlorine container in 24-hours is
    a. 40 pounds
    b. 100 pounds
    c. 400 pounds
    d. One ton
    e. Variable, depending on chlorine dosage requirements

74. A chlorine leak can be detected by
    a. An explosimeter
    b. Checking the leak gauge
    c. Applying ammonia solution
    d. A tri-gas detector
    e. None of the above

75. When using the continuous feed method of disinfection, a new water main should be flushed, disinfected at 50mg/L, and held at above 25mg/L for at least
    a. 6 hours
    b. 12 hours
    c. 24 hours
    d. 36 hours
    e. 48 hours

76. If you encounter a liquid chlorine leak in a one-ton container, what action should you take first, to reduce the severity of the leak?
    a. Apply a caustic solution
    b. Apply an acidic solution
    c. Spray the container with water
    d. Spray the container with an ammonia solution
    e. Rotate the container to place the leak at the top

77. What should the chlorine dosage be to water that has a chlorine demand of 1.5mg/L, when a free residual of 1.0mg/L is desired?
    a. 0.5mg/L
    b. 1.0mg/L
    c. 1.5mg/L
    d. 2.5 pounds per day
    e. 2.5mg/L

78. When chlorine reacts with natural organic matter in the water, it is possible to form
    a. Disinfection by-products
    b. Arsenic
    c. MTBE
    d. Coliforms
    e. Synthetic organic compounds

79. Which of the following best describes the characteristics of chlorine when used for disinfection in drinking water?
    a. Colorless, flammable, heavier than air
    b. Greenish-yellow, nonflammable, lighter than air
    c. Greenish-yellow, flammable, lighter than air
    d. Greenish-yellow, nonflammable, heavier than air

80. Killing of pathogenic organisms in water treatment is called
    a. Disinfection
    b. Oxidätion
    c. Pasteurization
    d. Sterilization

81. Chlorine reacts with nitrogenous compounds to form
    a. Ammonia nitrate
    b. Free chlorine
    c. Chlorinated hydrocarbons
    d. Chloramines

82. Sodium Hypochlorite is
    a. A commercially available chlorine solution
    b. A commercially available dry chlorine compound
    c. Chlorine that is available in 100- and 150-pound cylinders
    d. A reaction product of chlorine and caustic soda

83. A hypochlorinator is
    a. Used to measure residual chlorine
    b. Used in the treatment of iron and turbidity
    c. Used to feed a liquid solution into a water supply
    d. Used to measure an adequate amount of chlorine gas into the supply

84. When calcium hypochlorite is used for disinfecting a water supply, it should be
    a. Dissolved in water, allowed to settle, and the supernatant siphoned off and fed into the water system
    b. Dissolved in water as a dry chemical then injected into the water system
    c. Fed as a dry chemical directly into the pipeline
    d. Fed as a dry powder into the clear well

85. The chlorine gas feed rate is usually controlled by adjusting the
    a. water flow to the injector
    b. valve on the chlorine cylinder
    c.pressure in the chlorine cylinder
    d. rotameter control valve

86. If disinfection is incomplete because the chlorine residual is in the hypochlorite ion form, what should you change to improve disinfection?
    a. Calcium
    b. Hardness
    c. pH
    d. alkalinity

87. Breakpoint chlorination is achieved when
    a. Free ammonia can be tasted in the water
    b. No chlorine residual is detected
    c. The strong chlorine tasted at the plant did not persist in the distribution system
    d. When chlorine dosage is increased, a corresponding increase in residual is detected

88. Because chlorine residual is related to the pH of the water, it may be said that
    a. A higher pH requires a higher chiorine residual
    b. A higher pH requires a lower chlorine residual
    c. A lower pH requires a higher chlorine residual
    d. pH has no effect on chlorine residual

89. As long as the temperature is steady, the pressure indicator on a chlorine cylinder will until all the chlorine has been gasified
    a. Remain steady
    b. Decrease slowly
    c. Decrease rapidly
    d. Increase slightly

90. When fresh, the typical concentration of sodium hypochlorite solution is
    a. 1.25%
    b. 6.5%
    c. 12.5%
    d. 65%
    e. variable, depending on the manufacturer

91. Chlorine in a dry form is called:
    a. hypochlorite
    b. hypochlorous
    c. hydrochlorite
    d. hydroxide

92. Which of the following procedures is done when preparing to disconnect a chlorine cylinder?
    a. close the cylinder valve first to allow time for the chlorine to be drawn off
    b. loosen the line to the tank and then shut off the valve to the chlorine cylinder
    c. shut off the water supply and allow sufficient time for the chloril1e to be drawn off
    d. tum the chlorinator feed rate valve off then turn the valve on the chlorinator cylinder

93. A vacuum is formed in the chlorinator by the:
    a chlorine cylinder pressure
    b. pressure differential through the ejector
    c. chlorine feed pump
    d. rotameter-

94. When calcium hypochlorite is used for disinfecting a water supply, it should be be:
    a. Dissolved in water, allowed to settle, and the supernatant siphoned off and fed into the water system
    b. Dissolved in water as a dry chemical then injected into the water system
    c. Fed as a dry chemical directly into the pipeline
    d. Fed as a dry powder into the clear well

95. Because chlorine residual is related to the pH of the water, it may be said that: a. A higher pH requires a higher chlorine residual
    b. A higher pH requires a lower chlorine residual
    c. A lower pH requires a higher chlorine residual
    d. A lower pH has no effect on chlorine residual

96. If disinfection is incomplete because the chlorine residual is in the hypochlorite ion form, what should one change to improve disinfection?
    a. Calcium
    b. Hardness
    c. pH
    d. Alkalinity

Distribution

1. The tensile strength of a pipe is its ability to
   a. Stretch or pull without breakage
   b. Resist internal pressure without breakage
   c. Resist external pressure without breakage
   d. Twist or bend without breakage
   e. Resist heating without breakage

2. The lowest point of the inside of a pipe is known as the
   a Pervert
   b. Soffit
   c. Invert
   d. Curb stop
   e. None of the above

3. A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is
   a. Polyvinyl chloride
   b. Cast iron
   c. Ductile iron
   d. Concrete cylinder
   e. Steel

4. An example of a pipe material that is relatively easy to locate underground is
   a. ABS
   b. PVC
   c. Polyethylene
   d. Reinforced concrete cylinder
   e. Asbestos-cement

5. _____ is a type of valve typically found in a storage tank of a water distribution system it closes to prevent the storage tank from overflowing when a pre-set level is reached
   a. Ball valve
   b. Altitude valve
   c. Gate valve
   d. Spring valve

6. _____ is a valve which opens by lifting a round or rectangular gate/ wedge out of the path of the fluid are designed to fully open or closed service
   a. Ball valve
   b. Spring valve
   c. Altitude valve
   d. Gate valve

7. A _____ is a form of quarter turn valve which uses a hollow perforated and pivoting to control flow through it and is a pivoted 90 degrees by the valve handle.
   a. Gate valve
   b. Spring valve
   c. Ball valve
   d. d. Altitude valve

8. The sudden closure of a check valve will result in
   a. water hammer
   b. flow reversal
   c. cavitation
   d. water aeration

9. A _____ located at the bottom end of suction pipe on a pump this valve opens when the pump operates to allow water to enter the suction pipe but closes when the pump shuts off water from flowing out of the suction pipe
   a. Check valve
   b. Foot valve
   c. Spring valve
   d. Ball valve

10. A valve that automatically shuts off flow into an elevated storage tank when the water level in the tank reaches a preset level is termed a(n)
    a. Gate valve
    b. Air/ vacuum relief valve
    c. Wet-barrel hydrant
    d. Altitude valve
    e. Angle valve

11. A normally buried valve located on a street water main and leading to a water service is known as
    a. Check valve
    b. Gate valve
    c. Corporation stop
    d. Altitude valve
    e. Butterfly valve

12. The risk of pipeline damage from water hammer can be reduced by
    a. Installation of gate valves
    b. Air release valves
    c. Repair of defective pipes
    d. Trimming pump impellers
    e. Rapid closing of pump discharge valves

13. The valve type most commonly used for isolation in a water distribution system is:

a. Gate valve
b. Air relief valve
c. Globe valve
d. Ball valve
e. Butterfly valve

14. The proper location for air relief valves is
    a. At low points along a pipeline
    b. At high points along a pipeline
    c. At the bottom of surge tanks
    d. At the mid-line of water storage reservoirs
    e. At the springline of a pipeline

15. From a sanitary standpoint, the pressure in a distribution system should never be allowed to fall to zero because
    a. low pressure allows bacteria to multiply.
    b. ground water may enter and back siphonage may occur.
    c. the chlorine residual will drop fast.
    d the main may collapse.

16. When fully open, which of the following will have the highest friction loss?
    a Gate valve
    b. Butterfly valve
    c. Globe valve
    d. Ball valve
    e. All will have about the same friction loss.

17. A nutating disc is found in certain:
    a. Centrifugal pumps
    b. Positive displacement pumps
    c. Main line valves
    d. Chemical feeder
    e. Water meters

18. The drain hole in a fire hydrant is designed to
    a. Release air upon closing the valve
    b. Relieve vacuum upon opening the valve
    c. Allow access for interior inspection
    d. Relieve excess water. pressure when closing the valve
    e. Remove water from the riser to prevent freezing

19. A typical installation site for a compound meter is
    a. Any small commercial business
    b. A common single location with as many as 12 separate customers

c. A large industrial user
d. Any location that requires the electronic monitoring of peak flows
e. A typical residential water flow meter

20. A main break may cause low pressure in the distributions system, which in turn may result in
a. Contamination of the system by backsiphonage
b. "ice" formation in the pipes
c. Increase in chlorine residual
d. Water hammer

21. Check valves are used to prevent
a. Excessive pump pressure
b. Priming
c. Water from flowing in two directions
d. Water hammer

22. The water table is defined as the
a. Pumping water level in a well
b. Upper surface of the groundwater
c. Water level in a reservoir
d. Bottom of the aquifer

23. To protect stored water from contamination, a ground storage reservoir should
a. Be totally airtight
b. Have both the overflow pipe and vent screened
c. Have cathodic protection
d. Have its interior surface coated with an AWWA-approved paint system

24. The peak capacity of water mains is often reduced by
a. High pressure
b. Looping
c. Tuberculation
d. Vacuum breakers

25. The least amount of head loss in a pipeline would be caused by a fully open
a. Angle valve
b. Check valve
c. Gate valve
d. Globe valve

26. The variation in water demand during the course of a day is termed
a. Seasonal variation
b. Fire flow requirements
c. Emergency storage variation

d. The straight line equalization method
e. Diurnal variation

27. The maximum momentary load placed on a water supply system is known as
    a. Average daily flow
    b. Average daily demand
    c. Rated capacity
    d. System float
    e. Peak demand

28. Elevated storage tanks are used primarily to
    a. Eliminate the need for continuous pumping
    b. Minimize variations in the system water pressures
    c. Reduce auxiliary power requirements
    d. Provide a considerable amount of water for storage
    e. Protect against backflows

29. A valve that automatically shuts off flow into an elevated storage tank when the water level in the tank reaches a preset level is termed a(n)
    a. Gate valve
    b. Air / vacuum relief valve
    c. Wet-barrel hydrant
    d. Altitude valve
    e. Angle valve

30. Because pipe materials come into contact with drinking water, they must conform with
    a. Primary drinking water standards
    b. Secondary drinking water standards
    c. Surface water treatment rule
    d. NSF - National Sanitation Foundation
    d. ANSI/NSF Standard 61′
    e. All of the above

31. An example of a pipe material that is difficult to locate underground is
    a. Mortar lined and coated steel
    b. Reinforced concrete cylinder
    c. Ductile iron
    d. Asbestos-cement
    e. Steel

32. Pipe with a " C " factor of 140 is regarded as having $a(n)$
    a. Extremely smooth interior
    b. Extremely rough interior
    c. Extremely high corrosion resistance

d. Extremely low corrosion resistance
e. A purple color

33. A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is
a. Polyvinyl chloride : PVC
b. Cast iron
c. Ductile iron
d. Concrete cylinder
e. Steel

34. An example of a pipe material that is relatively easy to locate underground is
a. ABS
b. PVC
c. Reinforced concrete
d. Asbestos-cement

35. Sleeve-type and "victaulic" couplings are the most common forms of
a. Mechanical couplings
b. Welded joints
c. Asbestos-cement pipe fittings
d. PVC pipe fittings
e. Flanged joints

36. If possible, a water main leak should be repaired under pressure to
a. Prevent contamination of the water line
b. Prevent flooding of basements
c. Save repair time
d. Use fewer materials
e. All of the above

37. When is the best time to perform a distribution main flushing program?
a. During night hours, to minimize traffic and other customer concerns
b. During weekday day shift hours, to minimize overtime costs
c. During Summer months, due to high system velocities
d. During Spring months, prior to high system demands of Summer
e. None of the above

38. An system for the prevention of corrosion is called
a. Water hammer
b. Reverse osmosis
c. Diurnal variation
d. A foot valve
e. Cathodic protection

39. What category of meters is exemplified by propeller and turbine types?
    a. Differential pressure
    b. Positive displacement
    c. Mass flow
    d. Velocity

40. The hydraulic grade line in a pipeline is normally determined by
    a. Reading pressure gauges
    b. Checking for backflow
    c. Opening fire hydrants on each loop of the system
    d. Using a leak detector
    e. A venturi meter

41. The slope of the hydraulic grade line is due to
    a. Well elevations
    b. Elevations of storage facilities
    c. Pumping
    d. Backflows
    e. Friction loss

42. A normally buried valve located on a street water main and leading to a water service is known as a
    a. Check valve
    b. Gate valve
    c. Corporation stop
    d. Altitude valve
    e. Butterfly valve

43. The risk of pipeline damage from water hammer can be reduced by
    a. Installation of gate valves
    b. Air release valves
    c. Repair of defective pipes
    d. Trimming pump impellers
    e. Rapid closing of pump discharge valves

44. A venturi is a device used to
    a. Increase water flow
    b. Decrease water flow
    c. Regulate water flow
    d. Stop or start water flow
    e. Measure water flow

45. The most commonly used meter on small diameter domestic service is the
    a. Venturi meter
    b. Propeller meter

c. Orifice plate meter
d. Compound meter
e. Nutating disc meter

46. The valve type most commonly used for isolation in a water distribution system is the
a. Gate valve
b. Air relief valve
c. Globe valve
d. Ball valve
e. Butterfly valve

47. The proper location for air relief valves is
a. At low points along a pipeline
b. At high points along a pipeline
c. At the bottom of surge tanks
d. At the mid-line of water storage reservoirs
e. At the springline of a pipeline

48. When fully open, which of the following will have the highest friction loss?
a. Gate valve
b. Butterfly valve
c. Globe valve
d. Ball valve
e. All will have about the same friction loss.

49. Which of the following is a device used to measure flow?
a. Baffle
b. Diversion box
c. Stop logs
d. Weir
e. None of the above

50. A compound meter is a device which
a. Is installed to allow automated meter reading
b. Can be installed to measure water use by as many as 12 separate customers
c. Provides accurate readings over a wide range of flows
d. Electronically records peak flows, as a demand meter does for electricity
e. Is a typical residential water flow meter

51. Magnetic flow meters and ultrasonic flow meters are well suited to measure flow rates of water with a large concentration of suspended solids, because they have
a. The best accuracy of any meters
b. No parts within the flow stream
c. Easily accessed cleanout ports

d. Simple recalibration procedures
e. All of the above

52. A nutating disk is found in certain
a. Centrifugal pumps
b. Positive displacement pumps
c. Main line valves
d. Chemical feeders
e. Water meters

53. The most common valve in a water distribution system is the
a. Gate valve
b. Air relief valve
c. Globe valve
d. Ball valve
e. Butterfly valve

54. The drain hole in a fire hydrant is designed to
a. Release air upon closing the valve
b. Relieve vacuum upon opening the valve
c. Allow access for interior inspection
d. Relieve excess water pressure when closing the valve
e. Remove water from the riser to prevent freezing

55. A typical installation site for a compound meter is
a. Any small commercial business
b. A common single location with as many as 12 separate customers
c. A large industrial user
d. Any location that requires the electronic monitoring of peak flows
e. A typical residential water flow meter

56. An example of a pressure-differential type water meter is a
a. Venturi meter
b. Propeller meter
c. Nutating disk meter
d. Magnetic flow meter
e. Utrasonic flow meter

57. When closing a hydrant, it should be
a. Closed rapidly to minimize water loss
b. Closed slowly to reduce surges
c. Closed using a standard valve key
d. Closed using a standard pipe wrench
e. Closed at the street valve and left slightly open at the hydrant valve

58. Dry-barrel fire hydrants have their operating valves
    a. In the base
    b. In the head
    c. Either of the above, depending on the manufacturer
    d. In the street several feet away from the riser
    e. None of the above

59. An example of a valve that has a 90 degree travel is a:
    a. Butterfly valve
    b. Plug valve
    c. Ball valve
    d. All of the above
    e. None of the above

60. The valve type most commonly found on the discharge of a pump or well, and installed to prevent reverse flows is the
    a. Gate valve
    b. Check valve
    c. Globe valve
    d. Butterfly valve
    e. Ball or Plug valve

61. Features that impact the " C " factor for measuring friction in pipelines include
    a. Pipe length
    b. Pipe type
    c. Number of valves
    d. Type of valves
    e. All of the above

62. An abnormal flow condition caused by a difference in water pressures is known as:
    a. Backflow
    b. Reverse osmosis
    c. Peak demand
    d. Fire flow
    e. Minimum daily requirement

63. "Backflow Device" is a term used to describe a device that
    a. connects three inlet lines with one outlet line
    b. lets air into valve vaults
    c. prevents flow of potentially contaminated source into a drinking water supply
    d. tests for oxygen deficiency in valve vaults
    e. prevents backflow of water through an out-of-service pump

64. A cross-connection means

a. Four pipelines tied together
b. A T-shaped tool
c. A connection between potable water and "unapproved" water supplies
d. A backflow caused by negative pressure
e. A connection between two or more pressure zones

65. Egress is normally required (per OSHA guidelines) for trenches of what minimum depth?
a. 4-feet
b. 5 -feet
c. 6 -feet
d. 7-feet
e. 8-feet

66. A backflow prevention device that can be used in any cross-connection situation is a
a. Pressure vacuum breaker
b. Single check valve
c. Double check valve
d. Reduced pressure zone device
e. Atmospheric vacuum breaker

67. A backflow prevention device that is designed for intermittent use in situations where there is no backpressure, such as toilet flush valves and lawn sprinkler systems is a
a. Pressure vacuum breaker
b. Single check valve
c. Double check valve
d. Reduced pressure zone device
e. Atmospheric vacuum breaker

68. A completely fail-safe means of backflow prevention is
a. Atmospheric vacuum breaker
b. Pressure vacuum breaker
c. Air gap
d. Check valve
e. Double check valve

69. Two hydraulic conditions can induce backflow. These are backsiphonage and _____
a. Peak flow
b. Diurnal flow
c. Faulty solenoid valves
d. Back pressure
e. Fire flow

70. When using the continuous feed method of disinfection, a new water main should be flushed, disinfected at 50mg/L, and held at above 25mg/L for at least

a. 6 hours
b. 12 hours
c. 24 hours
d. 36 hours
e. 48 hours

71. To properly disinfect a water main after new construction, you should:
a. apply 50 mg/l chlorine for 24 hours.
b. clean the pipe out' with a pig and then disinfect at 10 mg/1 for 24 hours
c. use a 10% solution of calcium chloride
d don't use them main for one week

72. From a sanitary standpoint. the pressure in a distribution system should never be allowed to fall to zero because:
a. low pressure allows bacteria to multiply
b. ground water may e:oter and back siphonage may occur
c. the chlorine residual will drop faster
d. the main may collapse

73. The primary purpose of pressure-reducing valves between water system pressure zones is to
a. Minimize surge
b. Reduce downstream pressure
c. Control flows
d. Reduce upstream pressure

74. Because pipe materials come into contact with drinking water, they must conform with
a. Primary drinking water standards
b. Secondary drinking water standards
c. Surface water treatment rule
d. ANSI/NSF Standard 61
e. All of the above

75. An example of a: pipe material that is difficult to locate underground is
a. Mortar lined and coated steel
b. Reinforced concrete cylinder
c. Ductile iron
d. Asbestos-cement
e. Steel

76. A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is:
a. Polyvinyl chloride
b. Cast iron
c. Ductile iron

d. Concrete cylinder
e. Steel

77. Sleeve-type and "victaulic" couplings are the most common forms of
a. Mechanical couplings
b. Welded joints
c. Asbestos-cement pipe fittings
d. PVC pipe fittings
e. Flanged joints

78. The tensile strength of a pipe is its ability to
a. Stretch or pull without breakage b. Resist internal pressure without breakage
c. Resist external pressure without breakage
d. Twist or bend without breakage
e. Resist heating without breakage

79. When is the best time to perform a distribution main flushing program?
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b. Check valve
c. Globe valve
d. Butterfly valve
e. Ball or Plug valve

87. Features that impact the "K" factor for measuring friction in pipelines include
a. Pipe length
b. Pipe type
c. Number of valves
d. Type of valves
e. All of the above

88. A potable water supply discharges into an irrigation water storage tank. The 3-inch potable supply line should be terminated
a. Above the tank overflow by at least two pipe diameters
b. Above the tank outlet by at least two pipe diameters
c. Below the tank outlet by at least two pipe diameters
d. Level with the tank outlet
e. Level with the tank overflow

89. A backflow prevention device that is designed for intermittent use in situations where there is no backpressure, such as toilet flush valves and lawn sprinkler systems is a
a. Pressure vacuum breaker

b. Single check valve
c. Double check valve
d. Reduced pressure zone device
e. Atmospheric vacuum breaker

90. A completely fail-safe means of backflow prevention is
a. Atmospheric vacunm breaker
b. Pressure vacuum breaker
C. Air gap
d. Check valve
e. Double check valve

91. Back-siphonage is defined as:
a. Back flow that occurs when a vacuum exists.
b. Increase in pressure.
c. Interconnection between the plumbing systems in the building and water supply.
d. Open end of a water supply through which water is discharged in the plumbing fixture.

92. A venturi tube increases the velocity and decreases the pressure as water flows through it, This type of tube is used to measure the: ·
a. Amount of chlorine in the water.
b. Amount of turbidity in the water.
c. Rate of aeration.
d. Rate of water flowing through it.

93. A venturi meter measures flow of a fluid in a pipe based upon the:
a. Difference in pressure between a constricted and a fill size portion of the pipe,
b. Electronic measurement
c. Velocity of the fluid past a given point.
d. Weight of the fluid

94. Valves are provided in a distribution system to
a. Detect any safety hazards.
b. Detect weak links in the system.
c. Isolate small areas for maintenance and emergency conditions.·
d. Reduce costs of maintenance.

95. A connection that is made into a main that is under pressure is called a:
a. Cross connection
b. Dry Tap
c. Wet Tap
d. Valve Box

96. Because it permits flow in only one direction, which valve would help you determine the direction of the fluid flow?

a. Butterfly valve
b. Check Valve
c. Pressure valve
d. Gate valve

97. The size of water mains, pumping stations, and storage tanks is primarily determined by:
a. Maximum day demand during a 24 hr. period during the previous year.
b. Population served
c. Per-capita water use
d. Fire protection requirement

98. Firefighting may cause low pressure in an area of the distribution system. This low pressure might lead to:
a. contamination of the system by back-siphonage
b. ice formation in the pipes
c. loss of chlorine residual
d. None of the above

Pumping

1. Vertical turbine pumps that are used in wells may be oil-lubricated or water-lubricated. Operators should use extreme care not to start any water-lubricated pump before making sure that the:
   a. Valve on discharge side is open.
   b. Bearings are dry.
   c. Valve on suction side is closed.
   d. Bearings are wet.

2. The head against which a pump must operate:
   a. Is the sum of the static head and the head due to friction loss.
   b. Must always be above the shut-off head.
   c. Is the static head.
   d. Is the friction head.

3. What term describes the condition that exists when the source of the water supply is below the centerline of the pump?
   a. Pressure head
   b. Velocity head
   c. Suction lift
   d. Total discharge head

4. What is the most common use today for a positive-displacement pump?
   a. Raw water intake pump
   b. System booster pump
   c. Chemical feed pump
   d. Filter feed pump

5. A pumping condition where the eye of the impeller is above the water is called?
   a. Dry Well
   b. Suction Head
   c. Wet Well
   d. Suction Lift

6. The force used in an End-suction pump is called
   a. Pressure
   b. Centrifugal
   c. Velocity
   d. Kinetic

7. _____ is the loss of energy as a result of friction.
   a. Velocity loss
   b. Headloss
   c. Elevation Loss
   d. Pump Loss

8. As the water travels around the volute towards the discharge line the total energy shifts from
   a. High Velocity Head to low PSI b. Low Velocity Head to high PSI c. Low Velocity Head to low PSI d. High Velocity Head to high PSI

9. The part that in an End Suction pump that is used to collect the liquid discharged from the impeller is called?
   a. Shaft
   b. Packing
   c. Suction Head
   d. Volute

10. Head is the energy that a body has by virtue of its position or state.
    a. Velocity
    b. Potential
    c. Kinetic
    d. Pressure

11. An impeller that has no shrouds and used to pump fluid with large objects is called?
    a. Semi-open
    b. Open
    c. Closed
    d. Very-closed

12. A pump station design where the eye of the impeller is submerged in water is called?
    a. Dry Well
    b. Suction Head
    c. Wet Well
    d. Suction Lift

13. The discharge valve on a pump can be closed for short periods of time or during start up.
    a. Piston
    b. Progressive Cavity
    c. Diaphragm
    d. dynamic

14. Velocity of a pump is measured in:
    a. Inches per second
    b. PSI
    c. Feet per second
    d. Yards per second

15. An impeller that has shrouds on both sides and is used to pump fluid with little or no objects is called?
    a. Semi-open

b. Open
c. Closed
d. Very - closed

16. To change the discharge of displacement you have to change the:
    a. Speed
    b. Discharge valve
    c. Suction valve
    d. Rotation

17. Which pump component prevents leakage from the pump discharge to the suction?
    a. Lantern ring
    b. Volute
    c. Wear ring
    d. Shaft sleeve

18. Mechanical seals are being installed in pumps because
    a. packing requires an undesirable leakage that seals eliminate.
    b. seals prevent cross connections with potable water.
    c. seals will take more shaft misalignment than packing.
    d. there is a shortage of good packing available on the market.

19. A major cause of pump and motor shaft coupling wear is:
    a. discharge pressure too high.
    b. low suction pressure.
    c. misalignment between pumps and motor flanges.
    d. worn-out seal.

20. The discharge rate of a piston-type pump:
    a. Is constant as the main drive rpm changes
    b. Is constant at a constant speed
    c. Varies inversely with the head
    d. Varies with the total dynamic head

21. The flow of electrical current is measured in
    a. Amperes
    b. Ohms
    c. Volts
    d. Watts

22. An operator hears a pinging sound coming from the pump. What is the probable cause?
    a. Descaling
    b. Cavitation
    c. Corrosion
    d. Hardness

23. During a routine inspection on a centrifugal pump, the operator notices that the bearings are excessively hot. This is most likely caused by:
    a. Over lubrication
    b. The speed being too slow
    c. A worn impeller
    d. A worn packing

24. The-leakage of seal-wateraround-the-packing on a centrifugal pump is required because it acts as a(n)
    a. Adhesive
    b. Coolant
    c. Corrosion inhibitor
    d. Scale inhibitor

25. What can happen to a pump if the back pressure on the pump is allowed to drop too low and the pump is operated for a prolonged period of time?
    a. Efficiency would drop off and the pump would heat up
    b. No water would flow
    c. Pump lubricants would disperse more efficiently
    d. Water hammer would occur upstream in the distribution line

26. At a pumping station equipped with centrifugal pumps, what can cause the discharge pressure to suddenly increase and the discharge quantity to suddenly decrease?
    a. A discharge valve was closed
    b. A suction valve was closed
    c. The pump amperage was decreased
    d. The voltage was suddenly increased

27. The component of a centrifugal pump sometimes installed on the end of the suction pipe in order to hold priming is the
    a. Casing
    b. Foot valve
    c. Impeller
    d. Lantern ring

28. The difference between water levels upstream and downstream of a pump when it is not in operation is known as the
    a. Suction lift
    b. Total dynamic head
    c. Discharge head
    d. Friction loss
    e. Total static head

29. Static suction head plus friction suction head plus static discharge head plus friction discharge head is a pump's
    a. Pump curve
    b. Operating pressure
    c. Efficiency
    d. Total dynamic head
    e. Velocity head

30. Pumps are primed to
    a. Replace air inside the pump with water
    b. Seat the valves
    c. Wet the packing
    d. Provide water for flow testing
    e. Overcome positive suction head

31. Backspin is occurring after well shutdown; this indicates
    a. A high water table
    b. A low water table
    c. A confined aquifer
    d. A faulty check valve
    e. A leak in the sanitary seal

32. A water seal on a pump serves many purposes, including
    a. Acts as a coolant to keep the pump bearing from overheating
    b. Keeps gritty material from entering the packing box
    c. Keeps the pumps primed
    d. Is a reserve water supply
    e. Prevents cavitation

33. Enclosed, open, and semi-closed are terms used for the designation and selection of:
    a. Impellers
    b. Lantern rings
    c. Sleeves
    d. Stuffing boxes
    e. None of the above

34. A device that converts electrical energy into mechanical or kinetic energy is called a
    a. Motor
    b. Generator
    c. Transformer
    d. Battery
    e. Pump

35. If a pump sounds like it is pumping rocks, the most likely cause is

a. Cavitation
b. Corrosion
c. Over-tightening of the packing gland
d. Misalignment with the motor
e. Irregular wear of the mechanical seal

36. The flow of electrical current is measured in
a. Amperes
b. Volts
c. Watts
d. Ohms
e. Farads

37. The rotating element in a centrifugal pump is commonly called the
a. Fan
b. Impeller
c. Rotor
d. Volute
e. Stator

38. The purpose of the packing in a centrifugal pump is
a. Comparable to a bearing and is impregnated with lubricant
b. To prevent vibration of the shaft
c. To provide support for the impeller
d. To surround the bearings and lubricate them
e. None of the above

39. Which of the following is a positive displacement pump?
a. Air lift pump
b. Centrifugal pump
c. Reciprocating pump
d. Turbine pump
e. All of the above

40. The practical maximum suction lift for a centrifugal pump in good condition is
a. 0 feet
b. 2.31 feet
c. 14.7 feet
d. 20 feet to 25 -feet
e. 32-feet to 34-feet

41. The linkage between a centrifugal pump and its motor is commonly called the
a. Coupling
b. Impeller

c. Bearings
d. Volute
e. Stator

42. The electrical equivalent to friction in water lines is
a. Voltage
b: Resistance
c. Amperage
d. Capacitance
e. Inductance

43. The main water-containing body of a centrifugal pump is commonly called the
a. Shaft
b. Impeller
c. Bearings
d. Volute
e. Stator

44. A type of pump that produces high flow rates with low discharge heads is a
a. Radial flow
b. Axial flow
c. Vertical turbine
d. Piston
e. Mixed flow

45. Alternating current is produced by
a. A single battery
b. Two (or more) batteries in series
c. Two (or more) batteries in parallel
d. A solenoid
e. A generator

46. What do electrical transformers do?
a. Step-up or step-down current
b. Step-up or step-down voltage
c. Increase power output
d. Decrease power output
e. Reduce resistance

47. An "Open" electrical circuit is one in which
a. Resistance is low
b. Power production is high
c. Capacitance is low
d. Conductivity is high

e. Amperage is zero

48. Adding more stages (bowls) to a deep well turbine pump assembly will
    a. Increase the pump discharge capacity
    b. Decrease the pump discharge capacity
    c. Increase the pump discharge pressure
    d. Decrease the pump discharge pressure
    e. None of the above

49. When installing packing in a centrifugal pump, the packing should be
    a. Water tight
    b. Pre-heated
    c. Staggered 90°
    d. Soaked overnight in potable water
    e. Re-used

50. Standard electrical line frequency in the United States is
    a. 50 Hz
    b. 60 Hz
    c. 110 Hz
    d. 120 Hz
    e. 240/480 Hz

51. In contrast to conventional packing, mechanical seals
    a. Require no adjustment
    b. Do not leak
    c. Are generally more expensive
    d. Are more difficult to remove/replace
    e. All of the above

52. The level of water in a reservoir is 200 feet above the main line that carries water into and out of the reservoir. A standpipe in the main line a block away at the same elevation as the reservoir shows a water elevation of 185 feet. Which of the following statements is true?
    a. There is no flow into or out of the reservoir
    b. Water is flowing into the reservoir
    c. Water is flowing out of the reservoir
    d. There is a pump station adjacent to the pressure gauge
    e. Nothing can be deduced from the information in this question.

53. Pump motors draw more power starting than during normal operating conditions because:
    a. check valves have to be pushed open
    b. energy is required to get the water moving
    c. the motor and pump have to start turning
    d. all of the above

54. Which of the following does not affect the friction loss in a given length of pipe?
    a. hardness of the water
    b. number of fittings
    c. roughness of the interior of the pipe
    d. velocity of the flow

55. The component of a centrifugal pump sometimes installed on the end of the suction pipe in order to hold priming is the:
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    c. Impeller
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    d. The voltage was suddenly increased

57. The inlet to the pump is called:
    a. Suction
    b. Volute
    c. Impeller
    d. Effluent

58. The rotating element in a centrifugal pump is commonly called a(n):
    a. Fan
    b. Impeller
    c. Rotor
    d. Volute

59. Pumps are primed to:
    a) be sure the pump operates freely
    b) replace air with water inside the pump
    c) seat the valves ·
    d) wet the packing
    e) none of the above

60. The joints in the rings of pump packing should be:
    a) placed in line b) placed next to the motor
    c) placed next to pump
    d) staggered
    e) none of the above

61. A vertical turbine pump is an example of a : a) centrifugal pump b) parshall flume c) positive displacement pump
    d) reciprocating pump
    e) all of the above

62. Which type of pump is most commonly used for high capacity wells? a) air lift
    b) centrifugal
    c) positive displacement
    d) plunger
    e) none of the above

Safety

1. What federal law is designed to protect the safety and health of operators?
   A. OSHA
   B. FMLA
   C. FLSA
   D. ADEA

2. What are the two most important safety concerns when entering a confined space?
   A. Corrosive chemicals and falls
   B. Bad odors and claustrophobia
   C. Extreme air temperatures and slippery surfaces
   D. Oxygen deficiency and hazardous gases

3. Which document provides a profile of hazardous substances?
   A. CERCLA
   B. SARA
   C. CFR
   D. MSDS

4. What is the purpose of a pump guard?
   A. Allows operators to turn off pump in emergency situations
   B. Notifies operators of excessive temperatures
   c. Allows operators to pump against a closed discharge valve
   D. Protects operators from rotating parts

5. Atmosphere is considered oxygen deficient when the oxygen level is below
   A. 21.5%
   B. 20%
   C. 19.5%
   D. 17%

6. Employee hazards include
   A. Noxious or toxic gases or vapors
   B. Oxygen de

   ciency
   C. Physical injuries
   D. All of the above

7. Before entering a permit-required confined space, you must:
   A. Check the atmosphere with a calibrated gas detector.
   B. Make notification that personnel are entering the space.
   C. Lock out and tag out all equipment.
   D. All of the above.

8. When making a sulfuric acid dilution, the appropriate method is:
   A. Add the water to the acid.
   B. Add the acid to the water.
   C. Add both at the same time.
   D. None of the above.

9. When manually lifting any object, be sure to
   A. Hold it at arm's length.
   B. Keep your back bent and hold it low.
   C. Keep it close to your body and use leg strength.
   D. Keep your knees locked and bend at the waist.

10. What is the proper slope of a ladder?
    A. Every 4 feet up the ladder is 1 foot out from the wall.
    B. Every 5 feet up the ladder is 1 foot out from the wall.
    C. Every 6 feet up the ladder is 1 foot out from the wall.
    D. Every 7 feet up the ladder is 1 foot out from the wall.

11. When working on a chemical feed pump, what of the following is not required?
    A. Nitrile gloves.
    B. Safety glasses.
    C. Leather work gloves.
    D. Full face shield.

12. When must the atmosphere of a confined space be tested?
    A. Only before a worker enters
    B. Never, if adequate ventilation exists
    C. Continuously
    D. Only if welding or painting is being performed

13. Some gases in a confined space can be:
    A. Colorless
    B. Odorless
    C. Deadly
    D. All of the above

14. Why should you contact other area companies with underground utilities before starting an underground repair job?
    a. To determine if there have been recent excavations in that location
    b. To ask these companies to mark the location of their utilities in the area of the repair job
    c. To see if they also have excavating to do in the area
    d. To see if they will help route traffic while you are doing the repair job

15. The only acceptable breathing device to wear while handling chlorine leaks is the

a. Activated carbon canister type
b. Potassium tetroxide canister type
c. Self-contained breathing apparatus
d. Oxygen supply apparatus

16. It is essential to ventilate a vault before entry in order to
a. Remove excessive moisture
b. Equalize temperature and pressure
c. Eliminate foul odors
d. Remove dangerous gasses

17. Permit-required confined space entry requires
a. Bright orange jackets, rubber boots, and gloves
b. Safety harness and a lifeline
c. Tool belts with flashlight attached
d. Utility belts with a full complement of tools

18. During a confined space entry, how often must the confined space be monitored for hazardous atmospheres?
a. Continuously
b. Every five minutes
c. Before entry only
d. Before entry and then once per hour during entry

19. Which of the following is the most likely to be a fuel involved in a Class A fire?
a. Butane
b. Magnesium
c. Electrical equipment
d. Gasoline
e. Paper and/or fabrics

20. In an occupied trench where exits (i.e., ladders) are required, what is the maximum allowed travel distance between an occupant and the nearest exit?
i. 25 feet
b. 50 feet
c. 100 feet
d. At the discretion of the safety officer
e. None of the above

21. Standard first aid procedures direct that the first step to control bleeding is to
a. Apply a tight tourniquet
b. Apply pressure directly to the wound
c. Let it bleed until natural clotting takes place
d. Wash wound and bandage

e. None of the above

22. When excavating materials that will not stand in a vertical position, the most suitable form of shoring is
    a. Air shores
    b. Hydraulic shores
    c. Screw jacks
    d. Solid sheeting
    e. Cleats

23. A potable water supply discharges into an irrigation water storage tank. The 3-inch potable supply line should be terminated
    a. Above the tank overflow by at least two pipe diameters
    b. Above the tank outlet by at least two pipe diameters
    c. Below the tank outlet by at least two pipe diameters
    d. Level with the tank outlet
    e. Level with the tank overflow

24. Which of the following gases is toxic at the lowest concentration?
    a. Carbon dioxide
    b. Hydrogen sulfide
    c. Methane
    d. Nitrogen
    e. Oxygen

25. Entry into an atmosphere with high concentrations of chlorine gas requires
    a. A self-contained breathing apparatus
    b. An approved and uncontaminated canister mask
    c. Forced ventilation of the work area
    d. Atmospheric testing with ammonia solution prior to entry
    e. Rubber gloves and a full-face shield

26. Shoring is normally required (per OSHA guidelines) for trenches of what minimum depth?
    a. 4-feet
    b. 5-feet
    c. 6-feet
    d. 7-feet
    e. 8-feet

27. First aid for first-degree burns is to
    a. Bandage tightly
    b. Cover liberally with salve
    c. Pack in ice
    d. Submerge the burned area in cold water

e. All of the above

28. What information must be on a warning tag attached to a locked-out switch?
    a. Directions for removing the tag
    c. Signature of the person who locked out the switch and who will remove it
    d. Time to unlock the switch
    e. None of the above

29. A confined space that contains a material that has the potential for engulfing an entrant is
    a. A transition zone
    b. A permit space
    c. Prohibited by OSHA
    d. Required to undergo atmospheric testing with ammonia solution prior to entry
    e. S Required to use a complete "A" suit for personal protective equipment

30. What condition must exist for an area to be considered a confined space?
    a. Limited or restricted means of entry or exit
    b. Is large enough for a person to enter and perform work
    c. Is not designated for continuous occupancy
    d. All of the above
    e. None of the above

31. Which of the following is the most likely to be a fuel involved in a Class C fire?
    a. Butane
    b. Magnesium
    c. Paper and/or fabrics
    d. Gasoline
    e. Electrical equipment

32. Which of the following is the most likely to be a fuel involved in a Class B fire?
    a. Wood
    b. Magnesium
    c. Electrical equipment
    d. Gasoline
    e. Paper and/or fabrics

33. The angle of repose is the angle of the slope of a
    a. Sewer
    b. Graded and/or cut ground elevation
    c. Trench excavation
    d. Unsupported loose soil
    e. Filled and compacted ground elevation

34. At least 48 hours prior to conducting excavations in locations where other utilities may be present, whom should you notify?

a. WARN
b. USA
c. AWWA
d. DHS
e. EPA

35. Which of the following compounds emits a "rotten egg" odor?
a. Hydrogen sulfide
b. Chorine dioxide
c. Chloramines
d. Hydrochloric acid
e. Hypochlorous acid

36. Where is the best place to store a self -contained breathing apparatus (SCBA)?
a. inside a cabinet in the chlorinator room
b. in an unlocked cabinet outside the chlorinator room
c. locked in a cabinet in the office
d. locked in a cabinet just outside the chlorinator room

37. Which of the following is a hazard when handling hydrofluosilicic acid?
a. fire
b. explosion
c. corrosion
d. inhalation

38. Which of the following chemical substances ii most likely to cause corrosion or deterioration of metal and concrete surfaces
a. carbon dioxide
b. ethanol
c. methane
d. hydrogen sulfide

39. An employee ls caught in a room where ch1orine gas is leaking. He has no SCBA, he should
a. lay down on the floor and quickly crawl out of the room
b. walk out of the room quickly
c. pull shirt over mouth and face and quickly walk out of the room
d. keep mouth closed, head as high as possible, and quickly walk out of the room holding breath.