

- **ADVANCED INDUSTRIAL WASTEWATER CURRICULUM**

The information on the Basic Industrial Curriculum must be known.

INDUSTRIAL WASTE TREATMENT VOL. I, THIRD EDITION:

Chapter 3 - Regulatory Requirements

Pretreatment standards and regulations Section 3.2 – 3.3

RCRA Section 3.5,

Clean Water Act Section 3.55

Chapter 5 - Industrial Monitoring

Confined Space Section 5.61

Chapter 6 - Flow Measurement

Hydraulic and instrument calibration Section 6.5 – 6.51

Flows to measure Section 6.6

Flow proportioned composite samples Section 6.7

Chapter - 7 Preliminary Treatment

Flow equalization tanks-Lesson I Section 7.2

Types and maintenance of screens-Lesson 2 Section 7.5 – 7.52

pH adjustment-Lesson 3 Section 7.7 – 7.9

Chapter 8 - Physical-Chemical Treatment

Solids removal-Lesson 1 Section 8.0

Coagulation/Flocculation Section 8.2

Coagulation aids/chemicals used to improve settling-Lesson 2 Section 8.3

Polyelectrolytes/polymers Section 8.34

Jar testing Section 8.4 – 8.41

Example calculations Section 4.2

Clarifiers-Lesson 3 Section 8.54

Chapter 11 - Treatment of Metal Wastestreams

Sources of metal wastestreams-Lesson 1 Section 11.1

Types of metal wastestreams Section 11.2

Treatment processes Section 11.3

Metals recovery Section 11.36

Oily wastes Section 11.37

Process instrumentation and controls-Lesson 2 Section 11.4

Metallic sludge and dewatering Section 11.5

Chapter 13 - Safety

Laboratory-Lesson 3 Section 13.3

Fire prevention Section 13.4

Safety and procedures Section 13.6

OSHA Section 13.12

INDUSTRIAL WASTE TREATMENT VOL. II, SECOND EDITION:

Chapter 3 - Activated Sludge Process Control

Description of process-Lesson 1 Section 3.0

Aeration systems Section 3.01
Variations of activated sludge process Section 3.02
Return activated sludge-Lesson 2 Section 3.2
Waste activated sludge Section 3.3
Methods of sludge dewatering Section 3.31
Activated sludge microbiology Section 3.32
Factors affecting biological treatment-Lesson 3 Section 3.6 – 3.61

[APC&EC Regulation 3 \(PDF File\)](#)

WASTEWATER MATH (REFERENCE MATH FORMULA SHEET)

Sludge age
F/M ratio
MCRT
MLSS
MLVSS
RAS
SVI
WAS flow rate
Detention time
Surface loading rate
Weir overflow rate
Solids loading
Chemical dosage

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The following items are subjects and skills a person should know and understand before taking the Advanced Industrial examination – Need to know all the Basic Industrial N-T-K plus the following:

[Activated sludge, metals finishing, sedimentation/clarification with chemicals, DAF]

All of the Basic Industrial Wastewater NTK plus the following:

1. Regulations

- What is the purpose of the General Pretreatment Regulations?
 - Pretreatment regulations regulate pollutants that may do what?
 - What are the conventional pollutants?
 - Who is required to develop a pretreatment program?
 - Define "significant industrial user".
 - What is a "baseline monitoring report" and what is required in it?
 - Describe general and specific prohibitions.
 - What are toxic pollutants?
 - Describe BPT and BAT.
 - What are the two main different types of categorical standards?
 - What information is required in a periodic compliance report?
 - What are RCRA's primary goals?
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- What are some of RCRA's exemptions?
- What stormwater discharges require permitting under the NPDES?

2. Industrial Monitoring

- Confined Space

3. Flow Measurement

- What are the basic methods for checking the accuracy of flow metering?
- Flows to measure
- Flow proportioned samples
- When should composite samples be obtained?
- Describe flow-proportioned composite sampling.

4. Preliminary Treatment

- Flow equalization tanks: types, mixing, and shapes
- What are the two purposes of mixing?
- Define "short-circuiting".
- Describe some of the advantages/disadvantages of the different shapes of tanks.
- Why is screening used to pretreat industrial wastewater?
- What types of solids can be effectively screened?
- What are coarse screens also called and why are they used?
- How are coarse screens usually cleaned?
- What is the purpose of fine screens?
- Why are static screens popular in industrial wastewater treatment?
- How are static screens cleaned?
- Describe the different types of rotating screens and what types of waste they are best suited to handle.
- Explain the pH logarithmic scale.
- What is used to bring pH within a general range?
- What is used to "fine tune" pH?
- pH adjustment is also dependent upon what?
- What three elements contribute to a successful pH control strategy?
- Wastewaters may self-neutralize if there is enough what?
- What is the most important part of pH adjustment?
- What could happen if proper pH mixing does not occur?
- What is "dead time"?
- What affects dead time?
- What are the two types of mixing?
- For good intermixing, when should the reagent be added to wastewater?
- Residence time is dependent upon what?

5. Physical-Chemical Treatment Processes

- Solids removal using chemicals
 - What are the three steps in physical-chemical treatment?
 - Define coagulation and flocculation.
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- How is pinpoint floc formed?
- What is the purpose of flocculation?
- Why is chemical coagulation used?
- Addition of chemicals usually creates more what?
- What is coagulation?
- Fine suspended solids particles tend to accumulate what?
- Define electrostatic repulsion and coordination sphere formation.
- How is electrostatic charge reduction accomplished?
- Why is the initial process of rapid mix important?
- Why is the speed of paddles in rapid mix tanks important?
- Describe flocculation.
- What should be avoided during flocculation?
- How do polymers aid flocculation?
- What are the four most common chemicals added to improve settling of solids?
- What are some general safety precautions when using chemicals?
- Describe polyelectrolytes.
- How are synthetic polyelectrolytes classified?
- Why are polyelectrolytes used in small doses?
- What cautions should be taken when handling polyelectrolytes?
- What are some of the factors that should be considered when selecting chemicals?
- What is the most valuable tool in controlling and operating a chemical treatment process?
- Describe the jar test procedure.
- The two basic configurations of clarifiers are based upon what?
- What is one advantage of vertical-flow clarifiers?
- What are some physical characteristics that can affect clarifier efficiency?
- Define "short-circuiting" and some of the causes.

6. Treatment of Metal Wastestreams

- Why can't metal wastestreams be treated with biological processes?
- What is a refractory chemical and how is it usually handled?
- What are some of the procedures for reducing waste treatment costs?
- What are chelating agents and how do they affect wastestreams?
- What are "spent baths" and what are the two options for treating them?
- Why are dilute rinse waters easier to treat?
- How and where are valuable metals (gold, silver, etc.) treated?
- Why do cyanide and hexavalent chromium require special treatment?
- What is essential to ensure completion of chemical reactions?
- Precise and accurate control of what is important in physical-chemical reactions?
- Batch processes are usually used when dealing with what kind of wastewater flows?
- What kind of processes are easier to control?
- Many operators consider what process as the simplest and most dependable?
- Batch treatment is an effective way to handle what that could overwhelm a continuous process system?
- Continuous flow treatment facilities are used to treat what?

- Neutralization of strongly what is required before they are discharged?
- Wastewaters with high pH are neutralized by the addition of what?
- Wastewaters with low pH are neutralized by the addition of what?
- What precautions should be taken when using strong acids or bases?
- Common metals can be removed from wastestreams by what two methods?
- Why must hexavalent chromium and cyanide wastes be removed before other metals?
- What is commonly used when treating wastestreams with different optimum pH levels?
- What are some limitations of the hydroxide precipitation process?
- Why are complexed metals difficult to treat?
- How can complexed metals be treated?
- Explain high pH precipitation.
- Explain the chemical reduction process.
- Why does hexavalent chromium have to be converted to trivalent chromium?
- How can hexavalent chromium be converted to trivalent chromium?
- What precautions must be taken during cyanide destruction and why?
- What is the most practical and economical method of treating cyanide wastes?
- Precious metals recovery
- What are the principal reasons to minimize the discharge of oily wastes from a wastestream?
- What is the source of oily wastes?
- What are the three types of oily wastes?
- What can be used to separate free or floating oils from the wastestream?
- How are emulsified oils treated?
- Process instrumentation and controls
- What are some common methods used to dewater metallic sludge?
- What are some of the advantages of filter presses?

7. Safety

- What are the basic lockout/tagout procedures?
- What is a tagout device?
- Excavations
- Safety precautions when collecting wastewater samples.
- Labels for chemical containers should have what information?
- What is the largest single cause of accidents in the lab?
- Why should you always wash your hands before eating?
- Which is put in a container first-acid or water?
- Why should chemicals and reagents be handled with care?
- What protective equipment should be worn in the lab?
- What three ingredients are needed for a fire?
- Describe the four classes of fire.
- List some fire prevention practices.
- What emergency phone numbers should be listed in a noticeable place?
- What is OSHA and what is it designed to protect?

8. Activated Sludge Process Control

- Describe the activated sludge process.
- Activated sludge is also known as what?
- Define stabilization and oxidation.
- What must the operator control for the activated sludge process to work properly?
- An increase in organisms in an aeration tank will require greater amounts of what?
- What is an essential control test in an aeration tank?
- What happens in an aeration tank if the DO is too low or too high?
- What is another important control technique in the aeration tank?
- What is RAS?
- What is WAS?
- What is/are the purpose(s) of aeration?
- What are the two methods commonly used to disperse oxygen?
- What are two examples of surface aerators?
- How is oxygen transfer accomplished in surface aeration?
- Describe turbine aeration.
- What is the most common type of aeration system?
- Describe diffused aeration systems.
- Why does compressed air need to be clean?
- Describe positive displacement blowers and its components.
- Describe a centrifugal blower and its components.
- What are the three types of diffusers commonly in use today?
- What are the three most common activated sludge variations?
- Describe contact stabilization, step-feed aeration, and complete mix.
- What is the purpose of returning activated sludge?
- How can RAS be controlled?
- What is the advantage of a constant RAS flow control and where is it an advantage?
- Compare RAS control approaches.
- What are the most commonly used techniques in RAS?
- What are some methods to check the sludge blanket depth?
- At what depth should the sludge blanket depth be kept?
- When should the sludge blanket depth be measured and why?
- Define the 30 minute settleability test.
- Define sludge volume index.
- What is the purpose of wasting activated sludge?
- The amount of WAS affects what items?
- Define growth rate.
- Which process controls can be used to control WAS?
- Define sludge age and commonly experienced difficulties.
- What facts need to be remembered concerning F/M ratio?
- What does MCRT represent?
- Define nitrification.
- Why is MLVSS used by operators for process control? • Activated sludge microbiology
- What are common types of industrial contaminants and their possible effects?
- What are some of the common adverse effects that industrial waste constituents have on unit processes?

9. Arkansas Regulation 3 (PDF File)

10. Wastewater Math (Reference formula sheet)

Be able to calculate:

- Sludge age
- F/M ratio
- MCRT
- MLSS
- MLVSS
- RAS
- SVI
- WAS flow rate
- Detention time
- Surface loading rate
- Weir overflow rate
- Solids loading