

**Registration Form**

**Point-of-Use Water Treatment CEU Course**  
**48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

**Start and finish dates:** \_\_\_\_\_

*You will have 90 days from this date in order to complete this course*

**Name** \_\_\_\_\_ **Signature** \_\_\_\_\_

*I have read and understood the disclaimer notice on page 2. Digitally sign XXX*

**Address:** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Email** \_\_\_\_\_ **Fax** (\_\_\_\_) \_\_\_\_\_

**Phone:**  
**Home** (\_\_\_\_) \_\_\_\_\_ **Work** (\_\_\_\_) \_\_\_\_\_

**Operator ID #** \_\_\_\_\_ **Exp. Date** \_\_\_\_\_

**Please circle/check which certification you are applying the course CEU's/PDH's.**

Water Treatment \_\_\_\_\_ Distribution \_\_\_\_\_ Collection \_\_\_\_\_ Wastewater Treatment \_\_\_\_\_

Other \_\_\_\_\_

**Technical Learning College TLC PO Box 3060, Chino Valley, AZ 86323**  
**Toll Free (866) 557-1746 Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

**If you've paid on the Internet, please write your Customer#** \_\_\_\_\_

**Please invoice me, my PO#** \_\_\_\_\_

**Please pay with your credit card on our website under Bookstore or Buy Now. Or call us and provide your credit card information.**

***We will stop mailing the certificate of completion so we need either your fax number or e-mail address. We will e-mail the certificate to you, if no e-mail address; we will fax it to you.***

## **DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I fully understand that this type of study program deals with dangerous, changing conditions and various laws and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable in any fashion for any errors, omissions, advice, suggestions or neglect contained in this CEU education training course or for any violation or injury, death, neglect, damage or loss of your license or certification caused in any fashion by this CEU education training or course material suggestion or error or my lack of submitting paperwork. It is my responsibility to call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded. It is my responsibility to ensure all information is correct and to abide with all rules and regulations.

**State Approval Listing Link**, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

**Professional Engineers**; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

## **State Approval Listing URL...**

<http://www.ABCTLC.com/downloads/PDF/CEU%20State%20Approvals.pdf>

*You can obtain a printed version of the course manual from TLC for an additional \$169.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

## **Grading Information**

Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

## For Texas Licensed Wastewater Operators

### Wastewater/Collections Rule Changes

#### Rule Changes and Updates for Domestic Wastewater Systems

On Nov. 4, 2014, TCEQ commissioners adopted revisions to 30 Texas Administrative Code (TAC), Chapter 217, Design Criteria for Domestic Wastewater Systems, and “re-adopted” previously repealed rules in 30 TAC, Chapter 317, Design Criteria Prior to 2008.

#### *Some of the changes to Chapter 217 include:*

- Adding new definitions and clarifying existing definitions;
- Adding design criteria and approval requirements for rehabilitation of existing infrastructure;
- Adding design criteria for new technologies, including cloth filters and air lift pumps;
- Making changes to reflect modern practices, standards and trends;
- Modifying rule language to improve readability and enforceability; and
- Modifying the design organic loadings and flows for a new wastewater treatment facility.

#### **SUBCHAPTER A: ADMINISTRATIVE REQUIREMENTS §§217.1 - 217.18**

Effective December 4, 2015 §217.1. Applicability. (a) Applicability. (1) This chapter applies to the design, operation, and maintenance of: (A) domestic wastewater treatment facilities that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (B) treatment units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (C) collection systems that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (D) collection system units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (E) existing domestic wastewater treatment facilities that do not have a current Texas Pollutant Discharge Elimination System permit or a Texas Land Application Permit and are required to have an active wastewater permit; (F) existing wastewater treatment facilities and collection systems that never received approval for plans and specifications from the executive director; and (G) collection system rehabilitation projects covered in §217.56(c) and §217.69 of this title (relating to Trenchless Pipe Installation; and Maintenance, Inspection, and Rehabilitation of the Collection System). (2) Domestic wastewater treatment facilities, treatment units, collection systems, and collection system units with plans and specifications approved by the executive director that were received on or after August 28, 2008 and before the effective date of this chapter must comply with the rules in this chapter, as they existed immediately before the effective date of the amendments to this chapter.

The rules in Texas Commission on Environmental Quality Page 2 Chapter 217 - Design Criteria for Domestic Wastewater Systems effect immediately before the effective date of the amendments to this chapter are continued in effect for that purpose. (3) This chapter does not apply to: (A) the design, installation, operation, or maintenance of domestic wastewater treatment facilities, treatment units, collection systems, or collection system units with plans and specifications that were approved by the executive director on or before August 27, 2008, which are governed by Chapter 317 of this title (relating to Design Criteria Prior to 2008) or design criteria that preceded Chapter 317 of this title; and (B) systems regulated by Chapter 285 of this title (relating to On-Site Sewage Facilities); or collection systems or wastewater treatment facilities that collect, transport, treat, or dispose of wastewater that does not have the characteristics of domestic wastewater, although the wastewater may contain domestic wastewater.

(b) The executive director may grant variances from new requirements added by the amendments of this chapter to a person who proposes to construct, alter, or re-rate a collection system or wastewater treatment facility if the plans and specifications for the project are submitted within 180 days after the date the amendments to this chapter are effective, provided the plans and specifications comply with the rules in effect immediately prior to the amendment. Adopted November 4, 2015 Effective December 4, 2015

**The link to the rules is available on the TCEQ website at <https://www.tceq.texas.gov/rules/indxpdf.html>**

***For Texas Students Only....***

All TCEQ Students will need to sign this and date this form as well. TCEQ students will also be given special assistance if you fail the examination. You will also have access to failed or wrong questions and/or the area or topic of the assignment to complete your learning experience.

**Attention Texas TCEQ Operators, Irrigators, CSI and Backflow Testers...**

**NOTE:** Any course cannot be taken for same credit in the same renewal period. Please call TCEQ and make sure that these courses are still accepted for credit before starting. Do not retake this course for credit in the same renewal period.

**Signature** \_\_\_\_\_

## CERTIFICATION OF COURSE PROCTOR

Technical Learning College requires that our students who takes a correspondence or home study program course must pass a proctored course reading, quiz and final examination. The proctor must complete and provide to the school a certification form approved by the commission for each examination administered by the proctor.

**Instructions.** When a student completes the course work, fill out the blanks in this section and provide the form to the proctor with the examination.

Name of Course: \_\_\_\_\_

Name of Licensee: \_\_\_\_\_

**Instructions to Proctor.** After an examination is administered, complete and return this certification and examination to the school in a sealed exam packet or in pdf format.

I certify that:

1. I am a disinterested third party in the administration of this examination. I am not related by blood, marriage or any other relationship to the licensee which would influence me from properly administering the examination.
2. The licensee showed me positive photo identification prior to completing the examination.
3. The enclosed examination was administered under my supervision on \_\_\_\_\_. The licensee received no assistance and had no access to books, notes or reference material.
4. I have not permitted the examination to be compromised, copied, or recorded in any way or by any method.
5. Provide an estimate of the amount of time the student took to complete the assignment.

Time to complete the entire course and final exam. \_\_\_\_\_

Notation of any problem or concerns:

Name and Telephone of Proctor (please print):

\_\_\_\_\_  
  
\_\_\_\_\_

Signature of Proctor

*This course contains general EPA's SDWA federal rule requirements. Please be aware that each state implements water / sampling procedures/safety/ environmental / building regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to not be in non-compliance and do not follow this course for proper compliance.*

## **When Finished with Your Assignment...**

### **REQUIRED DOCUMENTS**

Please scan the **Registration Page, Answer Key, Proctoring Report, Survey and Driver's License** and email these documents to [info@TLCH2O.com](mailto:info@TLCH2O.com).

### **IPhone Scanning Instructions**

If you are unable to scan, take a photo of these documents with your **iPhone** and send these photos to TLC, [info@TLCH2O.com](mailto:info@TLCH2O.com).

### **FAX**

If you are unable to scan and email, please fax these documents to TLC, if you fax, call to confirm that we received your paperwork. **(928) 468-0675**

### **Rush Grading Service**

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00. This fee may not cover postage costs.

If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

Thank you...

## Point of Use Answer Key

Name \_\_\_\_\_

Phone # \_\_\_\_\_

Did you check with your State agency to ensure this course is accepted for credit?

**Method of Course acceptance confirmation. Please fill this section  
No refunds.**

Website \_\_\_ Telephone Call \_\_\_ Email \_\_\_ Spoke to \_\_\_\_\_

Did you receive the approval number, if applicable? \_\_\_\_\_

**You can use Adobe Acrobat DC Program to complete the assignment.**

Please circle, bold, underline or X, please choose one answer only.

### Water Chemistry Review Section 1 - 60 Questions

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 1. A B C D  | 16. A B C D | 31. A B C D | 46. A B C D |
| 2. A B C D  | 17. A B C D | 32. A B C D | 47. A B C D |
| 3. A B C D  | 18. A B C D | 33. A B C D | 48. A B C D |
| 4. A B C D  | 19. A B C D | 34. A B C D | 49. A B C D |
| 5. A B C D  | 20. A B C D | 35. A B C D | 50. A B C D |
| 6. A B C D  | 21. A B C D | 36. A B C D | 51. A B C D |
| 7. A B C D  | 22. A B C D | 37. A B C D | 52. A B C D |
| 8. A B C D  | 23. A B C D | 38. A B C D | 53. A B C D |
| 9. A B C D  | 24. A B C D | 39. A B C D | 54. A B C D |
| 10. A B C D | 25. A B C D | 40. A B C D | 55. A B C D |
| 11. A B C D | 26. A B C D | 41. A B C D | 56. A B C D |
| 12. A B C D | 27. A B C D | 42. A B C D | 57. A B C D |
| 13. A B C D | 28. A B C D | 43. A B C D | 58. A B C D |
| 14. A B C D | 29. A B C D | 44. A B C D | 59. A B C D |
| 15. A B C D | 30. A B C D | 45. A B C D | 60. A B C D |

## **pH Review Section 2 Assignment – 20 Questions**

- |            |             |             |             |
|------------|-------------|-------------|-------------|
| 1. A B C D | 6. A B C D  | 11. A B C D | 16. A B C D |
| 2. A B C D | 7. A B C D  | 12. A B C D | 17. A B C D |
| 3. A B C D | 8. A B C D  | 13. A B C D | 18. A B C D |
| 4. A B C D | 9. A B C D  | 14. A B C D | 19. A B C D |
| 5. A B C D | 10. A B C D | 15. A B C D | 20. A B C D |

## **Point-of-Use Water Treatment Section 3 Assignment 30 Questions**

- |            |             |             |             |
|------------|-------------|-------------|-------------|
| 1. A B C D | 9. A B C D  | 17. A B C D | 25. A B C D |
| 2. A B C D | 10. A B C D | 18. A B C D | 26. A B C D |
| 3. A B C D | 11. A B C D | 19. A B C D | 27. A B C D |
| 4. A B C D | 12. A B C D | 20. A B C D | 28. A B C D |
| 5. A B C D | 13. A B C D | 21. A B C D | 29. A B C D |
| 6. A B C D | 14. A B C D | 22. A B C D | 30. A B C D |
| 7. A B C D | 15. A B C D | 23. A B C D |             |
| 8. A B C D | 16. A B C D | 24. A B C D |             |

## **Nanofiltration (NF) Section 4 Assignment - 20 Questions**

- |            |             |             |             |
|------------|-------------|-------------|-------------|
| 1. A B C D | 6. A B C D  | 11. A B C D | 16. A B C D |
| 2. A B C D | 7. A B C D  | 12. A B C D | 17. A B C D |
| 3. A B C D | 8. A B C D  | 13. A B C D | 18. A B C D |
| 4. A B C D | 9. A B C D  | 14. A B C D | 19. A B C D |
| 5. A B C D | 10. A B C D | 15. A B C D | 20. A B C D |



## Osmotic Processes Section 5 Assignment - 35 Questions

- |            |            |             |             |
|------------|------------|-------------|-------------|
| 1. A B C D | 10.A B C D | 19. A B C D | 28.A B C D  |
| 2. A B C D | 11.A B C D | 20. A B C D | 29. A B C D |
| 3. A B C D | 12.A B C D | 21. A B C D | 30. A B C D |
| 4. A B C D | 13.A B C D | 22. A B C D | 31. A B C D |
| 5. A B C D | 14.A B C D | 23. A B C D | 32. A B C D |
| 6. A B C D | 15.A B C D | 24. A B C D | 33. A B C D |
| 7. A B C D | 16.A B C D | 25. A B C D | 34. A B C D |
| 8. A B C D | 17.A B C D | 26. A B C D | 35. A B C D |
| 9. A B C D | 18.A B C D | 27. A B C D |             |

## Alternative Water Disinfectant Section 6 – 50 Questions

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 1. A B C D  | 14. A B C D | 27. A B C D | 40. A B C D |
| 2. A B C D  | 15. A B C D | 28. A B C D | 41. A B C D |
| 3. A B C D  | 16. A B C D | 29. A B C D | 42. A B C D |
| 4. A B C D  | 17. A B C D | 30. A B C D | 43. A B C D |
| 5. A B C D  | 18. A B C D | 31. A B C D | 44. A B C D |
| 6. A B C D  | 19. A B C D | 32. A B C D | 45. A B C D |
| 7. A B C D  | 20. A B C D | 33. A B C D | 46. A B C D |
| 8. A B C D  | 21. A B C D | 34. A B C D | 47. A B C D |
| 9. A B C D  | 22. A B C D | 35. A B C D | 48. A B C D |
| 10. A B C D | 23. A B C D | 36. A B C D | 49. A B C D |
| 11. A B C D | 24. A B C D | 37. A B C D | 50. A B C D |
| 12. A B C D | 25. A B C D | 38. A B C D |             |
| 13. A B C D | 26. A B C D | 39. A B C D |             |

## Hard Water Section 7 Assignment - 35 Questions

- |            |            |            |             |
|------------|------------|------------|-------------|
| 1. A B C D | 4. A B C D | 7. A B C D | 10.A B C D  |
| 2. A B C D | 5. A B C D | 8. A B C D | 11. A B C D |
| 3. A B C D | 6. A B C D | 9. A B C D | 12. A B C D |

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 13. A B C D | 19. A B C D | 25. A B C D | 31. A B C D |
| 14. A B C D | 20. A B C D | 26. A B C D | 32. A B C D |
| 15. A B C D | 21. A B C D | 27. A B C D | 33. A B C D |
| 16. A B C D | 22. A B C D | 28. A B C D | 34. A B C D |
| 17. A B C D | 23. A B C D | 29. A B C D | 35. A B C D |
| 18. A B C D | 24. A B C D | 30. A B C D |             |

**EPA Rules Section 8 Assignment – 50 Questions**

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 1. A B C D  | 14. A B C D | 27. A B C D | 40. A B C D |
| 2. A B C D  | 15. A B C D | 28. A B C D | 41. A B C D |
| 3. A B C D  | 16. A B C D | 29. A B C D | 42. A B C D |
| 4. A B C D  | 17. A B C D | 30. A B C D | 43. A B C D |
| 5. A B C D  | 18. A B C D | 31. A B C D | 44. A B C D |
| 6. A B C D  | 19. A B C D | 32. A B C D | 45. A B C D |
| 7. A B C D  | 20. A B C D | 33. A B C D | 46. A B C D |
| 8. A B C D  | 21. A B C D | 34. A B C D | 47. A B C D |
| 9. A B C D  | 22. A B C D | 35. A B C D | 48. A B C D |
| 10. A B C D | 23. A B C D | 36. A B C D | 49. A B C D |
| 11. A B C D | 24. A B C D | 37. A B C D | 50. A B C D |
| 12. A B C D | 25. A B C D | 38. A B C D |             |
| 13. A B C D | 26. A B C D | 39. A B C D |             |

*I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored. I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will not hold TLC liable for any errors, injury, death or non-compliance with rules. I will abide with all federal and state rules and rules found on page 2. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.*

**Please Sign that you understand and will abide with TLC's Rules.**

---

**Signature**

Please e-mail or fax this survey along with your final exam

**POINT-OF-USE WATER TREATMENT  
CEU TRAINING COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

E-MAIL \_\_\_\_\_ PHONE \_\_\_\_\_

**PLEASE COMPLETE THIS FORM BY CIRCLING THE NUMBER OF THE APPROPRIATE ANSWER IN THE AREA BELOW.**

1. Please rate the difficulty of your course.  
Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.  
Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.  
Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? \_\_\_\_\_

5. What would you do to improve the course?

---

---

How about the price of the course?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

How was your customer service?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

Any other concerns or comments.

---

---

---



## Point-of-Use Water Treatment CEU Training Course Assignment

You are required to complete this assignment in order to obtain your CEUs or PDHs. You can find a copy of this assignment in Word format on the website for your convenience. You may e-mail the answer to TLC, [info@tlch2o.com](mailto:info@tlch2o.com). If you need any assistance, utilize the Search function in Adobe Acrobat. You will have 90 days to complete this assignment.

### ***If you need Assistance....***

All instructors and administrative staff are obligated to respond within 2 days by email, snail mail or telephone providing proper guidance to successfully complete the assignment. Email and telephone inquiries are handled quickly, generally within 4 hours of the call. We encourage students to complete their work with less frustration and fewer delays by calling or e-mailing us for any concern. We attempt to provide direct interaction similar to conventional classroom training.

You can complete the entire assignment at a time. Only One answer per question

## Water Chemistry Review Section 1 - 60 Questions

### Commonly found Chemical Types

- Which of the following terms are often called 'pure' to set them apart from mixtures?  
A. Chemical bond(s)                      C. Forms of energy  
B. Chemical substance(s)                D. Physical forms
- Chemical substances exist as solids, liquids, gases or plasma, and may change between these phases of matter with changes in temperature or pressure.  
A. True            B. False
- According to the text, many chemicals are commonly available in?  
A. Chemistry compounds                C. Forms of energy  
B. Chemical substance(s)                D. Pure form
- Which of the following terms is a form of matter that has constant chemical composition and characteristic properties?  
A. Chemical solids                      C. A chemical substance  
B. Chemical gases                        D. None of the Above
- A chemical substance cannot be separated into components by physical separation methods, i.e. without breaking chemical bonds.  
A. True            B. False
- Which of the following terms can be chemical elements, chemical compounds, ions or alloys?  
A. Chemical ions                         C. A pure chemical compound  
B. Chemical substance(s)                D. None of the Above
- Which of the following terms convert one chemical substance into another?  
A. Chemistry conversions                C. Chemical reactions  
B. Chemical transformation              D. None of the Above

8. Forms of energy, such as light and heat, are not considered to be \_\_\_\_\_, and thus they are not "substances" in this regard.

- A. Chemical bond(s)
- B. Matter
- C. Forms of energy
- D. Physical forms

9. Chemical substances (also called pure substances) may well be defined as "any material with a definite chemical composition".

- A. True
- B. False

10. According to this definition a chemical substance can either be a \_\_\_\_\_ or a pure chemical compound.

- A. Pure chemical element
- B. Chemical substance(s)
- C. Pure chemical compound
- D. None of the Above

### Principles of Modern Chemistry

11. What is the study of elementary particles, atoms, molecules, substances, metals, crystals and other aggregates of matter?

- A. Nuclear chemistry
- B. Neurochemistry
- C. Analytical chemistry
- D. Traditional chemistry

12. Matter can be studied in solid, liquid, or gas states, in isolation or in combination.

- A. True
- B. False

13. Chemistry is generally the study of various result of interactions between atoms, leading to rearrangements of the \_\_\_\_\_ which hold atoms together.

- A. Chemical bonds
- B. Chemical substance(s)
- C. Chemical compound
- D. Physical world

14. Which term is a transformation of some substances into one or more different substances?

- A. Chemical element(s)
- B. An electron
- C. A chemical reaction
- D. Energy and entropy

15. Which term means the basis of a chemical transformation is the rearrangement of electrons in the chemical bonds between atoms?

- A. Chemical element(s)
- B. Metamorphous
- C. Chemical reaction
- D. Chemical equation

16. The chemical transformation can be symbolically depicted through a \_\_\_\_\_, which usually involves atoms as subjects.

- A. True
- B. False

17. The number of atoms on the left and the right in the equation for a \_\_\_\_\_ is equal.

- A. Chemical transformation
- B. Atomic balance
- C. The type of chemical reaction(s)
- D. Mixture of substances

18. When the number of atoms on either side is unequal, the transformation is referred to as a nuclear reaction or radioactive decay.

- A. True
- B. False

19. What is the term that expresses a type of chemical reaction and the energy changes that may accompany it are constrained by certain basic rules?

- A. Chemical substance(s)
- B. Chemical propertie(s)
- C. Chemical law(s)
- D. None of the Above

20. What important considerations are invariably important in almost all chemical studies?

- A. Chemical element(s)
- B. Energy and entropy
- C. Mixture of substances
- D. None of the Above

21. What are classified in terms of their structure, phase, as well as their chemical compositions?

- A. Chemical substance(s)
- B. Atom(s)
- C. The type of chemical reaction(s)
- D. None of the Above

### **Matter**

22. This term is generally defined as anything that has rest mass and volume (it takes up space) and is made up of particles.

- A. Gas
- B. Energy
- C. Matter
- D. None of the Above

23. The particles that make up matter have rest mass as well - not all particles have rest mass, such as?

- A. Neutron
- B. An electron
- C. The photon
- D. None of the Above

24. The particles that make up matter have rest mass as well - not all particles have rest mass, such as?

- A. Neutron
- B. An electron
- C. The photon
- D. None of the Above

25. According to the text, Matter can be a pure chemical substance or?

- A. Chemical bond(s)
- B. A mixture of substances
- C. Forms of energy
- D. None of the Above

### **Atom**

26. The nucleus is made up of positively charged protons and uncharged neutrons while the electron cloud consists of negatively-charged electrons which orbit the nucleus.

- A. True
- B. False

27. What is the space that contains dense core the atomic nucleus?

- A. Neutron
- B. An electron
- C. Photon cloud
- D. Electron cloud

28. The nucleus is dense; the mass of a nucleon is 1,836 times that of an electron, yet the radius of \_\_\_\_\_ is about 10,000 times that of its nucleus.

- A. Nucleus
- B. An atom
- C. An electron
- D. None of the Above

29. What is the smallest entity that can be envisaged to retain the chemical properties of the element, such as electronegativity, ionization potential, preferred oxidation state(s), coordination number, and preferred types of bonds to form (e.g., metallic, ionic, covalent)?

- A. An electron
- B. The atom
- C. Positively charged proton(s)
- D. None of the Above

### Element

30. The standard presentation of which term is in the periodic table, which orders elements by atomic number.

- A. Chemical element(s)
- B. An electron
- C. Photon
- D. None of the Above

### Compound

31. The properties of a compound bear little similarity to those of its \_\_\_\_\_.

- A. Chemical bond(s)
- B. Elements
- C. Forms of energy
- D. None of the Above

### Chemical Compounds

32. This term means represents substances, but not all substances are compounds.

- A. Bulk chemical(s)
- B. Mass
- C. Compound(s)
- D. None of the Above

33. Organic compounds are \_\_\_\_\_ based primarily on carbon and hydrogen atoms.

- A. Bulk chemical(s)
- B. Chemical(s)
- C. Compound(s)
- D. None of the Above

34. Compounds containing bonds between carbon and a metal are called \_\_\_\_\_.

- A. Organometallic compound(s)
- B. Isomer(s)
- C. Mixture(s)
- D. None of the Above

35. Covalent compounds are compounds in which components share?

- A. Nucleus
- B. Electrons
- C. Negatively-charged electrons
- D. None of the Above

36. In organic chemistry, this term represents that there can be more than one chemical compound with the same composition and molecular weight.

- A. Organometallic compound(s)
- B. Isomer(s)
- C. Mixture(s)
- D. None of the Above

37. Which term usually have substantially different chemical properties, may be isolated and do not spontaneously convert to each other?

- A. Isomers
- B. Chemical(s)
- C. Compound(s)
- D. None of the Above

### Substances versus Mixtures

38. All matter consists of various elements and \_\_\_\_\_, but these are often intimately mixed together.

- A. Chemical compounds
- B. Chemical substance(s)
- C. Mixture(s)
- D. None of the Above



### Chemicals versus Chemical Substances

39. What is the best term that is synonymous with "chemical" for professional chemists, the meaning of the word chemical varies for non-chemists?

- A. Chemical mixtures
- B. Isomer(s)
- C. Chemical substance(s)
- D. None of the Above

### Molecule

40. A molecule is the smallest indivisible portion of a pure chemical substance that is, its potential to undergo a certain set of \_\_\_\_\_ with other substances.

- A. Tetra atomic molecule(s)
- B. Ions
- C. Existence of identifiable molecule(s)
- D. Chemical reactions

41. Molecules are a set of atoms bound together by covalent bonds, such that the structure is electrically neutral and \_\_\_\_\_ are paired with other electrons either in bonds or in lone pairs.

- A. Ionic compounds
- B. Structures
- C. All valence electrons
- D. None of the Above

42. Molecules exist as electrically neutral units, unlike ions. When this rule is broken, giving the "molecule" a charge, the result is sometimes named a molecular ion or?

- A. Tetra atomic molecule(s)
- B. Ions
- C. A polyatomic ion
- D. None of the Above

43. Which term is residing in solids (for example, common sulfate or nitrate ions) are generally not considered "molecules" in chemistry?

- A. Molecule(s)
- B. Ionic compounds
- C. Charged polyatomic collection(s)
- D. None of the Above

44. The "inert" or noble gas elements (helium, neon, argon, krypton, xenon and radon) are composed of lone atoms as their smallest discrete unit, but the other isolated?

- A. Ions
- B. A molecule
- C. Chemical element(s)
- D. None of the Above

45. Which term is used to compose familiar substances such as water, air, and many organic compounds like alcohol, sugar, gasoline, and the various pharmaceuticals?

- A. Identifiable molecules
- B. Isolated chemical element(s)
- C. Existence of identifiable molecule(s)
- D. None of the Above

46. Not all substances or chemical compounds consist of discrete molecules, and indeed most of the solid substances that make up the solid crust, mantle, and core of the Earth are chemical compounds without?

- A. Molecule(s)
- B. Ionic compounds
- C. Charged polyatomic collection(s)
- D. None of the Above

47. These other types of substances, such as \_\_\_\_\_ and network solids, are organized in such a way as to lack the existence of identifiable molecules.

- A. Tetra atomic molecule(s)
- B. Ionic compounds
- C. Existence of identifiable molecule(s)
- D. None of the Above

48. One of the main characteristics of a \_\_\_\_\_ is its geometry often called its structure.

- A. Molecule(s)
- B. Ionic compounds
- C. Charged polyatomic collection(s)
- D. None of the Above

49. While the structure of diatomic, triatomic or tetra atomic molecules may be trivial, (linear, angular pyramidal etc.) \_\_\_\_\_, that are constituted of more than six atoms (of several elements) can be crucial for its chemical nature.

- A. Tetra atomic molecule(s)
- B. A molecule
- C. The structure of polyatomic molecules
- D. None of the Above

### Substance and Mixture

50. Which term is a kind of matter with a definite composition and set of properties?

- A. Molecule(s)
- B. Ionic compounds
- C. Charged polyatomic collection(s)
- D. A chemical substance

### Mole and Amount of Substance

51. The mole is a unit of measurement that denotes an amount of substance also called?

- A. An amount of substance
- B. A triple point
- C. Chemical amount
- D. Multipole balance

### Phase

52. The chemical classifications are independent of these \_\_\_\_\_ classifications; however, some more exotic phases are incompatible with certain chemical properties.

- A. An ionic bond
- B. Bulk phase
- C. Phase transition
- D. None of the Above

53. Which term is of a chemical system that have similar bulk structural properties, over a range of conditions, such as pressure or temperature?

- A. An amount of substance
- B. A triple point
- C. A phase is a set of states
- D. Multipole balance

54. The phase of matter is defined by \_\_\_\_\_, which is when energy put into or taken out of the system.

- A. An ionic bond
- B. Bulk phase
- C. The phase transition
- D. Multiple solid phases

55. Sometimes the distinction between phases can be continuous instead of having a discrete boundary, in this case the matter is considered to be in?

- A. A supercritical state
- B. Crystal structure
- C. A triple point
- D. None of the Above

56. There are three phases of solid iron (alpha, gamma, and delta) that vary based on?

- A. An ionic bond
- B. Temperature and pressure
- C. Phase transition
- D. Multiple solid phases

57. Another phase commonly encountered is the \_\_\_\_\_, which is the state of substances dissolved in aqueous solution (that is, in water).

- A. Aqueous phase
- B. Crystal structure
- C. A triple point
- D. None of the Above

58. Less familiar phases include plasmas, \_\_\_\_\_ condensates and fermionic condensates and the paramagnetic and ferromagnetic phases of magnetic materials.

- A. Bose–Einstein
- B. Multiple solid phases
- C. Phase transition
- D. None of the Above

### **Bonding**

59. Atoms sticking together in \_\_\_\_\_ are said to be bonded with one another.

- A. A triple point
- B. Molecules or crystals
- C. Multipole balance
- D. None of the Above

### **Energy**

60. What type of transformation is accompanied by a change in one or more of these kinds of structures, it is invariably accompanied by an increase or decrease of energy of the substances involved?

- A. Chemical reaction(s)
- B. Chemical
- C. Breaking of chemical bonds
- D. Chemical equation

(S) Means the answer can be plural or singular in nature

## pH Review Section 2 Assignment – 20 Questions

(S) Means the answer can be plural or singular in nature

### pH Section

1. What is the theory which states that an acid is a substance that produces Hydronium ions when it is dissolved in water, and a base is one that produces hydroxide ions when dissolved in water?

- A. Newton's
- B. Arrhenius
- C. Amadeus
- D. Lord Calvin's

2. Pure water has a pH very close to \_\_\_\_\_.

- A. 5
- B. 6
- C. 7.7
- D. 7

3. According to the manual, which of the following parameter/methods/measurements determine a parameter using a concentration cell with transference by measuring the potential difference?

- A. Primary pH standard values
- B. Alkalinity
- C. pH measurement(s)
- D. Measurement of pH

4. Mathematically speaking, pH is the negative logarithm of the activity of the (solvated) hydronium ion, often expressed as the measurement of \_\_\_\_\_.

- A. Electrons
- B. Hydronium ion concentration
- C. Cation measurement(s)
- D. None of the Above

5. What is the term associated with a charged species, an atom or a molecule, that has lost or gained one or more electrons?

- A. A proton
- B. Ion
- C. An electron
- D. A cation

6. What is a substance that has the ability to reduce other substances and is said to be reductive in nature?

- A. Alkalinity
- B. An electron donor
- C. Reductive or Redux
- D. Cations

7. When measuring alkalinity in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater, this measurement can be one of the best measures of the sensitivity of the stream to acid inputs.

- A. True
- B. False

8. One definition of pH is that it is defined as the decimal logarithm of the reciprocal of the \_\_\_\_\_,  $a_{H^+}$ , in a solution.

- A. Hydrogen ion activity
- B. (Solvated) hydronium ion
- C. Brønsted–Lowry acid–base theory
- D. None of the Above

9. With respect to standard buffer values, when more than two buffer solutions are used the electrode can be calibrated by fitting observed pH values to a straight line.

- A. True
- B. False

10. Commercial standard buffer solutions usually comes with information about value and a correction factor to be applied for what temperatures?

- A. 4 °C
- B. 25 °C
- C. 10 °C
- D. 70 °F

11. Because the pH scale is logarithmic, therefore pH is?

- A. Universal indicator
- B. A dimensionless quantity
- C. Excess of Ion concentrations
- D. None of the Above

12. While the general case requires the pH solution of?

- A. The solution of a cubic equation
- B. The solution of a linear equation
- C. A set of linear simultaneous equations
- D. A set of non-linear simultaneous equations

13. Because alkalinity is significant in many uses and treatments of natural waters and wastewaters, the measured values also may include contributions from \_\_\_\_\_ or other bases if these are present.

- A. Acids
- B. Light metals
- C. Borates, phosphates, silicates
- D. Caustics

14. Calculations are not necessary except in extreme situations for strong acids and bases. The pH of a solution containing a weak acid requires \_\_\_\_\_.

- A. The solution of a quadratic equation
- B. The Spectrophotometer
- C. The solution of a cubic equation
- D. None of the Above

15. What factor is key in in determining the suitability of water for irrigation?

- A. pH of 8
- B. pH of 6
- C. Alkaline earth metal concentrations
- D. Borates, phosphates, silicates

16. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a \_\_\_\_\_ fold difference in hydrogen ion concentration

- A. 1
- B. 2
- C. 10
- D. 100

17. According to the manual, this key water measurement is used in the interpretation and control of water and wastewater treatment processes.

- A. Acid
- B. Alkalinity
- C. Chemical ion
- D. pH

18. According to the text, what is the pH of pure water at 50 °C?

- A. 7.7
- B. 8.0
- C. 6.55
- D. 7.00

### Hard Water Section

19. Water contains various amounts of \_\_\_\_\_, some of which impart a quality known as hardness.

- A. Water hardness
- B. Carbonate hardness
- C. Calcium (Ca) and magnesium (Mg)
- D. Dissolved minerals

### Occurrence of Hard Water

20. Hard water is caused by soluble, divalent, \_\_\_\_\_, (positive ions having valence of 2). The principal chemicals that cause water hardness are calcium (Ca) and magnesium (Mg).

- A. Water hardness
- B. Metallic cations
- C. Calcium (Ca) and magnesium (Mg)
- D. Noncarbonate hardness

## Point-of-Use Water Treatment Section 3 Assignment 30 Questions

### Types of Processes

1. Which of the following terms operate without heating and therefore use less energy than conventional thermal separation processes such as distillation, sublimation or crystallization?

- A. Macromolecule(s)
- B. RO membrane(s)
- C. Membrane separation processes
- D. None of the Above

2. Which of the following terms uses membrane technology and is widely used in the food technology, biotechnology and pharmaceutical industries?

- A. Fractional distillation
- B. Cold separation
- C. Thermal separation method(s)
- D. None of the Above

3. According to the text, it is impossible to separate the constituents of azeotropic liquids or solutes which form isomorphous crystals by distillation or recrystallization but such separations can be achieved using \_\_\_\_\_.

- A. Macromolecule(s)
- B. Membrane technology
- C. Conventional thermal separation process(es)
- D. None of the Above

4. Applications include the production of drinking water by \_\_\_\_\_ (worldwide approximately 7 million cubic meters annually), filtrations in the food industry, the recovery of organic vapors such as petro-chemical vapor recovery and the electrolysis for chlorine production.

- A. Fractional distillation
- B. Reverse osmosis
- C. Thermal separation method(s)
- D. None of the Above

5. Wastewater treatment membrane technology is becoming increasingly important. With the help of \_\_\_\_\_ it is possible to remove particles, colloids and macromolecules, so that waste-water can be disinfected in this way.

- A. Ultra/microfiltration
- B. Solute(s)
- C. Conventional thermal separation process(es)
- D. None of the Above

6. Many azeotropic mixtures of pairs of compounds are known, and many azeotropes of three or more compounds are also known, it is not possible to separate the components by \_\_\_\_\_.

- A. The recovery of organic vapor(s)
- B. Fractional distillation
- C. A selective barrier
- D. None of the Above

### Membrane Filtration Processes

7. Which of the following terms enables some water systems having contaminated water sources to meet new, more stringent regulations?

- A. Membrane technology
- B. Macromolecule(s)
- C. Conventional thermal separation process(es)
- D. RO membrane(s)

### Description of Membrane Filtration Processes

8. Which of the following terms water is forced through a porous membrane under pressure, while suspended solid, large molecules, or ions are held back or rejected?
- A. Fractional distillation      C. Thermal separation method(s)  
B. Membrane processes      D. None of the Above

### Microfiltration

9. The current primary use of MF is by industries to remove very fine particles from process water, the process has also been used as a pretreatment for?
- A. Potable water treatment      C. Microfiltration or MF  
B. Other membrane processes      D. None of the Above
10. RO membranes are susceptible to clogging or filter binding unless the \_\_\_\_\_ being processed is already quite clean.
- A. Process liquid      C. Total dissolved solids (TDS)  
B. Chloride and sodium      D. Water
11. Which of the following terms has been proposed as a filtering method for particles resulting from the direct filtration process?
- A. Colloids and substances      C. Direct filtration process  
B. Potable water treatment      D. Microfiltration or MF
12. The use of filter aids to improve filtering efficiency, especially for small particles that could contain \_\_\_\_\_ are recommended.
- A. Chloride and sodium      C. Bacterial and protozoan life  
B. Total dissolved solids (TDS)      D. None of the Above

### Ultrafiltration

13. The smaller pore size is designed to remove colloids and substances that have larger molecules, which are called?
- A. Low-molecular-weight materials      C. Direct filtration process  
B. High-molecular-weight materials      D. None of the Above
14. UF membranes can be designed to pass material that weigh less than or?
- A. Process liquid      C. Salt or dissolved solids  
B. Chloride and sodium      D. Equal to a certain molecular weight
15. UF does not generally work well for removal of \_\_\_\_\_, it can be used effectively for removal or most organic chemicals.
- A. Process liquid      C. Salt or dissolved solids  
B. Chloride and sodium      D. Equal to a certain molecular weight

### Nanofiltration

16. Nanofiltration (NF) process has been used primarily for water softening and reduction of?
- A. Process liquid      C. Salt or dissolved solids  
B. Total dissolved solids (TDS)      D. None of the Above
17. NF capability will undoubtedly increase the use of \_\_\_\_\_ for potable water treatment.
- A. Reverse osmosis or RO      C. DF- Direct filtration process  
B. NF      D. Microfiltration or MF

### Reverse Osmosis

18. RO membranes have very low MWC pore size that can reject ions at very high rates, including?

- A. Chloride and sodium
- B. Total dissolved solids (TDS)
- C. Bacterial and protozoan life
- D. None of the Above

19. RO also works most organic chemicals, and radionuclides and microorganisms. Industrial water uses such as semiconductor manufacturing is also an important?

- A. RO process
- B. Potable water treatment
- C. Direct filtration process
- D. Microfiltration or MF

### Microfiltration Specific Process

20. Microfiltration is a type of physical filtration process where a contaminated fluid is passed through a special pore-sized membrane to separate microorganisms and suspended particles from?

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Bacterial and protozoan life

21. Which of the following terms works with such as ultrafiltration and reverse osmosis to provide a product stream which is free of undesired contaminants?

- A. Various other separation processes
- B. Ultrafiltration and reverse osmosis
- C. Batch or semi-continuous filtration
- D. None of the Above

22. Microfiltration usually serves as a pre-treatment for other separation processes such as?

- A. Cross flow filtration
- B. Filtration process(es)
- C. Ultrafiltration
- D. Microfiltration process

### Common Applications

#### Water Treatment Process

23. Which of the following terms presents a physical means of separation (a barrier) as opposed to a chemical alternative?

- A. Fouling
- B. MF membranes
- C. Batch or semi-continuous filtration
- D. None of the Above

24. Which of the following terms are used in secondary wastewater effluents to remove turbidity but also to provide treatment for disinfection?

- A. Cross flow filtration
- B. Filtration process(es)
- C. MF membranes
- D. None of the Above

### Driving Force, Retentate Stream and Permeate Streams

25. Which of the following terms can be distinguished by three major characteristics; Driving force, retentate stream and permeate streams?

- A. Membrane filtration processes
- B. MF membranes
- C. Batch or semi-continuous filtration
- D. Retentate and product streams

26. Which of the following terms is pressure driven with suspended particles and water as retentate and dissolved solutes plus water as permeate?

- A. Filtration process(es)
- B. Performance of microfiltration
- C. Microfiltration process
- D. None of the Above



27. Which of the following terms accelerates the separation process by increasing the flow rate (flux) of the liquid stream but does not affect the chemical composition of the species in the retentate and product streams?

- A. Fouling
- B. The use of hydraulic pressure
- C. Batch or semi-continuous filtration
- D. None of the Above

### **Fouling**

28. A major characteristic that limits the performance of microfiltration or any membrane technology is a process known as?

- A. Cross flow filtration
- B. Performance of microfiltration
- C. Fouling
- D. None of the Above

29. Which of the following terms describes the deposition and accumulation of feed components such as suspended particles, impermeable dissolved solutes or even permeable solutes, on the membrane surface and or within the pores of the membrane?

- A. Fouling
- B. The use of hydraulic pressure
- C. Batch or semi-continuous filtration
- D. None of the Above

30. Fouling of the membrane during the filtration processes decreases the flux and thus overall efficiency of the operation. This is indicated when the pressure drop increases to a certain point. It occurs even when operating parameters are constant (pressure, flow rate, temperature and concentration)

- A. True
- B. False

(S) Means the answer can be plural or singular in nature

## **Nanofiltration (NF) Section 4 Assignment - 20 Questions**

1. Nanofiltration is a relatively recent membrane filtration process used most often with low total dissolved solids water with the purpose of softening (polyvalent cation removal) and removal of \_\_\_\_\_ such as natural organic matter and synthetic organic matter.

- A. Process liquid
- B. Chloride and sodium
- C. Disinfection by-product precursors
- D. Partial (monovalent ion) demineralization

2. Nanofiltration is also becoming more widely used in food processing applications and for \_\_\_\_\_ and partial (monovalent ion) demineralization.

- A. Process liquid
- B. Chloride and sodium
- C. Natural organic matter and synthetic organic matter
- D. Simultaneous concentration

3. Which of the following terms is a membrane filtration-based method that uses nanometer sized cylindrical through-pores that pass through the membrane at 90°?

- A. Reverse osmosis or RO
- B. Nanofiltration
- C. Direct filtration process
- D. None of the Above

4. Nanofiltration membranes have pore sizes from 1-10 nanometers, smaller than that used in microfiltration and?

- A. Reverse osmosis or RO
- B. Microfiltration or MF
- C. Direct filtration process
- D. Ultrafiltration

5. Which of the following terms are controlled by pH, temperature and time during development with pore densities ranging from 1 to 106 pores per cm<sup>2</sup>?
- A. Gentle molecular separation      C. Pore dimensions  
B. Solvent-stable membrane(s)      D. None of the Above
6. Membranes made from polyethylene terephthalate are referred to as \_\_\_\_\_, named after the way the pores on the membranes are made.
- A. Track-etch" membrane(s)      C. Organic solvent nanofiltration technology  
B. Membrane(s)      D. None of the Above
7. "Tracking" results in making tracks that are chemically developed into the membrane, or \_\_\_\_\_ into the membrane, which are the pores.
- A. Gentle molecular separation      C. "Etched"  
B. Method of softening water      D. Tracking
8. According to the text, membranes created from metal such as \_\_\_\_\_, are made by electrochemically growing a thin layer of aluminum oxide from aluminum metal in an acidic medium.
- A. Track-etch" membrane(s)      C. Organic solvent nanofiltration technology  
B. Solvent-stable membrane(s)      D. Alumina membranes

### Range of Applications

9. The original uses for nanofiltration were water treatment and?
- A. Gentle molecular separation      C. Water softening  
B. Solvent      D. Organic solvent nanofiltration technology
10. Which of the following terms can "soften" water by retaining scale-forming, hydrated divalent ions (e.g. Ca<sup>2+</sup>, Mg<sup>2+</sup>) while passing smaller hydrated monovalent ions?
- A. Track-etch" membrane(s)      C. Organic solvent nanofiltration technology  
B. Membrane(s)      D. Nanofilter(s)
11. Which of the following terms has allowed the application for nanofiltration membranes to extend into new areas such as pharmaceuticals, fine chemicals, and flavor and fragrance industries?
- A. Track-etch" membrane(s)      C. Organic solvent nanofiltration technology  
B. Solvent-stable membrane(s)      D. Alumina membranes
12. Organic solvent nanofiltration technology and commercialization of membranes used has extended possibilities for applications in a variety of \_\_\_\_\_ ranging from non-polar through polar to polar aprotic.
- A. Track-etch" membrane(s)      C. Organic solvents  
B. Alumina membranes      D. None of the Above

### Advantages and Disadvantages

13. One of the main advantages of nanofiltration as a method of softening water is that during the process of retaining calcium and magnesium ions while passing smaller hydrated monovalent ions, filtration is performed without adding extra sodium ions, as used in ion exchangers.
- A. True      B. False

14. Which of the following terms do not operate at room temperature (e.g. distillation), which greatly increases the cost of the process when continuous heating or cooling is applied?
- A. Track-etch" membrane(s)                      C. Organic solvent nanofiltration technology  
 B. Membrane(s)                                      D. Many separation processes
15. Which of the following terms is linked with nanofiltration that is often not included with other forms of separation processes (centrifugation)?
- A. Gentle molecular separation                      C. Water softening  
 B. Solvent-stable membrane(s)                      D. None of the Above
16. Which of the following terms has a very favorable benefit of being able to process large volumes and continuously produce streams?
- A. Reverse osmosis or RO                              C. Direct filtration process  
 B. Nanofiltration                                      D. None of the Above
17. Anything smaller, reverse osmosis is used and anything larger is used for?
- A. Ultrafiltration                                      C. Direct filtration process  
 B. NF    D. None of the Above
18. Which of the following terms can also be used in cases where nanofiltration can be used, due to it being more conventional?
- A. Reverse osmosis or RO                              C. Ultrafiltration  
 B. NF    D. None of the Above
19. Which of the following terms membranes are an expensive part of the process. Repairs and replacement of membranes is dependent on total dissolved solids, flow rate and components of the feed?
- A. Reverse osmosis or RO                              C. Direct filtration process  
 B. Nanofiltration                                      D. None of the Above
20. Which of the following terms being used across various industries, only an estimation of replacement frequency can be used?
- A. Reverse osmosis or RO                              C. Direct filtration process  
 B. Microfiltration or MF                              D. Nanofiltration

## Osmotic Processes Section 5 Assignment - 35 Questions

### Reverse Osmosis Process Section

1. Osmosis is a natural phenomenon in which a liquid - water in this case - passes through a semi-permeable membrane from a relatively dilute solution toward a more concentrated solution. This flow produces a measurable pressure, called osmotic pressure.
- A. True                      B. False
2. Which of the following terms produces high quality water at low cost compared to other purifications processes?
- A. Pressure differential                              C. RO  
 B. Osmotic pressure                                      D. None of the Above

3. Which of the following is determined by the total dissolved solids content of the saline solution, or contaminated solution on one side of the membrane?
- A. This pressure differential                      C. Colloidal and suspended matter  
B. Osmotic pressure                                D. Waste (concentrate)
4. The higher the content of dissolved solids, the higher the?
- A. Pressure differential                      C. Virtually 100% of colloidal and suspended matter  
B. Osmotic pressure                                D. Waste (concentrate)
5. Which of the following result in higher osmotic pressures?
- A. Pressure differential                      C. Colloidal and suspended matter  
B. Osmotic pressure                                D. Higher molecular weights
6. According to the text, common tap water as found in most areas may have an osmotic pressure of about 10 PSI (Pounds per Square Inch), or about?
- A. 36,000 PPM                      C. 1.68 Bar  
B. 3.58 PPM                                D. 376 PSI
7. According to the text, Seawater at \_\_\_\_\_ typically has an osmotic pressure of about 376 PSI (26.75 Bar).
- A. 36,000 PPM                      C. 1.68 Bar  
B. 10 PSI                                      D. 56 PSI
8. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of \_\_\_\_\_ would have to be applied to the seawater side of the membrane.
- A. 36,000 PPM                      C. 1.68 Bar  
B. A pressure of 10 PSI                      D. 376 PSI

**Brine Channel**

9. Concentrated raw water is called the reject stream or concentrate stream, it may also be called brine if it is coming from a?
- A. Microporous support layer                      C. Concentrations of TDS  
B. Salt water source                                D. None of the Above
10. Which of the following terms when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional?
- A. Pressure differential                      C. The concentrate  
B. Osmotic pressure                                D. Waste (concentrate)
11. The membrane material itself is a special thin film composite (TFC) polyamide material, cast in a microscopically thin layer on another, thicker cast layer of Polysulfone called?
- A. Membrane material                      C. Amount of permeate or product water  
B. Microporous support layer                      D. Concentrations of TDS
12. Each sheet of membrane material is inspected at special light tables to ensure the quality of the membrane coating, before being assembled into the?
- A. Spiral wound element design                      C. Amount of permeate or product water  
B. Microporous support layer                      D. Concentrations of TDS

13. To achieve Reverse Osmosis, the \_\_\_\_\_ pressure is generally doubled.
- A. Each sheet of membrane material      C. Amount of permeate or product water  
 B. Osmotic      D. None of the Above
14. The inverse occurs with lower temperatures, in that salt passage decreases (reducing the \_\_\_\_\_ in the permeate or product water), while operating pressures increase. Or, if operating pressures do not increase, then the amount of permeate or product water is reduced.
- A. TDS      C. Salt  
 B. Raw water      D. Concentrate
15. The rejection rate is the percentage of \_\_\_\_\_ rejected, or prevented from passing through the membrane.
- A. Percentage of permeate      C. Dissolved solids  
 B. Raw water      D. None of the Above
16. A membrane with a rejection rate of 99% (usually based on Na (Sodium)) will allow only 1% of the concentration of \_\_\_\_\_ to pass through into the permeate.
- A. Percentage of permeate      C. Dissolved solids  
 B. Raw water      D. Concentrate
17. As the raw water is processed, the concentrations of \_\_\_\_\_ increase as it passes along the membrane's length and usually multiple membranes are employed, with each membrane in series seeing progressively higher dissolved solids levels.
- A. Percentage of permeate      C. TDS  
 B. Raw water      D. Concentrate
18. Typically, starting with seawater of 36,000 PPM, standard rejection membranes produce?
- A. Permeate below 500 PPM      C. Permeate above 500 PPM  
 B. Permeate below 5,000 PPM      D. None of the Above
19. Optimum flows and pressures, optimum recovery rates (the \_\_\_\_\_ from a given stream of raw water), prefiltration and other pretreatment considerations, and so forth.
- A. Percentage of permeate      C. Amount of permeate or product water  
 B. Microporous support layer      D. Concentrations of TDS
20. Well-designed systems employ multiple stages of prefiltration, tailored to the application, including \_\_\_\_\_ and one or more stages of cartridge filtration.
- A. Each sheet of membrane material      C. Amount of permeate or product water  
 B. Multi-media filtration      D. None of the Above

### **Clean in Place" (CIP) System**

21. Which of the following terms has proved to be the most reliable and cost effective method of desalinating water, and hence its use has become more and more widespread?
- A. Reverse Osmosis      C. Direct filtration process  
 B. Potable water treatment      D. None of the Above
22. Energy consumption is usually some \_\_\_\_\_% less than for comparable evaporation technologies?
- A. 25      C. 50  
 B. 70      D. None of the Above

23. Which of the following terms have been improved as well, reducing maintenance and down time?
- A. Each sheet of membrane material                      C. Amount of permeate or product water  
 B. Microporous support layers                              D. Component parts
24. Which of the following terms delivers product water or permeate having essentially the same temperature as the raw water source?
- A. Reverse Osmosis    C. Direct filtration process  
 B. Nanofiltration     D. None of the Above
25. R/O Systems can be designed to deliver virtually any?
- A. Amount of permeate or product water              C. Concentrations of TDS  
 B. Required product water quality                      D. None of the Above
26. Reverse osmosis, also known as?
- A. Hyperfiltration    C. Direct filtration process  
 B. Nanofiltration     D. None of the Above
27. Reverse osmosis is used to purify water and remove salts and other impurities in order to improve the color, taste, or properties of the?
- A. Percentage of permeate                                  C. Fluid  
 B. Concentrate    D. None of the Above
28. RO can be used to purify fluids such as ethanol and glycol, which will pass through the reverse osmosis membrane, while rejecting?
- A. Salt    C. Raw water  
 B. Ions and contaminants                                  D. None of the Above
29. RO is used to produce \_\_\_\_\_ that are currently in place.
- A. Permeate    C. Water that meets the most demanding specifications  
 B. Concentrate    D. None of the Above
30. Reverse osmosis technology uses a process known as \_\_\_\_\_ to allow the membrane to continually clean itself.
- A. Upflow    C. Cross-flow  
 B. Backwash    D. None of the Above
31. Which of the following terms passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane?
- A. Some of the fluid    C. Concentrate  
 B. The high pressure    D. None of the Above
32. According to the text, the process of reverse osmosis \_\_\_\_\_ through the membrane, and the most common force is pressure from a pump.
- A. Percentage of permeate                                  C. Concentrate  
 B. A driving force to push the fluid                      D. None of the Above
33. Which of the following terms of the fluid being rejected increases, the driving force required to continue concentrating the fluid increases?
- A. The concentration    C. Cross-flow  
 B. The higher the pressure                                  D. None of the Above

34. RO is capable of rejecting bacteria, salts, \_\_\_\_\_, proteins, particles, dyes, and other constituents that have a molecular weight of greater than 150-250 daltons.

- A. Sugars
- B. Seawater and brackish water
- C. Concentrate
- D. None of the Above

35. The separation of ions with reverse osmosis is aided by?

- A. Charged Particles
- B. Cross-flow
- C. Filter aids
- D. None of the Above

## Alternative Water Disinfectant Section 6 Assignment – 50 Questions

1. Which of the following terms - people who use drinking water containing this substance well in excess of the EPA's standard could experience irritating effects to their eyes and nose?

- A. Ozone
- B. UV
- C. Chloramine
- D. None of the Above

2. Which of the following terms - infants and young children who drink water containing this substance in excess of the EPA's standard could experience nervous system effects?

- A. Chlorine Dioxide
- B. Ozone
- C. Aluminum
- D. None of the Above

3. Which of the following terms - in excess of the EPA's standard, some people may experience anemia?

- A. Chlorine Dioxide
- B. UV
- C. Iron
- D. None of the Above

4. Which of the following terms - some people who use drinking water containing this substance well in excess of the EPA's standard could experience irritating effects to their eyes and nose?

- A. Copper
- B. Ozone
- C. Chlorine
- D. None of the Above

### Disinfection Byproducts

5. Which of the following terms - form when disinfectants added to drinking water to kill germs react with naturally-occurring organic matter in water?

- A. Chlorite
- B. Disinfection byproducts
- C. Sulfates
- D. None of the Above

6. Which of the following terms - some people who drink water containing this substance in excess of the EPA's standard over many years may have an increased risk of getting cancer?

- A. Calcium
- B. Copper
- C. Haloacetic Acids
- D. None of the Above

7. Which of the following terms - some people who drink water containing this substance in excess of the EPA's standard over many years may have an increased risk of getting cancer?

- A. Byproducts
- B. Bromate
- C. Iron
- D. None of the Above

(S) Means the answer can be plural or singular in nature

8. Which of the following terms - some people who drink water containing this substance in excess of EPA's standard over many years may experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer?

- A. Total Trihalomethanes
- B. Bromoformate
- C. Byproducts
- D. None of the Above

9. Which of the following terms - some infants and young children who drink water containing this substance in excess of the EPA's standard could experience nervous system effects?

- A. Chlorite
- B. Bromate
- C. Total Halogens
- D. None of the Above

### Ozone Sub-Section

10. Which of the following terms - is probably the strongest oxidizing agent available for water treatment?

- A. Oxygen and nascent oxygen
- B. Ozone (O<sub>3</sub>)
- C. Chloramines or THMs
- D. None of the Above

11. Ozone is obtained by passing a flow of air or oxygen between two electrodes that are subjected to an alternating current in the order of 10,000 to 20,000 volts.

- A. 100,000 – 500,000
- B. 50,000 – 100,000
- C. 10,000 to 20,000
- D. None of the Above

12. Which of the following terms - is very unstable and can readily explode?

- A. Carbon dioxide
- B. Ozone (O<sub>4</sub>)
- C. Liquid ozone
- D. None of the Above

13. In use, ozone breaks down into?

- A. Oxygen and nascent oxygen
- B. UV
- C. Liquid ozone
- D. None of the Above

14. It is the Nascent oxygen that produces the high oxidation and disinfections, and even sterilization. Each water has its own ozone demand, in the order of 0.5 ppm to 5.0 ppm. Contact time, temperature, and \_\_\_\_\_ of the water are factors to be determined.

- A. pH
- B. TDS
- C. Temperature
- D. None of the Above

15. THMs, it may produce others when followed by?

- A. Oxygen
- B. Ozone (O<sub>3</sub>)
- C. Chlorination
- D. None of the Above

16. Which of the following terms - is not practical for complete removal of chlorine or chloramines, or of THM and other inorganics?

- A. Oxygen and nascent oxygen
- B. Ozone
- C. Chloramines or THMs
- D. None of the Above

### Significance of Ozone

17. Ozone is a very powerful oxidant, even more powerful than?

- A. Carcinogenic by-products
- B. Chlorine
- C. Cyanides, sulfides, nitrites
- D. None of the Above



**In Addition, Ozone:**

18. Oxidizes and mitigates pollutants from?  
A. Water and wastewater                      C. Chlorine and sulfates  
B. Cyanides, sulfides, nitrites              D. None of the Above
19. Which of the following terms - such as, phenols, benzene, pesticides and other aromatic hydrocarbons?  
A. IOCs and other compounds              C. Volatile organic compounds (VOC)  
B. Carcinogenic by-products                D. None of the Above
20. Breaks down inorganic compounds such as?  
A. Water and wastewater                      C. Inert materials  
B. Cyanides, sulfides, nitrites              D. None of the Above
21. Removes soluble \_\_\_\_\_ indirectly by converting them to filterable insoluble solids.  
A. VOCs and other compounds              C. Cyanides, sulfides, nitrites  
B. Iron and manganese                        D. None of the Above
22. Which of the following terms - is very friendly to the environment, the extra atom of oxygen makes ozone very unstable?  
A. IOCs    C. Oxygen  
B. Ozone     D. None of the Above
23. While it has a half-life of about \_\_\_\_\_ minutes in clean water, its half-life in dirty water is even shorter as it is consumed by the microorganisms, VOCs and other compounds.  
A. 60    C. 20  
B. 45    D. None of the Above
24. Because it breaks down to oxygen, \_\_\_\_\_ does not leave any toxic or carcinogenic by-products. It does not impart any taste, odor, color or solids.  
A. Cyanides, nitrites                          C. Ozone, Oxygen  
B. Oxygen Ozone                                D. None of the Above
25. By comparison, chlorine forms carcinogenic by-products, such as trihalomethanes (THM) and?  
A. Carcinogenic by-products                C. Other halogenated compounds  
B. Iron and manganese                        D. None of the Above
26. When added to water, chlorine hydrolyzes to \_\_\_\_\_ and then to hypochlorite ion, both of which can linger on and adversely affect our hydrological system.  
A. Sulfuric acid                                 C. Hypochlorous acid  
B. Nitric acid                                     D. None of the Above
27. Which of the following terms - reverts to oxygen very quickly it cannot be packaged and stored?  
A. THMs    C. Ozone  
B. UV    D. None of the Above

### Commercial Production

28. Ozone is produced commercially in the same way it is formed naturally by lightning or?

- A. THM
- B. Natural UV radiation
- C. UV radiation from the sun
- D. None of the Above

29. Dried air or oxygen is passed through an electrified field (corona) generated by a high voltage between positive and negative grids.

- A. True
- B. False

30. The high voltage splits the molecular oxygen into?

- A. Electrolytic and chemical reactions
- B. Atomic oxygen
- C. Natural UV radiation
- D. None of the Above

31. Oxygen is used as a feed gas, you can get ozone between \_\_\_\_\_ percent by weight.

- A. 75 - 80
- B. 20 - 25
- C. 6 - 12
- D. None of the Above

32. Natural UV radiation is simulated commercially by radiation from the sun.

- A. True
- B. False

33. Which of the following terms - is passed through a chamber between the UV lamp and a shield?

- A. Ozone
- B. Water
- C. Air
- D. None of the Above

34. Which of the following terms - and is usually suitable for small applications?

- A. Natural UV radiation
- B. A high level of ozone
- C. A very low level of ozone
- D. None of the Above

### Potential Health Hazards

35. Ozone in the upper atmosphere, referred to as \_\_\_\_\_, helps filter out damaging ultraviolet radiation from the sun.

- A. Stratospheric ozone
- B. Hole in the ozone layer
- C. Natural UV radiation
- D. None of the Above

36. OSHA has issued a threshold limit value (TLV) on Ozone exposure to 0.1 ppm over eight hours per day and five days per week, or 0.3 ppm for a 15-minute continuous exposure.

- A. 30
- B. 60
- C. 15
- D. None of the Above

37. Because of the potential health hazards, it is crucial to destroy any excess oxygen in a safe way.

- A. True
- B. False

### How is Ozone Injected?

38. Ozone is typically injected into water via a rotometer.

- A. True
- B. False

39. Ozone is injected under pressure through diffusers creating bubble columns – much like air diffusers in aquariums?  
A. True      B. False

### Destroying Ozone

40. Ozone can be destroyed by catalytic conversion units, activated carbon filters, thermal destructors or by?  
A. Thermal destruction      C. Electrolytic and chemical reactions  
B. Ultraviolet radiation      D. None of the Above
41. Activated carbon filtration decomposes ozone but \_\_\_\_\_ is also consumed in the process.  
A. Thermal destructor      C. Carbon  
B. Ozone      D. None of the Above
42. In thermal destruction, Ozone is destroyed by heating it in excess of \_\_\_\_\_ degrees Celsius.  
A. 500      C. 300  
B. 212      D. None of the Above
43. Ultraviolet radiation decomposes ozone at the wavelength of \_\_\_\_\_ nanometers.  
A. 300      C. 975  
B. 254      D. None of the Above

### Pneumophilia

44. Microbial is a concern because it contributes to and \_\_\_\_\_ by acting as a nucleation point or catalyst for these problems.  
A. Intended disinfection      C. Amplifies deposition, corrosion and fouling  
B. Corrosion and fouling inhibitor      D. None of the Above
45. Ozone failed to prevent mineral deposits under other conditions, such as super saturation, \_\_\_\_\_, and alkalinity.  
A. Excessive hardness      C. TDS  
B. Slight hardness      D. None of the Above
46. Because microorganisms also induce other problems such as corrosion and fouling, ozone was also marketed early on as a corrosion and fouling inhibitor, under similar biological pretext. Likewise, ozone failed to prevent these problems under?  
A. Intended disinfection      C. Non-biological conditions  
B. Localized corrosion      D. None of the Above
47. Which of the following terms - and oxidizing biocides are used to control microbial?  
A. Injection point      C. Oxidizing biocides  
B. Non-oxidizing biocides      D. None of the Above
48. There is a growing pressure to reduce or restrict \_\_\_\_\_, especially if the water is being discharged to a waterway.  
A. Alkalinity      C. These biocides in the blowdown water  
B. Corrosion and fouling inhibitor      D. None of the Above

### Limitations

49. Which of the following terms - levels drop off rapidly as time progresses and as it moves away from the injection point, decreasing its disinfecting efficacy?

- A. Alkalinity
- B. Ozone
- C. Disinfection rate
- D. None of the Above

50. Which of the following terms - can be added to penetrate and disperse the sessile bacteria so that they can become planktonic, thus enabling the bacteria to be transported to the ozone injection point for destruction?

- A. Lime
- B. A bio-dispersant
- C. Sulfuric acid
- D. None of the Above

## Hard Water Section 7 Assignment - 35 Questions

1. Which of the following terms does water contains which impart a quality known as hardness?

- A. Suspended material
- B. Precipitation
- C. Various amounts of dissolved minerals
- D. None of the Above

2. The precipitation process most frequently used is generally known as the?

- A. Softening
- B. Precipitation
- C. Lime process or lime soda process
- D. None of the Above

3. Lime softening can be used for surface water sources ONLY.

- A. True
- B. False

4. Which of the following terms can also be accomplished using membrane technology, electro dialysis, distillation, and freezing? Of these, the membrane methods seem to have the greatest use potential.

- A. Softening
- B. Precipitation
- C. Heat
- D. None of the Above

### Occurrence of Hard Water

5. Which of the following terms is caused by soluble, divalent, metallic cations, (positive ions having valence of 2)?

- A. Hardness ions
- B. Permanent hardness
- C. Carbonate hardness
- D. Hard water

6. Water hardness varies considerably and is due to different geologic formations, and is also a function of the contact time between water and?

- A.  $\text{CaCO}_3$
- B. Calcium-magnesium
- C. Limestone deposits
- D. None of the Above

7. According to the text, Magnesium is dissolved as water passes over and through \_\_\_\_\_ and other magnesium-bearing minerals.

- A. Hardness ions
- B. Permanent hardness
- C. Dolomite
- D. Calcium and magnesium

### Expressing Hardness Concentration

8. Which of the following terms that consumer consider objectionable will vary, depending on other qualities of the water and on the hardness to which they have become accustomed?
- A. The degree of hardness    C. Salts  
B. Calcium-magnesium        D. None of the Above

### Types of Hardness

9. Hardness can be categorized by either of two methods: calcium versus magnesium hardness and?
- A. Permanent hardness        C. Carbonate versus non-carbonate hardness  
B. Temporary hardness        D. None of the Above
10. Which of the following terms in which distinction is based on the minerals involved?
- A. Water hardness            C. Carbonate-noncarbonate  
B. Calcium-magnesium        D. None of the Above
11. Which of the following terms is caused by magnesium is called magnesium hardness?
- A. Permanent hardness        C. Hardness  
B. Temporary hardness        D. None of the Above

### Carbonate-Noncarbonate Distinction

12. According to the text, the carbonate-noncarbonate distinction, however, is based on hardness from either the bicarbonate salts of calcium or the \_\_\_\_\_ involved in causing water hardness.
- A.  $\text{CaCO}_3$                         C. Normal salts of calcium and magnesium  
B. Water hardness                D. Carbonate-noncarbonate
13. Which of the following terms s caused primarily by the bicarbonate salts of calcium and magnesium, which are calcium bicarbonate,  $\text{Ca}(\text{HCO}_3)_2$ , and magnesium bicarbonate  $\text{Mg}(\text{HCO}_3)_2$ ?
- A. Carbonate hardness        C. Permanent hardness  
B. Temporary hardness        D. None of the Above
14. Which of the following terms when combined with carbonate ( $\text{CO}_3$ ) also contribute to carbonate hardness?
- A. Water hardness            C. Carbonate-noncarbonate  
B. Calcium and magnesium    D. None of the Above
15. Which of the following terms is a measure of calcium and magnesium salts other than carbonate and bicarbonate salts?
- A. Hardness ions                C. Carbonate hardness  
B. Permanent hardness        D. Noncarbonate hardness
16. Which of the following terms represents calcium sulfate, calcium chloride, magnesium sulfate ( $\text{MgSO}_4$ ), and magnesium chloride ( $\text{MgCl}_2$ )?
- A.  $\text{CaCO}_3$                         C. Salts  
B. Water hardness                D. None of the Above

17. When hard water is boiled, \_\_\_\_\_ is driven off, bicarbonate salts of calcium and magnesium then settle out of the water to form calcium and magnesium carbonate precipitates.

- A. Hardness ions
- B. Permanent hardness
- C. Carbonate hardness
- D. Carbon dioxide (CO<sub>2</sub>)

18. Because it can be removed by heating, carbonate hardness is sometimes called?

- A. CaCO<sub>3</sub>
- B. Water hardness
- C. Temporary hardness
- D. Carbonate-noncarbonate

19. Because noncarbonated hardness cannot be removed or precipitated by prolonged boiling, it is sometimes called?

- A. Hardness ions
- B. Permanent hardness
- C. Carbonate hardness
- D. Temporary hardness

### Objections to Hard Water

20. When the magnesium hardness is more than about 40 mg/l (as CaCO<sub>3</sub>), \_\_\_\_\_ scale will deposit in hot water heaters that are operated at normal temperature of 140-150°F (60-66°C).

- A. Magnesium hydroxide
- B. Calcium-magnesium
- C. Water hardness
- D. None of the Above

21. Which of the following terms form precipitates with soap?

- A. Precipitation
- B. Hardness ions
- C. Brine
- D. None of the Above

22. Which of the following terms such as the familiar bathtub ring, as well as reduced efficiency in washing and laundering?

- A. Precipitation
- B. Hardness ions
- C. Curd
- D. None of the Above

23. Modern detergents counteract many of the problems of?

- A. Precipitation
- B. Lime softening
- C. Hard water
- D. None of the Above

### Water Softening Summary

24. Which of the following terms is a method of removing from water the minerals that make it hard?

- A. Water softening
- B. Permanent removal
- C. Carbonate removal
- D. Temporary suspension

25. In the lime soda process, Soda ash and lime are added to the water in amounts determined by chemical tests. These chemicals combine with the calcium and magnesium in the water to make insoluble compounds that settle to the bottom of the water tank.

- A. True
- B. False

26. In the ion exchange process, the water filters through minerals called zeolites. As the water passes through the filter, the sodium ions in the zeolite are exchanged for the Calcium and magnesium ions in the water, and the water is softened.

- A. True
- B. False

27. When household softeners become exhausted, a strong solution of \_\_\_\_\_ is passed through the filter to replace the sodium that has been lost.

- A. Sodium chloride (salt)
- B. Calcium and magnesium
- C. Hardness minerals
- D. None of the Above

28. Water softening units also remove?

- A. Sodium content
- B. Iron
- C. pH
- D. None of the Above

29. Softeners may be safely used to remove up to about 5 milligrams per liter of dissolved iron if the water softener is rated for that amount of iron removal.

- A. 100
- B. 50
- C. 5
- D. None of the Above

30. The principle behind water softening is really just simple chemistry. A water softener contains Calcium and magnesium.

- A. True
- B. False

31. When hard water passes through the softener, calcium and magnesium ions are attracted to the charged resin beads, resulting removal of calcium and magnesium ions that produces?

- A. Brine
- B. Soft water
- C. Calcium and magnesium
- D. None of the Above

32. Which of the following terms from the water softening salt reactivate the resin beads so they can continue to do their job?

- A. Sodium content
- B. Hardness minerals
- C. Calcium and magnesium
- D. Sodium ions

### **Mechanical Water Treatment Softeners**

33. Mechanical water treatment softening units can be permanently installed into the plumbing system to continuously remove Calcium and magnesium.

- A. True
- B. False

34. Water treatment softeners operate on the ion exchange process; the beads are supersaturated with?

- A. Sodium
- B. Calcium and magnesium
- C. Salt
- D. None of the Above

35. The ion exchange process takes place as the hard water passes through the softening material.

- A. True
- B. False

## **EPA Rules Section 8 Assignment – 50 Questions**

### **Inorganic Chemical Introduction**

#### **What are Inorganic Compounds?**

1. The synthesis of \_\_\_\_\_ in biological systems incorporates carbohydrates into the molecular structure.

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Maximum Contaminant Levels (MCL)
- D. Organic compounds

2. Organic chemists traditionally refer to any molecule containing carbon as an organic compound and by default this means that \_\_\_\_\_ deals with molecules lacking carbon.

- A. Presence of a carbon atom
- B. Inorganic chemistry
- C. Organic chemistry
- D. None of the Above

3. Which of the following terms have been metabolically incorporated into living tissues persist in decomposing tissues?

- A. Volatile Organic Compounds (VOCs)
- B. Inorganic matter
- C. Organic matter
- D. None of the Above

4. Some scientists, may consider atmospheric CO<sub>2</sub> as an organic compound.

- A. True
- B. False

5. Which of the following terms are rather simple chemicals present in ground water?

- A. Synthetic Organic Chemicals (SOCs)
- B. Inorganic compounds
- C. Organic compounds
- D. None of the Above

6. Typical examples include sodium, iron, calcium, magnesium, manganese, nitrate, chloride, sulfate, and zinc, many of these chemicals are naturally occurring?

- A. Presence of a carbon atom
- B. Atmospheric CO<sub>2</sub>
- C. Inorganic compounds
- D. Minerals

7. Some of compounds may be introduced into ground water by human activities. Nitrate (an agricultural fertilizer) and sodium chloride (road salt) are two examples.

- A. True
- B. False

8. Water purveyors need to test for 30 different?

- A. Presence of a carbon atom
- B. Organic compounds
- C. Inorganic compounds
- D. None of the Above

9. Which of the following terms were once living, or are living and can bring life to cells?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Presence of a carbon atom
- D. Organic compounds

10. Which of the following terms were never living, without carbon and cannot bring life to cells?

- A. Presence of a carbon atom
- B. Organic compounds
- C. Inorganic compounds
- D. None of the Above

## **SOC Section**

### **SOC Introduction**

11. Synthetic Organic Chemicals (SOCs) are organic (carbon based) chemicals that are less volatile than?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Maximum Contaminant Levels (MCL)
- D. None of the Above

12. Which of the following terms are used as pesticides, defoliants, fuel additives and as ingredients for other organic compounds?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Maximum Contaminant Levels (MCL)
- D. None of the Above



13. Some \_\_\_\_\_ are very persistent in the environment, whether in soil or water.  
 A. Synthetic Organic Chemicals (SOCs)    C. Organic compounds  
 B. Polychlorinated Biphenyls (PCBs)    D. None of the Above
14. SOCs are generally toxic and can have substantial health impacts from both acute (short-term) and chronic (long-term) exposure. Many are known carcinogens (cancer causing). EPA has set Maximum Contaminant Levels (MCL) for 30 Synthetic Organic Chemicals (SOCs) under the Safe Drinking Water Act.  
 A. True    B. False
15. The Safe Drinking Water Act requires that all water sources of all public water systems be periodically monitored for regulated?  
 A. Volatile Organic Compounds (VOCs)    C. Maximum Contaminant Levels (MCL)  
 B. Synthetic Organic Chemicals (SOCs)    D. None of the Above
16. "Blue baby syndrome" is from ingestion of elevated levels of sodium.  
 A. True    B. False
17. All public water systems must monitor for?  
 A. Synthetic Organic Chemicals (SOCs)    C. Nitrate and Nitrite  
 B. Polychlorinated Biphenyls (PCBs)    D. None of the Above

### **Volatile Organic Compounds (VOCs)**

#### **VOCs Explained**

18. Which of the following terms are organic chemicals that have a high vapor pressure at ordinary, room-temperature conditions?  
 A. Volatile Organic Compounds (VOCs)    C. Maximum Contaminant Levels (MCL)  
 B. Polychlorinated Biphenyls (PCBs)    D. None of the Above
19. VOCs are both human-made and naturally occurring chemical compounds.  
 A. True    B. False
20. Aqueous solvents are regulated by law, especially indoors, where concentrations are the highest.  
 A. True    B. False

### **Specific Components**

#### **Paints and Coatings**

21. Which of the following terms are required to spread a protective or decorative film?  
 A. Solvents    C. Cleaning products  
 B. Benzene    D. None of the Above

### **Chlorofluorocarbons and Chlorocarbons**

22. Carbon dioxide is banned or highly regulated, were widely used cleaning products and refrigerants.  
 A. True    B. False

23. A VOC that is a known human carcinogen is Benzene.  
 A. True      B. False
24. Which of the following terms evaporates into the air quickly and the vapor is heavier than air allowing the compound to sink into low-lying areas?  
 A. Carbon monoxide      C. Benzene  
 B. Ammonia      D. None of the Above

**Regulated Chemical Contaminants**

25. EPA established Maximum Contaminant Levels (MCL), Maximum Contaminant Level Goals (MCLG), monitoring requirements and best available technologies for removal for 65 chemical contaminants over a five-year period as EPA gathered and analyzed occurrence and health effects data.  
 A. True      B. False
26. Chemical Phase Rules and they define regulations for three contaminant groups: Synthetic Organic Chemicals (SOC), Inorganic Chemicals (IOC), and Volatile Organic Chemicals (VOC).  
 A. True      B. False
27. About 1/3 of public water systems must monitor for Nitrate and Nitrite.  
 A. True      B. False
28. Non-Community water systems and transient non-community water systems must also monitor for IOCs, SOCs, and VOCs.  
 A. True      B. False
29. Aldicarb, aldicarb sulfone, and aldicarb sulfoxide are considered regulated chemicals although their MCLs are stayed. Therefore PWS are not required to meet an MCL  
 A. True      B. False
30. For each contaminant, EPA set a health goal, or?  
 A. Maximum Contaminant Level (MCL)      C. Maximum Contaminant Level Goals (MCLG)  
 B. Maximum goal      D. None of the Above
31. Which of the following terms has EPA set the health goal at zero, under the assumption that any exposure to the chemical could present a cancer risk?  
 A. Sulfoxides      C. Carcinogens  
 B. Methemoglobinemia      D. None of the Above
32. Which of the following terms is as close to the health goal as possible, keeping in mind the technical and financial barriers that exist?  
 A. Maximum Contaminant Level (MCL)      C. Maximum Contaminant Level Goals (MCLG)  
 B. Local limit      D. None of the Above
33. Except for contaminants regulated as \_\_\_\_\_, most legal limits and health goals are the same.  
 A. Contaminants      C. Carcinogens  
 B. Pollutants      D. None of the Above

### Chemical Monitoring

34. The final federal rules regarding Phase II and V contaminants were promulgated by the U.S. EPA in 1992 and initial monitoring began in January 1993. This group of contaminants consists of Inorganic Chemicals (IOC), Volatile Organic Chemicals (VOC) and Synthetic Organic Chemicals (SOC).

- A. True      B. False

### Inorganic Chemical Monitoring

35. Only NCWS systems must monitor for inorganics.

- A. True      B. False

36. According to the text, all transient non-community water systems are required to complete a one-time inorganic chemical analysis. The sample is to be collected at \_\_\_\_\_ to the distribution system representative of each source after any application of treatment.

- A. Contamination sources      C. Entry points (POE)  
B. Areas of surface and ground water      D. None of the Above

### Nitrates

37. Nitrate is regarded as an “\_\_\_\_\_” because it can quickly cause illness.

- A. Drinking water treatment health risk      C. Chronic health risk  
B. Optimal health risk      D. Acute health risk

38.

Which of the following terms may go to yearly testing if community and nontransient noncommunity water must do quarterly monitoring whenever they exceed 5 mg/l in a test?

- A. Surface and ground water      C. All systems  
B. A surface water system      D. None of the Above

### Radiological Contaminants

39. Depending on your state rules, compliance will be based on the annual composite of 4 consecutive quarters or the average of the analyses of 4 quarterly samples.

- A. True      B. False

### Total Trihalomethanes (TTHM)

40. The MCL is \_\_\_\_\_ mg/l and consists of a calculation of the running average of quarterly analyses of the sum of the concentrations of bromodichloromethane, dibromochloromethane, bromoform and chloroform.

- A. 10      C. 0.1  
B. 0.5      D. None of the Above

### Lead and Copper Rule

41. The Lead and Copper Rule applies to all community and nontransient, noncommunity water systems and establishes an MCL for these two contaminants at the consumer's tap.

- A. True      B. False

42. The Lead and Copper Rule establishes maximum contaminant level goals (MCLGs) for lead and copper, treatment technique requirements for optimal corrosion control, \_\_\_\_\_, public education and lead service line replacement.

- A. Drinking water treatment process      C. Some groundwater  
B. Source water treatment      D. None of the Above

43. The rule also includes the best available technology (**BAT**) for complying with the treatment technique requirements, mandatory health effects language for public notification of violations and analytical methods and?

- A. Sample instructions
- B. Establishes action levels
- C. Laboratory performance requirements
- D. None of the Above

**IOC Sample Collection – Things to Remember**

44. Sample instructions should be supplied with the sample containers from the laboratory. If the laboratory fails to include sample instructions, contact the laboratory and?

- A. Collect samples
- B. Request sample instructions
- C. Laboratory performance requirements
- D. None of the Above

**Some general practices to remember:**

45. Samples should be collected at the entry point to the distribution system after all treatment (finished water).

- A. True
- B. False

46. Which of the following terms has also been known to contaminate food and water and if digested can lead to vomiting, dizziness, sleepiness, rapid heartbeat, and at high levels, even death may occur?

- A. Benzene
- B. Carbon dioxide
- C. Aqueous solvents
- D. None of the Above

**Methylene Chloride**

47. Which of the following terms is converted to carbon monoxide and a person will suffer the same symptoms as exposure to carbon monoxide?

- A. Methylene chloride
- B. Benzene
- C. Carbon dioxide
- D. None of the Above

**Perchloroethylene**

48. Which of the following terms represents Perchloroethylene has been linked to causing cancer in animals?

- A. Volatile organic compound
- B. SOC
- C. Organic chemical
- D. None of the Above

49. To avoid exposure to Perchloroethylene, if you do not detect an odor coming from clothing when picked up from the dry cleaner, do not accept them and request that less of the chemical be used as well as a complete drying of the garments

- A. True
- B. False

**MTBE**

50. MTBE was used as an octane booster and?

- A. Formaldehyde
- B. MTBE
- C. Oxygenated-additive
- D. None of the Above

## **When Finished with Your Assignment...**

### **REQUIRED DOCUMENTS**

Please scan the **Registration Page, Answer Key, Proctoring report, Survey and Driver's License** and email these documents to [info@TLCH2O.com](mailto:info@TLCH2O.com).

### **IPhone Scanning Instructions**

If you are unable to scan, take a photo of these documents with your **iPhone** and send these photos to TLC, [info@TLCH2O.com](mailto:info@TLCH2O.com).

### **FAX**

If you are unable to scan and email, please fax these documents to TLC, if you fax, call to confirm that we received your paperwork. **(928) 468-0675**