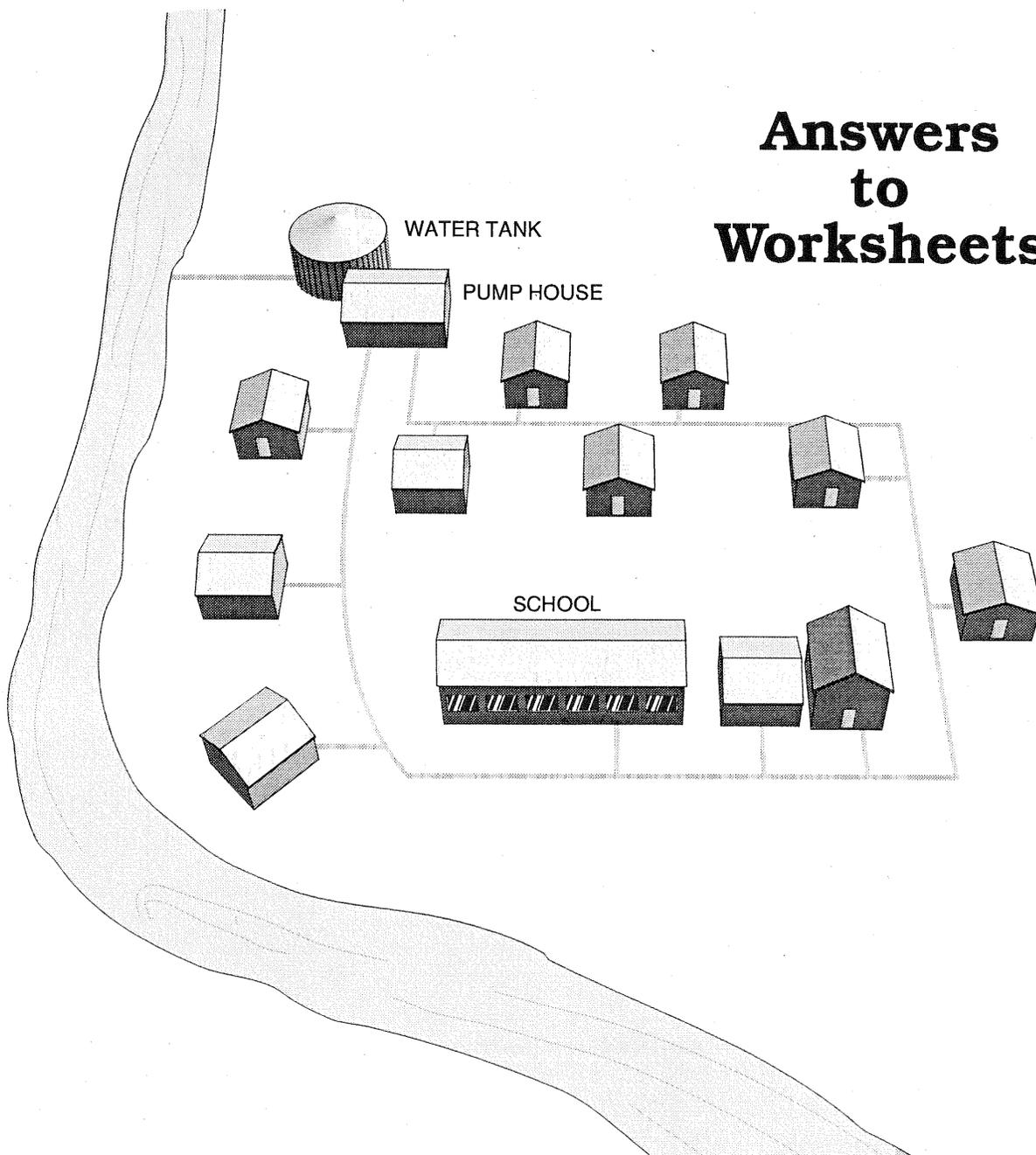


O & M of Small Water Systems

Answers to Worksheets



O & M of Small Water Systems

Answers to Worksheets

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O & M OF SURFACE WATER SOURCES

Worksheet

1. A water use agreement is between the water purveyor and the
 - a. US Forest Service
 - b. Bureau of Land Management
 - X c. Land owners
 - d. Loggers that are working in the area
 - e. Mine owners

2. What is the name used to describe information that is gathered to determine the activity level in a watershed and water quality of a stream.
 - a. Sanitary Survey
 - b. Water Quality Data
 - c. Watershed use and quality data
 - X d. Baseline data
 - e. Background information

3. The area of a watershed is measured in what units?
 - a. Square townships
 - b. Townships and ranges
 - X c. Acres
 - d. Square feet
 - e. Acre feet

4. The height of water in a stream is called:
 - a. Steam depth
 - X b. Stream stage
 - c. Stream Velocity
 - d. Stream Discharge
 - e. Stream magnitude

5. Good vegetation cover in a watershed will:
 - a. Reduce the quantity of water in the stream
 - b. Increase the turbidity in a stream
 - X c. Reduce the impact of precipitation on water quality
 - d. Allow the water in the stream to evaporate at an accelerated pace
 - e. Keep birds out of the stream

O & M of Small Water Systems

6. Nutrients can be carried out of the soil and into the water by:

- a. Birds
- b. Wildlife
- X c. Runoff
- d. Groundwater movement
- e. Removing logs

7. A surveying system used in the United States divides the land into rectangles. The vertical lines in this survey are called the:

- a. Vertical line
- b. Latitude
- c. Baseline
- d. Great survey line
- X e. Meridian

8. A section of land contains _____ acres.

- a. 120
- b. 240
- c. 360
- X d. 640
- e. 840

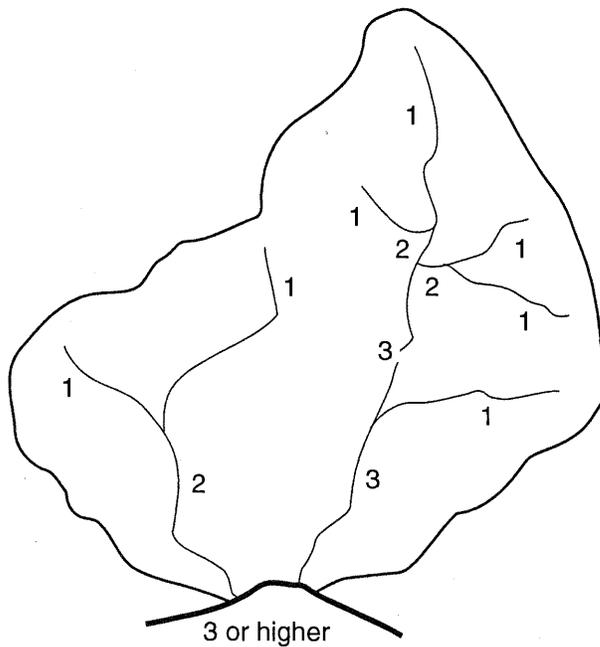
9. The description of a parcel of land,

- a. is given starting with the largest portion and then working into the actual location
- b. is given by starting with the location and working outward to the prime meridian.

10. The numbering of streams on a map is called:

- X a. ordering the streams
- b. counting the streams
- c. baseline criteria
- d. numbering the streams
- e. stream numbers

11. On the map below order the streams



12. A stream that flows all year long is called a _____ stream.

- a. Perennial
- b. Intermittent
- c. Ephemeral

13. The quantity and size of material on the bottom of a stream is called the _____

- a. Stream bottom
- b. Benthics
- c. Hypolimnion
- d. Epilmnion
- e. Bedload

14. A watershed is composed of 210 acres. If 20 % of a 0.6 inch hydrological event runs into the stream, how many gallons are in the runoff?

- a. 731,808 gallons
- b. 648,240 gallons
- c. 5,473,923 gallons
- d. 12,229 gallons
- e. 14,620 gallons

O & M of Small Water Systems

15. The height of water above a weir plate is called the _____.
- _____ a. Drawdown
 - _____ b. Napp
 - _____ c. Aeration
 - _____ d. Staff gage
 - X _____ e. Head
16. Water is flowing at 1.2 ft per second through a 12 inch wide and 16 inch deep flume. The depth of water in the flume is 6 inches. What is the flow in cfs?
- _____ a. 1.6 cfs
 - X _____ b. 0.6 cfs
 - _____ c. 230 cfs
 - _____ d. 0.4 cfs
 - _____ e. 86.4 cfs
17. The city has a water right for 1.5 cfs from a stream. How many gallons per minute is this?
- _____ a. 299 gpm
 - _____ b. 450.5 gpm
 - X _____ c. 674 gpm
 - _____ d. 11.2 gpm
 - _____ e. 743 gpm
18. Organisms that are found under the rocks in a stream bottom and can be used as indicators of water quality are called _____.
- X _____ a. Benthics
 - _____ b. Coliform bacteria
 - _____ c. Algae
 - _____ d. Flagellates
 - _____ e. Free swimming ciliates
19. The material found in water that is not water are called _____.
- _____ a. Contamination
 - _____ b. Pollution
 - _____ c. Organic
 - _____ d. Inorganics
 - X _____ e. Constituents

20. To determine the desired level of hardness in a raw water supply the test results should be compared to _____.

- a. AWWA standards
- X b. Water Quality Criteria
- c. Existing water quality standards
- d. SDWA
- e. APWA standards

21. When a body of water stratifies due to thermal differences the bottom layer is called the

- a. Thermocline
- b. Benthics
- X c. Hypolimnion
- d. Epilmnion
- e. Bedload

22. One acre-foot of water contains how many cubic feet?

- a. 7,48 ft³
- b. 325,829 ft³
- c. 16, 450 ft³
- X d. 43,560 ft³
- e. 5,824 ft³

23. A common chemical used as an algaecide in drinking water reservoirs is commonly called blue stone. What is the correct name for this material?

- a. Aluminum sulfate
- b. Soda Ash
- X c. Copper sulfate
- d. Sodium Hexametaphosphate
- e. Potassium permanganate

24. How many gallons of water are in a reservoir that covers 8 acres and averages 10 feet in depth?

- a. 80 million gallons
- b. 598,000 gallons
- c. 5.4 million gallons
- d. 43,560 gallons
- X e. 26 million gallons

O & M of Small Water Systems

25. Which of the following could be considered a confined space?

X ____ a. Infiltration gallery caisson

X ____ b. Spring box

X ____ c. Roof catchment

X ____ d. Valve pit

X ____ e. Intake collection box

WORKSHEET

O & M OF WELLS

1. Which strata would be the most likely to produce high quantities of water?

- a. Clay
- b. Consolidated
- c. Confined
- X d. Unconsolidated
- e. Basalt

2. The following is a list of material found in a bore hole. Identify which is a description of the largest particle.

- a. Clay
- X b. Gravel
- c. Sand
- d. Silt
- e. Fine Sand

3. Rocks that are formed from heat and pressure are called:

- a. Sedimentary
- b. Igneous
- x c. Metamorphic

4. Artesian well is primarily found in a _____ aquifer.

- a. Sedimentary
- b. Artesian
- c. Unconfined
- X d. Confined
- e. Any

5. The most desirable type of aquifer for a community water supply is the _____ aquifer.

- a. Sedimentary
- b. Artesian
- c. Unconfined
- X d. Confined
- e. Any

6. A well placed in a water table aquifer would most likely be classified as _____.

- X _____ a. GUDISW
- _____ b. Confined aquifer
- _____ c. Flowing artesian aquifer
- _____ d. Groundwater
- _____ e. Surface water

7. The ratio of pores to total volume of a section of an aquifer is called _____.

- _____ a. Permeability
- _____ b. Specific Yield
- _____ c. Specific Retention
- x _____ d. Porosity
- _____ e. Transmissibility

8. The ability of an aquifer to pass water is called _____.

- X _____ a. Permeability
- _____ b. Specific Yield
- _____ c. Specific Retention
- _____ d. Porosity
- _____ e. Transmissibility

9. The slope of the cone of depression is primarily influenced by _____.

- _____ a. Porosity
- _____ b. Motor size
- _____ c. Diameter of the well
- X _____ d. Transmissibility
- _____ e. Distance to the recharge area

10. The area inside the cone of depression is called, _____.

- _____ a. Cone area
- _____ b. Recharge area
- X _____ c. Zone of influence
- _____ d. Transmissibility area
- _____ e. Specific Yield zone

11. The _____ , the water level in the well prior to the start of the pump.

- X _____ a. Static level
- _____ b. Drawdown level
- _____ c. Standing level
- _____ d. Specific Capacity
- _____ e. Pre-pumping level

12. The the two most common methods of constructing municipal wells are?

- _____ a. Driven
- _____ b. Dug
- X _____ c. Rotary bit
- _____ d. Bored
- X _____ e. Percussion

13. Wells that are called deep wells are basically drilled in what type of aquifer?

- x _____ a. Confined
- _____ b. Unconfined
- _____ c. Water table
- _____ d. Community
- _____ e. Deep

14. In Alaska the casing on a public water system well must extend _____ above the ground.

- _____ a. 2 feet
- _____ b. 18 inches
- x _____ c. 1 foot
- _____ d. 28 inches
- _____ e. 6 inches

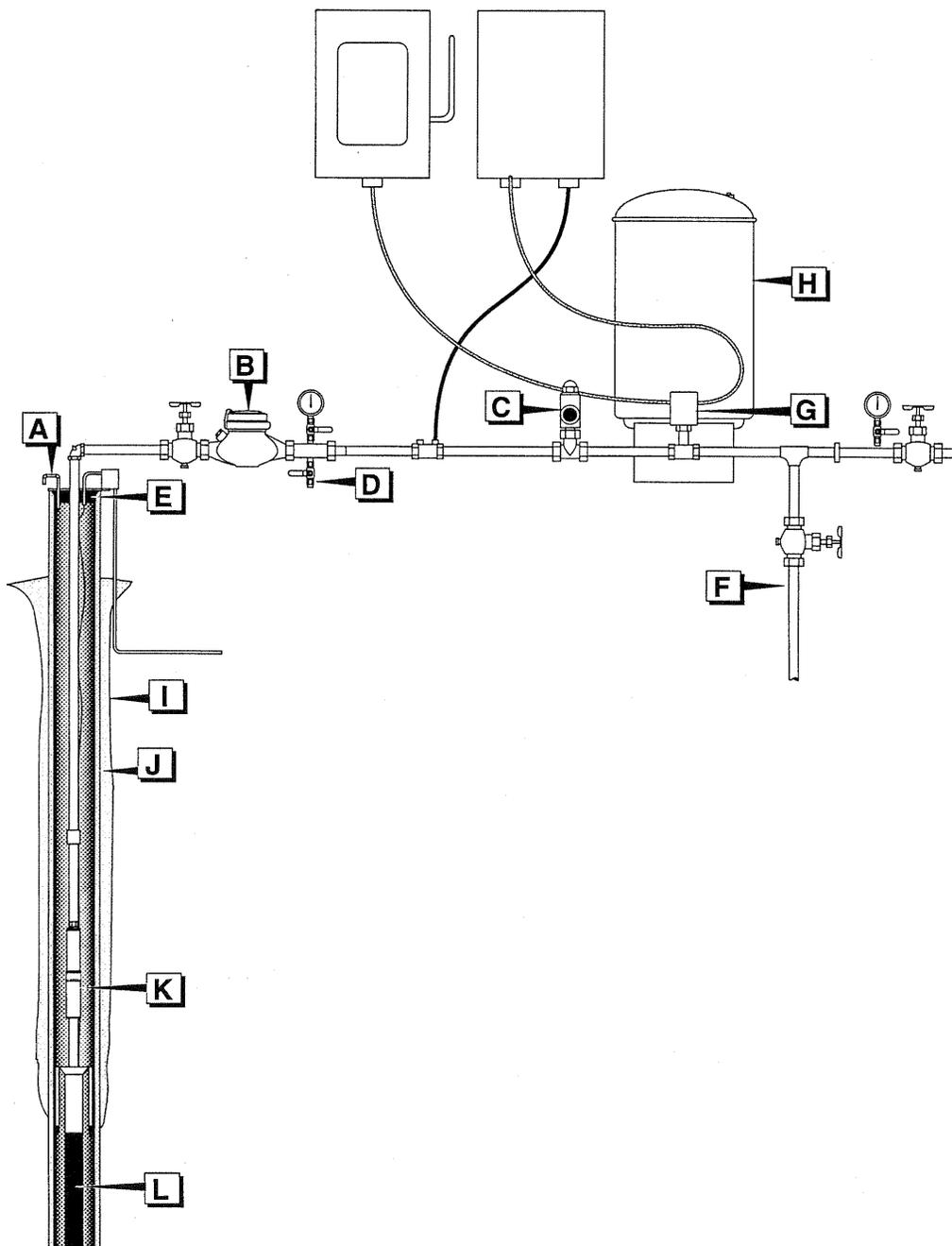
15. In Alaska, how many feet of grout must there be between the casing and the bore hole on a public water system.

- _____ a. 4 feet
- _____ b. there is no requirement, the well must be grouted only enough to assure the casing is held in place
- X _____ c. 10 feet
- _____ d. 25 feet
- _____ e. To the end of the first joint of the casing

O & M of Small Water Systems

16. The drawing below is composed of three wells. Identify the components indicated by matching them with the list provided.

- | | |
|-------------------------|------------------------------|
| I ____ Grout | A ____ Vent |
| J ____ Casing | D ____ Sample tap |
| E ____ Sanitary seal | B ____ Flow meter |
| K ____ Submersible pump | H ____ Pressure tank |
| G ____ Pressure Switch | F ____ Pump to waste line |
| L ____ Well screen | C ____ Pressure relief valve |



17. Public water systems in Alaska must have a concrete pad poured around the well head. How far must this pad extend from the well head?

- a. 5 feet
- b. 2 feet
- x c. 10 feet
- d. 20 feet
- e. 12 feet

18. How far down must the casing in a well used by a public water system in Alaska must extend?

- a. 20 feet
- b. 10 feet
- c. 3 feet into the confining aquifer
- d. 5 feet
- X e. 3 feet into bedrock

19. Why should there be an air vent in the casing of a well?

- a. Prevent water hammer
- b. Prevent air from entering the system
- c. Allow excessive air that is released from the water to exit the casing
- X d. Prevent collapse of the well casing
- e. Reduce the possibility of premature failure of the pump

20. A sanitary seal is placed on a well to _____.

- x a. prevent contamination
- b. prevent excess air from entering the well
- c. protect the electrical connections
- d. protect the motor from sudden drawdown
- e. reduce the run time of the electric motor

21. A wide body globe valve is often installed on the discharge of a lineshaft turbine pump. What is the function of the valve?

- a. Prevent air intrusion
- b. Protect the well from contamination
- c. Prevent water from running back down the casing
- X d. Reduce water hammer
- e. Prevent the pump motor from reversing direction

O & M of Small Water Systems

22. The gauge on the discharge of a well pump serves what purpose?
- a. Used to calculate specific capacity
 - b . Used to calculate transmissibility
 - X c. Evaluate the pump operating condition
 - d. Give the operator something useful to do
 - e. Tell when it is to replace the packing in the pump
23. A "Spider" bearing is found on what type of pumping installation?
- a. Pitless adapter
 - X b. Water lubricated lineshaft turbine
 - c. Submersible pump
 - d. Suction lift pumping conditions
 - e. Spider pumps
24. When referring to the motor used on a lineshaft turbine, the terms VHS and VSS are often used. What component are these terms referring to?
- a. Pitless adapter
 - b. Different impeller types
 - c. Different types of pumping units
 - X d. The motors
 - e. The type of bearings used on the column shaft of a lineshaft turbine
25. The electric device used to protect the building and its wiring in case of an electrical short is the _____.
- X a. Magnetic breaker
 - b. Transformers
 - c. Contactors
 - d. Magnetic starter
 - e. Motor heaters
26. With a groundwater supply, the process of identifying potential sources of contamination and developing a plan of action on how to deal with these sources of contamination is called....
- a. Contamination survey
 - b. Sanitary survey
 - x c. Well head protection program
 - d. Recharge survey
 - e. Federal well recharge area protection program

27. For a Class A water system in Alaska septic tanks must be at least _____ feet from the well.

- a. 50 feet
- b. 20 feet
- X c. 200 feet
- d. 100 feet
- e. 150 feet

28. 27. For a Class A water system in Alaska, buried fuel not specifically used for heating, must be at least _____ feet from the well.

- a. 50 feet
- b. 20 feet
- X c. 200 feet
- d. 100 feet
- e. 150 feet

29. For a Class A water system in Alaska, community sewer lines must be at least _____ feet from the well.

- a. 50 feet
- b. 20 feet
- X c. 200 feet
- d. 100 feet
- e. 150 feet

30. For a Class A water system in Alaska, roads should be _____ feet from the well.

- a. 50 feet
- b. 20 feet
- c. 200 feet
- X d. 100 feet
- e. 150 feet

31. For a Class A water system in Alaska, above ground fuel used of on-site emergency pumping equipment must be _____ feet from the well.

- a. 50 feet
- b. 20 feet
- c. 200 feet
- X d. 100 feet
- e. 150 feet

O & M of Small Water Systems

32. The presence of algae in a well supply would most likely classify the water sources as.....

- a. Groundwater supply
- b. A Class B groundwater supply
- c. A Class C groundwater supply
- X d. GUDISW
- e. Groundwater supply at step 4 with special provisions

33. Use the following data to calculate specific capacity of a well.

- The pressure at the start of the test was 10 psi
- The pressure at the end of the test was 18 psi
- The flow at the start was 145 gpm and the totalizer read 2,456,200 gallons
- The flow at the end of a 30 minute test was 95 gpm and the totalizer was 2,459,700 gallons

- | | |
|---|--|
| <input type="checkbox"/> a. 1.4 gpm/ft | Calculations for question 33 |
| <input type="checkbox"/> b. 0.25 gpm/ft | 18 psi - 10 psi = 8 psi |
| X <input checked="" type="checkbox"/> c. 0.6 gpm/ft | 8 psi ÷ 0.433 psi/ft = 18.5 feet |
| <input type="checkbox"/> d. 2.67 gpm/ft | 2459700 - 2456200 = 3,500 gallons ÷ 30 min = 116.7 gpm |
| <input type="checkbox"/> e. 33.7 gpm/ft | 116.7 gpm ÷ 18.5 feet = 0.6 gpm/ft |

34. Why is it operationayl sound to collect raw water quality data from a groundwater sources?

- a. If the regulations change you can be ahead of the game
- b. The engineer may need the data
- X c. Reduce the possibility of costly emergencies
- d. Allows the operator to know just how much water is available
- e. There is no reason, it is just a good idea

35. The oil in the motor of a lineshaft turbine should be changed every _____.

- X a. Year
- b. Month
- c. Quarter
- d. Week
- e. Two months

36. How often should the Specific Capacity of a well be checked. (The desirable frequency not the absolute minimum).

_____ a. Yearly

_____ b. Monthly

X _____ c. Quarterly

_____ d. Weekly

_____ e. Every two months

O & M OF PRESSURE FILTERS

WORKSHEET

1. The difference between conventional filtration and direct filtration is a direct filtration system does not have a _____.

- a. Flocculation chamber
- b. Chemical feed system
- X c. Sedimentation chamber
- d. Surface wash system
- e. Influent control valve

2. One method that has been successful in the removal of color in cold waters is to add a special coagulant called a _____.

- a. Iron salt
- b. Lime
- c. Soda Ash
- d. nonionic sulfur
- X e. Polymer

3. When turbidity shows up in the finished water prior to the end of the filter run the most probable cause is.....

- X a. Breakthrough
- b. Underfeeding alum
- c. Excessive mud balls in filter media
- d. The lack of proper coagulation
- e. Low water temperatures

4. Alum is another name for

- a. Ferric Sulfate
- b. Alkalinity
- c. Soda Ash
- X d. Aluminum Sulfate
- e. Sodium Aluminate

5. A pressure filter should be backwashed when the headloss is between ____ and ____ psi.

- X ____ a. 6 and 9
- ____ b. 1 and 5
- ____ c. 8 and 10
- ____ d. 6 and 12
- ____ e. 10 and 15

6. A multimedia filter contains which three medias?

- X ____ a. Silica sand
- ____ b. Coal
- ____ c. Fine gravel
- X ____ d. Garnet sand
- X ____ e. Anthracite coal

7. A typical pressure filter has a media bed that is ____ to ____ inches deep.

- ____ a. 12 to 24 inches
- ____ b. 48 to 54 inches
- ____ c. 36 to 60 inches
- ____ d. 24 to 60 inches
- X ____ e. 24 to 42 inches

8. Typical filtration rates for pressure filters are between ____ and ____ gpm/ft²

- ____ a. 1 to 5
- X ____ b. 2 to 4
- ____ c. 3 to 6
- ____ d. 1.5 to 4
- ____ e. 4 to 8

9. Typical backwash rates on pressure filters should be between ____ and ____ gpm/ft².

- X ____ a. 15 to 17
- ____ b. 2 to 4
- ____ c. 10 to 20
- ____ d. 6 to 15
- ____ e. 9 to 12

O & M of Small Water Systems

10. Identify the valves and piping on the pressure filter below by matching the numbers with the list provided.

D ____ Influent

H ____ Finished water

B ____ Waste line

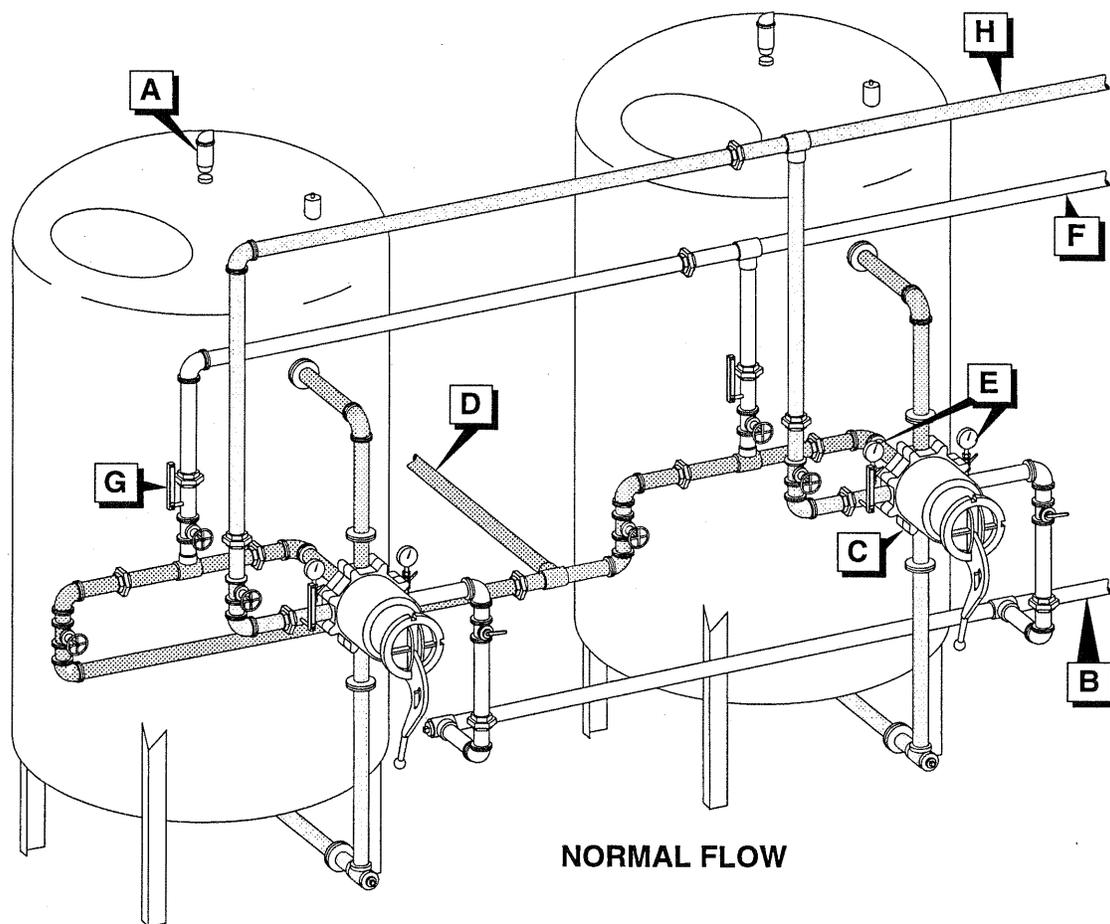
F ____ Backwash supply

C ____ Control valve

A ____ Vent

E ____ Headloss gauges

G ____ Flow indicator



11. There are two pressure filters each four feet in diameter. The flow rate is 120 gpm. What is the filtration rate?

_____ a. 2.4

_____ b. 6.8

_____ c. 1.5

_____ d. 3.8

X _____ e. 4.8

12. There are two pressure filters each four feet in diameter. What would the backwash pumping rate be if it were necessary to backwash the filter at 17 gpm/ft²?

- a. 55
- b. 107
- X c. 214
- d. 321
- e. 86

13. What type of breathing protection is required when handling alum?

- a. Dust mask
- b. Full face cartridge respirator
- c. SCBA
- d. None
- X e. Cartridge dust mask

14. The two most common chemicals used in small water treatment plants are alum and soda ash. Both are a powder. Which is the most hazardous to handle.

- X a. Alum
- b. Soda Ash

15. Which is the recommend material for handling a fire associated with alum?(Mark the most correct answer (s))

- a. Dry chemical
- b. CO₂
- c. Halon
- d. Water
- X e. All of the above

16. When using a polymer as a primary coagulant the most common dosage range is between _____ and _____ mg/L.

- a. 4 and 10
- b. 17 and 24
- c. 0.1 and 0.4
- X d. 1 and 5
- e. 12 and 20

O & M of Small Water Systems

17. 50 pounds of alum was placed into a 50 gallon container to make 45 gallons of solution. Find the concentration of the solution in percent.

- a. 6%
- X b. 13%
- c. 25%
- d. 95%
- e. 54 %

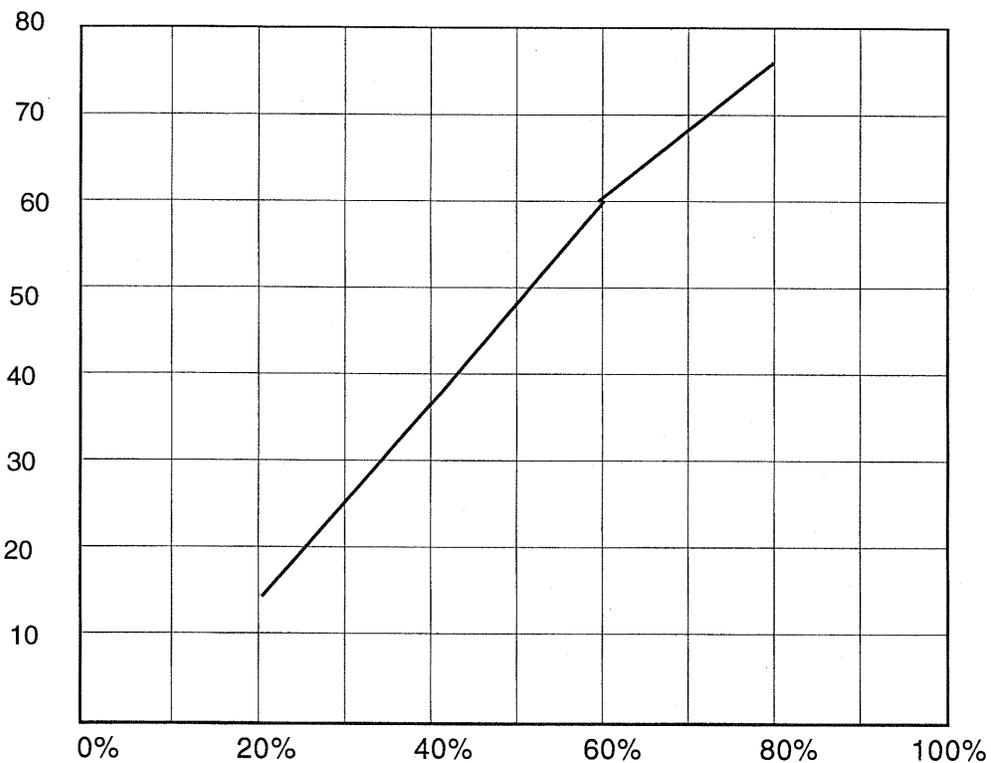
18. 12 gallons of a 8% solution was pumped into a flow of 34,000 gallons.

- a. 13 mg/l
- b. 17 mg/l
- c. 21 mg/l
- d. 3 mg/l
- X e. 28 mg/l

19. Complete the last column and develop a curve for the following chemical feed pump calibration data.

20% Frequency - based on 2 minute samples

Stroke	Start level	Stop level	mL	ml/min
20%	1000	993	32	16 _____
40%	985	947	76	38 _____
60%	920	860	120	60 _____
80%	800	724	152	76 _____



20. A typical backwash should take approximately _____ min.

_____ a. 5 min

_____ b. 30 min

X _____ c. 15 min

_____ d. 45 min

_____ e. 4 min

O & M OF GRAVITY FILTERS

WORKSHEET

1. The difference between conventional filtration and direct filtration is a direct filtration system does not have a _____.

- a. Flocculation chamber
- b. Chemical feed system
- X c. Sedimentation chamber
- d. Surface wash system
- e. Influent control valve

2. One method that has been successful in the removal of color in cold waters is to add a special coagulant called a _____.

- a. Iron salt
- b. Lime
- c. Soda Ash
- d. Nonionic sulfur
- X e. Polymer

3. When turbidity shows up in the finished water prior to the end of the filter run the most probable cause is.....

- X a. Breakthrough
- b. Underfeeding alum
- c. Excessive mud balls in filter media
- d. The lack of proper coagulation
- e. Low water temperatures

4. Alum is another name for

- a. Ferric Sulfate
- b. Alkalinity
- c. Soda Ash
- X d. Aluminum Sulfate
- e. Sodium Aluminate

5. A gravity filter should be backwashed when the headloss is between ____ and ____ feet.

- X ____ a. 6 and 8
- ____ b. 1 and 5
- ____ c. 8 and 10
- ____ d. 6 and 12
- ____ e. 10 and 15

6. A multi-media filter contains which three medias?

- X ____ a. Silica sand
- ____ b. Coal
- ____ c. Fine gravel
- X ____ d. Garnet sand
- X ____ e. Anthracite coal

7. A typical gravity filter has a media bed that is ____ to ____ inches deep.

- ____ a. 12 to 24 inches
- ____ b. 48 to 54 inches
- ____ c. 36 to 60 inches
- ____ d. 24 to 60 inches
- X ____ e. 24 to 42 inches

8. Typical filtration rates for gravity filters are between ____ and ____ gpm/ft².

- ____ a. 1 to 5
- X ____ b. 2 to 4
- ____ c. 3 to 6
- ____ d. 1.5 to 4
- ____ e. 4 to 8

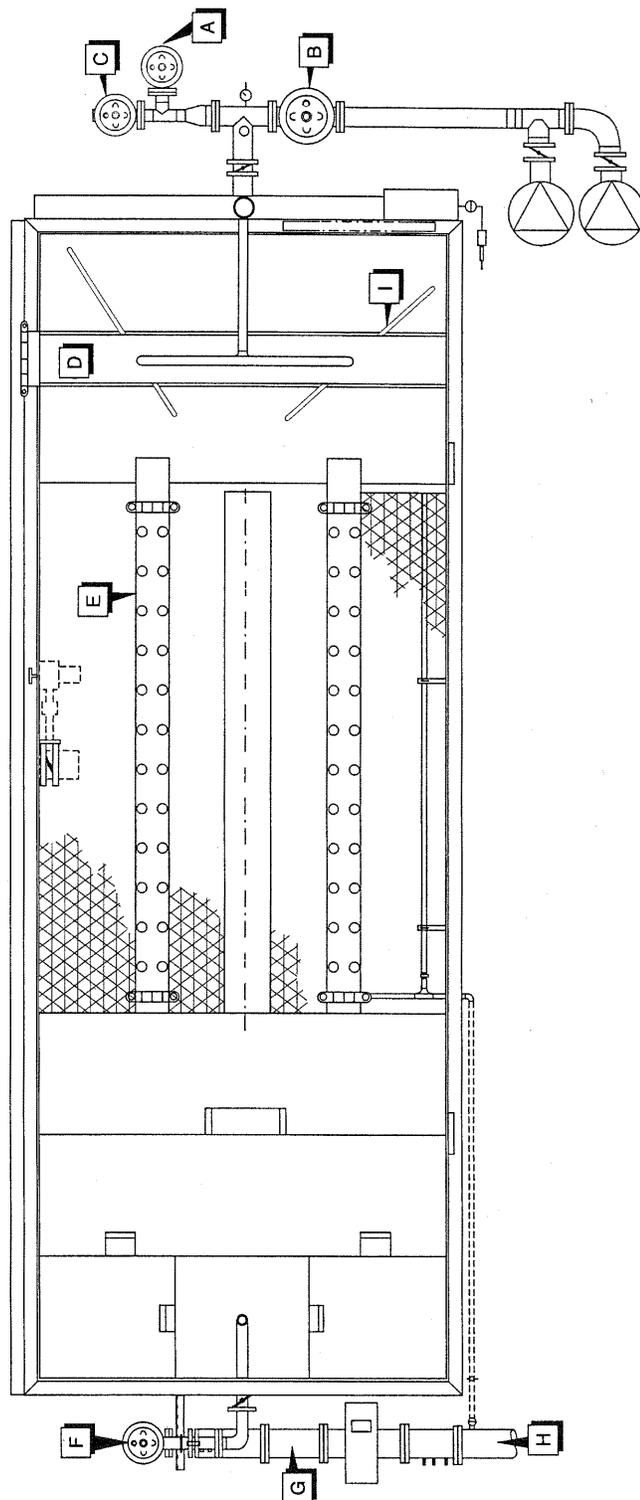
9. Typical backwash rates for gravity filters should be between ____ and ____ gpm/ft².

- X ____ a. 15 to 17
- ____ b. 2 to 4
- ____ c. 10 to 20
- ____ d. 6 to 15
- ____ e. 9 to 12

O & M of Small Water Systems

10. Identify the valves and piping on the package filter plant below by matching the numbers with the list provided.

- H _____ a. Influent
- A _____ b. Finished water VALVE
- C _____ c. Filter to waste valve
- G _____ d. Static mixer
- F _____ e. Inlet control valve
- I _____ f. Surface wash arms
- D _____ g. Launder
- E _____ h. Weirs
- A _____ i. Filtration rate control valve



11. A package plant has a filter that is 5 ft by 10 ft. The flow rate is 120 gpm. What is the filtration rate?

- a. 2.4
- b. 6.8
- c. 1.5
- d. 3.8
- e. 4.8

12. A package plant has a filter that is 5 ft by 10 ft. What would the backwash pumping rate be if it were necessary to backwash the filter at 17 gpm/ft²?

- a. 55
- b. 107
- c. 214
- d. 321
- e. 850

13. What type of breathing protection is required when handling alum?

- a. Dust mask
- b. Full face cartridge respirator
- c. SCBA
- d. None
- e. Cartridge dust mask

14. The two most common chemicals used in small water treatment plants are alum and soda ash. Both are a powder. Which is the most hazardous to handle?

- a. Alum
- b. Soda Ash

15. Which is the recommend material for handling a fire associated with alum?(Mark the most correct answer (s))

- a. Dry chemical
- b. CO₂
- c. Halon
- d. Water
- e. All of the above

O & M of Small Water Systems

16. When using a polymer as a primary coagulant in cold water to remove color, the most common dosage range is between _____ and _____ mg/L.

- a. 4 and 10
- b. 17 and 24
- X c. 0.1 and 0.4
- d. 1 and 4
- e. 12 and 20

17. 50 pounds of alum was placed into a 50 gallon container to make 45 gallons of solution. Find the concentration of the solution in percent.

- a. 6%
- X b. 13%
- c. 25%
- d. 95%
- e. 54 %

18. 12 gallons of an 8% solution was pumped into a flow of 34,000 gallons. What is the dosage in mg/L?

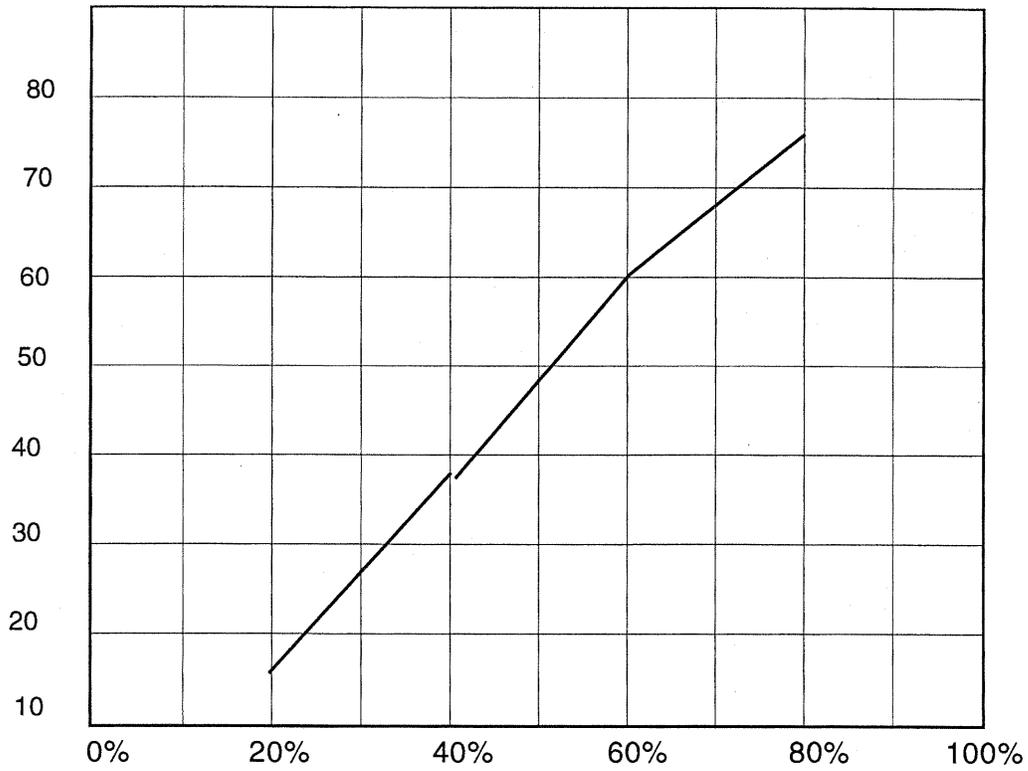
- a. 13 mg/L
- b. 17 mg/L
- c. 21 mg/L
- d. 3 mg/L
- X e. 28 mg/L

19. A typical backwash should take approximately _____ min.

- a. 5 min
- b. 30 min
- X c. 15 min
- d. 45 min
- e. 4 min

20. Complete the last column and develop a curve for the following chemical feed pump calibration data.
 20% Frequency - based on 2 minute samples

Stroke	Start level	Stop level	mL	mL/min
20%	1000	993	32	16 _____
40%	985	947	76	38 _____
60%	920	860	120	60 _____
80%	800	724	152	76 _____



O & M OF GREENSAND FILTERS

WORKSHEET

1. The symbol for iron is _____.

_____ a. Pb

_____ b. I

X _____ c. Fe

_____ d. Mn

_____ e. Ca

2. The symbol for manganese is _____.

X _____ a. Mn

_____ b. Fe

_____ c. Mg

_____ d. Ca

_____ e. M

3. Are iron and manganese considered to be

_____ a. Primary contaminants

X _____ b. Secondary contaminants

4. The MCL for iron is _____.

_____ a. 100 mg/L

_____ b. 0.05 mg/L

_____ c. 2.5 mg/L

_____ d. 1.5 mg/L

X _____ e. 0.3 mg/L

5. The MCL for manganese is _____.

_____ a. 100 mg/L

X _____ b. 0.05 mg/L

_____ c. 2.5 mg/L

_____ d. 1.5 mg/L

_____ e. 0.3 mg/L

6. Which of the compounds listed below are said to be soluble in water?

- X a. Ferrous iron
- b. Ferric iron
- X c. Manganous manganese
- d. Manganic manganese

7. Bacteria that reduces iron and manganese and produces slimes in the inside of pipes are called what type of bacteria?

- a. Anaerobic
- b. Flagellate
- X c. Iron
- d. Aerobic
- e. Facultative

8. Iron and manganese is said to be oxidized and brought into solution when the pH is..

- X a. Low
- b. High

9. Conditions that contribute to iron and manganese being brought into solution are those where the dissolved oxygen is..

- X a. Low
- b. High

10. When using chlorine as an oxidant for the removal of manganese it is best if the pH is ..

- a. Below 4
- b. Between 5 - 7
- c. Above 6
- d. Between 6 & 8
- X e. Above 9.5

11. Which compound is commonly used to oxidize iron and manganese other than potassium permanganate and chlorine?

- a. Nitrogen
- b. Fluoride
- X c. Air
- d. Hot water
- e. Soda ash

O & M of Small Water Systems

12. A natural occurring zeolite used in the removal of iron and manganese is called..

- a. Polyphosphate
- X b. Greensand
- c. Anthracite coal
- d. Silica sand
- e. Garnet sand

13. A _____ is a common name for chemicals that are used as sequestering agents.

- X a. Polyphosphates
- b. Zeolites
- c. Greensand
- d. Sorption chemicals
- e. Oxidation

14. When using potassium permanganate for the removal of iron and manganese, _____ of potassium permanganate will oxidize 1 mg/L of iron.

- a. 1
- b. 0.6
- X c. 0.94
- d. 2
- e. 2.5

15. When using potassium permanganate for the removal of iron and manganese, _____ of potassium permanganate will oxidize 1 mg/L of manganese.

- a. 1
- b. 0.6
- c. 0.94
- X d. 1.92
- e. 2.5

16. Potassium permanganate becomes _____ soluble in warm water.

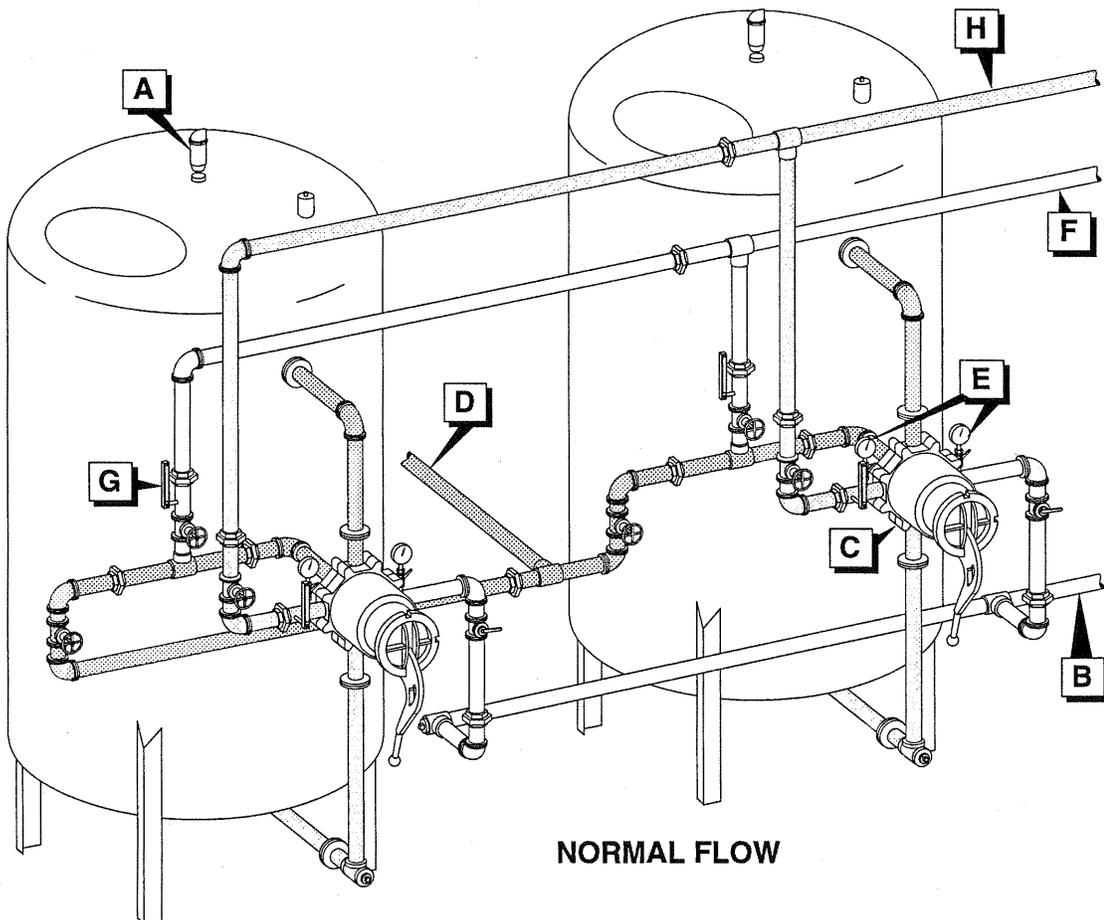
- X a. more
- b. less

17. Potassium is classified by OSHA as an _____ & _____.

- _____ a. Poison
- _____ b. Compressed gas
- _____ c. Dry crystal
- X _____ d. Oxidizer
- X _____ e. Corrosive

18. Identify the components identified below:

- | | |
|-------------------------|-------------------------|
| D _____ Influent | A _____ Vent |
| H _____ Finished water | E _____ Headloss gauges |
| B _____ Waste line | G _____ Flow indicator |
| F _____ Backwash supply | C _____ Control valve |



O & M of Small Water Systems

19. Typical filtration rates for a potassium permanganate greensand iron removal plant would range between ____ and ____ gpm/ft².

- a. 2 - 4
- b. 4 - 8
- c. 3 - 9
- X d. 3 - 5
- e. 3 - 7

20. A typical backwash of a greensand filter should last _____ minutes.

- a. 30
- b. 20
- X c. 15
- d. 10
- e. 5

21. The headloss in a pressure greensand filter should not exceed _____

- a. 5 psi
- b. 20 feet
- c. 10 feet
- X d. 10 psi
- e. 8 feet

22. Find the dosage in mg/L when 5 gallons of 2% KMnO₄ solution was used from a 50 gallon tank to treat a flow of 80,000 gallons.

- a. 1.7 mg/L
- b. 1.1 mg/L
- c. 1.4 mg/L
- d. 0.9 mg/L
- X e. 1.3 mg/L

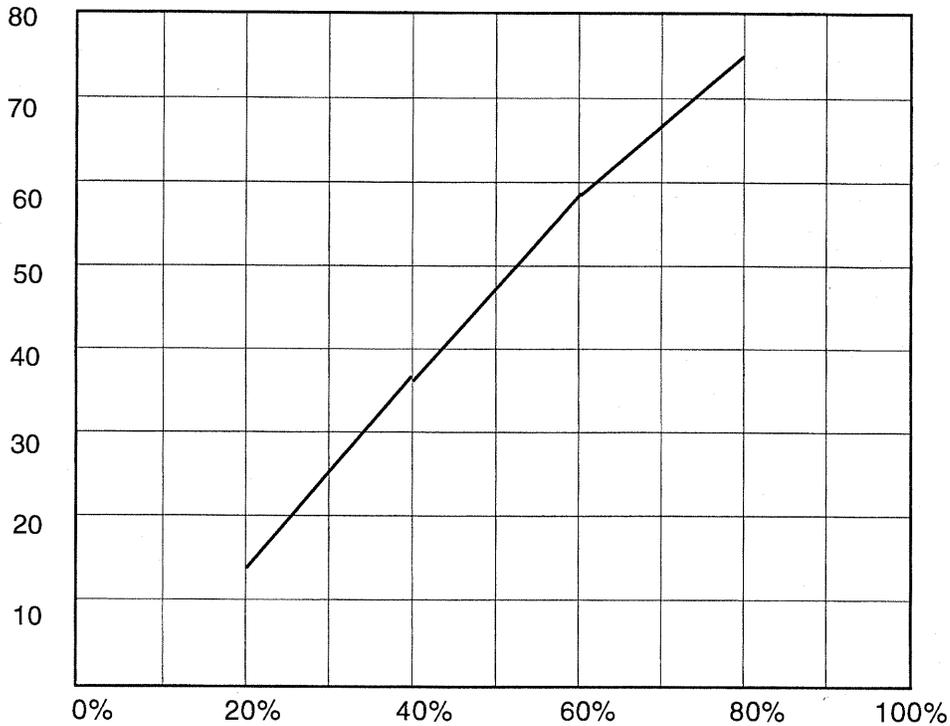
23. What is the required feed rate for a KMnO₄ pump when the system flow is 55 gpm, the desired dosage is 1.4 mg/L and the feed solution is 3%?

- a. 23 mL/min
- X b. 8 mL/min
- c. 63 mL/min
- d. 17.75 mL/min
- e. 15.5 mL/min

24. Complete the last column and develop a curve for the following chemical feed pump calibration data.

20% Frequency - based on 2 minute samples

Stroke	Start level	Stop level	mL	mL/min
20%	1000	993	32	16 _____
40%	985	947	76	38 _____
60%	920	860	120	60 _____
80%	800	724	152	76 _____



25. The iron level in a water supply is 1.8 mg/L and the manganese is 0.5 mg/L. What is the estimated KMnO_4 dosage in mg/L?

- X _____ a. 2.7 mg/L
- _____ b. 2.3 mg/L
- _____ c. 3.8 mg/L
- _____ d. 1.3 mg/L
- _____ e. 4.1 mg/L

O & M OF CARTRIDGE/BAG FILTERS

WORKSHEET

1. A cartridge filter system is classed as:

- a. Conventional treatment
- b. Direct filtration
- c. Slow filtration
- d. Complete filtration
- X e. Alternate technology

2. What is the size range for Giardia cysts?

- X a. 7 to 10 microns in width
- b. 1 to 5 microns in width
- c. .05 to 2.5 microns in width
- d. 9 to 20 microns in width
- e. .025 to 0.5 microns in width

3. From the filter sizes below select the one that could be used as a Giardia filter.

- a. 0.25 microns
- b. 25 microns
- X c. 5 micron
- d. 50 microns
- e. 10 microns

4. In order for a cartridge or bag filter to meet the Consensus Protocol it must be able to produce a turbidity of less than ____ in 95% of the samples.

- a. 5 ntu
- X b. 1 ntu
- c. 0.1 ntu
- d. 15 ntu
- e. 3 ntu

5. Cartridge filters are not effective in removing _____.

- a. Giardia
- b. Viruses
- c. Material larger than 50 microns
- d. Algae
- e. Microorganisms larger than 20 microns

6. In most tests, cartridge and bag filters have been shown to provide a _____ log removal of Giardia.

- a. 3
- b. 4
- c. 1
- d. 2
- e. 0.5

7. In order to use a cartridge or bag filter to remove Giardia, what other treatment process is required?

- a. Sedimentation
- b. Coagulation
- c. Disinfection
- d. Flocculation
- e. Filtration

8. The two common cartridge filter lengths are:

- a. 5 inch
- b. 28 inch
- c. 10 inch
- d. 30 inch
- e. 40 inch

9. The nominal size of a cartridge filter is...

- a. The size of particle that it will remove
- b. The size rating of the filter
- c. The length of the filter
- d. The actual size of the pores through the filter media
- e. The pressure rating of the filter

O & M of Small Water Systems

10. The efficiency of a cartridge filter is...

- a. The headloss divided by the flow rate
- b. The flow rate divided by the headloss
- X c. The percent of the nominal size particles removed
- d. The percentage of the actual size particles removed
- e. The relationship between the actual size and the nominal size

11. Typical polypropylene cartridge filters should be changed when the differential pressure reaches _____.

- a. 10 psi
- b. 45 psi
- c. 5 psi
- d. 20 psi
- X e. 35 psi

12. A polypropylene cartridge filter has reached one half of its life when the differential pressure is at _____.

- a. 10 psi
- b. 45 psi
- X c. 5 psi
- d. 20 psi
- e. 35 psi

13. A common size of a pre-filter in a cartridge filter string would be...

- a. 100 microns
- b. 2.5 microns
- c. 5 microns
- X d. 50 microns
- e. 200 microns

14. In a seasonal operation the cartridge filter housing should be disinfected

- X a. At the end of the season
- b. Each month during the off season
- c. Each month during operation
- d. Need not be disinfected at all since it is a NSF product
- X e. At the start of the season

INTRO. TO LOW PRESSURE BOILERS**WORKSHEET**

1. Low pressure boilers means boilers with pressure that does not exceed...

- a. 10 psi
- b. 50 psi
- X c. 30 psi
- d. 45 psi
- e. 150 psi

2. The typical tank in a fuel farm is _____ gallon.

- a. 300
- X b. 8000
- c. 500
- d. 1000
- e. 10,000

3. The fuel used in low pressure boilers in Alaska is ...

- X a. #1 Arctic grade diesel
- b. #2 Arctic grade diesel
- c. #1 Arctic grade kerosene
- d. #2 Bunker fuel
- e. #1 Bunker fuel

4. If the site fuel storage tank is with in 100 feet of the potable water well, then what is the maximum number of gallons the tank can hold?

- a. 50
- b. 250
- c. 300
- X d. 500
- e. 1000

5. A day tank usually holds between _____ and _____ gallons.

- a. 300 and 500
- b. 5 and 55
- X c. 10 and 20
- d. 25 and 42
- e. 100 and 250

O & M of Small Water Systems

6. Identify the boiler system components listed below

E ____ Expansion Tank

G ____ Pressure relief valve

H ____ Burner

F ____ Temp. and pressure gauge

I ____ Oil filter

M ____ Oil supply

L ____ Water loop

K ____ Glycol loop

D ____ Circulating Pump

N ____ Fuel return line

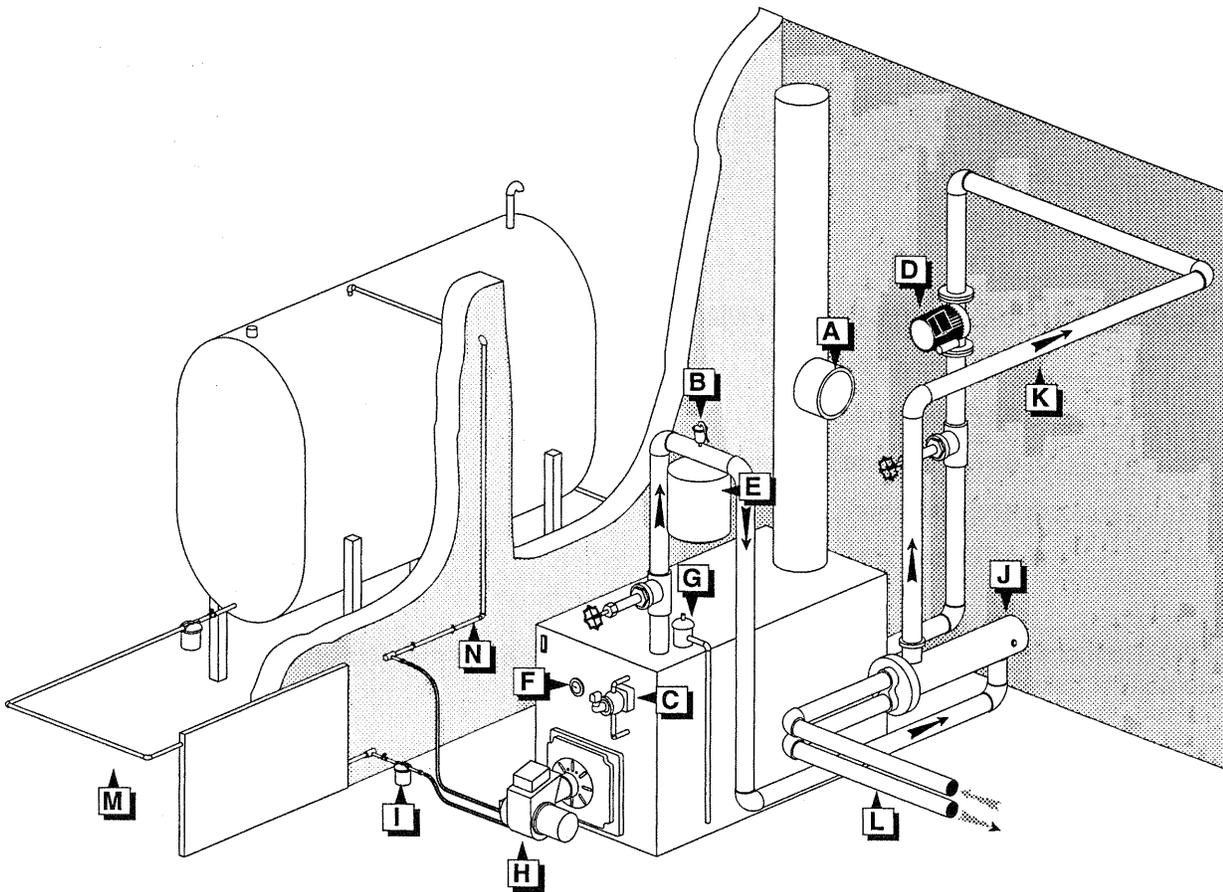
C ____ Low water cut-off

A ____ Barometric damper

B ____ Air release valve

J ____ Heat exchanger

N ____ Oil return line



7. The fusible valve used on a boiler fuel supply line is designed to close anytime the room temperature exceeds _____.

_____ a. 220° F

_____ b. 180° F

_____ c. 45° F

X _____ d. 140° F

_____ e. 35° F

8. Fuel filter should be changed at least every _____.

- a. Year
- b. Four months
- c. Quarter
- d. Month
- e. Week

9. The discharge pressure of the burner fuel pump must be at least _____ psi.

- a. 10 psi
- b. 50 psi
- c. 200 psi
- d. 30 psi
- e. 100 psi

10. What does the designation 0.5 g/h on a burner nozzle mean.

- a. 0.5 grains per hour - the weight of the fuel discharged from the nozzle
- b. It is a manufacturing designation for the size of the opening
- c. Gallons per hour
- d. A spray that is at 45 degrees
- e. A hollow spray covering 50% of the area with oil

11. The CAD cell is used for what?

- a. Sense the presence or absence of light
- b. Shut off the burner after 15 seconds if the heat is too intense
- c. Shut off the burner only after there has been a flame for 30 seconds
- d. Protects the motor from an overload condition
- e. Protects the primary control from a high current draw

12. What is the name of the device used to control a draft through the combustion chamber?

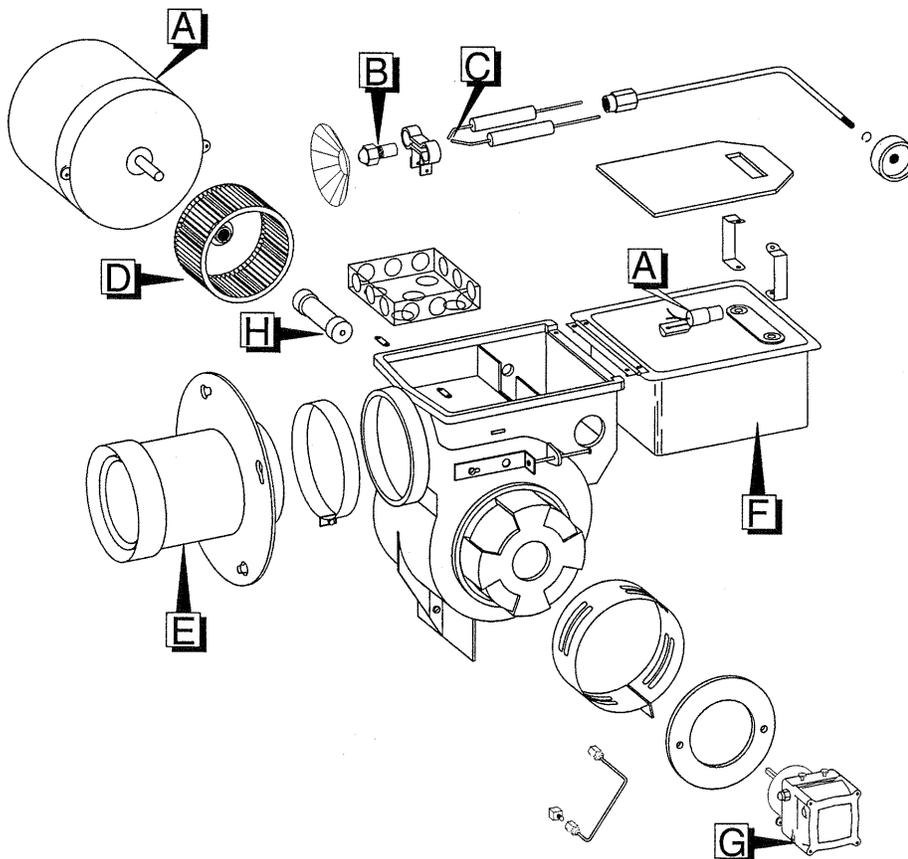
- a. Squirrel cage fan
- b. Electric motor
- c. Barometric damper
- d. Draft control
- e. Air flow control chamber

13. When glycol and water are mixed in the hydronic system, what is the most common mix.

- _____ a. 10 to 50
- _____ b. 5 to 55
- _____ c. 50 to 1
- X _____ d. 50 to 50
- _____ e. 20 to 40

14. Identify the components of the burner assembly shown below.

- | | |
|--------------------|---------------------|
| G _____ Pump | F _____ Transformer |
| E _____ Blast tube | A _____ Motor |
| B _____ Nozzle | H _____ Coupling |
| D _____ Fan | C _____ Electrodes |



15. The fluid loop between the boiler and the heat exchanger should pass through which portion of the heat exchanger?

- _____ a. Tubes
- X _____ b. Shell

16. When an air expansion chamber is placed on a hydronic loop there are two devices commonly installed above the chamber they are:

- a. Flow control valve
- X b. Air scoop
- c. Circulation pump
- d. Thermometer
- X e. Air release valve

17. The operating temperature of a low pressure boiler normally ranges between what two temperatures?

- a. 35 °F & 45 °F
- b. 100 °F & 150 °F
- c. 212 °F & 220 °F
- X d. 180 °F & 200 °F
- e. 300 °F & 350 °F

18. The operating pressure on a low pressure boiler normally range between what two levels?

- X a 12 psi & 15 psi
- b. 20 psi & 30 psi
- c. 35 psi & 45 psi
- d. 55 psi & 85 psi
- e. 45 psi & 90 psi

19. The high pressure blow-off on a low pressure boiler is set to exhaust at _____ psi.

- a. 10 psi
- b. 45 psi
- c. 20 psi
- d. 100 psi
- X e. 30 psi

20. The appropriate protection on a potable water make-up water line to a low pressure boiler is a:

- a. Atmospheric vacuum breaker
- b. Check valve
- c. Double check valve assembly
- X d. RPZ
- e. Air gap

O & M of Small Water Systems

21. The return temperature on a heated circulation loop should not drop below _____°F
- a. 10° F
 - b. 55° F
 - c. 30° F
 - d. 45° F
 - X e. 35° F
22. The exit temperature from the potable water side of a heat exchanger, exiting into a circulation loop should range between what two temperatures?
- a. 35° F & 38° F
 - X b. 40° F & 45° F
 - c. 45° F & 55° F
 - d. 180° F & 200° F
 - e. 140° F & 180° F
23. The high temperature cut off is designed to shutdown the boiler system anytime the temperature of the fluid in the boiler exceeds what temperature.
- a. 180° F to 200 °F
 - b. 300° F to 35 °F
 - c. 140° F to 160 °F
 - X d. 200° F to 220 °F
 - e. 190° F to 212° F
24. When oil is properly completely burnt in a combustion process, what by two products are produce?
- a. Aldehyde
 - X b. Water
 - c. Carbon monoxide
 - d. Carbon
 - X e. Carbon dioxide
25. There are three key items that must be control in order to controedl combustion, they are oil, spark and _____.
- a. Pressure
 - b. Temperature
 - c. Pump velocity
 - d. Fuel flow rate
 - X e. Air

26. A properly operating boiler should not have a stack temperature above _____°F.

- _____ a. 150° F
- _____ b. 350° F
- X _____ c. 550° F
- _____ d. 800° F
- _____ e. 212° F

27. When a burner is operating properly the CO₂ level will be _____.

- _____ a. 1 to 5%
- _____ b. 89 to 90%
- _____ c. 20 to 25%
- X _____ d. 10 to 14%
- _____ e. 15 to 45%

28. The most desirable smoke test reading for a properly operating burner would be..

- _____ a. 4 to 5
- _____ b. 8 to 9
- _____ c. 1 to 2
- X _____ d. 0 to 1
- _____ e. 2 to 3

29. When the pH of glycol reaches _____ it should be removed.

- _____ a. 5
- _____ b. 9
- _____ c. 2
- X _____ d. 7
- _____ e. 6

O & M OF HYPOCHLORITE SYSTEMS

WORKSHEET

1. The proper chlorine dosage would be one that would produce a residual entering the system of at least _____.
- _____ a. A trace of chlorine
 - _____ b. 5 mg/L
 - _____ c. 1%
 - X _____ d. 0.2 mg/L
 - _____ e. 0.1 mg/L
2. A properly disinfected water distribution system maintains a chlorine residual at all points in the system of _____.
- X _____ a. A trace of chlorine
 - _____ b. 5 mg/L
 - _____ c. 1%
 - _____ d. 0.2 mg/L
 - _____ e. 0.1 mg/L
3. The amount of chlorine added to a system is called..
- _____ a. Demand
 - _____ b. Residual
 - _____ c. CT
 - X _____ d. Dosage
 - _____ e. Disinfection
4. The effectiveness of disinfection is measured by the presence of a chlorine residual and the absence of _____.
- _____ a. Turbidity
 - X _____ b. Coliform Bacteria
 - _____ c. pH
 - _____ d. Microorganisms
 - _____ e. Combined residuals

5. Calcium hypochlorite ($\text{Ca}(\text{OCl})_2$) is available in concentrations of up to _____.

- a. 67%
- b. 45%
- c. 15%
- d. 65 mg/L
- e. 12 mg/L

6. Sodium hypochlorite (NaOCl), is available in concentrations up to _____.

- a. 67%
- b. 12.5%
- c. 15%
- d. 45%
- e. 20%

7. A small spill of sodium hypochlorite can be contained by:

- a. Call an emergency response team
- b. Flush with water and vinegar
- c. Use dry alum powder
- d. Dike and call for help
- e. Call CEMTREX

8. Calcium hypochlorite will burn at temperatures above _____ °F.

- a. 100
- b. 250
- c. 400
- d. 350
- e. 212

9. For storage purposes, calcium hypochlorite is classified by OSHA as an _____.

- a. Poison
- b. Flammable liquid
- c. Oxidizer
- d. Explosive
- e. Corrosive

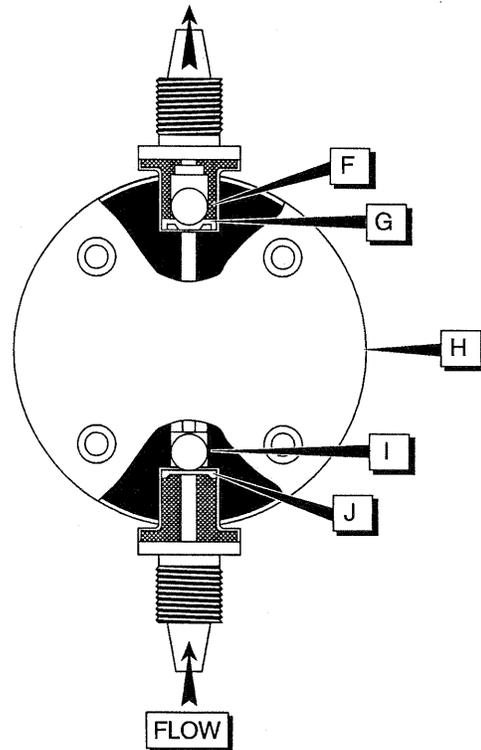
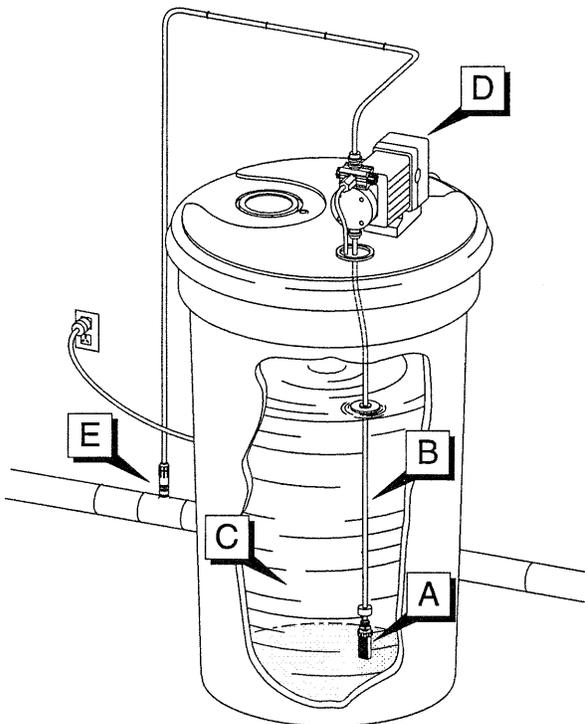
O & M of Small Water Systems

10. If a hypochlorite solution is spilled or splashed onto your hands you should ...

- X a. Flush with water for 15 minutes
- b. Call a doctor
- c. Flush with water and cover the area with a clean dry bandage & seal in plastic
- d. Cover the area with a salve and see a doctor
- e. Do nothing, hypochlorites will not harm you

11. Identify the components identified below

- | | |
|---------------------------------------|--------------------------------------|
| a. <u>Foot valve and screen</u> _____ | f. <u>Discharge valve</u> _____ |
| b. <u>Suction line</u> _____ | g. <u>Discharge valve seat</u> _____ |
| c. <u>Chlorine solution</u> _____ | h. <u>Pump head</u> _____ |
| d. <u>Chemical feed pump</u> _____ | i. <u>Suction valve</u> _____ |
| e. <u>Injector</u> _____ | j. <u>Suction seat</u> _____ |



12. A chemical feed pump should be wired so that..

- a. It will start anytime the pump motor starter is engaged.
- X b. It will start only when the pump starter is engaged and the flow switch is closed.
- c. It will start only when the contact relay is closed, the auxiliary contacts are closed and the tank is above the half way point.
- d. It will start only when the pump is actually pumping water and there is a residual below 0.2 in the incoming water.
- e. It will start only when the fluoride system is off line.

13. When mixing a calcium hypochlorite system you should

- a. Always allow 24 hours of settling before feeding the solution
- b. Always place the powder into the empty tank and then add the water
- c. Always wear hearing protection
- X d. Always place the powder into the water
- e. None of the above

14. If the maximum feed rate of a pump is 63 mL/min, what will the feed rate be if the stroke is set at 40% and the speed at 75%?

- a. 35 mL/min
- b. 22 mL/min
- c. 54.8 mL/min
- d. 118 mL/min
- X e. 18.9 mL/min

15. In a properly operated chlorination system which pieces of data should be collected or determined on a daily basis?

- X a. Plant flow
- X b. Gallons of chlorine used
- X c. Dosage in mg/L
- X d. pH of water
- X e. Temperature of water

16. Handling calcium hypochlorite requires one piece of safety equipment not required when handling sodium hypochlorite. That piece of safety equipment is?

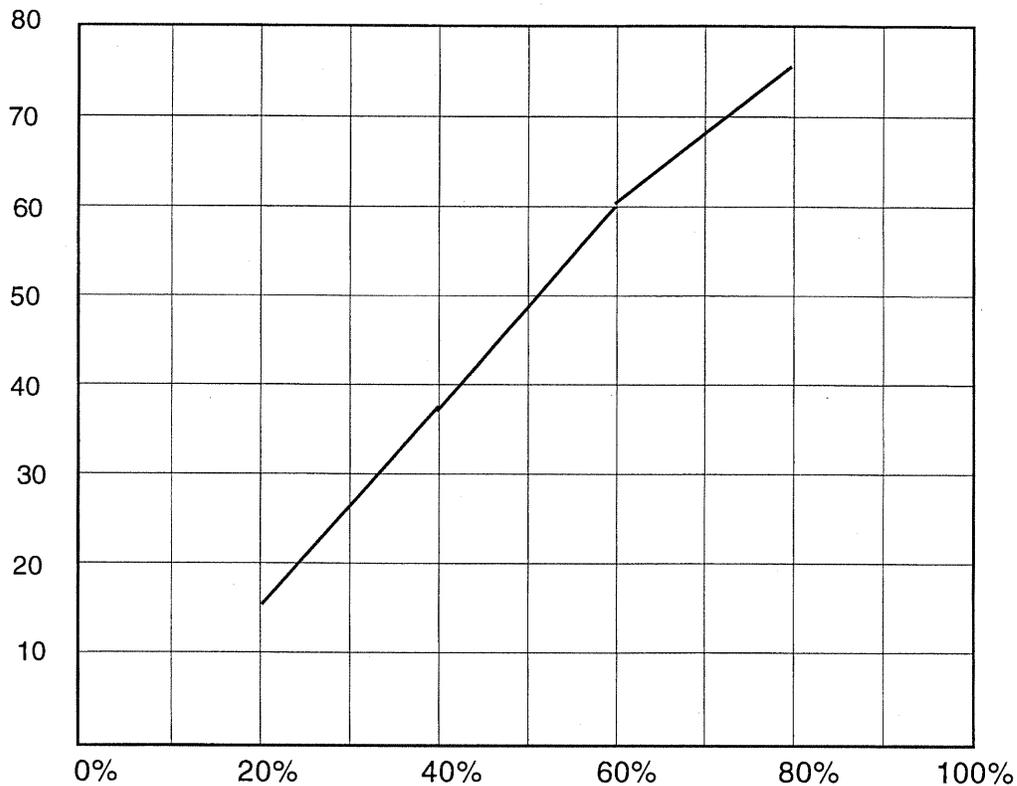
- a. Goggles
- X b. Cartridge respirator
- c. Apron
- d. Rubber gloves
- e. Rubber boots

O & M of Small Water Systems

17. Complete the last column and develop a curve for the following chemical feed pump calibration data.

20% Frequency - based on 2 minute samples

Stroke	Start level	Stop level	mL	mL/min
20%	1000	993	32	16 _____
40%	985	947	76	38 _____
60%	920	860	120	60 _____
80%	800	724	152	76 _____



18. Determine the number of pounds of 65 % HTH needed to make 50 gallons of a 1% solution.

- _____ a. 0.77 lbs
- _____ b. 32.5 lbs
- X _____ c. 6.4 lbs
- _____ d. 5.75 lbs
- _____ e. 271 lbs

19. Determine the number of 700 gram cups of 67 % calcium hypochlorite necessary to make 50 gallons of a 2% solution.

- X _____ a. 8
- _____ b. 10
- _____ c. 871,500
- _____ d. 12
- _____ e. 4.6

20. Find the concentration when four 700 gram cups of 65% calcium hypochlorite are placed in 25 gallons of water.

- a. 1.44 mg/L
- X b. 16 mg/L
- c. 0.96 mg/L
- d. 3.75 mg/L
- e. 2 mg/L

21. Find the amount of 12% bleach needed to make 50 gallons of 0.5% solution.

- X a. 2 gal
- b. 8.33 gal
- c. 17.4gal
- d. 6 gal
- e. 6.25gal

22. Find the concentration of 50 gallons of solution, if 10 gallons of 5% bleach were placed in the tank and then the tank filled to 50 gallons.

- a. 0.5 %
- b. 2 %
- c. 2.5 %
- d. 3.5 %
- X e. 1 %

23. Find the feed rate in milliliters per minute for a feed pump that must pump a 2% chlorine solution into a 2 inch line that flows at 50 gpm. The desired dosage is 2.5 mg/L.

- a. 283 mL/min
- b. 15.1 mL/min
- c. 0.04 mL/min
- X d. 23.6 mL/min
- e. 80 mL/min

24. Find the concentration needed to supply a dosage of 3 mg/L to a flow of 60 gpm when the chemical feed pump is producing 30 mL/min.

- X a. 2.3 %
- b. 0.567 %
- c. 11 %
- d. 27 %
- e. 1 %

O & M of Small Water Systems

25. Find the dosage in mg/L when 8 gallons was used from a 50 gallon tank to chlorinate a flow of 60,000 gallons per day. The concentration in the tank is 2%.

_____ a. 14 mg/L

_____ b. 1.5 mg/L

X _____ c. 2.7 mg/L

_____ d. 4 mg/L

_____ e. 3.3 mg/L

O & M OF SODIUM FLUORIDE SYSTEMS WORKSHEET

1. The most common fluoride addition system used in Alaska is the...

- a. Upflow diffuser
- b. Downflow saturator
- c. Upflow concentrator
- X d. Upflow saturator
- e. Downflow diffuser

2. Sodium fluoride when placed in a water solution will reach a concentration of..

- a. 1%
- b. 2%
- c. 3%
- X d. 4%
- e. 5%

3. Sodium fluoride saturation in water ...

- X a. varies little with water temperature
- b. varies widely with water temperature
- c. is dependent on the pH of the water
- d. is dependent on the alkalinity of the water
- e. is dependent on the hardness of the water

4. Fluoride is fed into a water system to...

- a. Improve water quality
- b. Remove turbidity
- c. Remove color
- d. Reduce alkalinity in the water
- X e. Reduce tooth decay

5. The primary MCL for fluoride is...

- a. 0.5 mg/l
- b. 5 mg/l
- c. 2 mg/l
- X d. 4 mg/l
- e. 0.03 mg/l

O & M of Small Water Systems

6. The secondary MCL for fluoride is ...

- a. 0.5 mg/l
- b. 5 mg/l
- X c. 2 mg/l
- d. 4 mg/l
- e. 0.03 mg/l

7. The chemical formula for sodium fluoride is ...

- X a. NaF
- b. CaCO₃
- c. FNa
- d. F
- e. KMnO₄

8. Sodium fluoride is classified by OSHA as a ...

- a. Non-combustible gas
- X b. Poison
- c. Corrosive
- d. Oxidizer
- e. Non regulated material

9. A small liquid spill of sodium fluoride can be cleaned-up by ...

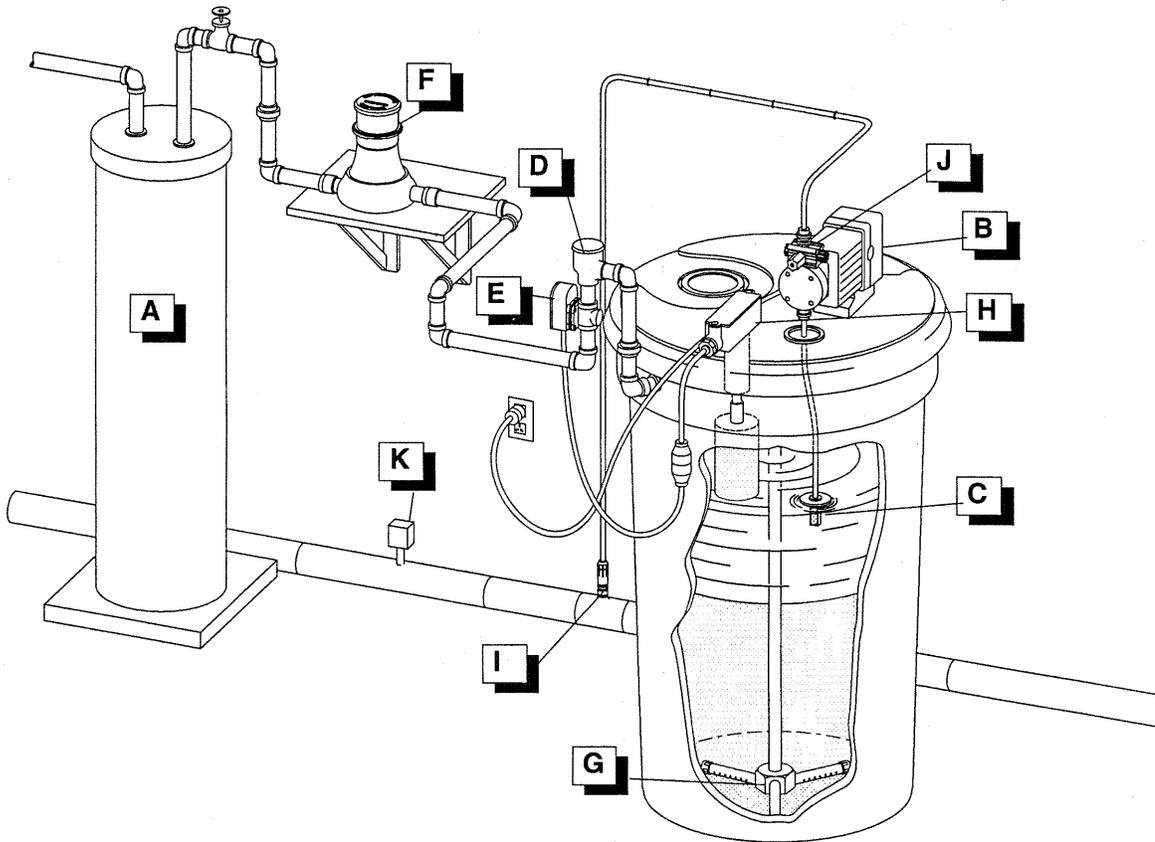
- X a. Flushing with water
- b. Adding lime and then pick up with a non-metallic device
- c. Call an emergency response team
- d. Use a boom to contain and then call an emergency response team
- e. Just ignore the spill, small spills are not a health risk

10. Two safety controls that prevent the over feeding of a fluoride solution are:

- X a. Flow switch
- b. Atmospheric vacuum breaker
- c. Dole valve
- X d. Using motor starter auxiliary contacts
- e. Solenoid valve

11. Identify the components in the fluoride system shown below.

- | | |
|--------------------------------|-----------------------|
| a. Softener _____ | g. Distributer _____ |
| b. Chemical feed pump _____ | h. Float switch _____ |
| c. Foot valve and screen _____ | i. Injector _____ |
| d. Vacuum breaker _____ | j. 4 in 1 valve _____ |
| e. Solenoid valve _____ | k. Flow valve _____ |
| f. Water meter _____ | |



12. When filling a fluoride saturator using a 50 gallon tank the sodium fluoride level should be...

- _____ a. 5 inches
- _____ b. 10 inches
- X _____ c. 20 inches
- _____ d. 1/3 of the depth of the tank
- _____ e. 3/4 of the depth of the tank

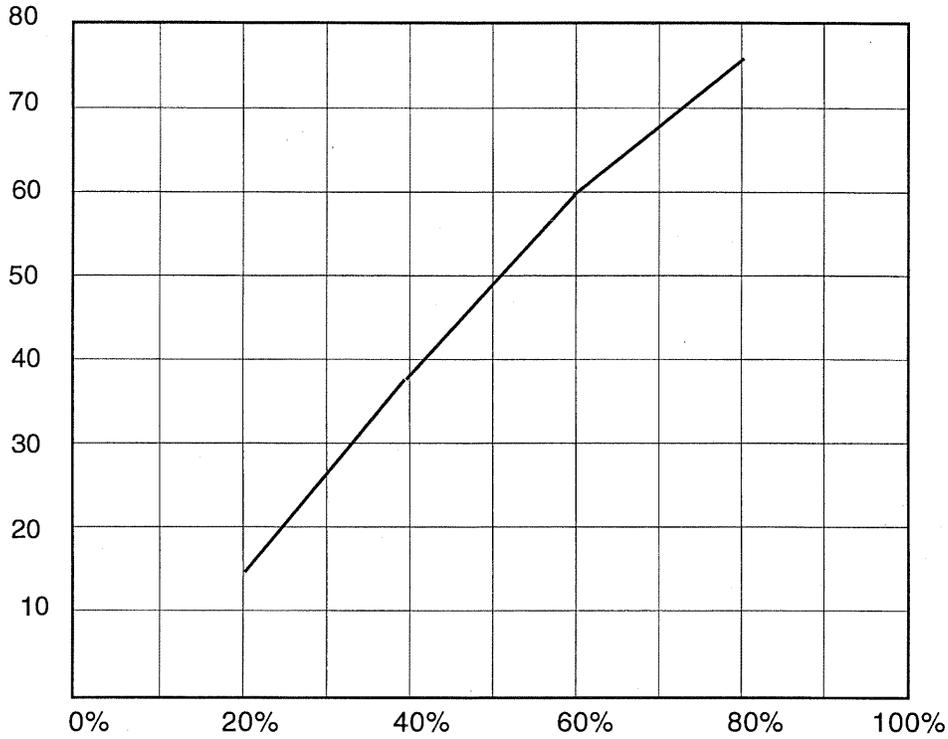
O & M of Small Water Systems

13. How long should a new batch of sodium fluoride set before you can be assured that it has reached saturation?
- a. 30 min
 - b. 1 hour
 - X c. 2 hours
 - d. 15 minutes
 - e. 1.5 hours
14. What is the required feed rate for a fluoride pump when the system flow is 55 gpm, the natural fluoride is 0.1 mg/l and the desired residual is 1.4 mg/l?
- a. 23 mL/min
 - b. 55 mL/min
 - c. 63 mL/min
 - d. 17.75 mL/min
 - X e. 15.5 mL/min
15. The maximum flow rate of an LMI A 151 is 63 ml/min. What would the flow rate be if the stroke were set at 60% and the frequency set at 45%?
- a. 37.8 mL/min
 - b. 28 mL/min
 - c. 23 mL/min
 - X d. 17 mL/min
 - e. 32 mL/min
16. At what level of hardness is it desirable to use a water softener on the feed water for a fluoride saturator?
- a. 25 mg/L
 - X b. 75 mg/L
 - c. 150 mg/L
 - d. 200 mg/L
 - e. 250 mg/L

17. Complete the last column and develop a curve for the following chemical feed pump calibration data.

20% Frequency - based on 2 minute samples

Stroke	Start level	Stop level	mL	mL/min
20%	1000	993	32	16 _____
40%	985	947	76	38 _____
60%	920	860	120	60 _____
80%	800	724	152	76 _____



18. Find the dosage in mg/l when 5 gallons of solution was used from a 50 gallon tank to fluoridate a flow of 80,000 gallons per day.

- _____ a. 1.7 mg/L
- X _____ b. 1.1 mg/L
- _____ c. 1.4 mg/L
- _____ d. 0.9 mg/L
- _____ e. 1.3 mg/L

O & M WASHETERIA

WORKSHEET

1. Which of the following services is **not normally** provided with a washeteria?

- a. Showers
- b. Clothes dryers
- X c. Solid waste disposal
- d. Drinking water
- e. Clothes washers

2. The functions of a washeteria can be divided into two (2) general areas they are:

- X a. Services and Treatment
- b. Washing and Drying
- c. Showers and Hot Water
- d. Water delivery and Services
- e. Sewage handling and clothes washing

3. An alternative to using coins to operate the washers and dryers in a washeteria is to use...

- a. Coin change machines
- b. Bill every member of the community monthly
- c. Charge as people enter the door
- X d. Use tokens
- e. Use wooden coins

4. When a hot water dryer is used the boiler maintains the temperature between _____ and _____.

- X a. 180 & 200
- b. 145 & 212
- c. 200 & 275
- d. 120 & 140
- e. 195 & 235

5. There are two lint traps in a washeteria. Where are they located?

- X a. Gray water from washers
- b. Gray water from shower stalls
- c. Return line from the utilidor
- d. Air intake line
- X e. Air duct from dryer

6. How often should toilets and shower stalls be cleaned?

- a. Hourly
- b. Once a week
- X c. Daily
- d. Twice a week
- e. Once a month

7. A low pressure boiler used to produce hot water and heat potable water maintains a temperature between _____ and _____ °F

- X a. 180 & 200
- b. 145 & 212
- c. 200 & 275
- d. 120 & 140
- e. 195 & 235

8. The two major keys to a successful washeteria operation are:

- a. Short hours
- b. Long operating hours
- X c. Operating equipment
- X d. Cleanliness
- e. Cheap prices

9. The surface and interior of washers and dryers should be cleaned how often?

- a. Hourly
- b. Weekly
- c. Monthly
- d. Quarterly
- X e. Daily

10. The gray water lint traps should be cleaned

- a. Hourly
- b. Weekly
- c. Monthly
- d. Quarterly
- X e. Daily

O & M OF DISTRIBUTION SYSTEMS

WORKSHEET

1. The primary function of a water distribution system is to:
 - a. Allow a means of collecting fees for using water
 - b. Provide fire protection
 - X c. Transport water from the treatment plant to the customer
 - d. Circulate water to prevent it from freezing
 - e. Provide a means of obtaining water for showers and drinking

2. The two criteria for a water distribution system is that it must be _____ and _____.
 - a. Economical
 - X b. Adequate
 - c. Large enough
 - d. Made from good materials
 - X e. Reliable

3. The pressure in a water distribution system should never drop below _____ psi.
 - a. 10 psi
 - X b. 20 psi
 - c. 30 psi
 - d. 40 psi
 - e. 60 psi

4. A map or blueprint that shows a cross-section of the earth is called the _____.
 - a. Plan
 - b. Cross section
 - c. Vertical view
 - X d. Profile
 - e. Underground view

5. On a blueprint what is a station?
 - a. Fire hydrants
 - X b. Horizontal Location
 - c. Distance to the end of the project
 - d. Points of interest on a project
 - e. Location of the pipe joints

6. A job begins at station 1+00 and stops at station 45+50. A fire hydrant is located at station 15+00. How far is it from the beginning of the project?

- a. 150 feet
- b. 300 feet
- c. 3000 feet
- X d. 1400 feet
- e. 2950 feet

7. The pressure at the treatment plant is 85 psi and the pressure at the highest house in the community is 45 psi. What will be pressure be at the treatment plant when the pressure at this house is 20 psi.

- X a. 60 psi
- b. 110 psi
- c. 40 psi
- d. 25 psi
- e. 45 psi

8. If there is a series of taste and odor complaints concerning chlorine and the residual leaving the plant is 0.3 mg/L. What would you suggest is the best course of action?

- a. Reduce the chlorine dosage
- b. Flush the system
- c. Stop feeding chlorine
- d. Provide bottled water to those that complain
- X e. Increase chlorine dosage

9. If the free chlorine residual is less than ____ percent of the total chlorine residual, taste and odor problems will most likely be present.

- a. 10%
- b. 15%
- X c. 85%
- d. 95%
- e. 25%

O & M of Small Water Systems

10. The MCL for lead is _____.

- a. 0.5 mg/L
- b. 0.003 mg/L
- X c. 0.015 mg/L
- d. 1.3 mg/L
- e. Zero

11. The MCL for copper is _____.

- a. 0.5 mg/L
- b. 0.003 mg/L
- c. 0.015 mg/L
- X d. 1.3 mg/L
- e. Zero

12. For a community of 100 _____ lead and copper samples should be collected every six months.

- X a. 5
- b. 10
- c. 15
- d. 2
- e. 6

13. Complaints about a blue or green ring on bathroom fixtures is an indication of high concentrations of _____.

- a. Iron
- b. Manganese
- c. Lead
- d. Hardness
- X e. Copper

14. To properly flush a distribution line the velocity should be at least _____.

- a. 1 ft/sec
- X b. 2.5 ft/sec
- c. 5 ft/sec
- d. 7.5 ft/ sec
- e. 3 ft/sec

15. Two methods of heating a utilidor are?

- a. Electric heaters every 100 feet
- X b. Forced air heaters
- c. Oil loop, circulating systems
- X d. glycol loop circulating systems
- e. Electric induction heaters

16. The chlorine residual entering a distribution system should be at least _____.

- a. 5 mg/L
- b. 0.5 mg/L
- c. 0.1 mg/L
- X d. 0.2 mg/L
- e. 2 mg/L

17. 500 feet of 2 inch line would hold _____ gallons

- X a. 82
- b. 25
- c. 500
- d. 110
- e. 106

18. A system produced 510,000 gallons per day. After reading the water meters and taking into account all water used for fire suppression and other maintenance activities only 420,000 gallons could be accounted for. What is the percent unaccounted for water?

- a. 10%
- X b. 18%
- c. 82%
- d. 42%
- e. 26%

19. The proper fitting for fixing a hole 1 inch in diameter in a DCIP would be the ...

- a. Repair band
- b. Compression coupling
- X c. Full circle repair band
- d. Cast iron coupling
- e. Wooden plug

PUMPS - NORMAL OPERATIONS

WORKSHEET

1. If the water that a pump is pumping is below the eye of the pump impeller the pump is in what type of pumping condition?

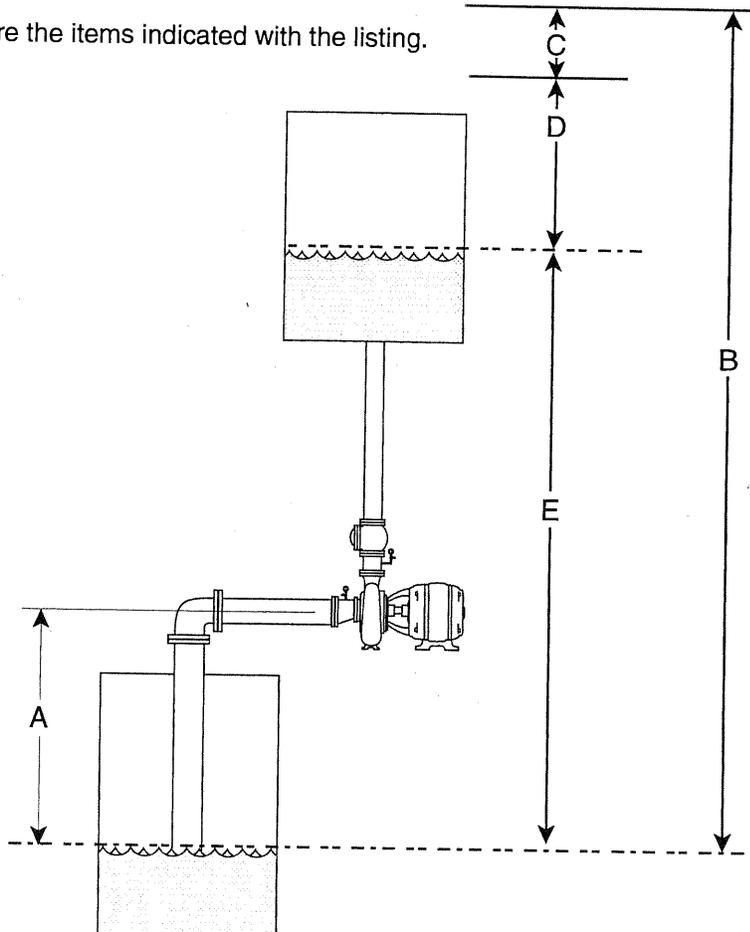
- a. Static condition
- b. Suction head condition
- c. Suction velocity lifting condition
- d. Velocity head condition
- X e. Suction lift condition

2. Submersible turbines and lineshaft turbines are always in a suction _____ condition.

- a. Pressure
- b. Lift
- X c. Head
- d. Velocity
- e. Dynamic

3. Using the diagram below, compare the items indicated with the listing.

- B _____ a. TDH
- C _____ b. Velocity Head
- E _____ c. Elevation Head
- D _____ d. Head Loss
- A _____ e. Suction Lift



4. As the horsepower requirements of a pump were to increase you would expect the:

- X a. Amperage to go up
- b. Amperage to go down

5. As an impeller wears down you would expect:(two answers)

- X a. Amperage to drop
- b. Amperage to increase
- c. Flow to increase
- X d. Flow to decrease
- e. Flow to remain the same

6. The most common pump used in wells in small communities in Alaska is the _____.

- X a. Submersible turbine
- b. Lineshaft turbine
- c. Can turbine
- d. End-suction centrifugal
- e. Self priming turbine

7. When the thermal overload (heater) has tripped, what should be done before you press reset?

- a. Turn the H-O-A switch to auto
- b. Check to see that the fuses are OK
- c. Check pump pressure
- X d. Turn the H-O-A to off
- e. Do nothing, press the reset

8. Before working on any pump you should shut off the power and _____. This meets the OSHA requirements.

- a. Press the reset button
- X b. Lock- out and tag breaker
- c. Place the starter in the off position
- d. Fasten the panel door open with a bungee cord
- e. Make a voltage measurement at the starter "Terminal" connections

O & M of Small Water Systems

9. Submersible turbines should be installed in a _____ position.

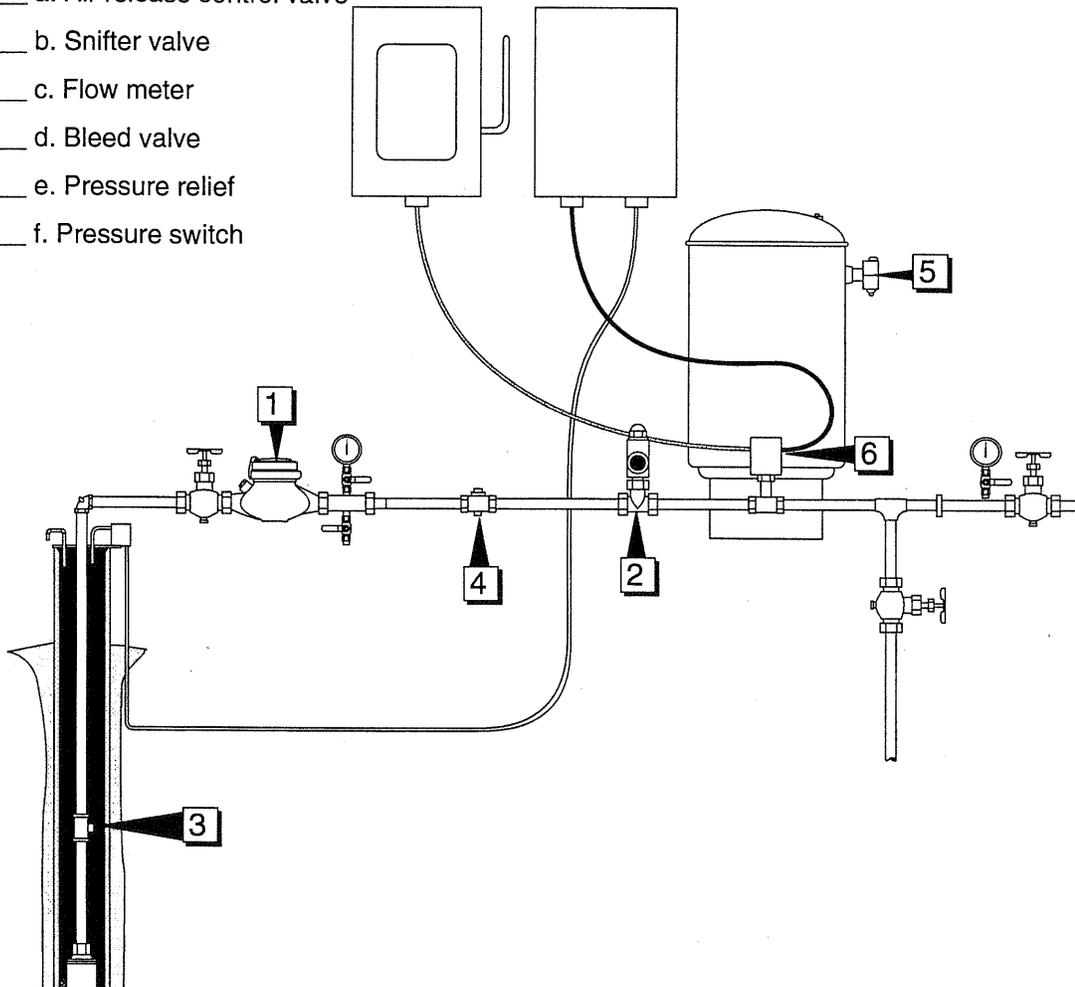
- _____ a. Horizontal
- _____ b. Angular
- _____ c. Deep
- X _____ d. Vertical
- _____ e. Lateral

10. The problem with using a hose or other flexible connection on the discharge of a pump is

- _____ a. It requires a great deal of support
- X _____ b. High headloss
- _____ c. It is difficult to make the connection
- _____ d. Hoses and other flexible connections may not be safe for drinking water
- _____ e. It does not offer the proper support for the pump

11. Match the items indicated on the drawing with the list below.

- 5 _____ a. Air release control valve
- 4 _____ b. Snifter valve
- 1 _____ c. Flow meter
- 3 _____ d. Bleed valve
- 2 _____ e. Pressure relief
- 6 _____ f. Pressure switch



11. On a pumping system with a hydropneumatic tank the common pressure range between pump off and pump on is

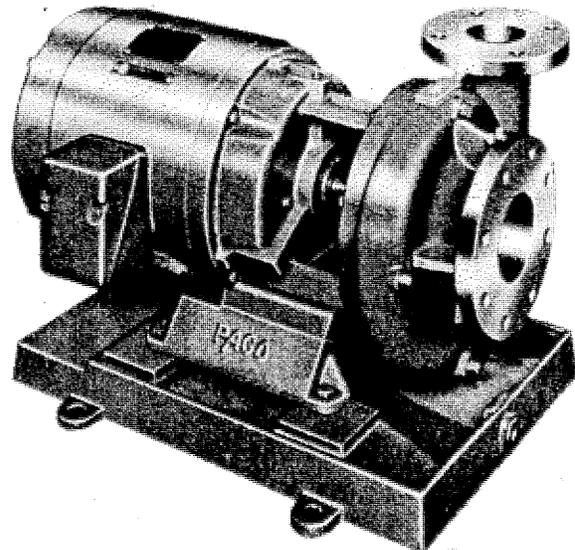
- a. 10 psi - 35 psi
- b. 20 psi - 60 psi
- X c. 20 psi - 40 psi
- d. 30 psi - 60 psi
- e. 30 psi - 50 psi

12. Pressure gauges are installed on pumping systems in order to...

- a. Determine the pumping efficiency
- b. Determine if the pump is running
- c. Determine impeller size
- d. Evaluate pump type
- X e. Evaluate operating conditions

13. For the pump in the drawing below, identify which of the following match.

- a. End-suction centrifugal, frame mounted
- X b. Counterclockwise rotation
- c. Non-back pull-out
- X d. Back pull-out
- e. Clockwise rotation



14. On an end-suction centrifugal pump a _____ reducer is used on the suction side of the pump.

- X a. Eccentric
- b. Large
- c. Bell
- d. Concentric
- e. Flange

O & M of Small Water Systems

15. On a end-suction centrifugal pump a _____ reducer is commonly used on the discharge of the pump.

- a. Eccentric
- b. Large
- c. Bell
- X d. Concentric
- e. Flange

16. The most common pump used for distribution circulation loops in small communities is the

- a. Submersible turbine
- b. Caned turbine
- c. Split case
- X d. End-suction centrifugal
- e. Lineshaft turbine

17. The function of the spool in the piping system is to

- a. Make the operators job easier
- X b. Reduce maintenance cost
- c. Reduce vibration
- d. Reduce cavitation
- e. Increase piping harmonics

18. The thermal overloads (heaters) function is to protect the....

- a. Building wiring
- b. Pump
- X c. Motor
- d. Breaker
- e. Capacitor

19. The magnetic breaker and fuses function is to protect the....

- X a. Building wiring
- b. Pump
- c. Motor
- d. Breaker
- e. Capacitor

20. A lineshaft turbine with adjustable impellers usually is using a _____ motor.

- a. Large
- b. VSS
- X c. VHS
- d. Single phase
- e. Horizontally mounted

21. Prelube is used on what type of pump?

- a. Submersible turbine
- b. End-suction centrifugal - frame mounted
- c. Can Turbine
- d. Split case
- X e. Lineshaft turbine

22. To prevent a lineshaft turbine from turning backwards at shutdown, a _____ is installed.

- a. Check valve
- X b. Non-reversing ratchet
- c. Backflow preventer
- d. Hollow shaft motor
- e. Head nut

23. When a pump uses packing to control leakage from the stuffing box, common drip rates for water from the stuffing box should range between _____ and _____ drops per minute.

- a. 5 to 100
- b. 30 drops per minute per inch of shaft diameter
- c. 10 to 30
- X d. 5 to 20
- e. 10 to 40

24. When external seal water is used on a centrifugal pump it should be _____ to _____ psi above the suction volute pressure.

- a. 5 to 40
- b. 20 to 40
- c. 30 to 60
- d. 5 to 20
- X e. 10 to 15

O & M of Small Water Systems

25. Typical lubrication frequency for electric motors of 20 hp and smaller, and their associated pumps is...

- a. Once every 3 years
- b. Once every month
- c. Twice a month
- d. Once a quarter
- e. Once every five years

26. The purpose of the mechanical seal is to _____ leakage.

- a. Stop
- b. Divert
- c. Control
- d. Reduce
- e. Eliminate

27. The major advantage to using mechanical seals is.....

- a. Cost
- b. Ability to control leakage
- c. Their life expectancy
- d. Ease of installation
- e. The improvement in pump performance

28. When should a mechanical seal be replaced?

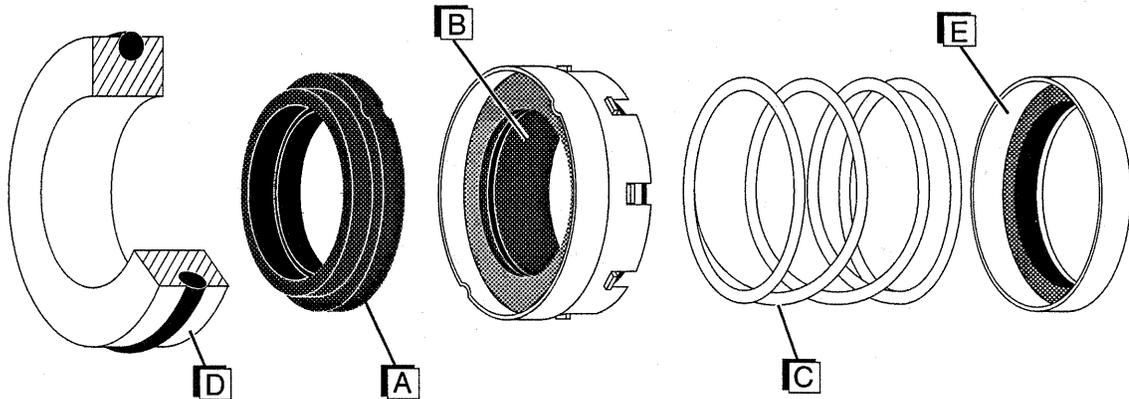
- a. When leakage occurs from the volute
- b. Every 3 to 5 years
- c. When the amperage goes up
- d. Only when the pump is rebuilt
- e. When leakage occurs from the stuffing box

29. In order for a mechanical seal to last its expected life the runout of the shaft should not exceed how many inches per inch of shaft diameter?

- a. 0.001
- b. 0.002
- c. 0.003
- d. 0.004
- e. 0.005

30. Identify the seal components below by matching the number with the list provided.

- D ____ a. Ceramic
- E ____ b. Spring holder
- C ____ c. Spring
- A ____ d. Carbon
- B ____ e. Boot



31. In order for a mechanical seal to last its expected life the end-play of the shaft should not exceed

- _____ a. 0.001
- _____ b. 0.002
- _____ c. 0.003
- _____ d. 0.004
- X _____ e. 0.005

O & M OF FIRE HYDRANTS

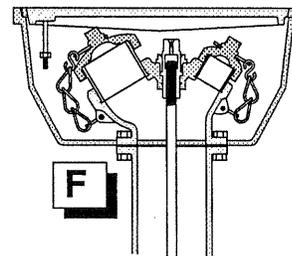
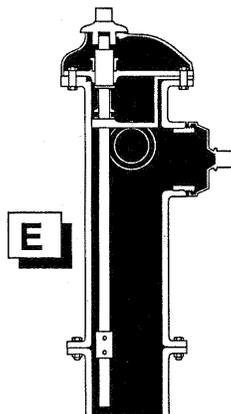
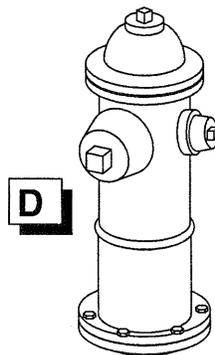
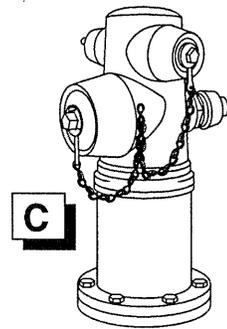
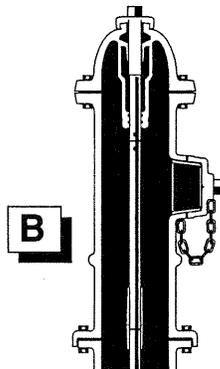
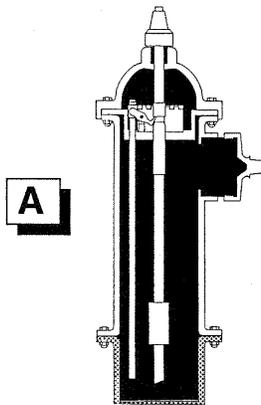
WORKSHEET

1. The most common fire hydrants installed in Alaska are:

- _____ a. Wet Barrel
- X _____ b. Dry Barrel
- X _____ c. Post type
- _____ d. Flush type
- _____ e. High pressure

2. Identify the hydrants below. If a hydrant is a dry barrel then identify if it is a toggle or compression type.

- _____ a. Wet or dry barrel, compression or Toggle
- _____ b. Wet or dry barrel, compression or Toggle
- _____ c. Wet or dry barrel, compression or Toggle
- _____ d. Wet or dry barrel, compression or Toggle
- _____ e. Wet or dry barrel, compression or Toggle
- _____ f. Wet or dry barrel, compression or Toggle

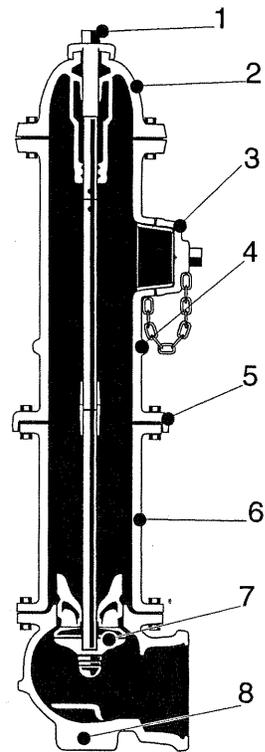


3. The major advantage to using a wet barrel hydrant is...

- a. Easier to repair
- b. Protected from freezing
- X c. Easier to connect a second fire truck
- d. Easier to install and maintain, reducing maintenance cost
- e. There is no advantage

4. Identify the hydrant components indicated.

- 8 a. Shoe
- 5 b. Safety Flange
- 4 c. Upper Barrel
- 6 d. Lower Barrel
- 2 e. Bonnet
- 1 f. Operating nut
- 3 g. Pumper Nozzle cap
- 7 h. Main valve



5. The most common hydrant inlet connection size is...

- a. 4 inch
- b. 2 inch
- X c. 6 inch
- d. 3 inch
- e. 8 inch

6. The most common outlet connection for a fire hydrant is the

- a. 3 inch pumper nozzle
- X b. 2.5 inch NST
- c. 2 inch IPT
- d. 3 inch IPT
- e. 4 inch NST

O & M of Small Water Systems

7. The bury of a hydrant is the distance between _____ and the _____.
- X _____ a. Bottom of the trench and just below the safety flange
 - _____ b. The invert of the pipe and a point 2 inches above the safety flange
 - _____ c. The invert of the pipe and a point 2 inches below the safety flange
 - _____ d. The bottom of the trench and the center of the safety flange
 - _____ e. The bottom of the trench and the top of the ground
8. When opening a compression hydrant the drain valve remains open during the first _____ to _____ turns.
- _____ a. 1 - 10
 - _____ b. 5 -10
 - _____ c. 3 - 8
 - _____ d. 2 - 6
 - X _____ e. 1 - 5
9. When the main valve of a compression fire hydrant is closed the drain valve is..
- _____ a. Closed
 - X _____ b. Open
10. How often should fire hydrants in an environment with freezing winter temperatures be inspected?
- _____ a. 3 times each year
 - _____ b. Only after they are used
 - X _____ c. Twice each year
 - _____ d. Once each year
 - _____ e. Only where there is expected problems
11. How is the operating nut on a Mueller hydrant lubricated?
- _____ a. It is not lubricated
 - X _____ b. An oil reservoir in the bonnet
 - _____ c. Water resistant grease
 - _____ d. Silicone lubricant
 - _____ e. By water flowing past the threads

12. On a fire hydrant what does MVO mean?

- a. Most Valuable Organization
- b. Main Valve Operation
- c. Most Variable Operation
- X d. Main Valve Opening
- e. Many Variable Openings

13. Where would you look on a fire hydrant to find the year of manufacture?

- a. Lower barrel
- b. Bonnet
- c. It is not on the hydrant
- d. Base
- X e. Nozzle section

14. The component used to separate the bonnet from the nozzle section is called the _____.

- a. "O" ring section
- b. Nozzle guard
- X c. Packing plate
- d. Packing gland
- e. Upper bonnet plate

15. The drain valve on a compression hydrant is located in what component?

- a. Main valve
- b. Lower barrel
- c. Nozzle section
- X d. Base
- e. Inlet connection

16. As a result of closing a fire hydrant rapidly ...

- X a. Water hammer can be produced
- b. The flow is stopped quickly
- c. The operating nut can be damaged
- d. The stem may come unthreaded
- e. The main valve will be pushed away from the seat causing excessive leakage

O & M of Small Water Systems

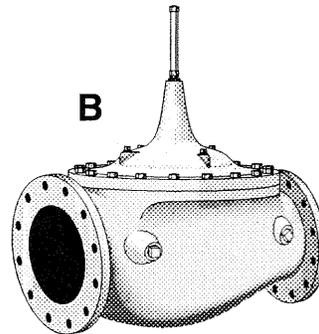
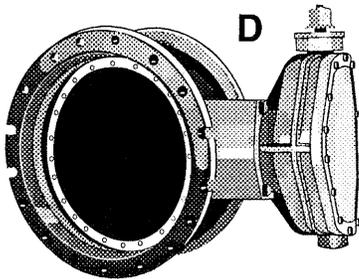
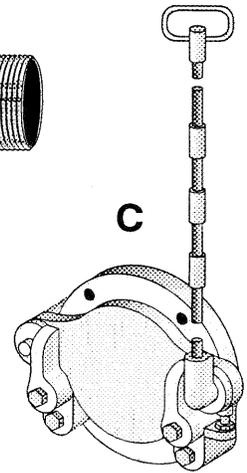
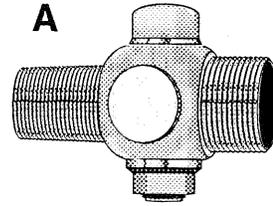
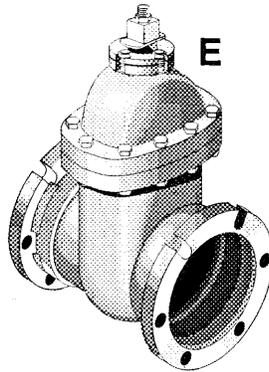
17. When opening a compression hydrant that opens against the flow you would expect the stem to turn easiest.
- a. When first opening the hydrant
 - X b. After the hydrant is nearly completely open
 - c. In the middle of the opening cycle
 - d. There should be no change in the amount of effort to rotate the shaft regardless of the position.
 - e. At the start and at the end of the opening cycle
18. A fire hydrant that uses a scissors-type action for its operating mechanism is called a _____.
- a. Compression hydrant
 - X b. Toggle hydrant
 - c. Slide gate hydrant
 - d. High pressure hydrant
 - e. Frost jacket hydrant
19. The NFPA suggest that fire hydrants that flow less than 500 gpm be color coded by painting some portion of the hydrant _____.
- a. White
 - X b. Red
 - c. Yellow
 - d. Green
 - e. Orange

O & M OF VALVES

WORKSHEET

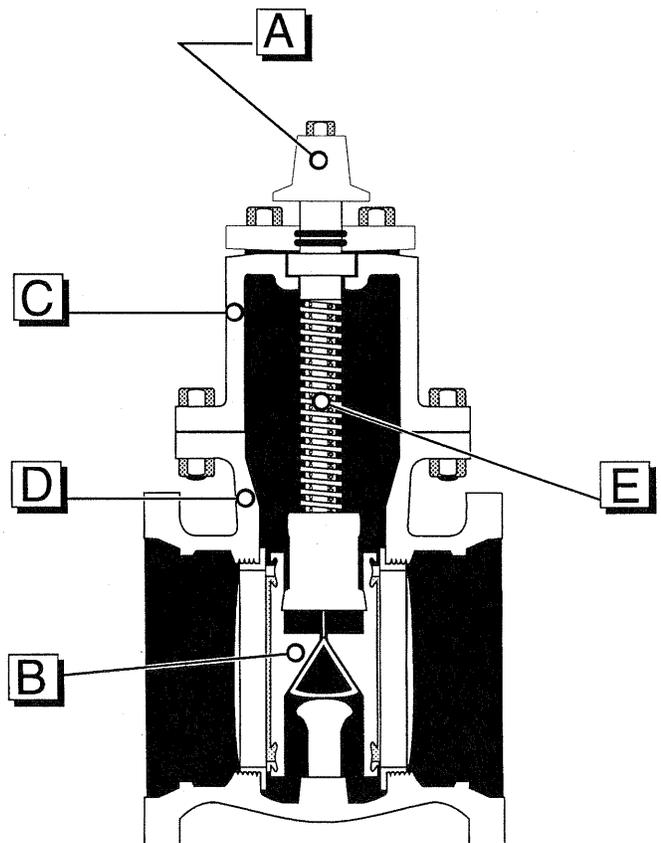
1. Identify the valves below.

- E ____ Gate valve
- D ____ Butterfly valve
- B ____ Globe valve
- A ____ Corp stop
- C ____ Shear gate



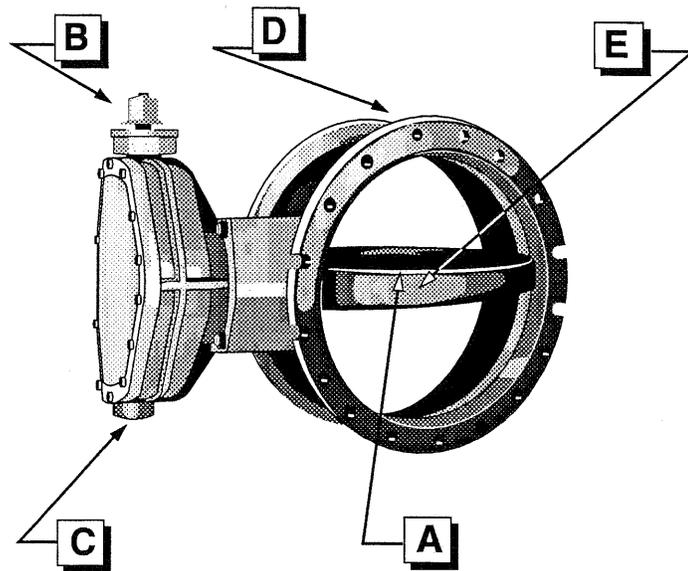
2. Identify the components indicated.

- D ____ Body
- A ____ Operator
- C ____ Bonnet
- B ____ Movable Closure
- E ____ Stem



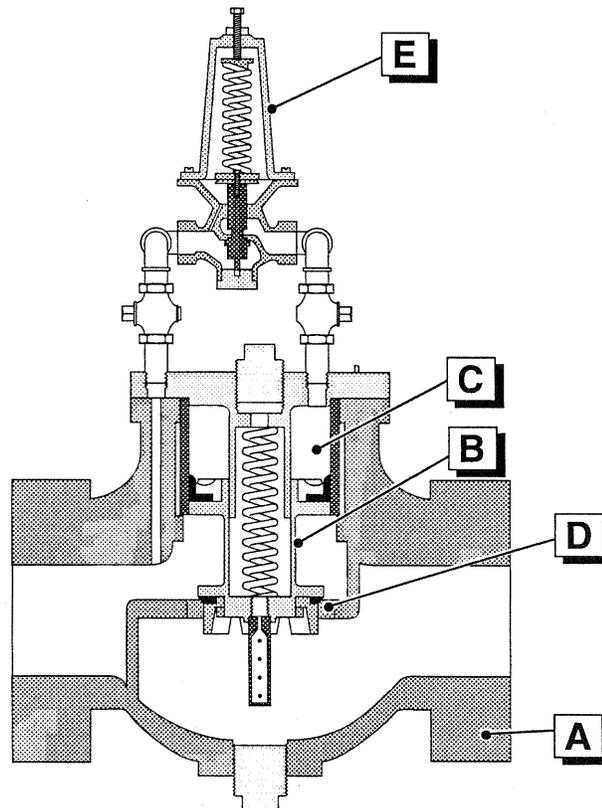
3. Identify the components indicated.

- B _____ Operator
- E _____ Movable Closure
- D _____ Body
- B _____ Gear Head
- A _____ Resilient Seat



4. Identify the components indicated.

- A _____ Body
- C _____ Control Chamber
- E _____ Pilot Valve
- B _____ Stem
- D _____ Valve Seat



5. Which of the following are **not** common functions of valves in a water distribution system?

- a. Flow control
- b. Pressure control
- X c. Pumping surge control
- d. Reversal of direction control
- e. Reservoir depth control

6. If a gate valve will not stop the flow of water when it is closed you should...

- a. Retighten the valve
- b. Allow it to leak
- c. Open the valve 1/2 way and then retighten
- X d. Open the valve just enough to allow water to pass freely and reclose
- e. Open and close 4 to 6 times

7. A double disk would be found in what type of valve?

- a. Butterfly
- b. Globe
- X c. Gate
- d. Plug
- e. Ball

8. A n O S & Y valve would be what type of valve?

- a. Butterfly
- b. Globe
- X c. Gate
- d. Plug
- e. Shear gate

9. Which of the valves listed below require only 1/4 turn from open to close?

- X a. Butterfly
- b. Globe
- c. Gate
- X d. Plug
- e. Shear gate

O & M of Small Water Systems

10. Which type of valve would be used on a screen box intake?

- a. Butterfly
- b. Globe
- c. Gate
- d. Plug
- X e. Shear gate

11. The rate of opening and closing on a Ross globe valve is controlled by...

- a. Pilot valve
- X b. Needle valve
- c. Wye strainer
- d. Differential pressure between the pilot and the pressure chamber
- e. The pressure on the underside of the pilot valve diaphragm

12. The discharge line from an air release valve should extend above the ground _____ inches.

- a. 6
- b. 12
- X c. 18
- d. 24
- e. 30

13. The reversal of flow as a result of a broken main line in the distribution system is what type of backflow?

- X a. Backsiphonage
- b. Backpressure

14. The reversal of flow as a result of a boiler at the school is called what type of backflow?

- a. Backsiphonage
- X b. Backpressure

15. The proper protection from a cross-connection at the clinic would require what type of device?

- a. Vacuum breaker
- b. Pressure vacuum breaker
- c. Double check valve
- d. Barometric loop
- X e. RPZ

16. The proper protection from a cross-connection at the harbor would require what type of device?

- a. Vacuum breaker
- b. Pressure vacuum breaker
- c. Double check valve
- d. Barometric loop
- X e. RPZ

17. Which device would be used on the lowest level of hazard?

- X a. Vacuum breaker
- b. Pressure vacuum breaker
- c. Double check valve
- d. Barometric loop
- e. RPZ

18. The valve most commonly used in a water distribution system is the...

- a. Ball valve
- b. Diaphragm valve
- X c. Gate valve
- d. Globe valve
- e. Eccentric valve

19. Which is the correct type of valve for controlling water levels in a distribution system's elevated tank?

- X a. Altitude valve
- b. Check valve
- c. Pressure regulating valve
- d. Pressure relief valve
- e. Storage tank level control valve

20. Rising stem valves are most often used...

- a. On blow-offs
- b. On hydrants
- c. Before and after household meters
- X d. In pumping stations
- e. On main lines

21. A reduced-pressure-zone backflow preventer will...

- a. stop backsiphonage but not backpressure
- b. stop backpressure but not backsiphonage
- X c. stop backpressure and backsiphonage
- d. stop cross-connections
- e. prevent high velocity flows

INTRODUCTION TO SUPERVISION WORKSHEET

1. Getting work done through others, is an informal definition of _____.

- a. Leadership
- b. Time management
- c. Maintenance management
- X d. Supervision
- e. Delegation

2. Management is the process used to direct the use of _____ to achieve desired results?

- a. Money
- b. People
- X c. Resources
- d. Others
- e. Equipment

3. The one thing you can delegate but not get rid of is _____.

- a. Authority
- b. Money
- c. Job title
- d. Position
- X e. Responsibility

4. Being _____ is taking responsibility for ones own actions.

- a. Authoritarian
- X b. Accountable
- c. Directing
- d. Desirable
- e. Efficient

5. Where does our authority to use the resources to get a job done come from?

- X a. Boss
- b. Customers
- c. Workers
- d. PHS
- e. DEC

6. We cannot control time but we can control _____.

- a. Life
- b. The situation
- X c. Events
- d. People
- e. Time increments

7. Important activities are those that get _____.

- a. Done
- b. Done first
- c. Placed first on the to-do list
- X d. Results
- e. Finished within the time allotted.

8. Items that would receive an "A" priority in a daily to-do list would be those that...

- a. are urgent
- b. are important
- X c. are urgent and important
- d. are not important
- e. are a crises

9. In order to be effective, once a to-do list is completed the next thing that must be done is to _____.

- a. Get the work done
- b. Divide the list into work that can be done and work that must be delegated
- c. Determine the amount of time and supplies needed for each taskX
- d. Prioritize the list
- e. Break the list into logical groups based on urgency

10. The importance of a PM listing on a wall chart or calendar is it allows us to _____ the work.

- X a. Schedule
- b. List
- c. Identify
- d. Understand
- e. Display

11. What is the main advantage of an effective information management system?

- a. It keeps our life neat and orderly
- b. Other people see us as organized
- c. Information has a place to be stored
- X d. Information is easily retrievable
- e. Everything has a place, and there is a place for everything

12. Communication is the process of transferring _____ and _____ from one person to another.

- a. information and ideas
- b. thoughts and data
- c. ideas and information
- d. direction and understanding
- X e. information and understanding

13. In the STP process of communicating ideas or problem solving, what is the definition for the "S."

- a. Sender
- X b. Situation
- c. Sudden
- d. Safeguard
- e. Sales

14. We will only know if our communication is effective if we....

- a. Ask for feedback
- b. Get the response in writing
- c. Use a verbal contract
- X d. Observe behavior
- e. Determine the personality style of the person

15. Which items below should go on an annual schedule?

- X a. When to order chemicals
- X b. When to order fuel
- X c. PM task
- X d. Fishing
- X e. Vacations

O & M of Small Water Systems

16. To make easier, the short definition of what supervision tool?

- a. Coaching
- b. Delegations
- X c. Facilitating
- d. Discipline
- e. Time management

17. When a job is delegated to another, we should give them the _____ and the _____ to complete the job.

- a. Time and money
- X b. Authority and responsibility
- c. Accountability and time
- d. Direction and support
- e. Focus and vision

18. Discipline should be used only ...

- a. When a person is late for work
- b. When the problem is competency
- c. When the problem is understanding the work
- d. When the problem is repeated
- X e. When the problem is willingness

19. A process of brainstorming with a group, where each person gets to write down their ideas in a loose format on a large sheet of paper is called what?

- a. Paper brainstorming
- b. Brainstorming
- X c. Mind mapping
- d. Diagramming
- e. STP & PMI approach

20. An _____ is essential to most successful meetings.

- X a. Agenda
- b. Agreement
- c. Disagreement
- d. STP approach
- e. Antagonist

WATER UTILITY O & M RECORD KEEPING

WORKSHEET

1. List three uses of collected data.
 - a. Improve the reliability of equipment.
 - b. Identify potential failures of equipment before failure occurs.
 - c. Verify the operating conditions of equipment.
 - d. Reduce repair maintenance cost.
 - e. Identify problems before there is a failure.
 - f. Tune the various water system processes for optimal performance and the best return on expenditures for operating materials and services.
 - g. Provide the basis of planning, budgeting and engineering studies.
 - h. O & M records are the basis of the water superintendent's communications with council and regulators
 - i. Isolate operating costs.
 - j. Locate and stake system components in preparation for utility construction.
 - k. Good O & M records help regulators and vendors provide phone support.

2. Give three reasons why utility record keeping should be organized.
 - a. To prevent loss of information through failure to record.
 - b. So the utility will not be held hostage by utility employees
 - c. Eliminate private methods of filing and indexing documents.
 - d. Prevent loss of original documents
 - e. Prevent illicit alteration of records
 - f. Control of updates of transaction records and maps
 - g. Prevent unauthorized destruction of documents
 - h. Prevent congestion in the office and filing equipment.

3. What are five operator responsibilities for record keeping.
 - a. Collect process control data.
 - b. Record incident and repair data.
 - c. Update inventory, plant and equipment records including maps and drawings.
 - d. Follow record keeping procedures.
 - e. Keep records organized and protected from moisture.

4. What types of records need to be set up for water utility O & M record keeping.
 - a. Records about utility information resources.
 - b. Records about utility plant and equipment assets.
 - c. Records about inventory.
 - d. Records about vendors.
 - e. Records of scheduled operation and maintenance activities.
 - f. Records of unscheduled activities.

5. Outline the recommend method of physically organizing your water utility information.
 - a. Information Storage
 - Bookshelf storage
 - Regulations
 - Plans
 - References
 - File cabinet storage
 - Utility generated reports
 - Water system assessments
 - b. Data Storage
 - File resistant cabinets

Construction projects
Archived materials
Map drawer storage
File cabinet storage organized by resources
File cabinet storage organized by activity

WATER UTILITY RESPONSIBILITIES WORKSHEET

1. What are the three levels of responsibility in an organization?
 - a. **Governing Body**
 - b. **Management**
 - c. **Field Operations**

2. What are the nine steps an organization takes to achieve its goals?
 - a. **Sets goals and policies**
 - b. **Commits to achieving its goals**
 - c. **Plans ahead**
 - d. **Assigns responsibility**
 - e. **Communicates goals, plans and policies**
 - f. **Gets the resources necessary to do the job**
 - g. **Operates the utility efficiently**
 - h. **Prepares for emergencies**
 - i. **Monitors its performance**

3. The two forms of local government in Alaska are **Council Manager Form** and **Strong Mayor Form**.

4. A **first** class city usually adopts the city-manager form of government.

5. A **second** class city typically adopts the strong-mayor form of government.

6. List three of the seven plans and programs the City Council must develop for its water utility.
 - a. **Utility enterprise plan**
 - b. **Annual operating plan**
 - c. **Emergency plan**
 - d. **O & M program**
 - e. **Capital improvements program**

f. Replacement and renewal reserve program

g. Safety program

7. Define a replacement and renewal reserve program.

a. Identify when equipment and facilities are to be overhauled or replaced and estimate how much the renewal or replacement will cost at that future time.

b. Set aside an annual amount out of the total user charges and if necessary a subsidy from the city's General Fund to accumulate and be available to pay for the replacement of equipment or the rehabilitation of a facility when its scheduled useful life ends.

8. List six of the ten responsibility areas of water utility operators.

a. Accept responsibility

b. Assist in planning

c. Communicate well

d. Maintain water system

e. Operate water system

f. Control inventory

g. Record operational data

h. Work safely

i. Prepare for emergencies

j. Monitor system condition, operations and product quality

9. What are the five types of resources that utility managers should develop and maintain?

a. People

b. Information

c. Facilities

d. Equipment

e. Inventory

10. List six maintenance tasks which are the responsibility of the utility operator.

- a. Maintains facilities, equipment and spare parts per the written Preventive Maintenance Plan**
- b. Inspects equipment according to preventive maintenance schedule**
- c. Performs scheduled maintenance including servicing well and booster pumps, exercising valves, and flushing lines.**
- d. Cleans reservoirs and storage tanks**
- e. Extends water mains and makes service connections**
- f. Performs emergency repair on plant equipment and distribution system.**

11. List six operations tasks which are the responsibility of the utility operator.

- a. Operates the system according to the Operations Manual provided by the engineering firm at the time the facility was constructed or updated.**
- b. Maintains correct water temperatures in treatment process**
- c. Performs any scheduled backwashing**
- d. Keeps plant clean and organized**
- e. Manually operates well and booster pumps when necessary**
- f. Keeps sufficient inventory of chemicals and spare parts on hand**

WATER QUALITY SAMPLING AND TESTING

WORKSHEET

1. The presence of coliform in a bacteriological sample indicates

Non compliance with the Total Coliform MCL.

2. What does a turbidimeter measure?

The ability to scatter or absorb light.

3. How long can a bacteriological sample be held before it must be tested?

In Alaska there are special provisions that allow a sample to be held for 30 hours.

4. The proper name for disease-causing microorganisms is

Pathogenic organism

5. What are the storage time limitations and storage conditions for holding a turbidity sample?

24 hours in the dark

6. For what period of time can chlorine residual sample be stored?

None

7. When testing for free chlorine residual you must wait **30 sec** before you check the intensity of the color, but you should not wait any longer than **60 sec**.

8. What is the cause of turbidity?

Inorganic clay particles less than 1 micron in size

9. When taking a bacteriological sample the water should be allowed to run for **5 minutes** or **until certain that all the standing water has been cleared from the building's plumbing.**

10. For a Class A filtered surface water system serving a population of fewer than 500 persons, what is the testing frequency for the following:

- a. Fluoride **Daily**
- b. Chlorine residual **Daily**
- c. pH **Daily**
- d. Temp **Daily**
- e. Bac-T samples **Monthly**
- f. Turbidity **Every four hours**

11. For a fill and draw system using a filtered surface water source, how often should the following be monitored?

- a. Fluoride **Daily on the days fluoride is added**
- b. Chlorine residual **Daily**
- c. pH **N/A**
- d. Turbidity **Daily on the days when filling and filtering**

12. What are the stages of the water quality monitoring process?

- a. Know the contamination control strategy for you water system.**
- b. Establish a sampling plan.**
- c. Collect samples.**
- d. Test samples.**
- e. Compare results to the standards, the MCL's.**
- f. Take corrective action**
- g. Report test results**
- h. If necessary, notify the public**
- i. Retain water quality testing records**

13. List three examples of unscheduled water quality monitoring.

- a. **Repeat Sampling**
- b. **Monitoring as a consequence of customer complaints**
- c. **Monitoring as a consequence of customer illness**
- d. **After completing repairs to distribution mains**
- e. **After installing new components or service connections**
- f. **In the event of a hazardous spill**

14. What are the three types of scheduled water quality monitoring?

- a. **Routine bacteriological monitoring**
- b. **Routine process control monitoring**
- c. **Non-routine chemical and radiological monitoring**

15. Under what circumstances must a water utility collect Repeat Samples?

When a bacteriological sample tests positive for Total Coliform

16. A utility that normally collects one routine sample per month must collect **4 Repeat Samples** over a **single day** within **24 hours** of receiving notification of a positive sample.

17. List the factors which determine the frequency of monitoring.

- a. **The contaminant,**
- b. **Severity of the threat the contaminant poses to the public health if not controlled,**
- c. **Vulnerability of the source to that contaminant,**
- d. **Type of treatment used to control contaminants,**
- e. **Size of the population at risk, and**
- f. **Cost of monitoring for the contaminant relative to the size of the population at risk.**

18. Give the stages involved in developing a monitoring plan?

- a. Review contamination control strategy**
- b. Review current monitoring plan**
- c. Establish sampling sites**
- d. Prepare a sampling site map**
- e. Prepare a sampling schedule for routine monitoring and a sampling calendar for non routine sampling**
- f. Prepare the written plan.**

19. List the five types of sampling sites which should be included in the monitoring plan.

- a. Process control sampling sites**
- b. Baseline sampling sites**
- c. System segment sampling sites**
- d. Sampling taps at individual customer sites**
- e. Additional state required routine sampling sites**

WATER UTILITY BUDGETING

WORKSHEET

1. Identify three types of revenue increases to balance a budget.
 - a. **Raise utility rates.**
 - b. **Charge fees for previously free services.**
 - c. **Charge late fees and interest to customers who pay late.**
 - d. **Charge all users for water, including each service to city and tribal buildings.**
 - e. **Charge the City General Fund for the cost of providing fire protection water.**
 - f. **Rent utility equipment or property when it is idle.**

2. List five ways to balance the budget by reducing operating costs.
 - a. **Extend the useful life of equipment by servicing it according to the preventive maintenance schedule before the equipment breaks down.**
 - b. **Tune pumping stations and treatment plant operations so that pumps do not needlessly cycle.**
 - c. **Tune the operation of boilers.**
 - e. **Maintain an aggressive safety program to reduce claims and employee lost time.**
 - f. **Reduce payroll expenses by cutting back employees hours, decreasing the hourly rate paid utility employees and cross training employees to perform multiple tasks.**
 - g. **Eliminate sick leave and vacation as separate benefits. Simply grant 15 days of leave per year, to be taken however the employee wishes.**
 - h. **Require employees to pay part of the cost of their health insurance.**
 - i. **Replace full time positions with lower rate part time people, especially when there is not enough work to justify full time positions.**
 - j. **Use volunteers whenever possible.**
 - k. **Eliminate any wasteful use of chemicals and repair materials,**
 - l. **Improve purchasing to decrease fuel and materials costs, as well as, freight costs.**
 - m. **Control small tools and power equipment in locked inventory. These items have a way of disappearing. Do not let utility employees borrow tools and equipment for personal use.**

3. Give one approach to improve cash flow.
- a. **Reduce the amount of customer receivables by enforcing prompt payment of bills.**
 - b. **Carefully balance purchasing and shipping economies against the hidden cost of tying up cash in inventory.**
 - c. **Aggressively sell surplus assets such as used vehicles and equipment.**

4. Describe the method of determining how much cash will be available for capital outlay next year.

Beginning Operating Cash

(plus) Forecast Net Income

(plus) Add Back Depreciation/Amortization

(less) Current Portion of Principal Payment Due on Debt Service

(less) Foreseen Increases (Decreases) in Accounts Receivable

(less) Foreseen Increases (Decreases) in Inventory

(less) Foreseen Increases (Decreases) in Unrestricted Cash on Hand

(less) Any Increase in Restricted Cash Held for General Operating Contingency.

(less) Any Increase in Restricted Cash Held for Bonded Debt Contingency.

(less) Increase in Restricted Cash for Equipment Replacement Reserves

(less) Increase in Restricted Cash for Facilities Renewal

= Cash available for capital outlay

5. What are the three types of operating revenue?
- a. **Per unit charges for water consumed.**
 - b. **Fixed charges.**
 - c. **Charges for miscellaneous services.**
6. What are the four major cost categories in a water utility operation?
- a. **Cost of Production**
 - b. **Cost of Distribution**
 - c. **Cost of Fire Protection**

d. Customer Cost

7. What are the two operating expense categories?
- a. General and Administrative**
 - b. Depreciation**
8. List two types of non-operating income.
- a. Interest**
 - b. Deposits**
 - c. Rental of Water Utility Property**
 - d. Charge to City General Fund for Fire Defense Water**
 - e. General Fund Subsidy**
 - f. Anticipated Refunds**
9. List two types of non-operating expenses.
- a. Deposits**
 - b. Refunds**
10. What are the seven budget expense objects?
- a. Personnel**
 - b. Travel and Training**
 - c. Operating Expense**
 - d. Operating Supplies**
 - e. Equipment Expense**
 - f. Facilities Expense**
 - g. General Expenses**
11. What are the three formats used to budget utility operations?
- a. Cash**
 - b. Income and Expense**
 - c. Combination Income, Expense and Cash Flow**

12. The two of the major fund types use in government are:

- a. Governmental Fund Types**
- b. Proprietary Fund Types**
- c. Fiduciary (Trust and Agency)**

13. What are the four types of governmental funds?

- a. General Fund**
- b. Special Revenue**
- c. Capital Projects**
- d. Debt Service**

14. List two examples of special revenue funds.

- a. Grant Fund**
- b. Street Fund**
- c. Special Assessment Fund**
- d. Replacement and Renewal Reserve Fund**

15. What are the two types of Proprietary Funds?

- a. Enterprise Funds**
- b. Internal Service Funds**

CUSTOMER SERVICE

WORKSHEET

1. A good customer service program can provide the following benefits?

- a. Reduce operating cost
- X b. Develop support for system improvements
- c. Reduce customer complaints
- X d. Improve collections
- e. Provide DEC with the data that is required under the SWTR

2. What a customer believes they know about the water system is called the customer's _____.

- a. Knowledge
- b. Expectations
- c. Understanding
- d. Beliefs
- X e. Perceptions

3. Which of the following should be in a publication shared with the customers?

- X a. Monthly service cost
- b. Last months bacteriological results
- c. Number of hours worked each week by the operators
- X d. General water system operating cost
- X e. What happens if a customer fails to pay for service

4. Which of the following are common customer complaint categories?

- X a. Low pressure
- b. Low water velocity
- c. MCL violations
- d. Bacteriological quality
- e. Chlorine level to low

5. Which of the following analysis tools use a bar graph to help prioritize information.

- a. Check list
- b. Cause and Effect diagram
- X c. Pareto chart
- d. Histogram
- e. Run chart

DRINKING WATER REGULATIONS

WORKSHEET

1. What are elements of a written regulation?

- a. Purpose
- b. Scope
- c. Authority
- d. Background
- e. Measurable Standards of Performance
- f. Required Procedures, if any included, to achieve standards of performance.

2. What are the purposes of regulations?

- a. Establish minimum levels of service.
- b. Protect the public from injury or loss.

3. Who makes the drinking water and water utility regulations?

- a. Federal Congress
- b. US Environmental Protection Agency
- c. State of Alaska Legislature
- d. Alaska Department of Environmental Conservation
- e. Local Government

4. Give three instances of EPA regulations which are part of the primary drinking water standards and enforceable by federal law.

- a. Volatile Organic Chemicals,
- b. Inorganics/Synthetic Organics - Phase II,
- c. Lead and Copper Rule,
- d. Disinfection By-Products,
- e. Coliform Rule, and
- f. Radio nuclides.

5. List two primary EPA procedural rules.

a. Surface Water Treatment Rule

b. Public Notification Rule

6. Define each of the three classes of public water systems in Alaska

a. A Class A water system is a public water system that is expected to serve, in the normal order of events for at least six months of the year:

1. At least 25 residents

OR

2. At least 10 service connections used by residents

OR

3. 13 or more bedrooms used by residents

OR

A Class A public water system is a system that regularly serves the same 25 or more persons for at least six months of the year.

b. A Class B water system is a public water system that is expected to serve, in the normal order of events, for at least 60 days of the year:

1. At least 25 persons each day

OR

2. At least 10 service connections

AND

3. Is not a Class A public water system

c. A Class C Public Water System is a public water system that is

1. Not a Class A public water system

2. Not a Class B public water system

3. Not a private water system

7. Name two of regulations which apply uniformly to all public water utilities.

a. Cross Connection Control when customers connect to the system or make modifica-

- tions to their plumbing.
- b. Disinfection after Emergency Repair**
 - c. Lab Procedures and Equipment for performing water quality tests**
 - d. Public Notification**
8. What are the four kinds of state drinking water regulations that may vary from system to system?
- a. Treatment**
 - b. Sampling**
 - c. Reporting**
 - d. Record Keeping**
9. List six of the circumstances which can change how regulations apply to a water system.
- a. The contaminants,**
 - b. The vulnerability of the system to contaminants,**
 - c. Type of water source,**
 - d. Type of water treatment,**
 - e. Number of connections,**
 - f. Population served,**
 - g. Days of continual service annually,**
 - h. The public health history of the system,**
 - i. The age, condition and level of maintenance of the system.**
10. Describe the four types of standards and rules which explicitly state how water systems will achieve compliance with the Maximum Contaminant Levels and performance standards, that is, the primary rules.
- a. Design and Construction Standards for water system sources, treatment and distribution.**
 - b. Operations and Maintenance Procedures, including requirements for operator certification, procedures to protect surface and groundwater sources, and guidance on performing emergency repairs.**
 - c. Administrative Procedures, including record keeping, plan review process and process for applying for a variance or exception from a performance standard or an implementing rule.**

d. Monitoring Procedures, including methods and frequency of sampling, testing, reporting and notifying the public.

11. Compliance with performance standards are measured by scheduled routine and nonroutine monitoring.

12. Compliance with design and construction standards are measured by state design review and by construction inspection.

13. Describe the four types of violations.

a. Acute MCL Violations present an acute health risk to humans and the public must be warned through radio and television or, where unavailable through individual notification.

- If a system had at least two separate bacteriological samples test positive for the presence of coliforms and one of those samples also tests E. Coli¹ or fecal positive, the system presents an acute health risk to humans, and the public must be immediately notified.

- If a system exceeds the MCL for nitrates, the system can retest within 24 hours. If the system does not retest or the retest exceeds the MCL, the water quality presents an acute health risk to humans, and the public must be immediately notified.

b. Non-Acute Mcl Violations

- When the utility submits two (2) coliform positive samples, it is in violation of the Total Coliform MCL (also called the Coliform Rule).

- When the tested level of any contaminant (other than micro biological) exceeds its Maximum Contaminant Level, it is in non-acute violation of an MCL.

c. Treatment Technique Violations

- The utility has failed to successfully provide a required treatment process or technique.

- The utility has failed to comply with the terms of a variance or exemption, including timeliness of required actions.

d. Monitoring Violations

- The utility has failed to submit the required number of samples in any one month and is therefore in violation of the monitoring requirements.

- The utility has failed to submit any repeat samples that might be required and is therefore in violation of the monitoring requirements.

- The utility has failed to comply with a testing (as opposed to a sampling) procedure.

¹ E. Coli - A specific coliform bacteria also termed "Fecal Coliform". The coliform test will indicate the presence of contamination by a warm blooded animal humans, because these bacteria live in the intestinal tract.

14. List the four contaminant categories of MCL's.

- a. Microbiological**
- b. Physical**
- c. Radiological**
- d. Chemical**

15. List the types of chemical contaminants.

- a. Inorganic chemicals**
- b. Organic chemicals**
 - 1. Disinfection By Products**
 - 2. Pesticides**
 - 3. Volatile Organic Chemicals**
 - 4. Other Organic Chemicals**

16. Under what conditions might the Department of Environmental Conservation require a system to meet secondary standards?

- a. The Alaska Department of Conservation may , at its discretion, require a water utility to meet the secondary MCL if the public health is threatened or if there is a strong public objection to the drinking water when it exceeds a listed secondary MCL.**

17. What mineral compounds can constitute an acute health risk when present in excess of their MCL?

- a. Nitrates**
- b. Nitrites**

18. When must a water utility notify the public that its water fails to comply with drinking water regulations?

- a. When the drinking water fails to meet one or more MCL's**
- b. When the water utility fails to meet the requirements for monitoring.**
- c. When the water utility is granted a variance or exemption from a MCL or a procedural requirement, including treatment techniques.**
- d. The water utility fails to comply with the provisions, including the timing of activities, established in variance or exemption agreements.**

19. The utility must notify its public within **72 hours** of the receipt of a notification from the certified lab.

O & M of Small Water Systems

20. Records of disinfectant residuals must be retained for **twelve months** , and bacteriological test results must be retained for **five years**.

21. The water utility must send ADEC a copy of bacteriological test results within **seven days** of receiving the results from the lab, and the utility must send ADEC a monthly report of in house process control testing within **ten days** of the end of the month.