Study Guide

The Study Guide is comprised of 17 Lessons, all covering subject matter found in

"Principles of Food Sanitation" by Norman Marriott and Robert Gravani, in the three volume "Environmental Engineering" set, which includes;

"Prevention and Response to Water, Food, Soil and Airborne Disease and Illness"

"Water and Wastewater, Soil and Groundwater Treatment and Remediation"

"Environmental Health & Safety for Municipal Infrastructure, Land Use, &Planning"

And the Pool and Spa Operators Manual

Tips To Pass the R.S. Exam

The exam is comprised of 135 questions in Part I and 135 questions in Part 2 for a total of 270 questions. All questions have been constructed from questions in the lessons you will complete. By answering all questions in these 17 lessons at least one month prior to taking the exam and then reviewing the completed lessons during the two to three weeks leading up to the exam, your chances of having a passing score will be greatly improved. Trying to pull all nighters like we did in College or cramming in the days just prior to taking the exam will likely be unsuccessful. A steady pace with time to review is recommended. The lessons will lead one through the specific pages from which questions were taken.

With busy schedules, one might be enticed to use lessons that were completed by another who has taken the exam prior. This would not be to your benefit, because part of the learning process is to locate the answers in the resources listed above and writing them down.

http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470083026. html

http://www.springer.com/food+science/book/978-0-387-25025-0

Environmental Engineering: Nemerow, Agardy, Sullivan and Salvato
Prevention and Response to Water, Food, Soil, Airborne Disease and Illness
Sixth Edition

Lesson 1

Chapter 1 Disease Transmission by Contaminated Water Page: 1-72

1. **The most plentiful form of available water is groundwater (subsurface water).**

2. **Provide an example for each of the following categories of disease transmission by contaminated water:**

   Waterborne diseases- Sickness or ailment results from ingestion of water that is harboring a pathogen

   Water-washed diseases- sickness or ailment is spread by the fecal-oral route or person-to person contact and facilitated by the lack of adequate water for personal hygiene

   Water-based infections- sickness or ailment is caused by the infection arising through ingestion or a pathogenic agent (e.g., guinea worm larvae) or invasion of the body through water contact (e.g., schistosome and other termatode larvae able to penetrate the skin of individuals in contact with water).

   Water-related diseases- sickness or ailment is facilitated by insect vectors that breed in waters (e.g., malaria mosquitoes and filariasis arthropods that carry viruses responsible for dengue and yellow fever).

   Inhalation of contaminated water aerosols contaminated by a pathogenic agent. This could include Legionella pneumophila, the etiologic agent of legionellosiss and Pontiac fever.

3. **The etiologic (study of causation, or origination) agent of cyclosporiasis is Cyclospora cayetanensis.**

4. **A food associated with cyclosporiasis is raspberries and lettuce from South American countries.**

5. **Most waterborne disease fatalities occurred before 1940 and were attributed to the waterborne illness typhoid fever.**

6. **Waters suitable for drinking water supplies and shellfish rearing are monitored routinely for microbiological quality. (pg.1)**

7. **Only 2.6% of the global content of water constitutes fresh water. (pg. 2)**

8. **A waterborne disease that can be prevented through vaccinations is typhoid bacilli. (pg.8)**

9. **The World Health Organization (WHO) estimates that 80% of all diseases are attributable to inadequate water or sanitation. (pg.12)**

10. **Viral infections readily spread through drinking water, food and water-contact recreation activities due to: water contaminated by excreta. (pg.13)**

Provide information requested for each of the following water and foodborne diseases.

11. **Shigellosis:**
Specific Agent: Genus, *Shigella, i.e.,flexneri, sonnei, boydii, dysenteriae*
Reservoir: Feces of carriers and infected persons
Common Vehicle: Contaminated water or foods, milk and milk products, flies, person-to-person
Symptoms: Acute onset with diarrhea, fever, tenesmus, frequent stools containing blood and mucus
Incubation period: 1-7 days, usually less than 4 days

12. **Botulism**
Specific Agent: *Clostridium botulinum* and C. *parabotulinum* that produce toxin
Reservoir: soil, dust, fruits, vegetables, foods, mud, fish, animal and human feces
Common Vehicle: improperly processed canned and bottled foods containing the toxin, also other foods
Symptoms: gastrointestinal pain, diarrhea or constipation, prostration, difficulty in swallowing, double vision, difficulty in respiration
Incubation period: 2hrs-8days usually 12-36hr

13. **Bacillus cereus food poisoning (Emetic (vomiting) Type)**
Specific Agent: *Bacillus cereus*, toxin heat stable
Reservoir: Spores found in wide variety of cereals, spices, vegetables, and milk
Common Vehicle: boiled and fried rice
Symptoms: vomiting, diarrhea, nausea, sometimes
Incubation period: 1-6hr

14. **Bacillus cereus foodborne illness (Diarrheal Type)**
Specific Agent: *Bacillus cereus*, toxin heat liable
Reservoir: Spores found in wide variety of cereals, spices, vegetables, and milk
Common Vehicle: Inadequately refrigerated cooked foods and subsequently inadequately reheated
Symptoms: Diarrhea, cramps; vomiting sometimes
Incubation period: 6-16hr

15. **Typhoid Fever**
Specific Agent: Typhoid bacillis, *Salmonella typhi*
Reservoir: feces and urine of typhoid carrier or patient
Common vehicle: contaminated water, milk, and milk products, shellfish, and foods; flies
Symptoms: general infection characterized by continued fever, usually rose spots of trunk, diarrheal disturbances
Incubation period: average 14 days, usually 7-21 days

16. **Campylobacter enteritis**
Specific Agent: *Campylobacter jejunui*
Reservoir: Chickens, swine, dogs, cats, man, raw milk
Common vehicle: undercooked beef, chicken, also pork, raw milk, contaminated water
Symptoms: watery diarrhea, abdominal pain, fever, chills, nausea, vomiting, blood in stool
Incubation period: 1-10 days, 2-5 days average

17. **Amebiasis**
Specific Agent: *Entamoeba histolytica*
Reservoir: Bowel discharges of carrier, and infected person; possibly also rats
Common vehicle: cysts, contaminated water, foods, raw vegetables and fruits, flies, cockroaches
Symptoms: Insidious and undetermined onset, diarrhea or constipation, or neither; loss of appetite, abdominal discomfort; blood, mucus in stool
Incubation period: 5 days or longer, average 2-4 weeks

18. **Staphylococcus food poisoning**
Specific Agent: Staphylocci that produce entero-toxin, *Staphylococcus aureus*. (Toxin is stable at boiling temperature.)
Reservoir: Skin, mucous membranes, pus, dust, air sputum, and throat
Common Vehicle: Contaminated custard pastries, cooked or processed meats, poultry, dairy products, hollandaise sauce, salads, milk
Symptoms: Acute nausea, vomiting, and prostration; diarrhea, abdominal cramps. Usually explosive in nature, followed by rapid recovery of those afflicted.
Incubation period: 1-6hr or longer, average 2-4hr

19. **Cholera**
Specific Agent: *Vibrio comma*
Reservoir: Feces, vomitus; carriers
Common Vehicle: Contaminated water, raw foods, flies, shellfish
Symptoms: Diarrhea, rice-water stools, vomiting, thirst, pain, coma
Incubation period: A few hours-5 days, usually 3 days

20. **Yersiniosis**

Specific Agent: ***Yersinia enterolitica, yersinia pseudotuberculosis***
Reservoir: **Wild and domestic animals, birds, man, surface water**
Common vehicle: **Raw milk and milk products, seafood, raw and rare meats, infected food-handlers, contaminated water**
Symptoms: **Diarrhea, cramps, fever, headache, vomiting, skin rash, pseudo-appendicitis**
Incubation period: **3-7 days, usually 2-3 days**

21. **Trichinosis (Trichiniasis)**
Specific Agent: ***Trichenella spiralis***
Reservoir: **Pigs, bears, wild boars, rats, foxes, wolves**
Common Vehicle: **Infected pork and pork products, bear and wild boar meat**
Symptoms: **Nausea, vomiting, diarrhea, muscle pain, swelling of face and eyelids, difficulty in swallowing**
Incubation period: **2-28 days, usually 9 days**

22. **Cryptospordiosis**
Specific Agent: ***Cryptospordium*** **spp**
Reservoir: **Farm animals, man, fowl, cats, dogs, mice**
Common Vehicle: **Contaminated water, food, fecal-oral, person-to-person**
Symptoms: **Mild fluid like symptoms, diarrhea, vomiting, nausea, stomach pain**
Incubation period: **2-21 days, average 2-10 days**

23. **Clostridium perfringins food poisoning**
Specific Agent: ***Clostridium perfringens*** **(C. welchi), a sporeformer. (Certain spores and resistant.)**
Reservoir: **Soil, gastrointestinal tract of man and animals, cattle, poultry, pigs, vermin, and wastes**
Common Vehicle: **Contaminated food, inadequately heated meats, including roasts, stews, beef, poultry, gravies, improperly held or cooled food**
Symptoms: **Sudden abdominal pain, then diarrhea and nausea Ingestion of large numbers of vegetative cells that grow in intestine and form spores. Cast off cell releases toxin causing symptoms.**
Incubation period: **8-22hr, usually 10-12hr**

24. **Giardiasis**
Specific Agent: ***Giardia lamblia***
Reservoir: **Bowel discharges of carrier and infected persons; dog, beaver**
Common Vehicle: **Cysts, contaminated water, food, raw fruits; also hand-to-mouth route**
Symptoms: **Prolonged diarrhea, abdominal cramps, severe weight loss, fatigue, nausea, gas; fever is unusual**
Incubation period: **6-22 days, average 9 days**

25. **Listeriosis**

Specific Agent: ***Listeria monocytogenes***
Reservoir: **Goats, cattle, man, fowl, soil, water, sewage**
Common Vehicle: **Raw milk, contaminated pasteurized milk and milk products, contaminated vegetables**
Symptoms: **Fever, headache, nausea, vomiting, meningeal symptoms**
Incubation period: **Probably a few days-3 weeks**

26. **Scombroid fish poisoning**
Specific Agent: **Scrombrotoxin (histamine like toxin)**
Reservoir: **Scrombridea family primarily tuna, bluefish, amberjack**
Common Vehicle: **Fish that have been held at room temperature forming toxic histamine in muscle**
Symptoms: **Headache, burning mouth, nausea, vomiting, diarrhea, tingling of fingers, fever, cramps**
Incubation period: **Several minutes to 1hr**

Prevention and Response to Water, Food, Soil, Airborne Disease and Illness
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Lesson 2
Chapter 1 Historical Waterborne Disease Background Page 45-58

1. **Prior to the 19th Century, civilization regarded the onset of infections being caused by foul air, commonly called miasma. (pg. 45)**

2. **Diseases such as typhus, cholera, typhoid, and dysentery were common in Europe, the United States, and other parts of the world prior to the 20th century. (pg.45)**

3. **Who was John Snow and what was his role in the cholera epidemic of 1849 and 1854? (pg.45)**
   John Snow investigated two epidemics in London in the years 1849 and 1853. Snow came to believe that feces of cholera patients were the source of the disease. Snow noted that the Broad Street well served an area where 616 people had died.

4. **What role did Robert Koch play in the study of cholera in the 1880s? (pg. 47)**
   Robert Koch isolated and cultured the organisms from the stools of advanced cholera patients. Koch isolated *Vibrio cholera* from the polluted Elbe River, providing relationship between polluted water and disease.

5. **Water treatment, specifically the application of disinfectant, has practically eliminated many of the traditional waterborne diseases in developed countries, However waterborne diseases such as; infectious hepatitis A, giardiasis, and cryptosporidiosis still occur.**

6. **Waterborne diseases in the U.S. occur more frequently in non community water systems.**

7. **Drinking water contaminated with sewage is the principle cause of waterborne diseases.**

8. **Cryptosporidium oocysts can survive in surface water at 39F (4 ^{0}C) for 18+ months.(pg. 51)**

9. **What are the six barriers of a multiple barrier plan of water treatment to ensure the safety of the consumer? (pg. 56)**
   1. **Source water protection**
   2. **Water treatment plant processes**
   3. **Disinfection practices**
   4. **Distribution systems**
   5. **Security**
   6. **Education**

10. **What do security concerns of a water treatment system take into account?**

Security involves the physical watch on the treatment system against the possibility of unlawful entry, with the intent to disrupt or compromise treatment operations and goal of producing quality water. (pg. 56)

11. What are the EPA recommendations for a minimum state regulatory program regarding the surveillance of a public water supply? (pg. 57)
The surveillance of public water-supply systems should involve water quality sampling—bacteriological, chemical, and radiological, also turbidity and residual chlorine; supervision of operation and maintenance, and use of approved state, utility, and private laboratory services; cross connection control; and bottled and bulk water safety.

12. What is involved in the security of water treatment facilities? (pg. 56)
Security involves the physical watch on the treatment system against the possibility of unlawful entry, with the intent to disrupt or compromise treatment operations and goal of producing quality water.

13. Schistosomiasis is largely endemic to Africa, Asia, and South America. (pg. 58)

14. Schistosomiasis is spread by freshwater snails. (pg.58)

15. It is estimated that there are more than 300 million cases or more annually of schistosomiasis and the number is expected to increase. (pg.58)

According to these readings, define or describe the meaning of the following terms:

16. **Bioterrorism- A disruptive and health-threatening event directed at an individual, group of individuals, a community, or at-large population within a nation and is facilitated by the intentional release of a highly virulent biological agent. (pg.59)**

17. **Biologic Agent- includes a microorganism or a biologically synthesized toxin that causes disease in man, plants, or animals or causes deterioration of materials. (pg.59)**

18. **Describe some of the earliest attempts of bioterrorism in the 14th, 15th and 18th centuries. (pg. 59)**
Scythian warriors coated the tips of their arrows with human feces as a means of infecting their enemies. This is the testimony to the very early suspicions about the noxious properties of excreta. In 1346, the Mongols used catapults to hurl the corpses of their dead soldiers, riddled with plague, over the walls in Kaffa, currently Theodosia. The practice of spreading infectious disease of exposure to the dead continued in the siege.

19. **The selection of an agent to be used in an act of terrorism should satisfy seven properties. What are they? (pg. 59)**
    1. **Be readily available**
    2. **Be easy to produce on large scale**
    3. **Be highly virulent for lethal or incapacitation purposes**
    4. **Be of appropriate size for distribution of aerosolization and uptake by victims (penetrate defense mechanisms of the upper respiratory tract)**
    5. **Be easy to disseminate by available means**
    6. **Be environmentally stable**
    7. **Be dispersible in a way that targeted individuals, but not the terrorists, suffer intended effects.**

20. **Explain the difference between a Category A, B, and C Agents as it relates to bioterrorism. (pg. 59)**
Category A: High level of priority for preparedness
Category B: Need for improved awareness, surveillance measures, and laboratory diagnosis
Category C: Need for continued review of potential threat to the public

21. **List three Category A Agents (pg. 60)**
    1. **Variola Virus**
    2. ***Clostridium botulinum* toxin**
    3. **Ebola Virus**

22. **List three Category B Agents (pg. 60)**

1. ***Brucella* species**
2. **Eastern equine encephalitis virus**
3. ***Coxielle burnetti***

23. List three Category C Agents (pg. 60)

1. **Tickborne encephalitis viruses**
2. **Hantavirus**
3. **Yellow Fever**

24. Discuss the possibility of smallpox as a viable bioterrorism tool. (pg.62)

The possibility of a smallpox as a viable bioterrorism tool is slim to none since the disease is now globally nonexistent.

Prevention and Response to Water, Food, Soil, Airborne Disease and Illness
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Lesson 3
Chapter 2 Page 99-137

1. **Define Communicable Disease and describe how communicable diseases are transmitted. (pg. 99)**
   Communicable diseases are illnesses due to a specific infectious agent or its toxic products. They arise through transmission of that agent or its products from an infected person, animal, or inanimate reservoir to a susceptible host, either directly or indirectly through an intermediate plant or animal host, vector, or the inanimate environment.

2. **List five core health problems of developing countries. (pg.99)**
   The communicable diseases (malaria, yellow fever, pneumonia, human immunodeficiency virus (HIV), tuberculosis, cholera, schistosomiasis, measles, onchocerciasis, intestinal parasites, and diarrheal diseases) and malnutrition have traditionally been considered the core health problems of developing countries, many of which are aggravated by contaminated drinking water, unhygienic housing, and poor sanitation.

3. **What are three factors that make developing countries susceptible to illnesses listed in the above question? (pg.99)**
   Contaminated drinking water, unhygienic housing, and poor sanitation.

4. **When a country shifts from infectious disease mortality to chronic disease mortality, the country is said to have undergone an epidemiologic transition.**

5. **To an epidemiologist, the term environment has a different meaning than what the general public might define it as. To an epidemiologist, the term refers to everything that humans encounter: everything that is eaten, drunk, and smoked; drugs, medicine, and occupational exposures; and air, water, and soil. In this context it means everything outside the body as distinct from a person's genetics. The aggregate of all the external conditions and influences affecting the life and development of humans. Included are the air, water, land, and climate and the interrelationship that exists between them and all living things. (pg.100)**

6. **How can the availability of clean water and better nutrition decrease morbidity and mortality rates? (pg. 105)**
   The ready availability of clean water can not only greatly reduce gastrointestinal diseases but also promote personal hygiene and cleanliness, prevent impetigo, reduce stress, and save time. Better nutrition can reduce mortality due to obesity, diabetes, and cardiovascular disease, but it would also improve resistance to certain infectious disease, reduce birth defects, stunted physical growth, and subtle cognitive deficits, leading to a greater earning potential at the individual level and more productivity and economic security at the population level.
7. **What are the goals of environmental health programs? (List 4) (pg. 106)**

Prevention of disease, disability, and premature deaths and the maintenance of an environment that is suited to humanity's efficient performance and preservation of comfort and enjoyment living today and in the future. The goal is not only the prevention of communicable disease but also non communicable disease, the chronic and acute illnesses, and the hazard to life and health.

8. Analyzing the Epidemiologic Triangle, what are the three factors that influence disease transmission? (pg. 107)
   Agent, environment, and host.

9. Give one example of each of these Epidemiologic triangle factors.
   Host factors include genetic and behavioral susceptibility. The agent is the infectious organism. The environment is the setting in which the interaction occurs and includes the social as well as the biological environment. (pg.107)

10. The only infectious disease to be eradicated by humans is smallpox. (pg. 112)

11. Define herd immunity:
    The higher the rates of immunity in the population, the lower the chances that a newly introduced infectious disease will infect enough people for the pathogen to be able to become endemic. (pg. 113)

12. Arthropods involved in the transmission of human and animal disease are called vectors. (pg.113)

13. The reservoir is the source of infection which is often non human animal.

14. List 3 control measures for eliminating or reducing the incidence of insectborne diseases.
    To eliminate or reduce the incidence of insectborne disease, it is necessary to control the environment and reservoirs and the vectors.

15. What is a nosocomial transmission (disease) and give an example from the text relating to sinks.
    A nosocomial disease is the spread of an infectious disease within a health care setting. The shapes of sinks in hospitals have been linked to the transmission of *Pseudomonas aeruginosa*, a severe respiratory infection, often resistant to drugs, and preferentially infect hospitalized patients. (pg.115)

16. What is the agent of West Nile Virus, what is the disease it causes and what species of mosquito is the vector?
    Flavivirus is the agent that causes West Nile Virus, the virus causes encephalitis in susceptible individuals. It is spread by the *Culex* mosquitoes, and is usually not spread from person to person. (pg. 117)

17. Match the Description to the Disease: (Insert corresponding letter to each disease in the blank.)

Rocky Mountain Spotted Fever: The reservoirs include dog ticks, wood tick, and the lone star tick. The etiologic Agent is Rickettsia rickettsii and it is transmitted by the bite or crushed tick blood with an incubation of 3-10 days.

Bubonic Plague: Is transmitted by the bite of an infective flea, X. cheopis, with rodents being the other reservoir being wild rodents. The etiologic agent is Pasteurella pestis and Yersinia pestis.

Trypanosomiasis, African (sleeping sickness): Transmitted by the bite of infected tsetse flies, the reservoir of this agent includes humans, wild game and cattle.

Colorado Tick Fever: Transmitted by the bite of an infected tick (Dermacentor andersoni). Symptoms occur usually four to five days after being bitten. The agent is a virus.

Tularemia: The reservoirs are rabbits, muskrats, and other wild animals. The agent is transmitted by the bite of infected flies or ticks or ingesting undercooked rabbit meat.

Filaris (elephantiasis after prolonged exposure) Caused by nematode worms, this disease is transmitted by the bite of a mosquito; Culex, Aedes, and Anopheles species with the reservoir being blood from the person harboring the agent.

Dengue Fever Also known as breakbone fever, this viral disease is transmitted by the bite of infected Aedes aegypti and A. albopictus.

Psittacosis (ornithosis): The etiologic agent's reservoirs include; infected parrots, parakeets, love birds and other birds. The disease is contracted through contact with infected birds or inhalation of their desiccated waste and the incubation is 4-15 days.

Myiasis: Fly infestation of humans and vertebrate animal tissue with fly larvae transmits this etiologic agent commonly known as the screwworm.

18. Nearly 40% of the world's population lives in regions at risk of contracting the vectorborne disease malaria and the WHO estimates over 500 million cases annually. (pg. 125)

19. Describe the following as it relates to Malaria: (pg. 126)

Etiologic agent- ***Plasmodium vivax, P. malariae, P. falciparum, P. ovale***
The Reservoir- Humans and infected mosquitoes, found between 45 N and 45 S latitude and where average summer temperature is above 70F or the average winter temperature is above 48F or the average winter temperature is 48F
How it is transmitted- Bite of certain species of infected mosquitoes (anopheles) and injection or transfusion of blood of infected person
Incubation period and symptoms-Average of 12 days for falciparum, 14 for vivax, 30 for malariae; sometimes delayed for 8-10 months. Symptoms are fever, headache, chills, and vomiting.
Environmental factors- Environmental factors directly influence malaria transmission. These include rainfall patterns, proximity of mosquito breeding sites to human settlements, the distribution and biting patterns of mosquito species, and mass application of commercial poisons. Changes in weather and climate, as well as natural disasters, can lead to outbreaks of malaria.

20. Describe the following as it relates to
Plague: (pg. 127)
Etiologic agent- ***Pasteurella pestis,*** **plague bacillus** ***(yersinia pestis)***
The Reservoir-Wild rodents and infected fleas.
How it is transmitted- Bite of infective flea X, cheopis, scratching feces into skin, handling wild animals, occasionally bedbug and human flea; pneumonic plague spread person to person
Incubation period and symptoms- 2-6 days. Patients with bubonic plague have one or more enlarged, tender, regional lymph nodes, often auxiliary or inguinal. Septicemia plague may be primary when the bacteria invade and multiply in the blood stream in the absence of apparent bubo, or may occur secondary to bubonic plague. Patients with pneumonic plague can have dyspnea, chest pain, and a cough that can produce bloody sputum.
Environmental factors- Most plague exposures occur in or around the home. Plague can be prevented by year-round rodent control, including rodent proofing structures, elimination of food sources such as pet food and garbage, and removal of sources of rodent harborage. Dogs and cats should be kept free of fleas and pets should be restricted from wandering.

21. Define zoonoses and discuss its prevalence in today's world.
Zoonoses are infections that are transmitted from animals to humans. Many vectorborne diseases are also capable of infecting other animals, with differing levels of severity. (pg. 127)

22. Describe the following at it relates to
Rabies (pg, 129-131)

Etiologic agent- Virus of rabies
The Reservoir- Infected dogs, foxes, cats, squirrels, cattle, horses, swine, goats, wolves, bats, skunks, wild and domestic animals
How it is transmitted- Bite of a rabid animal or its saliva on scratch or wound
Symptoms of a rabid dog- A rabid animal may be furious or it may be listless; it may salivate heavily or have spasms, paralysis, and a hung jaw, depending on the form of the disease.
Prevalence and Mortality Rates- One human case was reported to the CDC in 2001, and five in the previous year. Rabies virus is the only known infection to cause 100% mortality in humans.

23. Also known as woolsorter's disease, anthrax, malignant pustule, and chrabon is an infectious disease principally of cattle, swine, sheep and horses. (pg. 129)

24. In 2001, anthrax, in a purified spore form was implicated in an intentional release/terrorism event that resulted in deaths in five U.S. states. (pg, 129)

25. What actions should be taken in the possible event of a dog bite of a suspect animal?
The animal should be caged or tied up with a strong chain and isolated for 10 days. An animal suspected of being rabid that has not been vaccinated will have to be confined for four months or be killed. A dog or cat bitten by or exposed to a rabid animal should be confined for 6 months and vaccinated 1 month before release or be destroyed.

1. **Describe the history of bioterrorism and biological warfare and some examples.**
   There have been numerous cases of bioterrorism for instance the 2001 letters contain anthrax spores leading to 5 deaths. Both bioterrorism and biological warfare have a long history. Agents that are most likely to be used as lethal weapons- Agent A- agents include anthrax, smallpox, botulism, plague, tularemia and ebola and lassa virus. (pg. 142)

2. **If smallpox has been eradicated, why is the world still concerned with its use in a terroristic plot?**
   There are still remaining stocks of smallpox held in the United States and Russia, the destruction of the smallpox has been delayed, raising the possibility of their misappropriation and use as weapons. (pg. 142)

3. **How is anthrax contracted, what is the fatality rate?**
   Inhalation of anthrax spores is fatal in approximately 75% of untreated patients. (pg.143)

4. **With more than 2 million recognized chemical compounds and hundreds of new ones being introduced each year, there is a concern that we know so little about their affects on human health. Harmison views chemicals as falling into one of four categories. List each and include 4 to five examples of each category. (pg.145)**
   1. **Halogenated hydrocarbons and other organics; polychlorinated biphenyls (PCBs); chlorinated organic pesticides such as DDT, Kepone, Mirex, and endrin; polybromited biphenyls (PBBs); fluorocarbons; chloroform;and vinyl chloride. These chemicals are persistent, often accumulated in food organisms, and may, in small quantities cause cancer, nervous system disorders, and toxic reactions.**
   2. **Heavy metals: lead, mercury, cadmium, barium, nickel, vanadium, selenium, and beryllium. These metals do not degrade; they are very toxic and may build up in exposed vegetation, animals, fish and shellfish.**
   3. **Nonmetallic inorganic: arsenic and asbestos, for example, are carcinogens.**
   4. **Biological contaminants such as aflatoxins and pathogenic microorganisms; animal and human drugs such as diethylstilbestrol (DES) and other synthetic hormones; and food additives such as red dye No. 2.**

5. **Give three measures that can be taken to prevent and control environmental pollutants. (pg.146)**

1. ***Eliminate or control the pollutant at the source.*** **Minimize or prevent production and sale; substitute nontoxic or less toxic chemical; materials and process control and changes; recover and reuse; waste treatment, separation, concentration, incineration, detoxification and neutralization.**
2. ***Intercept the travel or transmission of the pollutant.*** **Control air and water pollution and prevent leachate travel.**
3. ***Protect humans to eliminate or minimize the effects of the pollutant.*** **This includes water treatment, air conditioning, land-use planning and occupational protection.**

6. Lead is a cumulative poison ending up in the body's bones, blood, and tissue. (pg. 151)

7. Lead is not easily excreted from the body of children; therefore children may experience afflictions such as: Mental retardation, blindness, chronic kidney diseases, fatigue, anemia, gastroenteritis, muscular paralysis, behavioral changes, high blood pressure, birth defects, and other impairments. (pg. 151)

8. What precautions must one take when removing lead based paint to protect children, adults and the workers during mitigation?
A heat gun is preferred. Precautions include enclosure of the work area to prevent spread of the dust to other apartments or public areas; protection of furnishings and clothing in the apartments; worker protection, including proper respirator and clothing; complete dust removal and collection using a vacuum with a high efficiency particle air filter; and proper disposal of the dust and debris, all in accordance with building code, the department of Housing and Urban development (HUD), the EPA, and related regulations. (pg.152)

9. What year was lead banned from being used in paint 1978 in the manufacture of cans, 1991 in gasoline 1995. (pg. 152)

10. What has been the result of the ban on lead in such items above?
The number of children with potentially harmful levels of lead in the blood has dropped by 85% in the last 20 years.

11. How do adults differ from children in the absorption of lead ingested?
Children 2 to 3 years old absorb 30 to 75% of their lead from ingesting substances, as compared to 11% for adults. Adults excrete up to 95% of ingested lead, whereas children may absorb half of it. (pg. 152)

12. List five sources of lead other than those mentioned in question 4.
Lead fumes and ashes produced in battery repair and burning lead battery casings, inadequately ventilated indoor firing ranges, emissions from industrial processes, soft corrosive water standing and flowing in lead pipe, pipe with lead soldered joints, some bronze and brass faucets, and chrome plated fixtures; natural added lead in food and drink lead in dust and soil.

13. What blood lead level is considered potentially harmful to children?
The CDC guideline for blood lead level has been lowered to ten micrometers/dl. (pg. 154)

14. The FDA has set a limit of 7.0 ppm lead lechate for ceramics used for liquids in food service dishes. (pg. 153)

Carbon Monoxide Page 166-168

15. Why is carbon monoxide sometimes confused with foodborne illness?

Carbon monoxide poisoning is sometimes confused with food poisoning as nausea and vomiting are common to both. (pg. 154)

16. What symptoms differentiate it from food borne illnesses?
    In carbon monoxide poisoning, the additional symptoms include headache, drowsiness, dizziness, flushed complexion, and general weakness, and carbon monoxide is found in the blood. (pg. 154)

17. Explain the physiologic affect of carbon monoxide on the human body?
    Excessive exposure results in reduced oxygen availability to the heart, brain and muscles leading to weakness, loss of consciousness, and possible death. Persons with cardiovascular disease are very sensitive to carbon monoxide in low concentrations. (pg.154)

18. Carbon monoxide gas has a distinctive odor and taste. True or False?
    False (pg. 154)

19. What are some of the more common causes of carbon monoxide poisoning?
    Motor vehicle exhaust is the principle source of carbon monoxide air pollution. Room space heaters are a major potential hazard indoors and cigarette smoke is also a significant source of carbon monoxide. (pg. 154)

20. What levels of CO can cause headaches?
    Carbon monoxide levels of 200 to 400ppm may cause headache. (pg.155)

21. What levels of CO can lead to unconsciousness?
    Levels of 800-1600ppm can cause unconsciousness. (pg. 155)

Mercury Poisoning Page 155-157

1. What foods are associated with mercury poisoning?
   Mercury poisoning in humans has been associated with the consumption of methylmercury-contaminated fish, shellfish, bread, and pork and, in wildlife, through the consumption of contaminated seed.

2. The form of mercury found in fish has been found to be practically all Methylmercury . pg. 156)

3. A whole-blood level above 20 ppm may pose a mercury poisoning hazard. (pg. 155)

DEFINITIONS: Page 165-169

4. Endemic- The constant presence of a disease or infectious agent within a given geographic area; may also refer to the usual prevalence of a given disease within such area. *Hyperendemic* expresses a persistent intense transmission and *holoendemic* a high level of infection, beginning early in life and affecting most of the population (e.g. malaria in some places) (pg. 166)

5. **Epidemic/Outback-The occurrence in a community or region of cases of an illness in excess of what would be expected during the same time period. The number of cases indicating the presence of an epidemic will vary according to the infectious agent, size and type of population exposed, previous experience or lack of exposure to the disease and time and place of occurrence; epidemicity is thus relative to usual frequency of disease in the same area, among the specified population, at the same season of the year. A single case of a communicable disease long absent from a population or the first invasion by a disease not previously recognized in that area requires immediate reporting and epidemiological investigation; two cases of such a disease associated in time and place are sufficient evidence of transmission to be considered an epidemic. The terms outbreak and epidemic can technically be used interchangeably; however, the public perception of the latter is more dramatic.**

6. **Pathogen- an infectious agent capable of causing disease.**

7. **Teratogen- an agent (radiation, virus, drug, chemical) that acts during pregnancy to produce a physical or functional defect in the developing offspring- Substances that have cause defects are methylmercury and thalidomine. Some environmental pollutants may be both carcinogenic and teratogenic.**

Residential and Institutional Environment Starting on Page 83
Lesson 5

1. **The World Health Organization's definition of housing is the physical structure that man uses for shelter and the environs of that structure including all necessary services, facilities, equipment and devices needed or desired for the physical and mental health and social well-being of the family and individual. (pg.83)**

2. **Substandard housing is said to exist when there are 1.51 or more persons per room in a dwelling unit, when the dwelling unit has no private bath or is dilapidated, or when the dwelling unit has no running water. (pg.84)**

3. **To "blight" is to prevent the growth and fertility of; hence to ruin; frustrate. A blighted area is an area of no growth in which buildings are permanently deteriorated. (pg.84)**

4. **According to a 1974 housing survey, what common problems in the late 1940s had almost been eliminated?**
   Lack of plumbing, leaking roofs, inadequate heating, and generally bad housing repair. (pg.86)

Backflow Prevention: Page 134-137

5. **The best way to eliminate the danger of a plumbing backflow is to terminate the water inlet or faucet a distance above the flood-level rim of the fixture. This distance, referred to as the air gap, is one inch for a 0.5 inch or smaller diameter faucet or inlet pipe and two inches for a 1 inch diameter pipe.**

6. **What are some installation guidelines for vacuum breakers?**
   Generally attatched to sill cocks and, in turn, are connected to hose supplied outlets such as garden hoses, slop sink hoses, and spray outlets. A spring on top of the disc and float assembly, two added gate valves, test cocks, and an additional first check make possible its utilization under constant pressure. They must be installed vertically, must not have shutoffs downstream, and must be installed at least 6in. higher than the final outlet. (pg. 136)

Indoor Air Quality: Page 137-154

7. **List four recently utilized energy saving techniques that resulted in an increase in the concentration of indoor air pollutants in our homes.**
   Improved building construction and insulation, including weather stripping, caulking, and storm and thermopane windows reduce infiltration and air exchange which results in less air dilution and an increase in the concentration of indoor air pollution. (pg.137)
8. **Good indoor air quality practices dictate that at least 33.3 % of the re-circulated air should be clean fresh air. (pg.137)**

9. Photocopying machines emit ozone into our indoor air we breathe. (pg.138)

10. The U.S. National Ambient Air Quality Standards (NAAQS) guidelines sets the limits of carbon monoxide exposure at 9 ppm for 8 hours and 35 ppm for one hour.(pg.139)

11. What is radon and from where does it originate?
Radon is an odorless, colorless, and tasteless chemically inert radioactive gas released in the decay or radium from uranium in most soils and rocks. It is found naturally in soil gas, underground water, and outdoor air. (pg.142)

12. Radon has a half-life of 3.8 days and is primarily emitting alpha decay products. (pg. 142)

13. The EPA has set a guideline limit of 4pCi/l per 24 hours for radon in our homes. (pg.142)

14. The EPA estimates 20 million homes exceed the aforementioned radon level limits. (pg. 142)

15. The major health problem associated with excessive radon exposure over a period of years is it can cause lung cancer. (pg. 142)

16. List five potential entry sources of indoor radon from the soil into our homes.
Major potential entry sources of indoor radon from soil are cracks in dwelling concrete floor slabs and basement walls; pores and cracks in concrete blocks, mortar joints, and floor-wall joints; spaces behind brick veneer walls that rest on uncapped hollow-block foundations; floor drains; footing drains; and exposed soil in the bottom drainage sumps. (pg.142)

17. What are some measures that can be taken to reduce radon contamination levels in an existing dwelling?
Radon contamination in an existing dwelling, if it is a problem, can be reduced by preventing its entry or by removing the radon. It can be reduced by closing and caulking all cracks, joints, and opening of the structure in the basement or in contact with the ground, or in flooring above the crawl space, and by tightly covering open drains and sumps. (pg. `143)

18. List five sources of formaldehyde in our home's indoor air.
Sources of formaldehyde are resins and glues to bond particle board and plywood, urea-formaldehyde foam insulation, permanent press fabric, embalming fluid, drugs, disinfectants, and cosmetics as well as chemicals used in pathology and anatomy laboratories and in the manufacture of automobiles, furniture, paper, and electrical equipment. (pg. 144)

19. Formaldehyde exposure levels of 1.0 to 5.0 ppm can cause symptoms such as Burning of the eyes, tearing, and general irritation of the upper respiratory passages, levels of 0.3 to 2.7 ppm has been found to cause people distrubed

sleep and to be irritating. Exposure of 10 to 20ppm may produce coughing, tightening in the chest, a sense of pressure in the head, and palpations. (pg.144)

20. Based on animal studies, PCBs are considered "probable" human carcinogens. (pg.145)

21. Possible major exposure routes to PCBs are inhalation when electrical transformers and other equipment containing PCBs are ruptured or burned, breathing PCBs contaminated air or skin contact in the work environment, the ingestions of food (fish) or drinking water containing PCBs, and spill or illegal dumping of fluid containing PCBs. (pg.145)

22. Typical chimney conditions apt to result in dangerous back-drafts, such as chimney placement, can be prevented by assuring a minimum clearance of 2 feet above the highest point of the roof line.(pg.152)

Institution Sanitation: Page 155-169

23. A noscomial infection is a hospital acquired infections resulting in additional morbidity, mortality, and cost pointing to the need for greater infection surveillance and control.

24. It has been estimated that 5% of patients admitted to hospitals incur infections during their stay annually. (pg.156)

25. Hospital acquired infection rates are highest in large teaching type hospitals and lowest in non-teaching hospitals.

26. The infection rate is highest on the surgical service floor followed by medicine, gynecology, and obstetrics.

27. Wash-water temperatures for hospital laundry should be, at minimum, 160 to 167 ^{o}F for 25 minutes. (pg.159)

28. Hospital wastes may include pathogenic, infectious, hazardous chemicals, and radioactive wastes as well as cultures and stocks, blood and blood products, animal carcasses, pharmaceutical wastes, pressurized containers, batteries, plastics, low level radioactive wastes, disposable needles, syringes, scalpels, and other sharp items. (pg.162)

29. Only 15 % of all hospital wastes are infectious waste. (pg.162)

30. Hospital wastes are regulated by EPA, OSHA, and the Nuclear Regulatory Commission, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act. (pg.163)

31. Overcrowding and poor food quality and food service are major problems at many jails and prisons, being the major reason for prisoner discontent.

32. List 5 of the most commonly found enteric pathogens reported in day care outbreaks.

Cryptsoporidium spp., Giardia lamilia, Salmonella, Shigell sonnei, E.Coli (toxic strain), and enterovirus are some commonly found enteric pathogens in reported outbreaks.

Define these terms:

1. **Garbage-** An older term that is often used interchangeably with the newer term food waste.

2. **Leachate-** a liquid resulting from precipitation percolating through landfills, which includes liquids resulting from the decomposed waste. With proper management, the amount of leachate can be minimized. Leachate that is collector is treated to prevent contamination of environment.

3. **Rubbish-** a general term for solid wastes, excluding food wastes and ashes, for materials collected from residences and commercial and institutional establishments.

4. **Source Reduction-** Refers to reducing the amount of waste generated that must eventually be discarded, including minimizing toxic substances in products, minimizing volume of products, and extending the useful life of products. Requires manufacturers and consumers to take an active role in reducing the amount of waste produced.

5. **Integrated Waste Management (IWM) -** the comprehensive management of solid waste involving several complementary activities and or process including source reduction, recycling, waste transformation, and land filling. (pg. 180)

6. **EPA has identified four basic management options for IWM. List them in hierarchal order: (pg.180)**
   1. Source reduction
   2. Recycling and composting
   3. Combustion (waste-to-energy facilities)
   4. Landfills

7. **Give three examples of source reduction: (pg.180)**
   1. Switch to reusable products and packaging.
   2. Buying less or using products more efficiently.
   3. Making sure the cost of waste management is fully internalized.

8. **How can consumers participate in source reduction practices?**
   Consumers can switch to reusable products and packaging. They can reevaluate procedures that needlessly distribute papers, require the purchase of products with longer lifespan, and cut down the purchase of disposable products. They can participate in buying more and using less more efficiently. (pg.181)

9. **Recycling is perhaps the most positively perceived and doable of all the waste management options. (pg. 182)**

10. **Landfills are the one form of waste management that nobody wants, but it is the only one that is both necessary and efficient. (pg.183)**

11. **The IWM option that reduces the volume of waste nine-fold is combustion. (pg. 183)**

12. **Many superfund sites are what is left of poorly managed recycling operations.**

13. **How do today's modern landfills differ from the older landfills? Today's operating landfills do not continue to take hazardous wastes. They do not receive bulk liquids. They have gas control systems, liners, leachate collecting systems, and extensive groundwater monitoring systems, they are better sited and located in the first place to take advantage of natural geological conditions. (pg. 184)**

14. **Residential and commercial wastes make up 60% of the total municipal waste generated per person in the United States.**

15. **Recycling will flourish where economic conditions support it and the costs of land filling is at least $40 to $50 dollars per ton or higher. (pg.182)**

16. **The latest data (2006) estimates that 4.6 pounds per capita per day is generated in the U.S. (pg.188)**

17. **The Resource Conservation and Recovery Act (RCRA) defines medical waste as: " any solid waste that is generated in the diagnosis treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biological. The term does not include any hazardous waste identified or listed under Subtitle C (mixtures with medical wastes are not excluded) or any household wastes as defined in regulations under Code of Federal Regulations, Title 40, Subtitle C (materials found in waste generated by consumers). (pg.194)**

18. **Examples of medical waste includes: cultures and stock of infectious agents and associated biological; human blood and blood products; pathological waste; used sharps (needles, syringes, surgical blades, pointed and broken glass); and contaminated animal carcasses and excludes surgery or autopsy waste; miscellaneous microbiology laboratory wastes, dialysis waste, discarded medical equipment, and isolation waste. (pg.194)**

19. **Most infectious waste can be treated for disposal by incineration or autoclaving. (pg.194)**

20. **The frequency of collection of solid waste in residential areas is twice-a-week during warm months. (pg.199)**

Lesson 7

1. **How can recycling affect savings in landfill space?**

Recycling can affect savings in landfill space and energy. One ton of newspapers can use 3.0 to 3.3 yd^3 of landfill space. It is estimated that 95% less energy is required to produce aluminum from recycled aluminum than from bauxite. (pg.217)

2. Why has the recycling of glass, for the most part, ceased?
The recycling of glass has essentially ceased because of flut of material available, the high cost of handling and processing recycled glass, and the cost associated with pollution control. (pg.217)

3. Compost improves soil moisture retention; it is a good soil conditioner, but is a poor fertilizer. (pg. 229)

4. How can compost be utilized?
Compost, depending on the waste source and its composition may be used as a soil amendment for agricultural soil and landscaping in municipal soil and landscaping in municipal parks, golf courses, gardens, and green belts; sod growing; home gardens; and nursery and green house use. It may also be used as landfill cover, land reclamation, animal litter, and possibly animal feed. It may also be used as an additive to fertilizer, as a fuel, or in building materials. (pg.229)

5. EPA requires compost attain temperatures of 131^{o}F for at least three consecutive days to obtain pathogen destruction before compost land spreading. (pg. 230)

6. The principal federal requirements for municipal solid waste landfills are in subtitle D or RCRA. (pg.242)

7. The trench sanitary landfill method is used primarily on level grounds. (pg.246)

8. In any landfill method, all exposed solid waste should be covered with at least 6 inches of earth at the end of each day's operation. (pg.247)

9. Landfills should be located at least 100 feet from any surface water. Distance is based on soil attenuation, drainage, and natural and manmade barriers. (pg. 247)

10. EPA and other have reported that hazardous wastes probably represent less than 0.5% of the total waste generated by household. (pg.189)

11. The two primary constituents in landfills gas generated is methane and carbon dioxide. (pg. 258)

Hazardous Wastes: Page 292-305

12. According to regulation, the term hazardous waste means A solid waste, or

combination of solid wastes, that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may do one of two things:

1. **Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness.**
2. **Pose a substantial present or potential hazard to hum health or the environment when improperly treated, stored, transported, or disposed of otherwise managed. (pg.292)**

13. Hazardous wastes are regulated under EPA's RCRA Act. (pg.292)

14. A waste is regarded hazardous if it is Lethal, non degradable, and persistent in the environment, can be magnified biologically (as in food chains), or otherwise causes or tends to cause detrimental cumulative effects. (pg. 292)

15. EPA lists four characteristics of hazardous waste. They are: (pg. 292)

- **a. ignitability**
- **b. corrosivity**
- **c. reactivity**
- **d. toxicity**

16. Domestic wastewater and irrigation waters are not covered by hazardous waste regulations.

a. TRUE b. FALSE

17. Under the 1976 RCRA regulations, businesses considered small quantity Generators, generating less than 220 pounds of hazardous waste per month, were exempted from regulations. (pg. 293)

18. The most common problems associated with the disposal of hazardous wastes in addition to public opposition, are ground water pollutions from lagoons, landfills, dumps, sludge disposal, other land disposal systems, spills, and unauthorized dumping. (pg 293)

19. List the three top generators of hazardous wastes among the 15 industries studied By EPA.

1. **Primary metals**
2. **Organic chemicals**
3. **Electroplating**
4. **Inorganic chemicals**
5. **Textiles**
6. **Petroleum refining**
7. **Rubber and plastics (pg. 296)**

20. Of all the options available to the management of hazardous wastes, the last resort is secure land burial and deep-well disposal. (pg.301)

Chapter 1 Water Supply page 1 to 108
Lesson 8

1. **A public water system is defined under the Safe Drinking Water Act as a system having at least 15 service connections, regularly serving at least 25 individuals daily at least 60 days out of the year. (pg.1)**

2. **About 2.4 billion people, 33.33% of the world's population do not have a safe and adequate water supply. (pg.2)**

3. **Three-fourths of all illnesses in the developing world are associated with inadequate water and sanitation. (pg.3)**

4. **According to the World Health Organization (WHO), how many people die each year from waterborne diseases caused by microbiologically contaminated water supplies or due to lack of access to sanitation facilities? 3.4 million (pg.3)**

5. **List four factors that should be considered when determining a safe distance between a well and a sewage disposal system.**
   1. **The amount of sand, clay, organic (humus) matter, and loam in the soil, the soil structure and texture, the effective size and uniformity coefficient, groundwater level, and unsaturated soil depth largely determine the ability of the soil to remove microbiological pollution deposited in the soil.**
   2. **The volume, strength, type, and dispersion of the polluting material, rainfall intensity and infiltration, and distance, elevation, and time for pollution to travel with relation to the groundwater level and flow and soil penetrated are important. Also important is the volume of water pumped and well drawdown.**
   3. **The well construction, tightness of the pump line casing connection, depth of well and well casing, geological formations penetrated, and sealing of the annular space have a major bearing on whether a well might be polluted by sewage, chemical spills or wastes and surface water.**
   4. **The well recharge (wellhead) area, geology, and land use possibly permit groundwater pollution. Local land-use and watershed control is essential to protect and prevent pollution of well-water supplies. (pg.9)**

6. **The percentage of the earth's water that is salt water is 97%, and the percentage that is fresh water is 3%. (pg.11)**

7. **Is rain water soft or hard water? Rain water is soft water. (pg. 12)**

8. **Rocks that are formed by the cooling and hardening of molten rock are known as igneous rock. (pg.12)**

9. **Give examples of the following rock formations:**

a. **Sedimentary-** result from the deposition, accumulation, and subsequent consolidation of materials weathered and eroded from older rocks by water, ice, or wind and the remains of plants, animals, or material precipitated out of solution. Sand and gravel, clay, silt, chalk, limestone, fossils, gypsum, salt, peat, shale, conglomerates, loess, and sandstone are some examples.

b. **Metamorphic-** produced by the alteration of igneous and sedimentary rocks, generally by means of heat and pressure. Gneisses and schists, quartzites, slates, marble, serpentines, and soapstones are metamorphic rocks. A small quantity of water is available in joints, crevices, and cleavage planes.

c. **Igneous-** The rocks are crystalline and contain quartz, feldspar, mica, hornblende, pyroxene, and olivine. Igneous rocks are not usually good sources of water, although basalats are exceptions. Small quantities of water are available in fractures and faults. Examples are granite, dioxite, gabbro, basalt, and syenite. (pg. 12-13)

10. **Karst areas are formed by movement of groundwater through** carbonate rock fractures and channels, such as limestone and gypsum. (pg. 13)

11. **What quantity of water is expected from igneous rock, from metamorphic rock and sedimentary rock?** Igneous rocks have small quantities of water. Sedimentary yield large quantities of water. A small quantity of water is available in metamorphic rock.

12. **Explain the main difference between the Primary Drinking Water Standards and Secondary Drinking Water Standards.**
The primary drinking water standards developed under the Safe Drinking Water Act of 1974 as amended in 1986 and 1996. The maximum capacity level goals (MCLGs) are enforceable health goals that are to be set at levels at which no known or anticipated adverse health effects occur and that allow an adequate margin of safety. Maximum contaminant levels (MCLs) are enforceable and must be set as close to MCLGs as is feasible, based on the use of best technology, treatment techniques, analytical capabilities, cost and other means. Secondary regulations have also been adopted, but these are designed to deal with taste, odor, and appearance of drinking water and are not mandatory unless adopted by a state. Although not mandatory, these parameters have an important indirect health significance. Water that is not palatable is not likely to be used for drinking, even though reported to be safe, in both developed and underdeveloped areas of the world. (pg.17)

13. **When collecting a water sample for bacteriological examination;**

a. What kind of container should be used? A laboratory prepared bottle. (pg. 29)
b. What should be added to the container if chlorinated water being sampled? The sample should contain sodium thiosulfate to dechlorinate the water. (pg.32)
c. Samples should be examined within 6-12 hours. (pg. 32)

14. If repeat samples are positive for coliform, the water system must also analyze to determine if E. Coli are present. (pg.33)

15. A 100 ml standard sample volume must be used in analyzing for total coliform, regardless of the analytical method used. (pg.36)

16. If the membrane filter technique is used, the coliform bacteria trapped on the filter produce a metallic sheen within 24hrs (18-22) hours on an Endo type medium containing lactose when placed in an incubator at 35 ^{o}C. (pg.40)

17. The fecal coliform test involves incubation at 112F (44.5 ^{o}C) for 24 hours as the formation of E.Coli indicates the presence of coliform. (pg.40)

18. An average person yields 2 billion coliform per day through excretement. (pg.40)

19. Normally, five hundred gallons of water (sample size) must be filtered to capture, concentrate, and identify viruses. (pg.42)

20. Sampling for giardia cysts usually involves the filtration of about 500 gallons of water through a 1 micrometer pore size filter at a rate of one gallon per minute. (pg. 43)

21. Why is it not practical to test water for specific pathogenic organisms?
The procedure would be too complex and time consuming for routine monitoring. (pg.43)

22. How are odors in drinking water controlled?
Activated carbon adsorption, aeration, chemical oxidation (chlorine, chlorine dioxide, ozone, potassium permangate), and coagulation and filtration will usually remove odors and tastes. (pg.44)

23. What causes turbidity in drinking water supplies?
Turbidity is due to suspended material such as clay, silt, or organic and inorganic materials. (pg. 44)

24. What are some constituents that cause water to have an unacceptable taste?
Algae, decomposing organic matter, dissolved gases, high concentrations of sulfates, chlorides, and iron or industrial wastes may cause tastes and odors. (pg.44)

Lesson 9

1. The alkalinity levels of water passing through distribution systems made of iron pipes should be in the range of 30 to 100 mg/l as $CaCO_3$ to prevent corrosion. (pg.48)

2. Game fish require a dissolved oxygen level of at least 5.0 mg/l to reproduce. (pg.54)

3. Levels of fluoride that are beneficial to children during their permanent teeth developing is 0.7 to 1.2 mg/l. (pg. 55)

4. What two inorganic substances are primarily responsible for water hardness? Hardness is due primarily to calcium and secondarily to magnesium carbonates and bicarbonates. (pg.56)

5. There is ample evidence arsenic in drinking water may cause certain cancers (e.g. skin, bladder, kidney, lung, and liver). (pg.49)

6. A dose of 5-20 mg/kg of arsenic is a probable lethal dose. (pg.49)

7. The MCL for arsenic in drinking water was lowered to 0.01 mg/l by EPA in 2001. (pg.49)

8. Game fish require a dissolved oxygen level of at least 5.0 mg/l to reproduce.

9. The compound hydrogen sulfide is most frequently found in groundwater as a natural constituent and is easily identifiable by a rotten egg smell. (pg. 56)

10. The final oxidation product of ammonia is nitrates (pg. 60).

11. Levels of nitrate above 10 mg/l appear to cause methemoglobinemia, commonly known as blue baby syndrome. (pg.60)

12. Under what circumstances are trihalomethanes (THMs) formed? Trihalomethanes and other nonvolatile, higher molecular weight compounds are formed by the interaction of free chlorine with humic and fulvic substances and other organic decomposition or by metabolism of aquatic biota. (pg. 67)

13. The most dire health effect from extended exposure to THMs is chloroform Source Protection of Water Supply ? (pg. 67)

14. "Wellhead area" has been defined, under the 1986 Safe Drinking Water Act amendments, as the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field (pg.77).

15. **List five critical factors in determining the wellhead protection area.**
The time of travel of potential contaminant, distance, drawdown, flow boundaries, and assimilative capacity are critical factors in determining the well head protection area. (pg.77)

16. **A well for a private home should preferably have a capacity of at least 500 gallons per hour. (pg.78)**

17. **About 50% of the U.S. population depends on groundwater for drinking and domestic purposes. (pg.88)**

18. **It is estimated that there is more than four times more groundwater than there is surface water.**
a. TRUE b. FALSE 100 times more groundwater than surface water. (pg. 88)

19. **Dug wells are not usually dependable sources of water supply. (pg.89)**

20. **What two types of wells are characterized as having small yields, being easily polluted, and are affected by draughts?**
Bored wells and dug wells. (pg.90)

21. **When well water shows the presence of bacterial contamination, it usually due to: (pg.99)**
a. lack of or improper disinfection of a well following repair or construction.
b. failure to seal the annular space between the drill hole and the outside of the casing
c. failure to provide a tight sanitary seal at the place where the pump line(s) passes through the casing
d. wastewater pollution of the well through polluted strata or a fissured or channeled formation

22. **What advantages do drilled wells have over all other types of wells?**
Drilled wells are less likely to become contaminated and are usually more dependable sources of water. (pg.91)

23. **To obtain satisfactory water from a spring it is necessary to find the source. Properly develop it, eliminate surface water, and prevent from animals from gaining access to the spring area. (pg.101)**

24. **It is recommended that cistern water be treated after every rain event with a chlorine compound of at least 5 mg/l of chlorine. (pg.105)**

25. What causes water hardness and how does one treat the problem?
Water hardness is caused by dissolved calcium and magnesium bicarbonates, sulfates, and chlorides in well water. A commercial zeolite of synthetic resin water softener is used to soften water. (pg.106)

26. What causes turbidity and how does one treat the problem?
Turbidity can occur from water from a pond, creek, or other surface source. Such water is polluted and requires coagulation, flocculation, sedimentation, filtration, and chlorination treatment. (pg.106)

27. Iron and manganese is usually found in water from deep wells and springs. (pg.106)

28. What are the effects of higher than normal levels of manganese and iron in water?
In high concentrations it can cause a bitter taste in tea or coffee.? (pg.106)

29. Chlorine bleach can be used to remove stains caused by iron on laundry.
a. TRUE b. FALSE(pg.106)

30. What problems can corrosive water cause and how might the problem be treated?
Corrosive water dissolves metal, shortens the life of water tanks, discolors water, and clogs pipes. Iron corrosion causes rusty water; copper or brass pipe causes blue-green stains. Water can be made non corrosive by passing it through a filter containing broken limestone, marble chips, or other acid neutralizers. (pg.107)

31. What two protozoa are not affected by normal chlorination or UV radiation?
Normal chlorination treatment and UV radiation treatment do not inactivate the *Giardia lamblia* and *Cryptosporidium* protozoan cysts. (pg.109)

32. Typically, about 75% of tap water flowing into a reverse osmosis system is wasted. (pg.110)

Lesson 10

1. The most common chemicals used in the disinfection of drinking water include chlorine (gas and hypochlorite), chlorine-ammonia, chlorine dioxide, and ozone. (pg.136)

2. Of these listed in the preceding question, chlorination is the most common method of destroying disease-producing organisms that normally might be found in drinking water. (pg.136)

3. A chlorinator should have a capacity to provide at least 2 mg/l free chlorine residual with 30 minute contact time at maximum flow and chlorine demand. (pg.137)

4. The recommended field test for measuring chlorine in water are the N,N – diethyl-p-phenylenediamine (DPD) colorimetric and the stabilized neutral orthotolidine (SNORT) methods. (pg.138)

5. The water treatment step that removes 99% of all viruses is chlorine (as final treatment). (pg.141)

6. The minimum free chlorine residual at distant points in the distribution system should be 0.2 to 0.5 mg/l and a combined chlorine reading of 1.0 to 2.0 mg/l at distant points in the distribution system. (pg.144)

7. What is plain sedimentation?
   Plain sedimentation is the quiescent settling or storage of water such as would take place in a reservoir, lake, or basin, without the aid of chemicals preferably for a month or longer, particularly if the source water is sewage polluted river water. (pg.146)

8. If sedimentation detention times are 10 to 30 days, a bacteria and virus removal of 80-90% can be expected. (pg.146)

9. What happened when aluminum sulfate is added to water during the water treatment process?
   Adding a coagulant such as alum (aluminum sulfate) to water permits particles to come together and results in the formation of a flocculent mass, or floc, which emmeshes and agglomerates microorganisms, suspended particles, and colloidal matter, removing and attracting these materials in settling out. (pg.147)

10. The mixing of coagulant is usually done in two steps. What are they?
    The first step is rapid or flash mixing and the second is slow mix, during which coagulation takes place. (pg.147)

11. For the control of coagulation, jar tests are performed in the laboratory to determine appropriate dosage of chemicals. (pg.148)

12. **The primary purpose of filters, in the drinking water treatment process is to:**
The primary purpose of filters is to remove suspended materials, although, microbiological organisms and color are also reduced. (pg.149)

13. **List some microorganisms that cause odor and taste problems.**
Some of the common causes are oils and products of decomposition exuded by algae and some other microorganism; wastes from gas plants, coke ovens, paper mills, chemical plants, canneries, tanneries, oil refineries, and dairies; decaying vegetation such as leaves. Algae, weeds, grasses, brush, and moss in the water; and chlorine compounds and high concentrations of chlorine. The control of taste and odor-producing substances is best accomplished by eliminating or controlling the source when possible. (pg.163)

14. **What problems do zebra mussels present to a water treatment plant?**
A major concern is the accumulation of the zebra mussels inside industrial plant, power plant, and drinking water intakes, causing restriction in flows and eventual clogging. (pg.169)

15. **From where did zebra mussels originate and how did they get to the U.S.?**
The zebra mussel is believed to have been introduced into the United States via the St. Lawrence River and the Great Lakes through international ship freshwater ballast discharges. (pg.169)

Emergency Water Supply and Treatment Page 262-269

16. **Boiling water vigorously for 1 to 2 minutes will kill most pathogens in possibly polluted water. (pg.263)**

17. **If water is not grossly polluted, is 68F and has a low pH and turbidity level, chlorination is a satisfactory method for disinfecting water in emergency situations. (pg.263)**

18. **If iodine is used as a disinfectant during emergency situations, 8 drops of 2% tincture of iodine may be used to disinfect one quart of water, which is equivalent to 8 mg/l of iodine. (pg.266)**

Wastewater Treatment and Disposal Chapter 3 Page 283
Lesson 11

1. **Define the following terms: (pg.285-289)**

   a. **Gray Water- all other domestic wastewater, grey water should be considered sewage.**

   b. **Black Water- Wastewater from toilets**

   c. **Excreta- The waste matter eliminated from the human body; about 27 grams per capita per day dry basis (100 to 200 grams wet). Mara reports that human feces have an average weight per capita per day of 150 grams wet basis and contain 2,000 million fecal coliform, and 450 million fecal streptococci.**

   d. **Non-point pollution- any source other than a point source that impacts the chemical, physical, biological, or radiological integrity of water.**

   e. **Aerobic bacteria- Bacteria that require free dissolved oxygen for their growth. Carbon, nitrogen, and phosphorus are required nutrients for growth.**

   f. **Anaerobic bacteria- Bacteria that grow only in the absence of free dissolved oxygen and obtain oxygen from breaking down complex organic substances.**

2. **Soils are divided into five classifications, they are gravel, sand, silt, clay, and clay loam. (pg.289)**

3. **Clay and clay loam soils do not drain well and thus are not usually considered suitable for the disposal of sewage by sub-surface means. (pg.289)**

4. **What effect does calcium and magnesium have on soil?**
   Calcium and magnesium keep the soil loose, where sodium and potassium have the opposite effect. (pg.290)

5. **According to information in this chapter, it is necessary to have at least 2 feet of suitable soil between the bottom of an absorption field trench and the highest groundwater table or impermeable layer. (pg.291)**

6. **What are septic tanks capable of accomplishing?**
   A septic tank is a watertight tank designed to slow down the movement of raw sewage passing through it so that solids can settle out and be broken down by liquefaction and anaerobic bacterial action. (pg.295)

7. **What are septic tanks <u>not</u> capable of accomplishing?**

Septic tanks do not purify the sewage, eliminate odors, or destroy all solid matter, but rather, simply condition sewage so that it can be disposed of using a subsurface absorption system. (pg.295)

8. The detention time should not be less than 24 to 72 hours (pg.296).

9. If a septic tank is to receive waste from an under the sink garbage disposal unit, its capacity (size) should be increased by at least 50 %. (pg.296)

10. A septic tank for a private home will generally require cleaning, by a licensed septic tank cleaning company, every 3 to 5 years. (pg.299)

11. Septic tanks serving commercial operations should be inspected at least every 6 months. (pg.299)

12. Sludge accumulation in a normal home septic tank has been estimated at 18 to 21 gallons per person per year. (pg.299)

13. What are 4 possible results of using septic tank cleaning solvents, additives, or other such hazardous chemicals to a septic tank?
The use of septic tank cleaning solvents or additives containing halogenated hydrocarbon, aromatic hydrocarbon, or hazardous chemicals can cause carryover of solids and clogging of absorption field as well as contamination of groundwater and should not be permitted. (pg.300)

14. What other kinds of household items should a homeowner not introduce into a septic tank?
Although soap, drain solvents, disinfectants, and similar materials used individually for household purposes are not harmful to septic tank operation unless used in large quantities, organic solvents and cleaners, pesticides, and compounds containing heavy metals could contaminate the ground water and well-water supplies and should not be disposed of in a septic tank system. Also, sanitary napkins, absorbent pads, and tampons should not be disposed of in septic systems. (pg.300)

15. Why is the use of copper sulfate crystals recommended for some septic tank systems? Copper sulfate crystals flushed down the toilet once a year can destroy tree roots that may be invading the septic system. (pg.300)

16. List six common causes of septic tank system failures.

- Seasonal high groundwater
- Carryover of solids into the absorption field due to use of septic tank cleaning compounds
- Lack out routine cleaning of the septic tank
- Outlet baffle disintegration or loss
- Excessive water use or hydraulic overloading
- Settlement of the septic tank, connecting pipe, or distribution box
- Improper design and construction of the absorption system, including compaction and smearing of absorption trench bottoms and sidewalls (pg.301)

17. In a septic tank, when the depth of settled sludge or floating scum approaches the depth of 14 inches in a 1000 gallon tank with a 30 inch liquid depth, the tank needs cleaning; in a septic tank with 36 inches of liquid depth, the depth of sludge requiring one to clean the tank is 18in. (pg.300)

18. The septic tank absorption field should be 100 feet from any well, 25 feet from any stream, 50ft recommended or more from any lake, swamp, ditch or watercourse.(pg.302)

Sewage Works Design- Small Treatment Works Page 322

19. What is the overall purpose of bar screens, comminutors, and grit chambers?
Bar screens or comminutors and grit chambers are provided ahead of pumping equipment and settling tanks to remove larger solids.

20. The most commonly used biological treatment process for removal of organic matter from wastewater is trickling filters. (pg.328)

21. The use of a mass of activated microorganisms in a basin that is aerated is a biological treatment process known commonly as activated sludge settling.

22. What are Rotating Biological Contactors (RBCs)?
A rotating biological contractor is another type of attached-growth biological process in which large closely spaced circular disks, which are mounted on horizontal shafts, rotate slowly through wastewater. (pg.330)

23. How are RBCs similar to trickling filter systems?

The main function of trickling filters and RBC's is to provide secondary treatment of primary settled wastewater. They function to remove dissolved organics and finely divided organic solids using microorganisms attached to the media. The growth on the media oxidizes organic materials biologically to form a more stable material. They remove dissolved and non-settleable solids as a result of the growth of bacteria and other microorganisms on the media. The biological growth of these organisms uses the dissolved organic material in the presence of oxygen as a food source. This produces cell mass. Finely divided organic solids are also adsorbed on the cell walls of the microorganisms.

24. **What is the BOD removal efficiency for the following treatment processes:**
    Activated Sludge- 85-95% (pg.331)
    Trickling filters 35% (pg.329)
    RBCs 85% (pg.330)

25. **Provide the following information related to facultative ponds:**
    Detention time 90 to 180 days, depending on climatic conditions; 180days for controlled discharge pond; 45 days minimum for small systems.
    Liquid depth 5 feet plus 2 feet freeboard, with minimum liquid depth of 2 feet
    BOD Removal % 85-90% (pg.33)

Chapter 1 Page 1-12 and Chapter 3 Page 25-36
Lesson 12

1. **What are psychotropic bacteria? Give 3 examples.**
   Psychotrophs are cold temperature tolerant microorganisms, which tolerate and thrive at temperatures below 68F. Examples are *Pseudomonas* and *Moraxella-Acinetobacter* (pg.31)

2. **What makes Salmonella a unique foodborne pathogen?**
   Salmonellae may persist for several months after the employee has recovered. The virus is responsible for hepatitis has been found in the intestinal tract over 5 years after the disease symptoms have disappeared. (pg.84)??????

3. **Explain the difference between the terms substantive and advisory regulations and "should" and "shall."**
   In regulations the word *shall* means a requirement, whereas *should* implies a recommendation. (pg.9)

4. **Products subject to seizure by FDA during interstate commerce include adulterated or misbranded. (pg.10)**

5. **FDA is under the jurisdiction of the U.S. Department of Health and Human Services. (pg.10)**

6. **The first HACCP regulation written by FDA required processors of fish and fishery (pg.11) products to develop and implement HACCP systems for their operations.**

7. **The USDA had jurisdiction over three areas of food processing; they are the Federal Meat Inspection Act, the Poultry Products Inspection Act, and the Egg Products inspection act. (pg.11)**
   The inspections are administered by Food Safety and Inspection Service (FSIS), established in 1981. (pg.11)

8. **The objective of the 1996 Pathogen Reduction: HACCP Final Rule was to reduce foodborne illness associated with meat and poultry products. (pg. 11)**

9. **Two types of pathogenic microorganisms that grow in or are carried by foods are those that cause intoxication or infection. (pg.25) Intoxication results from microorganisms growing and producing toxin (which causes the illness) in a food. An infection is an illness that results from ingestion of a disease causing microorganism. Infectious microorganisms may cause illness by the production of enterotoxins in the gastrointestinal tract or adhesion to and/or invasion of the tissues.**

10. **The microorganisms most common to food are bacteria and fungi. (pg.26)**

11. **Fungi consist of two major microbe groups, molds (which are multicellular) and yeasts (which are usually unicellular). (pg.26)**

12. **Describe the morphology and appearance of molds.**
Molds are multicellular microorganisms (eukaryotic cells) with mycelia (filamentous) morphology. Molds are characterized by their display of a variety of colors and are generally recognized by their mildew or fuzzy, cottonlike appearance. (pg.26)

13. **Molds can survive a pH as low as 2.0 (thrive best at 7.0 and can range from 2.0 to 8.0) and prefer a water activity of 0.90. (pg.26)**

14. **What are the pH and water activity requirements for yeasts?**
Yeasts prefer a water activity of 0.90 to 0.94, but can grow below 0.90. In fact, some osmiophilic yeasts can grow at a water activity as low as 6.0. These microorganisms grow best in the intermediate acid range, a pH from 4.0 to 4.5. (pg.27)

15. **A virus particle consists of a single molecule of DNA or RNA, surrounded by a coat made from protein. (pg.27)**

16. **To what extent do viruses cause foodborne illness?**
Foodborne viruses cause disease through viral gastroenteritis or viral hepatitis. A virus that caused a major increase in restaurants during the past 10 years is hepatitis A. (pg.28)

Define the following and give an example of each of these temperature related terms:

17. **Mesophilic- Medium temperature loving microorganisms, with growth optima between 68F and 113F. Examples are most lactobacilli and staphylococci. (pg.31)**

18. **Thermophilic- High temperature loving microorganisms, with growth optima at temperatures above 113F. Examples are *Bacillus tearothermophilus, Bacillus coagulans, and Lactobacillus thermophilu.s* (pg.31)**

19. **Microorganisms requiring free oxygen are called *aerobic* microbes, while those that thrive in the absence of oxygen are known as *anaerobic* microorganisms. (pg.31)**

21. **What are biofilms?**
Biofilms are microcolonies of bacteria closely associated with an inert surface attached by a matrix of complex polysaccharide-like material in which other debris, including nutrients and microorganisms, may be trapped. A biofilm is a unique environment that microorganisms generate for themselves, enabling the establishment of a "beachhead" on a surface resistant to intense assaults by sanitizing agents. (pg.33)

22. **Define foodborne outbreak.**
A foodborne disease outbreak is defined as "two or more persons experiencing similar illness, usually gastrointestinal, after eating a common food, if analysis identifies the food as the source of illness." (pg.36)

23. **66% of all foodborne outbreaks are caused by bacterial pathogens. (pg.36)**

24. **Explain the differences between food intoxications and food infections.**
Food poisoning caused by bacterial toxins is called *food intoxification*, whereas that caused by chemicals that have gotten into food is referred to as *chemical poisoning*. Illness that is not caused by bacterial-by-products, such as toxins, but through ingestion of infectious microorganisms, such as bacteria, rickettsia, viruses, or parasites, are referred to *food infections*. (pg.36)

25. **Evisceration and cold storage of chickens at 37.4 ^{0}F may permit an increase in this foodborne illness *A. hydrophila* which can cause gastroenteritis in humans and infections in patients immunocompromised by treatment for cancer. (pg.37)**

Principles of Food Sanitation, Marriott and Gravani, fifth Edition

Note: the majority of the information regarding specific foodborne illnesses on page 37-50 are in Lesson 3

Lesson 13

Following Questions are from Chapter 3 Page 37-53, Chapter 4 Page 70-75 and Chapter 16 Page 283-286

1. **The foodborne illness, *Campylobacter* is now recognized as one of the most frequent causes of bacterial diarrhea and there is mounting evidence that it causes ulcers. (pg.38)**

2. **What food preparation practice is generally the cause of Clostridium perfringins foodborne illness? Cooked meat, poultry, and fish held at non-refrigerated temperatures for long periods of time. (pg.39)**

3. **What food preparation practice is generally the cause of E-coli 0157:H7 foodborne illness?**
   The destruction of E. coli 0157:H7 can be accomplished by cooking ground beef to 162F, or incorporating a procedure that kills this pathogen in the manufacture of fermented sausages or the pasteurization of apple cider. The HACCP system is the most effective means for systemically developing good safety protocols that can reduce infection from this pathogen. (pg.44)

4. **What food preparation practice is generally the cause of Salmonellosis?**
   Salmonellosis can usually be blamed on poor sanitation and temperature abuse. (pg.47)

5. **What food preparation practice is generally the cause of Shigellosis?**
   Foods most likely to be infected with this microorganism are potato, chicken, shrimp, and tuna salads, and seafood/shellfish. Most of the outbreaks have occurred in foodservice establishments such as hospital cafeterias and restaurants and are frequently attributed to ineffective hand washing after defecation. (pg.48)

6. **What food preparation practice is generally the cause of Trichinosis?**
   Prevention is possible through protection from contamination and cooking to 104F with conventional cookery or 160F if microwave heating is practiced. Other destruction methods include irradiation or frozen storage of meat less than 15cm thick for 6 days at -20.2F or 20 days at 5F. (pg.48)

7. **What are aflatoxins and what public health danger do they pose?**
   Epidemiological evidence suggests an association between primary liver cancer and alflatoxin, one type of mycotoxin (compounds or metabolites produced by molds that are toxic or have other adverse biological effects on humans and animals), in the diet. (pg.51)

8. **The most common cause of "traveler's diarrhea, an illness frequently acquired during visits to developing nations is Enterotoxigenic *E. coli*, (pg.52)**

Chapter 4- Food Allergens Page 70-75

9. **What is an allergen?**
Allergens are substances that cause the immune system to trigger and act against itself. (pg.71)

10. **What foods are more likely to contain allergens? (pg.70)**
    1. **Peanuts**
    2. **Tree nuts such as almonds, cashews, brazil nuts, and pistachios**
    3. **Dairy products**
    4. **Eggs**
    5. **Soybeans**
    6. **Crustacean**
    7. **Fish**
    8. **Cerals**

11. **How is a food allergen triggered?**
A food allergy is triggered when a natural substance is mistaken for a hostile invader, causing immune systems to mobilize to repel the invader. (pg.71)

12. **How many emergency room visits and deaths are attributed to food allergens in the U.S. each year?**
Approximately 30,000 emergency room visits and 200 deaths each year are attributable to food allergens. (pg.70)

13. **2-3% of adults and 4-8% of infants and young children are affected by food allergens. (pg.70)**

14. **What areas should a food allergen control program address? (pg.72-73)**
    - **Employee education**
    - **Supplier monitoring**
    - **Control steps**
    - **Cleaning**
    - **Raw material storage**
    - **Plant layout**
    - **Color coding of utensils**
    - **Incorporation of reworked products**
    - **Label review**
    - **Documentation review of activities**
    - **Evaluation of program effectiveness**

15. What kinds of tests have been developed to give processors quick, accurate tools to check for traces of allergens in food items?

Enzyme linked immunosorbent assay tests. The immunoassay is based on the protein's characteristic of binding to specific enzyme-labeled antibodies to permit detection and quantification by comparison to standard curves. (pg.73)

Chapter 6- Personal Hygiene Page 83-97

16. **Define "carrier"**
In many illnesses, the disease causing microorganisms may remain with the person after recovery. A person with this condition is a carrier. (pg.83) A carrier is a person who harbors and discharges pathogens but does not exhibit the symptoms of the disease. (pg.88)

17. **Describe the difference between convalescent, chronic, and contact carriers.**
    1. ***Convalescent carriers*. People who, after recovering from an infectious disease, continue to harbor the causative organism for a variable length of time, usually less than 10 weeks.**
    2. ***Chronic carriers*. People who continue to harbor the infectious organism indefinitely, although they do not show symptoms of the disease.**
    3. ***Contact carriers*. People who acquire and harbor a pathogen through close contact with an infected person but do not acquire the disease. (pg.89)**

18. **The first line of defense against disease is frequent and effective hand washing. (pg.89)**

19. **Approximately 38% of food contamination is attributable to improper hand washing. (pg.89)**

20. **When describing methods of disease transmission, what is the difference between direct and indirect transmission.**
Many diseases are transmitted through direct transfer of the microorganisms to another person through close contact. In indirect transmission the host of An infectious disease may transfer to vehicles such as water, food, and soil. (pg.95)

21. **Selection of food service employees should be predicated on 5 facts. What are they?**
    1. **Absence of communicable diseases should be verified through a county health card or physician's report.**
    2. **Applicants should not exhibit evidence of a sanitary hazard, such as open sores or presence of excessive skin infection of acne.**
    3. **Applicants who display evidence of respiratory problems should not be hired to handle food or work in food processing or food prep areas.**
    4. **Applicants should be clean and neatly groomed and should wear clothing free of unpleasant odor.**
    5. **Applicants should successfully complete a sanitation course and examination such as that provided by the National Restaurant Association. (pg.96)**

22. **Hand washing for 15 seconds with soap and water will remove transient bacteria from the hands. (pg.89)**

23. **How effective are alcohol based sanitizers and which ones are best?**
Alcohal-based instant hand sanitizers used after handwashing, provide an additional 10-100 fold reduction. Ethanol is more effective at destroying viruses than isopropanol. (pg.90)

24. **Milk and milk products have been identified as a vehicle for transmission in approximately 5% of salmonellosis cases. (pg.285)**

25. **Approximately five to ten percent of raw bovine milk is contaminated with the bacteria *Listeria monocytogenes.* (pg.284)**

26. **What illness and what foods were implicated in a 1983 outbreak in Massachusetts and a 1985 outbreak in Los Angeles?**
The epidemiologic implication of pasteurized milk in the Massachusetts listeriosis outbreak in 1983 and in the outbreak in Los Angeles in 1985 attributed to a Mexican style soft cheese. (pg.284)

27. **Quaternary ammonium- based sanitizers should not be used on food contact surfaces or in cheese factories as lactic acid starter culture bacteria are inactivated by small residues of this sanitizer. (pg.285)**

Lesson 14
Chapter 7, 10 and 13
Chapter 7 The Role of HACCP in Sanitation Page 99-114

1. **The acronym HACCP stands for Hazard Analysis Critical Control Point. (pg.99)**

2. **The two major thrusts of HACCP are to determine how and where food safety hazards may exist and how to prevent their occurrence. (pg.99)**

3. **The HACCP concept was developed in the 1950s by National Aeronautics and Space Administration (NASA) and Natick Laboratories for use in aerospace manufacturing under the name "Failure Mode Effect Analysis." (pg.99)**

4. **What is a critical control point?**
   A critical control point (CCP) is an operation or step by which preventive or control measures can be exercised that will eliminate, prevent, or minimize a hazard (hazards) that has (have) occurred prior to this point. (pg.100)

5. **List the 7 principles of HACCP (pg. 107-111)**
   1. **Conduct a hazard analysis through the identification of hazards and assessment of their severity and risks by listing the steps in the process where significant hazards occur and describing preventative measures.**
   2. **Determine the CCPs which are required to control the identified hazards.**
   3. **Establish critical limits for preventative measures associated with each identified CCP.**
   4. **Establish procedures to monitor CCPs.**
   5. **Establish corrective measures to be taken when there is a deviation from an established critical limit.**
   6. **Establish procedures for verification that the HACCP plan is working correctly.**
   7. **Establish effective record-keeping procedures that document the HACCP plan.**

Chapter 10 Sanitizers Page 165-189

6. A sterilant is an agent that destroys or eliminates all forms of microbial life. (pg.165)

7. A disinfectant is an agent that kills infectious bacteria and fungi only, though do not kill bacterial spores. (pg. 165)

8. A sanitizer is a substance that reduces, but not necessarily eliminates microbial contaminants on inanimate surfaces to levels that are considered safe from a public health standpoint. (pg.165)

9. The most active of the chlorine sanitizers and also the most widely used are Hypochlorites; calcium hypochlorate and sodium hypochlorite. (pg.171)

10 Iodine sanitizers are effectively utilized at concentrations of 12.5 ppm to 25 ppm to sanitize surfaces. (pg.175)

11. The sanitizer that is most corrosive to stainless steel and other metals are chlorine compounds. (pg.174)

12. The sanitizer compounds that are more stable in the presence of organic matter are the chlorine dioxide compounds. (pg.172)

13. Because the acid sanitizer compounds are acidic, they are not affected by water hardness as the other types of sanitizers are. (pg.178)

14. The quaternary ammonium compounds are frequently used on floors, walls, furnishings and equipment because they are good penetrants. (pg.176)

15. Why are chemical sanitizers ineffective in killing microbes present in cracks and crevices?
Because chemical sanitizers lack penetration ability, microorganisms present in cracks, crevices, pockets, and in mineral soils may not be totally destroyed. (pg.168)

16. The sanitizer most effective at killing viruses is iodine compounds. (pg.175)

Chapter 13 Pest Control Page 235-255

17. House flies lay an average of 120 eggs within a week of mating. (pg.239)

18. What is the ideal environment for houseflies to lay and hatch their eggs with subsequent growth of the larvae?
Warm, moist, decaying material that is protected from sunlight provides an ideal environment for housefly eggs to hatch, with subsequent growth of fly larvae and maggots. (pg.238)

19. The National Restaurant Association has estimated the loss from rodent damage could be as high as $10 billion dollars annually. (pg.245)

20. Sewer rat, brown rat, wharf rat are common names for the *Rattus norvegicus* (Norway Rat), a red-brown to gray-brown rodent. (pg.245)

21. The female rat can produce 6 to 8 young per litter, 4 to 7 times per year. (pg.245)

22. Rats can force entry through openings as small as a quarter and can jump up to one meter vertically and 1.2 meters horizontally. (pg.245)

23. What is bromethalin and what are effects of its use?
Bromethalin, a nonanticoagulant has been reformulated and remarketed by two manufactures since its introduction in the early 1980s. This rodenticide produces deaths in 1 to 3 days. (pg.248)

24. The most common pests among food processing plants and food service facilities throughout the world are the housefly. (pg.238)

25. The first line of defense in the control of pests is an effective program against pests begins with a basic understanding of the characteristics of pest contamination sources and comprehensive knowledge of safe and effective extermination and control procedures. (pg.235)

26. What is diazinon and dursban?
Diazon offers potential for the control of cockroaches. Amidinohyrozone (Dursban) has been developed and sold as a bait, and can be effective against cockroaches that resist other poisonous compounds, but the use of insecticides indoors is not acceptable. A residual insecticide such as diazinon sprayed in hiding places is considered effective if these pests have not developed a resistance to this compound. (pg.238)

27. What diseases can potentially be spread by the housefly?
A housefly is a pest to all segments of the community, transmitting a variety of pathogenic organisms to humans and their food. Examples are human disease such as typhoid, dysentery, infantile diarrhea, and streptococcal and staphylococcal infections. (pg.238)

28. **Which species of cockroach is more likely to found in food preparation areas?**
German Cockroach (Blatella germanica)(pg.236)

29. **Which species of cockroach found in the U.S. is the largest at approximately 40 to 60 mm in length?**
American cockroach (periplaneta Americana)(pg.236)

30. **The most abundant species of rat in the U.S. is the *Rattus norvegicus* (Norway rat), a red-brown to gray-brown rodent, sometimes known as the *sewer rat, barn rat, brown rat,* or *wharf rat.* (pg.245)**

31. **What is IPM and what are its objectives?**
Integrated pest management (IPM) major objective is to control pests economically through environmentally sound techniques, many of which use biological control. The goals of IPM are to use pesticides wisely and to seek alternatives to commonly used pesticides. IPM implies that pests are "managed" and not necessarily eliminated. However the ultimate objective of pest management in food is to prevent of eliminate pests. (pg.252)

Lesson 15
Read State Pool and Spa Manual

1. **It has been well documented that _____ and _____ infections have been contracted from spa pools.**

2. **Why is pseudomonas of particular concern in spa pools?**
Pseudomonas grows in warm water and is more commonly associated with rashes from poorly maintained spas than swimming pools. It is the most common bacteria isolated from skin rashes and ear infections. (pg.40)

3. **If a pool is 30 feet long and 15 feet wide with a water depth of 6 feet, how many gallons of water does it hold? (pg. 25)**
Gallons = area x average depth x 7.5
Average depth = (shallow end + deep end) / 2
Area = width x length

Gallons = (30ft x 15ft) x 6ft x 7.5
Gallons = (450ft) x 6ft x 7.5
Gallons = 21,060 gallons

4. **The turnover rate required of wading pools is 1 to 2 hours or less and for pools other than diving or water slide pools is 6 hours or less. (pg.118)**

5. **Most pools should have 60 percent of the water removed by the skimmer or scum gutter and _____ percent removal by the drain during normal operation.**

6. **How often should spa pools be drained?**

7. **The skimmer works effectively at removing floating body oils and bacteria in a water level range of about _____ inches.**

8. **What are the filter rates in a high rate sand filter? (pg.139)**
5-20 gpm/ft2
204-813 lpm/m2

9. **_____ filters have limitations and for public pools, should not be used for indoor pools.**

10. **HTH and Sentry are two common brands of _____ _____, other brands may be used if they contain _____ _____.**

11. **What are the dangers inherent in using calcium hypochlorite?**
The National Fire Protection Association (NFPA) classifies cal-hypo as a class 3 oxidizer, meaning it "causes a severe increase in the burning rate of a combustible material with which it comes into contact." Oxidizers can ignite if contaminated or heated. It is incompatible with organic compounds, and

great care should be taken when storing and handling this disinfectant. (pg.52)

12. The granular form of calcium hypochlorite has 65-78 % available chlorine. (pg. 52)

13. What effect does granular chlorine have on pH?

14. Due to convenience, _____ chlorine has become more popular with pool operators.

15. Liquid chlorine has a pH of about _____, so the pH must be balanced by _____.

16. When chlorine gas is utilized as a swimming pool disinfectant, one must add _____ pounds of soda ash for every pound of chlorine added to a pool to _____ the pH.

17. Soda ash is a common name for sodium carbonate. (pg. 62)

18. If cyanuric acid is used, the cyanurate levels must not exceed _____ ppm.

19. Under what circumstances is cyanuric acid used?

20. List 5 factors that affect the germ killing powers of chlorine in swimming pools.

21. Perspiration and urine combine with chlorine forming a new chemical called ammonia and organic nitrogen-containing chemicals. (pg.49)???????

22. When is super-chlorination necessary and how is it accomplished?

23. Spa pools are required to maintain a minimum free chlorine residual of 1.0 to 3.0 ppm.

24. Bad odors associated with spa pools are often caused by chloramines. (pg.49)

25. Total chlorine minus free chlorine equals combined chlorine. (pg. 49)

26. The maximum allowable level of combined chlorine is 0.2 ppm in pools and 0.5 ppm in spas. (pg.74)

Lesson 16

Read State Pool and Spa Manual

1. **List 5 problems associated with water that has a pH level that is too high.**
   Scaling water
   - **Clogged filters**
   - **Clogged heater elements**
   - **Reduced Circulation**
   - **Cloudy water**

   Other problems
   - **Chlorine inefficiency**
   - **Eye/skin irritation (pg.61)**

2. **List four problems associated with water that has a pH level that is too low.**
   Corrosive water
   - **Etching of pool/spa surface**
   - **Corrosion of metals**
   - **Staining of surface walls**

   Other problems
   - **Chlorine loss**
   - **Wrinkles in vinyl liners**
   - **Eye/ skin irritation (pg.61)**

3. **The acceptable pH range is from 7.2 to 7.8, however the recommended pH range for a pool is 7.4 to 7.6. (pg.61)**

4. **When pH starts to go out of range, it can be easily corrected. To raise pH, add Sodium Carbonate and to lower pH, add Sodium Bisulfate. (pg.62)**

5. **The most frequent reason for closing a pool is _____.**

6. **How often should one testing for free chlorine? 3 times a day.**

7. **The only approved type of chlorine test kits are DPD (N,N Diethyl-1,4 Phenylenediamine Sulfate).**

8. **List four important tips to remember when testing for free chlorine.**
   Avoid inlets, take sample 18' below surface, read results within 1 minute, rinse afterward.

9. **Essentially all test kits use phenol-red test for the determination of pH.**

10. **The ideal total alkalinity water parameter in pools is 80-120 ppm. (pg.62)**

11. **What happens when alkalinity of pool water is too low?**
When there are not enough bicarbonate ions to provide buffering of the pH, the pool or spa water will ehibit pH bounce. Low alkalinity may result in water with a green tint if iron or copper are in the water. Low alkalinity may also cause corrosion/etching of the pool/spa surfaces. (pg.63)

12. **The chemical compound , sodium bicarbonate ,is commonly used to raise alkalinity. (pg.63)**

13. **If a pool is officially closed, who can re-open it?**
Health Officials

14. **Pools with maximum depths of less than 5 feet shall not be used for diving and must have "NO DIVING" signs with clean legible letters that are 2 inches high in plain view.**

15. **Algae is not a problem in pools if a chlorine level of 1.0 ppm is consistently maintained.**

16. **The proper pool parameter for calcium hardness is 200-400 ppm. (pg.64)**

17. **The amount of chlorine required to oxidize (remove) ammonia in water is known as _____.**