

Module 12:  
Laboratory Overview  
**Answer Key**



**Exercise for Unit 1 – Laboratory Equipment, Terms, and Techniques**

You need to mix a standard solution and wish to add precise amounts of the components of the solution so that you know the exact concentration. Which combination of glassware would you use to mix the solution as precisely as possible?

**Ans:** A pipet and volumetric flask are the most accurate ways to measure liquids when making a standard solution. Extra credit if participants said a TD (to deliver) pipet.

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**Exercise for Unit 1 – Laboratory Equipment, Terms, and Techniques**

1. An Imhoff cone would most likely be used for what type of analysis?

**Ans:** B. Sludge Volume

2. What is the purpose of a desiccator?

**Ans:** A desiccator is used to keep chemical reagents and samples dry. Typically, a sample is heated in an oven to dry it and then placed in the desiccator to cool prior to weighing or undergoing further preparation.

3. An analytical balance would be used to do what type of analysis?

**Ans:** D. Gravimetric

4. List three sample concentration techniques.

**Ans:** Centrifuge, Distillation and Digestion

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## Exercise for Unit 2 – Chemical Hygiene and Lab Safety

1. List the two general types of hazards that a Wastewater Treatment Plant Operator may find himself exposed to.

**Ans:** Infectious wastes and toxic chemicals.

2. List the three most common routes that infectious agents can enter your body.

**Ans:** Cutaneous, oral ingestion and inhalation.

3. List seven common types of laboratory accidents.

**Ans:** Any seven of the following: electric shock, cuts, burns, heat, chemical, toxic fumes, chemical spills, slip and fall and fire.



## Exercise for Unit 3 – Sampling

This is your first week of work in the lab at a large Wastewater Treatment Plant and the effluent composite sampler is broken. You need to run samples for NPDES compliance. The boss has told the operators to get grab samples, put them in the refrigerator and to read the effluent totalizer every hour. This morning he has told you to take the individual grab samples the operators collected and make the composite sample yourself. You are required to do a flow based composite and you will need about 1,000 ml of sample to conduct all of the required tests. The night shift operator threw a sheet at you as he ran out the door. It reads:

| <u>Time</u> | <u>Totalizer (1,000s)</u> | <u>Time</u> | <u>Totalizer (1,000s)</u> |
|-------------|---------------------------|-------------|---------------------------|
| Midnight    | 002215                    | 1 PM        | 010960                    |
| 1 AM        | 002740                    | 2 PM        | 010992                    |
| 2 AM        | 003925                    | 3 PM        | 011012                    |
| 3 AM        | 005037                    | 4 PM        | 011124                    |
| 4 AM        | 006135                    | 5 PM        | 011276                    |
| 5 AM        | 007500                    | 6 PM        | 011409                    |
| 6 AM        | 008555                    | 7 PM        | 011650                    |
| 7 AM        | 009869                    | 8 PM        | 011788                    |
| 8 AM        | 010050                    | 9 PM        | 011952                    |
| 9 AM        | 010650                    | 10 PM       | 012050                    |
| 10 AM       | 010725                    | 11 PM       | 012134                    |





## Exercise for Unit 4 – Laboratory Procedures

1. List the four types of solids analyses and explain the significance of each.

**Ans:** Dissolved solids. Solids analyses are important in the control of biological and physical wastewater treatment processes.

Settleable Solids. This analysis indicates the volume of solids removed by sedimentation.

Total Suspended Solids. This analysis indicates the quality of the influent wastewater and is used to gauge plant performance at various locations in the plant. It is also used to verify discharge compliance.

Total Solids (Volatile and Fixed). Total solids are the combined amounts of suspended and dissolved material in the sample. It is comprised of volatile and fixed solids. Volatile solids are composed of organic compounds which are either plant or animal origin (such as waste material that can be treated biologically). Fixed solids are inorganic compounds such as sand, gravel and minerals.

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## Exercise for Unit 4 – Laboratory Procedures

1. What is the significance of conducting pH and Alkalinity analyses?

**Ans:** pH: The purpose of the test is to determine whether the pH at various points of the treatment process is favorable for the process.

Alkalinity: Alkalinity is a measure of the wastewater's ability to neutralize acids. It is an indirect measure of the concentration of carbonate, bicarbonate and hydroxide in the sample.

2. When conducting a pH analysis, the sample is collected from which locations?

**Ans:** From the influent, recirculated sludge, digester supernatant and plant effluent.

3. When conducting an alkalinity analysis, the sample is collected from which locations?

**Ans:** The sample is collected from the influent and effluent.

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#### Exercise for Unit 4 – Laboratory Procedures

1. Explain the principal difference between BOD and COD analyses.

**Ans:** BOD quantifies the depletion of oxygen due to biological activity over a 5 day period. COD uses a chemical reflux to quantify the amount of oxygen used by a sample. COD analyses can be run in a matter of hours rather than days.

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#### Exercise for Unit 4 – Laboratory Procedures

1. Explain the purpose of testing a WWTP's effluent for total coliform.

**Ans:** It is used as a surrogate to indicate the quantity of human or animal waste in finished water.

2. Explain the purpose of testing a WWTP's effluent for fecal coliform.

**Ans:** It is used as a surrogate to indicate the quantity of human or animal waste in finished water. The presence of fecal coliforms indicates that disease producing organisms may be present in the sample tested.

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#### Exercise for Unit 4 – Laboratory Procedures

1. Why are there limits placed on the amount of certain metals that can be discharged from a WWTP?

**Ans:** High concentrations of some metals can be toxic to some forms of aquatic life.

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#### Exercise for Unit 4 – Laboratory Procedures

1. What is the significance of conducting a chlorine analysis?

**Ans:** To determine the presence of chlorine in the discharge since it is toxic to aquatic life.

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### Exercise for Unit 4 – Laboratory Procedures

1. List the three types of nitrogen/ammonia analyses and explain the significance of each.

**Ans:** Nitrate/Nitrite: The presence of nitrate in the effluent of a WWTP is significant because it is an essential nutrient for algae growth. Excessive amounts of nitrate can cause algae blooms. When the algae die and decays it can exhibit a large oxygen demand on the stream which in turn can cause the fish and other aquatic life to be killed.

Ammonia: Ammonia in the effluent of a wastewater treatment plant can create a significant oxygen demand in the receiving stream. This demand will lower the amount of DO available for aquatic life and lead to fish and aquatic life kills.

TKN: TKN is the sum of organic nitrogen and the ammonia nitrogen in a sample.

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### Exercise for Unit 4 – Laboratory Procedures

1. What is the significance of conducting a phosphate analysis?

**Ans:** Wastewater is usually quite rich in phosphorus compounds and its removal is extremely important because their presence can stimulate the growth of algae. These growths can be a great nuisance and the die-off of algae will create a large DO demand in the receiving stream.

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### Exercise for Unit 4 – Laboratory Procedures

1. List 5 elements of a good QA plan.

**Ans:** Any five of the following should be included in a QA plan: a cover sheet with plan approval signatures, a laboratory organization chart, sample control and documentation procedures, Standard Operating Procedures (SOPs) for each analytical method, analyst training procedures, equipment preventative maintenance procedures, calibration procedures, quality control procedures, and data reduction, validation, and reporting procedures.

2. Duplicates are used to demonstrate the \_\_\_\_\_ of a laboratory method.

**Ans:** precision

3. Spikes are used to demonstrate the \_\_\_\_\_ of a laboratory method.

**Ans:** accuracy

4. A well written QA manual can be used for what other purpose?

**Ans:** B.

A is not the correct answer because even a poorly written QA plan makes a fine door stop. C is not true because a lab QA manual only deals with the laboratory issues not plant operations. D is not true because even if the QA manual is perfect, the QA Officer must verify that the procedures contained in the manual are being adhered to.

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#### Exercise for Unit 4 – Laboratory Procedures

1. What are the two general types of laboratory records?

**Ans:** Analytical results and QC results.

2. Which of the following information does not need to be reported on a DMR?

**Ans:** c. Routine chemical deliveries are not reportable. However, if a spill of a treatment chemical occurred while receiving the chemical it would, most likely, be reportable.

3. DMRs must be received at the appropriate office within \_\_\_\_\_ days of the end of the monitoring period.

**Ans:** 28.

4. Completed DMRs and the data used to complete them must be maintained for at least \_\_\_\_\_ years after the date of submission, sample measurement, report or application.

**Ans:** 3.

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