

Registration Form

Point-of-Use Water Treatment CEU Course \$100.00
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

Address: _____

City _____ **State** _____ **Zip** _____

Email _____ **Fax ()** _____

Phone:
Home () _____ **Work ()** _____

Operator ID # _____ **Exp. Date** _____

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

Water Treatment _____ Distribution _____ Collection _____ Wastewater Treatment _____

Other _____

Your certificate will be mailed to you in about two weeks.

Technical Learning College
PO Box 420, Payson AZ 85547-0420
Fax (928) 272-0747 e-mail info@tlch2o.com
(928) 468-0665 Toll Free (866) 557-1746

Discover card _____ **CCV code on card** _____
American Express
Visa or MasterCard # _____ **Exp. Date** _____

If you've paid on the Internet, please write your Customer# _____

Please invoice me, my PO# _____

We will stop mailing the certificate of completion we need your e-mail address.
We will e-mail the certificate to you, if no e-mail address; we will mail it to you.

DISCLAIMER NOTICE

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. I will 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.

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

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

State Approval Listing URL...

<http://www.tlch2o.com/PDF/CEU%20State%20Approvals.pdf>

You can obtain a printed version of the course manual from TLC for an additional \$79.95 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

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. 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.

Point of Use Answer Key Name _____

Phone # _____

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

- | | | |
|---------------|---------------|----------------|
| 1. A B C D E | 42. A B C D E | 83. A B C D E |
| 2. A B C D E | 43. A B C D E | 84. A B C D E |
| 3. A B C D E | 44. A B C D E | 85. A B C D E |
| 4. A B C D E | 45. A B C D E | 86. A B C D E |
| 5. A B C D E | 46. A B C D E | 87. A B C D E |
| 6. A B C D E | 47. A B C D E | 88. A B C D E |
| 7. A B C D E | 48. A B C D E | 89. A B C D E |
| 8. A B C D E | 49. A B C D E | 90. A B C D E |
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| 31. A B C D E | 72. A B C D E | 113. A B C D E |
| 32. A B C D E | 73. A B C D E | 114. A B C D E |
| 33. A B C D E | 74. A B C D E | 115. A B C D E |
| 34. A B C D E | 75. A B C D E | 116. A B C D E |
| 35. A B C D E | 76. A B C D E | 117. A B C D E |
| 36. A B C D E | 77. A B C D E | 118. A B C D E |
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| 124. A B C D E | 150. A B C D E | 176. A B C D E |
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| 126. A B C D E | 152. A B C D E | 178. A B C D E |
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| 138. A B C D E | 164. A B C D E | 190. A B C D E |
| 139. A B C D E | 165. A B C D E | 191. A B C D E |
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| 142. A B C D E | 168. A B C D E | 194. A B C D E |
| 143. A B C D E | 169. A B C D E | 195. A B C D E |
| 144. A B C D E | 170. A B C D E | 196. A B C D E |
| 145. A B C D E | 171. A B C D E | 197. A B C D E |
| 146. A B C D E | 172. A B C D E | 198. A B C D E |
| 147. A B C D E | 173. A B C D E | 199. A B C D E |
| 148. A B C D E | 174. A B C D E | 200. A B C D E |
| 149. A B C D E | 175. A B C D E | |

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

Always call to confirm we've 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've 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

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

It is necessary to define the terms associated with these treatment devices. The term home drinking water treatment is fairly descriptive of the field. It covers the vast majority of uses, but many individual treatment devices are also installed in factories, offices, and other buildings. There is a need to differentiate between units installed to treat all of the water at a building and those at just one water tap, so the following definitions have come into general use.

1. These devices are treatment units that are connected so they treat all of the water entering a building.
 - A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

2. A common example is a water softener installed to treat all of the water used in a building.
 - A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

3. This generally refers to a small treatment unit that rests on the counter near the sink and is connected to the regular faucet by a hose when it is needed.
 - A. Countertop
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

4. This refers to a small treatment units that are clamped on the spout of the regular faucet.
 - A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

5. These units usually have a bypass valve to select either treated or untreated water.
 - A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

6. These are portable, self-contained units, similar to a coffee maker.
- A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use
7. Water is poured through the unit for treatment.
- A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use
8. Point-of-Use (POU) devices are units connected to treat water at a single location in a building.
- A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use
9. An example is a treatment unit mounted under a kitchen sink to treat all water to the cold-water faucet.
- A. Stationary
 - B. Point-of-Entry
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use
10. An example is a treatment unit, mounted under a kitchen sink, that takes water from the cold-water pipe but delivers into a separate, third faucet.
- A. Stationary
 - B. Line bypass
 - C. Faucet mounted
 - D. Pour-through
 - E. Point-of-Use

Technology Related Words

11. Compliance cycle is the nine-year calendar year cycle during which public water systems must monitor.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
12. Each compliance cycle consists of three three-year compliance periods.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle

13. The first calendar year cycle begins January 1, 1993 and ends December 31, 2001; the second begins January 1, 2002 and ends December 31, 2010; the third begins January 1, 2011 and ends December 31, 2019.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
14. Compliance period is a three-year calendar year period within a compliance cycle.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
15. Each compliance cycle has three three-year compliance periods.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
16. Within the first compliance cycle, the first compliance period runs from January 1, 1993 to December 31, 1995; the second from January 1, 1996 to December 31, 1998; the third from January 1, 1999 to December 31, 2001.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
17. Best available technology or BAT means the best technology, treatment techniques, or other means which the _____ finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration).
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
18. For the purposes of setting MCLs for synthetic organic chemicals, any _____ must be at least as effective as granular activated carbon.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
19. Community water system is a _____ which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above

20. _____ is a treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
21. Point-of-use treatment device (POU) is a treatment device applied to a _____ used for the purpose of reducing contaminants in drinking water at that one tap.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
22. A public water system is either a " _____ " or a "noncommunity water system."
- A. Community water system
 - B. Compliance period
 - C. Best available technology
 - D. Compliance cycle
 - E. None of the Above
23. _____ means all water which is open to the atmosphere and subject to surface runoff.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
24. Contaminant is any physical, chemical, biological, or _____ or matter in water.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
25. _____ is the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.
- A. Surface water
 - B. Radiological substance
 - C. MCL
 - D. None of the Above
26. Maximum contaminant level goal or _____ is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above

27. Maximum contaminant level goals are non-enforceable health goals.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
28. Non-transient non-community water system or _____ is a public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.
- A. Surface water
 - B. Point-of-entry treatment device
 - C. Radiological substance
 - D. MCLG
 - E. None of the Above
29. _____ Some people who drink water containing arsenic in excess of the EPA's standard over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
30. Many communities add fluoride to their drinking water to promote dental health. Each community makes its own decision about whether or not to add _____.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
31. The EPA has set an enforceable drinking water standard for _____ of 4 mg/L (some people who drink water containing fluoride in excess of this level over many years could get bone disease, including pain and tenderness of the bones).
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
32. The EPA has also set a secondary _____ standard of 2 mg/L to protect against dental fluorosis.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone

33. Dental fluorosis, in its moderate or severe forms, may result in a brown staining and/or pitting of the permanent teeth. This problem occurs only in _____, before they erupt from the gums.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. None of the Above
34. Children under nine should not drink water that has more than 2 mg/L of _____.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
35. _____ typically leaches into water from plumbing in older buildings.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
36. _____ pipes and plumbing fittings have been banned since August 1998.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
37. Children and pregnant women are most susceptible to _____ health risks.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
38. _____ is probably the strongest oxidizing agent available for water treatment.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone
39. Although it is widely used throughout the world, is has not found much application in the United States.
- A. Chlorine
 - B. Fluoride
 - C. Lead
 - D. Arsenic
 - E. Ozone

40. Ozone is obtained by passing a flow of air of _____ between two electrodes that are subjected to an alternating current in the order of 10,000 to 20,000 volts.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
41. Liquid _____ is very unstable and can readily explode.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
42. As a result, it is not shipped and must be manufactured on-site.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
43. Ozone is a _____ at room temperature.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
44. It has a _____ similar to that sometimes noticed during and after heavy electrical storms.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
45. In use, ozone breaks down into oxygen and _____.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
46. It is the nascent oxygen that produces the _____ and disinfections, and even sterilization.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above

47. Each water has its own _____ demand, in the order of 0.5 ppm to 5.0 ppm.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
48. Contact time, temperature, and _____ of the water are factors to be determined.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
49. _____ acts as a complete disinfectant. It is an excellent aid to the flocculation and coagulation process, and will remove practically all color, taste, odor, iron, and manganese.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
50. It does not form chloramines or THMs, and while it may destroy some THMs, it may produce others when followed by chlorination.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
51. _____ is not practical for complete removal of chlorine or chloramines, or of THM and other inorganics.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
52. Further, because of the possibility of formation of other carcinogens (such as aldehydes or phthalates) it falls into the same category as other disinfectants in that it can produce DBPs.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
53. Some people who use drinking water containing chlorine well in excess of the EPA's standard could experience irritating effects to their eyes and nose.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above

54. Some people who drink water containing _____ well in excess of EPA's standard could experience stomach discomfort.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
55. Some people who use drinking water containing _____ well in excess of the EPA's standard could experience irritating effects to their eyes and nose.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
56. Some people who drink water containing _____ well in excess of EPA's standard could experience stomach discomfort or anemia.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
57. Some infants and young children who drink water containing _____ in excess of the EPA's standard could experience nervous system effects.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
58. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of the EPA's standard. Some people may experience _____.
- A. Chlorine
 - B. Chloramine
 - C. Chlorine Dioxide
 - D. Ozone
 - E. None of the Above
59. _____ Some people who drink water containing trihalomethanes 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. Bromate
 - C. Haloacetic Acids
 - D. Total Trihalomethanes
 - E. None of the Above
60. Some people who drink water containing _____ in excess of the EPA's standard over many years may have an increased risk of getting cancer.
- A. Chlorite
 - B. Bromate
 - C. Haloacetic Acids
 - D. Total Trihalomethanes
 - E. None of the Above

61. Some people who drink water containing _____ in excess of the EPA's standard over many years may have an increased risk of getting cancer.
- A. Chlorite
 - B. Bromate
 - C. Haloacetic Acids
 - D. Total Trihalomethanes
 - E. None of the Above
62. Some infants and young children who drink water containing _____ in excess of the EPA's standard could experience nervous system effects.
- A. Chlorite
 - B. Bromate
 - C. Haloacetic Acids
 - D. Total Trihalomethanes
 - E. None of the Above
63. Similar effects may occur in fetuses of pregnant women who drink water containing _____ in excess of the EPA's standard. Some people may experience anemia.
- A. Chlorite
 - B. Bromate
 - C. Haloacetic Acids
 - D. Total Trihalomethanes
 - E. None of the Above

Let's look at water diseases and pathogens.

64. Technically, influenza is an upper respiratory illness and rarely has diarrhea associated with it; therefore, _____ is a misleading description for foodborne or waterborne illnesses, yet is accepted by the general public.
- A. Chain
 - B. Stomach flu
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
65. So the next time you get the _____, you may want to think twice about what you've digested within the past few days.
- A. Chain
 - B. Feces
 - C. Stomach flu
 - D. Campylobacteriosis
 - E. None of the Above
66. When water is contaminated with _____, this contamination may be of human or animal origin.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
67. The feces must contain _____. If the human or animal source is not infected with a pathogen disease-causing bacteria, viruses or protozoa, no disease will result.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. None of the Above

68. The _____ must survive in the water. This survival depends on the temperature of the water and the length of time the pathogens are in the water.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
69. Some pathogens will survive for only a short time in water, others, such as Giardia or _____, may survive for months.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
70. The pathogens in the water must enter the _____ and in numbers sufficient to infect people. The water is either not treated or inadequately treated for the pathogens present.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
71. A susceptible person must drink the water that contains the _____. In order for illness (disease) to occur.
- A. Chain
 - B. Feces
 - C. Pathogen
 - D. Campylobacteriosis
 - E. None of the Above
72. This _____ lists the events that must occur for the transmission of disease via drinking water.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
73. By breaking the _____ at any point, the transmission of disease will be prevented.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
74. _____ is the most common diarrheal illness caused by bacteria.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above

75. Other symptoms include abdominal pain, malaise, fever, nausea and vomiting.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
76. _____ symptoms begin three to five days after exposure.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
77. The illness is frequently over within two to five days and usually lasts no more than 10 days.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
78. Campylobacteriosis outbreaks have most often been associated with food, especially chicken and _____ as well as unchlorinated water.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
79. These organisms are also an important cause of "**travelers' diarrhea.**"
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
80. Medical treatment generally is not prescribed for _____ because recovery is usually rapid.
- A. Chain
 - B. Feces
 - C. Pathogens
 - D. Campylobacteriosis
 - E. None of the Above
81. Cholera, Legionellosis, salmonellosis, shigellosis, yersiniosis, are other bacterial diseases that can be transmitted through water. All _____ in water are readily killed or inactivated with chlorine or other disinfectants.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst

82. _____ is an example of a common viral disease that may be transmitted through water.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
83. The onset is usually abrupt with fever, malaise, loss of appetite, nausea and abdominal discomfort, followed within a few days by jaundice.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
84. _____ varies in severity from a mild illness lasting one to two weeks, to a severely disabling disease lasting several months (rare).
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
85. The incubation period is 15-50 days and averages 28-30 days.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
86. _____ outbreaks have been related to fecally contaminated water; food contaminated by infected food handlers, including sandwiches and salads that are not cooked or are handled after cooking and raw or undercooked mollusks harvested from contaminated waters.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
87. _____, polio and viral gastroenteritis (Norwalk agent) are other viral diseases that can be transmitted through water.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
88. Most _____ in drinking water can be inactivated by chlorine or other disinfectants.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Viruses

89. Protozoan pathogens are larger than _____ and viruses but still microscopic.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
90. Protozoan pathogens invade and inhabit the gastrointestinal tract. Some parasites enter the environment in a dormant form, with a protective cell wall, called a _____.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Cyst
91. The _____ can survive in the environment for long periods of time and be extremely resistant to conventional disinfectants such as chlorine. Effective filtration treatment is therefore critical to removing these organisms from water sources.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
92. _____ is a commonly reported protozoan-caused disease.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
93. It has also been referred to as “**backpacker’s disease**” and “**beaver fever**” because of the many cases reported among hikers and others who consume untreated surface water.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
94. _____ symptoms include chronic diarrhea, abdominal cramps, bloating, frequent loose and pale greasy stools, fatigue and weight loss.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
95. The incubation period is 5-25 days or longer, with an average of 7-10 days.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst

96. Many infections are asymptomatic (no symptoms).
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
97. _____ occurs worldwide.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. Aseptic meningitis
 - E. Cyst
98. Waterborne outbreaks in the United States occur most often in communities receiving their drinking water from streams or rivers without _____ or a filtration system.
- A. Bacteria
 - B. Giardiasis
 - C. Hepatitis A
 - D. None of the Above
99. The organism, _____, has been responsible for more community-wide outbreaks of disease in the U.S. than any other pathogen. Drugs are available for treatment but are not 100% effective.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
100. _____ is an example of a protozoan disease that is common worldwide but was only recently recognized as causing human disease.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
101. The major symptom in humans is diarrhea, which may be profuse and watery. The diarrhea is associated with cramping abdominal pain. _____, fever, anorexia, nausea and vomiting occur less often.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
102. _____ usually come and go, and end in fewer than 30 days in most cases. The incubation period is 1-12 days, with an average of about seven days.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above

103. _____ organisms have been identified in human fecal specimens from more than 50 countries on six continents.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
104. The mode of transmission is _____, either by person-to-person or animal-to-person.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
105. There is no specific treatment for _____ infections.
- A. General malaise
 - B. Cryptosporidium
 - C. Giardia lamblia
 - D. Cryptosporidiosis
 - E. None of the Above
106. All these diseases, with the exception of _____, have one symptom in common: diarrhea. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact, and the same routes of transmission, being either foodborne or waterborne.
- A. Hepatitis A
 - B. Pathogens
 - C. HIV
 - D. Waterborne diseases
 - E. None of the Above
107. Although most _____ cause mild, self-limiting disease, on occasion, they can cause serious, even life threatening illness.
- A. Hepatitis A
 - B. Pathogens
 - C. HIV
 - D. Waterborne diseases
 - E. None of the Above
108. Particularly vulnerable are persons with weak immune systems such as those with _____ infections or cancer.
- A. Hepatitis A
 - B. Pathogens
 - C. HIV
 - D. Waterborne diseases
 - E. None of the Above
109. By understanding the nature of _____, the importance of properly constructed, operated and maintained public water systems becomes obvious.
- A. Hepatitis A
 - B. Pathogens
 - C. HIV
 - D. Waterborne diseases
 - E. None of the Above

110. While water treatment cannot achieve sterile water (no microorganisms), the goal of treatment must clearly be to produce drinking water that is as _____-free as possible at all times.

- A. Hepatitis A
- B. Pathogen
- C. HIV
- D. Waterborne diseases
- E. None of the Above

111. For those who operate water systems with inadequate source protection or treatment facilities, the potential risk of a _____ outbreak is real.

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

112. For those operating systems that currently provide _____ and treatment, operating and maintaining the system at a high level on a continuing basis is critical to prevent disease.

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

113. _____ is usually synonymous with chlorination.

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

114. Chlorine addition is by far the most common form of disinfection used today. In this section, the main emphasis will be on chlorination: how it works, safety, types of chlorine, basic chemistry of chlorine and an introduction to _____.

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

115. _____ is the process of killing microorganisms in water that might cause disease (pathogens).

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

116. _____, however, should not be confused with sterilization, which is the destruction of all microorganisms.

- A. Coliform bacteria
- B. Fecal contamination
- C. Disinfection
- D. CT values
- E. None of the Above

117. _____ is concerned only with killing pathogens.
- A. Coliform bacteria
 - B. Fecal contamination
 - C. Disinfection
 - D. CT values
 - E. None of the Above
118. Most waterborne disease and illnesses have been related to the microbiological quality of drinking water. The routine microbiological analysis of your water is for _____.
- A. Coliform bacteria
 - B. Fecal contamination
 - C. Disinfection
 - D. CT values
 - E. None of the Above
119. The _____ group is used as an indicator organism to determine the biological quality of your water.
- A. Coliform bacteria
 - B. Fecal contamination
 - C. Disinfection
 - D. CT values
 - E. None of the Above
120. The presence of an indicator or pathogenic bacteria in your _____ is an important health concern.
- A. Coliform bacteria
 - B. Fecal contamination
 - C. Disinfection
 - D. CT values
 - E. None of the Above
121. _____ signal possible fecal contamination and therefore, the potential presence of pathogens. They are used to monitor for pathogens because of the difficulties in determining the presence of specific disease-causing microorganisms.
- A. Coliform bacteria
 - B. Indicator bacteria
 - C. Disinfection
 - D. CT values
 - E. None of the Above
122. _____ are usually harmless, occur in high densities in their natural environment and are easily cultured in relatively simple bacteriological media.
- A. Coliform bacteria
 - B. Indicator bacteria
 - C. Disinfection
 - D. CT values
 - E. None of the Above
123. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms and _____.
- A. Escherichia coli
 - B. Indicator bacteria
 - C. Disinfection
 - D. CT values
 - E. None of the Above

Sampling Procedures

124. Water samples for _____ must always be collected in a sterile container.
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
125. Take the sample from an inside faucet with the _____.
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
126. Run the water for five minutes to _____ lines and bring in fresh water.
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
127. Do not touch or contaminate the inside of the _____.
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
128. Carefully open the sample container and hold the outside of the cap. Fill the container and _____.
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
129. Refrigerate the sample and _____ testing laboratory within six hours (in an ice chest).
- A. Replace the top
 - B. Bottle or cap
 - C. Aerator removed
 - D. Clear the water
 - E. None of the Above
130. Many labs _____ on Friday so check the lab's schedule.
- A. Is usually a result of a problem
 - B. Forms an obvious slime
 - C. Laboratory analysis results are
 - D. Will not accept bacteria samples
 - E. Slime inside a toilet tank

131. Mailing bacteria samples is not recommended because _____ not as reliable.
- A. Is usually a result of a problem
 - B. Forms an obvious slime
 - C. Laboratory analysis results are
 - D. Will not accept bacteria samples
 - E. Slime inside a toilet tank
132. Iron bacteria _____ on the inside of pipes and fixtures. A water test is not needed for identification.
- A. Is usually a result of a problem
 - B. Forms an obvious slime
 - C. Laboratory analysis results are
 - D. Will not accept bacteria samples
133. Check for a reddish-brown _____ or where water stands for several days.
- A. Is usually a result of a problem
 - B. Forms an obvious slime
 - C. Laboratory analysis results are
 - D. Will not accept bacteria samples
 - E. Slime inside a toilet tank
134. Coliform bacteria are common in the environment and are generally not harmful. However, the presence of these bacteria in drinking water _____ with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.
- A. Is usually a result of a problem
 - B. Forms an obvious slime
 - C. Laboratory analysis results are
 - D. Will not accept bacteria samples
 - E. Slime inside a toilet tank
135. There are two types of MCL violations for _____.
- A. MCL
 - B. Coliform bacteria
 - C. E.coli
 - D. Samples
 - E. Acute risk
136. The first violation is for total coliform; the second violation is an acute risk to health violation characterized by the confirmed presence of fecal coliform or _____.
- A. MCL
 - B. Coliform bacteria
 - C. E.coli
 - D. Samples
 - E. Acute risk
137. This _____ is based on the presence of total coliforms and compliance is on a monthly or quarterly basis, depending on your water system type and state rule.
- A. MCL
 - B. Coliform bacteria
 - C. E.coli
 - D. Samples
 - E. Acute risk

138. For systems which collect fewer than 40 samples per month, no more than one sample per month may be positive. In other words, the second positive result (repeat or routine) in a month or quarter results in an _____ violation.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

139. For systems which collect 40 or more _____ per month, no more than five (5) percent may be positive, check with your state drinking water section or health department for further instructions.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

140. An _____ to human health violation occurs if a routine analysis shows total coliform present and is followed by a repeat analysis which indicates fecal coliform or E. coli present.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

141. An acute risk to human health violation occurs if a routine analysis shows total and fecal coliform or _____ present and is followed by a repeat analysis which indicates total coliform present.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

142. An _____ violation requires the water system to provide public notice via radio and television stations in the area. This type of contamination can pose an immediate threat to human health and notice must be given as soon as possible but no later than 72 hours after notification from your laboratory of the test results.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute health risk

143. A public notice is required to be issued by a water system whenever it fails to comply with an applicable _____ or treatment technique or fails to comply with the requirements of any scheduled variance or permit. This will inform users when there is a problem with the system and give them information.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

144. A _____ is also required whenever a water system fails to comply with its monitoring and/or reporting requirements or testing procedure. Each public notice must contain certain information, be issued properly and in a timely manner and contain certain mandatory language.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Public notice
- E. Acute risk

145. The timing and place of posting of the public notice depends on whether an _____ is present to users.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

146. This is an acute violation: Violation of the _____ for nitrate.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

147. This is an acute violation: Any violation of the MCL for total coliforms, when fecal coliforms or _____ are present in the distribution system.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute risk

148. This is an _____ violation: Any outbreak of waterborne disease, as defined by the rules.

- A. MCL
- B. Coliform bacteria
- C. E.coli
- D. Samples
- E. Acute

149. pH: A measure of the _____ of water.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity
- E. None of the Above

150. The pH scale runs from 0 to 14 with 7 being the mid point or _____.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity
- E. None of the Above

151. A pH of less than 7 is on the _____ of the scale with 0 as the point of greatest acid activity.

- A. Neutral
- B. pH
- C. Basic
- D. Acid
- E. None of the Above

152. A pH of more than 7 is on the _____ (alkaline) side of the scale with 14 as the point of greatest basic activity.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity

153. The _____ of a water sample is measured on a pH scale. This scale ranges from 0 (maximum acidity) to 14 (maximum alkalinity). The middle of the scale, 7, represents the neutral point. The acidity increases from neutral toward 0.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity
- E. None of the Above

154. Because the scale is logarithmic, a difference of one _____ unit represents a tenfold change.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity
- E. None of the Above

155. Normal rain has a _____ of 5.6 – slightly acidic because of the carbon dioxide picked up in the earth's atmosphere by the rain.

- A. Neutral
- B. pH
- C. Basic
- D. Acidity
- E. None of the Above

Chlorine Section

156. _____ can be added as sodium hypochlorite, calcium hypochlorite or chlorine gas.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

157. All three forms of chlorine produce _____ when added to water.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

158. _____ is a weak acid but a strong disinfecting agent.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

159. The amount of hypochlorous acid depends on the pH and temperature of the water. Under normal water conditions, hypochlorous acid will also chemically react and break down into a _____.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

160. The hypochlorite ion is a much weaker disinfecting agent than _____, about 100 times less effective.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

161. _____ and temperature affect the ratio of hypochlorous acid to hypochlorite ions. As the temperature is decreased, the ratio of hypochlorous acid increases.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

162. _____ plays a small part in the acid ratio. Although the ratio of hypochlorous acid is greater at lower temperatures, pathogenic organisms are actually harder to kill.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

163. All other things being equal, higher water _____ and a lower pH are more conducive to chlorine disinfection.

- A. pH
- B. Chlorine
- C. Hypochlorous acid (HOCl)
- D. Hypochlorite ion
- E. Temperature

Reverse Osmosis Process

164. Osmosis is a natural phenomenon in which a liquid - water, in this case - passes through a _____ membrane from a relatively dilute solution toward a more concentrated solution.

- A. Membranes
- B. Osmotic pressure
- C. Semi-permeable
- D. Reverse osmosis
- E. Concentrate

165. This flow as mentioned above produces a measurable pressure, called _____.
- A. Membranes
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
166. If pressure is applied to the more concentrated solution, and if that pressure exceeds the _____, water flows through the membrane from the more concentrated solution toward the dilute solution.
- A. Membranes
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
167. This process, called _____, or RO, removes up to 98% of dissolved minerals, and virtually 100% of colloidal and suspended matter.
- A. Membranes
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
168. _____ produces high quality water at low cost compared to other purifications processes.
- A. Membranes
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
169. The RO _____ must be physically strong to stand up to high osmotic pressure - in the case of sea water, 2500 kg/m.
- A. Membrane
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
170. Most RO _____ are made of cellulose acetate or polyamide composites cast into a thin film, either as a sheet or fine hollow fibers.
- A. Membrane
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate
171. The RO membrane is constructed into a cartridge called a _____ module.
- A. Membranes
 - B. Osmotic pressure
 - C. Semi-permeable
 - D. Reverse osmosis
 - E. Concentrate

172. After filtration to remove suspended particles, incoming water is pressurized with a pump to 200 - 400 psi (1380 - 2760 kPa) depending on the RO system model. This exceeds the water's _____.

- A. Membranes
- B. Osmotic pressure
- C. Semi-permeable
- D. Reverse osmosis
- E. Concentrate

173. A portion of the water (**permeate**) diffuses through the membrane leaving dissolved salts and other contaminants behind with the remaining water where they are sent to drain as waste (_____).

- A. Membranes
- B. Osmotic pressure
- C. Semi-permeable
- D. Reverse osmosis
- E. Concentrate

174. _____ is important because it influences permeate quality and quantity. It also affects the module's life because many water-borne contaminants can deposit on the membrane and foul it.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

175. Generally, the need for _____ increases as systems become larger and operate at higher pressures, and as permeate quality requirements become more demanding.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

176. To understand Reverse Osmosis, one must begin by understanding the process of _____, which occurs in nature.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

177. The component parts include a pure or relatively pure water solution and a saline or contaminated water solution, separated by a _____, and a container or transport mechanism of some type.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

178. The _____ is so designated because it permits certain elements to pass through, while blocking others. The elements that pass through include water, usually smaller molecules of dissolved solids, and most gases.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

179. The _____ are usually further restricted based on their respective electrical charge.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

180. In _____, naturally occurring in living things, the pure solution passes through the membrane until the osmotic pressure becomes equalized, at which point osmosis ceases.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

181. The _____ pressure is defined as the pressure differential required to stop osmosis from occurring. This pressure differential is determined by the total dissolved solids content of the saline solution or contaminated solution on one side of the membrane.

- A. Osmosis
- B. Semi-permeable membrane
- C. Pretreatment
- D. Dissolved solids
- E. None of the Above

182. The higher the content of dissolved solids, the higher the osmotic pressure. Each element that may be dissolved in the solution contributes to the _____, in that the molecular weight of the element affects the osmotic pressure.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

183. Generally, higher molecular weights result in higher osmotic pressures. Hence the formula for calculating _____ is very complex. However, approximate osmotic pressures are usually sufficient to design a system.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

184. Common tap water as found in most areas may have an _____ of about 10 PSI (Pounds per Square Inch), or about 1.68 Bar.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

185. Seawater at 36,000 PPM typically has an _____ of about 376 PSI (26.75 Bar).

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

186. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of 376 PSI would have to be applied to the seawater side of the _____.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

187. Several decades ago, U.S. Government scientists had the idea that the principles of _____ could be harnessed to purify water from various sources, including brackish water and seawater.

- A. Colloidal
- B. Spiral wound
- C. Osmosis
- D. Osmotic pressure
- E. Synthetic

188. In order to transform this process into one that purifies water, osmosis would have to be reversed, and suitable _____ membrane materials would have to be developed. Additionally, ways of configuring the membranes would have to be engineered to handle a continuous flow of raw and processed water without clogging or scaling the membrane material.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

189. These ideas were crystallized and fueled by U.S. Government funding, usable membrane materials and designs resulted. One of the membrane designs was the _____ membrane element.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

190. This design enabled the engineers to construct a _____ element that could contain a generous amount of membrane area in a small package, and to permit the flow of raw water to pass along the length of the membrane.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

191. This design as above question permits flows and pressures to be developed to the point that ample processed or purified water is produced, while keeping the membrane surface relatively free from particulate, _____, bacteriological or mineralogical fouling.

- A. Colloidal
- B. Spiral wound
- C. Membrane
- D. Osmotic pressure
- E. Synthetic

192. The design as mentioned above, features a perforated tube in the center of the element, called the product or permeate tube, and wound around this tube are one or more " _____ " of membrane material, opening at the permeate tube.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

193. Each envelope is sealed at the incoming and exiting edge. Thus when water penetrates or permeates through the membrane, it travels, aided by a fine mesh called the permeate channel, around the spiral and collects in the _____ tube.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

194. The _____ or product water is collected from the end of each membrane element, and becomes the product or result of the purification process.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

195. As raw water flows along the " _____ " or coarse medium provided to facilitate good flow characteristics, it gets more and more concentrated.

- A. Synthetic fibers
- B. Permeate
- C. Brine channel
- D. Concentrate
- E. Fouling

196. The concentrated raw water is called the reject stream or _____. It may also be called brine if it is coming from a salt water source.

- A. Synthetic fibers
- B. Concentrate stream
- C. Envelope
- D. Concentrate
- E. Fouling

197. The _____, when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

198. This is important, as buildup on the membrane surface, called _____, impedes or even prevents the purification process.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

199. The membrane material itself is a special _____ (**TFC**) polyamide material, cast in a microscopically thin layer on another, thicker cast layer of Polysulfone, called the microporous support layer.

- A. Thin film composite
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

200. The microporous support layer is cast on sheets of paper-like material that are made from _____ such as polyester, and manufactured to the required tolerances.

- A. Synthetic fibers
- B. Permeate
- C. Envelope
- D. Concentrate
- E. Fouling

Please fax the answer key to TLC Western Campus Fax (928) 272-0747.

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