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\usepackage[utf8]{inputenc}

%\usepackage[T1]{fontenc}

\usepackage{amsmath}

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\begin{document}

\begin{enumerate}

\item Groundwaters generally have consistent water quality that include\\

a. \*having a higher total dissolved solids content than surface water\\

b. having a lower mineral content than surface waters\\

c. having lower $\mathrm{pH}$ values than surface waters\\

d. having a higher amount of bacteria than surface waters\\

\item When underground water is under pressure greater than atmospheric pressure and could rise above the its confining space and above the ground level is referred to as a(n)\\

a. aquifer\\

b. anaerobic condition\\

c. \*artesian effect\\

d. drawdown\\

e. pressure gradient\\

\item The gradual flow or movement of water into and through the pores of the soil is called\\

a. \*percolation\\

b. run-off\\

c. precipitation\\

d. impermeable flow\\

e. evapotranspiration\\

\item Water rights which are acquired by diverting water and putting it to use in accordance with specified procedures is referred to as\\

a. artesian wells\\

b. potable water\\

c. \*prescriptive water\\

d. safe yield water\\

e. palatable water\\

\item Water that has been used to carry solids away from a home or office into a treatment facility is referred to as\\

a. \*wastewater or sewage\\

b. potable\\

c. seawater intrusion injection water\\

d. riparian water\\

\item The water right to put it to beneficial use of the surface water adjacent to your land is called water.\\

a. wastewater\\

b. \*riparian\\

c. filter ripening\\

d. infiltration\\

e. run-off\\

\item The difference between static level and pumping level in a well is called:\\

a. \*drawdown.\\

b. cone of depression\\

c. zone of saturation\\

d. radius of influence\\

\item Which one of the following best defines the term aquifer?\\

a. A low lying area where water pools\\

b. Water-bearing stratum of rock, sand, or gravel\\

c. Impervious stratum near the ground surface\\

d. Treated water leaving the water system\\

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

a. Pumping water level\\

b. Water table\\

c. Piezometric surface\\

d. Drawdown\\

e. Radius of influence\\

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

a. 97\\

b. 50\\

c. 2\\

d. 1\\

e. 0.34\\

\item To prevent the entry of surface contamination into a well is the purpose of\\

a. The well casing\\

b. The water table\\

c. The louvers or slots\\

d. Well development\\

e. The annular grout seal\\

\item An aquifer that is located underneath an aquiclude is called\\

a. An unconfined aquifer\\

b. A confined aquifer\\

c. A water table\\

d. Unreachable groundwater\\

e. An Artesian spring\\

\item The process by which water changes from the gas to the liquid phase is termed\\

a. Condensation ·\\

b. Evaporation\\

c. Percolation\\

d. Precipitation\\

e. Runoff\\

\item The free surface of the water in an unconfined aquifer is known as the\\

a. Pumping water level\\

b. Artesian spring\\

c. Water table\\

d. Drawdown\\

e. Percolation\\

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

a. Transpiration\\

b. Evaporation\\

c. Condensation\\

d. Runoff\\

e. Percolation\\

\item The elevation of water in the casing of an operating well is called the\\

a. Piezometric surface\\

b. Water table\\

c. Pumping water level\\

d. Drawdown\\

e. Radius of influence\\

\item An aquifer under pressure is often termed\\

a. Unconfined\\

b. Pacific\\

c. Artesian\\

d. Alluvial\\

e. Elevated\\

\item An aquifer is usually composed of\\

a. Sand and gravel\\

b. Clays and silts\\

c. Bedrock\\

d. Large voids in the soil, resembling underground lakes\\

e. None of the above\\

\item Which of the following best defines the term specific capacity?\\

a. Amount of water a given volume of saturated rock or sediment will yield to gravity\\

b. Amount of water a given volume of saturated rock or sediment will yield to pumping\\

c. Rate at which water would flow in an aquifer if the aquifer were an open conduit\\

d. Amount of water a well will produce for each foot of drawdown\\

\item The most common type of well used for public water supply systems is a\\

a. Jetted well\\

b. Driven well\\

c. Drilled well\\

d. Bored well

\item Which one of the following best defines the term aquifer?\\

a. A low lying area where water pools\\

b. Water-bearing stratum of rock, sand, or gravel\\

c. Impervious stratum near the ground surface\\

d. Treated water leaving the water system\\

\item Which of the following best defines the term static water level?\\

a. Water level in a well after a pump has operated for a period of time\\

b. Water level in a well when the well is not in operation\\

c. Water level in a well measured from the ground surface to the drawdown water level\\

d. Waterlevel in a well measured from the natural water level to the drawdown water level\\

\item The residual drawdown of a well is defined as\\

a. Water level in a well after a pump has operated over a period of time\\

b. Measured distance from the ground to the pumping level\\

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

d. Measured distance between the water level and the top of the screen\\

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

a. 20 feet\\

b. 30 feet\\

c. 50 feet\\

d. 70 feet\\

e. 100 feet\\

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

a. $97 \%$\\

b. $50 \%$\\

c. $2 \%$\\

d. $1 \%$\\

e. $0.34 \%$\\

\item To prevent the entry of surface contamination into a well is the purpose of\\

a. The well casing\\

b. The water table\\

c. The louvers or slots\\

d. Well development\\

e. The annular grout seal\\

\item The process by which water changes from the gas to the liquid phase is termed\\

a. Condensation\\

b. Evaporation\\

c. Percolation\\

d. Precipitation\\

e. Runoff\\

\item The free surface of the water in an unconfined aquifer is known as the\\

a. Pumping water level\\

b. Artesian spring\\

c. Water table\\

d. Drawdown\\

e. Percolation\\

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

a. Transpiration\\

b. Evaporation\\

c. Condensation\\

d. Runoff\\

e. Percolation\\

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

a. Percolation\\

b. Evapotranspiration\\

c. Sublimation\\

d. Overdraft\\

e. Precipitation\\

\item A primary advantage of using surface water as a water source includes:\\

a. Usually higher in turbidity\\

b. Generally softer than groundwater\\

c. Easily contaminated with microorganisms\\

d. Can be variable in quality\\

\item Which source of water has the greatest natural protection from bacterial contamination?\\

a. Shallow well\\

b. Deep well\\

c. Surface water\\

d. Spring\\

\item A water-bearing formation in the soil is referred to as\\

a. An aquitard or aquiclude\\

b. An aquifer\\

c. An aqueduct\\

d. The drawdown\\

e. The static water level 34. An operating well will drain the water from a volume of soil around the well during pumping. This volume is referred to as the\\

a. Pumping water level\\

b. Radius of influence\\

c. Drawdown\\

d. Cone of depression\\

e. Recharge zone\\

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

a. 1 acre-foot\\

b. 43,560 cubic feet\\

c. 325,829 gallons\\

d. All of the above\\

e. None of the above\\

\item The safe yield of an aquifer is\\

a. Determined by the Department of Health Services\\

b. Variable, depending on rainfall\\

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

d. The difference between the static water level and the pumping water level\\

e. All of the above\\

\item The movement of water from the surface of the earth into the soil is called\\

a. Condensation\\

b. Evaporation\\

c. Evapotranspiration\\

d. Runoff\\

e. None of the above\\

\item The freezing point of water is\\

a. $0^{\circ} \mathrm{F}$\\

b. $32^{\circ} \mathrm{C}$\\

c. $32^{\circ} \mathrm{F}$\\

d. $0^{\circ} \mathrm{C}$\\

e. $100^{\circ} \mathrm{F}$\\

\item The movement of water from the atmosphere to the surface of the earth is called\\

a. Condensation\\

b. Evaporation\\

c. Evapotranspiration\\

d. Runoff\\

e. Precipitation\\

\item The movement of water on the surface of the earth is called\\

a. Percolation\\

b. Evaporation\\

c. Evapotranspiration\\

d. Runoff\\

e. Infiltration\\

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

a. An aquitard or aquiclude\\

b. An aquifer\\

c. An aqueduct\\

d. The drawdown\\

\item Another term for the percolation that transports water from the surface into an aquifer is\\

a. Artesian springs\\

b. Recharge\\

c. Extraction\\

d. Overdraft\\

e. Runoff\\

\item Water that is safe to drink is called water.\\

a. Potable\\

b. Palatable\\

c. Good\\

d. Clear\\

\item Groundwaters generally have consistent water quality that include\\

a. having a higher total dissolved solids content than surface water\*\\

b. having a lower mineral content than surface waters\\

c. having lower $\mathrm{pH}$ values than surface waters\\

d. having a higher amount of bacteria than surface waters\\

\item What is the middle layer of a stratified lake called?\\

a. Thermocline\\

b. Benthic Zone\\

c. Epilimnion\\

d. Hypolimnion\\

\item What is the conversion of liquid water to gaseous water known as?\\

a. Advection\\

b. Condensation\\

c. Precipitation\\

d. Evaporation\\

\item Water weighs\\

a. $7.481 \mathrm{bs} / \mathrm{gal}$\\

b. $8.34 \mathrm{lbs} / \mathrm{gal}$\\

c. $62.4 \mathrm{lbs} / \mathrm{ft}^{3}$\\

d. Both B. and C. 48. What is the static level of an unconfined aquifer also known as?\\

a. Drawdown\\

b. Water Table\\

c. Pumping Water Level\\

d. Aquitard\\

\item A water bearing geologic formation that accumulates water due to its porousness\\

a. Aquifer\\

b. Lake\\

c. Aquiclude\\

d. Well\\

\item What kind of stream flows continuously throughout the year?\\

a. Ephemeral\\

b. Perennial\\

c. Intermittent\\

d. Stratified\\

\item The surface to atmosphere movement of water is known as\\

a. Precipitation\\

b. Percolation\\

c. Stratification\\

d. Evapotranspiration\\

\item An aquifer that is underneath a layer of low permeability is known as\\

a. Confined aquifer\\

b. Water Table aquifer\\

c. Unconfined aquifer\\

d. Unreachable groundwater\\

\item What is the middle layer of a stratified lake known as?\\

a. Hypolimnion\\

b. Benthic Zone\\

c. Thermocline\\

d. Epilimnion\\

\item The amount of water that can be pulled from a aquifer without depleting\\

a. Drawdown\\

b. Safe yield\\

c. Overdraft\\

d. Subsidence\\

\item The primary origin of coliforms in water supplies is\\

a. Natural algae growth\\

b. Industrial solvents\\

c. Fecal contamination by warm-blooded animals\\

d. Acid raid 56. A primary source of volatile organic chemical (VOC) contamination of water supplies is\\

a. Agricultural pesticides\\

b.Industrial solvents\\

c. Acid rain\\

d. Agricultural fertilizers\\

\item The term "surface runoff" refers to\\

a. Rainwater that soaks into the ground\\

b. Rain that returns to the atmosphere from the earth's surface\\

c. Surface water that overflows the banks of rivers\\

d. Water that flows into rivers after a rainfall\\

\item A disease that can be transferred by water is\\

a. Gonorrhea\\

b. Malaria\\

c. Mumps\\

d. Typhoid\\

\item To prevent the entry of surface contamination into a well is the purpose of\\

a. The well casing\\

b. The water table\\

c. The louvers or slots\\

d. Well development\\

e. The annular grout seal\\

\item Potable water may be defined as\\

a. Water high in organic content\\

b. Any water that occasionally may be polluted from another source\\

c. Any water that, according to recognized standards, is safe for consumption\\

a. Water that indicates a septic condition\\

e. Water that has been transported from outside the service area\\

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

a. Pumping water level\\

b. Radius of influence\\

c. Drawdown\\

d. Cone of depression\\

e. Recharge zone\\

\item A well screen must be installed in\\

a. deep wells\\

b. consolidated materials\\

c. shallow wells\\

d. unconsolidated materials\\

\item A well is acidified in order to\\

a disinfect\\

b. increase yield\\

c. remove objectionable gases\\

d. remove disinfection by-products\\

\item The amount of water that a well will produce for each foot of drawdown is called:\\

a. specific head\\

b. static yield\\

c. yield/feet\\

d. specific capacity\\

\item Surging a well to loosen scale deposits on the screen refers to:\\

a. turning the pumps on and off as fast as possible to cause a water hammer\\

b. pumping the water in and out of a well\\

c. sending shock waves through the aquifer to cause a surge of water\\

d. using a water jet to surge around the well casing.\\

\item A well is acidized in order to\\

a. Disinfect the water\\

b. Increase yield\\

c. Remove objectionable gasses\\

d. Remove disinfection by-products\\

\item To prevent the entry of surface contamination into a well is the purpose of\\

a, The well casing\\

b. The water table\\

c. The louvers or slots\\

d. Well development\\

e. The annular grout seal\\

\item The variation in water demand during the course of a day is termed\\

a. Seasonal variation\\

b. Fire flow requirements\\

c. Emergency storage variation\\

d. The straight line equalization method\\

e. Diurnal variation\\

\item The maximum momentary load placed on a water supply system is known as\\

a. Average daily flow\\

b. Average daily demand\\

c. Rated capacity\\

d. A System float\\

d. Peak demand\\

\item The term aquifer refers to:\\

a. A special type of aqueduct.\\

b. A natural source of water.\\

c. A potable water.\\

d. Water bearing strata.\\

\item The use of a well supply as a source normally results in: a. Water that is high in nitrates\\

b. Water of consistent quality\\

c. Water very high in mineral content\\

d. Water that is considered "soft".\\

\item Maximum Safe Yield of a water source is defined as:\\

a) Where the state health department has approved the source of use.\\

b) The quantity of water that can be taken from a source of supply over a period of years without depleting the source permanently - beyond it's ability to replenish in wet years.\\

c) Water that is free of bacteria.\\

d) Quantity of water that may be treated in the plant.\\

\item Movement of water through the ground is called:\\

a) Hydraulic subsidence\\

b) Runoff\\

c. Percolation\\

d. Infiltration\\

\item A primary source of volatile organic chemical (VOC) contamination of water supplies is\\

a. Agricultural pesticides\\

b. Industrial solvents\\

c. Acld rain\\

d. Agricultural fertilizers\\

\item Surging a well to loosen scale deposits on the screen refers to:\\

a. turning the pumps on and off as fast as possible to cause a water hammer\\

b. pumping the water in and out of a well\\

c. sending shock waves through the aquifer to cause a surge of water\\

d. using a water jet to surge around the well casing.\\

\item A sanitary well seal is used to:\\

a. seal the clear well\\

b. seal the top of the well casing\\

c. seal the water tower\\

d. seal a break in the distribution system\\

\item The amount of water that a well will produce for each foot of drawdown is called:\\

a. specific head\\

b. static yield\\

c. yield/feet\\

d. specific capacity\\

\item After replacing a repaired pump back into a well, the operator should first:\\

a put the seal on tight to avoid contamination\\

b. add chlorine to disinfect the well and surrounding aquifer c. start the pump to make sure that it will pump water\\

d. open the valve to let the pressure off the line\\

\item The amount of water in a water-bearing formation depends on the\\

a. Depth of the well\\

b. Size of the pump\\

c. Thickness and permeability of the formation\\

d. Type of well casing 1. Hard water contains an abundance of\\

a. sodium\\

b. iron\\

c. lead\\

d. \*calcium carbonate\\

\item A specific class of bacteria that only inhibit the intestines of warm-blooded animals is referred to as?\\

a. Eutrophic\\

b. Grazing\\

c. Salmonella\\

d. \*Fecal coliform\\

e. pathogenic\\

\item Water with a $\mathrm{pH}$ of 8.0 is considered to be\\

a. acidic\\

b. \*basic or alkaline\\

c. neutral\\

d. undrinkable\\

\item Over which water quality indicator do operators have the greatest control?\\

a. alkalinity\\

b. $\mathrm{pH}$\\

c. temperature\\

d. \*turbidity\\

\item Which piece of laboratory equipment is used to titrate a chemical reagent?\\

a. graduated cylinder\\

b. \*burette\\

c. pipet\\

d. Buchner funnel\\

\item Which $\mathrm{pH}$ range is generally accepted as most palatable (drinkable)?\\

a. $\* 6.5$ to 8.5\\

b. 4.5 to 6.5\\

c. 8.5 to 9.5\\

d. 9.5 and above\\

e. all of the above\\

\item Which of the following conditions is favorable for the rapid growth of algal?\\

a. \*moderate to high dissolved oxygen and nutrients\\

b. high $\mathrm{pH}$ and water hardness\\

c. low temperatures and low dissolved oxygen\\

d. high alkalinity and water hardness\\

\item Which of the following is the name given for a turbidity meter that has reflected or scattered light off suspended particles as a measurement?\\

a. $\mathrm{HACH}$ colorimeter\\

b. spectrophotometer\\

c. Wheaton bridge\\

d. \*Nephelometer\\

\item Water hardness is the measure of the concentrations of and dissolved in the water sample.\\

a. iron, manganese\\

b. nitrates, nitrites\\

c. sulfates, bicarbonates\\

d. \*calcium \& magnesium carbonates\\

e. ferric chlorides and polymers\\

\item The electrical potential required to transfer electrons from one compound or element to another is commonly referred to as\\

a. \*oxidation-reduction potential (ORP)\\

b. voltage potential $(\mathrm{OHM} / \mathrm{P})$\\

c. resistance-impedance potential\\

d. microMho differential\\

\item Water has physical, chemical, and biological characteristics. Which of the following is a physical characteristic? a. Coliform b. \*Turbidity c. Hardness d. All the above\\

\item Tastes and odors in surface water are most often caused by:\\

a. clays\\

b. hardness\\

c. \*algae\\

d. coliform bacteria\\

\item Which of the following elements cause hardness in water?\\

a. sodium and potassium\\

b. \*calcium and magnesium\\

c. iron and manganese\\

d. turbidity and suspended solids\\

\item When measuring for free chlorine residual, which method is the quickest and simplest?\\

a. DPD color comparater\\

b. Orthotolidine method\\

c. Amperometric titration\\

d. 1, 2 nitrotoluene di-amine method\\

\item Which water quality parameter requires a grab sample because it cannot be collected as a composite sample?\\

a. $\mathrm{pH}$\\

b. Iron\\

c. Nitrate\\

d. Zinc\\

\item If a water sample is not analyzed immediately for chlorine residual, it is acceptable if it is analyzed within\\

a. 10 minutes.\\

b. 15 minutes.\\

c. 20 minutes.\\

d. 30 minutes.\\

\item The volume of a sample for coliform compliance is\\

a. $100 \mathrm{~mL}$.\\

b. $200 \mathrm{~mL}$.\\

c. $300 \mathrm{~mL}$.\\

d. 0 ; there is no volume compliance for coliforms.\\

\item Which of the following is an indicator organism?\\

a. Giardia\\

b. Cryptosporidium\\

c. Hepatitis\\

d. E. Coli\\

\item What is the primary origin of coliform bacteria in water supplies?\\

a. Natural algae growth\\

b. Industrial solvents\\

c. Animal or human feces\\

d. Acid rain\\

\item What ls the term for water samples collected at regular intervals and combined in equal volume with each other?\\

a. Time grab samples\\

b. Time flow samples\\

c. Proportional time composite samples\\

\item What is the basis for the number of samples that must be collected for utilities monitoring for lead and copper that are in compliance or have installed corrosion control'?\\

a. Size of distribution system\\

b. Population\\

c. Amount of water produced\\

d. Number of raw water sources\\

\item Where should bacteriological samples be collected in the distribution system?\\

a. Uniformly distributed throughout the system based on area\\

b. At locations that are representative of conditions within the system\\

c. Always from extreme locations in the system but occasionally at other locations\\

d. Uniformly throughout the system based on population density\\

\item The quantity of oxygen. that can remain dissolved in water is related to\\

a. Temperature\\

b. $\mathrm{pH}$\\

c. Turbidity\\

d. Alkalinity\\

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

a. 24 hours at $25^{\circ} \mathrm{C}$\\

b. 36 hours at $35^{\circ} \mathrm{C}$\\

c. 24 and 36 hours at $25^{\circ} 0$\\

d. 24 and 48 hours at $35^{\circ} \mathrm{C}$\\

\item A major source of error when obtaining water quality information is improper:\\

a. Sampling\\

b. Preservation\\

c. Tests of samples\\

d. Reporting of data\\

\item What is commonly used as an indicator of potential contamination in drinking water samples?\\

a. Viruses\\

b. Coliform bacteria\\

c. Intestinal parasites\\

d. Pathogenic organisms\\

\item The type of organisms that can cause disease are said to be microorganisms.\\

a. $\mathrm{Bad}$\\

b. Pathogenic\\

c. Undesirable\\

d. Sick\\

\item Four types of aesthetic contaminants in water include the following:\\

a. Odor, turbidity, color, hydrogen sulfide gas\\

b. Pathogens, microorganisms, arsenic, disinfection by-products\\

c. Odor, color, turbidity, hardness\\

d. Color, pathogens, metals, organics\\

\item What is the purpose of adding fluoride to drinking water?\\

a. Increase tooth decay\\

b. Reduce tooth decay\\

c. Make teeth white\\

d. Government conspiracy\\

\item The test used to determine the effectiveness of disinfection is called the:\\

a. Coliform bacteria test\\

b. Color test\\

c. Turbidity test\\

d. Particle test\\

\item Turbidity is measured as:\\

a. $\mathrm{mg} / \mathrm{L}$\\

b. $\mathrm{mL}$\\

c. $\mathrm{gpm}$\\

d. NTU\\

\item Giardia and cryptosporidium are a type of:\\

a. Mineral\\

b. Organism\\

c. Color\\

d. Bird\\

\item Chronic contaminants are those that can cause sickness after:\\

a. Prolonged exposure\\

b. Low levels or low exposure\\

\item A positive total coliform test indicates that:\\

a. Disease-causing organisms may be present in the water supply\\

b. The water is safe to consume\\

c. The water supply has high iron levels\\

d. There is nothing to be concerned about\\

\item What is the purpose of the bacteriological site sampling plan?\\

a. To have a map showing where BacT samples are drawn\\

b. In case of a positive Bac $\mathrm{T}$ sample, the operator will know where to take the four repeat samples\\

c. The state will know where you are taking your repeat samples\\

d. All of the above\\

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

a. Have water analyzed at an approved water testing laboratory\\

b. Determine a sampling schedule based on state requirements\\

c. Send all analyses results to the state\\

d. All of the above\\

\item Samples taken for routine bacteriological testing should be preserved by:\\

a. Freezing\\

b. Boiling\\

c. DPD preservative\\

d. Refrigeration\\

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

a. 1\\

b. 2\\

c. 3\\

d. 4\\

\item Before taking a bacteriological (BacT) water sample from a faucet, you should:\\

a. Wash hands thoroughly b. Remove the faucet aerator\\

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

d. All of the above\\

\item Monthly BacT samples should be taken from:\\

a. The well pump house\\

b. The distribution system\\

c. The treatment plant\\

d. An outside hose spigot\\

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

a. 12 hours\\

b. 24 hours\\

c. 48 hours\\

d. 72 hours\\

\item \\_\\_ is a measure of the capacity of water to neutralize acids.\\

a. Concentration\\

b. Alkalinity\\

c. $\mathrm{pH}$\\

d. Conductivity\\

\item The DPD method is used to determine the of a water sample.\\

a. Dissolved oxygen content\\

b. Conductivity\\

c. $\mathrm{pH}$\\

d. Free chlorine residual\\

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

a. Brown\\

b. Green\\

c. Blue\\

d. Pink\\

\item The presence-absence ( $\mathrm{P}-\mathrm{A})$ test used for microbiological testing is also commonly referred to as\\

a. Multiple Tube Fermentation\\

b. Membrane Filtration\\

c. Confirmed Test\\

d. Colilert\\

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

a. Color change\\

b. Gas bubble formation\\

c. Formation of a cyst d. Formation of turbidity\\

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

a. They survive longer in water\\

b. They grow in the intestines\\

c. There are less coliform than pathogenic organisms\\

d. They are still present in water without fecal contamination\\

\item What is the second step in the multiple tube fermentation test?\\

a. Presumptive test\\

b. Negative test\\

c. Completed\\

d. Confirmed\\

\item What is the removal and deactivation requirement for Giardia?\\

a. $2 \log$\\

b. $3 \log$\\

c. $4 \log$\\

d. There is no requirement\\

\item The multiple barrier approach to water treatment includes removal through which method?\\

a. Filtration\\

b. Coagulation\\

c. Disinfection\\

d. a and c\\

\item A pH reading of 7 is considered\\

a. Slightly acidic\\

b. Acidic\\

c. Basic\\

d. Neutral\\

\item EDTA titration is used to determine the of a water sample.\\

a. Hardness\\

b. Conductivity\\

c. Alkalinity\\

d. Free chlorine residual\\

\item A higher than normal turbidity reading could signify\\

a. A change in water quality\\

b. Nothing. Keep operating as normal\\

c. Microbiological contamination\\

d. Both $A \& C$\\

\item What is the ingredient used during the second multiple tube fermentation test?\\

a. Colilert\\

b. MMO/MUG\\

c. Brilliant Green Bile \\

d. Chlorine\\

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

a. A minimum of five minutes.\\

b. $1 \mathrm{hr}$.\\

c. $30 \mathrm{~min}$\\

d. only a few seconds\\

\item Black stains on plumbing fixtures might be attributed to\\

a. calcium.\\

b. copper.\\

c. magnesium.\\

d. manganese.\\

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

a. preliminary, confirmed, and completed tests.\\

b. preliminary, presumptive and confirmed tests.\\

c. presumptive, confirmed, and completed tests.\\

d. prespumtive, preliminary, and completed tests.\\

\item What should the sample volume be when testing for total coliform bacteria?\\

a. $100 \mathrm{~mL}$\\

b. $250 \mathrm{~mL}$\\

c. $500 \mathrm{~mL}$\\

d. $1,000 \mathrm{~mL}$\\

\item $\mathrm{pH}$ is a measure of :\\

a. conductivity\\

b. water's ability to neutralize acid\\

c. hydrogen ion activity\\

d. dissolved solids\\

\item Sodium Thiosulfate is used to\\

a. Buffer chlorine solutions\\

b. Neutralize chlorine residuals\\

c. Detect chlorine leaks\\

d. Sterilize sample bottles\\

\item The presence of total coliforms in drinking water indicates\\

a. The presence of pathogens.\\

b. The absence of an adequate chlorine residual\\

c. The existence of an urgent public health problem\\

d. The potential presence of pathogens\\

\item A primary health risk associated with microorganisms in drinking water is\\

a. Cancer\\

b. Acute gastrointestinal diseases\\

c. Birth defects\\

d. Nervous system disorders\\

\item After 5 years use, a portion of cast iron pipe shows a white scale about $1 / 2$ inch thick lining the inside. This means\\

a. Red water will soon become a problem\\

b. The water has been corrosive\\

c. The water is chemically unstable and is depositing\\

d. Water should flow easier since the lining is smooth\\

\item Hardness in water is caused by\\

a. Dissolved minerals\\

b. High $\mathrm{pH}$.\\

c. Low turbidity\\

d. Alkalinity\\

\item The meniscus on calibrated glassware is read at the\\

a. Bottom of curvature for mercury but the top for water\\

b. Extreme point of contact between the liquid and glass, i.e., where gas, liquid, and air all meet at one point\\

c. Mid-height of the curvature so that beginning and ending readings will results in zero error\\

d. Top of curvature for mercury but at the bottom for most other liquids including water\\

\item An unknown substance is found on the bottom of the water within a drinking water reservoir. Which of the following statements is true of this substance?\\

a. It has a specific gravity less than 1.0\\

b. It has a specific gravity equal to 1.0\\

c. It has a specific gravity greater than 1.0\\

d. It has no specific gravity\\

e. None of the above\\

\item The term "Chain of Custody" refers to\\

a. A large accessory to a come-along\\

b. An attachment to a pipe-cutter\\

c. Employee labor laws\\

d. Procedures and documentation required for water quality sampling\\

e. Procedures and documentation required for chemical application\\

\item Water samples to be analyzed for taste and odor must be\\

a. Analyzed in the field\\

b. Collected in glass sample containers\\

c. Dechlorinated with sodium thiosulfate\\

d. Preserved with dilute hydrochloric acid e. None of the above\\

\item Bacteriological samples for a distribution system must be collected in accordance with\\

a. The Surface Water Treatment Rule\\

b. OSHA requirements\\

c. An approved sample siting plan\\

d. FLSA requirements\\

e. ANSI/NSF Standard 61\\

\item Trihalomethanes are classified as\\

a. Metals\\

b. Inorganic constituents\\

c. Secondary drinking water standards\\

d. Radiological contaminants\\

e. Volatile organic compounds\\

\item The multiple tube fermentation analysis consists of\\

a. Positive, negative, and neutral tests\\

b. Presumptive, confirmed, and completed tests\\

c. Preliminary, presumptive, and confirmed tests\\

d. Preliminary, confirmed, and completed tests\\

e. Presence or absence testing\\

\item Which of the following is NOT a characteristic of coliform organisms?\\

a. Intestinal origin\\

b. Will produce carbon dioxide from lactose\\

c. Heartier in a water environment than pathogenic organisms\\

d. Far less numerous than pathogenic organisms\\

e. Able to survive with or without oxygen\\

\item A bacteriological test that measures only the presence or absence of coliforms is\\

a. ColiLert (MMO/MUG)\\

b. Multiple tube fermentation\\

c. Most probable number (MPN)\\

d. Membrane filtration\\

e. Presumptive test\\

\item After collection, if stored at $4^{\circ} \mathrm{C}$, bacteriological samples must be processed within\\

a. 1 hour\\

b. 6 hours\\

c. 24 hours\\

d. 48 hours\\

e. 72 hours\\

\item Sample bottles which are furnished by a certified laboratory for collection of bacteriological samples\\

a. Should be rinsed with the water to be sampled before use b. Should be placed in boiling water for at least 10 minutes before use\\

c. Should be rinsed with a chlorine solution before use\\

d. Should be rinsed with distilled water before use\\

e. Are ready to use\\

\item The standard indicator of potential fecal contamination of a water supply is\\

a. Cryptosporidium\\

b. $\mathrm{pH}$\\

c. Alkalinity\\

d. Hardness\\

e. Coliform Presence - Absence\\

\item Where should bacteriological samples be collected?\\

a. At different locations on each sampling cycle, to make sure the entire system is sampled\\

b. Only from public locations, such as drinking fountains and restrooms\\

c. Only from locations owned by consumers\\

d. Only from specially constructed sampling stations\\

e. From several sampling locations around the entire distribution system, in accordance with a DHS-approved sample siting plan\\

\item Storage of bacteriological samples during transport to a laboratory is best accomplished using\\

a. A clean storage box specifically designed to hold sample containers\\

b. An ice chest packed with ice\\

c. An insulated storage box with "blue ice".\\

d. An insulated storage box with "dry ice"\\

e. No particular sample storage requirements apply, as long as the samples can be delivered to a laboratory prior to the end of the work day\\

\item Sodium thiosulfate is added in the laboratory to bacteriological sample bottles to:\\

a. Thoroughly disinfect the sample bottle\\

b. -Complete the cleaning and sterilization process\\

c. Neutralize any residual chlorine present in the sample at the time of collection\\

d. Counteract the effects of sunlight on the water sample\\

e. Prevent further growth of bacteria in water samples following collection\\

\item Radiological contaminant concentrations in drinking water are measured in\\

a. Milligrams per liter\\

b. Micrograms per liter\\

c. Nanograms per liter\\

d. Picograms per liter\\

e. None of the above\\

\item Which of the following is NOT a characteristic of coliform organisms?\\

a. Intestinal origin\\

b. Will produce carbon dioxide from lactose\\

c. Heartier in a water environment than pathogenic organisms\\

d. Far less numerous than pathogenic organisms\\

e. Able to survive with or without oxygen\\

\item A water supply is found to have a calcium carbonate concentration of $50 \mathrm{mg} / \mathrm{L}$. This water would be considered\\

a. soft water\\

b. hard water\\

c. potable water\\

d. non-potable water\\

\item Cathodic protection refers to protection against\\

a. contamination\\

b. corrosion\\

c. hardness\\

d. alkalinity\\

\item An operator uses to test for residual chlorine\\

a. DPD\\

b. Cresol red\\

c. Methyl orange\\

d. Sulfuric acid\\

\item The meniscus on calibrated glassware is read at the:\\

a. Bottom of curvature for mercury but the top for water\\

b. Extreme point of contact between the liquid and glass, i.e., where gas, liquid, and air all meet at one point\\

c. Mid-height of the curvature so that beginning and ending readings will results in zero error\\

d. Top of curvature for mercury but at the bottom for most other liquids including water\\

\item The type of corrosion caused by the use of dissimilar metal in a water system is\\

a. Caustic corrosion\\

b. Galvanic corrosion\\

c. Oxygen corrosion\\

d. Tubercular corrosion\\

\item Which of the following can cause tastes and odors in a water supply?\\

a. Dissolved zinc\\

b. Algae\\

c. High $\mathrm{pH}$\\

d. Low $\mathrm{pH}$\\

\item The primary health risk associated with volatile organic chemicals.(VOCs) is\\

a. Cancer\\

b. Acute respiratory diseases\\

c. "Blue baby" syndrome d. Reduced IQ. in children\\

\item Lead in drinking water can result in\\

a. Impaired mental functioning in children\\

b. Prostate cancer in men\\

c. Stomach and intestinal disorders\\

d. Reduced white blood cell count\\

Sodium thiosulfate is used to\\

a. Buffer chlorine solutions\\

b. Neutralize chlorine residuals\\

c. Raise pH d. Sterilize sample bottles\\

\item Cathodic protection means protection against\\

a. contamination\\

b. corrosion\\

c. hardness\\

d. infiltration\\

\item A water supply is found to have a calcium carbonate concentration of $50 \mathrm{mg} / \mathrm{l}$. This water would be considered\\

a. soft water\\

b. hard water\\

c. potable water\\

d. non-potable water\\

\item The main characteristic of raw water that enables algae to grow is\\

a. Presence of copper sulfate\\

b. Low $\mathrm{pH}$\\

c. High hardness\\

d. Presence of nutrients 1. Primary drinking water standards are set to protect the public from illnesses as a direct result in drinking water that exceeds maximum set levels. Secondary standards were set to alert the public to\\

a. the incidences of local cancer numbers\\

b. dissolved solids in water\\

c. immediate health concerns\\

d. radiological conditions concerning drinking water\\

e. \*aesthetic issues with drinking water\\

\item A positive fecal coliform test must be reported to the primacy agency within\\

a. 8 hours.\\

b. 12 hours.\\

c. 24 hours.\\

d. 48 hours.\\

\item Which agency sets legal limits on the concentration levels of harmful contaminants in potable water distributed to customers?\\

a. National Primary Drinking Water Regulations\\

b. United States Environmental Protection Agency\\

c. United States Public Health Service\\

d. Occupational Health and Safety Organization\\

\item Which may be substituted for the analysis of residual disinfectant concentration, when total coliforms are also sampled at the same sampling point?\\

a. Heterotrophic plate count (HPC)\\

b. Fecal coliforms\\

c. Giardia lamblia\\

d. Combined chlorine\\

\item What does the acronym MCL stand for?\\

a. Minimum contaminant level\\

b. Micron contaminant level\\

c. Maximum contaminant level\\

d. Milligrams counted last\\

\item How long do sanitary surveys have to be retained for records?\\

a. 3 years\\

b. 5 years\\

c. 7 years\\

d. 10 years\\

\item The most severe water system violation that requires the fastest public notification\\

a. Tier I\\

b. Tier II\\

c. Tier III\\

d. Tier IV 8. The primacy agency may grant a variance or exemption as long as\\

a. The agency is using the Best Available Technology\\

b. There is no threat to public health\\

c. There is never a scenario for a variance or exemption\\

d. Both A. and B.\\

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

a. Nontransient noncommunity\\

b. Transient noncommunity\\

c. Community public water system\\

d. None of the above\\

\item Regulations based on the aesthetic quality of drinking water\\

a. Primary Standards\\

b. Secondary Standards\\

c. Microbiological Standards\\

d. Radiological Standards\\

\item The lowest reportable limit for a water sample\\

a. $0.5 \mathrm{mg} / 1$\\

b. Zero\\

c. Public health goal\\

d. Detection Level for reporting\\

\item Primary Standards are based on\\

a. Color and Taste\\

b. Aesthetic quality\\

c. Public Health\\

d. Odor\\

\item A disease causing microorganism\\

a. Pathogen\\

b. Colilert\\

c. Pathological\\

d. Turbidity\\

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

a. $1.0 \log s$\\

b. $2.0 \log \mathrm{s}$\\

c. $3.0 \log s$\\

d. 4.0 Logs\\

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

a. $99.9 \%$\\

b. $99.99 \%$\\

c. $99.0 \%$\\

d. $99.999 \%$\\

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

a. $10 \%$\\

b. $7 \%$\\

c. $5 \%$\\

d. No positive samples allowable\\

\item The National Primary Drinking Water Regulations apply to drinking water contaminants that may have adverse effects on\\

a. Water color\\

b. Water taste\\

c. Water odor\\

d. Human health\\

\item Which of the following is considered an acute risk to health?\\

a. Two Tier 2 violations\\

b. One Tier 2 violation\\

c. Two Tier 1 violations\\

d. One Tier 1 violation\\

\item Records on turbidity analyses should be kept for a minimum of\\

a. 5 years\\

b. 7 years\\

c. 10 years\\

d. 25 years\\

\item Records on bacteriological analyses should be kept for a minimum of\\

a. 5 years\\

b. 7 years\\

c. 10 years\\

d. 25 years\\

\item Difference between primary and secondary standard substances:\\

a. Primary standards refer to substances that are carcinogenic, secondary standards do not.\\

b. Primary standards refer to substances that are thought to pose a threat to human health, secondary standards do not.\\

c. Primary standards refer to substances that, if not.put in check, will eventually kill humans, secondary standards do not.\\

d. Secondary qualities are aesthetic qualities and will only make some people sick, while primary standards refer to substances that will make everyone sick and may possibly cause death.\\

\item The SDWA defines a public water system that supplies piped water for human consumption as one that has\\

a. 10 service connection or serves 20 or more people for 60 or more days per year b. 15 service connections or serves 20 or more people for 90 or more days per year\\

c. 10 service connections or serves 25 or more people for 30 or more days per year\\

d. 15 service connections or serves 25 or more people for 60 or more days per year\\

\item According to the USEPA regulations, the owner or operator of a public water system that fails to comply with applicable\\

monitoring requirements shall give notice to the public within\\

a. 1 week of the violation in a letter hand-delivered to customers\\

b. 45 days of the violation by posting a notice at the town hall\\

c. 3 months of the violation in a daily newspaper in the area served by the system d. 1 year of the violation by including the notice with the water-bill .\\

\item What US agency establishes drinking water standards?\\

a. AWWA\\

b. USEPA\\

c. NIOSH\\

d. NSF\\

\item If a water supply exceeds the MCL, whose responsibility is it to notify the consumer?\\

a. the testing lab\\

b. the supplier\\

c. the DOH\\

d. the USEPA\\

\item According to the Lead and Copper Rule. the action for the 90th percentile lead level is:\\

a. $0.005 \mathrm{mg} / 1$\\

b. $0.015 \mathrm{mg} / \mathrm{l}$\\

c. $0.030 \mathrm{mg} / 1$\\

d. $0.050 \mathrm{mg} / \mathrm{l}$\\

\item The term "maximum contaminant level goal (MCLG)" means the:\\

a. Maximum allowable level of a given contaminant in drinking water\\

b. Level of a contaminant .in drinking water below which there are no known or suspected adverse health effects with a margin of safety\\

c. Level of a contaminant in drinking water that will trigger a Tier 1 violation\\

d. Minimum detectable level of a given contaminant\\

\item The maximum contaminant level goal (MCLG) of known or probable carcinogens is:\\

a. Set by the state\\

b. The same number as the maximum contaminant level (MCL)\\

c. Zero\\

d. The minimum detectable level of a given contaminant\\

\item The difference between Tier 1 and Tier 2 violations is:\\

a. Tier 1 violations-potentially impose-direct and adverse health effects;-Tier 2 violations do not pose a a direct threat to public health. $b$. Tier 1 violations require public notification; Tier 2 violations do not require public notification c. Tier 1 violations are acute; Tier 2 violations are not acute\\

d. Tier 1 violations have legal consequences; Tier 2 violations do not\\

\item The Safe Drinking Water Act requires to develop a comprehensive coliform monitoring plan\\

a. Large public water systems (serving $>50,000$ people)\\

b. Large and medium public water systems (serving $>3,300$ people)\\

c. Small and medium public water systems (serving $>25$ and $<3,300$ people)\\

d. All public water systems\\

\item The most important factor to consider in locating a well site from the health point of view is\\

a. Anticipated yield\\

b. Availability of electric power\\

c. Distance from other wells\\

d. Vulnerability\\

\item Trihalomethanes are classified as:\\

a. Metals\\

b. Inorganic constituents\\

c. Secondary drinking water standards\\

d. Radiological contaminants\\

e. Volatile organic compounds\\

\item The primary health risk associated with volatile organic chemicals.(VOCs) is\\

a. Cancer\\

b. Acute respiratory diseases\\

c. "Blue baby" syndrome\\

d. Reduced IQ in children\\

\item The term "primacy" means the\\

a. Authority by the states to supersede USEPA drinking water regulations\\

b. Authority by the USEPA to supersede state drinking water regulations\\

c. Requirements for states to maintain drinking water regulations more stringent than USEPA regulations\\

d. Primary authority for implementation and enforcement of drinking water regulations\\

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c. Small and medium public water systems (serving $>25$ and $<3,300$ people)\\

d. All public water systems\\

\item Contaminant monitoring requirements can depend on\\

a. The results of a vulnerability assessment\\

b. The size of the water system c. Previous maximum contaminant level (MCL) violations\\

d. All of the above\\

\item For public water systems using surface water and groundwater under the influence of surface water, turbidity must be measure at least\\

a. Every 4 hours\\

b. Daily\\

c. Weekly\\

d. Monthly\\

\item The difference between Tier 1 and Tier 2 violations is\\

a. Tier1-violations potentially impose-direct and adverse health effects; Tier 2 violations do not pose a direct threat to public health\\

b. Tier 1 violations require public notification; Tier 2 violations do not require public notification\\

c. Tier 1 violations are acute; Tier 2 violations are not acute\\

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a. Set by the state\\

b. The same number as the maximum contaminant level (MCL)\\

c. Zero\\

d. The minimum detectable level of a given contaminant\\

\item All of the following diseases may be transmitted by contaminated water, except for:\\

a. Cryptosporidiosis\\

b. Giardiasis\\

c. Cholera\\

d. Typhoid\\

e. Tuberculosis\\

\item The maximum disinfectant residual allowed in a distribution system is\\

a. $\quad 0.2 \mathrm{mg} / \mathrm{L}$\\

b. $\quad 2.0 \mathrm{mg} / \mathrm{L}$\\

c. $\quad 2.0 \mu \mathrm{g} / \mathrm{L}$\\

d. $4.0 \mathrm{mg} / \mathrm{L}$\\

e. There is no maximum disinfectant residual standard\\

\item What steps must be taken when a single routine sample tests positive for total coliform? a. Immediately notify the Department of Health Services\\

b. Immediately notify customers\\

c. Re-test a new sample taken from the original sample point\\

d. Re-test a new sample taken from the original sample point, plus at points immediately upstream and downstream\\

e. Flush the system around the original sample point to re-establish disinfectant levels\\

\item For drinking water distribution systems with over 40 routine coliform samples per month, the maximum amount of coliform-positive samples permitted is\\

a. 2\\

b. $2 \%$\\

c. 5\\

d. $5 \%$\\

e. variable, depending on the size of the system\\

\item Final determination of vulnerability is made by\\

a. Private contractor/consultants\\

b. The primacy agency\\

c. The water supplier\\

d. All of the above\\

\item The regulation that establishes standards for microbiological quality in drinking water is a. The Disinfection By-Product Rule\\

b. Secondary Drinking Water Standards\\

c. The Total Coliform Rule\\

d. The Lead and Copper Rule\\

e. Maximum Contaminant Level\\

\item Primary and secondary drinking water standards are normally established with a\\

a. Maximum contaminant level\\

b. Minimum contaminant level\\

c. Public health goal\\

d. Maximum contaminant level goal\\

e. Minimum contaminant level goal\\

\item The presence of coliform bacteria in a distribution system\\

a. Is positive proof that pathogenic organisms are present\\

b. Indicates that chlorine demand has increased dramatically c. Indicates that pathogenic organisms may be present also\\

d. Requires the use of brilliant green bile as a secondary disinfectant\\

e. Has no particular significance\\

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a. Every 4 hours\\

b. Daily\\

c. Weekly.\\

d. Monthly\\

\item Contaminant monitoring requirements can depend on\\

a. The results of a vulnerability assessment\\

b. The size of the water system\\

c. Previous maximum contaminant level (MCL) violations\\

d. All of the above\\

\item The term "primacy" means the\\

a. Authority by the states to supersede USEPA drinking water regulations\\

b. Authority by the USEPA to supersede state drinking water regulations\\

c. Requirements for states to maintain drinking water regulations more stringent than USEPA regulations\\

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\item The Safe Drinking Water Act requires to develop a comprehensive coliform monitoring plan a. Large public water systems (serving $>50,000$ people)\\

b. Large and medium public water systems (serving $>3,300$ people)\\

c. Small and medium public water systems (serving $>25$ and $<3,300$ people)\\

d. All public water systems 1. What is the purpose of coagulation and flocculation?\\

a. control corrosion\\

b. to kill disease causing organisms\\

c. to remove leaves, sticks, and fish debris\\

d. \*to remove particulate impurities and suspended matter\\

\item How are filter production (capacity) rates measured?\\

a. Mgd/sq.ft.\\

b. $\* \mathrm{Gpm} / \mathrm{sq} . \mathrm{ft}$.\\

c. $\mathrm{Gpm}$\\

d. Mgd\\

\item Why should a filter be drained if it is going to be out-of-service for a prolonged period?\\

a. to allow the media to dry out\\

b. to save water\\

c. to prevent the filter from floating on groundwater levels\\

d. \*to avoid algal growth\\

\item Which of the following are commonly used coagulation chemicals?\\

a. hypochlorites and free chlorine\\

b. sodium and potassium chlorides\\

c. \*alum and polymers\\

d. bleach and HTH\\

\item How can an operator tell if a filter is NOT completely cleaned after backwashing?\\

a. \*the initial headloss is on the high side\\

b. the backwash rate was too slow\\

c. mudballs are NOT present\\

d. backwashing pumping rate is too low\\

\item Flocculation is defined as\\

a. \*the gathering of fine particles after coagulation by gentle mixing\\

b. clumps of bacteria\\

c. the capacity of water to neutralize acids\\

d. a high molecular weight of compounds that have negative charges\\

\item A multi-barrier water filtration plant that contains a flash mix, a coagulation/flocculation zone, sedimentation, filtration and a clear well is considered to be a\\

a. community special treatment plant\\

b. direct filtration plant\\

c. reverse osmosis plant\\

d. \*conventional filtration plant\\

e. traditional plant\\

\item The filtration unit process usually\\

a. is located at the beginning of a filtration plant\\

b. \*follows the coagulation/flocculation/sedimentation processes\\

c. is located after the clear well area\\

d. is located on the plant effluent line after the clearwell\\

\item Filters are generally backwashed when the loss-of-head indicator registers a certain set value, such as 6-ft, or upon a certain time, say 48-hours, or upon a rise in\\

a. alkalinity\\

b. a jar-test result\\

c. \*turbidity\\

d. temperature\\

\item What is a method of reducing hardness?\\

a. \*Softening\\

b. Hardening\\

c. Lightning\\

d. Flashing\\

\item The solid that adsorbs a contaminant is called the:\\

a. \*Adsorbent\\

b. Adsorbate\\

c. Sorbet\\

d. Rock\\

\item The adsorption process is used to remove:\\

a. \*Organics or inorganics\\

b. Bugs or salts\\

c. Organisms or dirt\\

d. Color or particles\\

\item Describe two primary methods used to control taste and odor?\\

a. \*Oxidation and adsorption\\

b. Filtration and sedimentation\\

c. Mixing and coagulation\\

d. Sedimentation and clarification\\

\item What is the recommended loading rate for copper sulfate for algae control at an alkalinity greater than $50 \mathrm{mg} / \mathrm{L}$ ?\\

a. $0.9 \mathrm{lb}$ of copper sulfate per acre of surface area\\

b. $1.9 \mathrm{lb}$ of copper sulfate per acre of surface area\\

c. 2-4 lb of copper sulfate per acre of surface area\\

d. $.4 \mathrm{lb}$ of copper sulfate per acre of surface area\\

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

a. Yellow cloud\\

b. White cloud\\

c. Gray cloud\\

d. Brown cloud 16. What is the recommended minimum contact time water mains with the chlorine slug method?\\

a. 3 hours\\

b. 6 hours\\

c. 10 hours\\

d. 12 hours\\

\item The basic goal for water treatment is to\\

a. Protect public health\\

b. Make it clear\\

c. Make it taste good\\

d. Get stuff out\\

\item Greensand can be operated in either regeneration or regeneration modes.\\

a. Continuous or intermittent\\

b. Fast or slow\\

c. Hot or cold\\

d. Constant or unusual\\

\item The two most common types of chlorine disinfection by-products include:\\

a. TTHM and HAA5\\

b. TTHA of HMM5\\

c. Turbidity and color\\

d. Chloride and fluoride\\

\item GAC contactors are used to reduce the amount of contaminants in water.\\

a. Inorganic\\

b. Turbidity\\

c. Particle\\

d. Organic\\

\item List the five types of surface water filtration systems.\\

a. Bag filtration, cartridge filtration, fine filtration, coarse filtration, media filtration\\

b. Conventional treatment, direct filtration, slow sand filtration, diatomaceous earth filtration, membrane filtration\\

c. Turbidity filtration, color filtration, bag filtration, fine filtration, media filtration\\

d. None of the above\\

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b. Filtration and sedimentation\\

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c. Lightning\\

d. Flashing\\

\item Bag and cartridge filters are used to remove which two pathogenic microorganisms?\\

a. Viruses and giardia\\

b. Giardia and cryptosporidium\\

c. Viruses and bacteria\\

d. None of the above\\

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

a. Backwashing\\

b. Rewashing\\

c. Purging\\

d. Lifting\\

\item In a typical water treatment plant, alum would be added into the mixer.\\

a. Speed\\

b. Large\\

c. Slow\\

d. Flash\\

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

a. Filter\\

b. Clarifier\\

c. Mixer\\

d. Detention\\

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

a. Coagulation, flocculation, sedimentation, filtration\\

b. Flocculation, coagulation, sedimentation, filtration\\

c. Filtration, coagulation, flocculation, sedimentation\\

d. Coagulation, sedimentation, flocculation, filtration 31. The four most common oxidants include:\\

a. Chlorine, potassium permanganate, ozone, chlorine dioxide\\

b. Chlorides, soap, air, coagulants\\

c. Air, chemicals, sodium, chloride\\

d. Flocculants, coagulants, sediments, granules\\

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

a. Different\\

b. Differential\\

c. High\\

d. Low\\

\item What type of polymer is used to improve the efficiency of the sedimentation process?\\

a. Cationic\\

b. Nonionic\\

c. Anionic\\

d. All of the above\\

\item A(n)\\_ polymer is commonly used as a coagulant.\\

a. Anionic\\

b. Cationic\\

c. Nonionic\\

d. Ionic\\

\item $\mathrm{A}(\mathrm{n}) \ldots$ polymer is used to enhance flocculation.\\

a. Anionic\\

b. Cationic\\

c. Nonionic\\

d. Ionic\\

\item $\mathrm{Al}\_{2}\left(\mathrm{SO}\_{4}\right)\_{3} \cdot 18 \mathrm{H}\_{2} \mathrm{O}$ is the chemical formula for:\\

a. Alum\\

b. Iron\\

c. Manganese\\

d. Lead\\

\item Particles that are less than $1 \mu \mathrm{m}$ in size and will not settle easily and are called:\\

a. Light particles\\

b. Colloidal particles\\

c. Colored particles\\

d. Flat particles\\

\item The sedimentation portion of water treatment is also called a(n):\\

a. Clarifier\\

b. Filter\\

c. Adsorber\\

d. Water treater\\

\item Slowly agitating coagulated materials is the process of:\\

a. Flocculation\\

b. Coagulation\\

c. Sedimentation\\

d. Filtration\\

\item The process of decreasing the stability of colloids in water is called:\\

a. Flocculation\\

b. Coagulation\\

c. Sedimentation\\

d. Clarification\\

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

a. Organic contaminants\\

b. Inorganic contaminants\\

c. Large contaminants\\

d. None of the above\\

\item Flocculation, sedimentation, filtration, and adsorption are processes.\\

a. Physical\\

b. Chemical\\

c. Biological\\

d. Mechanical\\

\item Oxidation, coagulation, and disinfection are\\

a. Physical\\

b. Chemical\\

c. Biological\\

d. Mechanical\\

\item A precipitate can be formed after which one of the following processes:\\

a. Oxidation\\

b. Flocculation\\

c. Filtration\\

d. Adsorption\\

\item Water that is safe to drink is called water.\\

a. Potable\\

b. Palatable\\

c. Good\\

d. Clear\\

\item The type of organisms that can cause disease are said to be microorganisms.\\

a. $\mathrm{Bad}$\\

b. Pathogenic\\

c. Undesirable\\

d. Sick\\

\item The basic goal for water treatment is to\\

a. Protect public health\\

b. Make it clear\\

c. Make it taste good\\

d. Get stuff out\\

\item Four types of aesthetic contaminants in water include the following:\\

a. Odor, turbidity, color, hydrogen sulfide gas\\

b. Pathogens, microorganisms, arsenic, disinfection by-products\\

\item What does $\mathrm{mg} / \mathrm{L}$ stand for?\\

a. Microorganisms/Liter\\

b. Milligrams/Loser\\

c. Milligrams/Liter\\

d. None of the above\\

\item Disinfection by-products are a product of:\\

a. Filtration\\

b. Disinfection\\

c. Sedimentation\\

d. Adsorption\\

\item Acute contaminants are those that can cause sickness after:\\

a. Prolonged exposure\\

b. Low levels or low exposure\\

\item Chronic contaminants are those that can cause sickness after:\\

a. Prolonged exposure\\

b. Low levels or low exposure\\

\item TTHMs and HAA5s can affect:\\

a. Health\\

b. Aesthetics\\

c. Color\\

d. Odor\\

\item Oxidation, coagulation, and disinfection are processes.\\

a. Physical\\

b. Chemical\\

c. Biological\\

d. Mechanical\\

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\item A precipitate can be formed after which one of the following processes:\\

a. Oxidation\\

b. Flocculation\\

c. Filtration\\

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\item Giardia and cryptosporidium are a type of:\\

a. Mineral\\

b. Organism\\

c. Color\\

d. Bird\\

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a. Light particles\\

b. Colloidal particles\\

c. Colored particles\\

d. Flat particles\\

\item One micrometer is also equal to:\\

a. $0.1 \mathrm{~mm}$\\

b. $0.0001 \mathrm{~mm}$\\

c. $0.001 \mathrm{~mm}$\\

d. $1 \mathrm{~m}$\\

\item Particles less than $0.45 \mu \mathrm{m}$ in size are considered to be:\\

a. Dissolved\\

b. Really little\\

c. Colored particles\\

d. Flat particles\\

\item Turbidity is measured as:\\

a. $\mathrm{Mg} / \mathrm{L}$\\

b. $\mathrm{mL}$\\

c. $\mathrm{gpm}$\\

d. NTU\\

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d. Lead\\

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b. Cationic\\

c. Nonionic\\

d. Ionic\\

\item The concentration of a chemical added to the water is measured in:\\

a. $\mathrm{mL}$\\

b. $\mathrm{mg}$\\

c. $\mathrm{mg} / \mathrm{L}$\\

d. Liters\\

\item The quantity of chlorine remaining after primary disinfection is called a residual.\\

a. Chlorine\\

b. Permaganate\\

c. Hot\\

d. Cold\\

\item Primary disinfectants are used to microorganisms.\\

a. Hurt\\

b. Inactivate\\

c. Burn up\\

d. Evaporate\\

\item Secondary disinfectants are used to provide a in the distribution system.\\

a. Color\\

b. Chemical\\

c. Smell\\

d. Residual\\

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b. Giardia and cryptosporidium\\

c. Viruses and bacteria\\

d. None of the above\\

\item List the four types of membrane filtration processes commonly used in water treatment.\\

a. MF, UF, NF, and RO\\

b. MNF, UOF, NOF, and ROO\\

c. CFM, FM, FN, and OR\\

d. None of the above\\

\item What is a method of reducing hardness?\\

a. Softening\\

b. Hardening\\

c. Lightning\\

d. Flashing\\

\item Adsorption of a substance involves its accumulation onto the surface of a:\\

a. Solid\\

b. Rock\\

c. Pellet\\

d. Snow ball\\

\item The solid that adsorbs a contaminant is called the:\\

a. Adsorbent\\

b. Adsorbate\\

c. Sorbet\\

d. Rock\\

\item The adsorption process is used to remove:\\

a. Organics or inorganics\\

b. Bugs or salts\\

c. Organisms or dirt\\

d. Color or particles\\

\item Describe two primary methods used to control taste and odor?\\

a. Oxidation and adsorption\\

b. Filtration and sedimentation\\

c. Mixing and coagulation\\

d. Sedimentation and clarification\\

\item List the five types of surface water filtration systems.\\

a. Bag filtration, cartridge filtration, fine filtration, coarse filtration, media filtration\\

b. Conventional treatment, direct filtration, slow sand filtration, diatomaceous earth filtration, membrane filtration\\

c. Turbidity filtration, color filtration, bag filtration, fine filtration, media filtration\\

d. None of the above\\

\item GAC contactors are used to reduce the amount of contaminants in water.\\

a. Inorganic\\

b. Turbidity\\

c. Particle\\

d. Organic\\

\item Greensand can be operated in either regeneration or regeneration modes.\\

a. Continuous or intermittent\\

b. Fast or slow\\

c. Hot or cold\\

d. Constant or unusual\\

\item What is the cause of taste and odor problems in raw surface water?\\

a. Copper sulfate\\

b. Blue-green algae\\

c. Oxygen\\

d. Lake turnover\\

\item What chemical reduces blue-green algae growth?\\

a. Chlorine\\

b. Caustic Soda\\

c. Copper Sulfate\\

d. Alum\\

\item What is the purpose of adding fluoride to drinking water?\\

a. Increase tooth decay\\

b. Reduce tooth decay\\

c. Make teeth white\\

d. Government conspiracy\\

\item The optimal coagulant dose is determined by a\\

a. Chlorine Test\\

b. Flocculation test\\

c. Jar Test\\

d. Coagulation test\\

\item The most common primary coagulant is\\

a. Alum\\

b. Cationic polymer\\

c. Fluoride\\

d. Anionic polymer\\

\item Bacteria and Viruses belong to a particle size known as\\

a. Suspended\\

b. Dissolved\\

c. Strained\\

d. Colloidal\\

\item The purpose of coagulation is to\\

a. Increase filter run times\\

b. Increase sludge\\

c. Increase particle size\\

d. Destabilize colloidal particles\\

\item The purpose of flocculation\\

a. Destabilize colloidal particles\\

b. Increase particle size\\

c. Decrease sludge\\

d. Decrease filter run times\\

\item Primary coagulant aids used in treatment process are\\

a. Poly-aluminum chloride\\

b. Aluminum sulfate\\

c. Ferric chloride\\

d. All of the Above\\

\item How do water agencies monitor the effectiveness of their filtration process?\\

a. Alkalinity\\

b. Conductivity\\

c. Turbidity\\

d. $\mathrm{pH}$\\

\item Flocculation is used to enhance\\

a. Number of particle collisions to increase floc\\

b. Charge neutralization\\

c. Dispersion of chemicals in water\\

d. Settling speed of floc\\

\item If there is a problem with floc formation, what would you consider changing?\\

a. Adjust coagulant dose\\

b. Stay the course\\

c. Adjust mixing intensity\\

d. Both $A \& C$\\

\item Which step in the treatment process is the shortest?\\

a. Filtration\\

b. Sedimentation\\

c. Flocculation\\

d. Coagulation\\

\item To lower the $\mathrm{pH}$ for enhanced coagulation the operator will add\\

a. Chlorine\\

b. Sulfuric acid\\

c. Lime\\

d. Caustic Soda\\

\item The flocculation process lasts how long?\\

a. Seconds\\

b. 5-10 minutes\\

c. 15-45 minutes\\

d. Over an hour\\

\item The function of a flocculation basin is to\\

a. Settle colloidal particles\\

b. Destabilize colloidal particles\\

c. Mix chemicals\\

d. Allow suspended particles to grow\\

\item The treatment process that involves coagulation, flocculation, sedimentation, and filtration is known as\\

a. Direct filtration\\

b. Slow sand Filtration\\

c. Conventional treatment\\

d. Pressure filtration\\

\item Sedimentation produces waste known as\\

a. Backwash water\\

b. Sludge\\

c. Waste water\\

d. Mud\\

\item What kind of process is the sedimentation step?\\

a. Physical\\

b. Chemical\\

c. Biological\\

d. Direct\\

\item The weirs at the effluent of a sedimentation basin are also called\\

a. Effluent weirs\\

b. Baffling\\

c. Launders\\

d. Spokes\\

\item Sedimentation is used in water treatment plants to\\

a. Settle pathogenic material\\

b. Destabilize particles\\

c. Disinfect water\\

d. Reduce loading on Filters\\

\item Scouring is a term that describes conditions in a sedimentation tank which\\

a. Could impact the rest of treatment process\\

b. Higher flow rates in the sludge zone\\

c. Re-suspends settle sludge\\

d. All of the above\\

The four zones in a Sedimentation basin include\\

a. Inlet, sedimentation, sludge, outlet\\

b. Inlet, filter, waste, outlet\\

c. Inlet, top, bottom, outlet\\

d. Surface, sedimentation, sludge, outlet\\

\item The removal and inactivation requirement for Giardia is?\\

a. $99.9 \%$\\

b. $99.99 \%$\\

c. $99.00 \%$\\

d. $90 \%$\\

\item Short circuiting in a sedimentation basin could be caused by\\

a. Surface wind\\

b. Ineffective weir placement, or weirs covered in algae\\

c. Poor baffling in sedimentation inlet zone\\

d. All of the Above\\

\item How much solids should be removed during sedimentation?\\

a. $95 \%$ or more\\

b. $80-95 \%$\\

c. $70-80 \%$\\

d. $60-70 \%$\\

\item The type of basin that includes coagulation and flocculation is\\

a. Rectangular\\

b. Triangular\\

c. Up-Flow\\

d. None of the above\\

\item Recarbonation basins are used to stabilize water after\\

a. Filtration\\

b. Disinfection\\

c. Softening\\

d. Coagulation\\

\item Which of the following is an effective way for removing iron water? a. adding baffles\\

b. adding sodium chloride\\

c. aeration and filtration\\

d. flash mixing\\

\item How can iron bacteria be controlled in a water distribution system?\\

a. by aeration\\

b. filtration\\

c. chlorination\\

d. precipitation\\

\item Which of the following is a hazard when handling hydrofluosilicic acid?\\

a. fire\\

b. explosion\\

c. corrosion\\

d. inhalation\\

\item Trihalomenthane may be partially removed from water by:\\

a. fluoridation\\

b. chlorination\\

c. oxidation\\

d. ultraviolet radiation\\

\item Which of the following forms of iron is most soluble in water?\\

a. Ferric $\left(\mathrm{Fe}^{+3}\right)$\\

b. Ferric hydroxide $\left[\mathrm{Fe}\left(\mathrm{OH}\_{3}\right)\right]$\\

c) Ferrous $\left(\mathrm{Fe}^{+2}\right)$\\

d. Ferrous oxide $(\mathrm{FeO})$\\

\item Two fundamental treatment requirements for public water systems using surface sources are\\

a. Coagalat1on and sedimentation\\

b. Lime softening and disinfection\\

c. Filtration and aeration\\

d. Disinfection and filtration\\

\item A zeolite softening unit will replace calcium and magnesium ions with ions.\\

a. Fluoride\\

b. Iron\\

c. Sodium\\

d. Sulfur\\

\item One use of polyphosphates is to:\\

a. Control algae\\

b. Improve taste\\

c. Sequester iron and manganese\\

d. Kill bacteria 124. An acceptable means of corrosion control for relatively small systems is\\

a. Activated carbon\\

b. Lime-soda ash softening\\

c. $\mathrm{pH}$ control\\

d. zeolite softening\\

\item Which of the following chemicals will most likely keep iron in suspension?\\

a. Chlorine\\

b. Fluoride\\

c. Polyphosphate\\

d. Lime inhibitor\\

\item Lead in drinking water can result in\\

a. Impaired mental functioning in children\\

b. Prostate cancer in men\\

c. Stomach and intestinal disorders\\

d. Reduced white blood cell count\\

\item If raw water turbidity changed from 10 to 300 turbidity units and the finished water turbidity had increased from 0.1 to 1.0 turbidity units, the unit process having the most impact to correct this situation is\\

a. Coagulation\\

b. Sedimentation\\

c. Filtration\\

d. Disinfection\\

\item The problem caused by dissolved carbon dioxide in the water of the distribution system is\\

a. increased Trihalomethanes\\

b. Corrosion\\

c. Excessive encrustation\\

d. Tastes and odors\\

\item The presence of the coliform group of bacteria in water indicates\\

a. Contamination\\

b. Inadequate disinfection\\

c. Improper sampling\\

d. Taste and odor problems\\

\item The granular filtration process is designed to reduce\\

a. Calcium and magnesium sulfates\\

b. True color\\

c. Total dissolved solids\\

d. Turbidity\\

\item The presence of the coliform group of bacteria in water indicates\\

a. Contamination\\

b. Inadequate disinfection\\

c. Improper sampling\\

d. Taste and odor problems\\

\item Aeration in water treatment plants is used to\\

a. Lower the $\mathrm{pH}$\\

b. Reduce concentrations of dissolved gasses\\

c. Reduce turbidity\\

d. Stabilize chlorine residuals\\

\item What can the operator do if iron fouling appears to be a problem in an ion exchange softener?\\

a. Decrease the strength of the brine used in the regeneration stage\\

b. Increase backwash flow rates\\

c. Inçrease duration of backwash stage\\

d. Increase duration of service stage\\

\item At what $\mathrm{pH}$ would a chlorinated water have the highest concentration of hypochlorous acid?\\

a. 5\\

b. 7\\

c. 9\\

d. 11\\

\item One use of polyphosphates is to\\

a. Control algae\\

b. Improve taste\\

c. Sequester iron and manganese\\

d. Kill bacteria\\

\item Which of the following can cause tastes and odors in a water supply?\\

a. Dissolved zinc\\

b. Algae\\

c. High $\mathrm{pH}$\\

d. Low $\mathrm{pH}$\\

\item What happens when lime is fed to water for corrosion control?\\

a. Alkalinity is decreased\\

b. CO2 does not change\\

c. Turbidity is decreased\\

d. $\mathrm{pH}$ is increased\\

\item The main characteristic of raw water that enables algae to grow is\\

a. Presence of copper sulfate\\

b. Low $\mathrm{pH}$\\

c. High hardness\\

d. Presence of nutrients\\

\item The type of corrosion caused by the use of dissimilar metal in a water system is\\

a. Caustic corrosion\\

b. Galvanic corrosion\\

c. Oxygen corrosion\\

d. Tubercular corrosion\\

\item A zeolite softening unit will replace calcium and magnesium ions with ions.\\

a. Fluoride\\

b. Iron\\

c. Sodium\\

d. Sulfur\\

\item Two fundamental treatment requirements for public water systems using surface sources are\\

a. Coagulation and sedimentation\\

b. Lime softening and disinfection\\

c. Filtration and aeration\\

d. Disinfection and filtration\\

\item A method used to soften water is\\

a. Aeration\\

b. Sedimentation\\

c. Ion exchange\\

d. Adsorption\\

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\item Trihalomenthane may be partially removed from water by:\\

a. fluoridation\\

b. chlorination\\

c. oxidation\\

d. ultraviolet radiation\\

\item Temporary cloudiness in a freshly drawn sample of tap water may be caused by:\\

a. air\\

b. chlorine\\

c. hardness\\

d. silica\\

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b. $\mathrm{CO}\_{2}$ does not change\\

c. Turbidity is decreased\\

d. $\mathrm{pH}$ is increased\\

\item Which two chemicals are used to remove turbidity?\\

a. Soda Ash and lime\\

b. Copper sulphate and caustic soda\\

c. Alum and lime\\

\item Which of the following is considered to be a coagulant aid?\\

a. Lime\\

b. Polymer\\

c. Bentonite\\

d. All of the above\\

\item Alum precipitates as\\

a. Aluminum carbonate\\

b. Aluminum sulphate\\

c. Aluminum hydroxide\\

\item Turbidity removal with alum is best accomplished at what $\mathrm{pH}$ ?\\

a. 3.5\\

b. 5.0\\

c. 6.5\\

\item Which of the following will not lower the $\mathrm{pH}$ ?\\

a. Alum\\

b. Carbonic acid\\

c. Ferric chloride\\

d. Sodium carbonate\\

\item Liquid fluoride is delivered as:\\

a. Sodium Fluoride\\

b. Hydrofluorosilicic acid\\

c. Sodium Silicofluoride\\

d. Hydrofluoric acid\\

\item An upflow clarifier will have which of the following processes?\\

a. Coagulation\\

b. Flocculation\\

c. Sedimentation\\

d. All of the above\\

\item Sludge that rises to the surface of a sedimentation basin is caused by:\\

a. Not removing sludge often enough\\

b. Removing sludge too often\\

c. $\mathrm{pH}$ is too low\\

d. Surface loading rate is too low\\

\item Pin floc leaving a sedimentation basin may indicate a problem with:\\

a. Coagulation\\

b. Flocculation\\

c. Sedimentation\\

d. Disinfection\\

\item What is the backwash rate for a rapid sand filter?\\

a. 2 gpm/sq.ft.\\

b. $15 \mathrm{gpm} / \mathrm{sq} . \mathrm{ft}$.\\

c. $20 \mathrm{gpm} / \mathrm{sq} . \mathrm{ft}$.\\

d. $25 \mathrm{gpm} / \mathrm{sq} . \mathrm{ft}$.\\

\item What is the maximum run time for a gravity filter?\\

a. 8 hours\\

b. 20 hours\\

c. 48 hours\\

d. 100 hours\\

\item During backwash, the filter bed should expand:\\

a. $5-10 \%$\\

b. $15-20 \%$\\

c. $30-50 \%$\\

d. $60-80 \%$\\

\item If the backwash time is too short, what may result?\\

a. Too much freeboard\\

b. Mudballs\\

c. Loss of filter media\\

d. Filter breakthrough\\

\item If the filtration rate is too high, what may result?\\

a. Filter breakthrough\\

b. Mudballs\\

c. Reduction in operating costs\\

d. Lower headloss\\

\item Solids removed from a filter are most commonly removed by what method?\\

a. Adsorption\\

b. Straining\\

c. Deactivation\\

d. Flocculation\\

\item What is a typical filtration rate for slow sand filters?\\

a. 2.0-6.0 GPM/sq. ft.\\

b. 6.0-10.0 GPM/sq. ft.\\

c. $1.0-2.0 \mathrm{GPM} / \mathrm{sq}$. ft.\\

d. $0.5-0.10 \mathrm{GPM} / \mathrm{sq}$. ft.\\

\item In a typical conventional treatment plant, the finished water turbidity for an individual filter should be less than\\

a. 1.0 NTUs\\

b. 0.3 NTUs\\

c. $5.0 \mathrm{NTUs}$\\

d. 3.0 NTUs\\

\item A filter running under normal conditions will see head loss in a filter\\

a. Remain constant\\

b. Increase slowly\\

c. Rapidly increase\\

d. Decrease slowly\\

\item A filter must be washed if this condition is met\\

a. Head Loss\\

b. Turbidity break through\\

c. Maximum Filter run time\\

d. All of the Above\\

\item Filter performance is measured by the removal of\\

a. Oxygen\\

b. Head loss\\

c. Turbidity\\

d. Chlorine\\

\item What is the biologically active layer of a slow sand filter called?\\

a. Mixed Media\\

b. Duel Media\\

c. Sludge Layer\\

d. Schmutzdecke\\

\item The pressure drop in a filter is called\\

a. Turbidity breakthrough\\

b. Head Loss\\

c. Filtration\\

d. Backwash\\

\item What is the most common reason for putting a filter into the wash cycle?\\

a. Head loss\\

b. Filter run time\\

c. Turbidity breakthrough\\

d. Water level decrease\\

\item Formation of mud balls and excessive boiling during a wash is an indicator of\\

a. Proper backwash rate\\

b. Too low backwash rate\\

c. Excessive backwash rate\\

d. Improper chemical dose\\

\item Important processes which occur during filtration are\\

a. Sedimentation\\

b. Adsorption\\

c. Straining\\

d. All of the Above\\

\item Typical filtration rates for a conventional treatment plant are\\

a. 0.2-0.6 GPM/sq.ft.\\

b. 2.0-10.0 GPM/sq.ft.\\

c. 10.0-20.0 GPM/sq.ft.\\

d. 200-400 GPM/sq.ft. 1. Chlorine gas is times heavier than breathing air\\

a. 2.5\\

b. 20\\

c. 60\\

d. 460\\

\item A commonly used method to test for chlorine residual in water is called the method.\\

a. HTH\\

b. THM\\

c. VOC\\

d. $\* \mathrm{DPD}$\\

\item When chlorine gas is added to water the $\mathrm{pH}$ goes down due to\\

a. chlorine gas producing caustic substances\\

b. two base materials that form\\

c. \*two acids that form\\

d. caustic soda being formed in the water\\

\item Disinfection by-products are a product of:\\

a. Filtration\\

b. Disinfection\\

c. Sedimentation\\

d. Adsorption\\

\item Chloramine is most effective as a disinfectant.\\

a. Primary\\

b. Secondary\\

c. Third\\

d. First\\

\item Name the two types of hypochlorites used to disinfect water.\\

a. Chloride and monochloride\\

b. Sodium and calcium\\

c. Ozone and hydroxide\\

d. Arsenic and manganese\\

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

a. Ozone and ultraviolet light\\

b. Soap and agitation\\

c. Filtration and adsorption\\

d. Salt and vinegar\\

\item In order to determine the effectiveness of disinfection, it is desirable to maintain a disinfectant residual of at least $\mathrm{mg} / \mathrm{L}$ entering the distribution system.\\

a. 0.10\\

b. 0.5\\

c. 0.3 d. 0.2\\

\item Secondary disinfectants are used to provide a in the distribution system.\\

a. Color\\

b. Chemical\\

c. Smell\\

d. Residual\\

\item Primary disinfectants are used to microorganisms.\\

a. Hurt\\

b. Inactivate\\

c. Burn up\\

d. Evaporate\\

\item The quantity of chlorine remaining after primary disinfection is called a residual.\\

a. Chlorine\\

b. Permaganate\\

c. Hot\\

d. Cold\\

\item The two most common types of chlorine disinfection by-products include:\\

a. TTHM and HAA5\\

b. TTHA of HMM5\\

c. Turbidity and color\\

d. Chloride and fluoride\\

\item In order to determine the effectiveness of disinfection, it is desirable to maintain a disinfectant residual of at least $\mathrm{mg} / \mathrm{L}$ entering the distribution system.\\

a. 0.10\\

b. 0.5\\

c. 0.3\\

d. 0.2\\

\item A\\_\\_ residual of chlorine is required throughout the system.\\

a. Large\\

b. High\\

c. Trace\\

d. Hot\\

\item The test used to determine the effectiveness of disinfection is called the:\\

a. Coliform bacteria test\\

b. Color test\\

c. Turbidity test\\

d. Particle test\\

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

a. Ozone and ultraviolet light\\

b. Soap and agitation\\

c. Filtration and adsorption\\

d. Salt and vinegar\\

\item Name the two types of hypochlorites used to disinfect water.\\

a. Chloride and monochloride\\

b. Sodium and calcium\\

c. Ozone and hydroxide\\

d. Arsenic and manganese\\

\item Free chlorine can only be obtained after point chlorination has been achieved.\\

a. Breakpoint\\

b. Fastpoint\\

c. Softpoint\\

d. Onpoint\\

\item The meaning of the " $\mathrm{C}$ " and the " $\mathrm{T}$ " in the term $\mathrm{CT}$ stands for:\\

a. Concentration and time\\

b. Color and turbidity\\

c. Calcium and tortellini\\

d. Chlorine and turbidity\\

\item Chloramine is most affective as a disinfectant.\\

a. Primary\\

b. Secondary\\

c. Third\\

d. First\\

\item TTHMs and HAA5s can affect:\\

a. Health\\

b. Aesthetics\\

c. Color\\

d. Odor\\

\item The multiple barrier treatment approach includes\\

a. Sterilization and filtration\\

b. Disinfection and filtration\\

c. Disinfection and sterilization\\

d. Infection and filtration\\

\item The maximum disinfectant residual allowed for chlorine in a water system is\\

a. $.02 \mathrm{mg} / \mathrm{L}$\\

b. $2.0 \mathrm{mg} / \mathrm{L}$\\

c. $3.0 \mathrm{mg} / \mathrm{L}$\\

d. $4.0 \mathrm{mg} / \mathrm{L}$\\

\item What is the disinfectant byproduct caused by ozonation?\\

a. Trihalomethanes\\

b. Bromate\\

c. Chlorite\\

d. No DBP formation\\

\item Haloacitic Acids are also known as\\

a. TTHM\\

b. HOCL\\

c. Chlorite\\

d. HAA5\\

\item What is the MCL for trihalomethanes?\\

a. $.10 \mathrm{mg} / \mathrm{L}$\\

b. $.06 \mathrm{mg} / \mathrm{L}$\\

c. $.08 \mathrm{mg} / \mathrm{L}$\\

d. $.12 \mathrm{mg} / \mathrm{L}$\\

\item What is the MCL for Haloacitic Acids?\\

a. $100 \mathrm{ppb}$\\

b. $60 \mathrm{ppb}$\\

c. $80 \mathrm{ppb}$\\

d. $120 \mathrm{ppb}$\\

\item What is the MCL for bromate?\\

a. $.010 \mathrm{mg} / \mathrm{L}$\\

b. $.020 \mathrm{mg} / \mathrm{L}$\\

c. $.030 \mathrm{mg} / \mathrm{L}$\\

d. $.040 \mathrm{mg} / \mathrm{L}$\\

\item What is residual Chlorine?\\

a. Chlorine used to disinfect\\

b. The amount of chlorine after the demand has been satisfied\\

c. The amount of chlorine added before disinfection\\

d. Film left on DPD kit to measure residual\\

\item When Chlorine reacts with natural organic matter in water it can create\\

a. Disinfectant by-products\\

b. Coliform bacteria\\

c. Chloroform\\

d. Calcium\\

\item What are trihalomenthanes classified as\\

a. Salts\\

b. Inorganic compounds\\

c. Volatile organic compounds\\

d. Radio\\

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

a. Chlorine\\

b. Iodine\\

c. Ozone\\

d. Chlorine Dioxide\\

\item What is the disinfectant with the least killing power but that has the longest lasting residual?\\

a. Chlorine\\

b. Ozone\\

c. Chlorine Dioxide\\

d. Chloramines\\

\item The active ingredient in household bleach is\\

a. Calcium hypochlorite\\

b. Calcium hydroxide\\

c. Sodium hypochlorite\\

d. Sodium hydroxide\\

\item Cryptosporidium is not resistant to this chemical\\

a. Ozone\\

b. Chlorine Dioxide\\

c. Chlorine\\

d. Both $A \& B$\\

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

a. None\\

b. 1\\

c. 3\\

d. Depends on the severity of the positive sample\\

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

a. $3 \%$ Yes\\

b. $5 \% \mathrm{No}$\\

c. $8 \%$ Yes\\

d. $10 \% \mathrm{No}$\\

\item The form of Chlorine which is $100 \%$ available chlorine is?\\

a. Sodium Hypochlorite\\

b. Calcium Hypochlorite\\

c. Calcium Hydroxide\\

d. Gaseous Chlorine\\

\item What is the minimum amount of chlorine residual required in the distribution system?\\

a. There is no minimum\\

b. $\mathrm{mg} / \mathrm{L}$\\

c. $0.2 \mathrm{mg} / \mathrm{L}$\\

d. $\mathrm{mg} / \mathrm{L}$\\

\item What is the approximate $\mathrm{pH}$ range of sodium hypochlorite?\\

a. 4-5\\

b. 6-7\\

c. $9-11$\\

d. $12-14$\\

\item What is the typical concentration of sodium hypochlorite utilized in water treatment?\\

a. $5 \%$\\

b. $65 \%$\\

c. $100 \%$\\

d. $12.5 \%$\\

\item Chlorine demand refers to\\

a. Chlorine in the system for a given time\\

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

c. Chlorine needed to produce a higher $\mathrm{pH}$\\

d. None of the above\\

\item What is the most effective chlorine disinfectant?\\

a. Dichloramine\\

b. Trichloramine\\

c. Hypochlorite Ion\\

d. Hypochlorous acid\\

\item What can form when chlorine reacts with natural organic matter in source water?\\

a. Disinfectant by-products\\

b. Sulfur\\

c. Algae\\

d. Coliform bacteria\\

\item What kind of solution is used to check for a gas chlorine leak?\\

a. Sodium hydroxide\\

b. Ozone\\

c. Ammonia\\

d. Calcium hypochlorite\\

\item Chlorine is\\

a. Heavier than air\\

b. Lighter than air\\

c. Brown in color\\

d. not harmful to your health\\

\item Chlorine demand may vary due to\\

a. Chlorine demand always stays the same\\

b. Temperature\\

c. $\mathrm{pH}$\\

d. Both B and C\\

\item What effect does high turbidity have on disinfection?\\

a. It can increase chlorine demand\\

b. It has no effect\\

c. It gives the water a milky appearance that will clear out after some time\\

d. You must increase the temperature of the water\\

\item What is the target chlorine:ammonia ratio?\\

a. $2: 1$\\

b. $3: 1$\\

c. $4: 1$\\

d. $5: 1$\\

\item What is the MCL for Nitrates?\\

a. $1 \mathrm{ppm}$\\

b. $10 \mathrm{ppm}$\\

c. $5 \mathrm{ppm}$\\

d. None of the above\\

\item What is the molecular weight of Chlorine?\\

a. 70\\

b. 14\\

c. 65\\

d. 20\\

\item What disinfectant has the longest lasting residual?\\

a. Ozone\\

b. Chlorine\\

c. Chloramine\\

d. Chlorine Dioxide\\

\item What are some of the early indicators of Nitrification?\\

a. Lowering chlorine residual\\

b. Excess ammonia in treated water\\

c. Raise in bacterial heterotrophic plate counts\\

d. All of the above\\

\item What are THMs classified as?\\

a. Turbidity\\

b. Radiological\\

c. Volatile Organic Chemicals\\

d. Salts\\

\item What method can operators employ to combat nitrification?\\

a. Lower residual chlorine target b. Keep reservoir levels static\\

c. Minimize free ammonia in treated water\\

d. Increase water age\\

\item How many times stronger is Chlorine compared to monochloramine?\\

a. 250 times\\

b. 20 times\\

c. 1500 times\\

d. 5 times\\

\item What chemicals are formed when chlorine is mixed with water?\\

a. Hydrogen sulfide and ammonia\\

b. DPD and carbon dioxide\\

c. Sodium hypochlorite and calcium hypochlorite\\

d. Hypochlorous acid and hydrochloric acid\\

\item Chlorine residual is measured in the field using the\\

a. Electroconductivity method\\

b. EDTA titrimetric method\\

c. Ortho-tolidine colorimetric method\\

d. DPD colorimetric method\\

e. Differential $\mathrm{pH}$ method\\

\item In nitrification, bacteria consume excess ammonia in the water and produce\\

a. Chloramines\\

b. Free chlorine\\

c. Urine\\

d. Nitrite\\

e. Sodium thiosulfate\\

\item Which of the following is a form of free chlorine?\\

a. Nitrite\\

b. Hypochlorous acid\\

c. Monochloramine\\

d. Hydrochloric acid\\

e. Trichloramine\\

\item A distribution system operator measures a total chlorine residual of $1.25 \mathrm{mg} / \mathrm{L}$. How many points on the chlorine breakpoint curve may display this residual?\\

a. Zero\\

b. One\\

c. Two\\

d. Three\\

e. Four\\

\item What is the chlorine dosage that must be applied when disinfecting a pipeline using the slug method?\\

a. $300 \mathrm{mg} / \mathrm{L}$\\

b. $\quad 100 \mathrm{mg} / \mathrm{L}$\\

c. $50 \mathrm{mg} / \mathrm{L}$\\

d. $25 \mathrm{mg} / \mathrm{L}$\\

e. $6 \mathrm{mg} / \mathrm{L}$\\

\item Which of the following is a form of combined chlorine?\\

a. Hypochlorite ion\\

b. Hypochlorous acid\\

c. Monochloramine\\

d. Hydrochloric acid\\

e. Free ammonia\\

\item A distribution system operator measures a total chlorine residual of $1.25 \mathrm{mg} / \mathrm{L}$, and a free chlorine residual of $1.15 \mathrm{mg} / \mathrm{L}$ : This indicates that\\

a. The system is operating with a chloramine residual\\

b. The chlorine demand is $0.10 \mathrm{mg} / \mathrm{L}$\\

c. The chlorine demand is $2.40 \mathrm{mg} / \mathrm{L}$\\

d. Chloramines are being destroyed by free chlorine\\

e. The system is operating to the right of the breakpoint on the chloramine curve\\

\item Which of the following is the most desirable form of combined residual chlorine?\\

a. Hypochlorite ion\\

b. Hypochlorous acid\\

c. Monochloramine\\

d. Dichloramine\\

e. Trichloramine\\

\item Of the following, which is the most effective disinfectant?\\

a. Hypochlorite ion\\

b. Hypochlorous acid\\

c. Monochloramine\\

d. Dichloramine\\

e. Trichloramine\\

\item A field chlorine residual measurement shows no reading at one minute, but $2.1 \mathrm{mg} / \mathrm{L}$ after three minutes. This indicates that\\

a. The field DPD test kit needs to be returned to the laboratory for maintenance\\

b. There is no chlorine residual\\

c. There is no free chlorine residual, but there are $2.1 \mathrm{mg} / \mathrm{L}$ of chloramines\\

d. There is no combined residual, but the free chlorine residual is $2.1 \mathrm{mg} / \mathrm{L}$\\

e. The analyst should wait an additional three minutes and re-test\\

\item When disinfecting a storage tank, one method calls for the bottom $6 \%$ of the tank volume to be chlorinated for at least 6 hours with an applied chlorine dosage of a. $50 \mathrm{mg} / \mathrm{L}$\\

b. $25 \mathrm{mg} / \mathrm{L}$\\

c. $6 \mathrm{mg} / \mathrm{L}$\\

d. $4 \mathrm{mg} / \mathrm{L}$\\

e. $\quad 0.2 \mathrm{mg} / \mathrm{L}$\\

\item Residual chlorine refers to\\

a. The amount of chlorine in the chlorinated water after several minutes\\

b. The chlorine needed to disinfect the water supply\\

c. The chlorine needed to produce floc in the water\\

d. The sludge in the bottom of the chlorine solution tank\\

e. None of the above\\

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

\item The fusible plug that is in all chlorine containers\\

a. Is not necessary\\

b. May be used as a tap for the chlorine source\\

c. Should be removed after the cylinders are empty\\

d. Should never be removed or tampered with\\

e. Should be removed prior to withdrawing chlorine from the container\\

\item Sodium hypochlorite is a a. Compound purchased in liquid solution used for disinfection\\

b. Dry neutralizing powder for treating chlorine burns\\

c. Gas delivered in 100-pound, 150-pound, or one-ton containers\\

d. Salt that is formed when hydrochloric acid is neutralized with caustic soda\\

e. None of the above\\

\item The chlorine demand abruptly jumps in your source water. This may indicate that a. The water source has been contaminated $b$. Flow rates in the distribution system have increased\\

c. The hypochlorite solution used for disinfection has deteriorated\\

d. The hypochlorite solution tank is empty\\

e. The hypochlorite ion has a higher concentration than hypochlorous acid\\

\item The chemical compound typically found in chlorination tablets and granules is\\

a. Sodium hypochlorite\\

b. Sodium hydroxide\\

c. Sodium chloride\\

d. Calcium hypochlorite\\

e. Calcium hydroxide\\

\item The maximum rate of withdrawal of gas from a 150-pound chlorine cylinder in 24-hours is\\

a. 20 pounds\\

b. 40 pounds\\

c. 100 pounds\\

d. $\quad 150$ pounds\\

e. None of the above\\

\item The maximum rate of withdrawal of gas from a one-ton chlorine container in 24-hours is\\

a. 40 pounds\\

b. $\quad 100$ pounds\\

c. 400 pounds\\

d. One ton\\

e. Variable, depending on chlorine dosage requirements\\

\item A chlorine leak can be detected by\\

a. An explosimeter\\

b. Checking the leak gauge\\

c. Applying ammonia solution\\

d. A tri-gas detector\\

e. None of the above\\

\item When using the continuous feed method of disinfection, a new water main should be flushed, disinfected at $50 \mathrm{mg} / \mathrm{L}$, and held at above $25 \mathrm{mg} / \mathrm{L}$ for at least\\

a. 6 hours\\

b. 12 hours\\

c. 24 hours\\

d. 36 hours\\

e. 48 hours\\

\item If you encounter a liquid chlorine leak in a one-ton container, what action should you take first, to reduce the severity of the leak?\\

a. Apply a caustic solution\\

b. Apply an acidic solution\\

c. Spray the container with water\\

d. Spray the container with an ammonia solution\\

e. Rotate the container to place the leak at the top\\

\item What should the chlorine dosage be to water that has a chlorine demand of $1.5 \mathrm{mg} / \mathrm{L}$, when a free residual of $1.0 \mathrm{mg} / \mathrm{L}$ is desired?\\

a. $\quad 0.5 \mathrm{mg} / \mathrm{L}$\\

b. $\quad 1.0 \mathrm{mg} / \mathrm{L}$\\

c. $\quad 1.5 \mathrm{mg} / \mathrm{L}$\\

d. 2.5 pounds per day\\

e. $2.5 \mathrm{mg} / \mathrm{L}$\\

\item When chlorine reacts with natural organic matter in the water, it is possible to form\\

a. Disinfection by-products\\

b. Arsenic\\

c. MTBE\\

d. Coliforms e. Synthetic organic compounds\\

\item Which of the following best describes the characteristics of chlorine when used for disinfection in drinking water?\\

a. Colorless, flammable, heavier than air\\

b. Greenish-yellow, nonflammable, lighter than air\\

c. Greenish-yellow, flammable, lighter than air\\

d. Greenish-yellow, nonflammable, heavier than air\\

\item Killing of pathogenic organisms in water treatment is called\\

a. Disinfection\\

b. Oxidätion\\

c. Pasteurization\\

d. Sterilization\\

\item Chlorine reacts with nitrogenous compounds to form\\

a. Ammonia nitrate\\

b. Free chlorine\\

c. Chlorinated hydrocarbons\\

d. Chloramines\\

\item Sodium Hypochlorite is\\

a. A commercially available chlorine solution\\

b. A commercially available dry chlorine compound\\

c. Chlorine that is available in 100- and 150-pound cylinders\\

d. A reaction product of chlorine and caustic soda\\

\item A hypochlorinator is\\

a. Used to measure residual chlorine\\

b. Used in the treatment of iron and turbidity\\

c. Used to feed a liquid solution into a water supply\\

d. Used to measure an adequate amount of chlorine gas into the supply\\

\item When calcium hypochlorite is used for disinfecting a water supply, it should be\\

a. Dissolved in water, allowed to settle, and the supernatant siphoned off and fed into the water system\\

b. Dissolved in water as a dry chemical then injected into the water system\\

c. Fed as a dry chemical directly into the pipeline\\

d. Fed as a dry powder into the clear well\\

\item The chlorine gas feed rate is usually controlled by adjusting the\\

a. water flow to the injector\\

b. valve on the chlorine cylinder\\

c.pressure in the chlorine cylinder\\

d. rotameter control valve\\

\item If disinfection is incomplete because the chlorine residual is in the hypochlorite ion form, what should you change to improve disinfection?\\

a. Calcium\\

b. Hardness\\

c. $\mathrm{pH}$\\

d. alkalinity\\

\item Breakpoint chlorination is achieved when\\

a. Free ammonia can be tasted in the water\\

b. No chlorine residual is detected\\

c. The strong chlorine tasted at the plant did not persist in the distribution system\\

d. When chlorine dosage is increased, a corresponding increase in residual is detected\\

\item Because chlorine residual is related to the $\mathrm{pH}$ of the water, it may be said that\\

a. A higher $\mathrm{pH}$ requires a higher chiorine residual\\

b. A higher $\mathrm{pH}$ requires a lower chlorine residual\\

c. A lower $\mathrm{pH}$ requires a higher chlorine residual\\

d. $\mathrm{pH}$ has no effect on chlorine residual\\

\item As long as the temperature is steady, the pressure indicator on a chlorine cylinder will until all the chlorine has been gasified\\

a. Remain steady\\

b. Decrease slowly\\

c. Decrease rapidly\\

d. Increase slightly\\

\item When fresh, the typical concentration of sodium hypochlorite solution is\\

a. $1.25 \%$\\

b. $6.5 \%$\\

c. $12.5 \%$\\

d. $65 \%$\\

e. variable, depending on the manufacturer\\

\item Chlorine in a dry form is called:\\

a. hypochlorite\\

b. hypochlorous\\

c. hydrochlorite\\

d. hydroxide\\

\item Which of the following procedures is done when preparing to disconnect a chlorine cylinder?\\

a. close the cylinder valve first to allow time for the chlorine to be drawn off\\

b. loosen the line to the tank and then shut off the valve to the chlorine cylinder\\

c. shut off the water supply and allow sufficient time for the chlorille to be drawn off\\

d. tum the chlorinator feed rate valve off then turn the valve on the chlorinator cylinder\\

\item A vacuum is formed in the chlorinator by the:\\

a chlorine cylinder pressure\\

b. pressure differential through the ejector\\

c. chlorine feed pump\\

d. rotameter-\\

\item When calcium hypochlorite is used for disinfecting a water supply, it should be be:\\

a. Dissolved in water, allowed to settle, and the supernatant siphoned off and fed into the water system\\

b. Dissolved in water as a dry chemical then injected into the water system\\

c. Fed as a dry chemical directly into the pipeline\\

d. Fed as a dry powder into the clear well\\

\item Because chlorine residual is related to the $\mathrm{pH}$ of the water, it may be said that: a. A higher $\mathrm{pH}$ requires a higher chlorine residual\\

b. A higher $\mathrm{pH}$ requires a lower chlorine residual\\

c. A lower $\mathrm{pH}$ requires a higher chlorine residual\\

d. A lower $\mathrm{pH}$ has no effect on chlorine residual\\

\item Which of the following best describes "chlorine demand"?\\

a. The difference between the amount of chłorine added and turbidity\\

b. The difference between the amount of chlorine added and $\mathrm{pH}$\\

c. The difference between the total chlorine residual and the free chlorine residual\\

(d.) The difference between the amount of chlorine added and the amount of residual chlorine remaining after a given contact time\\

\item Chlorine reacts with nitrogenous compounds to form\\

a. Ammonia nitrate\\

b. Free chlorine\\

c. Chlorinated hydrocarbons\\

d. Chloramines\\

\item When two ton cylinders are feeding gas and one of them is frosted, what might be the problem?\\

a. The feed rate is too high\\

b. The line on the frosted tank is clogged\\

c. The valve on the unfrosted tank\\

d. The injector is clogged\\

\item There is low vacuum on the system and the flow rate is low when the rate valve is wide open, what is the problem?\\

a. The feed rate is too high\\

b. The injector is clogged\\

c. There is a clogged feed line\\

d. The rotameter is clogged 1. Name the type of valve that is sometimes found on the suction side of a centrifugal pump and is located where the water enters the casing. a. Check valve b. Gate valve c. Altitude valve d. Pressure relief valve e. \*Foot valve\\

\item After a pump is shut off but continues to run backwards indicates: a. The bearings are failing $b$. The packing needs tightening $c$. The main lock nut needs to be tightened d. \*The check valve is leaking e. A valve on the discharge side of the pump is shut\\

\item Wear rings are installed in a pump to:\\

a. hold the shaft in position\\

b. keep the impeller in place\\

c. \*keep wear concentrated on economically replaceable part\\

d. wear out the sleeve\\

\item Pump motors draw more power starting than during normal operating conditions because:\\

a. check valves have to be pushed open\\

b. energy is required to get the water moving\\

c. the motor and pump have to start turning\\

d. \*all of the above\\

\item Head is measured in\\

a. absolute pressure.\\

b. gauge pressure.\\

c. \*feet.\\

d. foot-pounds.\\

\item To ease installation of impeller wear rings, they can be\\

a. lubricated with a light oil.\\

b. greased with lithium.\\

c. heated.\\

d. cooled.\\

\item Packing is designed to\\

a. add lubricant to the shaft.\\

b. expand and deteriorate with normal use.\\

c. protect the shaft.\\

d. wear and deteriorate with normal use.\\

\item Bearings on a line shaft turbine can be lubricated with\\

a. oil or water.\\

b. grease or oil.\\

c. lithium or grease.\\

d. graphite or grease.\\

\item Packing replacement is usually performed when\\

a. water leakage sprays out of the pump housing.\\

b. no further tightening can be done on the packing gland.\\

c. the packing gland bolts are exposed by more than $2^{1 / 2}$ inches above the nut. d. the packing has completely disintegrated.\\

\item Water hammer can be described as\\

a. particle waves.\\

b. acoustic waves.\\

c. rogue waves.\\

d. longitudinal waves.\\

\item Which is at the top of a stuffing box?\\

a. Packing gland\\

b. Lantern ring\\

c. Mechanical seal\\

d. Seal cage\\

\item Which assembly holds the lantern ring and packing?\\

a. Shaft assembly\\

b. Casing ring assembly\\

c. Packing gland casing\\

d. Stuffing box\\

\item Which of the following prevents the impeller of a pump from turning on the shaft?\\

a. Lock nut on threaded shaft\\

b. Key\\

c. Steel pin\\

d. Caliper pin\\

\item Which device serves the same function as the packing?\\

a. Inline suction gland\\

b. Packing gland\\

c. \*Mechanical seal\\

d. Lantern seal\\

\item Vertical turbine pumps that are used in wells may be oil-lubricated or water-lubricated. Operators should use extreme care not to start any water-lubricated pump before making sure that the:\\

a. Valve on discharge side is open.\\

b. Bearings are dry.\\

c. Valve on suction side is closed.\\

d. Bearings are wet.\\

\item The head against which a pump must operate:\\

a. Is the sum of the static head and the head due to friction loss.\\

b. Must always be above the shut-off head.\\

c. Is the static head.\\

d. Is the friction head.\\

\item What term describes the condition that exists when the source of the water supply is below the centerline of the pump?\\

a. Pressure head\\

b. Velocity head\\

c. Suction lift\\

d. Total discharge head\\

\item What is the most common use today for a positive-displacement pump?\\

a. Raw water intake pump\\

b. System booster pump\\

c. Chemical feed pump\\

d. Filter feed pump\\

\item A pumping condition where the eye of the impeller is above the water is called?\\

a. Dry Well\\

b. Suction Head\\

c. Wet Well\\

d. Suction Lift\\

\item The force used in an End-suction pump is called\\

a. Pressure\\

b. Centrifugal\\

c. Velocity\\

d. Kinetic\\

\item \\_\\_ is the loss of energy as a result of friction.\\

a. Velocity loss\\

b. Headloss\\

c. Elevation Loss\\

d. Pump Loss\\

\item As the water travels around the volute towards the discharge line the total energy shifts from\\

a. High Velocity Head to low PSI b. Low Velocity Head to high PSI c. Low Velocity Head to low PSI d. High Velocity Head to high PSI\\

\item The part that in an End Suction pump that is used to collect the liquid discharged from the impeller is called?\\

a. Shaft\\

b. Packing\\

c. Suction Head\\

d. Volute\\

\item Head is the energy that a body has by virtue of its position or state.\\

a. Velocity\\

b. Potential\\

c. Kinetic\\

d. Pressure\\

\item An impeller that has no shrouds and used to pump fluid with large objects is called?\\

a. Semi-open\\

b. Open\\

c. Closed\\

d. Very-closed\\

\item A pump station design where the eye of the impeller is submerged in water is called?\\

a. Dry Well\\

b. Suction Head\\

c. Wet Well\\

d. Suction Lift\\

\item The discharge valve on a pump can be closed for short periods of time or during start up.\\

a. Piston\\

b. Progressive Cavity\\

c. Diaphragm\\

d. dynamic\\

\item Velocity of a pump is measured in:\\

a. Inches per second\\

b. PSI\\

c. Feet per second\\

d. Yards per second\\

\item An impeller that has shrouds on both sides and is used to pump fluid with little or no objects is called?\\

a. Semi-open\\

b. Open\\

c. Closed\\

d. Very - closed\\

\item To change the discharge of displacement you have to change the:\\

a. Speed\\

b. Discharge valve\\

c. Suction valve\\

d. Rotation\\

\item Which pump component prevents leakage from the pump discharge to the suction?\\

a. Lantern ring\\

b. Volute\\

c. Wear ring\\

d. Shaft sleeve\\

\item Mechanical seals are being installed in pumps because\\

a. packing requires an undesirable leakage that seals eliminate.\\

b. seals prevent cross connections with potable water.\\

c. seals will take more shaft misalignment than packing.\\

d. there is a shortage of good packing available on the market. 33. A major cause of pump and motor shaft coupling wear is:\\

a. discharge pressure too high.\\

b. low suction pressure.\\

c. misalignment between pumps and motor flanges.\\

d. worn-out seal.\\

\item The discharge rate of a piston-type pump:\\

a. Is constant as the main drive rpm changes\\

b. Is constant at a constant speed\\

c. Varies inversely with the head\\

d. Varies with the total dynamic head\\

\item The flow of electrical current is measured in\\

a. Amperes\\

b. Ohms\\

c. Volts\\

d. Watts\\

\item An operator hears a pinging sound coming from the pump. What is the probable cause?\\

a. Descaling\\

b. Cavitation\\

c. Corrosion\\

d. Hardness\\

\item During a routine inspection on a centrifugal pump, the operator notices that the bearings are excessively hot. This is most likely caused by:\\

a. Over lubrication\\

b. The speed being too slow\\

c. A worn impeller\\

d. A worn packing\\

\item The-leakage of seal-wateraround-the-packing on a centrifugal pump is required because it acts as a(n)\\

a. Adhesive\\

b. Coolant\\

c. Corrosion inhibitor\\

d. Scale inhibitor\\

\item What can happen to a pump if the back pressure on the pump is allowed to drop too low and the pump is operated for a prolonged period of time?\\

a. Efficiency would drop off and the pump would heat up\\

b. No water would flow\\

c. Pump lubricants would disperse more efficiently\\

d. Water hammer would occur upstream in the distribution line\\

\item At a pumping station equipped with centrifugal pumps, what can cause the discharge pressure to suddenly increase and the discharge quantity to suddenly decrease?\\

a. A discharge valve was closed\\

b. A suction valve was closed\\

c. The pump amperage was decreased\\

d. The voltage was suddenly increased\\

\item The difference between water levels upstream and downstream of a pump when it is not in operation is known as the\\

a. Suction lift\\

b. Total dynamic head\\

c. Discharge head\\

d. Friction loss\\

e. Total static head\\

\item Static suction head plus friction suction head plus static discharge head plus friction discharge head is a pump's\\

a. Pump curve\\

b. Operating pressure\\

c. Efficiency\\

d. Total dynamic head\\

e. Velocity head\\

\item Pumps are primed to\\

a. \*Replace air inside the pump with water\\

b. Seat the valves\\

c. Wet the packing\\

d. Provide water for flow testing\\

e. Overcome positive suction head\\

\item Backspin is occurring after well shutdown; this indicates\\

a. A high water table\\

b. A low water table\\

c. A confined aquifer\\

d. A faulty check valve\\

e. A leak in the sanitary seal\\

\item A water seal on a pump serves many purposes, including\\

a. Acts as a coolant to keep the pump bearing from overheating\\

b. Keeps gritty material from entering the packing box\\

c. Keeps the pumps primed\\

d. Is a reserve water supply\\

e. Prevents cavitation\\

\item Enclosed, open, and semi-closed are terms used for the designation and selection of:\\

a. Impellers\\

b. Lantern rings\\

c. Sleeves\\

d. Stuffing boxes\\

e. None of the above\\

\item A device that converts electrical energy into mechanical or kinetic energy is called a\\

a. Motor\\

b. Generator\\

c. Transformer\\

d. Battery\\

e. Pump\\

\item If a pump sounds like it is pumping rocks, the most likely cause is\\

a. Cavitation\\

b. Corrosion\\

c. Over-tightening of the packing gland\\

d. Misalignment with the motor\\

e. Irregular wear of the mechanical seal\\

\item The flow of electrical current is measured in\\

a. Amperes\\

b. Volts\\

c. Watts\\

d. Ohms\\

e. Farads\\

\item The rotating element in a centrifugal pump is commonly called the\\

a. Fan\\

b. Impeller\\

c. Rotor\\

d. Volute\\

e. Stator\\

\item The purpose of the packing in a centrifugal pump is\\

a. Comparable to a bearing and is impregnated with lubricant\\

b. To prevent vibration of the shaft\\

c. To provide support for the impeller\\

d. To surround the bearings and lubricate them\\

e. None of the above\\

\item Which of the following is a positive displacement pump?\\

a. Air lift pump\\

b. Centrifugal pump\\

c. Reciprocating pump\\

d. Turbine pump\\

e. All of the above\\

\item The practical maximum suction lift for a centrifugal pump in good condition is\\

a. 0 feet\\

b. 2.31 feet\\

c. 14.7 feet\\

d. 20 feet to 25 -feet\\

e. 32-feet to 34-feet\\

\item The linkage between a centrifugal pump and its motor is commonly called the\\

a. Coupling\\

b. Impeller\\

c. Bearings\\

d. Volute\\

e. Stator\\

\item The electrical equivalent to friction in water lines is\\

a. Voltage\\

b: Resistance\\

c. Amperage\\

d. Capacitance\\

e. Inductance\\

\item The main water-containing body of a centrifugal pump is commonly called the\\

a. Shaft\\

b. Impeller\\

c. Bearings\\

d. Volute\\

e. Stator\\

\item A type of pump that produces high flow rates with low discharge heads is a\\

a. Radial flow\\

b. Axial flow\\

c. Vertical turbine\\

d. Piston\\

e. Mixed flow\\

\item Alternating current is produced by\\

a. A single battery\\

b. Two (or more) batteries in series\\

c. Two (or more) batteries in parallel\\

d. A solenoid\\

e. A generator\\

\item What do electrical transformers do?\\

a. Step-up or step-down current\\

b. Step-up or step-down voltage\\

c. Increase power output\\

d. Decrease power output\\

e. Reduce resistance 60. An "Open" electrical circuit is one in which\\

a. Resistance is low\\

b. Power production is high\\

c. Capacitance is low\\

d. Conductivity is high\\

e. Amperage is zero\\

\item Adding more stages (bowls) to a deep well turbine pump assembly will\\

a. Increase the pump discharge capacity\\

b. Decrease the pump discharge capacity\\

c. Increase the pump discharge pressure\\

d. Decrease the pump discharge pressure\\

e. None of the above\\

\item When installing packing in a centrifugal pump, the packing should be\\

a. Water tight\\

b. Pre-heated\\

c. Staggered $90^{\circ}$\\

d. Soaked overnight in potable water\\

e. Re-used\\

\item Standard electrical line frequency in the United States is\\

a. $50 \mathrm{~Hz}$\\

b. $\quad 60 \mathrm{~Hz}$\\

c. $110 \mathrm{~Hz}$\\

d. $\quad 120 \mathrm{~Hz}$\\

e. $240 / 480 \mathrm{~Hz}$\\

\item In contrast to conventional packing, mechanical seals\\

a. Require no adjustment\\

b. Do not leak\\

c. Are generally more expensive\\

d. Are more difficult to remove/replace\\

e. All of the above\\

\item The level of water in a reservoir is 200 feet above the main line that carries water into and out of the reservoir. A standpipe in the main line a block away at the same elevation as the reservoir shows a water elevation of 185 feet. Which of the following statements is true?\\

a. There is no flow into or out of the reservoir\\

b. Water is flowing into the reservoir\\

c. Water is flowing out of the reservoir\\

d. There is a pump station adjacent to the pressure gauge\\

e. Nothing can be deduced from the information in this question.\\

\item Pump motors draw more power starting than during normal operating conditions because:\\

a. check valves have to be pushed open b. energy is required to get the water moving\\

c. the motor and pump have to start turning\\

d. all of the above\\

\item Which of the following does not affect the friction loss in a given length of pipe?\\

a. hardness of the water\\

b. number of fittings\\

c. roughness of the interior of the pipe\\

d. velocity of the flow\\

\item The component of a centrifugal pump sometimes installed on the end of the suction pipe in order to hold priming is the:\\

a. Casing\\

b. Footvalve\\

c. Impeller\\

d. Lantern ring\\

\item At a pumping station equipped with centrifugal pumps, what can cause the discharge pressure to suddenly increase and the discharge quantity to suddenly decrease?\\

a. A discharge valve was closed\\

b. A suction valve was closed\\

c. The pump amperage was decreased\\

d. The voltage was suddenly increased\\

\item The inlet to the pump is called:\\

a. Suction\\

b. Volute\\

c. Impeller\\

d. Effluent\\

\item The rotating element in a centrifugal pump is commonly called a(n):\\

a. Fan\\

b. Impeller\\

c. Rotor\\

d. Volute\\

\item Pumps are primed to:\\

a) be sure the pump operates freely\\

b) replace air with water inside the pump\\

c) seat the valves .\\

d) wet the packing\\

e) none of the above\\

\item The joints in the rings of pump packing should be:\\

a) placed in line b) placed next to the motor\\

c) placed next to pump\\

d) staggered e) none of the above\\

\item A vertical turbine pump is an example of a : a) centrifugal pump b) parshall flume c) positive displacement pump\\

d) reciprocating pump\\

e) all of the above\\

\item Which type of pump is most commonly used for high capacity wells? a) air lift\\

b) centrifugal\\

c) positive displacement\\

d) plunger\\

e) none of the above\\

\item What can happen to a pump if the back pressure on the pump is allowed to drop too low and the pump is operated for a prolonged period of time?\\

a. Efficiency would drop off and the pump would heat up\\

b. No water would flow\\

c. Pump lubricants would disperse more efficiently\\

d. Water hammer would occur upstream in the distribution line\\

\item Check valves are used to prevent\\

a. Excessive pump pressure\\

b. Priming\\

c. Water from flowing in two directions\\

d. Water hammer\\

\item Positive displacement pumps should be operated when\\

a. Suction and discharge line valves are closed\\

b. Suction and discharge line valves are open\\

c. Suction line valves are closed and discharge line valves are open\\

d. Suction tine valves are open and discharge line valves are closed\\

\item When comparing friction loss in various types of pumps, a larger Hazen-Williams ' $C$ ' value indicates the pipe\\

a. is more durable,\\

b. is rougher outside.\\

d. is able to withstand a higher pressure.\\

c. is smoother inside.\\

\item Proper alignment between two shafts can be checked using a:\\

a. caliper\\

b. micrometer\\

c. straight edge d. feeler gauge\\

\item The maximum practical suction lift of a properly engineered centrifugal pump is about:\\

a. $5-10 \mathrm{ft}$\\

b. $10-15 \mathrm{ft}$\\

c. $15-25 \mathrm{ft}$\\

d. $25-34 \mathrm{ft}$\\

\item Which type of pump is most commonly used for high capacity wells?\\

a. air lift\\

b. centrifugal\\

c. positive displacement\\

d. plunger\\

e. none of the above\\

\item A vertical turbine is an example of a:\\

a. centrifugal pump\\

b. parshall flume\\

c. positive displacement pump\\

d. reciprocating pump\\

e. all of the above\\

\item The joints in the rings of pump packing should be:\\

a. placed in line\\

b. placed next to the motor\\

c. placed next to pump\\

d. staggered\\

e. none of the above\\

\item Ppmps are primed to:\\

a. be sure the pump operates freely\\

b. replace air with water inside the pump\\

c. seat the valves\\

d. wet the packing\\

e. none of the above\\

\item When comparing friction loss in various types of pumps, a larger Hazen-Williams ' $C$ ' value indicates the pipe\\

a. is more durable.\\

b. is rougher outside.\\

c. is smoother inside.\\

d. is able to withstand a higher pressure.\\

\item If the packing on an operating centrifugal pump has a slight leakage, the following action should be taken:\\

a. shut down immediately\\

b. tighten packing gland\\

c. lubricate pump packing gland\\

d. decrease pump speed and head\\

\*e. nothing\\

\item If bearings on a centrifugal pump are running hot, checking for over lubrication or under lubrication would be. listed as a general preventive maintenance service. If the lubrication is satisfactory, the next preventive maintenance check would be:\\

a. replace bearings\\

b. operate only when needed\\

c. clean the pump\\

d. recheck TDH\\

\*e. inspect alignment of pump and motor\\

\item If a wastewater pump is to be shut down for a long period of time, the proper procedure is to open and lock out the motor disconnect switch and shut the valves on both sides of the pump.\\

a. True\\

\*b. False\\

\item Centrifugal pump parts include\\

a. Diaphragm\\

\*b. Impeller\\

c. Piston\\

d. Rotor\\

\item Where does wear most frequently occur on a plunger pump?\\

\*a. Cylinder\\

b. Rotor\\

c. Stators\\

d. Volute\\

\item As rotors or stators accumulate wear on progressive cavity pumps, the capacity of the pump is decreased. What is the easiest way to tell if the pump elements are worn?\\

a. Tap into the line between the pump and the discharge valve and determine the pump capacity by timing how long it takes to fill a 20-liter pail\\

\*b. Measure the pressure on the discharge side of the pump with valves open and the pump pumping\\

c. Disassemble the pump, measure the parts and compare it to the original specifications\\

d. Close the discharge valve and measure the resultant pressure\\

\item A centrifugal pump vibrates and is noisy From the choices below, select the most probable cause\\

a. Impeller too small\\

b. Foot valve too small\\

c. Dirt or grit in sealing liquid\\

\*d. Air in the pump\\

\item Given the following data, what is the most likely cause of the pump problem?\\

DATA: Pump is running\\

Reduced discharge from lift station\\

Impeller is clear\\

Level sensors are operating properly\\

a. Improper packing\\

b. Misaligned belt drives\\

\*c. Pump air bound\\

d. None of the above\\

\item Excessive leakage around seals on the shafts and plungers of a plunger pump may indicate what?\\

a. Attempting to pump against too great a head\\

\*b. Excessive wear of the shaft and plunger\\

c. The eccentric needs replacement\\

d. The pump needs new ball checks\\

\item In operating a small pumping station, which is provided with two identical pumps, it is best to adjust the controls so that\\

a. One pump does most of the work and the second pump is held in reserve being operated intermittently to keep it in good running condition\\

\*b. The pumps alternate in operation\\

c. The pumps both turn on together\\

d. None of the above\\

\item A positive displacement sludge pump should never be placed into operation\\

a. Without being primed.\\

\*b. With the discharge valve closed.\\

c. With the discharge valve opened.\\

d. None of the above\\

\item Prior to repairing a pump's electrical circuit, which of the following actions should you take?\\

\*a. Disconnect the circuit breaker, place a red tag stating "do not activate," and lock out\\

b. Notify your supervisor\\

c. Tell all of the operators not to activate the circuit\\

d. Turn pump off\\

\item Pump maintenance includes\\

a. Checking operating temperature of bearings\\

b. Checking packing gland.\\

c. Operating two or more pumps of the same size alternately to equalize wear\\

\*d. All of the above\\

\item When carrying out a routine inspection on a centrifugal pump, it is noted by the operator that the bearings are excessively hot This could be caused by\\

\*a. Over lubrication\\

b. Speed too slow\\

c. Worn impeller\\

d. Worn packing\\

\item In a centrifugal pump, internal leakage is prevented by\\

a. Impellers\\

b. Sleeves\\

c. Volutes\\

\*d. Wear rings\\

\item A horizontal centrifugal pump has "rope" packing When the pump is operating, water slowly drips from the packing gland. This indicates that the\\

a. Packing bolts or nuts on the packing gland should be tightened.\\

b. Packing bolts or nuts on the packing gland should be loosened.\\

\*c. Packing bolts or nuts on the packing gland are properly adjusted.\\

d. Packing should be replaced.\\

\item Wear rings are installed in a pump to\\

a. Hold the shaft in position\\

b. Keep the impeller in place\\

\*c. Concentrate wear on an economically replaceable part\\

d. Wear out rings instead of sleeves\\

\item A water seal on a pump serves a dual purpose It acts as a lubricant and it also\\

a. Acts as a coolant to keep the pump bearing from overheating\\

\*b. Keeps gritty material from entering the packing box\\

c. Keeps the pump primed.\\

d. Is a reserve water supply\\

\item The elevation of any pump above the source of supply should not exceed feet\\

a. 2.2\\

\*b. 22\\

c. 200\\

d. 224\\

\item What is the vertical distance between the elevation of the free water surface at the suction and that of the free water surface at the discharge of a pump called?\\

a. Discharge head.\\

b. Dynamic head.\\

c. Velocity head.\\

\*d. Static head.\\

\item In electrical circuits, a device used to reduce the voltage is a(n)\\

a. Ammeter\\

b. Transducer\\

c. Transformer\\

d. Voltmeter\\

\item What can happen to a pump if the back pressure on the pump is allowed to drop too low and the pump is operated for a prolonged period of time?\\

a. Efficiency would drop off and the pump would heat up\\

b. No water would flow c. Pump lubricants would disperse more efficiently\\

d. Water hammer would occur upstream in the distribution line\\

\item Connect a motor to a pump using:\\

a. A sleeve clamp\\

b. A coupling\\

c. Mechanical seals\\

d. Bailing wire and bubble gum\\

\item Which of the following would be a good application for a peristaltic pump?\\

a. Booster pump\\

b. Well pump\\

c. Chemical feed pump\\

d. Air compressor\\

\item Which component in a diaphragm pump causes the most maintenance problems?\\

a. Shaft\\

b. Check valves\\

c. Diaphragm\\

d. Pump head

What is the reason for keeping adequate, reliable records in a treatment plant?\\

a. \*to record the plant's effectiveness and because of requirements by regulatory agencies\\

b. to maintain records for cold cases\\

c. in case the IRS wishes to check files for due diligence\\

d. because of homeland security issues and files being available to the public\\

\item Which statement about displacement meters is not correct:\\

a. The most common type of water service meter is the displacement type\\

b. Displacement meters are accurate at low flows\\

c. Excess sediment can cause the meter to stop registering\\

d. \*Displacement meters have little head loss due to friction\\

e. Displacement meters operated at a rate in excess of its stated capacity can result in excessive wear\\

\item A fire hydrant should be closed slowly to avoid:\\

a. Excessive wear\\

b. \*Water hammer\\

c. Excessive head loss\\

d. Injury to operator\\

\item The minimum separation between municipal water mains and sanitary sewers for installation in a common trench shall be:\\

a. 5 feet horizontal separation\\

b. $\* 10$ feet horizontal separation\\

c. 15 feet horizontal separation\\

d. 25 feet horizontal separation\\

\item To properly disinfect a water main after new construction, you should:\\

a. \*apply $50 \mathrm{mg} / \mathrm{l}$ chlorine for 24 hours.\\

b. clean the pipe out' with a pig and then disinfect at $10 \mathrm{mg} / 1$ for 24 hours\\

c. use a $10 \%$ solution of calcium chloride\\

$\mathrm{d}$ don't use them main for one week\\

\item When using a dry-barrel fire hydrant, the valve: a. should never be opened completely\\

b. be opened only during the hours of 8AM to 5PM\\

c. be opened to the desired amount of flow\\

d. be opened all the way\\

\item The primary reason for dry barrel-fire hydrants is to:\\

a. allow easy maintenance\\

b. prevent water hammer\\

c. \*keep the hydrant from freezing\\

d. keep the barrel from rusting\\

\item A centrifugal pump should not be run empty except momentarily because:\\

a. a serious counter pressure could develop and damage the pump casing. b. it is a waste of energy to run a pump without water.\\

c. the excessive end thrust of the shaft would damage the thrust bearing.\\

d. \*the parts lubricated by water could be damaged.\\

\item Pipes of dissimilar metal should not be connected together because of problems due:\\

a. to scale formation\\

b. \*corrosion\\

c. water hammer\\

d. the venturi effect\\

\item Which type of valve will prevent the collapse of a pipe?\\

a. Pressure-relief valve\\

b. Needle valve\\

c. Pinch valve\\

d. \*Air-and-vacuum relief valve\\

\item The correct protective methods for backflow-prevention devices in order of decreasing effectiveness are\\

a. air gap, VB, RPZ, and DCVA.\\

b. air gap, VB, DCVA, and RPZ.\\

c. air gap, RPZ, VB, and DCVA.\\

d. \*air gap, RPZ, DCVA, and VB.\\

\item The $\mathrm{C}$-value is a measure of a pipe's wall\\

a. smoothness.\\

b. smoothness giving even flow.\\

c. smoothness that retards turbulent flow.\\

d. \*roughness that retards flow due to friction.\\

\item Which one of the following is a type of joint for ductile iron piping?\\

a. Expansion joint\\

b. \*Push-on joint\\

c. Bell and spigot with rubber o-ring\\

d. Rubber gasket joint\\

\item Water hammer can be described as\\

a. particle waves.\\

b. \*acoustic waves.\\

c. rogue waves.\\

d. longitudinal waves.\\

\item Which thrust control is easy to use, especially in locations where existing utilities or structures are numerous?\\

a. \*Restraining fittings\\

b. Tie rods\\

c. Thrust anchors\\

d. Thrust blocks 16. The backfill material for a pipe installation should contain enough to allow for thorough compaction.\\

a. moisture\\

b. \*sand\\

c. gravel\\

d. mixed sizes\\

\item Thrust from a water surge almost always acts pushes against. to the inside surface that it\\

a. \*vertically\\

b. horizontally\\

c. perpendicular\\

d. vertically and horizontally\\

\item The breaking of a buried pipe when it is unevenly supported is called\\

a. stress breakage.\\

b. shear breakage.\\

c. \*beam breakage.\\

d. flexural breakage.\\

\item Compression fittings used with copper or plastic tubing seal by means of a\\

a. \*beveled sleeve.\\

b. compression ring.\\

c. compressed beveled gasket.\\

d. compressed o-rings located at either end of the fitting's beveled neck.\\

\item Which should be installed at a dead-end water main?\\

a. Vacuum valve\\

b. Air valve\\

c. \*Blowoff valve\\

d. Water quality sampling station\\

\item First draw samples for the analysis of lead and copper water must be collected from taps where the water has stood motionless in the plumbing for at least\\

a. 4 hours.\\

b. 6 hours.\\

c. 8 hours.\\

d. $\* 24$ hours.\\

\item According to AWWA Standard C651, disinfection of water mains requires 24-hour exposure to which minimum free chlorine residual?\\

a. $10 \mathrm{mg} / \mathrm{L}$\\

b. $\* 25 \mathrm{mg} / \mathrm{L}$\\

c. $50 \mathrm{mg} / \mathrm{L}$\\

d. $100 \mathrm{mg} / \mathrm{L}$\\

\item The tensile strength of a pipe is its ability to\\

a. \*Stretch or pull without breakage\\

b. Resist internal pressure without breakage\\

c. Resist external pressure without breakage\\

d. Twist or bend without breakage\\

e. Resist heating without breakage\\

\item The lowest point of the inside of a pipe is known as the\\

a Pervert\\

b. Soffit\\

c. \*Invert\\

d. Curb stop\\

e. None of the above\\

\item A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is\\

a. \*Polyvinyl chloride\\

b. Cast iron\\

c. Ductile iron\\

d. Concrete cylinder\\

e. Steel\\

\item An example of a pipe material that is relatively easy to locate underground is\\

a. ABS\\

b. PVC\\

c. Polyethylene\\

d. \*Reinforced concrete cylinder\\

e. Asbestos-cement\\

\item \\_\\_\\_ is a type of valve typically found in a storage tank of a water distribution system it closes to prevent the storage tank from overflowing when a pre-set level is reached\\

a. Ball valve\\

b. Altitude valve\\

c. Gate valve\\

d. Spring valve\\

\item \\_\\_\\_ is a valve which opens by lifting a round or rectangular gate/ wedge out of the path of the fluid are designed to fully open or closed service\\

a. Ball valve\\

b. Spring valve\\

c. Altitude valve\\

d. Gate valve\\

\item A \\_ \\_ is a form of quarter turn valve which uses a hollow perforated and pivoting to control flow through it and is a pivoted 90 degrees by the valve handle.\\

a. Gate valve\\

b. Spring valve\\

c. Ball valve d. d. Altitude valve\\

\item The sudden closure of a check valve will result in\\

a. water hammer\\

b. flow reversal\\

c. cavitation\\

d. water aeration\\

\item A \\_\\_\\_ located at the bottom end of suction pipe on a pump this valve opens when the pump operates to allow water to enter the suction pipe but closes when the pump shuts off water from flowing out of the suction pipe\\

a. Check valve\\

b. Foot valve\\

c. Spring valve\\

d. Ball valve\\

\item A valve that automatically shuts off flow into an elevated storage tank when the water level in the tank reaches a preset level is termed a(n)\\

a. Gate valve\\

b. Air/ vacuum relief valve\\

c. Wet-barrel hydrant\\

d. Altitude valve\\

e. Angle valve\\

\item A normally buried valve located on a street water main and leading to a water service is known as\\

a. Check valve\\

b. Gate valve\\

c. Corporation stop\\

d. Altitude valve\\

e. Butterfly valve\\

\item The risk of pipeline damage from water hammer can be reduced by\\

a. Installation of gate valves\\

b. Air release valves\\

c. Repair of defective pipes\\

d. Trimming pump impellers\\

e. Rapid closing of pump discharge valves\\

\item The valve type most commonly used for isolation in a water distribution system is:\\

a. Gate valve\\

b. Air relief valve\\

c. Globe valve\\

d. Ball valve\\

e. Butterfly valve\\

\item The proper location for air relief valves is\\

a. At low points along a pipeline\\

b. At high points along a pipeline\\

c. At the bottom of surge tanks\\

d. At the mid-line of water storage reservoirs\\

e. At the springline of a pipeline\\

\item When fully open, which of the following will have the highest friction loss?\\

a Gate valve\\

b. Butterfly valve\\

c. Globe valve\\

d. Ball valve\\

e. All will have about the same friction loss.\\

\item A nutating disc is found in certain:\\

a. Centrifugal pumps\\

b. Positive displacement pumps\\

c. Main line valves\\

d. Chemical feeder\\

e. Water meters\\

\item The drain hole in a fire hydrant is designed to\\

a. Release air upon closing the valve\\

b. Relieve vacuum upon opening the valve\\

c. Allow access for interior inspection\\

d. Relieve excess water. pressure when closing the valve\\

e. Remove water from the riser to prevent freezing\\

\item A typical installation site for a compound meter is\\

a. Any small commercial business\\

b. A common single location with as many as 12 separate customers\\

c. A large industrial user\\

d. Any location that requires the electronic monitoring of peak flows\\

e. A typical residential water flow meter\\

\item A main break may cause low pressure in the distributions system, which in turn may result in\\

a. Contamination of the system by backsiphonage\\

b. "ice" formation in the pipes\\

c. Increase in chlorine residual\\

d. Water hammer\\

\item Check valves are used to prevent\\

a. Excessive pump pressure\\

b. Priming\\

c. Water from flowing in two directions\\

d. Water hammer 43. The water table is defined as the\\

a. Pumping water level in a well\\

b. Upper surface of the groundwater\\

c. Water level in a reservoir\\

d. Bottom of the aquifer\\

\item To protect stored water from contamination, a ground storage reservoir should\\

a. Be totally airtight\\

b. Have both the overflow pipe and vent screened\\

c. Have cathodic protection\\

d. Have its interior surface coated with an AWWA-approved paint system\\

\item The peak capacity of water mains is often reduced by\\

a. High pressure\\

b. Looping\\

c. Tuberculation\\

d. Vacuum breakers\\

\item The least amount of head loss in a pipeline would be caused by a fully open\\

a. Angle valve\\

b. Check valve\\

c. Gate valve\\

d. Globe valve\\

\item The variation in water demand during the course of a day is termed\\

a. Seasonal variation\\

b. Fire flow requirements\\

c. Emergency storage variation\\

d. The straight line equalization method\\

e. Diurnal variation\\

\item The maximum momentary load placed on a water supply system is known as\\

a. Average daily flow\\

b. Average daily demand\\

c. Rated capacity\\

d. System float\\

e. Peak demand\\

\item Elevated storage tanks are used primarily to\\

a. Eliminate the need for continuous pumping\\

b. Minimize variations in the system water pressures\\

c. Reduce auxiliary power requirements\\

d. Provide a considerable amount of water for storage\\

e. Protect against backflows\\

\item A valve that automatically shuts off flow into an elevated storage tank when the water level in the tank reaches a preset level is termed a(n)\\

a. Gate valve\\

b. Air / vacuum relief valve\\

c. Wet-barrel hydrant\\

d. Altitude valve\\

e. Angle valve\\

\item Because pipe materials come into contact with drinking water, they must conform with\\

a. Primary drinking water standards\\

b. Secondary drinking water standards\\

c. Surface water treatment rule\\

d. NSF - National Sanitation Foundation\\

d. ANSI/NSF Standard 61'\\

e. All of the above\\

\item An example of a pipe material that is difficult to locate underground is\\

a. Mortar lined and coated steel\\

b. Reinforced concrete cylinder\\

c. Ductile iron\\

d. Asbestos-cement\\

e. Steel\\

\item Pipe with a " C " factor of 140 is regarded as having $a(n)$\\

a. Extremely smooth interior\\

b. Extremely rough interior\\

c. Extremely high corrosion resistance\\

d. Extremely low corrosion resistance\\

e. A purple color\\

\item A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is\\

a. Polyvinyl chloride : PVC\\

b. Cast iron\\

c. Ductile iron\\

d. Concrete cylinder\\

e. Steel\\

\item An example of a pipe material that is relatively easy to locate underground is\\

a. $\mathrm{ABS}$\\

b. PVC\\

c. Reinforced concrete\\

d. Asbestos-cement\\

\item Sleeve-type and "victaulic" couplings are the most common forms of\\

a. Mechanical couplings\\

b. Welded joints\\

c. Asbestos-cement pipe fittings\\

d. PVC pipe fittings\\

e. Flanged joints\\

\item If possible, a water main leak should be repaired under pressure to\\

a. Prevent contamination of the water line\\

b. Prevent flooding of basements\\

c. Save repair time\\

d. Use fewer materials\\

e. All of the above\\

\item When is the best time to perform a distribution main flushing program?\\

a. During night hours, to minimize traffic and other customer concerns\\

b. During weekday day shift hours, to minimize overtime costs\\

c. During Summer months, due to high system velocities\\

d. During Spring months, prior to high system demands of Summer\\

e. None of the above\\

\item An system for the prevention of corrosion is called\\

a. Water hammer\\

b. Reverse osmosis\\

c. Diurnal variation\\

d. A foot valve\\

e. Cathodic protection\\

\item What category of meters is exemplified by propeller and turbine types?\\

a. Differential pressure\\

b. Positive displacement\\

c. Mass flow\\

d. Velocity\\

\item The hydraulic grade line in a pipeline is normally determined by\\

a. Reading pressure gauges\\

b. Checking for backflow\\

c. Opening fire hydrants on each loop of the system\\

d. Using a leak detector\\

e. A venturi meter\\

\item The slope of the hydraulic grade line is due to\\

a. Well elevations\\

b. Elevations of storage facilities\\

c. Pumping\\

d. Backflows\\

e. Friction loss\\

\item A normally buried valve located on a street water main and leading to a water service is known as a\\

a. Check valve\\

b. Gate valve\\

c. Corporation stop\\

d. Altitude valve\\

e. Butterfly valve\\

\item The risk of pipeline damage from water hammer can be reduced by\\

a. Installation of gate valves\\

b. Air release valves\\

c. Repair of defective pipes\\

d. Trimming pump impellers\\

e. Rapid closing of pump discharge valves\\

\item A venturi is a device used to\\

a. Increase water flow\\

b. Decrease water flow\\

c. Regulate water flow\\

d. Stop or start water flow\\

e. Measure water flow\\

\item The most commonly used meter on small diameter domestic service is the\\

a. Venturi meter\\

b. Propeller meter\\

c. Orifice plate meter\\

d. Compound meter\\

e. Nutating disc meter\\

\item The valve type most commonly used for isolation in a water distribution system is the\\

a. Gate valve\\

b. Air relief valve\\

c. Globe valve\\

d. Ball valve\\

e. Butterfly valve\\

\item The proper location for air relief valves is\\

a. At low points along a pipeline\\

b. At high points along a pipeline\\

c. At the bottom of surge tanks\\

d. At the mid-line of water storage reservoirs\\

e. At the springline of a pipeline\\

\item When fully open, which of the following will have the highest friction loss?\\

a. Gate valve\\

b. Butterfly valve\\

c. Globe valve\\

d. Ball valve\\

e. All will have about the same friction loss. 70. Which of the following is a device used to measure flow?\\

a. Baffle\\

b. Diversion box\\

c. Stop logs\\

d. Weir\\

e. None of the above\\

\item A compound meter is a device which\\

a. Is installed to allow automated meter reading\\

b. Can be installed to measure water use by as many as 12 separate customers\\

c. Provides accurate readings over a wide range of flows\\

d. Electronically records peak flows, as a demand meter does for electricity\\

e. Is a typical residential water flow meter\\

\item Magnetic flow meters and ultrasonic flow meters are well suited to measure flow rates of water with a large concentration of suspended solids, because they have\\

a. The best accuracy of any meters\\

b. No parts within the flow stream\\

c. Easily accessed cleanout ports\\

d. Simple recalibration procedures\\

e. All of the above\\

\item A nutating disk is found in certain\\

a. Centrifugal pumps\\

b. Positive displacement pumps\\

c. Main line valves\\

d. Chemical feeders\\

e. Water meters\\

\item The most common valve in a water distribution system is the\\

a. Gate valve\\

b. Air relief valve\\

c. Globe valve\\

d. Ball valve\\

e. Butterfly valve\\

\item The drain hole in a fire hydrant is designed to\\

a. Release air upon closing the valve\\

b. Relieve vacuum upon opening the valve\\

c. Allow access for interior inspection\\

d. Relieve excess water pressure when closing the valve\\

e. Remove water from the riser to prevent freezing\\

\item A typical installation site for a compound meter is\\

a. Any small commercial business\\

b. A common single location with as many as 12 separate customers\\

c. A large industrial user\\

d. Any location that requires the electronic monitoring of peak flows\\

e. A typical residential water flow meter\\

\item An example of a pressure-differential type water meter is a\\

a. Venturi meter\\

b. Propeller meter\\

c. Nutating disk meter\\

d. Magnetic flow meter\\

e. Utrasonic flow meter\\

\item When closing a hydrant, it should be\\

a. Closed rapidly to minimize water loss\\

b. Closed slowly to reduce surges\\

c. Closed using a standard valve key\\

d. Closed using a standard pipe wrench\\

e. Closed at the street valve and left slightly open at the hydrant valve\\

\item Dry-barrel fire hydrants have their operating valves\\

a. In the base\\

b. In the head\\

c. Either of the above, depending on the manufacturer\\

d. In the street several feet away from the riser\\

e. None of the above\\

\item An example of a valve that has a 90 degree travel is a:\\

a. Butterfly valve\\

b. Plug valve\\

c. Ball valve\\

d. All of the above\\

e. None of the above\\

\item The valve type most commonly found on the discharge of a pump or well, and installed to prevent reverse flows is the\\

a. Gate valve\\

b. Check valve\\

c. Globe valve\\

d. Butterfly valve\\

e. Ball or Plug valve\\

\item Features that impact the " $\mathrm{C}$ " factor for measuring friction in pipelines include\\

a. Pipe length\\

b. Pipe type\\

c. Number of valves\\

d. Type of valves\\

e. All of the above 83. An abnormal flow condition caused by a difference in water pressures is known as:\\

a. Backflow\\

b. Reverse osmosis\\

c. Peak demand\\

d. Fire flow\\

e. Minimum daily requirement\\

\item "Backflow Device" is a term used to describe a device that\\

a. connects three inlet lines with one outlet line\\

b. lets air into valve vaults\\

c. prevents flow of potentially contaminated source into a drinking water supply\\

d. tests for oxygen deficiency in valve vaults\\

e. prevents backflow of water through an out-of-service pump\\

\item A cross-connection means\\

a. Four pipelines tied together\\

b. A T-shaped tool\\

c. A connection between potable water and "unapproved" water supplies\\

d. A backflow caused by negative pressure\\

e. A connection between two or more pressure zones\\

\item Egress is normally required (per OSHA guidelines) for trenches of what minimum depth?\\

a. 4 feet\\

b. 5 feet\\

c. 6 feet\\

d. 7 feet\\

e. 8 feet\\

\item A backflow prevention device that can be used in any cross-connection situation is a\\

a. Pressure vacuum breaker\\

b. Single check valve\\

c. Double check valve\\

d. Reduced pressure zone device\\

e. Atmospheric vacuum breaker\\

\item A backflow prevention device that is designed for intermittent use in situations where there is no backpressure, such as toilet flush valves and lawn sprinkler systems is a\\

a. Pressure vacuum breaker\\

b. Single check valve\\

c. Double check valve\\

d. Reduced pressure zone device\\

e. Atmospheric vacuum breaker\\

\item A completely fail-safe means of backflow prevention is\\

a. Atmospheric vacuum breaker\\

b. Pressure vacuum breaker\\

c. Air gap\\

d. Check valve\\

e. Double check valve\\

\item Two hydraulic conditions can induce backflow. These are backsiphonage and\\

a. Peak flow\\

b. Diurnal flow\\

c. Faulty solenoid valves\\

d. Back pressure\\

e. Fire flow\\

\item When using the continuous feed method of disinfection, a new water main should be flushed, disinfected at $50 \mathrm{mg} / \mathrm{L}$, and held at above $25 \mathrm{mg} / \mathrm{L}$ for at least\\

a. 6 hours\\

b. 12 hours\\

c. 24 hours\\

d. 36 hours\\

e. 48 hours\\

\item To properly disinfect a water main after new construction, you should:\\

a. apply $50 \mathrm{mg} / \mathrm{l}$ chlorine for 24 hours.\\

b. clean the pipe out' with a pig and then disinfect at $10 \mathrm{mg} / 1$ for 24 hours\\

c. use a $10 \%$ solution of calcium chloride\\

$\mathrm{d}$ don't use them main for one week\\

\item From a sanitary standpoint. the pressure in a distribution system should never be allowed to fall to zero because:\\

a. low pressure allows bacteria to multiply\\

b. ground water may e:oter and back siphonage may occur\\

c. the chlorine residual will drop faster\\

d. the main may collapse\\

\item The primary purpose of pressure-reducing valves between water system pressure zones is to\\

a. Minimize surge\\

b. Reduce downstream pressure\\

c. Control flows\\

d. Reduce upstream pressure\\

\item Because pipe materials come into contact with drinking water, they must conform with\\

a. Primary drinking water standards\\

b. Secondary drinking water standards\\

c. Surface water treatment rule\\

d. ANSI/NSF Standard 61\\

e. All of the above\\

\item An example of a: pipe material that is difficult to locate underground is\\

a. Mortar lined and coated steel\\

b. Reinforced concrete cylinder\\

c. Ductile iron\\

d. Asbestos-cement\\

e. Steel\\

\item A lightweight type of pipe that has a very smooth interior, is essentially corrosion-free, and which is difficult to locate when buried is:\\

a. Polyvinyl chloride\\

b. Cast iron\\

c. Ductile iron\\

d. Concrete cylinder\\

e. Steel\\

\item Sleeve-type and "victaulic" couplings are the most common forms of\\

a. Mechanical couplings\\

b. Welded joints\\

c. Asbestos-cement pipe fittings\\

d. PVC pipe fittings\\

e. Flanged joints\\

\item The tensile strength of a pipe is its ability to\\

a. Stretch or pull without breakage b. Resist internal pressure without breakage\\

c. Resist external pressure without breakage\\

d. Twist or bend without breakage\\

e. Resist heating without breakage\\

\item When is the best time to perform a distribution main flushing program?\\

a. During night hours, to minimize traffic and other customer concerns\\

b. During weekday day shift hours, to minimize overtime costs\\

c. During Summer months, due to high system velocities\\

d. During Spring months, prior to high system demands of Summer\\

e. None of the above\\

\item The drain hole in a fire hydrant is designed to\\

a. Release air upon closing the valve\\

b. Relieve vacuum upon opening the valve\\

c. Allow access for interior inspection\\

d. Relieve excess water pressure when closing the valve\\

e. Remove water from the riser to prevent freezing\\

\item A typical installation site for a compound meter is\\

a. Any small commercial business\\

b. A common single location with as many as 12 separate customers\\

c. A large industrial user\\

d. Any location that requires the electronic monitoring of peak flows e. A typical residential water flow meter\\

\item An example of a pressure-differential type water meter is a:\\

a. Venturi meter b. Propeller meter c. Nutating disk meter d. Magnetic flow meter e. Ultrasonic flow meter\\

\item When closing a hydrant, it should be\\

a. Closed rapidly to minimize water loss\\

b. Closed slowly to reduce surges\\

c. Closed using a standard valve key\\

d. Closed using a standard pipe wrench\\

e. Closed at the street valve and left slightly open at the hydrant valve\\

\item Dry-barrel fire hydrants have their operating valves\\

a. Inthe base\\

b. In the head\\

c. Either of the above, depending on the manufacturer\\

d. In the street several feet away from the riser\\

e. None of the above\\

\item An example of a valve that has a 90 degree travel is a\\

a. Butterfly valve\\

b. Plug valve\\

c. Ball valve\\

d. All of the above\\

e. None of the above\\

\item The valve type most commonly found on the discharge of a pump or well, and installed to prevent reverse flows is the\\

a. Gate valve\\

b. Check valve\\

c. Globe valve\\

d. Butterfly valve\\

e. Ball or Plug valve\\

\item Features that impact the " $\mathrm{K}$ " factor for measuring friction in pipelines include\\

a. Pipe length\\

b. Pipe type\\

c. Number of valves\\

d. Type of valves\\

e. All of the above\\

\item A potable water supply discharges into an irrigation water storage tank. The 3-inch potable supply line should be terminated\\

a. Above the tank overflow by at least two pipe diameters\\

b. Above the tank outlet by at least two pipe diameters\\

c. Below the tank outlet by at least two pipe diameters\\

d. Level with the tank outlet\\

e. Level with the tank overflow\\

\item A backflow prevention device that is designed for intermittent use in situations where there is no backpressure, such as toilet flush valves and lawn sprinkler systems is a\\

a. Pressure vacuum breaker\\

b. Single check valve\\

c. Double check valve\\

d. Reduced pressure zone device\\

e. Atmospheric vacuum breaker\\

\item A completely fail-safe means of backflow prevention is\\

a. Atmospheric vacunm breaker\\

b. Pressure vacuum breaker\\

c. Air gap\\

d. Check valve\\

e. Double check valve\\

\item Back-siphonage is defined as:\\

a. Back flow that occurs when a vacuum exists.\\

b. Increase in pressure.\\

c. Interconnection between the plumbing systems in the building and water supply.\\

d. Open end of a water supply through which water is discharged in the plumbing fixture.\\

\item A venturi tube increases the velocity and decreases the pressure as water flows through it, This type of tube is used to measure the: .\\

a. Amount of chlorine in the water.\\

b. Amount of turbidity in the water.\\

c. Rate of aeration.\\

d. Rate of water flowing through it.\\

\item A venturi meter measures flow of a fluid in a pipe based upon the:\\

a. Difference in pressure between a constricted and a fill size portion of the pipe,\\

b. Electronic measurement\\

c. Velocity of the fluid past a given point.\\

d. Weight of the fluid\\

\item Valves are provided in a distribution system to\\

a. Detect any safety hazards.\\

b. Detect weak links in the system.\\

c. Isolate small areas for maintenance and emergency conditions.\\

d. Reduce costs of maintenance.\\

\item A connection that is made into a main that is under pressure is called a:\\

a. Cross connection\\

b. Dry Tap\\

c. Wet Tap\\

d. Valve Box\\

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

a. Butterfly valve\\

b. ${ }^{\*}$ Check Valve\\

c. Pressure valve\\

d. Gate valve\\

\item The size of water mains, pumping stations, and storage tanks is primarily determined by:\\

a. Maximum day demand during a $24 \mathrm{hr}$. period during the previous year.\\

b. Population served\\

c. Per-capita water use\\

d. Fire protection requirement\\

\item Firefighting may cause low pressure in an area of the distribution system. This low pressure might lead to:\\

a. contamination of the system by back-siphonage\\

b. ice formation in the pipes\\

c. loss of chlorine residual\\

d. None of the above\\

\item The problem caused by dissolved carbon dioxide in the water of the distribution system is b. Corrosion\\

c. Excessive encrustation\\

d. Tastes and odors\\

a. increased trihalomethanes (THMs)\\

\item The peak capacity of water mains is often reduced by\\

a. High pressure\\

b. Looping\\

c. Tuberculation\\

d. Vacuum breakers\\

\item When using the $A W W A$ spray method for disinfecting the interior walls of water tanks, the minimum applied chlorine dose is\\

a. $5 \mathrm{ppm}$\\

b. $50 \mathrm{ppm}$\\

c. $10 \mathrm{ppm}$\\

d. $200 \mathrm{ppm}$\\

\item Water should be delivered with a minimum working pressure of:\\

a. $45 \mathrm{psi}$\\

a. $100 \mathrm{psi}$\\

b. $35 \mathrm{psi}$\\

c. $50 \mathrm{psi}$\\

d. $15 \mathrm{psi}$ 124. Thrust blocks are installed to\\

a. boost flexible joints.\\

b. boost water pressure.\\

c. minimize corrosion\\

d. prevent movement of pipes \& joints.\\

\item Distribution system pressure (even during fire fighting demands) should not be allowed to drop below psi.\\

a. 0\\

b. 5\\

c. 20\\

d. 40\\

\item Whenever possible the end of a distribution system should be to prevent taste and odor problems.\\

a. inspected\\

b. looped.\\

c. plugged\\

d. capped\\

\item The three common types of plastic pipes are listed as PVC, PE, \& PB. These names refer to the:\\

a. Chemical resistance of the pipe\\

b. Composition of the pipe\\

c. Pressure for which the pipe is designed\\

d. Types of appropriate application\\

\item An invert of a pipe is located:\\

a). According to the pipe manufacturers specifications\\

b. At the inside bottom of the pipe\\

c. At the inside cross section\\

d. At the outside bottom of the pipe\\

\item An Altitude valve is a device used to:\\

a. turn water flow off or on\\

b. allow two or more pumps to alternate operation\\

c. prevent backflow due to a cross connection\\

d. regulate the water surface level in a water storage tank\\

e. none of the above\\

\item The type of corrosion caused by the use of dissimilar metal in a water system is\\

a. Caustic corrosion\\

b. Galvanic corrosion\\

c. Oxygen corrosion\\

d. Tubercular corrosion\\

item The best way to protect the water supply from contamination by cross-connection is:\\

a. A double check valve\\

b. A vacuum breaker\\

c. An air gap\\

d. A reduced pressure zone device\\

\item The positive side of the cathodic protection system is the:\\

a. Tank\\

b. Cathode\\

c. Rectifier\\

d. Sacrificial anode\\

\item A flow meter on a fire line would probably be a:\\

a. Venturi meter\\

b. Nutating disk meter\\

c. Oscillating piston meter\\

d. Compound meter\\

\item When filling a main, the water velocity should never exceed:\\

a. $1 \mathrm{ft} / \mathrm{sec}$\\

b. $2.5 \mathrm{ft} / \mathrm{sec}$\\

c. $10 \mathrm{ft} / \mathrm{sec}$\\

d. $20 \mathrm{ft} / \mathrm{sec}$\\

\item When two storage tanks that serve the same area have different overflow elevations, what type of valve should be included on the lower tank?\\

a. Check valve\\

b. Altitude valve\\

c. Air relief valve\\

d. Ball valve\\

\item Water hammer is caused by:\\

a. Opening a valve too slowly\\

b. Closing a valve too quickly\\

c. Excessive hardness\\

d. High pressure on the suction side of a pump\\

\item Comprehensive maps of medium to large systems generally have scales ranging from\\

a. 250-500 feet to 1 inch.\\

b. $500-1,000$ feet to 1 inch.\\

c. $1,000-1,500$ feet to 1 inch.\\

d. $1,500-2,000$ feet to 1 inch.\\

\item Sectional maps generally have scales ranging from\\

a. 50-100 feet to 1 inch.\\

b. $100-200$ feet to 1 inch.\\

c. $200-250$ feet to 1 inch. d. 250-400 feet to $1 \mathrm{inch}$.\\

\item A comprehensive map should be\\

a. compact enough to fit in a folder.\\

b. as large as possible.\\

c. as detailed as possible.\\

d. written in technical language so that only engineers can read it.\\

\item On a plan and profile drawing, what does the abbreviation EL mean? a. English language\\

b. Estimated length\\

c. Electric\\

d. Elevation\\

\item What type of map is also referred to as a wall map?\\

Comprehensive map\\

\item What type of map, commonly called a plat, is a series of maps covering sections of the water system?\\

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\item What is the most important aspect in maintaining a high degree of safety awareness in the water treatment facility?\\

a. \*Making sure carelessness or negligence is stressed\\

b. driver's training away from the workplace\\

c. reading the MSDS postings each day\\

d. maintaining batteries in flashlights and emergency storage areas\\

\item Which is the approximate angle of repose for average soils when using the sloping method for the prevention of cave-ins? (Note: horizontal to vertical distance, respectively)\\

a. $0.5: 1.0$\\

b. $1.0: 1.0$\\

c. $1.5: 1.0$\\

d. $2.0: 1.0$\\

\item What federal law is designed to protect the safety and health of operators?\\

a. OSHA\\

b. FMLA\\

c. FLSA\\

d. ADEA\\

\item What are the two most important safety concerns when entering a confined space?\\

a. Corrosive chemicals and falls\\

b. Bad odors and claustrophobia\\

c. Extreme air temperatures and slippery surfaces\\

d. Oxygen deficiency and hazardous gases\\

\item Which document provides a profile of hazardous substances?\\

a. CERCLA\\

b. SARA\\

c. CFR\\

d. MSDS\\

\item What is the purpose of a pump guard?\\

a. Allows operators to turn off pump in emergency situations\\

b. Notifies operators of excessive temperatures\\

c. Allows operators to pump against a closed discharge valve\\

d. Protects operators from rotating parts\\

\item Atmosphere is considered oxygen deficient when the oxygen level is below\\

a. $21.5 \%$\\

b. $20 \%$\\

c. $19.5 \%$\\

d. $17 \%$\\

\item Employee hazards include\\

a. Noxious or toxic gases or vapors\\

b. Oxygen deficiency\\

c. Physical injuries\\

d. All of the above\\

\item Before entering a permit-required confined space, you must:\\

a. Check the atmosphere with a calibrated gas detector.\\

b. Make notification that personnel are entering the space.\\

c. Lock out and tag out all equipment.\\

d. All of the above.\\

\item When making a sulfuric acid dilution, the appropriate method is:\\

a. Add the water to the acid.\\

b. Add the acid to the water.\\

c. Add both at the same time.\\

d. None of the above.\\

\item When manually lifting any object, be sure to\\

a. Hold it at arm's length.\\

b. Keep your back bent and hold it low.\\

c. Keep it close to your body and use leg strength.\\

d. Keep your knees locked and bend at the waist.\\

\item What is the proper slope of a ladder?\\

a. Every 4 feet up the ladder is 1 foot out from the wall.\\

b. Every 5 feet up the ladder is 1 foot out from the wall.\\

c. Every 6 feet up the ladder is 1 foot out from the wall.\\

d. Every 7 feet up the ladder is 1 foot out from the wall.\\

\item When working on a chemical feed pump, what of the following is not required?\\

a. Nitrile gloves.\\

b. Safety glasses.\\

c. Leather work gloves.\\

d. Full face shield.\\

\item When must the atmosphere of a confined space be tested?\\

a. Only before a worker enters\\

b. Never, if adequate ventilation exists\\

c. Continuously\\

d. Only if welding or painting is being performed\\

\item Some gases in a confined space can be:\\

a. Colorless\\

b. Odorless\\

c. Deadly\\

d. All of the above\\

\item Why should you contact other area companies with underground utilities before starting an underground repair job?\\

a. To determine if there have been recent excavations in that location b. To ask these companies to mark the location of their utilities in the area of the repair job\\

c. To see if they also have excavating to do in the area\\

d. To see if they will help route traffic while you are doing the repair job\\

\item The only acceptable breathing device to wear while handling chlorine leaks is the\\

a. Activated carbon canister type\\

b. Potassium tetroxide canister type\\

c. Self-contained breathing apparatus\\

d. Oxygen supply apparatus\\

\item It is essential to ventilate a vault before entry in order to\\

a. Remove excessive moisture\\

b. Equalize temperature and pressure\\

c. Eliminate foul odors\\

d. Remove dangerous gasses\\

\item Permit-required confined space entry requires\\

a. Bright orange jackets, rubber boots, and gloves\\

b. Safety harness and a lifeline\\

c. Tool belts with flashlight attached\\

d. Utility belts with a full complement of tools\\

\item During a confined space entry, how often must the confined space be monitored for hazardous atmospheres?\\

a. Continuously\\

b. Every five minutes\\

c. Before entry only\\

d. Before entry and then once per hour during entry\\

\item Which of the following is the most likely to be a fuel involved in a Class A fire?\\

a. Butane\\

b. Magnesium\\

c. Electrical equipment\\

d. Gasoline\\

e. Paper and/or fabrics\\

\item In an occupied trench where exits (i.e., ladders) are required, what is the maximum allowed travel distance between an occupant and the nearest exit?\\

i. 25 feet\\

b. 50 feet\\

c. 100 feet\\

d. At the discretion of the safety officer\\

e. None of the above\\

\item Standard first aid procedures direct that the first step to control bleeding is to\\

a. Apply a tight tourniquet\\

b. Apply pressure directly to the wound\\

c. Let it bleed until natural clotting takes place\\

d. Wash wound and bandage\\

e. None of the above\\

\item When excavating materials that will not stand in a vertical position, the most suitable form of shoring is\\

a. Air shores\\

b. Hydraulic shores\\

c. Screw jacks\\

d. Solid sheeting\\

e. Cleats\\

\item A potable water supply discharges into an irrigation water storage tank. The 3 -inch potable supply line should be terminated\\

a. Above the tank overflow by at least two pipe diameters\\

b. Above the tank outlet by at least two pipe diameters\\

c. Below the tank outlet by at least two pipe diameters\\

d. Level with the tank outlet\\

e. Level with the tank overflow\\

\item Which of the following gases is toxic at the lowest concentration?\\

a. Carbon dioxide\\

b. Hydrogen sulfide\\

c. Methane\\

d. Nitrogen\\

e. Oxygen\\

\item Entry into an atmosphere with high concentrations of chlorine gas requires\\

a. A self-contained breathing apparatus\\

b. An approved and uncontaminated canister mask\\

c. Forced ventilation of the work area\\

d. Atmospheric testing with ammonia solution prior to entry\\

e. Rubber gloves and a full-face shield\\

\item Shoring is normally required (per OSHA guidelines) for trenches of what minimum depth?\\

a. 4-feet\\

b. 5-feet\\

c. 6-feet\\

d. 7-feet\\

e. 8 -feet\\

\item First aid for first-degree burns is to\\

a. Bandage tightly\\

b. Cover liberally with salve\\

c. Pack in ice\\

d. Submerge the burned area in cold water e. All of the above\\

\item What information must be on a warning tag attached to a locked-out switch?\\

a. Directions for removing the tag\\

c. Signature of the person who locked out the switch and who will remove it\\

d. Time to unlock the switch\\

e. None of the above\\

\item A confined space that contains a material that has the potential for engulfing an entrant is\\

a. A transition zone\\

b. A permit space\\

c. Prohibited by OSHA\\

d. Required to undergo atmospheric testing with ammonia solution prior to entry\\

e. S Required to use a complete "A" suit for personal protective equipment\\

\item What condition must exist for an area to be considered a confined space?\\

a. Limited or restricted means of entry or exit\\

b. Is large enough for a person to enter and perform work\\

c. Is not designated for continuous occupancy\\

d. All of the above\\

e. None of the above\\

\item Which of the following is the most likely to be a fuel involved in a Class $\mathrm{C}$ fire?\\

a. Butane\\

b. Magnesium\\

c. Paper and/or fabrics\\

d. Gasoline\\

e. Electrical equipment\\

\item Which of the following is the most likely to be a fuel involved in a Class B fire?\\

a. Wood\\

b. Magnesium\\

c. Electrical equipment\\

d. Gasoline\\

e. Paper and/or fabrics\\

\item The angle of repose is the angle of the slope of a\\

a. Sewer\\

b. Graded and/or cut ground elevation\\

c. Trench excavation\\

d. Unsupported loose soil\\

e. Filled and compacted ground elevation\\

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

a. WARN\\

b. USA\\

c. AWWA\\

d. DHS\\

e. EPA\\

\item Which of the following compounds emits a "rotten egg" odor?\\

a. Hydrogen sulfide\\

b. Chorine dioxide\\

c. Chloramines\\

d. Hydrochloric acid\\

e. Hypochlorous acid\\

\item Where is the best place to store a self -contained breathing apparatus (SCBA)?\\

a. inside a cabinet in the chlorinator room\\

b. in an unlocked cabinet outside the chlorinator room\\

c. locked in a cabinet in the office\\

d. locked in a cabinet just outside the chlorinator room\\

\item Which of the following is a hazard when handling hydrofluosilicic acid?\\

a. fire\\

b. explosion\\

c. corrosion\\

d. inhalation\\

\item Which of the following chemical substances ii most likely to cause corrosion or deterioration of metal and concrete surfaces\\

a. carbon dioxide\\

b. ethanol\\

c. methane\\

d. hydrogen sulfide\\

\item An employee ls caught in a room where ch1orine gas is leaking. He has no SCBA, he should\\

a. lay down on the floor and quickly crawl out of the room\\

b. walk out of the room quickly\\

c. pull shirt over mouth and face and quickly walk out of the room\\

d. keep mouth closed, head as high as possible, and quickly walk out of the room holding breath.\\

\item It is essential to ventilate a vault before entry in order to\\

a. Rennove exçessive moisture\\

b. Equalize temperature and pressure\\

c. Eliminate foul odors\\

d. Remove dangerous gasses\\

\item A portable ladder must extend at least feet above the upper surface of an excavated trench.\\

a. 1\\

b. 3\\

c. 4\\

d. 4.5\\

\item A trench must be shored if it is feet deep or more.\\

a. 3\\

b. 4\\

c. 5\\

d. 6\\

\item When employees are working in a trench $5 \mathrm{ft}$ deep or more, an adequate means of exit, such as a ladder or steps, must be located no mote than $\mathrm{ft}$ away from them.\\

a. 5\\

b. 10\\

c. 25\\

d. 40\\

\item Permit-required confined space entry requires\\

a. Bright orange jackets, rubber boots, and gloves\\

b. Safety harness and a lifeline\\

c. Tool belts with flashlight attached\\

d. Utility belts with a full complement of tools

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\item How many pounds per day of $100 \%$ chlorine gas are needed to arrive at a dosage of $2 \mathrm{mg} / \mathrm{L}$, when the flow is $8.8 \mathrm{mgd}$ and a zero chlorine demand exists?\\

a. $\* 147$\\

b. $1,097.9$\\

c. 1,468\\

d. 211.3\\

e. 417\\

\item How many pounds per day of $100 \%$ chlorine gas are needed to arrive at a residual of $2.3 \mathrm{mg} / \mathrm{L}$, when the flow is $8.25 \mathrm{mgd}$ and a chlorine demand is $0.35 \mathrm{mg} / \mathrm{L}$ ?\\

a. 21.8\\

c. 27.4\\

e. 812.3\\

b. $\* 182.3$\\

d. 158.3\\

\item When a filter whose surface loading rate is $1,500 \mathrm{gpd} / \mathrm{sq}$.ft. and its size is 400 -sq. ft. Determine the total flow through the filter in gallons per day.\\

a. 0.6\\

c. 7.85\\

e. $\* 600,000$\\

b. 375,000\\

d. 3.75\\

\item Determine the Unit Filter Run Volume of a 15-ft. x 20-ft. filter when it registered 2,000,000 gallons during its run.\\

a. 600\\

c. 989\\

b. 9423\\

d. $\* 6667$\\

e. 7200\\

\item A filter has the dimensions of $15-\mathrm{ft}$. $x 20-\mathrm{ft}$ and a backwash rate of $19.5 \mathrm{gpm} / \mathrm{sq} . \mathrm{ft}$. Determine its backwash rise rate in, inches per minute.\\

a. 58.5\\

c. 5.85\\

e. $\* 31.2$\\

b. 37\\

d. 81.3\\

\item Using the Quantity formula $(\mathrm{Q}=\mathrm{AV})$, determine the $\mathrm{Q}$ when $\mathrm{A}=15 \mathrm{sq}$. $\mathrm{ft}$. and velocity is $3.3 \mathrm{ft} / \mathrm{sec}$.\\

a. $\* 49.5 \mathrm{cfs}$\\

c. $19.88 \mathrm{cfs}$\\

e. $4.9 \mathrm{cfs}$\\

b. $495 \mathrm{cfs}$\\

d. $4.545 \mathrm{cfs}$\\

\item Find the gpm/sq.ft. filtration rate when 6,775,000 gallons were produced in 24-hours through a filter that measures $30-\mathrm{ft} . x 54-\mathrm{ft}$.\\

a. 0.029\\

c. 2904.2\\

e. 4.18\\

b. 0.29\\

d. $\* 2.9$\\

\item What is the grain per gallon (gpg) hardness of water that has a total hardness of $228 \mathrm{mg} / \mathrm{L}$ ?\\

a. \*14\\

c. 18\\

e. 133.3\\

b. 3898.8\\

d. 39\\

\item A water tank had a pressure gauge reading of 14 psig on its bottom. Determine the water level in the tank.\\

a. 23.3 feet\\

c. $\* 32.3$ feet\\

e. 19.8\\

b. 28.6 feet\\

d. 38.3 feet\\

\item A tank had a diameter of 22 -feet and a pressure of $7.7 \mathrm{psi}$ on its bottom. Determine how many pounds of $65 \%$ calcium hypochlorite (dry powder chlorine) are needed to arrive at a dosage of $1 \mathrm{ppm}$.\\

a. 0.42 pounds\\

b. $\* 0.65 \mathrm{lbs}$\\

c. $50,302.5$ pounds\\

d. $41.9 \mathrm{lbs}$\\

e. $6.5 \mathrm{lbs}$\\

\item An iron removal plant processes water with an average iron concentration of $2.5 \mathrm{mg} / \mathrm{l}$. If the iron concentration is $0.01 \mathrm{mg} / \mathrm{l}$ after treatment and the total daily pumpage is one million gallons, how many pounds of iron will be removed per day?\\

a. 10.77 pounds\\

a. $\* 20.77$ pounds\\

b. 25.77 pounds\\

c. 30.77 pounds\\

d. 35.77 pounds\\

\item A water system bills quarterly at a rate of $25 \notin / 1000$ gallons for the first 10,000 gallons, $30 \notin / 1000$ gallons for the next 10,000 gallons, $35 \phi / 1000$ gallons for all over 20,000 gallons. If a customer uses 35,000 gallons per quarter, what is the water bill?\\

a. $\$ 9.50$\\

b. $\* \$ 10.75$\\

c. $\$ 12.25$\\

d. $\$ 12.50$\\

e. $\$ 13.25$\\

\item A ground level storage tank is 25 feet long, 20 feet wide, and 10 feet deep. When the storage tank is completely empty, calculate how many minutes it will take to fill the tank with a pump that has a capacity of 300 gallons per minute.\\

a. 60 minutes\\

b. 100 minutes\\

c. $\* 125$ minutes\\

d. 150 minutes\\

e. 200 minutes\\

\item A room measures $12 \mathrm{ft}$ high, $30 \mathrm{ft}$ long, and $17 \mathrm{ft}$ wide. How many cubic feet per minute of air must a blower in an air exchange unit move to completely change the air every 10 minutes?\\

a. 102\\

b. 612\\

c. 1,020\\

d. 6,120\\

\item If a trench is $526 \mathrm{ft}$ long, $4.0 \mathrm{ft}$ wide, and $5.5 \mathrm{ft}$ deep, how many cubic yards of soil were excavated?\\

$$\\

526 \times 4 \times 5.5=\frac{11,572 \mathrm{f}^{3}}{27}=428\\

$$\\

\item If exactly $100 \mathrm{gal}$ of polymer costs $\$ 19.50$, what will $5,500 \mathrm{gal}$ cost, assuming no quantity discount?\\

$$\\

\frac{19.50}{100} \times 5500=1,072.5\\

$$\\

\item What is the velocity of flow in feet per second for an 8.0-in. diameter pipe if it delivers 675 gprax?\\

$$\\

\begin{gathered}\\

\frac{150}{6.35} \\

\frac{675}{449}=15 \mathrm{cuft} / \mathrm{s} \\

430 \mathrm{ft} / \mathrm{s}\\

\end{gathered}\\

$$\\

\item What should the setting be on a chlorinator in pounds per day if the dosage desired is $2.90 \mathrm{mg} / \mathrm{L}$ and the pumping rate from the well is $975 \mathrm{gpm}$ ?\\

$$\\

\frac{975}{69)^{1}}=1.4 M G D\\

$$\\

$$\\

1.4 \times 8.34 \times 2.90\\

$$\\

\item A treatment plant uses $278 \mathrm{lb} / \mathrm{d}$ of chlorine gas. If the chlorine demand is $0.85 \mathrm{mg} / \mathrm{L}$ and the chlorine residual is $1.50 \mathrm{mg} / \mathrm{L}$, how many million gallons per day are being treated?\\

$$\\

\begin{gathered}\\

\frac{278}{8.34 \times 2 \times 35}= \\

\text { dojarge } ; \\

0.85+1.50= \\

2.35 \mathrm{mg} / \mathrm{h}\\

\end{gathered}\\

$$\\

\item A water tank that is $105 \mathrm{ft}$ in diameter needs to be disinfected with a $5.0 \%$ sodium hypochlorite solution. If the tank is to be filled to only a depth of 5.0ft and the concentration required is $20.0 \mathrm{mg} / \mathrm{L}$, how many gallons of sodium hypochlorite are needed? Assume the sodium hypochlorite solution weighs $8.92 \mathrm{lb} / \mathrm{gal}$.\\

$$\\

\begin{gathered}\\

\frac{0.323 M G P}{0.323 \times 8.34 \times 20}= \\

9 / 23 / 19\\

\end{gathered}\\

$$\\

\item Convert $8.0 \mathrm{cfs}$ to gpm.\\

a. $1.07 \mathrm{gpm}$\\

b. $64.2 \mathrm{gpm}$\\

c. $480 \mathrm{gpm} \quad 8 \times 449$\\

(e.) 3,436gpm\\

\item Conyert $4,000 \mathrm{gpm}$ to $\mathrm{cfs}$.\\

a. $8.91 \mathrm{cfs}$\\

b. $66.65 \mathrm{cfs}$\\

c. $499 \mathrm{cfs}$\\

d. $535 \mathrm{cfs}$\\

e. $32,076 \mathrm{cfs}$\\

\item Convert 12MGD to gpm.\\

a. $0.00833 \mathrm{gpm}$\\

b. $7,200 \mathrm{gpm} 12 \times 700$\\

d. $17,280 \mathrm{gpm}$\\

e. $199,992 \mathrm{gpm}$\\

\item Convert 5.5 cfs to MGD.\\

a. $0.059 \mathrm{MGD}$\\

b. $0.148 \mathrm{MGD}$\\

c. $0.475 \mathrm{MGD}$\\

(64) more Aaumole\\

e. 7,920 MGD\\

\item Convert 45 Acre-feet into million gallons.\\

a. $6.02 \mathrm{Mgal}$\\

b. $1.96 \mathrm{Mgal}$\\

c. $14.7 \mathrm{Mgal}$\\

d. $45 \mathrm{Mgal}$\\

e. $336.6 \mathrm{Mgal}$\\

\item Convert 6.5 feet per second into miles per hour.\\

a. $4.43 \mathrm{mph}$\\

c. $13.3 \mathrm{mph}$\\

d. $106 \mathrm{mph}$\\

e. $266 \mathrm{mph}$\\

\item Convert 3.4 miles into feet.\\

a. 5,000 feet\\

b. 5,280 feet\\

c. 5,984 feet\\

d. 10,000 feet\\

(e.) 17,952 feet\\

$$\\

=\frac{6.5 / 5280}{1 / 60 \times 60}\\

$$\\

$1 \mathrm{~m} / \mathrm{e}=25 \mathrm{ft}$\\

\item Convert 2,250gpm into MGD.\\

a. $0.054 \mathrm{MGD}$\\

b. 3.24MGD\\

d. 2, 250MGD\\

e. 3,240 MGD\\

\item Convert 9.75MGD into cfs.\\

a. $15.1 \mathrm{cfs}$\\

b. $37.75 \mathrm{cfs}$\\

c. $113 \mathrm{cfs}$\\

d. $363 \mathrm{cfs}$\\

e. $845 \mathrm{cfs}$\\

\item Convert $1,000,000$ cubic feet into Acre-feet.\\

a. $0.04356 \mathrm{AF}$\\

b. $0.325829 \mathrm{AF}$\\

c. $3.07 \mathrm{AF}$\\

d. $22.96 \mathrm{AF}$\\

e. $172 \mathrm{AF}$\\

\item What is the chlorine residual in a treated water if the dosage is $2.1 \mathrm{mgi} 1$ and has a demand of $0.8 \mathrm{mg} / 1$\\

a. $0.8 \mathrm{mg} / 1$\\

b. $1 \mathrm{mg} / \mathrm{l}$\\

c. $2.1 \mathrm{mg} /$ !\\

d. $2.9 \mathrm{mg} / 1$\\

\item What is the maximum amount of ch1orine gas that can be removed from a 150-lb cylinder in $24 \mathrm{hrs}$ ?\\

a. 26 lbs.\\

b. $40 \mathrm{Jbs}$.\\

c. $75 \mathrm{lbs}$.\\

d. there is no maxim.um\\

\item Bow many gallons would be contained in a circular tank that is $100 \mathrm{ft}$. in diameter and $10 \mathrm{ft}$ deep?\\

a. $587,0.00$ gallons\\

b. 657,000 gallons\\

c. 1,340,000 gallons\\

d. 2,349,000 gallons\\

\item In order to rebuild a manhole, it will be necessary to remove the asphalt from a 35-foot diameter circle in a street. The pavement area involved is:\\

a. $\quad 208$ sq.ft\\

b. 241, sq.ft\\

c. $\quad 962$ sq.ft\\

d. 1125 sq.ft\\

\item If the chlorine demand of water is $2.5 \mathrm{mg} / 1$ and you want a residual of $0.5 \mathrm{mg} / \mathrm{l}$, how much chlorine would need to be fed to one million gallons?\\

a. 25lbs.\\

b. 30lbs.\\

c. 34lbs.\\

d. 38lbs.\\

\item If you need to feed chlorine at orate of $2.1 \mathrm{mg} / 1$ and you treat $2,300,000$ gallons. How many pounds of chlorine should you use?\\

a. 4lbs.\\

b. 17lbs.\\

c. 35lbs.\\

d. 40lbs.\\

\item What is the head on a system exerting a static pressure of 62 psi?\\

a. 89 feet\\

b. 107 feet\\

c. 143 feet\\

d. 189 feet\\

\item A head of 200 feet would equal:\\

a. $46.6 \mathrm{psi}$\\

b. $56.6 \mathrm{psi}$\\

c. $66.6 \mathrm{psi}$\\

d. $86.6 \mathrm{psi}$\\

\item If a 3,000,000 gpd flow is to be dosed with $1.2 \mathrm{mg} / \mathrm{l}$, what should the chlorinator feed rate be set at in lbs. of chlorine per day?\\

a. 3.0lbs./ day\\

b. $4.5 \mathrm{1bs} . / \mathrm{day}$\\

c. 10lbs./ day\\

d. 30lbs./ day\\

\item Which of the following does not affect the friction loss in a given length of pipe?\\

a. hardness of the water\\

b. number of fittings\\

c. roughness of the interior of the pipe\\

d. velocity of the flow\\

\item Calculate the area in square feet of: a space $100 \mathrm{ft}$ long and $75 \mathrm{ft}$ svide. $100 \times 75$ Ans. TTur Sq. Fr.\\

\item Calculate the volume of a rectangular tank 20 feet high, $100 \mathrm{ft}$ long, and 75 feet wike. Ans. $\frac{10 \text { wo }}{1} \mathrm{Cu} . \mathrm{Ft}$.\\

\item Calculate the gallons the tank in the preceding problem will hold. Ans. 1,122,000 Gallons\\

\item Calculate the area in square feet of a space $40 \mathrm{ft}$ long and 50 feet vvide. Ans, 2000 Sq. Ft\\

\item Calculate the volume of a rectangular tank $40 \mathrm{ft}$ long, $50 \mathrm{ft}$ wide and 25 feet tall.\\

$$\\

\text { Ans. 50, } 000 \text { Cu.Ft }\\

$$\\

\item Calculate the gallons the tank in the preceding problem will contain. Ans. 374,000 Gallons\\

\item Calculate the area of a circle with a $10 \mathrm{ft}$ radius.\\

Ans. $314 \mathrm{Sq} \mathrm{Ft}$\\

\item Calculate the aren of a circle with a $10 \mathrm{ft}$ diameter.\\

Ans. $78-5$\\

\item Calculate the yolmue of a tank with a $50 \mathrm{ft}$ diameter that is 20 feet high.\\

Ans. 39, 260\\

$\mathrm{Cu} . \mathrm{Ft}$\\

\item How many gallons will the tank in the preceding problem hold?\\

\item Calculate the area of a circle with a $100 \mathrm{ft}$ dibmeter.\\

$$\\

\text { Ans. 293, } 590\\

$$\\

\\textbf{Ans. 7, 800SqFt}\\

\item Calculate the volume of a tank with a $100 \mathrm{ft}$ diameter that is 50 feet high. Ans.\\

\item How many gallons ryill the tank in the preceding problen hold? Auls.\\

$2,935,960$\\

$$\\

18 \times 18 \times 0^{\prime} 0408 \times 1200\\

$$\\

\item How many gallons will an $18^{\prime \prime}$ diameter pipeline, 1200 ' long contain?\\

$$\\

\text { imi }=5280 \text { Ans. } 15,863 \text { Gallons }\\

$$\\

\item How many gallons will a 24 " pipeline, 2 miles long contain?\\

$$\\

24 \times 24 \times 0.0408 \times 248,168\\

$$\\

\item 500 GPM is how many gallons per houl?\\

10560\\

$$\\

\frac{500 \mathrm{~g}^{\prime}}{1 \mathrm{~m}}=\frac{500}{1 / 10 h}=\text { Ans } \frac{30 \mathrm{e} 0 \mathrm{r}}{\mathrm{gph}}\\

$$\\

\item $30,000 \mathrm{gph}$ is how many gallons per day?\\

$$\\

\frac{30,000 \mathrm{~g}}{h}=\frac{30,000}{1 / 24}=30,020 \times 24 \text { Ans. } \frac{720,010}{\mathrm{gpd}}\\

$$\\

\item A flow of $25 \mathrm{gpm}$ is low many gpd?\\

$$\\

\frac{25 \mathrm{~g}}{m}=\frac{25}{1 / 60} \times \frac{1}{24} \quad(25 \times 1440) \text { Ans. 36, } 0 w \mathrm{gpd}\\

$$\\

\item A flow of $800,000 \mathrm{gpd}$ is how many gpm? $\frac{800,000}{0.8 M G D \times 700}=560 \times 24 \times 60 \quad 555.55$ $0.80 \mathrm{gpm}$\\

\item A flow of $150 \mathrm{gpnn}$ is how many MGD?\\

$$\\

700 \text { (wm. }\\

$$\\

Ans.\\

MGD\\

\item How many gallons will an $8^{\prime \prime}$ pipeline 550 ' long contain?\\

$$\\

8 \times 8 \times 0.0408 \times 550\\

$$\\

Ans. $1436 \cdot \frac{16}{\text { gallons }}$\\

\item Water is filling a tank at the rate of $50 \mathrm{gpm}$ for a $10 \mathrm{~min}$. period, How many gallons of water are contained in the tank at the end of the 10 minute time period?\\

\item A well pump is discharging water at the rate of $400 \mathrm{gpm}$ into a tank for 15 minutes. Haw many gallons will be in the tank at the end of this time period?\\

$$\\

6,000 \ldots \text { Gal. }\\

$$\\

Dose $=$ Demand T Residual $\frac{300}{20} \times 16$\\

\item A tank is filling at the rate of $300 \mathrm{gpm}$ for a 20 minute period. How many of water will be contained in the tank at the end of 16 minutes?\\

4880 Gal.\\

\item Before pumping, the static water level in a well is 15 feet. During pumping, the water lewel drops to 45 feet. What is the drawdown? $45-15=30$\\

a. 15\\

b. 30\\

c. 45\\

d. 60\\

e. 90\\

\item Over a four year period, the hour meter on a electrical panel at a well site had the following readings at the end of each year: $1^{\text {st }}$ year $-976.3,2^{\text {nd }}$ year $-1325.8,3^{\text {rd }}$ year -2007.1 , and $4^{\text {th }}$ year -2371.4 . How many hours does the meter show the well ran during the $3^{\text {rd }}$ year?\\

a. $349.5 \mathrm{hrs}$\\

b. $3364.3 \mathrm{hrs}$\\

c. $981.3 \mathrm{hrs}$\\

d. $830.2 \mathrm{hn} / \mathrm{s}$\\

e. 900.1\\

\item One gallon of water weighs how many lbs?\\

a. 7.48\\

b. 8.34\\

c. 2.31\\

d. 43318 .\\

\item A water tank is filled to depth of 22 feet. What is the psi at the bottom of the tank?\\

$$\\

22 / 2.31 \quad 9.52\\

$$\\

\item The static pressure in a water main is 85 psi. What elevation of water is needed to provide that kind of pressure?\\

$$\\

85 \times 2.31 \quad 196\\

$$\\

\item Calculate the pressure at the bottom of a water tank if it is filled to a depth of 33 feet.\\

$$\\

33 / 2.31\\

$$\\

$\mathrm{ft}$\\

\item A psi gauge is located at the bottom of a water tank and reads 24 psi. What is the elevation of the water inside the tank?\\

$$\\

24 \times 2.31 \quad 55\\

$$\\

\item A gauge is reading the pressure at the outlet of a fire hydrant. A tank is elevated 200 feet above the hydrant. What is the gaige pressure at the hydirant?\\

$$\\

20 s / 2.31\\

$$\\

\item A gauge is attached to a hose bib at a house. The gauge reads $45 p$ ps. How much elevation is needed to supply that pressure?\\

$$\\

45 \times 2.31 \quad 104\\

$$\\

\item How many galtons will the above cylinder hold?\\

$$\\

100 \times 7.48=748\\

$$\\

\item Calculate the area in square feet of a space $100 \mathrm{ft}$. long and $75 \mathrm{ft}$ widie.\\

Ans. 7500 Sq. Fit\\

\item Calculate the volume of a rectangular tank 20 feet high, $100 \mathrm{ft}$ long, and 75 feet wide. Ans. 150,00 Cu.F.\\

\item Calculate the gallons the tauk in the preceding problem will hold.\\

\item Calculate the area in square feet of a space $40 \mathrm{ft}$ long and 50 feet wide. Ans, $\frac{2,000}{1}$ Sq. Ft\\

\item Calculate the volume of a rectangular tank $40 \mathrm{ft}$ long, $50 \mathrm{ft}$ wide and 25 feet tall. Ans. 50000 Cu.Ft\\

\item Calculate the gallons the tank in the preceding problem will contain.\\

$$\\

50,000 \times 7.48 \text { Ans. 374,000 Gallons }\\

$$\\

\item Caiculate the area of a circle with a $10 \mathrm{ft}$ radius.\\

$$\\

D=20 .\\

$$\\

Ans. $314 \mathrm{SqFt}$\\

\item Calculate the area of a circle with a $10 \mathrm{ft}$ diameter. Ans. 78.5 SqFt\\

\item Calculate the volume of a tank with a $50 \mathrm{ft}$ diameter that is 20 feet high.\\

$$\\

\text { Ans. } 250 \text { Cu. Ft }\\

$$\\

\item How many gallons will the tank in the preceding problem hold?\\

\item Calculate the area of a circle with a $100 \mathrm{ft}$ ciameter. Ans. $\frac{293590}{7850}$ Gallons\\

\item Caiculate the volume of a tank zwith a $100 \mathrm{ft}$ diameter that is 50 feet higl,\\

$$\\

\frac{300 \text { gallons }}{1 \text { mute }} \times 6 \mathrm{~mm}\\

$$\\

\item A tank is filling at the rate of $300 \mathrm{gpm}$ for a 20 minute period. How many of water will be contained in the tank at the end of 16 minutes?\\

\item Before pumping, the static water level in a well is 15 feet. During pumping, the water level drops to 45 feet. What is the drawdown?\\

a. 15\\

b. 30\\

c. 45\\

d. 60\\

e. 90\\

\item Over a four year period, the hour meter on a electrical panel at a well site had the following.readings at the end of each year: $1^{\text {sl }}$ year $-976.3,2^{\text {td }}$ year $-1325.8,3^{\text {rd }}$ year -20071 , and $4^{\text {th }}$ year -2371 . 4 . How many hours does the meter show the well ran during the $3^{\text {rd }}$ year?\\

a. $349.5 \mathrm{hrs}$\\

b. 3364.3 his\\

c. $\oint 81.3 \mathrm{hrs}$\\

d. $830.2 \mathrm{hrs}$\\

e. 900.1\\

\item Approximately how many gallons of water can fit into a reservoir that is 35 feet tall and has a 100 foot diameter?\\

a. 2,000,000\\

b. $2.055 \mathrm{MG}$\\

c. $4 \mathrm{MG}$\\

d. 275,000\\

\item Determine the detention time in hours for the following water treatment system:\\

Distribution pipe from water plant to storage tank is $549 \mathrm{ft}$ in length and $14 \mathrm{in}$. in diameter - Storage tank averages 2,310,000 gal of water at any given time. Flow through system is $6.72 \mathrm{mgd}$\\

a. $7.2 \mathrm{hr}$\\

b. $7.4 \mathrm{hr}$\\

c. $8.0 \mathrm{hr}$\\

d. $8.3 \mathrm{hr}$\\

\item If chlorine is being fed at a rate of $260 \mathrm{lb} / \mathrm{day}$ for a flow rate of $23 \mathrm{cfs}$, what should be the adjustment on the chlorinator when the flow rate is decreased to $16 \mathrm{cfs}$, if all other water parameters remain the same?\\

a. $160 \mathrm{lb} / \mathrm{day}$\\

b. $180 \mathrm{lb} / \mathrm{day}$\\

c. $310 \mathrm{lb} /$ day\\

d. $370 \mathrm{lb} /$ day\\

\item How many gallons of a sodium hypochlorite solution that contains $12.1 \%$ available chlorine are needed to disinfect a 1.5 -ft diameter pipeline that is $283 \mathrm{ft}$ long, if the dosage required is $50.0 \mathrm{mg} / \mathrm{L}$ ? Assume the sodium hypochlorite is $9.92 \mathrm{lb} / \mathrm{gal}$.\\

a. 0.87 gal sodium hypochlorite\\

b. 1.0 gal sodium hypochlorite\\

c. 1.3 gal sodium hypochlorite\\

d. 1.5 gal sodium hypochlorite\\

\item A storage tank has a 60.0-ft radius and averages $25.5 \mathrm{ft}$ in water depth. Calculate the average detention time in hours for this storage tank, if flow through the tank averages 2.91 mgd during the month in question.\\

a. $17.5 \mathrm{hr}$\\

b. $17.8 \mathrm{hr}$\\

c. $18.6 \mathrm{hr}$\\

d. $19.8 \mathrm{hr}$ 95. A 24.0-in. pipeline, $427 \mathrm{ft}$ long, was disinfected with calcium hypochlorite tablets with $65.0 \%$ available chlorine. Determine the chlorine dosage in $\mathrm{mg} / \mathrm{L}$, if $7.0 \mathrm{1b}$ of calcium hypochlorite was used.\\

a. $25 \mathrm{mg} / \mathrm{L}$ chlorine\\

b. $39 \mathrm{mg} / \mathrm{L}$ chlorine\\

c. $43 \mathrm{mg} / \mathrm{L}$ chlorine\\

d. $54 \mathrm{mg} / \mathrm{L}$ chlorine\\

\item A well yields 2,840 gallons in exactly 20 minutes. What is the well yield in gpm?\\

a. $140 \mathrm{gpm}$\\

b. $142 \mathrm{gpm}$\\

c. $145 \mathrm{gpm}$\\

d. $150 \mathrm{gpm}$\\

\item What is the area of a circular tank pad in $\mathrm{ft} 2$, if it has a diameter of $102 \mathrm{ft}$ ?\\

a. $6,160 \mathrm{ft} 2$\\

b. $6,167 \mathrm{ft} 2$\\

c. $8,170 \mathrm{ft} 2$\\

d. $8,200 \mathrm{ft} 2$\\

\item What is the pressure at 1.85 feet from the bottom of a water storage tank if the water level is 28.7 feet?\\

a. $11.6 \mathrm{psi}$\\

b. $12.4 \mathrm{psi}$\\

c. $62.0 \mathrm{psi}$\\

d. 66.3 psi\\

\item How many gallons are in a pipe that is 18.0 inches in diameter and 1,165 feet long?\\

a. 2,060 gal\\

b. $10,300 \mathrm{gal}$\\

c. 15,400 gal\\

d. 17,200 gal\\

\item Convert 37.4 degrees Fahrenheit to degrees Celsius.\\

a. $3.0 \mathrm{C}$\\

b. $5.3 \mathrm{C}$\\

c. $7.9 \mathrm{C}$\\

d. $9.7 \mathrm{C}$\\

\item If 288 is $70.3 \%$, how much is $100 \%$ ?\\

a. 410\\

b. 202\\

c. 218\\

d. 438\\

\item If the pressure head on a fire hydrant is $134 \mathrm{ft}$, what is the pressure in psi?\\

a. $50 \mathrm{psi}$\\

b. $52 \mathrm{psi}$\\

c. 54 psi\\

d. $58 \mathrm{psi}$\\

\item A meter indicates the water flow from a fire hydrant is $5.5 \mathrm{ft} 3 / \mathrm{min}$. How many gallons will flow from the hydrant in 20 minutes?\\

a. 820 gal\\

b. $850 \mathrm{gal}$\\

c. $880 \mathrm{gal}$\\

d. 920 gal\\

\item Records for a pump show that on June 1 at exactly 9:00 a.m. the number of pumped gallons was 71,576,344 and on July 1 at exactly 9:00 a.m. it was 72,487,008 gallons. Determine the average gallons pumped per day (gal/day) for this month to the nearest gallon.\\

a. $18,605 \mathrm{gal} / \mathrm{day}$\\

b. $25,875 \mathrm{gal} / \mathrm{day}$\\

c. $30,355 \mathrm{gal} / \mathrm{day}$\\

d. $34,325 \mathrm{gal} / \mathrm{day}$\\

\item How much paint will it take for a single coat of the top and sidewalls of the storage tank that is 100 -feet in diameter and 30 -feet tall, if one gallon of paint covers 200 square feet?\\

a. 86 gallons\\

b. 96 gallons\\

c. 106 gallons\\

d. 116 gallons\\

e. 126 gallons\\

\item Under like conditions, how much more water would an 8-inch pipe carry than a 4-inch pipe?\\

a. 2 times\\

b. 3 times\\

c. 4 times\\

d. not enough information given\\

\item If a lake is 574 feet deep, what is the pressure in pounds per square inch at the bottom of the lake?\\

a. $248 \mathrm{psi}$\\

b. $1326 \mathrm{psi}$\\

c. $69 \mathrm{psi}$\\

d. $62.4 \mathrm{psi}$\\

\item A pressure gauge reading is 80 psi. How many feet of head is this?\\

a. 173 feet\\

b. 185 feet\\

c. 200 feet\\

d. 212 Feet 109. The pump is 150 feet below the reservoir level. What is the pressure reading on the gauge in psi?\\

a. $52 \mathrm{psi}$\\

b. 60 psi\\

c. 65 psi\\

d. $75 \mathrm{psi}$\\

\item A tank is $20^{\prime}$ ' $60^{\prime}$ ' by $15^{\prime}$ deep. What is the volume in gallons?\\

a. 115, 000 gallons\\

b. 128,000 gallons\\

c. 135,000 gallons\\

d. 154,000 gallons\\

\item A tank is 60 ' in diameter and 22' high. How many gallons will it hold?\\

a. 465,000 gallons\\

b. 528,000 gallons\\

c. 640,000 gallons\\

d. 710,000 gallons\\

\item A dosage of $2.4 \mathrm{mg} / \mathrm{l}$ of chlorine gas is added to $3.8 \mathrm{mgd}$. How many pounds per day of chlorine are needed?\\

a. $68 \mathrm{lbs} /$ day\\

b. $76 \mathrm{lbs} / \mathrm{day}$\\

c. $82 \mathrm{lbs} /$ day\\

d. $88 \mathrm{lbs} /$ day\\

\item How many gallons are in a 6" pipe 950 feet long?\\

a. 1108 gallons\\

b. 1253 gallons\\

c. 1308 gallons\\

d. 1395 gallons\\

\item A 12 " pipe is carrying water at a velocity of $5.8 \mathrm{fps}$. What is the flow?\\

a. $4.55 \mathrm{cfs}$\\

b. $5.36 \mathrm{cfs}$\\

c. $5.67 \mathrm{cfs}$\\

d. $6.04 \mathrm{cfs}$\\

\item The pressure at the top of the hill is 62 psi. The pressure at the bottom of the hill, 60 feet below, is $100 \mathrm{psi}$. The water is flowing uphill at $120 \mathrm{gpm}$. What is the friction loss, in feet, in the pipe?\\

a. 24.6 feet\\

b. 27.8 feet\\

c. 31.2 feet\\

d. 33.8 feet 116. A tank is 82 ' in diameter and 31 feet high. The flow is $1600 \mathrm{gpm}$. What is the detention time in hours?\\

a. 12.75 hours\\

b. 14.80 hours\\

c. 16.00 hours\\

d. 18.25 hours\\

\item A tank is $120^{\prime}$ x $50^{\prime}$ ' $14^{\prime}$ 'deep. The flow is $2.8 \mathrm{mgd}$. What is the detention time in hours?\\

a. 3.8 hours\\

b. 4.4 hours\\

c. 5.3 hours\\

d. 6.2 hours\\

\item A 16" pipe is 1250 feet long. How much $65 \%$ HTH is needed to dose it with $50 \mathrm{mg} / \mathrm{l}$ of chlorine?\\

a. $6.50 \mathrm{lbs}$\\

b. $7.25 \mathrm{lbs}$\\

c. $7.96 \mathrm{lbs}$\\

d. $8.34 \mathrm{lbs}$\\

\item A solution of hydrofluosilisic acid is $22 \%$ fluoride. If $750 \mathrm{ppb}$ are added to 5,600,000 gallons/day, how many $\mathrm{ml} / \mathrm{min}$ should the pump be feeding?\\

a. $26 \mathrm{ml} / \mathrm{min}$\\

b. $35 \mathrm{ml} / \mathrm{min}$\\

c. $42 \mathrm{ml} / \mathrm{min}$\\

d. $50 \mathrm{ml} / \mathrm{min}$\\

\item A bleach system feeds $12 \%$ bleach. The dosage is $1.4 \mathrm{mg} / \mathrm{l}$ for $8.2 \mathrm{mgd}$. How many $\mathrm{ml} / \mathrm{min}$ should the pump feed?\\

a. $200 \mathrm{ml} / \mathrm{min}$\\

b. $250 \mathrm{ml} / \mathrm{min}$\\

c. $300 \mathrm{ml} / \mathrm{min}$\\

d. $350 \mathrm{ml} / \mathrm{min}$\\

\item Pump Data:\\

\item Feet - Positive Suction Head\\

158 Feet - Discharge Head\\

26 Feet - Friction Loss\\

1200 gpm - Flow\\

Motor Efficiency - 86\%\\

Pump Efficiency - 78\%\\

What is the motor horsepower?\\

a. $60 \mathrm{MHp}$\\

b. $65 \mathrm{MHp}$\\

c. $70 \mathrm{MHp}$\\

d. $75 \mathrm{MHp}$\\

\item Pump Data:\\

20 Feet - Positive Suction Head\\

185 Feet - Discharge Head\\

18 Feet - Friction Loss\\

$300 \mathrm{gpm}$ - Flow\\

Motor Efficiency - 90\%\\

Pump Efficiency - 80\%\\

$\mathrm{Kw}$-Hour Cost $=0.11 / \mathrm{Kw}-\mathrm{Hr}$\\

Average Run Time - 6 Hours/day\\

What is the cost to run the pump for 30 days?\\

a. $\$ 245.08$\\

b. $\$ 284.34$\\

c. $\$ 410.50$\\

d. $\$ 463.82$\\

\item Determine the drawdown from a well measuring a static water level of 120 feet and a pumping water level of 205 feet?\\

a. $105 \mathrm{ft}$\\

b. 320 feet\\

c. 85 feet\\

d. 310 feet\\

\item Before pumping, the static water level in a well is 15 feet. During pumping, the water level drops to 45 feet. What is the drawdown?\\

a. $15 \mathrm{ft}$\\

b. $30 \mathrm{ft}$\\

c. $45 \mathrm{ft}$\\

d. $60 \mathrm{ft}$\\

e. $90 \mathrm{ft}$\\

\item What is the chlorine demand of a tank that is dosed at $3.5 \mathrm{ppm}$ and has a residual of 1.25 ppm.\\

a. 2.25\\

b. 4.75\\

c. 1.25\\

d. 3.5\\

e. not enough information\\

\item What $1 \mathrm{~s}$ the area of a trench that is $22.4 \mathrm{ft}$ Jong and 3.3 feet wide?\\

a. 26 sq.ft\\

b. 74 sq. ft.\\

c. 143 sq. $\mathrm{ft}$\\

d. 187 sq. ft. 127. What is the pounds per square inch pressure at the bottom ofa tank if the water level is 38.29 feet?\\

a. $7.3 \mathrm{psi}$\\

b. $16.6 \mathrm{psi}$\\

c. $53.9 \mathrm{psi}$\\

d. $88.4 \mathrm{psi}$\\

\item What is the pressure head on a system exerting a static pressm.e of 62 psi?\\

a. $27 \mathrm{ft}$\\

b. $89 \mathrm{ft}$\\

c. $143 \mathrm{ft}$\\

d. $175 \mathrm{ft}$\\

\item How many gallons are in a pipe that is 18 " in diameterand 216 feet long?\\

a.1908 gallons\\

b. 2246 gallons\\

c. 2430 gallons\\

d. 2861 gallons\\

\item How many pounds of chlorine are required to u.eat $8.65 \mathrm{mgd}$ if the dosage is $2.75 \mathrm{ppm}$ ?\\

a. $11 \mathrm{lb} /$ day\\

b. $24 \mathrm{lb} / \mathrm{day}$\\

c. $72 \mathrm{lb} /$ day\\

d. $198 \mathrm{lb} /$ day\\

\item What should the setting be on a chlorinator in pounds per day if the dosage desired is 2.9 $\mathrm{mg} / \mathrm{l}$ and the pumping rate from the well is $975 \mathrm{gpm}$ ?\\

a. $29 \mathrm{lb} /$ day\\

b. $34 \mathrm{lb} / \mathrm{day}$\\

c. $41 \mathrm{lb} /$ day\\

d. $336 \mathrm{lb} / \mathrm{day}$\\

\item What is the chlorine residual in a system that bas a chlorine dosage of $2.75 \mathrm{mg} / 1 \mathrm{and} \mathrm{a}$ chlorine demand of $1.93 \mathrm{mg} ! 1$ ?\\

a. $0.82 \mathrm{mg} / \mathrm{l}$\\

b. $1.75 \mathrm{mg} / \mathrm{l}$\\

c. $4.67 \mathrm{mg} / \mathrm{l}$\\

d. $5.31 \mathrm{mg} / \mathrm{l}$\\

\item How many pounds per day of chlorine are needed to treat $38.75 \mathrm{mgd}$ if the residual is 2.0 $\mathrm{mg} / 1$ and the demand is $1.5 \mathrm{mg} / \mathrm{l}$ ?\\

a. $42 \mathrm{lb} /$ day\\

b. $136 \mathrm{lb} / \mathrm{day}$\\

c. $323 \mathrm{lb} / \mathrm{day}$\\

d. $1131 \mathrm{lb} / \mathrm{day}$ 134. A pump discharges 680 gpm, How many gallons will it discharge in 8 hours?\\

a. 5440 gallons.\\

b. 130560 gallons\\

c. 1 ac-ft\\

d. 408000 gallons.\\

\item How many gallons are contained in 2167 cu.ft?\\

a. 260 gallons\\

b. 295 gallons\\

c. 16253 gallons\\

d. 18070 gallons\\

\item What is the typical strength of calcium hypochlorite, i.e., available chlorine range?\\

a. 5 to $10 \%$\\

b. 45 to $50 \%$\\

c. 65 to $70 \%$\\

d. 80 to $85 \%$\\

\item A four log removal is\\

a. $90.00 \%$\\

b. $99.00 \%$\\

c. $99.90 \%$\\

d. $99.99 \%$\\

\item A circular clearwell is 150 feet in diameter and 40 feet tall. The Clearwell has an overflow at 35 feet. What is the maximum amount of water the clearwell can hold in Million gallons rounded to the nearest hundredth?\\

a. $0.92 \mathrm{MG}$\\

b. $4.62 \mathrm{MG}$\\

c. $18.50 \mathrm{MG}$\\

d. 7.50 MG\\

\item A sedimentation basin is 400 feet length, 50 feet in width, and 15 feet deep. What is the volume expressed in cubic feet?\\

a. $100,000 \mathrm{ft}^{3}$\\

b. $200,000 \mathrm{ft}^{3}$\\

c. $300,000 \mathrm{ft}^{3}$\\

d. $400,000 \mathrm{ft}^{3}$\\

\item A clearwell holds $314,000 \mathrm{ft}^{3}$ of water. It is $100 \mathrm{ft}$ in diameter. What is the height of the clearwell?\\

a. $25 \mathrm{ft}$\\

b. $30 \mathrm{ft}$\\

c. $35 \mathrm{ft}$\\

d. $40 \mathrm{ft}$\\

\item A treatment plant operator must fill a clearwell with $10,000 \mathrm{ft} 3$ of water in 90 minutes. What is the rate of flow expressed in GPM?\\

a. 111 GPM\\

b. 831 GPM\\

c. 181 GPM\\

d. 900 GPM\\

\item A water tank has a capacity of 6MG. It is currently half full. It will take 6 hours to fill. What is the flow rate of the pump?\\

a. 3,333 GPM\\

b. 6,333 GPM\\

c. 8,333 GPM\\

d. 16,666 GPM\\

\item A clearwell with the capacity of $2.5 \mathrm{MG}$ is being filled after a maintenance period. The flow rate is 2,500 GPM. The operator begins filling at 7 AM. At what time will the clearwell be full?\\

a. 10:00 PM\\

b. 10:40 PM\\

c. 11:00 PM\\

d. 11:40 PM\\

\item There are four filters at a water treatment plant. The filters measure 20 feet wide by 30 feet in length. What is the filtration rate if the plant processes 8.0 MGD?\\

a. $1.51 \mathrm{GPM} / \mathrm{sq} . \mathrm{ft}$.\\

b. $2.31 \mathrm{GPM} / \mathrm{sq} . \mathrm{ft}$.\\

c. $2.61 \mathrm{GPM} / \mathrm{sq} . \mathrm{ft}$.\\

d. $2.91 \mathrm{GPM} / \mathrm{sq} . \mathrm{ft}$.\\

\item A water treatment plant treats 6.0 MGD with four filters. The filters use 60,000 gallons per wash. What is the percent backwash at the plant?\\

a. $10 \%$\\

b. $8 \%$\\

c. $6 \%$\\

d. $4 \%$\\

\item A treatment plant filter washes at a rate of $10,000 \mathrm{GPM}$. The filter measures $18 \mathrm{ft}$. wide by $24 \mathrm{ft}$. long. What is the rate of rise expressed in inches per minute?\\

a. $17 \mathrm{inch} / \mathrm{min}$\\

b. $27 \mathrm{inch} / \mathrm{min}$\\

c. $37 \mathrm{inch} / \mathrm{min}$\\

d. $47 \mathrm{inch} / \mathrm{min}$\\

\end{enumerate}

\end{document}