Subject: Public Health Engineering (17503)
Chapter No. 1: PUBLIC WATER SUPPLY (48 MARKS)

Que.1 What do you meant by demand of water.
Ans: Rate of water supplied per head per day is known as water demand. It is expressed as, liters/person/day or liter/capita/day.
Rate of demand = \( \frac{Q}{(P \times 365)} \)
Where, \( Q \) = quantity of water required per years in liters
\( P \) = Estimated population to be served.

Que.2 What are the various types of demands? Give their percentage in terms of total demand. State four factors affect water demand.
Ans: The various types of water demands, which a city may have, may be broken into following classes:

<table>
<thead>
<tr>
<th>Types of Consumption</th>
<th>Normal Range (lit/capita/day)</th>
<th>Average</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Consumption</td>
<td>65-300</td>
<td>160</td>
<td>35</td>
</tr>
<tr>
<td>Industrial and Commercial Demand</td>
<td>45-450</td>
<td>135</td>
<td>30</td>
</tr>
<tr>
<td>Public Uses including Fire Demand</td>
<td>20-90</td>
<td>45</td>
<td>10</td>
</tr>
</tbody>
</table>

Factors affecting the Water Demand
1. Climate
2. Season (summer or winter)
3. Economic level
4. Population density
5. Degree of industrialization
6. Industrial potential
7. Proximity of resources
8. Transportation
9. Potential markets
10. Neighboring municipalities
Que.3 What is meant by design period? Give common design periods adopted for any four components of water supply scheme. What are factors affecting water demand. S09, S11

Ans: **Design Periods**

This quantity should be worked out with due provision for the estimated requirements of the future. The future period for which a provision is made in the water supply scheme is known as the design period.

Design period is estimated based on the following:

- Useful life of the component, considering obsolescence, wear, tear, etc.
- Expandability aspect.
- Anticipated rate of growth of population, including industrial, commercial developments & migration-immigration.
- Available resources.
- Performance of the system during initial period.

Que.4 Common design periods adopted for any four components of water supply scheme:

Ans:

1. Pipes:
2. Pumps and Machinery:
3. Valves:
4. Reservoir
5. 
6. 

[Sanjay Ghodawat Polytechnic, Atigre]
Que.5  State any four methods of population forecasting? W10
Ans:  Population Forecasting Methods
The various methods adopted for estimating future populations are given below. The particular method to be adopted for a particular case or for a particular city depends largely on the factors discussed in the methods, and the selection is left to the discretion and intelligence of the designer.

1. Arithmetic Increase Method
2. Geometric Increase Method
3. Incremental Increase Method
4. Decreasing Rate of Growth Method
5. Simple Graphical Method
6. Comparative Graphical Method
7. Ratio Method
8. Logistic Curve Method

Que.6  Classify the sources of water and explain any one. W11
Ans:  The various sources of water can be classified into two categories:
1. Surface sources, such as
   a. Ponds and lakes;
   b. Streams and rivers;
   c. Storage reservoirs; and.
   d. Oceans, generally not used for water supplies, at present.
2. Sub-surface sources or underground sources, such as
   a. Springs;
   b. Infiltration wells; and
   c. Wells and Tube-wells.
Natural Sources
Rain, snow, hail and sleet are precipitated upon the surface of the earth as meteorological water and may be considered as the original source of all the water supplied. Water, as source of drinking water, occurs as surface water and ground water. Three aspects should be considered in appraising water resources e.g., the quantity, the quality, and the reliability of available water.

Surface source
Surface water accumulates mainly as a result of direct runoff from precipitation (rain or snow). Precipitation that does not enter the ground through infiltration or is not returned to the atmosphere by evaporation, flows over the ground surface and is classified as direct runoff.
Direct runoff is water that drains from saturated or impermeable surfaces, into stream channels, and then into natural or artificial storage sites (or into the ocean in coastal areas).
The amount of available surface water depends largely upon rainfall. When rainfall is limited, the supply of surface water will vary considerably between wet and dry years.
Surface water supplies may be further divided into river, lake, and reservoir supplies. Dams are constructed to create artificial storage. Canals or open channels can be constructed to convey surface water to the project sites. The water is also conveyed through pipes by gravity or pumping.
In general, the surface sources are characterized by soft water, turbidity, suspended solids, some colour and microbial contamination.
Que. 7 Enlist different types of intakes. Explain river intake with sketch? S09

Ans: Intake Structure

The basic function of the intake structure is to help in safely withdrawing water from the source over predetermined pool levels and then to discharge this water into the withdrawal conduit (normally called intake conduit), through which it flows up to water treatment plant.

A) INTAKES ON RIVERS WITH HIGH WATER LEVEL FLUCTUATION:

B) INTAKES ON TIDAL RIVER:

C) INTAKES IN MOUNTAINOUS STREAMS:

D) OFFSHORE INTAKES:

INTAKES ON RIVERS WITH HIGH WATER LEVEL FLUCTUATION:

This type of river can be found in regions where rainfall and runoff occur in a short duration during the year such as the monsoon season. Designing a conventional intake in this type of environment may not be technically or economically feasible. To overcome this condition, an intake structure was designed as a super structure with an access pier connecting the intake to the shoreline as shown on Figure. This structure was also used in a lake with large water level variation and can be used in a coastal area where an offshore intake with a buried pipe is not practical.

Fish protection is accomplished by installing wedge wire screens with air back wash systems. The design of the intake caisson and the supporting piles for the pier must be based on geologic and geotechnical considerations.
**Figure** Hydraulik design of a river water intake with high water level fluctuations

**Que.8** What is the need for protected water supply?

**Ans:** The pressure of increasing population, growth of industries, urbanization, energy intensive life style, loss of forest cover, lack of environmental awareness, lack of implementation of environmental rules and regulations and environment improvement plans, untreated effluent discharge from industries and municipalities, use of non-biodegradable pesticides/fungicides/ herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc are causing water pollution. The pollutants from industrial discharge and sewage besides finding their way to surface water reservoirs and rivers are also percolating into ground to pollute ground water sources. The polluted water may have undesirable colour, odour, taste, turbidity, organic matter contents, harmful chemical contents,
toxic and heavy metals, pesticides, oily matters, industrial waste products, radioactivity, high Total Dissolved Solids (TDS), acids, alkalies, domestic sewage content, virus, bacteria, protozoa, rotifers, worms, etc. The organic content may be biodegradable or non-biodegradable. Pollution of surface waters (rivers, lakes, ponds), ground waters, sea water are all harmful for human and animal health. Pollution of the drinking water and that of food chain is by far the most worry-some aspect.

In order to avoid ill effects of water pollution on the human and animal health and agriculture, standards/rules/guidelines have been devised for discharge of effluents from industries and municipalities, quality of drinking water, irrigation water, criteria for aquatic life in fresh water by various authorities including central pollution control board (India).

Que.9 Write any two objects of water analysis.
Ans: The available raw waters must be treated and purified before they can be supplied to the public for their domestic, industrial or any other uses. The extent of treatment required to be given to the particular water depends upon the characteristics and quality of the available water, and also upon the quality requirements for the intended use.

Objects of analysis of water:
1. Water analysis is done to determine the different impurities in water.
2. Depending on the type of impurities, the treatment of raw water is decided.
3. To find out the organisms responsible for developing certain effect on water wrt color, odor, test etc.
**Que.10** List any four physical and chemical test on water and give their permissible limits.

**Ans:** Indian Standards for drinking water

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Desirable-Tolerable</th>
<th>If no alternative source available, limit extended upto</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbidity (NTU CLASS)</td>
<td>&lt; 10</td>
<td>25</td>
</tr>
<tr>
<td>Colour (Hazen scale)</td>
<td>&lt; 10</td>
<td>50</td>
</tr>
<tr>
<td>Taste and Odour</td>
<td>Unobjectionable</td>
<td>Un-objectionable</td>
</tr>
<tr>
<td><strong>Chemical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.0-8.5</td>
<td>6.5-9.2</td>
</tr>
<tr>
<td>Total Dissolved Solids mg/l</td>
<td>500-1500</td>
<td>3000</td>
</tr>
<tr>
<td>Total Hardness mg/l (as CaCO₃)</td>
<td>200-300</td>
<td>600</td>
</tr>
<tr>
<td>Chlorides mg/l (as Cl)</td>
<td>200-250</td>
<td>1000</td>
</tr>
<tr>
<td>Sulphates mg/l (as SO₄)</td>
<td>150-200</td>
<td>400</td>
</tr>
<tr>
<td>Fluorides mg/l (as F)</td>
<td>0.6-1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Nitrates mg/l (as NO₃)</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Calcium mg/l (as Ca)</td>
<td>75</td>
<td>200</td>
</tr>
<tr>
<td>Iron mg/l (as Fe )</td>
<td>0.1-0.3</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Que.11 Explain the characteristics of drinking water in brief. S09

Ans: For the purpose of classification, the impurities present in water may be divided into the following three categories:

1. Physical Impurities
2. Chemical impurities
3. Bacteriological impurities

Physical Characteristics of water
1. Temperature
2. Turbidity
3. Colour
4. Taste and Odour

Chemical Characteristics of water
1. pH
2. Acidity
3. Alkalinity
4. Hardness
5. Chlorides
6. Sulphates
7. Iron
8. Solids
9. Nitrates

Bacteriological Characteristics:
1. Standard Plate Count Test
2. Most Probable Number
3. Membrane Filter Technique
Que.12 How can aeration improve water quality? What methods are available to aerate water. W09,

Ans: Aeration

- Aeration removes odour and tastes due to volatile gases like hydrogen sulphide and due to algae and related organisms.

- Aeration also oxidise iron and manganese, increases dissolved oxygen content in water, removes CO2 and reduces corrosion and removes methane and other flammable gases.

- Principle of treatment underlines on the fact that volatile gases in water escape into atmosphere from the air-water interface and atmospheric oxygen takes their place in water, provided the water body can expose itself over a vast surface to the atmosphere. This process continues until an equilibrium is reached depending on the partial pressure of each specific gas in the atmosphere.

**Types of Aerators**

1. Gravity aerators
2. Fountain aerators
3. Diffused aerators
4. Mechanical aerators.

Que.13 Draw neat sketch of conventional water treatment plant showing different treatments? W10,

Ans: The layout of conventional water treatment plant is as follows:

![Conventional Water Treatment Plant Diagram]
Que. 14 What are the different layouts for water distribution systems? Explain any one with sketch?

Ans: Layouts of Distribution Network

The distribution pipes are generally laid below the road pavements, and as such their layouts generally follow the layouts of roads. There are, in general, four different types of pipe networks; any one of which either singly or in combinations, can be used for a particular place.

They are:
- Dead End System
- Grid Iron System
- Ring System
- Radial System

Que. 15 Differentiate between gravity and pumping distribution system.

Ans:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Gravity System</th>
<th>Pumping System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In this system water flows under gravitational force.</td>
<td>In this system water is pumped in the distribution mains for supply of distribution area.</td>
</tr>
<tr>
<td>2</td>
<td>It is suitable when source is at a higher level than distribution level.</td>
<td>This system is used when gravity flow is not possible.</td>
</tr>
<tr>
<td>3</td>
<td>Simple and economical.</td>
<td>Not economical</td>
</tr>
<tr>
<td>4</td>
<td>It is reliable system.</td>
<td>It is not reliable system</td>
</tr>
</tbody>
</table>
Que.16 Write advantages of gravity system over pumping system. Compare Grid iron with Dead end system of distribution.

Ans: Advantages of Gravity system over pumping system:
1. In this system water flows under gravitational force.
2. It is suitable when source is at a higher level than distribution level.
3. Simple and economical.
4. It is reliable system.

Dead end System:
In this system as shown in fig, main pipe is laid along main road and submains, branches, minor distributaries are laid along the other roads and streets connecting main road. This system is also known as tree system.

Suitability: Dead end system is used in town or in cities which are not well planned.

Advantages of Dead end system:
1. Cheap in initial cost.
2. Easy determination of pipe sizes.
3. Laying of pipes is simple.
4. Less number of valves are required.

Disadvantages:
1. Due to stagnation, water gets polluted.
2. In case of repairs the whole locality beyond that point is affected.
3. This system cannot meet fire demand.

| Dead end System | Grid Iron System |
**Grid Iron System:** A main pipe is laid along main roads and submains, branches are laid along inner road and interconnect so that water remains in circulations and there are no dead ends. This is also known as the interlaced system or reticulation system.

**Suitability:** Grid iron system is suitable for well planned cities, where the roads are at right angle to each other.

**Que.17 State any four differences between Dead end system and Grid iron system of distribution of water.**

<table>
<thead>
<tr>
<th>Dead end System</th>
<th>Grid Iron System</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this system as shown in fig, main pipe is laid along main road and submains, branches, minor distributaries are laid along the other roads and streets connecting main road. This system is also known as tree system.</td>
<td>A main pipe is laid along main roads and submains, branches are laid along inner road and interconnect so that water remains in circulations and there are no dead ends. This is also known as the interlaced system or reticulation system.</td>
</tr>
<tr>
<td>Dead end system is used in town or in cities which are not well planned.</td>
<td>Grid iron system is suitable for well planned cities, where the roads are at right angle to each other.</td>
</tr>
<tr>
<td>Cheap in initial cost.</td>
<td>Costly in initial cost.</td>
</tr>
<tr>
<td>Due to stagnation, water gets polluted.</td>
<td>Water is not get polluted.</td>
</tr>
<tr>
<td>In case of repairs the whole locality beyond that point is affected.</td>
<td>In case of repairs the whole locality beyond that point is not affected.</td>
</tr>
<tr>
<td>This system cannot meet fire demand.</td>
<td>This system meet fire demand.</td>
</tr>
</tbody>
</table>
Que.18 What is disinfection of water? List any four methods of disinfection. List any two disinfectants.

Ans: Disinfection

The filtered water may normally contain some harmful disease producing bacteria in it. These bacteria must be killed in order to make the water safe for drinking. The process of killing these bacteria is known as Disinfection or Sterilization.

Methods of Disinfection

1. Boiling: The bacteria present in water can be destroyed by boiling it for a long time. However it is not practically possible to boil huge amounts of water. Moreover it cannot take care of future possible contaminations.

2. Treatment with Excess Lime: Lime is used in water treatment plant for softening. But if excess lime is added to the water, it can in addition, kill the bacteria also. Lime when added raises the pH value of water making it extremely alkaline. This extreme alkalinity has been found detrimental to the survival of bacteria. This method needs the removal of excess lime from the water before it can be supplied to the general public. Treatment like recarbonation for lime removal should be used after disinfection.

3. Treatment with Ozone: Ozone readily breaks down into normal oxygen, and releases nascent oxygen. The nascent oxygen is a powerful oxidising agent and removes the organic matter as well as the bacteria from the water.

4. Chlorination: The germicidal action of chlorine is explained by the recent theory of Enzymatic hypothesis, according to which the chlorine enters the cell walls of bacteria and kill the enzymes which are essential for the metabolic processes of living organisms.
Que.19  Enlist different forms of chlorination. Explain the break point chlorination with graph.

**Ans:** Depending upon the stage of treatment at which chlorine is added, forms of chlorine are:

<table>
<thead>
<tr>
<th>1. Plain Chlorination</th>
<th>2. Pre chlorination</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Post chlorination</td>
<td>4. Double chlorination</td>
</tr>
<tr>
<td>5. Break point chlorination</td>
<td>6. Super chlorination</td>
</tr>
<tr>
<td>7. Dechlorination.</td>
<td></td>
</tr>
</tbody>
</table>

**Break Point Chlorination:**

Break point chlorination represent the dosage beyond which any further addition of chlorine will appear as free residual chlorine.

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**Free Chlorine, Chloramine, and Ammonia Nitrogen Reactions**

Chlorine which is added to water perform the following two functions:

1. To remove bacteria from water and
2. To oxidize the organic matter present in water.

Figure represents the main features and process involved in Break point. When chlorine is added to water, it first react with ammonia present therein to form chloramines with increase in the addition of cl2, the residual chlorine is also increase. The slight reduction in the residual chlorine after successive addition is due to fact that some chlorine is used for killing the organisms.
Addition of chlorine beyond the point B results in rapid oxidation of organisms and residual chlorine content decreases drastically. This stage is sometimes accompanied by bad smell. When chlorine is added beyond point C, it will equally appear as free chlorine, thus when point C is reached bad smell and taste suddenly disappear. Thus point C on the curve is known as the break point as any chlorine added in the water beyond this point breaks through water and appears as residual chlorine.

Que.20 Explain principle behind sedimentation with coagulation.

Ans: Principle:

Sedimentation is a treatment process in which the velocity of the water is lowered below the suspension velocity and the suspended particles settle out of the water due to gravity. The process is also known as settling or clarification.

Most water treatment plants include sedimentation in their treatment processes. However, sedimentation may not be necessary in low turbidity water of less than 10 NTU. In this case, coagulation and flocculation are used to produce pinpoint (very small) floc which is removed from the water in the filters.

Thus, reducing the velocity of water to cause the settlement of suspended solids by gravity is the principle of sedimentation.

Processes involve are:

1. **Floc formation:** When coagulants are added to water, an insoluble gelatinous precipitate is formed. This precipitate is known as the floc. Floc has the property of arresting the suspended impurities in water during its downward travel towards the bottom of tank.

2. **Electric charges:** The floc positively charged and arrests negatively charged clay particles and thus they cause the removal of such particles from water.
Que.21  Describe process of coagulation. What is purpose of jar test. Describe procedure. W09, or Explain jar test to determine approximate dose of coagulant dose with help of fig.

Ans:  **Definition & Purpose:**

The process of mixing certain chemicals to water to neutralize the electrical charges and to form an insoluble, gelatinous flocculent precipitate for absorbing and entraining suspended and colloidal particles of the impurities is called as coagulation.

**Jar Test:** The jar test is a common laboratory procedure used to determine the optimum operating conditions for water or wastewater treatment. This method allows adjustments in pH, variations in coagulant or polymer dose, alternating mixing speeds, or testing of different coagulant or polymer types, on a small scale in order to predict the functioning of a large scale treatment operation.

**Jar Testing Apparatus:** The jar testing apparatus consists of six paddles which stir the contents of six 1 liter containers. One container acts as a control while the operating conditions can be varied among the remaining five containers. A rpm gage at the top-center of the device allows for the uniform control of the mixing speed in all of the containers.

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![Jar Testing Apparatus Diagram](image-url)
Jar Test Procedure: The jar test procedures involve the following steps: Fill the jar testing apparatus containers with sample water. One container will be used as a control while the other 5 containers can be adjusted depending on what conditions are being tested. For example, the pH of the jars can be adjusted or variations of coagulant dosages can be added to determine optimum operating conditions.

- Add the coagulant to each container and stir at approximately 100 rpm for 1 minute. The rapid mix stage helps to disperse the coagulant throughout each container.
- Turn off the mixers and allow the containers to settle for 30 to 45 minutes. Then measure the final turbidity in each container.
- Reduce the stirring speed to 25 to 35 rpm and continue mixing for 15 to 20 minutes. This slower mixing speed helps promote floc formation by enhancing particle collisions which lead to larger flocs.

Residual turbidity vs. coagulant dose is then plotted and optimal conditions are determined. The values that are obtained through the experiment are correlated and adjusted in order to account for the actual treatment system.

Que.22 State principle of sedimentation and two important factors affecting design of sedimentation tank.

Ans: Sedimentation is a treatment process in which the velocity of the water is lowered below the suspension velocity and the suspended particles settle out of the water due to gravity. The process is also known as settling or clarification.

Factors affecting the design of sedimentation tank:
1. Detention time.
2. Viscosity of water.
3. Velocity of flow water.
4. Size, shape and specific gravity of water.
Que.23 State any four object of aeration?

Ans: **Aeration**

Aeration removes odour and tastes due to volatile gases like hydrogen sulphide and due to algae and related organisms. Aeration also oxidise iron and manganese, increases dissolved oxygen content in water, removes CO2 and reduces corrosion and removes methane and other flammable gases. Principle of treatment underlines on the fact that volatile gases in water escape into atmosphere from the air-water interface and atmospheric oxygen takes their place in water, provided the water body can expose itself over a vast surface to the atmosphere. This process continues until an equilibrium is reached depending on the partial pressure of each specific gas in the atmosphere.

Que.24 Make a comparison between Rapid and slow sand filter.

Ans: **Slow Sand Filters vs. Rapid Sand Filters**

- **Base material:** In SSF it varies from 3 to 65 mm in size and 30 to 75 cm in depth while in RSF it varies from 3 to 40 mm in size and its depth is slightly more, i.e. about 60 to 90 cm.

- **Filter sand:** In SSF the effective size ranges between 0.2 to 0.4 mm and uniformity coefficient between 1.8 to 2.5 or 3.0. In RSF the effective size ranges between 0.35 to 0.55 and uniformity coefficient between 1.2 to 1.8.

- **Rate of filtration:** In SSF it is small, such as 100 to 200 L/h/sq.m. of filter area while in RSF it is large, such as 3000 to 6000 L/h/sq.m. of filter area.

- **Flexibility:** SSF are not flexible for meeting variation in demand whereas RSF are quite flexible for meeting reasonable variations in demand.
• **Post treatment required:** Almost pure water is obtained from SSF. However, water may be disinfected slightly to make it completely safe. Disinfection is a must after RSF.

• **Method of cleaning:** Scrapping and removing of the top 1.5 to 3 cm thick layer is done to clean SSF. To clean RSF, sand is agitated and backwashed with or without compressed air.

• **Loss of head:** In case of SSF approx. 10 cm is the initial loss, and 0.8 to 1.2m is the final limit when cleaning is required. For RSF 0.3m is the initial loss, and 2.5 to 3.5m is the final limit when cleaning is required.

Que.25  **Explain in brief working of rapid sand filter with neat sketch.**

Ans: The working of filter is started by operating the inlet valve, which allows water to admit in filter bed. This water passes through the filter bed. Treated water goes out of filter by operating the outlet valve. Following valves are used for working and cleaning of filter:
1. When the filtered water quality of water is deteriorating.
2. Terminal head loss is equal to permissible value.

Que.26  **Enlist the fixtures used in the water supply for residential building?**

Ans: Following are the various fixtures used in the water supply for residential building:

1. Elbow  
2. Tees  
3. Crosses  
4. Reducer  
5. Plug  
6. Union  
7. Sockets  
8. Double nipple  
9. Barrel nipple  
10. Stop cock  
11. Service pipe  
12. Water meter  
13. Sluice valve  
14. Pressure relief valve  
15. reflux valve  
16. Air relief valve  
17. Scour valve  
18. Globe valve
Que.27 Enlist any four types of valves provided in water supply scheme. Give their location & functions in pipe.

Ans: Types of valves:
1. Air valve
2. Reflux Valve
3. Relief valve
4. Scour valve.

1. **Air Valve:**

   **Uses:**
   Some quantity of air is contained in the flowing water. This air tries to accumulate at high point along water pipe. Thus there are chances for pipes to be air locked. To prevent this air valves are provided.

   **Location:**
   1. In order to provide an exit for such accumulated air, the air valves are provided at summits along the water pipe.
   2. The air valves should be located at points which are closed to or above the hydraulic gradient.

2. **Reflux Valve:**

   **Location:**
   The reflux valve is invariably placed in water pipe which obtains water directly from pump.

   **Function:**
   When pump fails or stop. The water will not run back to the pump and thus pumping equipment will be saved from damage.

Que.28 List different types of pipes used in water distribution system. State advantages and disadvantages of pipe mostly used.

Ans: Types of pipes mostly used in water distribution system are:
1. Asbestos
2. Cast iron
3. Steel
4. RCC
5. Pre-stressed
6. Wrought iron
7. Copper
8. Lead
9. Plastic pipes
10. Wooden pipes
Advantages and disadvantages of mostly used pipes:

Cast iron pipes:

Advantages:
1. The cost is moderate.
2. The pipes are not subjected to corrosion.
3. The pipes are strong and durable.
4. The pipes are easy to joint.
5. The usual life of pipes under normal condition is about 100 years.

Disadvantages:
1. The breakage of this pipes are large.
2. The carrying capacity of these pipes decreases with the increase in life of pipe.

Que.29 Draw neat sketch of pressure relief valve?
Que.30 Explain Zeolite process of water softening?
Ans: Zeolite process of water softening:
This process is also known as ion exchange process. Ion exchange is displacement of one ion by another. In the process of softening the Ca and Mg from solution is removed on ion exchange material used. The ion exchange material may be zeolite or synthetic resins. These are cation exchange materials. The solution from these enters into the water and Ca and Mg from water enters into these materials. After the exhaustion capacity of these materials, these can be regenerated by addition of sodium chloride solution. Thus, the resins or zeolite again will be put in operation.

Advantages:
1. Sludge is not formed. There is no problem of sludge disposal.
2. No need of skill supervision as well as operation is easy.
3. This process of reduces the hardness of water to zero.
4. We can prepare water of desire hardness by adding softening water of zero hardness to raw water.
5. The process proves economical where salt is cheaply available.

Disadvantages:
1. Process can not be used for high turbid water.
2. This process is not suitable for water containing iron and manganese. Care must be taken in operation of this unit to avoid damage to instrument and quality of water.
For Details contact:

Mr. V.S. kumbhar

HOD

Civil Department,
Sanjay Ghodawat Polytechnic, Atigre.

Mob. No.: 7798306363
Ph. No.: 0230 -246312
Email ID: vikas.kumbhar@sgplytechnic.in