

2015 DW Module 1: General Overview – VOLUME II
Answer Key

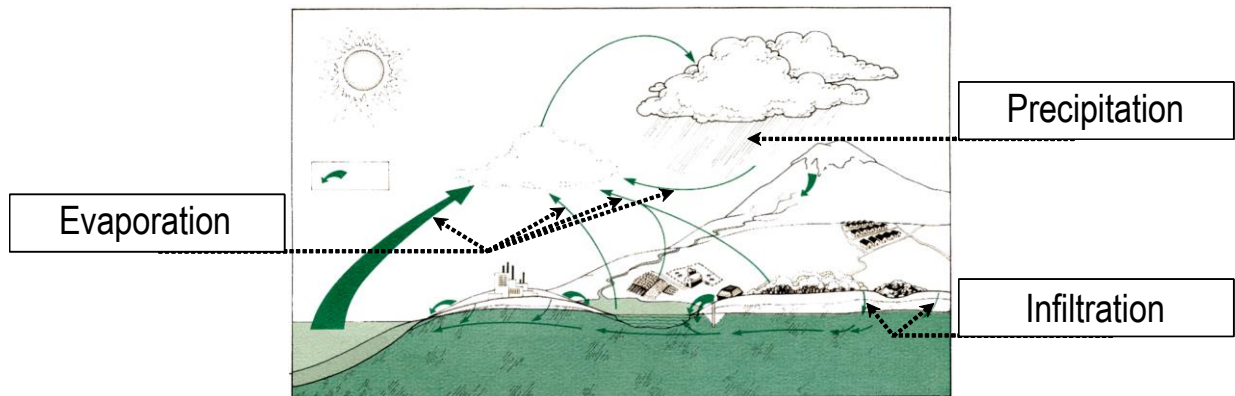
Unit 1:



Unit 1 Exercise

1. On the diagram below, label the following parts of the Hydrologic Cycle: Precipitation, Evaporation and Infiltration.

ANS:



Unit 2:



Unit 2 Exercise

1. List the three types of groundwater sources.

ANS: Wells, springs, infiltration galleries and radial collectors

2. **True or False:** A stratum is a layer of earth

ANS: True

3. Which one of the following best defines the term **aquifer**?
 - a. A low lying area where water pools

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- b. Water-bearing stratum of rock, sand, or gravel
- c. Impervious stratum near the ground surface
- d. Treated water leaving the water system

ANS: b. Water-bearing stratum of rock, sand, or gravel

4. List the three types of aquifers.

ANS: Unconfined Aquifer, Confined Aquifer, Perched Aquifer, or Perched Water Table.

Unit 3:

Organic Compounds

Common Sources



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

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), volatile and non-volatile?

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.



Unit 3 Exercise

Using the workbook, answer the following questions:

1. List one example of a regulated waterborne microorganism.

ANS: *E. coli*, *Cryptosporidium*, *Giardia lamblia*, Fecal coliforms, Legionella, Viruses, Heterotrophic plate count, total coliforms, turbidity

2. Waterfowl droppings, septic fields, and run-off from farm fields are some of the common sources of waterborne pathogenic microorganisms.

- a. True
- b. False

ANS: a. True

3. List one characteristic of an effective microbial indicator. (page 3-11)

ANS:

- Present in large numbers in fecal matter
- Present when the pathogenic microorganism is present
- High ratio of indicators to pathogens
- Stable and non-pathogenic
- Absent in uncontaminated water
- Should respond similarly to natural conditions and be at least as susceptible to treatment as the pathogenic microorganism
- Easily detected by simple, inexpensive lab tests in the shortest time with accurate results
- Should be suitable for all types of drinking water supplies

4. A sudden increase in Heterotrophic Plate Count (HPC) may suggest a problem with treatment, including disinfection practices.

- a. True
- b. False

ANS: a. True

5. List the Maximum Disinfectant Residual Level (MDRL) for chlorine: **4.0 mg/L as Cl₂**

6. Give the Primary Maximum Contaminant Level (PMCL) for cadmium **0.005 mg/L**

7. Hard water is caused by iron in the water:
- True
 - False

ANS: b. False (primarily calcium and magnesium salts)

Unit 4:



Unit 4 Math

1. The specific gravity of Aqua Mag is 1.4. How much (lbs) does a one gallon weigh?

ANS: ? lbs/gal = (S.G.) x (8.34 lbs/gal) = **12 lbs/gal**

2. How much does a 30 gallon drum of 60% fluorosilic acid weigh (lbs) if it has a specific gravity of 1.46?

ANS:

$$\text{Weight, lbs} = (\text{gallons of drum or tank}) \times (\text{S.G.}) \times (8.34 \text{ lbs/gal})$$

$$\text{Weight, lbs} = (30) \times (1.46) \times 8.34 = \mathbf{365 \text{ lbs}}$$

3. Your plant has a 10,000 gallon tank of Aluminum Chloride. The specific gravity of Aluminum Chloride is 1.2. How much (in pounds) does the tank of Aluminum Chloride weigh when the tank is full?

ANS:

$$\text{Weight, lbs} = (\text{gallons of drum or tank}) \times (\text{S.G.}) \times (8.34 \text{ lbs/gal})$$

$$\text{Weight, lbs} = (10,000) \times (1.2) \times (8.34 \text{ lbs/gal}) = \mathbf{100,000 \text{ lbs}}$$

Converting temperatures between the Fahrenheit and Celsius scales

$$0.555 (^\circ\text{F} - 32) = ^\circ\text{C} \quad (\text{NOTE: } 0.555 = 5/9 \text{ which is on the formula/conversion sheet})$$
$$(1.8 \times ^\circ\text{C}) + 32 = ^\circ\text{F}$$

Problem:

Convert $10\text{ }^\circ\text{C} = ?\text{ }^\circ\text{F}$

Problem Set Up and Calculation:

Step 1: Select correct conversion formula which is: $(1.8 \times ^\circ\text{C}) + 32 = ^\circ\text{F}$

Step 2: Insert known value into formula: $(1.8 \times 10) + 32$

Step 3: Complete the math within the parentheses $(1.8 \times 10) = 18$

Step 4: Do the addition $(18 + 32)$ for final answer = $50\text{ }^\circ\text{F}$



Physical and Chemical Changes

[Review the following statements and mark whether the change is physical or chemical.]

	PHYSICAL	CHEMICAL
1. Drinking water from ocean water by means of evaporation and condensation	✓	
2. Sodium from sodium chloride		✓
3. Pulverizing rock salt	✓	
4. Burning wood		✓
5. Dissolving sugar into water	✓	
6. Rusting of Iron		✓
7. The evaporation of alcohol	✓	



Unit 4 Exercise

1. Define the term matter and list the three states of matter.

ANS: Matter occupies space and has mass. The air that surrounds us, the pencil that we write with and the water that we drink are all examples of matter. The three states of matter are solid, liquid and gas.

2. Differentiate between mass, weight, density and specific gravity.

ANS: Mass is the amount of matter present in a given object.

Weight is the mass of an object being acted upon by gravity.

Density is the mass of a substance per unit of volume of the substance.

Specific gravity is the density of a substance compared to the weight of the same volume of water.

3. Explain the difference between a physical and a chemical change in matter.

ANS: A physical change in matter is a change in the form of matter but not in its chemical identity. A chemical change in matter is a change in which one or more kinds of matter transform into a new kind of matter.

4. List and define three classes of matter.

ANS: Element – a substance that cannot be decomposed into simpler substances by any chemical reaction.

Compound – a substance that is composed of two or more elements that are chemically combined in fixed proportions.

Mixture – a material that can be separated by physical means into two or more substances.