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EE & DM
C.S.E / 7th sem
18EREECS016
I st Mid term Paper.

Sec - C

Q.3 What is filtration ? Describe the working and ~~principle~~ principle of rapid sand filter in details with neat sketch.

Ans The process of filtration forms the most important stage in the purification of water.

It usually consists in allowing water to pass through a thick layer of Sand.

~~During the~~

Rapid Sand filter. :-

→ Operation of rapid sand filter is same as that of slow sand filter.
→ At the time of operation valve 1 and 4 remains open and 2, 3, 5, & 6 remain close
→ In Case of rapid sand filter, size of sand particles are large hence impurities can penetration deep inside the sand layer thus

Surface washing alone will not be effective.
In this case we go for back washing.

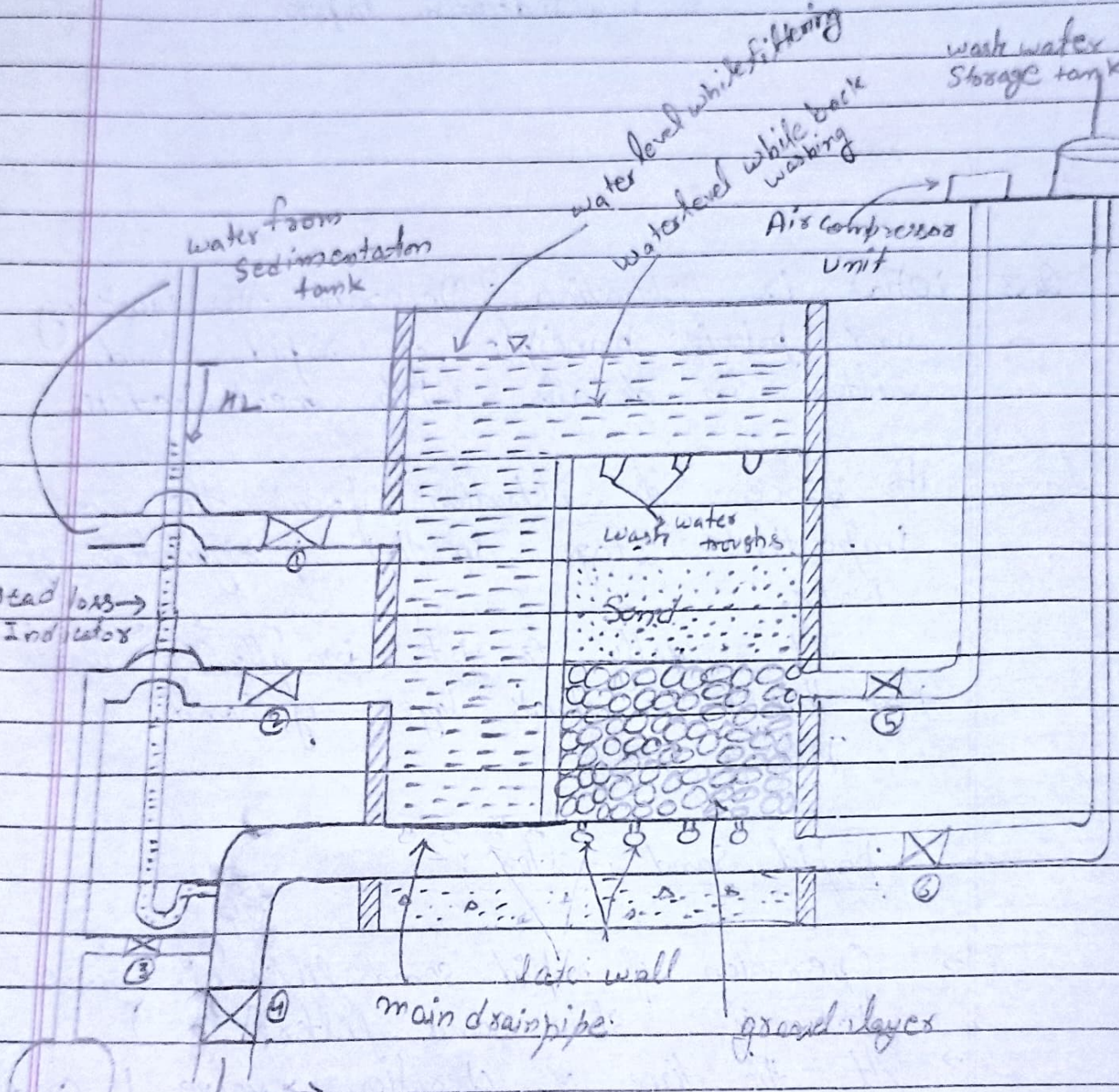


fig:- Rapid Sand filter

Back washing is necessary so that the bed of sand is expanded and impurities they having better chance to come in contact with water because porosity of bed increase due to expansion.

Once washing is complete valve 2, 5, 6 are closed and valve 1 & 3 are opend. This removes the remains of wash water and makes a dirty skin on the sand.

finally valve 3 is closed and valve 4 is opend. The entire process of back washing takes 15 to 30 minutes.

The washing period in normally 24 to 48 hrs.

The back washing velocity should not be more than the setting velocity of smallest size particle to be retained in filter.

Rate of filtration is 3000 to 6000 L/m$^2$-hr.

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**Q.1** A water sample contains the following dissolved ions: $[Na^+] = 112\ mg/l$, $[Ca^{2+}] = 80\ mg/l$, $[Mg^{2+}] = 6\ mg/l$, $[Al^{3+}] = 6\ mg/l$, $[HCO_3^-] = 380\ mg/l$, $[OH^-] = 68\ mg/l$, $[Cl^-] = 16\ mg/l$. pH of water sample 7. Atomic weight of Ca = 40, Mg = 24, Al = 27, H = 1, C = 12, O = 16, Na = 23, Cl = 35.5 in grams. Then find out the total hardness and Carbonate hardness of the sample in mg/l as $CaCO_3$.

Sol.$^n$ (i) For total Hardness [

$$\text{total Hardness} = \left[\frac{80}{20\times10^{-3}} + \frac{60}{12\times10^{-3}} + \frac{6}{9\times10^{-3}}\right] \times 50\times10^{-3}$$

$$= 483.34\ mg/l \text{ as } CaCO_3$$

for Non-Carbonate Hardness.

$$\text{Total Hardness} = C.H + N.C.H$$

$$\text{Alkalinity} = \left[\frac{380}{61\times10^{-3}} + \frac{68}{17\times10^{-3}}\right] \times 50\times10^{-3}$$

$$= \frac{380}{61\times10^{-3}} + \frac{68}{17\times10^{-3}}$$

$$= \frac{380 + 4\times61}{61\times10^{-3}} \times 50\times10^{-3}$$

$$= 511.47\ mg/L$$

## Sec-B

Q.3 How many ~~Describe the~~ types of spring water are used as underground source of water discuss in brief?

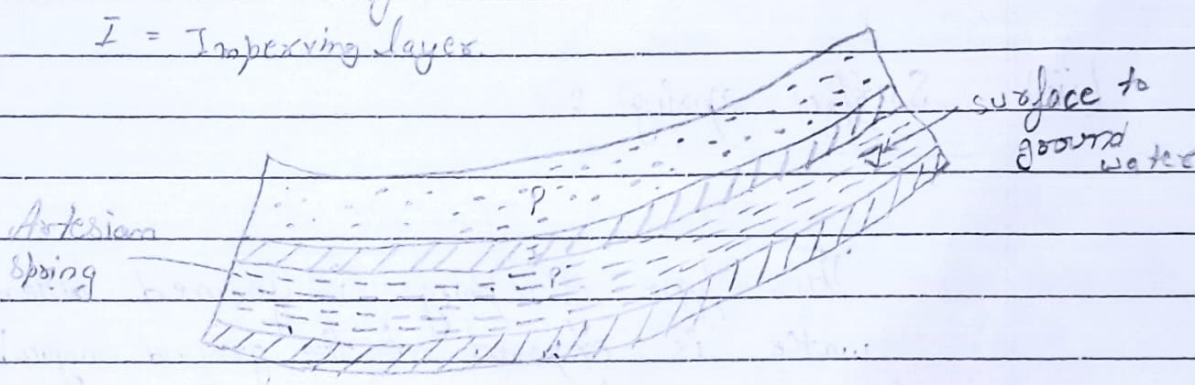
Ans Three types of spring :-

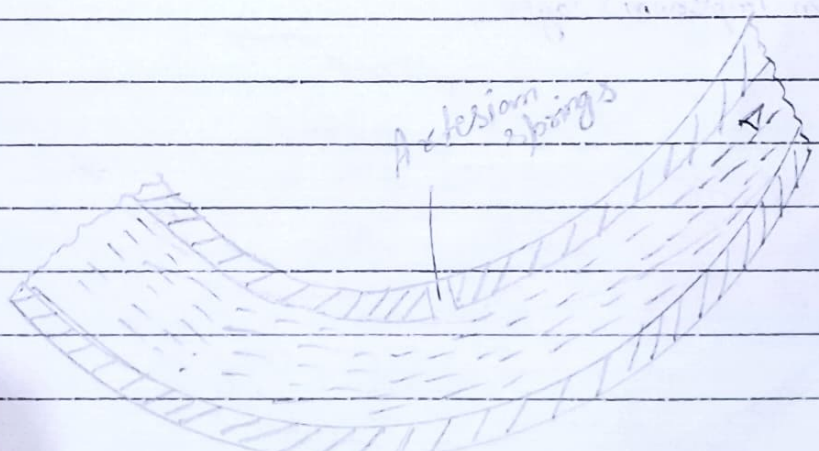
(i) Arte Sian Springs :-

→ In this type of spring the ground water comes to the surface under pressure.

→ The artesian springs may also be formed due to presence of fissure or crak in the impervious layes.

P = Pervious layer
I = Impervious layer



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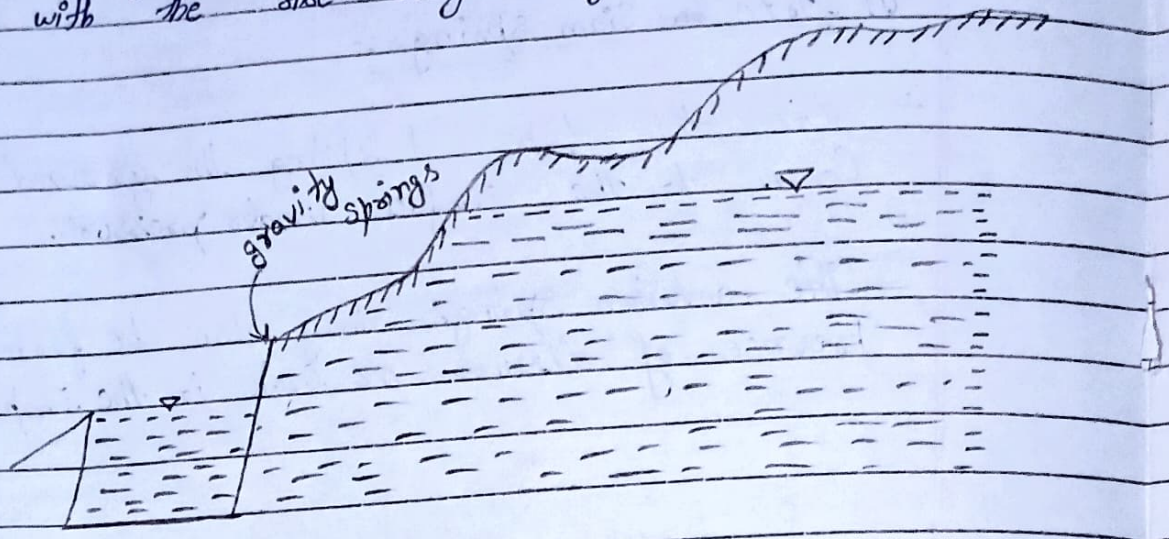
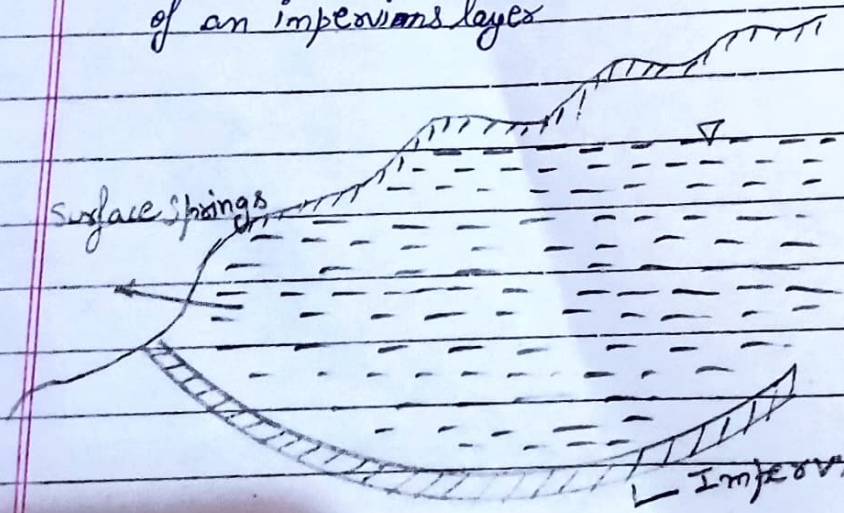
(ii) Gravity springs :-

This type of springs develope due to overflowing of the water table.
The yflow from a gravity spring is variable with the rise or fall of water table.




(iii) Surface springs :-

This type of springs is formed when subsoil water is exposed to the ground surface by the obstruction of an impervious layer



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Q2 Describe the domestic purposes of water requirement of urban and rural area in details.

(1) Domestic purposes :—

The quantity of water required for domestic purposes can be sub-divided as follows.

(i) Drinking :- A human body contains about 70% of water the consumption of water by a person depends on various things. But on the average and under normal condition it is about 2 litres per day.

(ii) Cooking :- Some quantity of water will also be required for cooking. The quantity of water required for this purpose will depends upon the stage of advancement of ~~fam~~ family in particular and in society in general.

(iii) Bathing :- The quantity of water required for bathing purpose will depends on the habits of people and types of ~~clim~~ climate

(vi) House hold sahitary purpose :- Under this division the water is required for washing clothes, floors, utensils, etc. and it may be assumed to be about 50-60 lit per capita per day.

(vi) Private gardening and Irrigation :-

In case of developed cities, there will be practically no demand of water for this purpose.

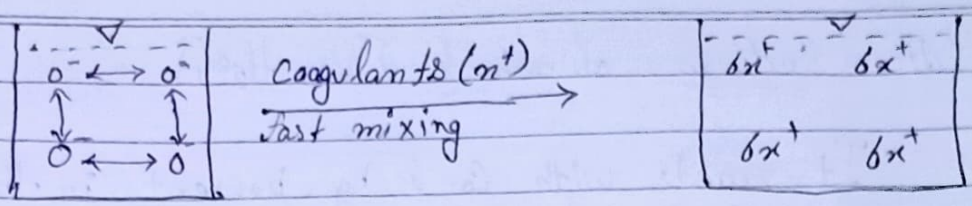
(vii) Domestic animals & private vehicles :-

The amount of water required for the use of domestic animals and private vehicles is not of much concern to a water supply enginner.

Q 4. What is Coagulation ? Describe different types of chemicals that can be used as Coagulant.

Ans Coagulation :-

→ It is process in which certain chemicals termed as Coagulants are added in water in order to neutrilze the negative protective charge over the suspended partice and to form sticky precipitate resulting in the formation of bigger size particle which can get easily settled in sedimentation process.




→ Different types of chemical that can be used as coagulant

(a.) Alum :-
$[Al_2(SO_4)_3 \cdot 18H_2O]$ - Hydrated Aluminium sulphate

→ Alum when added in water reacts with alkalinity present in water and leads to the formation of sticky precipitate of $[Al(OH)_3]$ which attracts fine suspended particles over its surface resulting in the formation of bigger size particle which can get easily settled.

→(b) Capperas :- $[FeSO_4 \cdot 7H_2O]$ - Hydrated ferrous sulphate.

→ Sticky precipitate of $[Fe(HCO_3)_2]$ ⇒ pH range 8.5 and above

(c)→ Chlorinate Copperas :- $[Fe_2(SO_4)_3 + FeCl_3]$

→ Chlorinate Copperas is formal by addition of Cl in Copperas.

→ If ferric chloride is used independently as a coagulent it works with the pH range 3.5 to 6.5 and above 8.5.

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(d) Sodium aluminate [$Na_2Al_2O_4$]

→ It reacts with Ca & Mg present in the water and leads to the formation of sticky precipited of Ca/Mg - Aluminate [Ca/Mg $Al_2O_4$].

→ It does not required alkalinity to be present in the water. Also remove the hardness of water.

→ working pH-range 6 - 8.5.

6. Discuss the advantage and Disadvantage of Cement Concrete pipe?

| Advantage | disadvantage. |
|---|---|
| (i) They are more suitable to resist the external loads and loads due to book fill | ⇒ Unreinforced pipes are liable to tensile cracks and they can not with high pressure. |
| → The maintenance cost is low. | ⇒ The tendency of leakage is not ruled out as a result of its porosity and shrinkage cracks. |
| → The problem of corrosion is rust here. | ⇒ It is very difficult to repair them. |
| → pipe can be cast at site and hence the transportation problem are reduced. | ⇒ precast pipes are very heavy and it is difficult to transport them. |
| The inside surface of pipes can be made smooth they reducing the frictional losses. | |

Sec-A

Q1 Fir deman formula :→

Freeman's formula :-

$$Q = 1135.5\left[\frac{P}{10} + 10\right]$$

Q.2 What should be the desirable limit and permissible limit of color in water sample.

Ans Limits :

Acceptable limit - 2 TCU

Cause of rejection - 25 TCU

Q.3. In lime soda process of softening of water. 2 mole of magnesium bicarbonate consumes how many moles of lime ? Write reaction also.

No. of mole lime = 2o

Rate of bicarbonate in limesed

1:2

residecal hardness = 15 - 50ppm.

4. If initial volume of the water sample is 10ml and dilution ratio is 20, then find out the threshold order number of water sample.

Ans Initial = 10ml

dilution ratio = 20

$\frac{\text{final volume}}{\text{initial}}$ ~~$\frac{\text{initial}}{\text{final volume}}$~~ = dilution factor

$20 = \frac{\text{final volume}}{10}$ $20 = \frac{10}{\text{final volume}}$ =

final volume = 20x10

= 200

~~$\frac{\text{final volume}}{20} = \frac{1}{2} = 0.5$~~

Q.5 What is the difference b/w nitrite and Nitrate?

| Nitrite | Nitrate |
|---|---|
| Made up of a nitrogen atom and two oxygen atoms | Made up of a nitrogen atom and three oxygen atoms |
| The oxidation num. of nitrogen in nitrites is +3 | The oxidation num. of nitrogen in nitrates is +5. |
| Forms a week acid known as nitrous acid | Forms a strong acid known as nitric acid |
| Oxidized to form nitrates | Reduced to form nitrites |
| Used in food preservatives | Used in fertilizers and explosives. |