Water Sanitation

2nd June 2016

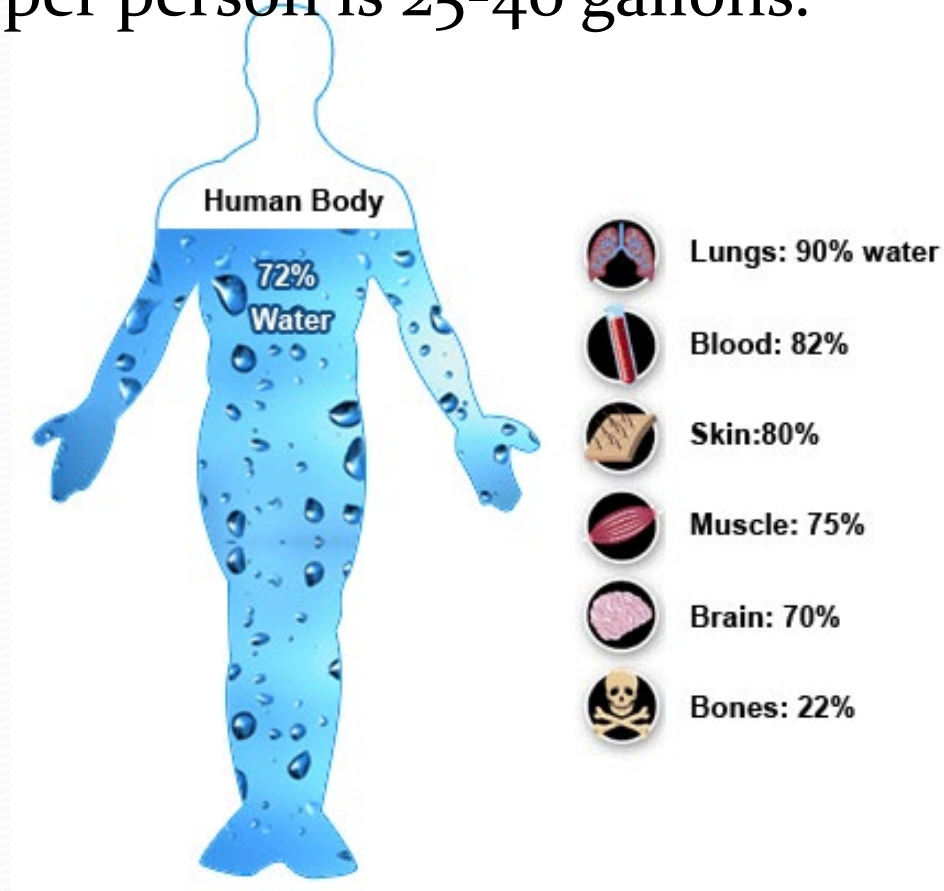
Safe and Wholesome Water (portable water)

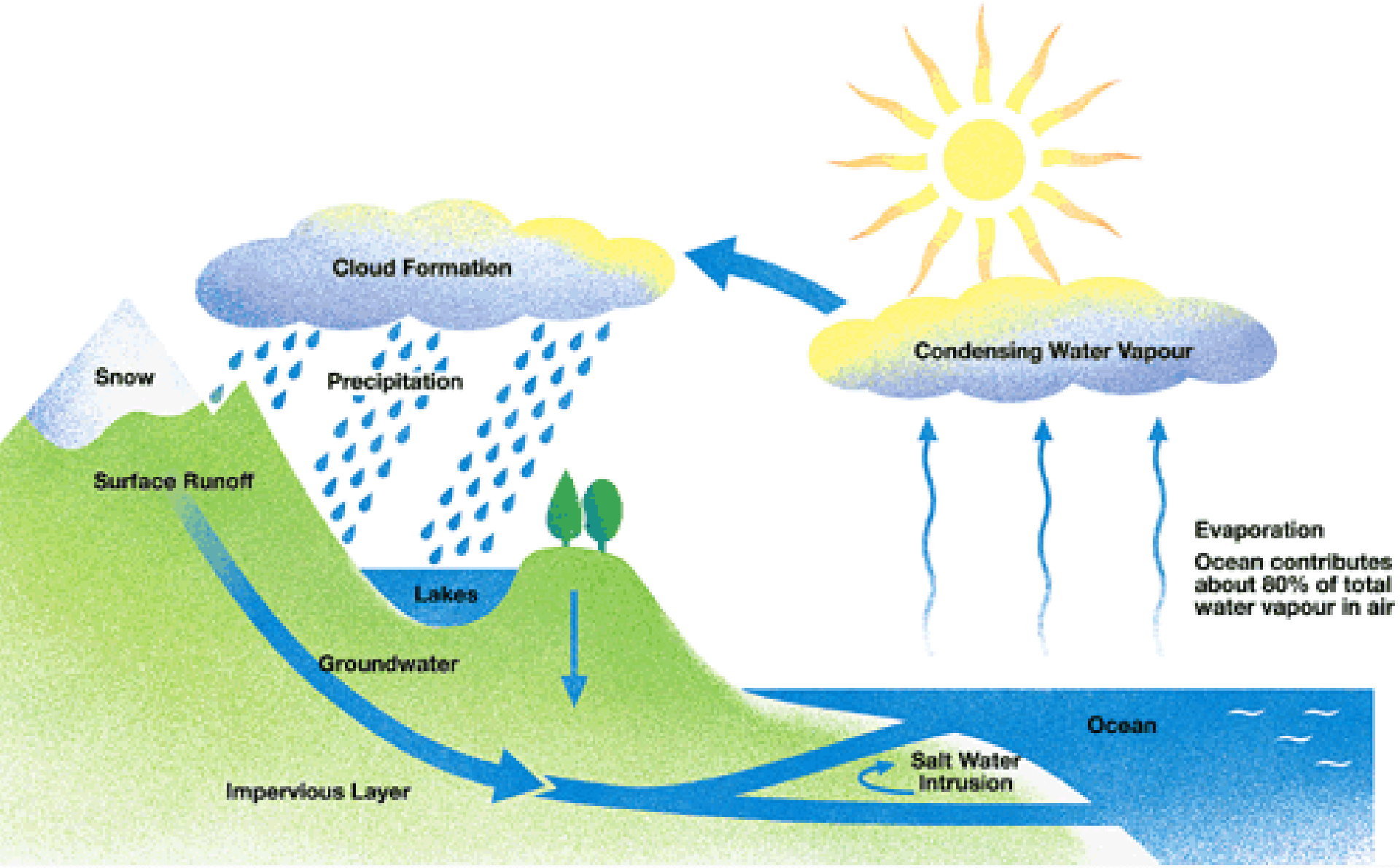
Safe and wholesome water is important for human consumption. The followings are characteristics of safe and wholesome water:

- 1. free from pathogenic agents
- 2. free from harmful chemical substances
- 3. pleasant to the taste i.e. free from colour and odour
- 4. usable for domestic purposes

Adequate water supply

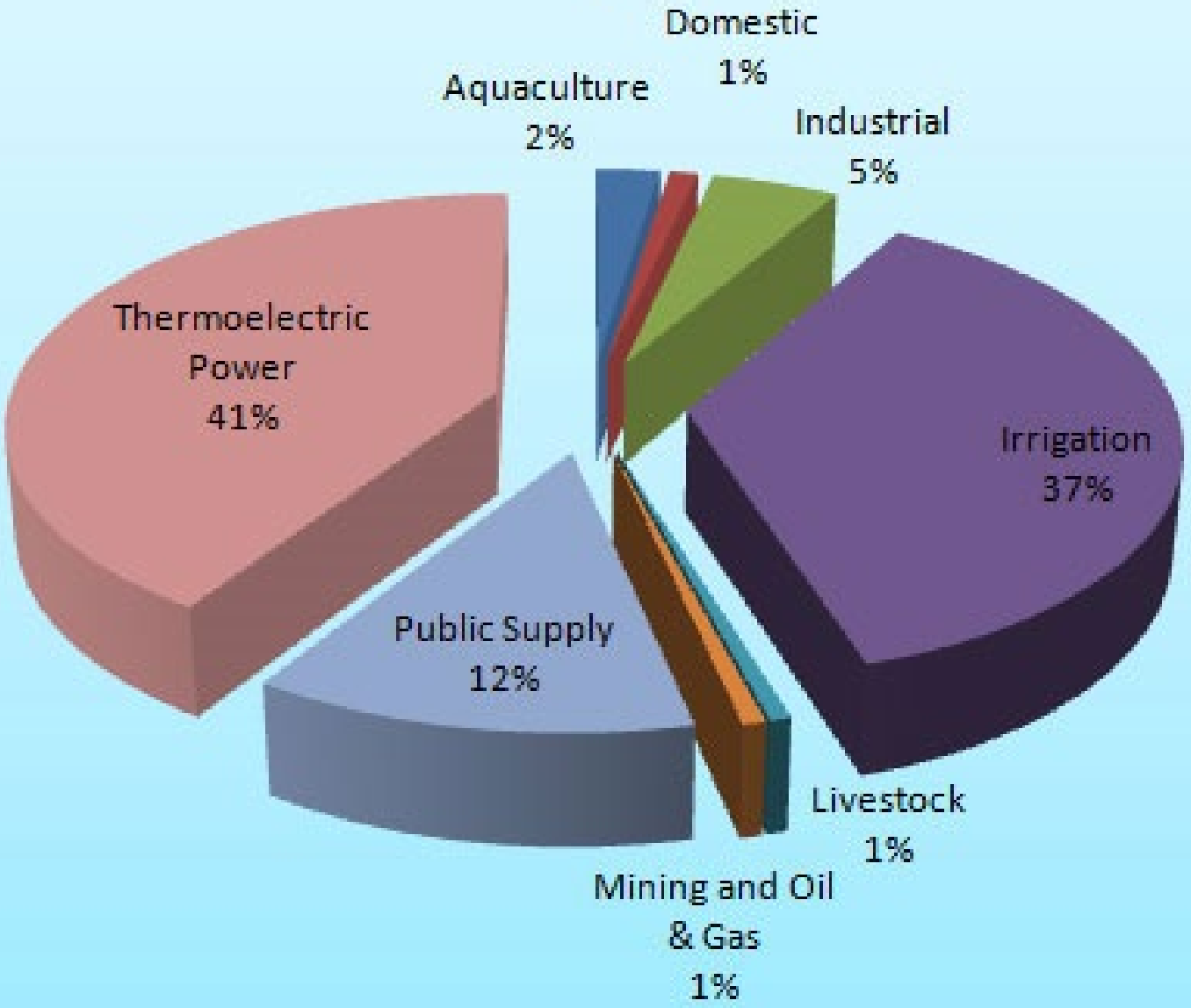
World Health Organization recommended that daily requirement per person is 25-40 gallons.




Cloud Formation
Condensing Water Vapour
Snow
Precipitation
Surface Runoff
Evaporation
Ocean contributes about 80% of total water vapour in air
Lakes
Groundwater
Ocean
Salt Water Intrusion
Impervious Layer

Uses of Water

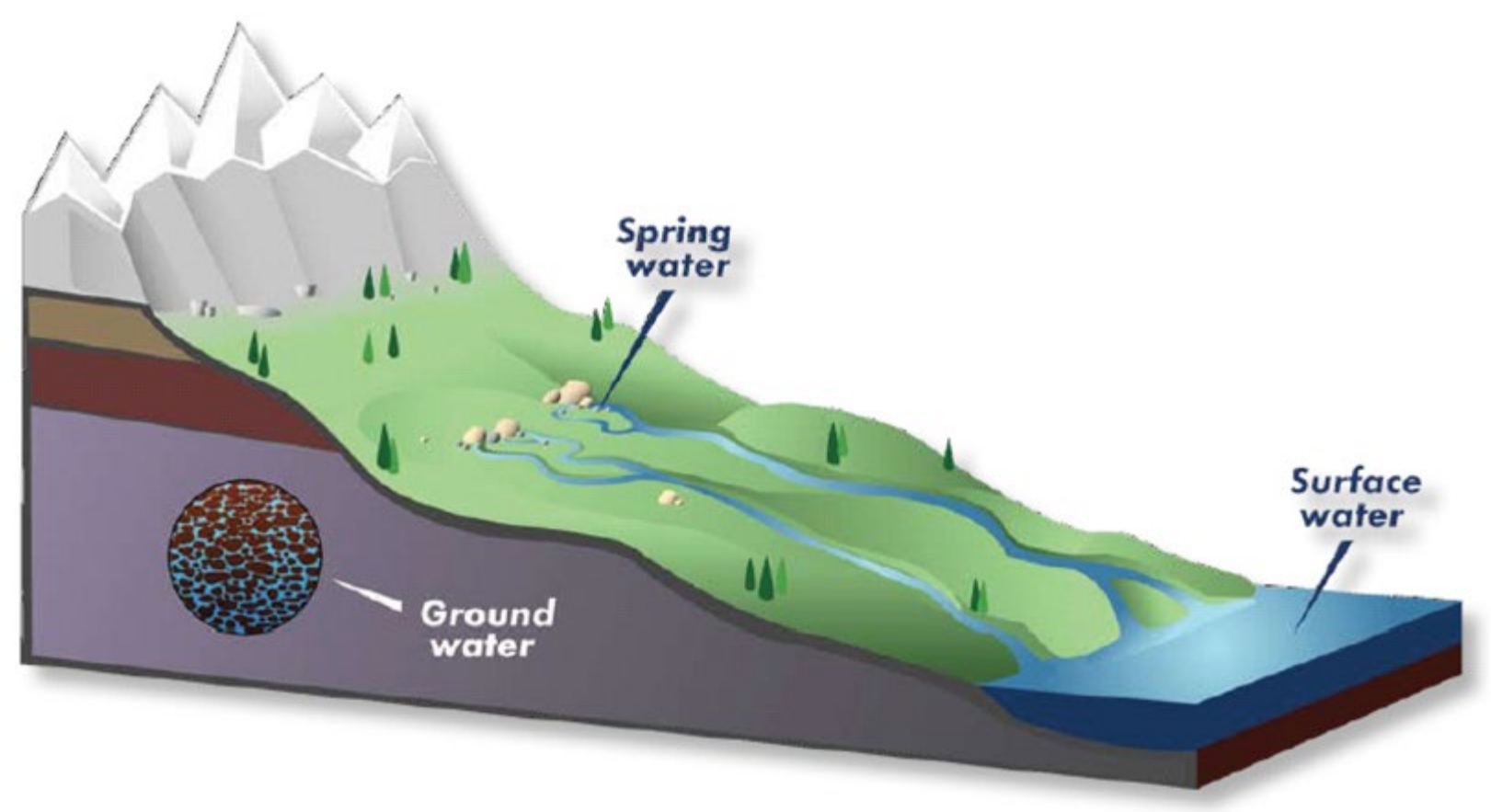
Percentage of Water Used by Category



Uses of Water

1. Domestic use: drinking, cooking, washing, bathing, flushing of toilets, gardening, etc.
2. Public purpose: cleaning street, recreational purpose like swimming pools, public foundations and ornamental ponds, fire protection and public parks
3. Industrial purpose: for processing and cooling
4. Agricultural purpose: irrigation
5. Power production from hydropower and stream power
6. Carrying away waste from all manner of establishments and institutions

Sources of Water



Sources of Water

- Rain
- Ground water
- Surface water

Ground Water

Advantages of ground water are

- (1) It is likely to be free from pathogenic agents.
- (2) It usually requires no treatment.
- (3) The supply is likely to be certain even during dry season.
- (4) It is less subject to contamination than surface water.

Disadvantages of ground water are

- (1) It is high in mineral content e.g. salts of calcium and magnesium which render the water hard.
- (2) It requires pumping or some arrangement to lift the water.

Surface water

- a. Upland lakes and reservoirs
- b. Rivers, canals and low land reservoirs
- c. Rainwater harvesting or fog collection
- d. Desalination of seawater

Water sources in emergency

Survivors from cyclone Nargis

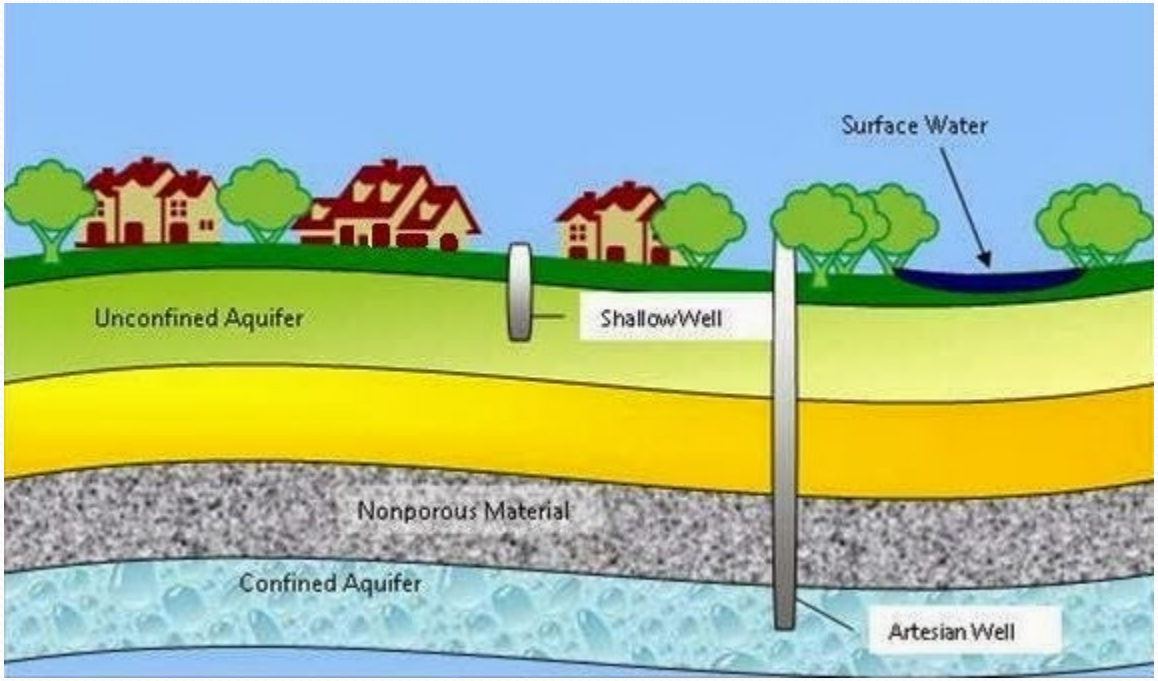
Water sources in emergencies

- Surface Water
- Lakes
- Dug Wells
- Springs
- Boreholes
- Rivers
- Streams

Difference between ground water and surface water

No.	Characteristics	Ground water	Surface water
1	Speed of access	Slow	Very fast
2	Need for treatment	Low	Very high
3	Seasonal change	Low	Very high
4	Cost of use	Low to high	Low to high

Differences between a shallow well and deep well



Differences between a shallow well and deep well

No.	Characteristics	Shallow well	Deep Well
1	Definition	Taps the water from above the first impervious layer	Taps the water from below first impervious layer
2	Chemical quality	Moderately hard	Much hard
3	Bacteriological quality	Often grossly contaminated	Taps pure water
4	Yield	Usually goes dry in summer	Provides a source of constant supply

Water Sources Register

Water Sources Register (20--)

----------Sub-center ----------RHC

----------Township ----------State/Division

Sr. No	Name of Village	Hand pump	Deep well	Shallow well	Rain water tank	Pond	Spring	public water pipe line system	Total

Water Sources Register

Water Source Register (for each village)

Name of village _____

RHC /Sub-center _____

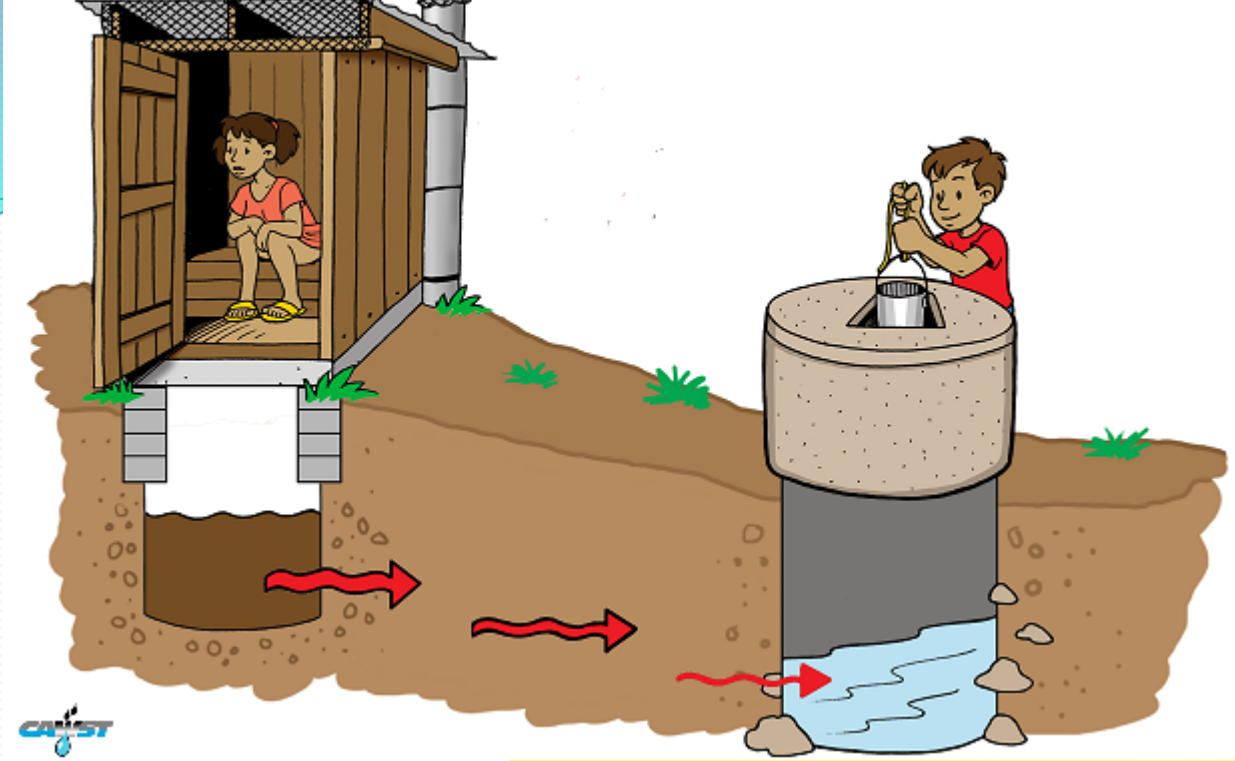
Township _____ State/ Region _____

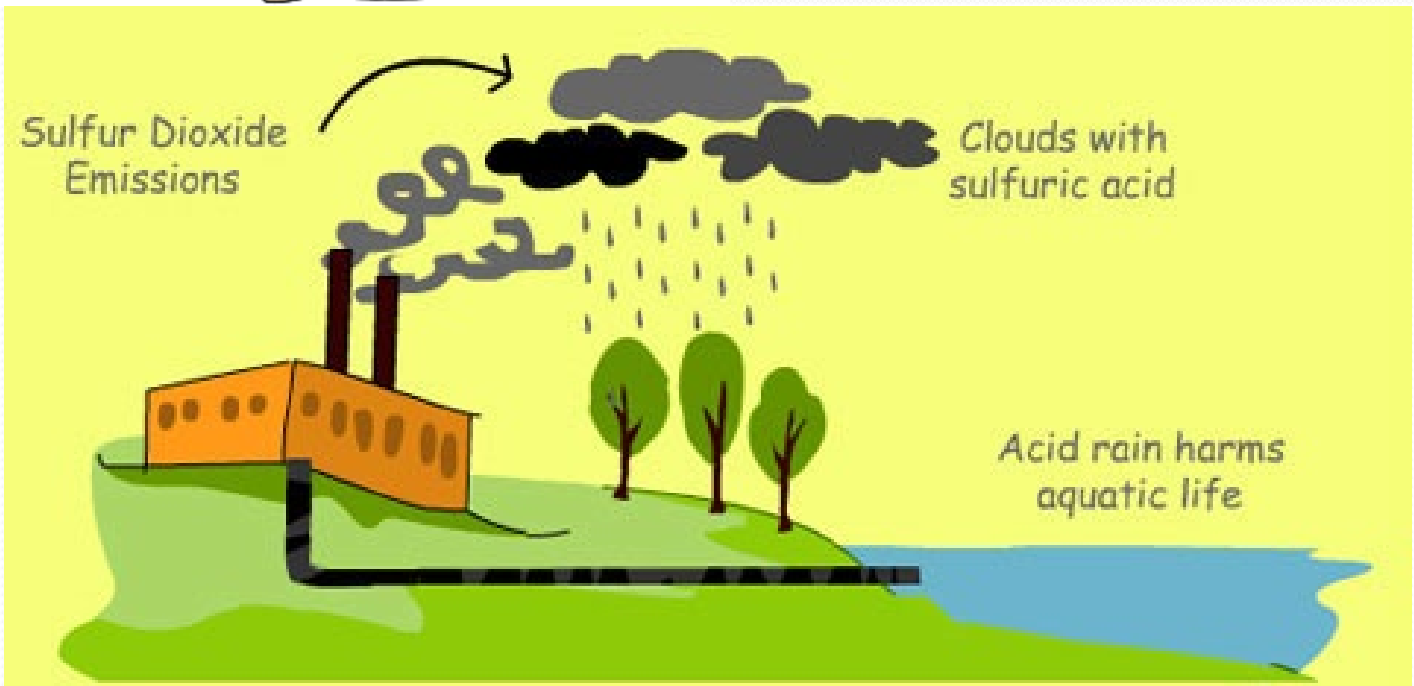
Date of inspection _____

Sr. No.	Type of water						Name of owner	Inspection status		Yield		Action taken		
	Shallow well	Deep well	Pond	Lake	Rain water tank	Spring		Sanitary	Insanitary	Adequate	Inadequate	Chlorination	Modification	New construction

Water Pollution

- Natural impurities




Sulfur Dioxide Emissions
Clouds with sulfuric acid
Acid rain harms aquatic life

Water Pollution

- Manmade impurities

Video

Classification of diseases related to water

- Water-borne Diseases
- Water-based Diseases
- Water-washed Diseases
- Water-related Diseases

Water Borne Diseases

Bacterial Infections

E. coli	Escherichia coli
Cholera	Vibrio chalerae
Typhoid Fever	Salmonella enteritica
Salmonellosis	Salmonella spp.
Bacillaria Dysentry	Shigellaenteriae
Botulism	Clostridium botulinum
Campylobacteriosis	Campylobacter jejuni

Protozoan Infections

Giardiasis	Giardia lamblia
Amoebic Dysentry	Entamoeba histolytica
Cryptosporidiosis	Cryptosporidium parvum

Viral Infections

Adenovirus	Adenovirus
Gastroenteritis	Rotdvirus, Norovirus
SARS	CoronavirusGiardia
Hepatitis	Hepatitis A

Parasitic Infections

Echinococcosis	Echinococcus granulosus
Coenurosis	Taenia multiceps
Enterobiasis	Enterobius vermicularis

Water Carried

Ortitis externa	Pseudomonas aeruginosa
Legionellosis	Legionella spp.

Water Washed

Skin & Eye Infections

Nosocomial	Staphylococcus aureus
Leprosy	Mycobacterium leprae
Scabies	Sarcoptes scabieiCholera
Trachoma	Chlamydia trachomatis

Biting Invertebrate

Typhus	Rickettsia spp.
Spotted Fever	Rickettsia spp.
Bubonic Plague	Yersinis pestis

Water Based

Skin Penetration

Schiostosomiasis	Schistosoma spp.

Interstinal Penetration

Guinea Work	Dracunculus medinensis
Clonorchiasis	Clonorchiasis sinensis

Vector Based - *Breeding in Water*

Malaria	Plasmodium spp.
Dengue	Flavivirus Aedes spp.
Yellow Fever	Flavivirus Aedes spp.
Viral Encephalitis	Arboviruses & others

Bite near Water

Sleeping Sickness	Trypanosoma brucei

Chlamydia trachomatis

The Life Cycle of Trachoma

INFECTING THE EYES

Flies carrying the micro-organism land on children's eyes, to feed on discharge.

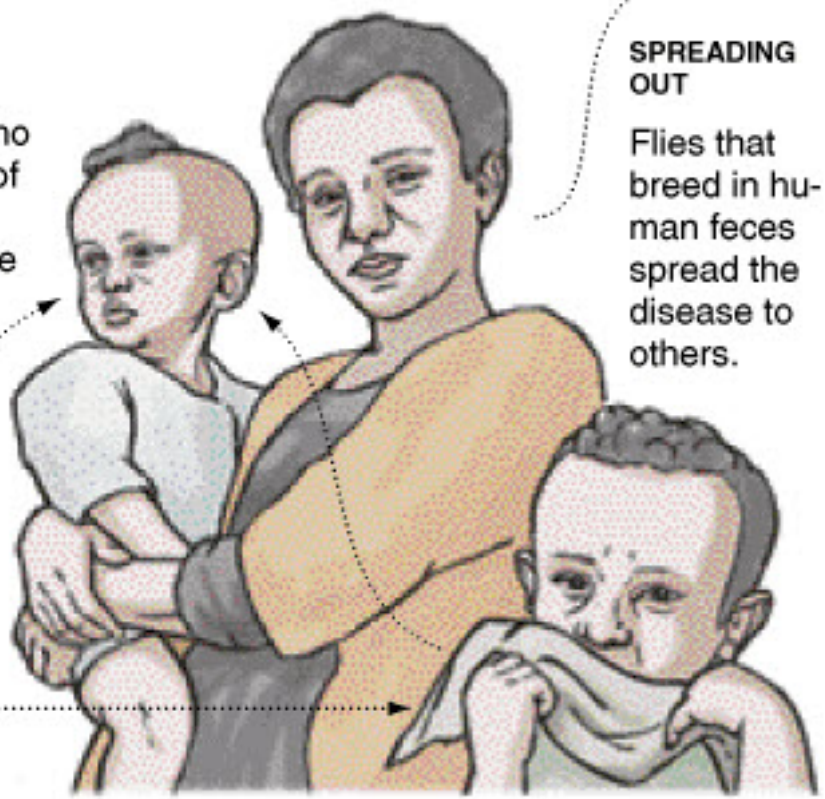
FAMILY CONTACT

Women who take care of children also get the infection.

SPREADING OUT

Flies that breed in human feces spread the disease to others.

Dirty hands or face cloths also spread the disease.



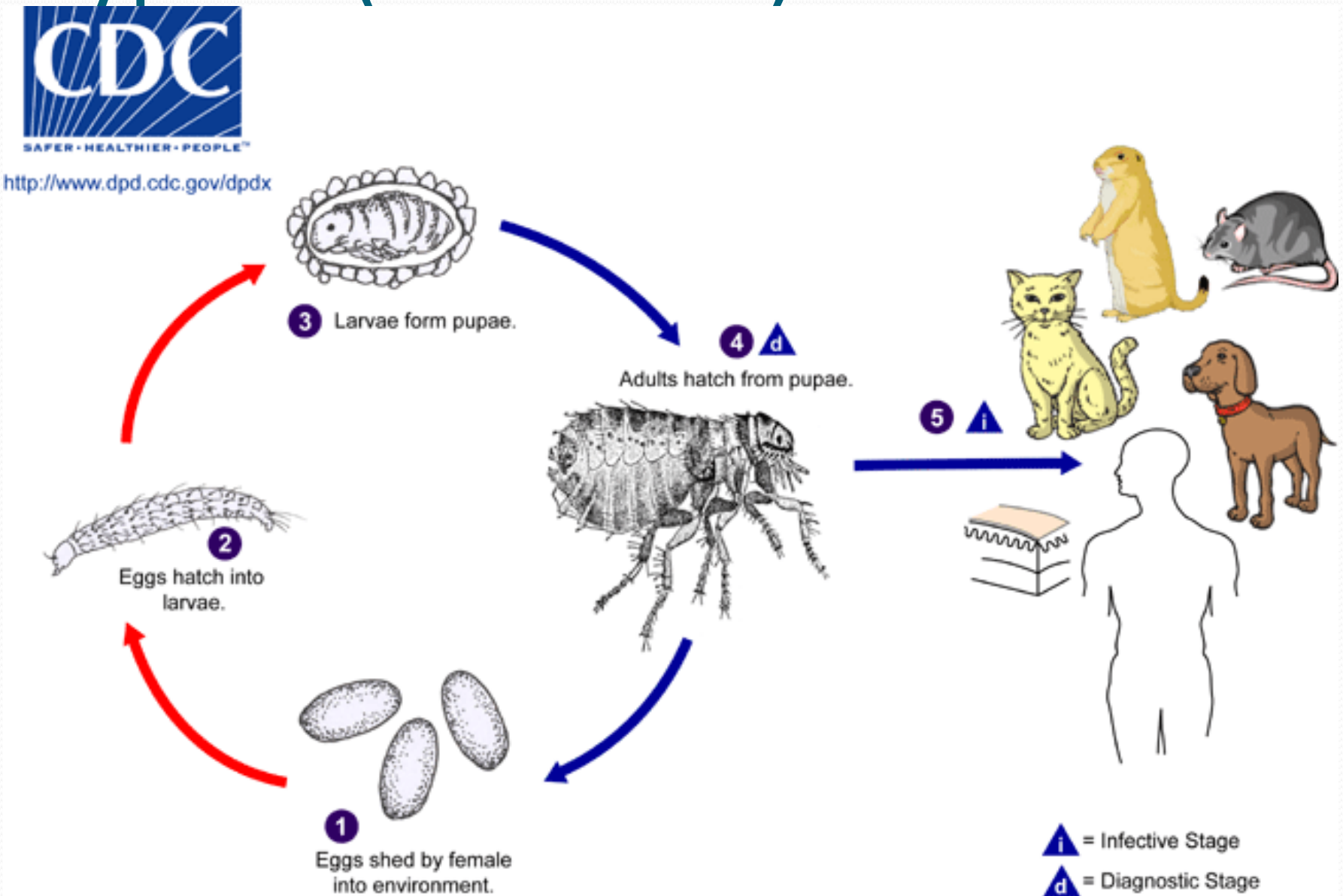
HOW TRACHOMA BLINDS

Infections inflame and thicken the upper eyelid.

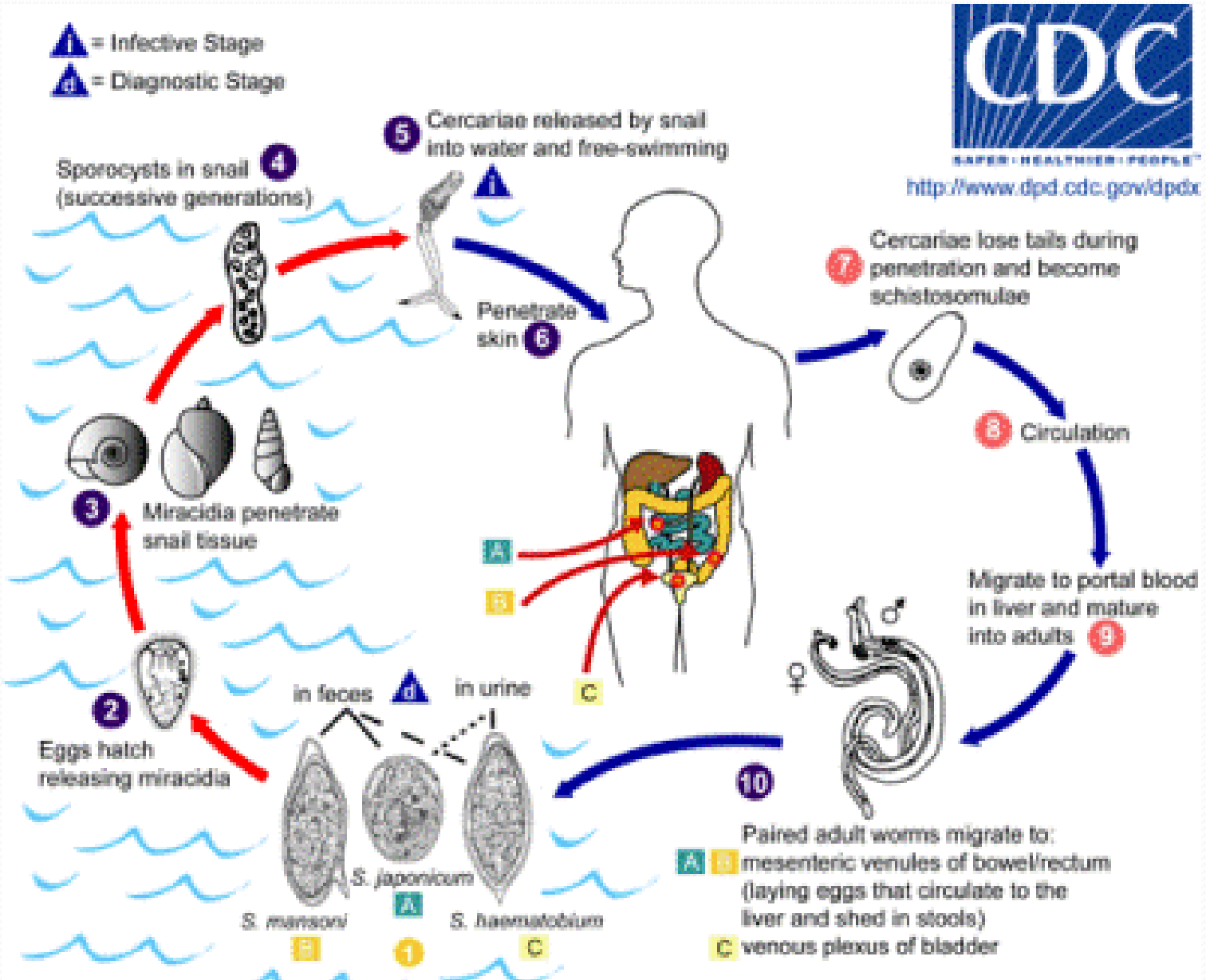
Scarred eyelids turn inward.

The lashes scratch the cornea, leading to blindness.

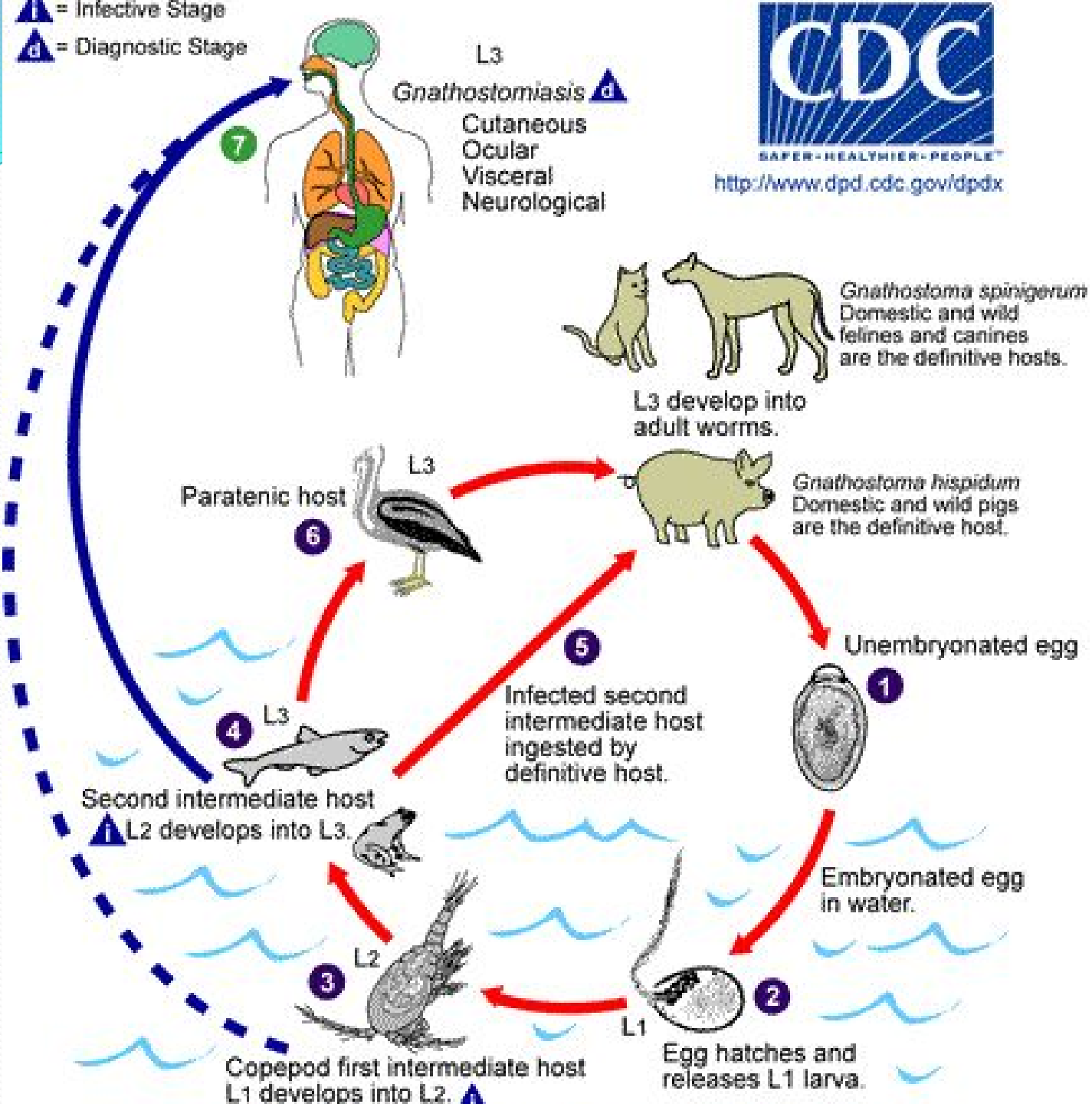
Typhus (Rickettsia)



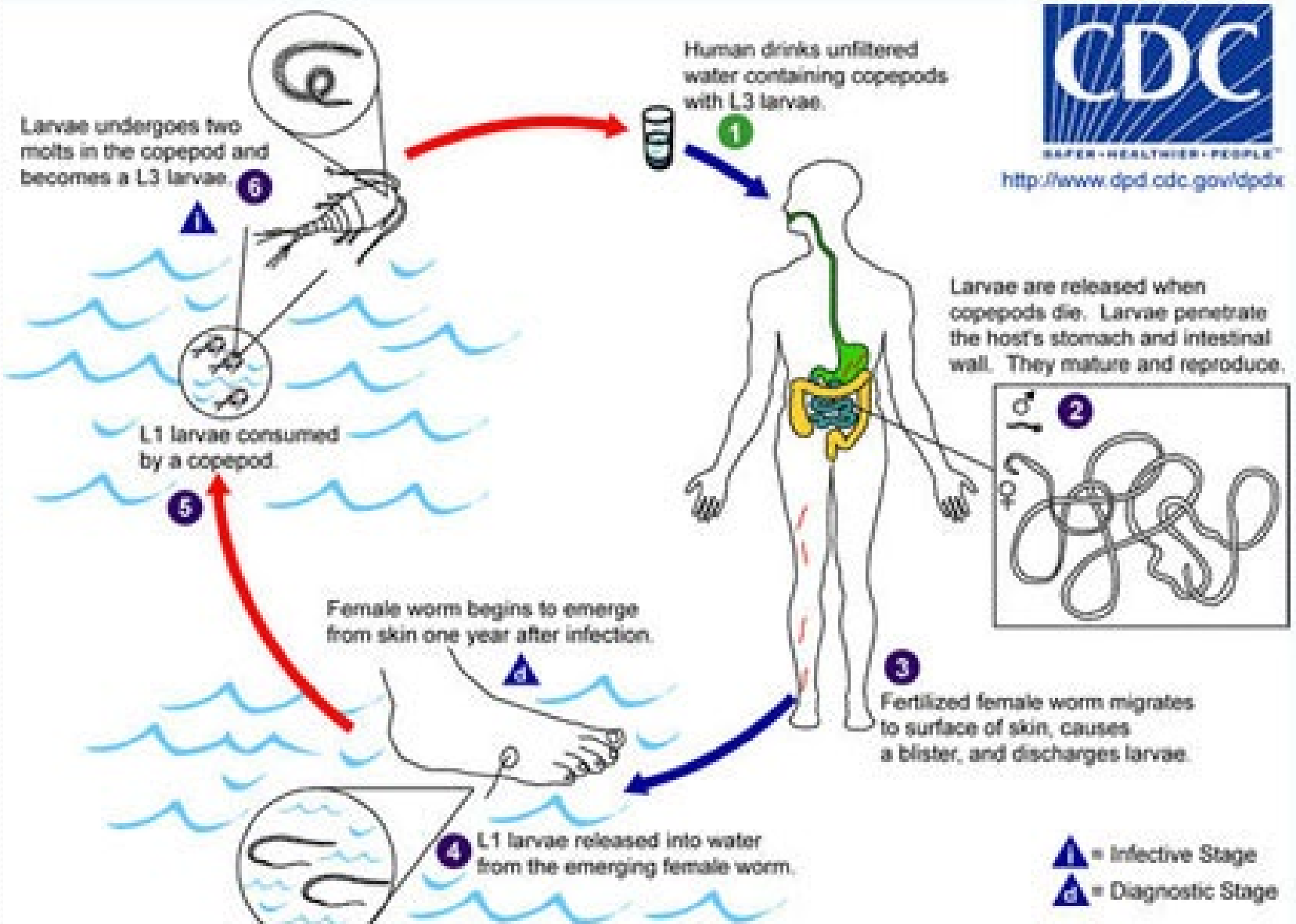
Schistosomiasis (Schistosoma)



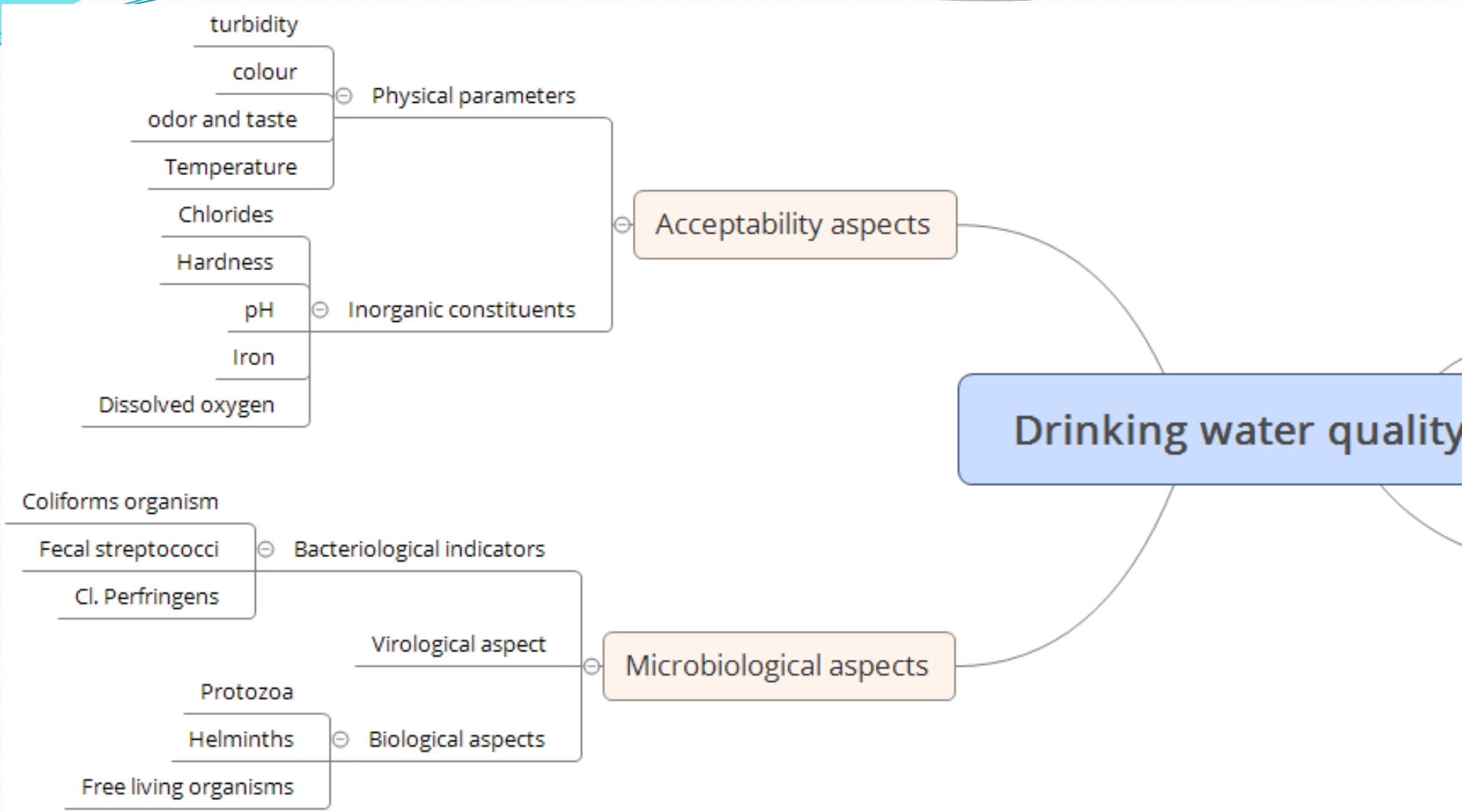
Fish Tape worm (Cyclops)

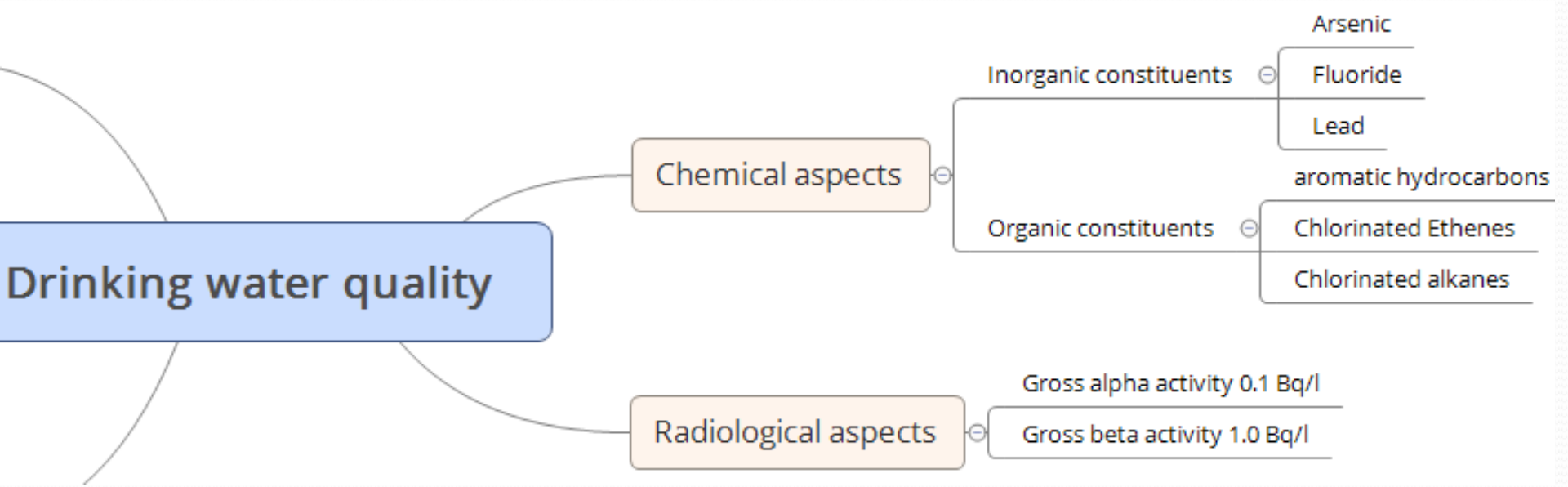


Guinea worm


Human drinks unfiltered water containing copepods with L3 larvae.
1
Larvae are released when copepods die. Larvae penetrate the host's stomach and intestinal wall. They mature and reproduce.
2
Fertilized female worm migrates to surface of skin, causes a blister, and discharges larvae.
3
L1 larvae released into water from the emerging female worm.
4
Female worm begins to emerge from skin one year after infection.
d
L1 larvae consumed by a copepod.
5
Larvae undergoes two molts in the copepod and becomes a L3 larvae.
6
CDC
SAFER·HEALTHIER·PEOPLE™
http://www.dpd.cdc.gov/dpdx
= Infective Stage
= Diagnostic Stage

Drinking water quality


Drinking water quality
Acceptability aspects
Physical parameters
turbidity
colour
odor and taste
Temperature
Inorganic constituents
Chlorides
Hardness
pH
Iron
Dissolved oxygen
Microbiological aspects
Bacteriological indicators
Coliforms organism
Fecal streptococci
Cl. Perfringens
Virological aspect
Biological aspects
Protozoa
Helminths
Free living organisms


Drinking water quality
Chemical aspects
Inorganic constituents
Arsenic
Fluoride
Lead
Organic constituents
aromatic hydrocarbons
Chlorinated Ethenes
Chlorinated alkanes
Radiological aspects
Gross alpha activity 0.1 Bq/l
Gross beta activity 1.0 Bq/l

Sanitary water source

Selection of site for construction of sanitary water source

a. should be at least 50 feet away from source of contamination like latrines

b. must be located at a higher than surrounding area to avoid entrance of flood water

c. Distance between the water source and houses of users should also be considered. The source should be located that no user will have to carry water for more than 100 meter.

Rain water collection system + vid

Guideline for sanitary inspection of rain water collection system + video

1. The roof or collection surface should be clean.
2. The guttering should be clean.
3. The filter box should be in good condition.
4. The cover should be sanitary and closed.
5. The tank should not be cracked.
6. The collection area should be cleaned and well drained.
7. The bucket should be stored so that it cannot be contaminated.
8. There must be no human or animal excreta on the ground.


© ChinaFotoPress via Getty Images

Shallow well sanitation + video

Requirements of a sanitary well

- 1. Location: Should be located at a higher level than latrines in the vicinity, At least 50 feet away from latrines, not more than 100 yards from the users (dwellings of consumers).

- 2. Lining: Should be built of bricks or stones set in cement up to 3 meters depth. Lower part should be lined with concrete rings with perforation, so that water enters from the bottom & not from the sides of the well. The lining should be carried 60-90 cm (2-3 feet) above the ground level, to prevent caving in.

- 3. Parapet: There should be a parapet wall up to height of at least 1 meter (3 feet) all around the around the rim, to prevent falling.

- 4. Platform: A cement concrete platform around the well extending at least 1 meter (3 feet) in all direction should be constructed. The platform should have gentle slope at outwards toward a drain built along its edges.

- 5. Drain: There should be a pucca drain to carry off spilled water to a public drain or soakage pit

- 6. Covering: The top of the well should be closed by a cement concrete cover to protect from outside contamination.

- 7. Hand pump: Well should be equipped with a hand pump for lifting water in a sanitary manner.

- 8. Consumer responsibility: Strict cleanliness should be enforced in the vicinity of the well; bathing, washing of clothes & animals, dumping of refuse & waste etc. should be prohibited. All this requires health education.

- 9. Quality: Physical, chemical and bacteriological quality of water should confirm to the acceptable standards of quality of safe and wholesome water.

- 10.Disinfection: should be done if necessary. (See chlorination)

Surveillance functions on drinking water

1. Approval of new sources

2. Watershed protection

3. Approval of construction and operating procedures of waterworks including

4. Sanitary surveys

5. Monitoring programs, including provision for central and regional analytical laboratory services

6. Development of codes of practice for well construction, pump installation and plumbing

7. Inspection quality control in bottled-water and ice manufacturing operations

The elements of surveillance program

1. Sanitary survey

2. Sampling

3. Bacteriological surveillance

4. Biological examination

5. Chemical surveillance

Inspection of shallow well

Rainwater storage system

Collection of tap water + video

- The tap should be opened fully, water to run to waste at least 2 minutes in order to flush the interior of the nozzle and to discharge stagnant water in the service pipe. If the tap to collect water in not in regular use, it should be sterilized by heating it either with a blow lamp or ignited piece of cotton soaked in methylated spirit until it is unbearably hot to touch. Then tap should be cooled by allowing water to run to waste before sample is collected.
- The bottle should be held near the base with one hand and stopper and paper cover over it removed together and geld in fingers. The sample bottle should be filled from a gentle stream of water from tap, avoiding splash.

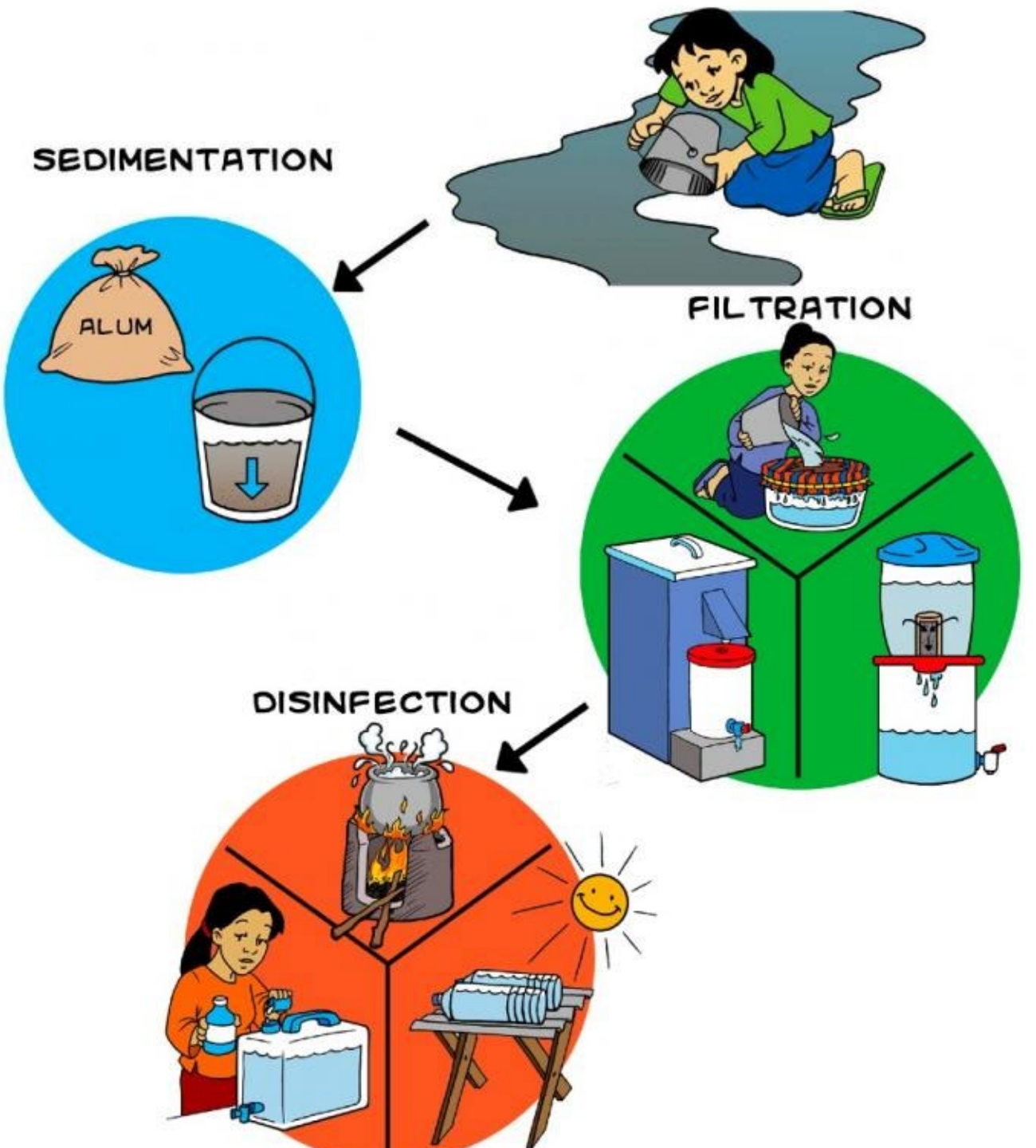
Transport and storage of samples

- The bacteriological examination of sample should be commenced as soon as possible after collection. If possible, sample should be kept in ice. Iced samples should be taken for analysis within 48 hours. Certain particulars regarding date of collection and dispatch, source of water, particulars of recent rainfall and findings of sanitary survey should also be supplied with the sample.

Natural purification

1. Evaporation and condensation (rain water)
2. Filtration through earth (ground water)
3. Dilution (river, streams)
4. Storage and sedimentation (lakes, ponds, reservoirs)
5. Ultraviolet rays and sunlight (surface and rain water)
6. Aeration-Oxidation (rain and surface water)

Artificial purification of water on small scale



Filtration+ video

Ceramic filter + vid


LifeStraw

Disinfection by boiling

- - Boiling is a very effective though energy consuming method to destroy various pathogens such as viruses, spores, cysts and worm eggs.
- Water temperatures above 70 °C (158 °F) will kill all pathogens within 30 minutes, above 85 °C (185 °F) within a few minutes, and at boiling point (100 °C (212 °F)), most pathogens will be killed.

Disinfection using chlorine

When used correctly, chlorine will kill all viruses and bacteria, but some species of protozoa and helminthes are resistant.

The chemical should also have sufficient contact time with the pathogens (at least 30 minutes for chlorine).

The strength of the disinfectant may decline with time depending on how it is stored.

It is therefore in emergency situations, chlorine solutions be centrally dispensed to the users by qualified personnel.

The most effective and cheapest method of disinfecting well is by bleaching powder.

The main purposes of chlorination are: -

- 1. Disinfection of water
- 2. Control of algae and other plants in the reservoir
- 3. Destroy taste and odour producing constituents
- 4. Prevention of organic growth in pipe line especially growth of iron fixing and slime producing bacteria.

Principle of chlorination

- 1. Water to be chlorinated should be clear/free from turbidity
- 2. The amount of chlorine required should be estimated

- 3. Contact time of at least half to one hour is essential to kill bacteria and viruses.
- 4. The minimum recommended concentration of free residual chlorine after a contact period of ½ to 1 hour is 0.1 to 0.2 ppm.

Chorine residual – It is the amount of chlorine left in water after the reaction of chlorine with water during a specific contact period, which is essential to kill bacteria and viruses. It may be in the form of free or combined available chlorine.

- 5. The sum of chlorine demand of specific water plus the required level of free residual chlorine is the chlorine dosage (the amount of chlorine to be added into water).

Factors influencing the effectiveness of chlorination

- 1. Type of chlorine used.
- 2. Amount of chlorine added (Dosage)
- 3. Turbidity of the water to be chlorinated.
- 4. Organic load, type and amount of bacteria contaminated in water.
- 5. Length of contact period
- 6. Temperature of water
- 7. pH of water.

Principle of chlorination	Factors influencing the chlorination
Water clear/free from turbidity	Turbidity of water
amount of chlorine	Amount of chlorine
Contact time of half hour	Contact period
residual chlorine 0.1 to 0.2 ppm	
Total Cl = Required amount + Residual chlorine	
	Type of chlorine
	Organic load
	Temperature and pH of water

1. Simple chlorination

- It is an application of chlorine for the purpose of disinfection a water supply.
- Free residual chlorine is 0.1 to 0.2 ppm.

2. Super - chlorination

- highly polluted water, or during epidemics of water borne diseases.

- (a) Residual chlorine is usually 1-2ppm.

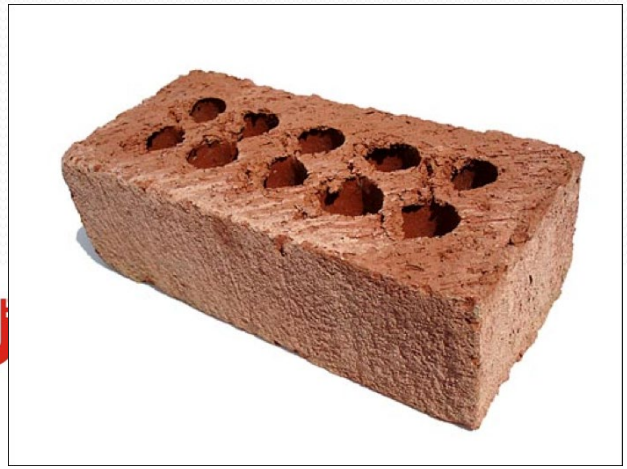
- (b) followed by dechlorination

(which is carried out by addition of dechlorinating agents such as sodium thiosulphate, potassium permanganate)

to achieve residual chlorine of 0.1 – 0.2 ppm.

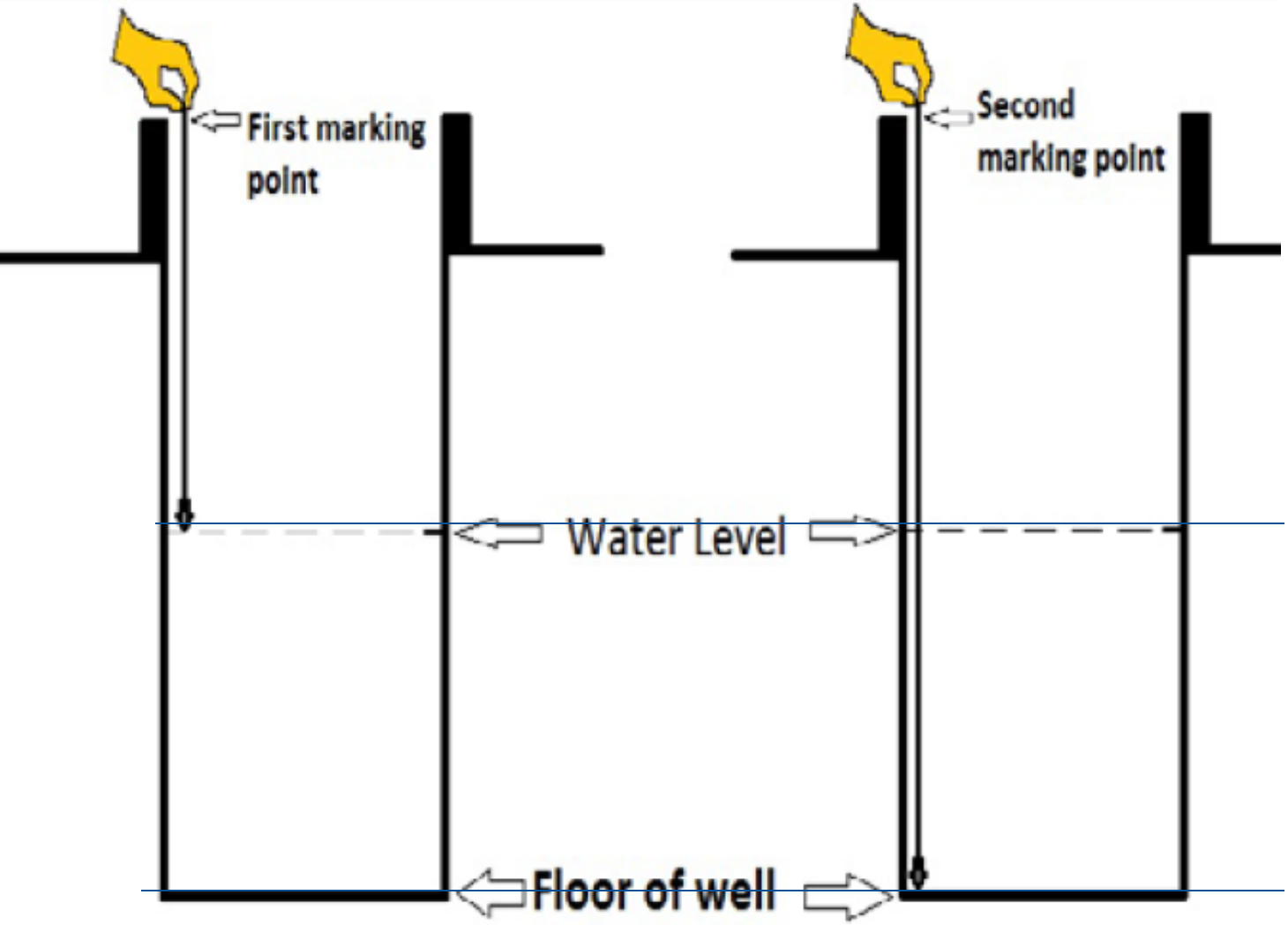
Materials required


Potassium Iodide
KI
100 Grams




JETECH
TOOL
MEASURING TAPE
5.0M
PSP19-5.0

Find the volume of water in a well



Depth of water

- (a) For circular well

5 D2 H (in gallons)

D = 6 feet

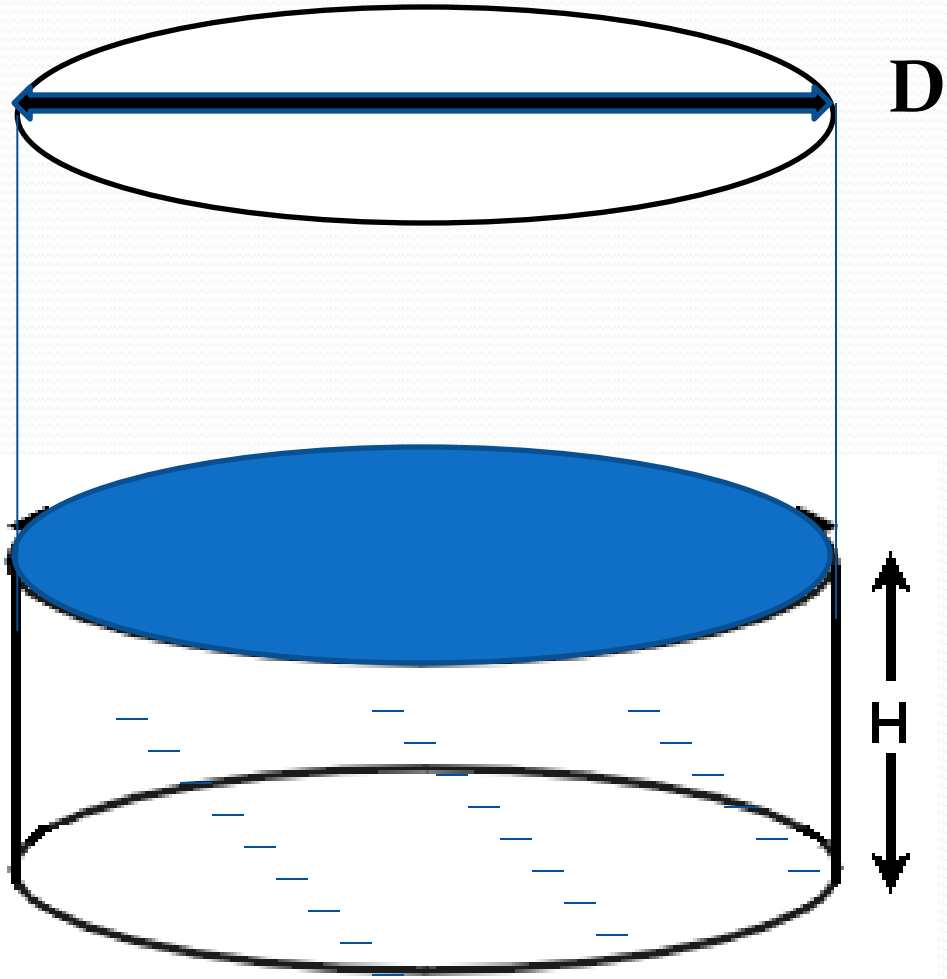
H = 10 feet

Vol = 5 * 6 * 6 * 10

= 1800 gallons

Diameter တိုင်းရင်

ေရတြင်းေဘာင်တိုင်းမျှ



Maths Time!

စကၠဝိုင်းပုံေရတြင်း

(၁) ပထမ အတိုင်း = ၅ ေပ
ဒုတိယ အတိုင်း = ၁၂ ေပ
အခ်င်း = ၄ ေပ
ေရထုထည် ကို ရွာပါ

၅၆၀

(၂) ပထမ အတိုင်း = ၄ ေပ
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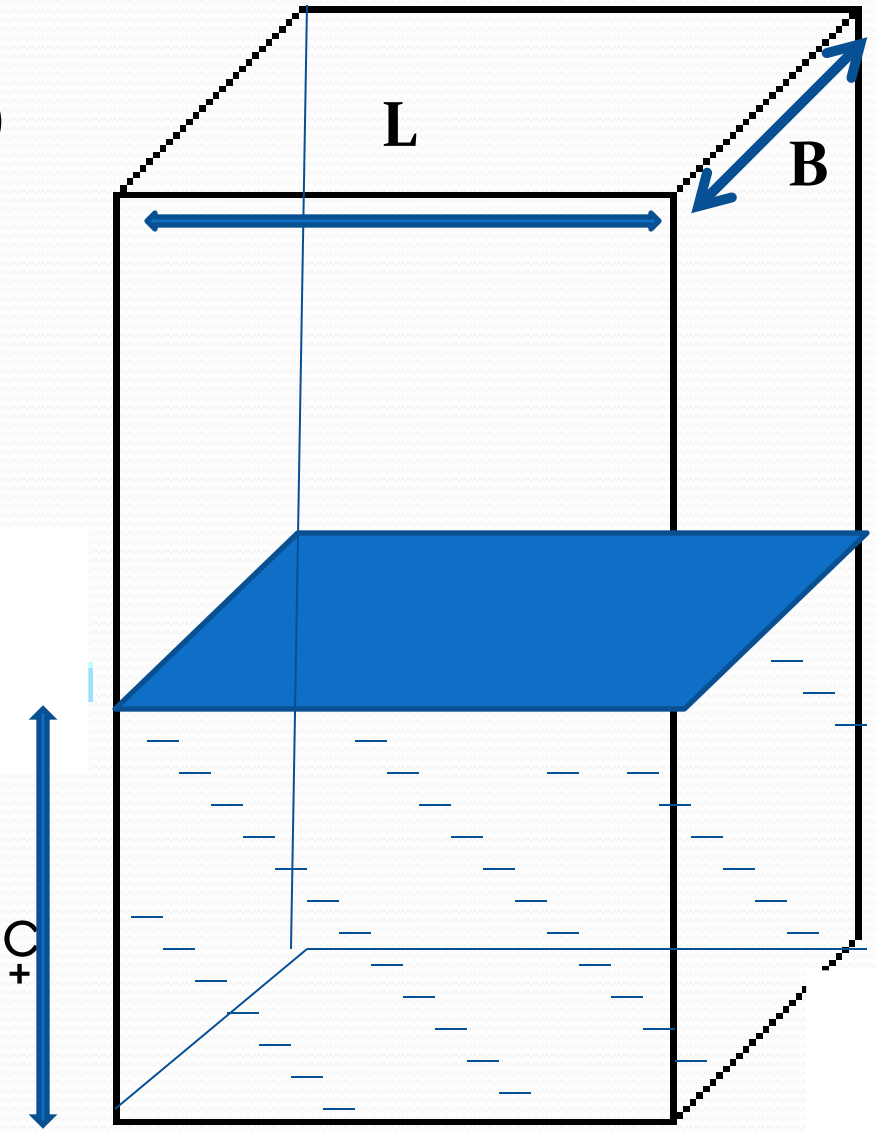
အခ်င်း = ၆ ေပ
ေရထုထည် ကို ရွာပါ

၂၁၆၀

- (b) For rectangular well:
- L x B x H x 6.25 (in gallons)
- L=10 feet
- B=5 feet
- H=10 feet
- Vol = 10*5*10*6.25
- = 3125 gallons
- အလ်ား၊ အနံတိုင်းရင် ဘာဝ ပါဆဲ့တိုင်းရန်



Maths Time!

ေလးေထာင့္ပံု ေရတြက္ျခင္း

(၁) ပထမ အတိုင္း = ၅ ေပ
ဒုတိယ အတိုင္း = ၁၂ ေပ
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အနံ = ၃ ေပ
ေရထုထည္ ကို ရွာပါ

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(၂) ပထမ အတိုင္း = ၆ ေပ
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အလ်ား = ၅ ေပ
အနံ = ၆ ေပ
ေရထုထည္ ကို ရွာပါ

၅၄.၅

If feet + inch

- 5 feet 3 inch = 5’ 3”
- 5 feet + 0.25 feet
- = 5.25 feet

12 inch → 1 feet
3 inch → ?

= 3
12

= 0.25 feet

Maths Time!

(၁) ၅ ေပ ၃ လက္မ ကို ေပ ဖြဲ႔ပါ

(၂) ၇ ေပ ၁၁ လက္မ ကို ေပ ဖြဲ႔ပါ

(၃) ၁၂ ေပ ၃ လက္မကို ေပ ဖြဲ႔ပါ

(၄) ၈ ေပ ၇ လက္မကို ေပ ဖြဲ႔ပါ

Maths Time!

- (၁) အခ်င္း ၆၀ လက္မကို ေပ ဖြဲ႔ပါ
- (၂) အနံ ၁၀၀ လက္မ ကို ေပ ဖြဲ႔ပါ
- (၃) အလ်ား ၁၅၀ လက္မကို ေပ ဖြဲ႔ပါ

Find the amount of Chlorine

- 1 oz of bleaching powder used for 1000 gals of water

(1 oz = 2g = 1 table spoon)

1000 gals -→ 1 oz of Chlorine

1800 gals → ?

$$= \frac{1 * 1800}{1000}$$

= 1.8 oz of Chlorine

= 1.8 table spoon

1 oz Cl → 2 gram

1.8 oz Cl → ?

= 2 * 1.8 = 3.6 gram

1000 gals → 1oz of chlorine

3125 gals → ?

$$= 1 * \frac{3125}{1000}$$

= 3.1 oz of chlorine

= 3.1 table spoon

1 oz Cl → 2 gram

3.1 oz Cl →?

= 2 * 3.1 = 6.2 gram

Maths Time!

(၁) ေရ ၃၀၀၀ ဂါလံ အတြက္ လိုအပ္ေသာ Chlorine oz, စားပြဲတင္ခြန္း ႏွင့္ gram ကို ရွာပါ

(၂) ေရ ၄၅၀၀ ဂါလံ အတြက္ လိုအပ္ေသာ Chlorine oz, စားပြဲတင္ခြန္း ႏွင့္ gram ကို ရွာပါ

(၃) ေရ ၆၈၀၀ ဂါလံ အတြက္ လိုအပ္ေသာ Chlorine oz, စားပြဲတင္ခြန္း ႏွင့္ gram ကို ရွာပါ

Maths Time!

(၁) အဝိုင်းပံုေရတြင်း

ပထမ အတိုင်း = ၈ ေပ ၃ လက်မ
ဒုတိယ အတိုင်း = ၁၃ ေပ ၆ လက်မ
အခ်င်း = ၅ ေပ ၇ လက်မ

လိုအပ်ေသာ Chlorine oz, စားပြဲတင်ြခန်း ုံးွင့် gram ကို
ရှာပါ

Maths Time!

(၂) အဝိုင်းပံုေရတြင်း

ပထမ အတိုင်း = ၆ ေပ ၉ လက်မ
ဒုတိယ အတိုင်း = ၁၃ ေပ ၂ လက်မ
အခ်င်း = ၅ ေပ ၄ လက်မ

လိုအပ်ေသာ Chlorine oz, စားပြဲတင်ြေန်း ုိးဝင့် gram ကို
ရှာပါ

Maths Time!

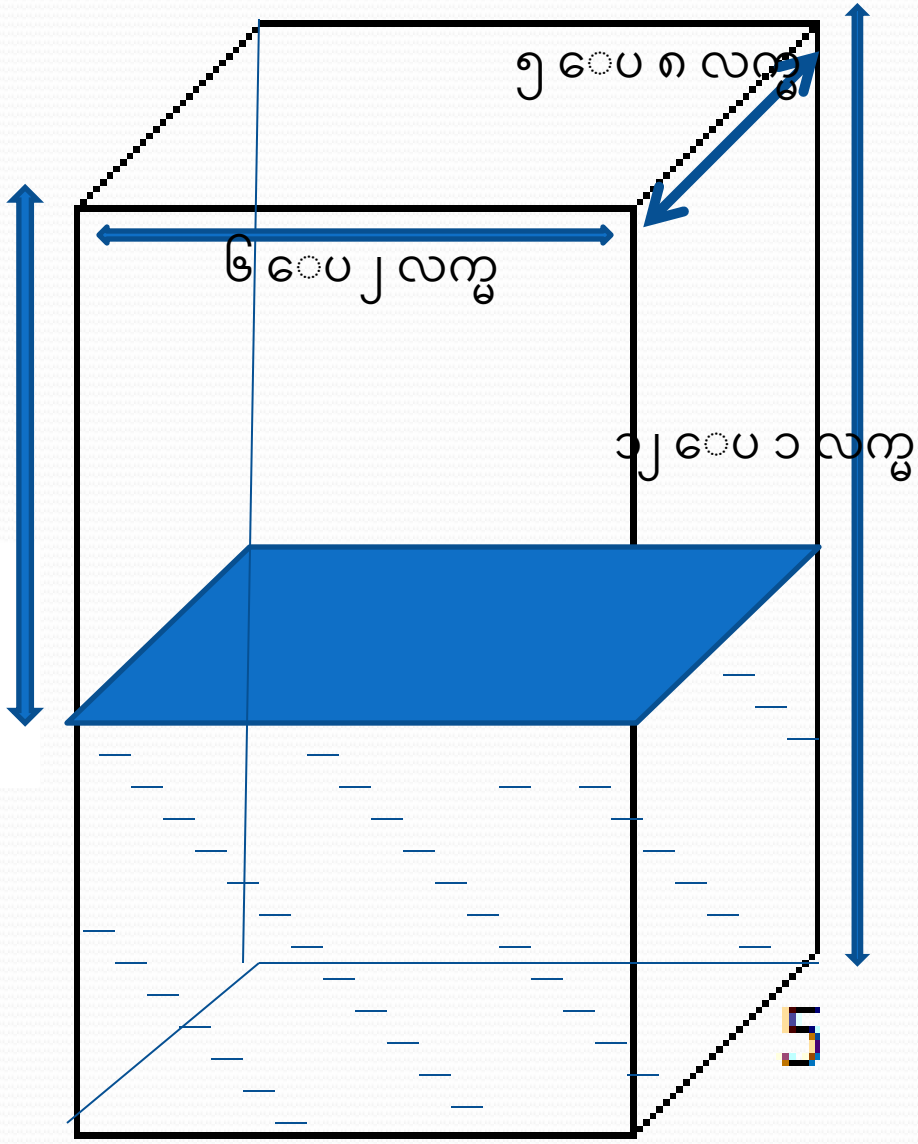
(၃) ေလးေထာင့္ပံု ေရတြင္း

ပထမ အတိုင္း = ၈ ေပ ၂ လက္မ
ဒုတိယ အတိုင္း = ၁၀ ေပ ၅ လက္မ
အလ်ား = ၄ ေပ ၁၁ လက္မ
အနံ = ၃ ေပ ၉ လက္မ

လိုအပ္ေသာ Chlorine oz, စားပြဲတင္ဆြန္း ႏွင့္ gram ကို ရွာပါ

ေလးေထာင့်ပုံ ေရကြည်း

- လိုအပ်ေသာ Chlorine
- oz, စားပြဲတင်ြခင်း
- ုံ့ gram ကို ရှာပါ



Maths Time!

(၄) ေလးေထာင့္ပံု ေရတြင္း

ပထမ အတိုင္း = ၆ ေပ ၉ လက္မ
ဒုတိယ အတိုင္း = ၁၂ ေပ ၁ လက္မ
အလ်ား = ၆ ေပ ၂ လက္မ
အနံ = ၅ ေပ ၈ လက္မ

လိုအပ္ေသာ Chlorine oz, စားပြဲတင္ဆြန္း ႏွင့္ gram ကို ရွာပါ

ညောင်ပင်သာရွာ အတွက် လိုအပ်သော Chlorine oz, gram ပမာဏကို ရှာပါ

- အဝိုင်းပုံ ရေတွင်း ၂ တွင်း

(၁) ပထမ အတိုင်း = ၈ ပေ ၃ လက်မ၊ ဒုတိယ အတိုင်း = ၁၃ ပေ ၆ လက်မ

အချင်း = ၅ ပေ ၇ လက်မ

(၂) ပထမ အတိုင်း = ၆ ပေ ၉ လက်မ၊ ဒုတိယ အတိုင်း = ၁၃ ပေ ၂ လက်မ

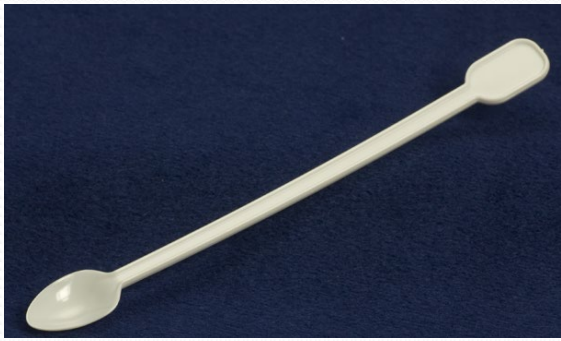
အချင်း = ၅ ပေ ၄ လက်မ

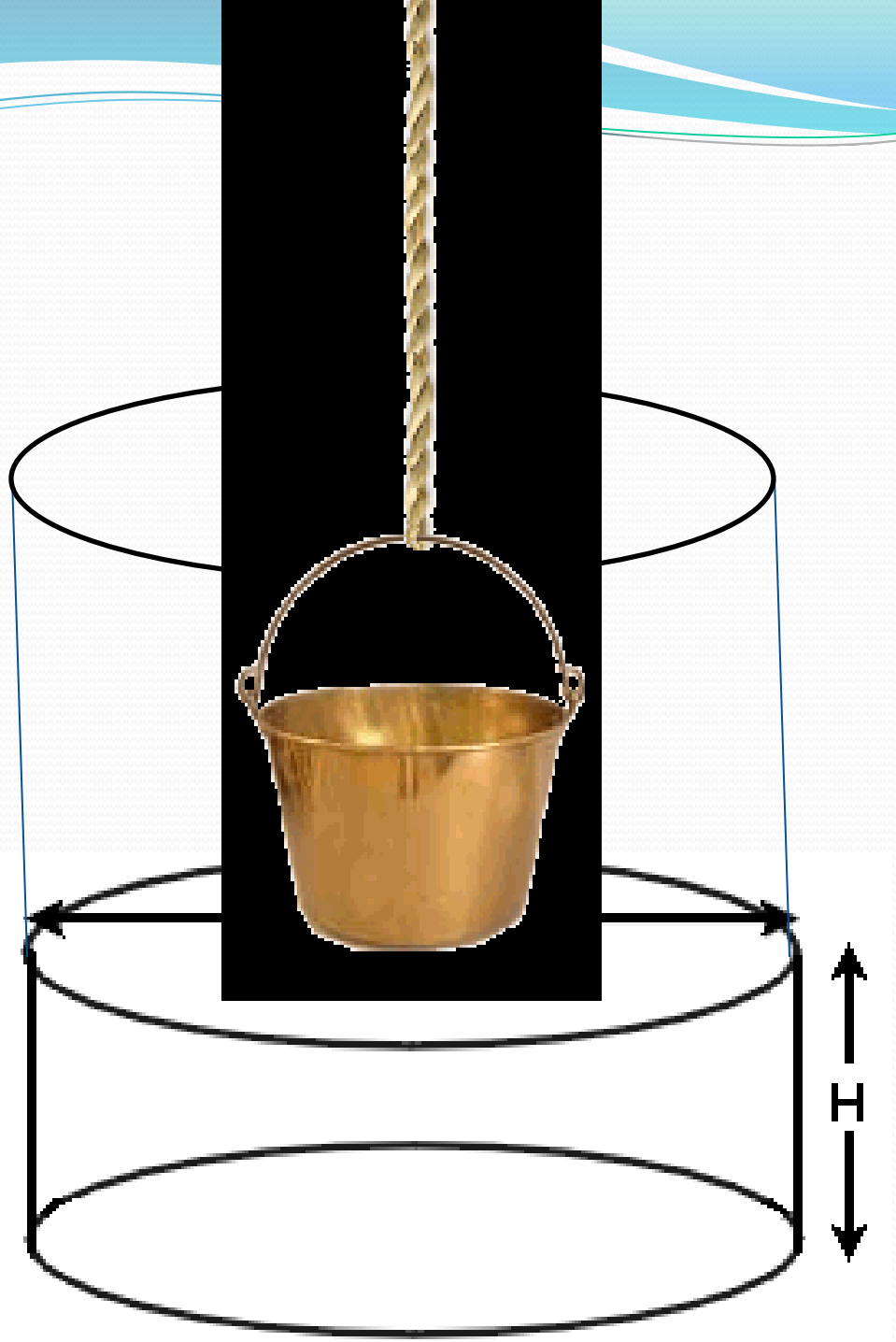
(၃) လေးထောင့်ပုံ ရေတွင်း ၁တွင်း

ပထမ အတိုင်း = ၆ ပေ ၉ လက်မ၊ ဒုတိယ အတိုင်း = ၁၂ ပေ ၁ လက်မ

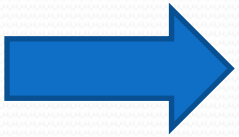
အလျား = ၆ ပေ ၂ လက်မ၊ အနံ = ၅ ပေ ၈ လက်မ

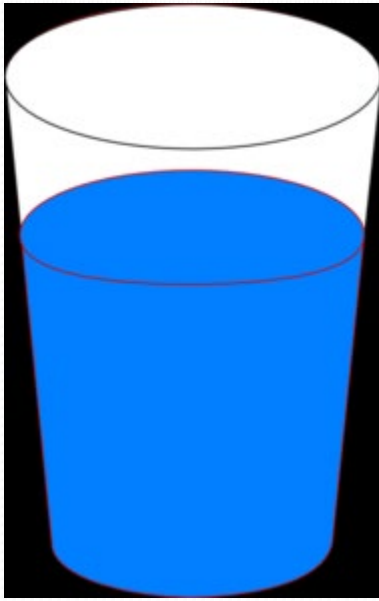

Beauty
Bleaching
Powder



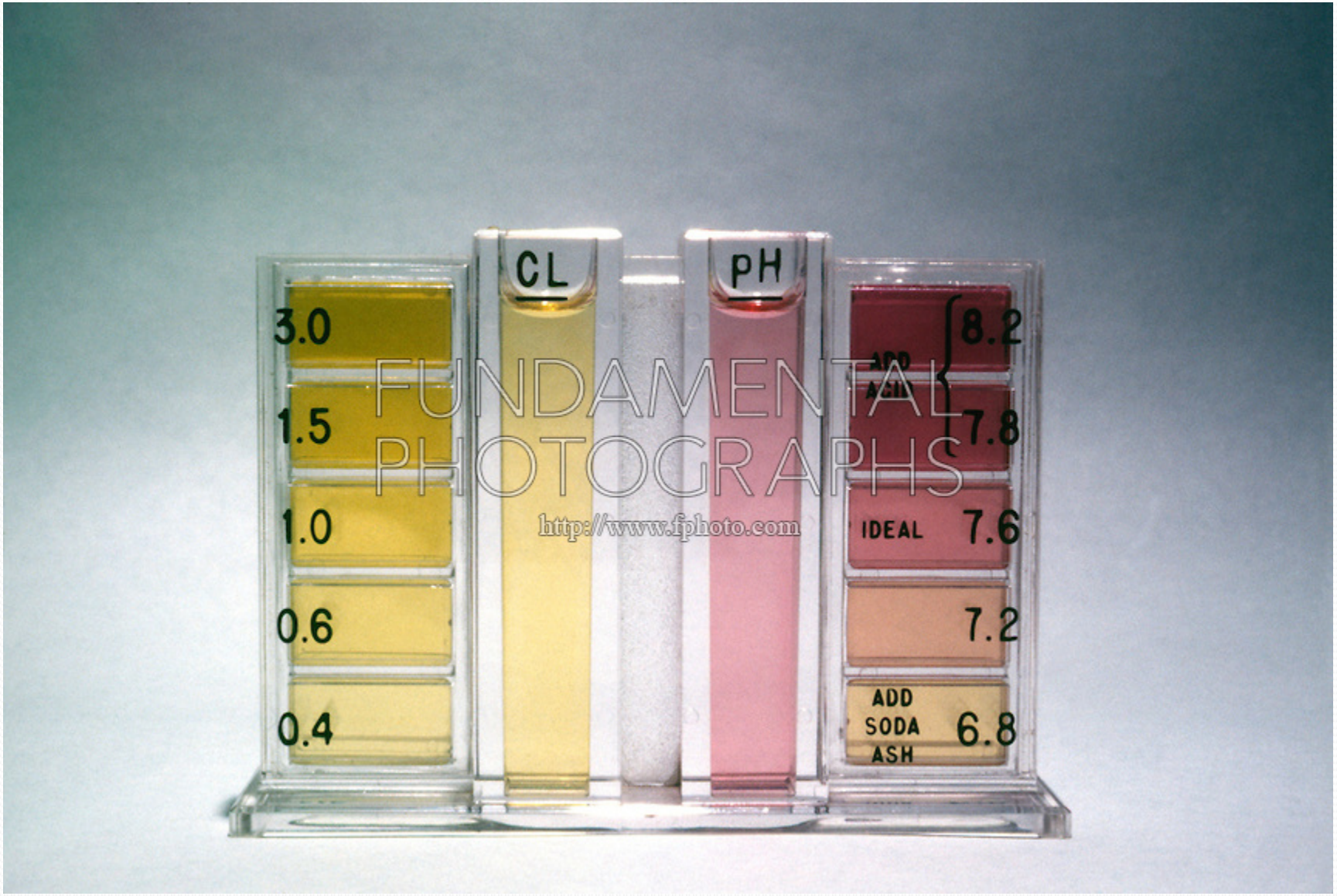

H

Test for residual chlorine

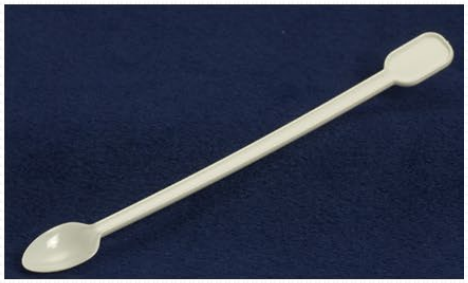




Orthotolidine Test



Household Chlorination



500 ml

Stock solution

1 Gallon

- ရေ ၁ ဂါလံကို ပင်မဖျော်ရည် လက်ဖက်ရည်ဖွန်း တစ်ဖွန်း
- (၁ဂါလံ = ၃.၆ လီတာ)
- ရေ ၂၀ လီတာကို ပင်မဖျော်ရည် မည်မျှ ထည့်ရမည်နည်း

- အိမ်ခြေ ၇၀၀ ရှိသောရွာတွင် တစ်အိမ်လျှင် ပင်မဖျော်ရည် တစ်ပုလင်း ဝေလိုပါက ကလိုရင်း မည်မျှ အောင်စ ဝယ်ရမည်နည်း

The facts which should be included in health education are as follow;

- 1. Do not pour toxic chemicals down the drain or into the toilet.
- 2. Do not pour toxic chemicals on the ground. These substances can contaminate ground water supplies in runoff.
- 3. Use phosphate free detergents and biodegradable soaps and shampoos. A biodegradable product is a product that can be broken down by living organisms into harmless and useable materials.
- 4. Let water run for at least 30 seconds when you first turn it on. Water that has stood in the pipes might have absorbed lead. Or boil water for ten minutes before drinking it if there is a chance that it might contain microorganisms.
- 5. Pump out the septic tank once a year to avoid ground water contamination.
- 6. Support community efforts to clean up rivers, lakes, and streams and to preserve wet lands.
- 7. Support local and state legislation to control water pollution.

- 8. Do not dump garbage or toxic chemicals into lakes, streams, rivers, ponds, storm sewers, or ditches.
- 9. Do not dispose of plastics, such as plastic cups and bags in water ways.
- 10.Select yard plants that require little or no fertilizer.
- 11.Plant trees and shrubs to discourage water runoff and soil erosion.
- 12.Convert yard trimmings into compost. As plant materials decay, they can be used as a soil conditioner, gradually releasing nutrients to a lawn or garden. This allows less fertilizer to be used.
- 13.Contact the public health department if water has unusual appearance, smell or taste. It could be contaminated. Do not use this water until the water is tested and pronounced safe to drink.
- 14.Follow the recommendation of the Public Health Worker.
- 15.Test drinking water for lead and arsenic if you suspect that there is lead and arsenic in water.

- Hand pumps for accessing water are generally categorized into
- a) Shallow well pump and
- (b) Deep well pumps.

- Suction and lift are important considerations when pumping fluids. Suction is the vertical distance between the fluid to be pumped and the centre of the pump, while lift is the vertical distance between the pump and the delivery point. The depth from which a hand pump will suck is limited by atmospheric pressure to an operating depth of less than 7 metres. The height to which a hand pump will lift is governed by the ability of the pump and the operator to lift the weight in the delivery pipe. Thus the same pump and operator will be able to achieve a greater lift with a smaller diameter pipe than they could with a larger diameter pipe.

ဝက် ၃ ပေ ၄ ၃ ၁၀ ပေ ၇ ၆ ထည်ကို ရှာပါ	အချင်း ၆ ပေ အနက် ၁၂ ပေ ၈ လက်မ ရေထုထည်ကို ရှာပါ	အချင်းဝက် ၄ ပေ ၅ လက်မ အနက် ၁၄ ပေ ၉ လက်မ ရေထုထည်ကို ရှာပါ
း ၃၀ လကျဲ ၀ လကျဲ ိ ၄၀ လကျဲ ုထည်ကို ရှာပါ	အလ်ား ၃၅ လကျဲ အနံ ၂၅ လကျဲ အျမင့ ၄၅ လကျဲ ေရထုထည်ကို ရှာပါ	အလ်ား ၄၀ လကျဲ အနံ ၃၅ လကျဲ အျမင့ ၅၀ လကျဲ ေရထုထည်ကို ရှာပါ