

Registration Form

Point-of-Use Water Treatment CEU Course \$150.00
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

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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

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

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. Do not solely trust our list for it may be outdated. It is your sole responsibility to ensure this course is accepted 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.

You can obtain a printed version of the course manual from TLC for an additional \$69.95 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.

Some States and many employers require the final exam to be proctored.

All downloads are electronically tracked and monitored for security purposes.

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.

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/indxpathdf.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 _____

Point of Use Answer Key

Name _____

Phone _____

*You are solely responsible in ensuring that this course is accepted for credit by your State. **No refunds.** Did you check with your State agency to ensure this course is accepted for credit?*

Method of Course acceptance confirmation. Please fill this section

Website __ Telephone Call __ Email ____ Spoke to _____

Did you receive the approval number if Applicable? _____

What is the approval number if Applicable? _____

You are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.

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

Water Chemistry Review Section 1 - 60 Questions

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

- 46. A B C D E F
- 47. A B C D E F
- 48. A B C D E F
- 49. A B C D E F
- 50. A B C D E F

- 51. A B C D E F
- 52. A B C D E F
- 53. A B C D E F
- 54. A B C D E F
- 55. A B C D E F

- 56. A B C D E F
- 57. A B C D E F
- 58. A B C D E F
- 59. A B C D E F
- 60. A B C D E F

pH Review Section 2 Assignment – 20 Questions

- 1. A B C D E F
- 2. A B C D E F
- 3. A B C D E F
- 4. A B C D E F
- 5. A B C D E F
- 6. A B C D E F
- 7. A B C D E F

- 8. A B C D E F
- 9. A B C D E F
- 10. A B C D E F
- 11. A B C D E F
- 12. A B C D E F
- 13. A B C D E F
- 14. A B C D E F

- 15. A B C D E F
- 16. A B C D E F
- 17. A B C D E F
- 18. A B C D E F
- 19. A B C D E F
- 20. A B C D E F

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

- 1. A B C D E F
- 2. A B C D E F
- 3. A B C D E F
- 4. A B C D E F
- 5. A B C D E F
- 6. A B C D E F
- 7. A B C D E F
- 8. A B C D E F
- 9. A B C D E F
- 10. A B C D E F

- 11. A B C D E F
- 12. A B C D E F
- 13. A B C D E F
- 14. A B C D E F
- 15. A B C D E F
- 16. A B C D E F
- 17. A B C D E F
- 18. A B C D E F
- 19. A B C D E F
- 20. A B C D E F

- 21. A B C D E F
- 22. A B C D E F
- 23. A B C D E F
- 24. A B C D E F
- 25. A B C D E F
- 26. A B C D E F
- 27. A B C D E F
- 28. A B C D E F
- 29. A B C D E F
- 30. A B C D E F

Nanofiltration (NF) Section 4 Assignment - 20 Questions

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

Osmotic Processes Section 5 Assignment - 35 Questions

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

Alternative Water Disinfectant Section 6 – 50 Questions

- | | | |
|----------------|-----------------|-----------------|
| 1. A B C D E F | 8. A B C D E F | 15. A B C D E F |
| 2. A B C D E F | 9. A B C D E F | 16. A B C D E F |
| 3. A B C D E F | 10. A B C D E F | 17. A B C D E F |
| 4. A B C D E F | 11. A B C D E F | 18. A B C D E F |
| 5. A B C D E F | 12. A B C D E F | 19. A B C D E F |
| 6. A B C D E F | 13. A B C D E F | 20. A B C D E F |
| 7. A B C D E F | 14. A B C D E F | 21. A B C D E F |

- 22. A B C D E F
- 23. A B C D E F
- 24. A B C D E F
- 25. A B C D E F
- 26. A B C D E F
- 27. A B C D E F
- 28. A B C D E F
- 29. A B C D E F
- 30. A B C D E F
- 31. A B C D E F

- 32. A B C D E F
- 33. A B C D E F
- 34. A B C D E F
- 35. A B C D E F
- 36. A B C D E F
- 37. A B C D E F
- 38. A B C D E F
- 39. A B C D E F
- 40. A B C D E F
- 41. A B C D E F

- 42. A B C D E F
- 43. A B C D E F
- 44. A B C D E F
- 45. A B C D E F
- 46. A B C D E F
- 47. A B C D E F
- 48. A B C D E F
- 49. A B C D E F
- 50. A B C D E F

Hard Water Section 7 Assignment - 35 Questions

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

- 13. A B C D E F
- 14. A B C D E F
- 15. A B C D E F
- 16. A B C D E F
- 17. A B C D E F
- 18. A B C D E F
- 19. A B C D E F
- 20. A B C D E F
- 21. A B C D E F
- 22. A B C D E F
- 23. A B C D E F
- 24. A B C D E F

- 25. A B C D E F
- 26. A B C D E F
- 27. A B C D E F
- 28. A B C D E F
- 29. A B C D E F
- 30. A B C D E F
- 31. A B C D E F
- 32. A B C D E F
- 33. A B C D E F
- 34. A B C D E F
- 35. A B C D E F

EPA Rules Section 8 Assignment – 50 Questions

1. A B C D E F

2. A B C D E F

3. A B C D E F

4. A B C D E F

5. A B C D E F

6. A B C D E F

7. A B C D E F

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9. A B C D E F

10. A B C D E F

11. A B C D E F

12. A B C D E F

13. A B C D E F

14. A B C D E F

15. A B C D E F

16. A B C D E F

17. A B C D E F

18. A B C D E F

19. A B C D E F

20. A B C D E F

21. A B C D E F

22. A B C D E F

23. A B C D E F

24. A B C D E F

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28. A B C D E F

29. A B C D E F

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31. A B C D E F

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34. A B C D E F

35. A B C D E F

36. A B C D E F

37. A B C D E F

38. A B C D E F

39. A B C D E F

40. A B C D E F

41. A B C D E F

42. A B C D E F

43. A B C D E F

44. A B C D E F

45. A B C D E F

46. A B C D E F

47. A B C D E F

48. A B C D E F

49. A B C D E F

50. A B C D E F

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.

Additional certificate for another Agency – additional fee \$50

Please fax or e-mail the answer key to TLC info@tlch2o.com
Western Campus Fax (928) 272-0747.

Always call to confirm we have received your work.

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 have received your assignment and to confirm your identity.

Thank you...

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

The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit www.ABCTLC.com and download the assignment and e-mail it back to TLC.

You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to info@tlch2o.com.

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your Answer Key and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular. Multiple Choice Section, One answer per question and please use the answer key.**

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) D. Forms of energy
B. Chemical substance(s) E. Physical chemistry
C. Chemical(s) F. None of the Above
- 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 laboratory D. Forms of energy
B. Chemical substance(s) E. Pure form
C. Chemical(s) F. None of the Above
- Which of the following terms is a form of matter that has constant chemical composition and characteristic properties?
A. Chemical bond(s) D. A chemical substance
B. Chemical substance(s) E. Chemical reactions
C. Compound F. 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 reactions D. A pure chemical compound
B. Chemical substance(s) E. Physical chemistry
C. Chemical(s) F. None of the Above

7. Which of the following terms convert one chemical substance into another?
- | | |
|--------------------------|-----------------------|
| A. Chemistry laboratory | D. Chemical reactions |
| B. Chemical substance(s) | E. Physical chemistry |
| C. Chemical(s) | F. 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) | D. Forms of energy |
| B. Matter | E. Physical chemistry |
| C. Chemical(s) | F. None of the Above |
9. Chemical substances may 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 | D. Pure chemical compound |
| B. Chemical substance(s) | E. Physical chemistry |
| C. Chemical(s) | F. 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 | D. Analytical chemistry |
| B. Neurochemistry | E. Traditional chemistry |
| C. Organic chemistry | F. None of the Above |
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 | D. Chemical compound |
| B. Chemical substance(s) | E. Physical chemistry |
| C. Chemical(s) | F. None of the Above |
14. Which term is a transformation of some substances into one or more different substances?
- | | |
|------------------------|------------------------|
| A. Chemical element(s) | D. A chemical reaction |
| B. An electron | E. Energy and entropy |
| C. Atom | F. None of the Above |
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) | D. Chemical reaction |
| B. Metamorphous | E. Chemical equation |
| C. Chemistry | F. None of the Above |
16. The chemical transformation can be symbolically depicted through a chemical equation, which usually involves atoms as subjects.
- A. True B. False

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

- A. Chemical transformation
- B. Atomic balance
- C. Chemical propertie(s)
- D. The type of chemical reaction(s)
- E. Mixture of substances
- F. None of the Above

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 which 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. Atomic balancing
- C. Chemical propertie(s)
- D. Chemical law(s)
- E. Mixture of substances
- F. None of the Above

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

- A. Chemical element(s)
- B. An electron
- C. The type of chemical reaction(s)
- D. Mixture of substances
- E. Energy and entropy
- F. None of the Above

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

- A. Chemical substance(s)
- B. Atom(s)
- C. Chemical propertie(s)
- D. The type of chemical reaction(s)
- E. Mixture of substances
- F. 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. Chemical element(s)
- B. An electron
- C. Atom
- D. Matter
- E. Energy and entropy
- F. 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. Chemical element(s)
- B. An electron
- C. Atom
- D. The photon
- E. Energy and entropy
- F. None of the Above

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

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

Atom

25. An Atom consists of a tightly packed core called the atomic nucleus surrounded by a space called the electron cloud.

- A. True
- B. False

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

- A. True B. False

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

- A. Chemical element(s) D. Photon
B. An electron E. Electron cloud
C. Atom F. None of the Above

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 D. Ion
B. An electron E. Cloud
C. An atom F. 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. Nucleus D. Negatively-charged electron(s)
B. An electron E. Positively charged proton(s)
C. The atom F. None of the Above

Element

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

- A. Chemical element(s) D. Photon
B. An electron E. Energy and entropy
C. Atom F. None of the Above

Compound

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

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

Chemical Compounds

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

- A. Bulk chemical(s) D. Compound(s)
B. Chemical(s) E. A pure chemical compound
C. Mechanical processe(s) F. None of the Above

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

- A. Bulk chemical(s) D. Compound(s)
B. Chemical(s) E. A pure chemical compound
C. Mechanical processe(s) F. None of the Above

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

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

35. Covalent compounds are compounds in which components share?

- A. Nucleus
- B. Electrons
- C. The atom
- D. Negatively-charged electrons
- E. Positively charged protons
- F. 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. Chemical substance(s)
- C. Isomer(s)
- D. Mixture(s)
- E. Chemical substance(s)
- F. 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. Mechanical processe(s)
- D. Compound(s)
- E. A pure chemical compound
- F. 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. Isomer(s)
- D. Mixture(s)
- E. Chemical mixtures
- F. 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. Organometallic compound(s)
- B. Chemical mixtures
- C. Isomer(s)
- D. Mixture(s)
- E. Chemical substance(s)
- F. 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. Chemical reactions
- D. Existence of identifiable molecule(s)
- E. Isolated chemical element(s)
- F. None of the Above

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. Molecule(s)
- B. Ionic compounds
- C. Structure
- D. Charged polyatomic collection(s)
- E. All valence electrons
- F. 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 molecule
- D. A polyatomic ion
- E. Isolated chemical element(s)
- F. None of the Above

43. Which term is residing in solids are generally not considered "molecules" in chemistry?
 A. Molecule(s) D. Charged polyatomic collection(s)
 B. Ionic compounds E. A chemical substance
 C. Structure F. None of the Above
44. The "inert" or noble gas elements are composed of lone atoms as their smallest discrete unit, but the other isolated?
 A. Tetra atomic molecule(s) D. Existence of identifiable molecule(s)
 B. Ions E. Chemical element(s)
 C. A molecule F. 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 D. Existence of identifiable molecule(s)
 B. Ions E. Isolated chemical element(s)
 C. A molecule F. 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) D. Charged polyatomic collection(s)
 B. Ionic compounds E. A chemical substance
 C. Structure F. 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) D. Existence of identifiable molecule(s)
 B. Ions E. Isolated chemical element(s)
 C. Ionic compounds F. None of the Above
48. One of the main characteristics of a _____ is its geometry often called its structure.
 A. Molecule(s) D. Charged polyatomic collection(s)
 B. Ionic compounds E. A chemical substance
 C. Structure F. 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) D. Existence of identifiable molecule(s)
 B. Ions E. The structure of polyatomic molecules
 C. A molecule F. 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) D. Charged polyatomic collection(s)
 B. Ionic compounds E. A chemical substance
 C. Structure F. None of the Above

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. Crystal structure
- D. Chemical amount
- E. Multipole balance
- F. None of the Above

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. Another atom
- C. Multiple solid phases
- D. Phase transition
- E. Bulk phase
- F. 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. Crystal structure
- D. A phase is a set of states
- E. Multipole balance
- F. None of the Above

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. Another atom
- C. Multiple solid phases
- D. The phase transition
- E. Bulk phase
- F. None of the Above

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. An amount of substance
- B. A triple point
- C. Crystal structure
- D. A supercritical state
- E. Multipole balance
- F. None of the Above

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

- A. An ionic bond
- B. Another atom
- C. Multiple solid phases
- D. Phase transition
- E. Temperature and pressure
- F. None of the Above

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

- A. An amount of substance
- B. A triple point
- C. Crystal structure
- D. Aqueous phase
- E. Multipole balance
- F. 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. Another atom
- C. Multiple solid phases
- D. Phase transition
- E. Bulk phase
- F. None of the Above

Bonding

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

- A. An amount of substance
- B. A triple point
- C. Molecules or crystals
- D. Pressure or temperature
- E. Multipole balance
- F. 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. Energy exchange
- C. Chemical equation
- D. Breaking of chemical bonds
- E. Chemical
- F. None of the Above

(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 that 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. Alkalinity
- C. Lord Calvin's
- D. Amadeus
- E. Arrhenius
- F. None of the Above

2. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Pure water has a pH very close to _____.

- A. 5
- B. 6
- C. 7
- D. 7.7
- E. 7.5
- F. None of the Above

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
- D. pH measurement(s)
- E. Measurement of pH
- F. None of the Above

4. pH is the negative logarithm of the activity of the (solvated) hydronium ion, often expressed as the measurement of _____.

- A. Electrons
- B. Alkalinity
- C. Hydronium ion concentration
- D. Cation measurement(s)
- E. Ions
- F. 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. Anti-matter
- D. An electron
- E. A cation
- F. None of the Above

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

- A. Protons
- B. An electron donor
- C. Anti-matter
- D. Electrons
- E. Cations
- F. None of the Above

7. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater.

- A. True
- B. False

8. One definition of pH is defined as the decimal logarithm of the reciprocal of the _____, a_{H^+} , in a solution.
- A. Hydrogen ion activity D. Brønsted–Lowry acid–base theory
 B. Ion-selective electrode(s) E. Acid-base behavior
 C. (Solvated) hydronium ion F. 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 D. 10 °C
 B. 25 °C E. 70 °F
 C. 39 °F F. None of the Above
11. Because the pH scale is logarithmic, therefore pH is?
- A. Universal indicator D. Excess of Ion concentrations
 B. A dimensionless quantity E. A set of non-linear equations
 C. A Spectrophotometer F. None of the Above
12. While the general case requires the pH solution of?
- A. The solution of a cubic equation D. A set of linear simultaneous equations
 B. The solution of a linear equation E. A set of non-linear simultaneous equations
 C. The solution of a squared equation F. None of the Above
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 D. Borates, phosphates, silicates
 B. Light metals E. Caustics
 C. Rare earths F. None of the Above
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 concentration value D. Visual comparison
 B. The solution of a quadratic equation E. The solution of a cubic equation
 C. The Spectrophotometer F. None of the Above
15. What factor is key in in determining the suitability of water for irrigation?
- A. pH of 8 D. Alkaline earth metal concentrations
 B. pH of 7 E. Borates, phosphates, silicates
 C. pH of 3 F. None of the Above
16. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a _____ difference in hydrogen ion concentration
- A. 1 D. 10
 B. 2 E. 100
 C. 5 F. None of the Above

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. pH
- D. Chemical ion
- E. Hydrogen bond formation
- F. None of the Above

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

- A. 7.7
- B. 8.0
- C. 9.0
- D. 6.55
- E. 7.00
- F. None of the Above

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. The calcium-magnesium distinction
- D. Calcium (Ca) and magnesium (Mg)
- E. Dissolved minerals
- F. None of the Above

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. Carbon dioxide (CO₂)
- D. Calcium (Ca) and magnesium (Mg)
- E. Noncarbonate hardness
- F. None of the Above

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. Brackish groundwater
- B. Macromolecule(s)
- C. RO membrane(s)
- D. Conventional thermal separation process(es)
- E. Membrane separation processes
- F. 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. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Cold separation
- D. A selective barrier
- E. Thermal separation method(s)
- F. None of the Above

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

- A. Brackish groundwater
- B. Macromolecule(s)
- C. Membrane technology
- D. Conventional thermal separation process(es)
- E. RO membrane(s)
- F. None of the Above

4. Applications include the production of drinking water by _____, filtrations in the food industry, the recovery of organic vapors such as petro-chemical vapor recovery and the electrolysis for chlorine production.

- A. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Reverse osmosis
- D. A selective barrier
- E. Thermal separation method(s)
- F. 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. Macromolecule(s)
- C. Solute(s)
- D. Conventional thermal separation process(es)
- E. RO membrane(s)
- F. 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. Large molecules, or ions
- D. A selective barrier
- E. Thermal separation method(s)
- F. 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. Solute(s)
- D. Conventional thermal separation process(es)
- E. RO membrane(s)
- F. None of the Above

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. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Membrane processes
- D. A selective barrier
- E. Thermal separation method(s)
- F. 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. Reverse osmosis or RO
- B. Potable water treatment
- C. Other membrane processes
- D. Direct filtration process
- E. Microfiltration or MF
- F. 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
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Water
- F. None of the Above

11. Which of the following terms has been proposed as a filtering method for particles resulting from the direct filtration process?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. Colloids and substances
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

12. The use of filter aids to improve filtering efficiency, especially for small particles that could contain _____ are recommended.

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Bacterial and protozoan life
- F. 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. Reverse osmosis or RO
- B. Potable water treatment
- C. High-molecular-weight materials
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

14. UF membranes can be designed to pass material that weigh less than or?

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Equal to a certain molecular weight
- F. None of the Above

15. UF does not generally work well for removal of _____, it can be used effectively for removal of most organic chemicals.

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Salt or dissolved solids
- F. None of the Above

Nanofiltration

16. Nanofiltration process has been used primarily for water softening and reduction of?

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

17. NF capability will undoubtedly increase the use of _____ for potable water treatment.

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. NF
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

Reverse Osmosis

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

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Bacterial and protozoan life
- F. 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. Colloids and substances
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

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. Material
- E. Bacterial and protozoan life
- F. None of the Above

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

- A. Various other separation processes
- B. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. 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. Performance of microfiltration
- D. Ultrafiltration
- E. Microfiltration process
- F. None of the Above

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. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. 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. Performance of microfiltration
- D. MF membranes
- E. Microfiltration process
- F. 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. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

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

- A. Cross flow filtration
- B. Filtration process(es)
- C. Performance of microfiltration
- D. Species such as phosphorus and arsenic
- E. Microfiltration process
- F. None of the Above

27. Which of the following terms accelerates the separation process by increasing the flow rate 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. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. 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. Filtration process(es)
- C. Performance of microfiltration
- D. Fouling
- E. Microfiltration process
- F. 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. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. 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 and removal of _____ such as natural organic matter and synthetic organic matter.

- A. Process liquid
- B. Chloride and sodium
- C. Material
- D. Disinfection by-product precursors
- E. Partial (monovalent ion) demineralization
- F. None of the Above

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. Material
- D. Natural organic matter and synthetic organic matter
- E. Simultaneous concentration
- F. None of the Above

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. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. 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 D. Direct filtration process
 B. Potable water treatment E. Microfiltration or MF
 C. Ultrafiltration F. None of the Above
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 cm²?
- A. Gentle molecular separation D. Pore dimensions
 B. Method of softening water E. Tracking
 C. Solvent-stable membrane(s) F. 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) D. Organic solvent nanofiltration technology
 B. Membrane(s) E. Nanofiltration
 C. Nanofilter(s) F. 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 D. "Etched"
 B. Method of softening water E. Tracking
 C. Solvent-stable membrane(s) F. None of the Above
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) D. Organic solvent nanofiltration technology
 B. Membrane(s) E. Alumina membranes
 C. Nanofilter(s) F. None of the Above

Range of Applications

9. The original uses for nanofiltration were water treatment and?
- A. Gentle molecular separation D. Water softening
 B. Method of softening water E. Tracking
 C. Solvent-stable membrane(s) F. None of the Above
10. Which of the following terms can "soften" water by retaining scale-forming, hydrated divalent ions (e.g. Ca²⁺, Mg²⁺) while passing smaller hydrated monovalent ions?
- A. Track-etch" membrane(s) D. Organic solvent nanofiltration technology
 B. Membrane(s) E. Nanofiltration
 C. Nanofilter(s) F. None of the Above
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. Gentle molecular separation D. Water softening
 B. Method of softening water E. Tracking
 C. Solvent-stable membrane(s) F. None of the Above

12. Organic solvent nanofiltration technology and _____ used has extended possibilities for applications in a variety of organic solvents ranging from non-polar through polar to polar aprotic.

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Commercialization of membranes
- E. Nanofiltration
- F. 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, which greatly increases the cost of the process when continuous heating or cooling is applied?

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Organic solvent nanofiltration technology
- E. Many separation processes
- F. None of the Above

15. Which of the following terms is linked with nanofiltration that is often not included with other forms of separation processes?

- A. Gentle molecular separation
- B. Method of softening water
- C. Solvent-stable membrane(s)
- D. Water softening
- E. Tracking
- F. 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
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

17. Anything smaller, reverse osmosis is used and anything larger is used for?

- A. Ultrafiltration
- B. Potable water treatment
- C. NF
- D. Direct filtration process
- E. Microfiltration or MF
- F. 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
- B. Potable water treatment
- C. NF
- D. Ultrafiltration
- E. Microfiltration or MF
- F. 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
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

20. Which of the following terms is being used across various industries, only an estimation of replacement frequency can be used?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

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
- B. Osmotic pressure
- C. Higher molecular weights
- D. RO
- E. Waste (concentrate)
- F. 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
- B. Osmotic pressure
- C. Higher molecular weights
- D. Virtually 100% of colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

4. The higher the content of dissolved solids, the higher the?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. Virtually 100% of colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

5. Which of the following result in higher osmotic pressures?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. Colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

6. According to the text, common tap water as found in most areas may have an osmotic pressure of about 10 PSI, or about?

- A. 36,000 PPM
- B. A pressure of 10 PSI
- C. Osmotic pressure(s)
- D. 1.68 Bar
- E. 376 PSI
- F. None of the Above

7. According to the text, Seawater at _____ typically has an osmotic pressure of about 376 PSI.

- A. 36,000 PPM
- B. A pressure of 10 PSI
- C. Osmotic pressure(s)
- D. 1.68 Bar
- E. 56 PSI
- F. 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
- B. Raw water
- C. Seawater and brackish water
- D. Dissolved solids
- E. Concentrate
- F. None of the Above

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
- B. Raw water
- C. Seawater and brackish water
- D. TDS
- E. Concentrate
- F. None of the Above

18. Typically, starting with seawater of 36,000 PPM, standard rejection membranes produce?

- A. Each sheet of membrane material
- B. Permeate below 500 PPM
- C. Brine
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. 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
- B. Microporous support layer
- C. Brine channel
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

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
- B. Microporous support layer
- C. Multi-media filtration
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. 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
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

22. Which of the following terms is usually some 70% less than for comparable evaporation technologies?

- A. Reverse Osmosis
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Energy consumption
- F. 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
- B. Microporous support layer
- C. Brine channel
- D. Amount of permeate or product water
- E. Component parts
- F. 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
- B. The higher the pressure
- C. A driving force
- D. Purify fluid(s)
- E. Cross-flow
- F. 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. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Sugars
- E. Concentrate
- F. None of the Above

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

- A. Charged Particles
- B. The higher the pressure
- C. A driving force
- D. Filter aids
- E. Cross-flow
- F. None of the Above

Alternative Water Disinfectant Section 6 Assignment – 50 Questions

1. Which of the following terms are 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. Chlorine Dioxide D. Trihalomethanes
B. Ozone E. Chloramine
C. UV F. None of the Above
2. Which of the following terms are 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 D. Aluminum
B. Ozone E. Chloramine
C. UV F. 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 D. Iron
B. Ozone E. Chloramine
C. UV F. None of the Above
4. Which of the following terms are 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 D. Chlorine
B. Ozone E. Chloramine
C. UV F. 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 D. Total Trihalomethanes
B. Haloacetic Acids E. Disinfection byproducts
C. Bromate F. 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. Chlorite D. Total Trihalomethanes
B. Haloacetic Acids E. Disinfection byproducts
C. Copper F. 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. Chlorite D. Total Trihalomethanes
B. Neutral pH E. Disinfection byproducts
C. Bromate F. 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. Chlorite
- B. Haloacetic Acids
- C. Bromate
- D. Total Trihalomethanes
- E. Disinfection byproducts
- F. 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. Haloacetic Acids
- C. Bromate
- D. Total Trihalomethanes
- E. Disinfection byproducts
- F. 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. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

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

- A. Oxygen and nascent oxygen
- B. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

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

- A. Oxygen and nascent oxygen
- B. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

13. In use, ozone breaks down into?

- A. Oxygen and nascent oxygen
- B. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

14. It is the _____ 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 pH of the water are factors to be determined.

- A. Nascent oxygen
- B. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

15. THMs may produce others when followed by?

- A. Oxygen and nascent oxygen
- B. Oxygen
- C. Ozone (O₃)
- D. Chloramines or THMs
- E. Chlorination
- F. 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. Oxygen
- C. Ozone
- D. Chloramines or THMs
- E. Liquid ozone
- F. None of the Above

Significance of Ozone

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

- A. VOCs and other compounds
- B. Carcinogenic by-products
- C. Chlorine
- D. Oxygen
- E. Cyanides, sulfides, nitrites
- F. None of the Above

In Addition, Ozone:

18. Oxidizes and mitigates pollutants from?

- A. Water and wastewater
- B. Cyanides, sulfides, nitrites
- C. Ozone
- D. Chlorine
- E. Oxygen
- F. None of the Above

19. Which of the following terms - such as, phenols, benzene, pesticides and other aromatic hydrocarbons?

- A. IOCs and other compounds
- B. Carcinogenic by-products
- C. Iron and manganese
- D. Volatile organic compounds (VOC)
- E. Cyanides, sulfides, nitrites
- F. None of the Above

20. Breaks down inorganic compounds such as?

- A. Water and wastewater
- B. Cyanides, sulfides, nitrites
- C. Ozone
- D. Chlorine
- E. Oxygen
- F. None of the Above

21. Removes soluble _____ indirectly by converting them to filterable insoluble solids.

- A. VOCs and other compounds
- B. Carcinogenic by-products
- C. Iron and manganese
- D. Oxygen
- E. Cyanides, sulfides, nitrites
- F. 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. Water and wastewater
- B. Cyanides, sulfides, nitrites
- C. Ozone
- D. Chlorine
- E. Oxygen
- F. None of the Above

23. While it has a half-life of about 20 minutes in _____, its half-life in dirty water is even shorter as it is consumed by the microorganisms, VOCs and other compounds.

- A. Clean water
- B. Carcinogenic by-products
- C. Iron and manganese
- D. Oxygen
- E. Cyanides, sulfides, nitrites
- F. 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. Water and wastewater
- B. Cyanides, sulfides, nitrites
- C. Ozone
- D. Chlorine
- E. Oxygen
- F. None of the Above

25. By comparison, chlorine forms carcinogenic by-products, such as trihalomethanes (THM) and?

- A. VOCs and other compounds
- B. Carcinogenic by-products
- C. Iron and manganese
- D. Oxygen
- E. Other halogenated compounds
- F. 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. Water and wastewater
- B. Cyanides, sulfides, nitrites
- C. Ozone
- D. Hypochlorous acid
- E. Oxygen
- F. None of the Above

27. Which of the following terms reverts to oxygen very quickly it cannot be packaged and stored?

- A. VOCs and other compounds
- B. Carcinogenic by-products
- C. Iron and manganese
- D. Oxygen
- E. Ozone
- F. None of the Above

Commercial Production

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

- A. Ozone
- B. Natural UV radiation
- C. O₂
- D. UV radiation from the sun
- E. Radiation from the sun
- F. None of the Above

29. Which of the following terms is passed through an electrified field (corona) generated by a high voltage between positive and negative grids?

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Dried air or oxygen
- E. O₂
- F. None of the Above

30. The high voltage splits the molecular oxygen into?

- A. Ozone
- B. Natural UV radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. Atomic oxygen
- F. None of the Above

31. Which of the following terms is used as a feed gas, you can get ozone between 6 and 12 percent by weight?

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Corona discharge
- E. Oxygen
- F. None of the Above

32. Natural UV radiation is simulated commercially by?

- A. Ozone
- B. Natural UV radiation
- C. UV lamps
- D. Electrolytic and chemical reactions
- E. Radiation from the sun
- F. None of the Above

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

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Corona discharge
- E. Air
- F. None of the Above

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

- A. Ozone
- B. Natural UV radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. A very low level of ozone
- F. 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. Ozone
- C. Chemical reaction(s)
- D. Corona discharge
- E. O₂
- F. None of the Above

36. OSHA has issued a threshold limit value (TLV) on _____ 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. Ozone
- B. Natural UV radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. Radiation from the sun
- F. None of the Above

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

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Corona discharge
- E. O₂
- F. None of the Above

How is Ozone Injected?

38. Which of the following terms is typically injected into water via a venturi?

- A. Ozone
- B. Natural UV radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. Radiation from the sun
- F. None of the Above

39. Which of the following terms is injected under pressure through diffusers creating bubble columns – much like air diffusers in aquariums?

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Corona discharge
- E. O₂
- F. None of the Above

Destroying Ozone

40. Ozone can be destroyed by catalytic conversion units, activated carbon filters, and thermal destructors or by?

- A. Ozone
- B. Ultraviolet radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. Radiation from the sun
- F. None of the Above

41. Activated carbon filtration decomposes ozone but _____ is also consumed in the process.

- A. Thermal destruction
- B. Ozone
- C. Chemical reaction(s)
- D. Carbon
- E. O₂
- F. None of the Above

42. In thermal destruction, _____ is destroyed by heating it in excess of 300 degrees Celsius.

- A. Ozone
- B. Natural UV radiation
- C. O₂
- D. Electrolytic and chemical reactions
- E. Radiation from the sun
- F. None of the Above

43. Which of the following terms decomposes ozone at the wavelength of 254 nanometers?

- A. Thermal destruction
- B. Ultraviolet radiation
- C. Chemical reaction(s)
- D. Corona discharge
- E. O₂
- F. 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
- B. localized corrosion
- C. A bio-dispersant
- D. Amplifies deposition, corrosion and fouling
- E. Corrosion and fouling inhibitor
- F. None of the Above

45. Ozone failed to prevent mineral deposits under other conditions, such as super saturation, _____, and alkalinity.

- A. Injection point
- B. Excessive hardness
- C. Ozone
- D. Non-oxidizing biocides and oxidizing biocides
- E. Ozone level at the injection point
- F. 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
- B. Localized corrosion
- C. A bio-dispersant
- D. Non-biological conditions
- E. Corrosion and fouling inhibitor
- F. None of the Above

47. Which of the following terms - and oxidizing biocides are used to control microbial?

- A. Injection point
- B. Non-oxidizing biocides
- C. Ozone
- D. Non-oxidizing biocides and oxidizing biocides
- E. Ozone level at the injection point
- F. 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. Intended disinfection
- B. Localized corrosion
- C. A bio-dispersant
- D. These biocides in the blowdown water
- E. Corrosion and fouling inhibitor
- F. 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. Injection point
- B. Alkalinity
- C. Ozone
- D. Non-oxidizing biocides and oxidizing biocides
- E. Ozone level at the injection point
- F. 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. Intended disinfection
- B. localized corrosion
- C. A bio-dispersant
- D. Chlorine, bromine and chlorine dioxide
- E. Corrosion and fouling inhibitor
- F. None of the Above

Hard Water Section 7 Assignment - 35 Questions

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

- A. Hardness
- B. Precipitation process
- C. Lime softening
- D. Various amounts of dissolved minerals
- E. Hard water
- F. None of the Above

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

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

3. Which of the following terms can be used for treatment of either groundwater or surface water sources?

- A. Hardness
- B. Precipitation process
- C. Lime softening
- D. Softening
- E. Hard water
- F. None of the Above

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. Hardness
- B. Precipitation process
- C. Lime softening
- D. Softening
- E. Hard water
- F. 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. Temporary hardness
- D. Carbonate hardness
- E. Hard water
- F. None of the Above

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

- A. CaCO_3
- B. Water hardness
- C. Calcium-magnesium
- D. Limestone deposits
- E. Carbonate-noncarbonate
- F. 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. Temporary hardness
- D. Dolomite
- E. Calcium and magnesium
- F. None of the Above

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
- B. Water hardness
- C. Calcium-magnesium
- D. These salts
- E. Carbonate-noncarbonate
- F. None of the Above

Types of Hardness

9. Hardness can be categorized by either of two methods: calcium versus magnesium hardness and?

- A. Hardness ions
- B. Permanent hardness
- C. Temporary hardness
- D. Carbonate hardness
- E. Carbonate versus non-carbonate hardness
- F. None of the Above

10. Which of the following terms distinction is based on the minerals involved?

- A. CaCO_3
- B. Water hardness
- C. Calcium-magnesium
- D. These salts
- E. Carbonate-noncarbonate
- F. None of the Above

11. Which of the following terms is caused by magnesium is called magnesium hardness?

- A. Hardness ions
- B. Permanent hardness
- C. Temporary hardness
- D. Carbonate hardness
- E. Hardness
- F. 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. CaCO_3
- B. Water hardness
- C. Calcium-magnesium
- D. Normal salts of calcium and magnesium
- E. Carbonate-noncarbonate
- F. None of the Above

13. Which of the following terms is 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. Hardness ions
- B. Permanent hardness
- C. Temporary hardness
- D. Carbonate hardness
- E. Calcium and magnesium
- F. None of the Above

14. Which of the following terms combined with carbonate also contribute to carbonate hardness?

- A. CaCO_3
- B. Water hardness
- C. Calcium and magnesium
- D. These salts
- E. Carbonate-noncarbonate
- F. 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
- B. Permanent hardness
- C. Temporary hardness
- D. Carbonate hardness
- E. Noncarbonate hardness
- F. None of the Above

16. Which of the following terms are calcium sulfate, calcium chloride, magnesium sulfate, and magnesium chloride?

- A. CaCO_3
- B. Water hardness
- C. Calcium-magnesium
- D. These salts
- E. Carbonate-noncarbonate
- F. 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. Temporary hardness
- D. Carbonate hardness
- E. Carbon dioxide (CO_2)
- F. None of the Above

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

- A. CaCO_3
- B. Water hardness
- C. Calcium-magnesium
- D. Temporary hardness
- E. Carbonate-noncarbonate
- F. None of the Above

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

- A. Hardness ions
- B. Permanent hardness
- C. Temporary hardness
- D. Carbonate hardness
- E. Calcium and magnesium
- F. None of the Above

Objections to Hard Water

20. When the magnesium hardness is more than about 40 mg/l as CaCO_3 , _____ scale will deposit in hot water heaters that are operated at normal temperature of 140-150°F .

- A. Magnesium hydroxide
- B. Water hardness
- C. Calcium-magnesium
- D. These salts
- E. Carbonate-noncarbonate
- F. None of the Above

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

- A. Hardness
- B. Precipitation process
- C. Hardness ions
- D. Softening
- E. Hard water
- F. 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. Hardness
- B. Precipitation
- C. Curd
- D. Softening
- E. Hard water
- F. None of the Above

23. Modern detergents counteract many of the problems of?

- A. Hardness
- B. Precipitation process
- C. Lime softening
- D. Softening
- E. Hard water
- F. 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. Brine
- B. Hard water
- C. Soft water
- D. Hardness
- E. Water softening
- F. None of the Above

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. Hardness minerals
- C. Calcium and magnesium
- D. Hardness
- E. Iron
- F. None of the Above

28. Water softening units also remove?

- A. Sodium content
- B. Hardness minerals
- C. Calcium and magnesium
- D. Hardness
- E. Iron
- F. 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 _____ removal.

- A. Brine
- B. Hard water
- C. Iron
- D. Hardness
- E. Calcium and magnesium
- F. None of the Above

30. The principle behind water softening is really just simple chemistry. A water softener contains resin beads which hold?

- A. Sodium content
- B. Hardness minerals
- C. Calcium and magnesium
- D. Hardness
- E. Electrically charged ions
- F. None of the Above

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. Hard water
- C. Soft water
- D. Hardness
- E. Calcium and magnesium
- F. 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. Hardness
- E. Sodium ions
- F. None of the Above

Mechanical Water Treatment Softeners

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

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

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

- A. Sodium
- B. Hardness minerals
- C. Calcium and magnesium
- D. Hardness
- E. Iron
- F. None of the Above

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

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

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. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

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. Atmospheric CO₂
- C. Inorganic chemistry
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

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

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Organic matter
- E. Organic compounds
- F. None of the Above

4. Some scientists may consider atmospheric CO₂ as?

- A. Presence of a carbon atom
- B. An organic compound
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

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

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. 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 CO₂
- C. Typical examples
- D. Inorganic compounds
- E. Minerals
- F. None of the Above

7. Which of the following terms may be introduced into ground water by human activities?

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

8. Water purveyors need to test for 30 different?

- A. Presence of a carbon atom
- B. Atmospheric CO₂
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

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

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

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

- A. Presence of a carbon atom
- B. Atmospheric CO₂
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. 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. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. 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. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

13. Some _____ are very persistent in the environment, whether in soil or water.

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

14. SOCs are generally toxic and can have substantial health impacts from both acute and chronic exposure.

- 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)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

16. Which of the following terms or "blue baby syndrome" from ingestion of elevated levels of nitrate or nitrite?

- A. Methemoglobinemia
- B. Most contaminants
- C. Three contaminant groups
- D. Elevated levels of nitrate or nitrite
- E. Chemical compounds
- F. None of the Above

17. All public water systems must monitor for?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Nitrate and Nitrite
- F. 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)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

19. VOCs are both human-made and naturally occurring chemical compounds. _____ are of VOCs.

- A. 60 organic chemicals
- B. Most scents or odors
- C. Three contaminant groups
- D. Elevated odors
- E. Chemical compounds
- F. None of the Above

20. Which of the following terms - are regulated by law, especially indoors, where concentrations are the highest?

- A. Anthropogenic VOCs
- B. Aqueous solvents
- C. VOCs
- D. Benzene
- E. Methylene chloride
- F. None of the Above

Specific Components

Paints and Coatings

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

Chlorofluorocarbons and Chlorocarbons

22. Which of the following terms are banned or highly regulated, were widely used cleaning products and refrigerants?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. None of the Above

Benzene

23. A VOC that is a known human carcinogen is _____, which is a chemical found in environmental tobacco smoke, stored fuels, and exhaust from cars in an attached garage.

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. None of the Above

24. Which of the following terms evaporates into the air quickly and the vapor of benzene is heavier than air allowing the compound to sink into low-lying areas?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. 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), and Volatile Organic Chemicals (VOC).

- A. Inorganic Chemicals (IOC)
- B. IOUs and UFOs
- C. Products and reactants
- D. Carcinogens
- E. Chemical Phase Rules
- F. None of the Above

27. All public water systems must monitor for Nitrate and Nitrite.

- A. True
- B. False

28. Which of the following terms must monitor for IOCs, SOCs, and VOCs?

- A. Maximum Contaminant Level (MCL)
- B. Chain of custody procedures
- C. All systems
- D. Maximum Contaminant Level Goals (MCLG)
- E. Small systems
- F. None of the Above

29. Aldicarb, aldicarb sulfone, and aldicarb sulfoxide are considered regulated chemicals although their _____ are stayed.

- A. MCLs
- B. CMOMs
- C. Products and reactants
- D. Carcinogen Rule
- E. Chemical Phase Rules
- F. None of the Above

30. For each contaminant, EPA set a health goal, or?

- A. Maximum Contaminant Level (MCL)
- B. Procedures
- C. Field goal
- D. Maximum Contaminant Level Goals (MCLG)
- E. A legal rule or sometimes a theory
- F. None of the Above

31. Which of the following terms - EPA set the health goal at zero, under the assumption that any exposure to the chemical could present a cancer risk?

- A. Sulfoxides
- B. Methemoglobinemia
- C. Reactants
- D. Carcinogens
- E. Chemicals
- F. None of the Above

32. Which of the following terms is close to the health goal as possible, keeping in mind the technical and financial barriers that exist?

- A. Maximum Contaminant Level (MCL)
- B. Procedures
- C. Legal limits
- D. Maximum Contaminant Level Goals (MCLG)
- E. Inorganic species
- F. None of the Above

33. Except for contaminants regulated as _____, most legal limits and health goals are the same.

- A. Contaminants
- B. Pollutants
- C. Products and reactants
- D. Carcinogens
- E. Chemicals
- F. 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. All systems must monitor for inorganics. The monitoring for these contaminants is also complex with reductions, waivers and detections affecting the sampling frequency.

- 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
- B. Areas of surface and ground water
- C. Signs of gross alpha activity
- D. Entry points (POE)
- E. Water main breaks
- F. None of the Above

Nitrates

37. Nitrate is regarded as an “_____” because it can quickly cause illness.
- A. Drinking water treatment health risk
 - B. Optimal health risk
 - C. A surface water system health risk
 - D. Chronic health risk
 - E. Acute health risk
 - F. None of the Above
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. Drinking water treatment process
 - B. Mix surface and ground water
 - C. A surface water system
 - D. Some groundwater
 - E. All systems
 - F. None of the Above

Radiological Contaminants

39. Compliance will be based on the annual composite of 4 consecutive quarters or?
- A. Sample instructions
 - B. Established action levels
 - C. Minimum aeration
 - D. Laboratory performance requirements
 - E. Average annual concentration
 - F. None of the Above

Total Trihalomethanes (TTHM)

40. The MCL is 0.1 mg/l and consists of a calculation of _____ of the concentrations of bromodichloromethane, di-bromochloromethane, bromoform and chloroform.
- A. Treatment process
 - B. Optimal corrosion control
 - C. Surface water system
 - D. Some groundwater
 - E. The running average of quarterly analyses of the sum
 - F. None of the Above

Lead and Copper Rule

41. The Lead and Copper Rule applies to all community and nontransient, noncommunity water systems and _____ for these two contaminants at the consumer’s tap.
- A. Sample instructions
 - B. Establishes action levels
 - C. Establishes MCL levels
 - D. Laboratory performance requirements
 - E. Average annual concentration
 - F. None of the Above
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
 - B. Source water treatment
 - C. A surface water system
 - D. Some groundwater
 - E. All systems
 - F. 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. An action level is exceeded
 - D. Laboratory performance requirements
 - E. The action level for the system
 - F. 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. Call the EPA
- C. Request sample instructions
- D. Do not change the flow
- E. Maintain chemical analysis reports
- F. None of the Above

45. Samples should be collected at _____ after all treatment (finished water).

- A. Homes
- B. Tank
- C. Sample locations
- D. The entry point to the distribution system
- E. At water storage tanks
- F. None of the Above

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. Organics
- B. Aqueous solvents
- C. VOCs
- D. Benzene
- E. Methylene chloride
- F. 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. Solvent
- B. VOC
- C. Benzene
- D. Methylene chloride
- E. Carbon monoxide
- F. None of the Above

Perchloroethylene

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

- A. Volatile organic compound
- B. Organic chemical
- C. SOC
- D. Cancer causer
- E. Chemical
- F. None of the Above

49. To avoid exposure to perchloroethylene, if a _____ is 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. Perchloroethylene
- B. Organic chemical
- C. VOC
- D. Strong chemical odor
- E. Furry creature
- F. None of the Above

50. MTBE was used as an octane booster and?

- A. Formaldehyde
- B. MTBE
- C. VOCs
- D. Oxygenated-additive
- E. Organic chemicals
- F. None of the Above