

DW Module 4:
Water Quality and Characteristics
Answer Key

Exercise:

Try this exercise to test your knowledge of the regulatory terms we just reviewed. Place the letter of the definition before the correct term.

<u> C </u>	Maximum Contaminant Level	A. This is a regulatory standard that is used in place of the MCL when it is not feasible to determine the level of the contaminant.
<u> A </u>	Treatment Technique	B. The highest level of a disinfectant allowed in drinking water
<u> B </u>	Maximum Disinfectant Residual Level	C. The highest level of a contaminant that is allowed in drinking water



UNIT 2 EXERCISE

[Have the class take five minutes to complete the quiz. They can complete it individually or with a partner. Once completed, take five minutes to review the answers.]

1. How did the increase in the number of municipal water systems in the U.S. contribute to major disease outbreaks in the early part of the 20th century?

A: By the year 1900, the number of municipal water systems in the US had increased to over 3,000, although only approximately 10 systems filtered their supplies (slow sand filter plants). The result of this explosion of water systems contributed to major disease outbreaks due to the distribution of contaminated water through pumped and piped supplies.

2. Match the following terms with their definitions (place the letter of the term in the line in front of the definition):

<u> C </u>	Toxicology	A. Causing heritable alteration to genetic material
<u> A </u>	Mutagenic	B. Long term, low dose exposure to a contaminant
<u> D </u>	Acute	
<u> B </u>	Chronic	

E. Genotoxic

C. The study of adverse effects of chemicals on living things

D. Short term, high dose exposure to a contaminant

E. Causing alteration or damage to genetic material

3. **True or False:** Maximum Contaminant Levels (MCL) are non-enforceable levels that relate to the taste and odor (aesthetic quality) of the water.
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Indicator – Surrogate microorganisms and other water quality parameters used as a sign of a water system's vulnerability to the presence of pathogenic microorganisms. For example, the presence of coliform bacteria indicates that pathogenic bacteria may be present.



Can you think of any reasons for this procedure?

Ans: Waterborne pathogens generally occur in such low numbers relative to other waterborne microorganisms that they are difficult to test and would not provide real time data for process control. Therefore, testing for indicators that are present when the pathogen is present is an expedient alternative.



Exercise - Microorganisms

[Have the class take five minutes to complete the exercise. They can complete it individually or with a partner. Once completed, take five minutes to review the answers.]

- List three examples of regulated waterborne microorganisms.
 - Cryptosporidium
 - E. coli
 - Fecal Coliforms
- Waterfowl droppings, septic fields, and run-off from farm fields are some of the common sources of waterborne pathogenic microorganisms.
 - True
 - False
- Protozoa can survive in water for up to

- a. One hour
- b. One day
- c. One month
- d. One year

4. Best Available Technologies for treating water with bacteria include conventional filtration and disinfection.

- a. True
- b. False

5. List three examples of microbial Indicators and give one shortcoming for each.

{Instructor: See pages 3-11 and 3-12 for possible answers to this question}

- a. _____
- b. _____
- c. _____



Exercise - Inorganic Constituents

[Have the class take five minutes to complete the exercise. They can complete it individually or with a partner. Once completed, take five minutes to review the answers.]

1. Give the Maximum Contaminant Level (MCL) for the following inorganic constituents.

- a. Arsenic = 0.01 mg/L
- b. Fluoride = 4 mg/L
- c. Cadmium = 0.005 mg/L
- d. Mercury = 0.002 mg/L

2. List the Best Available Technologies (BATS) for treating water with the following inorganic constituents.

- a. Mercury GAC
- b. Cadmium Coagulation/Filtration
- c. Arsenic Coagulation/Filtration

3. List three common inorganic constituents and their sources. *[Instructor: See pages 3-18 and 3-19 to for many possible answers to this question].*

- a. _____
- b. _____
- c. _____

4. What could cause a metallic or salty taste in drinking water?

A: Copper, iron, manganese, zinc, pH, total dissolved solids, sulfate or chloride

5. High levels of fluoride in drinking water could cause tooth discoloration.
 6. Which of the following produce water with the highest hardness?
 - a. Lake
 - b. Well
 - c. River
 - d. Stream
 7. True or False: Hard water is caused by iron in the water
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Common Sources



Can you think of some common sources of Natural Organic Compounds (NOMs)?

[Encourage answers from the class.]

Ans: Many answers including: breakdown of plant debris including algae, aquatic plants, leaves, humic matter from wetlands in the watershed.



"Humic matter" can be defined as a substance derived from humus, a black or brown organic substance consisting of partially or wholly decayed vegetable matter.



Can you think of some common sources of Synthetic Organic Chemicals (SOCs)?

Ans: Many answers including: chemical industrial discharges, metal degreasing chemicals, wasted dry cleaning chemicals, leakage from old electrical transformers (PCB), agricultural runoff containing pesticides, drinking water chemicals, storm water runoff from developed areas.



Exercise - Organic Compounds

[Have the class take five minutes to complete the exercise. They can complete it individually or with a partner. Once completed, take five minutes to review the answers.]

- 1) SOC is an acronym for Synthetic Organic Chemicals
- 2) Synthetic Organic Chemicals can be further classified as Volatile Organic Compounds or Non-volatile Organic Compounds.

3) List the Maximum Contaminant Level (MCL) for the following volatile organic compounds.

- a) Benzene = 0.005 ppm
- b) Ethylbenzene = 0.7 ppm
- c) Vinyl Chloride = 0.002 ppm

4) List three non-volatile organic compounds.

[Instructor: See page 3-27 for possible answers.]

- 1. Atrazine _____
- 2. Diquat _____
- 3. Lindane _____

5) List the best available technologies (BATs) for removing Benzene from drinking water.

GAC and PTA

Exercise - Radionuclides and DBP

1. Besides alpha emitters, radium-226 and radium-228, what radionuclide must be monitored?

A: Uranium

2. T/F: The source of most radionuclides is the erosion of natural deposits

A: True

3. Which of the following are reasons a water system measures chloramine

- a) Use the chloramine result to determine how well reactions of chlorine with ammonia are working
- b) Determine if chlorine will react with hydrogen sulfide
- c) Determine the concentration of Total Available Chlorine (TAC) residual in the distribution system
- d) Determine the acidity of the water

A: a and c

4. List the Maximum Disinfectant Residual Levels (MDRLs) for the following disinfectants:
- Chlorine (4 mg/L)
 - Chloramines (4 mg/L)
 - Chlorine dioxide (0.3 mg/L)
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UNIT 4 EXERCISE

- A grab sample is collected at a specific site and is representative of the conditions at the time of sampling.
- A sample from a continuously flowing source which is taken automatically is called a on-line sample.
- A sample collected at a specific site, but portions of the sample are collected at different time intervals is called a composite sample.
- When there is considerable variation in water quality, the sampling frequency should be (pick the best answer):
 - Higher X
 - Lower _____
- Good insight into the effectiveness of filter operations can be provided by using a:
 - pH meter
 - particle counter
 - flow meter
 - thermometer
- On-line monitoring for disinfectant residual can be used to automatically control the chlorine feed rate to maintain a set chlorine residual.
- To assure that water delivered to the consumer is bacteriological safe, total coliform is used as a:
 - Microbiological indicator
 - Color comparator
 - Turbidity measurement
 - Taste and odor test
- A DPD Colorimetric test using a color comparator field test kit is a common method for measuring chlorine residual in water.
 - True X
 - False _____
- An on-line _____ is an analytical instrument used to measure the effectiveness of the surface water treatment process. Readings from the instrument are in NTUs.

- a. Atomic absorption spectrometer
- b. Turbidimeter
- c. Spectrophotometer
- d. Gas Chromatograph