

**Registration form**

**WATER TREATMENT 303 \$200.00  
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*

**List number of hours worked on assignment must match State Requirement.** \_\_\_\_\_

**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** \_\_\_\_\_

**Class/Grade** \_\_\_\_\_  
*Your certificate will be emailed to you in about two weeks.*

**Please circle/check which certification you are applying the course CEU's.**  
Water Treatment \_\_\_ Water Distribution \_\_\_ Other \_\_\_\_\_

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

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

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

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

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

## **DISCLAIMER NOTICE**

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

**State Approval Listing Link**, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. 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.

## **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 \$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**

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.

**Do not solely depend on TLC's Approval list for it may be outdated.**

**Many States and employers require the final exam to be proctored.**

**All downloads are electronically tracked and monitored for security purposes.**

# Water Treatment 303 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.*

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

Please Circle, Bold, Underline or X, one answer per question.

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

49. ABCDEF
50. ABCDEF
51. ABCDEF
52. ABCDEF
53. ABCDEF
54. ABCDEF
55. ABCDEF
56. ABCDEF
57. ABCDEF
58. ABCDEF
59. ABCDEF
60. ABCDEF
61. ABCDEF
62. ABCDEF
63. ABCDEF
64. ABCDEF
65. ABCDEF
66. ABCDEF
67. ABCDEF
68. ABCDEF
69. ABCDEF
70. ABCDEF
71. ABCDEF
72. ABCDEF
73. ABCDEF
74. ABCDEF
75. ABCDEF
76. ABCDEF
77. ABCDEF
78. ABCDEF
79. ABCDEF
80. ABCDEF
81. ABCDEF
82. ABCDEF
83. ABCDEF
84. ABCDEF
85. ABCDEF
86. ABCDEF
87. ABCDEF
88. ABCDEF
89. ABCDEF
90. ABCDEF
91. ABCDEF
92. ABCDEF
93. ABCDEF
94. ABCDEF
95. ABCDEF
96. ABCDEF
97. ABCDEF
98. ABCDEF
99. ABCDEF
100. ABCDEF
101. ABCDEF
102. ABCDEF
103. ABCDEF
104. ABCDEF
105. ABCDEF
106. ABCDEF
107. ABCDEF
108. ABCDEF
109. ABCDEF
110. ABCDEF
111. ABCDEF
112. ABCDEF
113. ABCDEF
114. ABCDEF
115. ABCDEF
116. ABCDEF
117. ABCDEF
118. ABCDEF
119. ABCDEF
120. ABCDEF
121. ABCDEF
122. ABCDEF
123. ABCDEF
124. ABCDEF
125. ABCDEF
126. ABCDEF
127. ABCDEF
128. ABCDEF
129. ABCDEF
130. ABCDEF
131. ABCDEF
132. ABCDEF
133. ABCDEF
134. ABCDEF
135. ABCDEF
136. ABCDEF
137. ABCDEF
138. ABCDEF
139. ABCDEF
140. ABCDEF
141. ABCDEF
142. ABCDEF
143. ABCDEF
144. ABCDEF
145. ABCDEF
146. ABCDEF
147. ABCDEF

148. A B C D E F  
149. A B C D E F  
150. A B C D E F  
151. A B C D E F  
152. A B C D E F  
153. A B C D E F  
154. A B C D E F  
155. A B C D E F  
156. A B C D E F  
157. A B C D E F  
158. A B C D E F  
159. A B C D E F  
160. A B C D E F  
161. A B C D E F  
162. A B C D E F  
163. A B C D E F  
164. A B C D E F  
165. A B C D E F  
166. A B C D E F  
167. A B C D E F  
168. A B C D E F  
169. A B C D E F  
170. A B C D E F  
171. A B C D E F  
172. A B C D E F  
173. A B C D E F  
174. A B C D E F  
175. A B C D E F  
176. A B C D E F  
177. A B C D E F  
178. A B C D E F  
179. A B C D E F  
180. A B C D E F  
181. A B C D E F  
182. A B C D E F  
183. A B C D E F  
184. A B C D E F  
185. A B C D E F  
186. A B C D E F  
187. A B C D E F  
188. A B C D E F  
189. A B C D E F  
190. A B C D E F  
191. A B C D E F  
192. A B C D E F  
193. A B C D E F  
194. A B C D E F  
195. A B C D E F  
196. A B C D E F  
197. A B C D E F  
198. A B C D E F  
199. A B C D E F  
200. A B C D E F  
201. A B C D E F  
202. A B C D E F  
203. A B C D E F  
204. A B C D E F  
205. A B C D E F  
206. A B C D E F  
207. A B C D E F  
208. A B C D E F  
209. A B C D E F  
210. A B C D E F  
211. A B C D E F  
212. A B C D E F  
213. A B C D E F  
214. A B C D E F  
215. A B C D E F  
216. A B C D E F  
217. A B C D E F  
218. A B C D E F  
219. A B C D E F  
220. A B C D E F  
221. A B C D E F  
222. A B C D E F  
223. A B C D E F  
224. A B C D E F  
225. A B C D E F  
226. A B C D E F  
227. A B C D E F  
228. A B C D E F  
229. A B C D E F  
230. A B C D E F  
231. A B C D E F  
232. A B C D E F  
233. A B C D E F  
234. A B C D E F  
235. A B C D E F  
236. A B C D E F  
237. A B C D E F  
238. A B C D E F  
239. A B C D E F  
240. A B C D E F  
241. A B C D E F  
242. A B C D E F  
243. A B C D E F  
244. A B C D E F  
245. A B C D E F  
246. A B C D E F

247. A B C D E F  
248. A B C D E F  
249. A B C D E F  
250. A B C D E F  
251. A B C D E F  
252. A B C D E F  
253. A B C D E F  
254. A B C D E F  
255. A B C D E F  
256. A B C D E F  
257. A B C D E F  
258. A B C D E F  
259. A B C D E F  
260. A B C D E F  
261. A B C D E F  
262. A B C D E F  
263. A B C D E F  
264. A B C D E F  
265. A B C D E F  
266. A B C D E F  
267. A B C D E F  
268. A B C D E F  
269. A B C D E F  
270. A B C D E F  
271. A B C D E F  
272. A B C D E F  
273. A B C D E F  
274. A B C D E F  
275. A B C D E F  
276. A B C D E F  
277. A B C D E F  
278. A B C D E F  
279. A B C D E F  
280. A B C D E F  
281. A B C D E F  
282. A B C D E F  
283. A B C D E F  
284. A B C D E F  
285. A B C D E F  
286. A B C D E F  
287. A B C D E F  
288. A B C D E F  
289. A B C D E F  
290. A B C D E F  
291. A B C D E F  
292. A B C D E F  
293. A B C D E F  
294. A B C D E F  
295. A B C D E F  
296. A B C D E F  
297. A B C D E F  
298. A B C D E F  
299. A B C D E F  
300. A B C D E F  
301. A B C D E F  
302. A B C D E F  
303. A B C D E F  
304. A B C D E F  
305. A B C D E F  
306. A B C D E F  
307. A B C D E F  
308. A B C D E F  
309. A B C D E F  
310. A B C D E F  
311. A B C D E F  
312. A B C D E F  
313. A B C D E F  
314. A B C D E F  
315. A B C D E F  
316. A B C D E F  
317. A B C D E F  
318. A B C D E F  
319. A B C D E F  
320. A B C D E F  
321. A B C D E F  
322. A B C D E F  
323. A B C D E F  
324. A B C D E F  
325. A B C D E F  
326. A B C D E F  
327. A B C D E F  
328. A B C D E F  
329. A B C D E F  
330. A B C D E F  
331. A B C D E F  
332. A B C D E F  
333. A B C D E F  
334. A B C D E F  
335. A B C D E F  
336. A B C D E F  
337. A B C D E F  
338. A B C D E F  
339. A B C D E F  
340. A B C D E F  
341. A B C D E F  
342. A B C D E F  
343. A B C D E F  
344. A B C D E F  
345. A B C D E F

- |                  |                  |                  |
|------------------|------------------|------------------|
| 346. A B C D E F | 365. A B C D E F | 384. A B C D E F |
| 347. A B C D E F | 366. A B C D E F | 385. A B C D E F |
| 348. A B C D E F | 367. A B C D E F | 386. A B C D E F |
| 349. A B C D E F | 368. A B C D E F | 387. A B C D E F |
| 350. A B C D E F | 369. A B C D E F | 388. A B C D E F |
| 351. A B C D E F | 370. A B C D E F | 389. A B C D E F |
| 352. A B C D E F | 371. A B C D E F | 390. A B C D E F |
| 353. A B C D E F | 372. A B C D E F | 391. A B C D E F |
| 354. A B C D E F | 373. A B C D E F | 392. A B C D E F |
| 355. A B C D E F | 374. A B C D E F | 393. A B C D E F |
| 356. A B C D E F | 375. A B C D E F | 394. A B C D E F |
| 357. A B C D E F | 376. A B C D E F | 395. A B C D E F |
| 358. A B C D E F | 377. A B C D E F | 396. A B C D E F |
| 359. A B C D E F | 378. A B C D E F | 397. A B C D E F |
| 360. A B C D E F | 379. A B C D E F | 398. A B C D E F |
| 361. A B C D E F | 380. A B C D E F | 399. A B C D E F |
| 362. A B C D E F | 381. A B C D E F | 400. A B C D E F |
| 363. A B C D E F | 382. A B C D E F |                  |
| 364. A B C D E F | 383. A B C D E F |                  |

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

Always call us after faxing the paperwork to ensure that we've received it. 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 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.*



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

**WATER TREATMENT 303 CEU 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.

---

---



## Water Treatment 303 CEU Training Course Assignment

***The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit [www.ABCTLC.com](http://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](mailto: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.**

### Common Water Treatment Terms

#### Safe Drinking Water Act Terms

1. A public water system that serves \_\_\_\_\_ service connections used by year-round residents of the area served by the system or regularly serves at least 25 year-round residents.
- |                |                      |
|----------------|----------------------|
| A. At least 5  | D. At least 30       |
| B. At least 15 | E. At least 500      |
| C. 1,000       | F. None of the Above |

2. Which of the following EPA terms is under section 1452 of the SDWA, the EPA awards capitalization grants to states to develop drinking water revolving loan funds to help finance drinking water system infrastructure improvements?

- A. Drinking Water State Revolving Fund
- B. Contamination Source Inventory
- C. Class V Underground Injection Control
- D. Phase I
- E. Phase II
- F. None of the Above

#### Preface-National Drinking Water Regulations Contaminant Selection

3. P.L. 104-182 directs the EPA to evaluate contaminants that present the greatest health concern and to regulate contaminants that occur at concentration levels and frequencies of public health concern.

A. True B. False

4. The law also includes a schedule for the EPA to complete regulations for disinfectants and disinfection byproducts (D/DBPs) and Copper.

A. True B. False

#### Standard Setting

5. For each contaminant that the EPA has determined merits regulation, the EPA must set a non-enforceable action levels at a level at which no known or anticipated recommended health effects occur, and which allows an adequate margin of safety.

A. True B. False

6. The EPA must then set an enforceable standard, a maximum contaminant level (MCL), as close to the MCLG as is "feasible" using the best technology, treatment techniques, or other means available (taking costs into consideration).

A. True B. False

7. Each regulation establishing an MCL must list any technologies, treatment techniques, or other means that comply with the MCL and that are affordable for three categories of small public water systems.

A. True B. False

8. The 1996 Amendments authorize the EPA to set a standard at other than the feasible level if the feasible level would lead to an increase in some risks by increasing the concentration of other contaminants or by interfering with the technologies used to comply with other SDWA regulations.

A. True B. False

9. If the EPA determines that the benefits do not justify the costs, the EPA may, with certain exceptions, promulgate a standard that minimizes benefits at a low cost that is justified by the benefits.

A. True B. False

### **Topic 1 -Water Treatment Section - Preliminary Treatment**

10. Weeds, leaves, and trash, if not removed, will cause problems to the treatment plant's pumps and equipment, the best way to protect the plant is?

- A. Screening
- B. Settling
- C. Coagulation
- D. Change source
- E. Pump groundwater
- F. None of the Above

11. According to the text, wire mesh screens need maintenance and will require \_\_\_\_\_.

- A. Manual cleaning
- B. Automatic cleaning
- C. No cleaning
- D. Replacement
- E. A and B
- F. None of the Above

12. Mechanical bar screens vary in size and use some type of raking mechanism that travels horizontally down the bars to scrap the debris off.

A. True B. False

### **Pre-Sedimentation**

13. Sand and grit will damage plant equipment and pipes, so it must be removed with either rectangular or round shaped basin prior to?

- A. Filtration
- B. Coagulation
- C. Purification
- D. Flocculation
- E. Sedimentation basin(s)
- F. None of the Above

14. Which of the following treatment processes is used after the flocculation process?

- A. Filtration
- B. Coagulation
- C. Purification
- D. Flocculation
- E. Sedimentation basin(s)
- F. None of the Above

15. Scrapers on the bottom move the settled sludge to one or more hoppers at the influent end of the tank; it may have a \_\_\_\_\_ or traveling bridge used to collect the sludge.

- A. Screw conveyor
- B. Conveyor belts
- C. Dissolved air floatation
- D. Manual skimmers
- E. Turnstile
- F. None of the Above

16. Most clarifiers will have baffles to prevent backflow from entering the effluent.

- A. True
- B. False

### Flights and Chains

17. Flights and chains remove the scum from the \_\_\_\_\_ of the basin.

- A. Supernatant
- B. Surface
- C. Scum box
- D. Armature
- E. A and B
- F. None of the Above

18. The flights are usually concrete flights mounted on parallel chains and the motor shaft is connected through a shaft which turns the gear.

- A. True
- B. False

19. To prevent damage to the flights and chains due to overloads, a \_\_\_\_\_ is used.

- A. Bearing
- B. Reducer
- C. Shear pin
- D. Safety net
- E. A and B
- F. None of the Above

### Circular Clarifiers

20. Which of the following systems uses a 30 to 50 mg/L alum dosage to form a large floc that requires extensive retention time to permit settling?

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional sand filter
- D. All of the above except C
- E. Chemical pretreatment
- F. None of the Above

21. Which of the following systems use graded silica sand filter media?

- A. Conventional technology
- B. Reconditioning cycle
- C. Membranes
- D. All of the above except C
- E. Chemical pretreatment
- F. None of the Above

22. Filtration occurs only within the last few inches of the courser materials at the bottom of the bed.

- A. True
- B. False

23. The media becomes progressively finer and denser in the lower layers.

- A. True
- B. False

24. The most common type of circular clarifier has a center pier or column.

- A. True
- B. False

25. Which of the following processes uses alum and cationic polymers to neutralize the charge?

- A. Filtration
- B. Reconditioning
- C. Purification
- D. Flocculation
- E. Conventional
- F. None of the Above

26. Which of the following compounds combines with alkalinity in the raw water to form a white precipitate that neutralizes suspended particles' electrical charge?

- A. Activated sodium
- B. PAC
- C. Activated carbon
- D. Dissolved organic carbon
- E. Alum
- F. None of the Above

27. As suspended particles accumulate in a filter bed, the pressure drop through the filter increases.

- A. True
- B. False

28. According to the text, when the pressure difference between filter inlet and outlet increases by 5 - 10 psi from the beginning of the cycle, the filter should be reconditioned. Operating beyond this pressure drop increases the chance of fouling - called " Mud-balling " - within the filter.

- A. True
- B. False

29. \_\_\_\_\_ consists of an up-flow backwash followed by a down-flow rinse.

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional
- D. Fast rinse
- E. Chemical pretreatment
- F. None of the Above

30. Which of the following terms lasts about 5 to 10 minutes?

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional
- D. Fast rinse
- E. Chemical pretreatment
- F. None of the Above

31. \_\_\_\_\_ is often used to enhance filter performance.

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional
- D. Fast rinse
- E. Chemical pretreatment
- F. None of the Above

32. Feeding chemicals such as alum, ferric chloride, or a cationic polymer neutralizes the charge, allowing the particles to cling to one another and to the filter media.

- A. True
- B. False

33. Which of the following terms may increase filtered water clarity, measured in NTU, by 90% compared with filtration alone?

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional
- D. Fast rinse
- E. Chemical pretreatment
- F. None of the Above

34. According to the text, if an operator is present to make adjustments for variations in the sedimentation process, clarity improvements in the range of 93 to 95% are achievable.

- A. True
- B. False

## Topic 2 - Direct Filtration Plant vs. Conventional Plant

35. The primary difference between Direct Filtration Plant vs. Conventional Plant is that the \_\_\_\_\_ or step is omitted from the Direct Filtration plant.
- A. Conventional technology
  - B. Reconditioning cycle
  - C. Sedimentation process
  - D. Fast rinse
  - E. Chemical pretreatment
  - F. None of the Above

### Rapid Sand Filtration

36. \_\_\_\_\_ is the most prevalent form of water treatment technology in use today.
- A. Conventional technology
  - B. Reconditioning cycle
  - C. Sedimentation process
  - D. Rapid Sand filtration
  - E. Chemical pretreatment
  - F. None of the Above
37. Rapid Sand filtration process employs a combination of \_\_\_\_\_ in order to achieve maximum effectiveness.
- A. Filtration
  - B. Aluminum Sulfate
  - C. Chemical pretreatment
  - D. Sedimentation process
  - E. Physical and chemical processes
  - F. None of the Above

### Coagulation

38. At the Water Treatment Plant, alum is added to the water in the "flash mix" to cause microscopic impurities in the water to clump together.
- A. True
  - B. False
39. The alum and the water are mixed rapidly by the \_\_\_\_\_.
- A. Cationic polymers
  - B. Flash mixer
  - C. Coagulant chemicals
  - D. Shaker
  - E. All of the Above
  - F. None of the Above
40. What is the process of joining together particles in water to help remove organic matter called?
- A. Cationic polymers
  - B. Coagulation
  - C. Coagulant chemicals
  - D. Flocculation
  - E. All of the Above
  - F. None of the Above
41. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment.
- A. True
  - B. False
42. Fine particles must be coagulated, or "stuck together" to form larger particles, which can be filtered, this is achieved through the use of?
- A. Sedimentation
  - B. Coagulation
  - C. Coagulant chemicals
  - D. Flocculation
  - E. All of the Above
  - F. None of the Above
43. Which of the following terms are required since colloidal particles by themselves have the tendency to stay suspended in water and not settle out?
- A. Cationic polymers
  - B. Coagulation
  - C. Coagulant chemicals
  - D. Flocculation
  - E. All of the Above
  - F. None of the Above

44. Which of the following terms are so small, their charge per volume is significant?
- A. Cationic polymers                      D. Aluminum Sulfate molecules  
 B. Colloidal particles                      E. All of the Above  
 C. Coagulant chemicals                    F. None of the Above
45. Coagulation is necessary to meet the current regulations for almost all potable water plants using surface water.
- A. True                      B. False
46. Coagulant chemicals such as "alum" work by neutralizing the negative charge, which allows the particles to come together.
- A. True                      B. False
47. Which of the following terms can be thought of as positively charged strings that attract the particles to them, and in the process, form a larger particle.
- A. Cationic polymers                      D. Lime  
 B. Coagulation helpers                    E. All of the Above  
 C. Salts                                      F. None of the Above
48. New chemicals have been developed which combine the properties of alum-type coagulants and?
- A. Cationic polymers                      D. Ammonia Hydroxide  
 B. Chlorine                                  E. All of the Above  
 C. Salts                                      F. None of the Above
49. Which of the following terms is the most widely used coagulant in water treatment?
- A. Cationic polymers                      D. Aluminum Sulfate  
 B. Coagulation helpers                    E. Soda ash  
 C. Salts                                      F. None of the Above

**Flocculation**

50. Flocculation is the process of bringing together destabilized or coagulated particles to form larger masses which can be settled and/or filtered out of the water being treated.
- A. True                      B. False
51. Flocculation is the process where the suspended particles can collide, \_\_\_\_\_, and form heavier particles called "floc".
- A. Equalization                              D. Destabilized or coagulated particles  
 B. Agitation of the water                    E. All of the Above  
 C. Agglomerate                              F. None of the Above
52. Inside the contact chambers, water is slowly mixed allowing the coagulated particles, this is called "floc," and the particles become larger and stronger.
- A. True                      B. False
53. Which of the following process terms happens in the water, in which bacteria and other microorganisms are caught in the floc structure?
- A. Equalize the basin                      D. Coagulated particles  
 B. Agitate the water                      E. All of the Above  
 C. Floc particles mix                      F. None of the Above

### Pre-Sedimentation

54. According to the text, depending on the quality of the source water, some plants have pre-sedimentation, this allows larger \_\_\_\_\_ in a reservoir or lake reducing solid removal loads.

- A. Equalize the basin
- B. Agitate the water
- C. Floc particles mix
- D. Coagulated particles
- E. Particles time to settle
- F. None of the Above

### Sedimentation

55. Sedimentation is the process of destabilizing coagulated particles in water.

- A. True
- B. False

56. \_\_\_\_\_ before sedimentation in which the velocity of the water is decreased so that the suspended material, including flocculated particles, can settle out by gravity.

- A. Conventional technology
- B. Flocculation
- C. Sedimentation process
- D. Rapid Sand filtration
- E. Chemical pretreatment
- F. None of the Above

57. Which of the following terms is later removed from the bottom of the basin?

- A. Equalize the basin
- B. Agitate the water
- C. Floc particles mix
- D. Particles combine to form a sludge
- E. Particles time to settle
- F. None of the Above

### Filtration

58. Filtration is a water treatment process step used to remove turbidity, dissolved organics, odor, taste and color.

- A. True
- B. False

59. According to the text, the filter is periodically cleaned by a reversal of flow and the \_\_\_\_\_ into a drain.

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Discharge of back-flushed water
- F. None of the Above

60. Which of the following terms are made of fabric, paper, or plastic?

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite filters
- D. Rapid-sand filters
- E. Granular synthetic filters
- F. None of the Above

61. \_\_\_\_\_ will also remove turbidity, but would not be recommended for that purpose only.

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Granular synthetic material
- F. None of the Above

62. According to the text, water is filtered at a rate of between 2 and 10 gpm per square foot, the water is filtered through an approximate 36" depth of graded sand.

- A. True
- B. False

63. The water flows by gravity through large filters of \_\_\_\_\_, silica sand, garnet and gravel.

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. All of the Above
- F. None of the Above

64. Water filters for suspended particle removal can also be made of graded sand, \_\_\_\_\_, screens of various materials, and fabrics.

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Granular synthetic material
- F. None of the Above

65. Which are the most widely used filters, that in these units, gravity holds the material in place and the flow is downward?

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Granular synthetic material
- F. None of the Above

66. For the removal of organic contaminants and taste and odor problems, Anthracite coal or \_\_\_\_\_ may also be included in the sand to improve the filtration process, especially

- A. Sand
- B. Garnet
- C. Activated carbon
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

67. Which of the following terms should be conducted on a routine basis, at least once per day?

- A. Wall scum
- B. Gate position
- C. Effluent control measurement
- D. Post-disinfection
- E. Filtration process performance
- F. None of the Above

68. Good chemical treatment management can often result in either early turbidity breakthrough or rapid head loss buildup.

- A. True
- B. False

### Declining Rate Filters

69. The flow rate will vary with \_\_\_\_\_.

- A. Head loss
- B. Uniform media
- C. Effluent control
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

70. Declining rate filters system requires \_\_\_\_\_ to provide adequate media submergence.

- A. Head loss
- B. Uniform media
- C. Effluent control structure
- D. Post-disinfection
- E. Flocculation
- F. None of the Above

### Detention Time

71. Detention time is actual time required for a small amount of water to pass through a Sedimentation basin at a given rate of flow, or the calculated time required for a small amount of liquid to pass through a tank at a given rate of flow.

- A. True
- B. False

### Water Filtration Key Terms

72. Chlorine is added again after filtration for?

- A. Residual
- B. Control THMS
- C. Contact time
- D. Post-disinfection
- E. Pre-disinfection
- F. None of the Above

73. Jar testing traditionally has been done on a monthly basis in most water treatment plants to control THMs.

- A. True
- B. False

74. According to the text, pH is an expression of a basic or acid condition of a liquid. The range is from 0-14, zero being the most acid and 14 being the most alkaline. A pH of 7 is considered to be neutral.

- A. True
- B. False

75. NaOH is a strong chemical used in the treatment process to neutralize acidity, and to lower the pH value.

- A. True
- B. False

76. Polymer is a water treatment chemical that when combined with other types of coagulants, aids in binding small \_\_\_\_\_ to larger particles to help in the settling and filtering processes.

- A. Excess floc
- B. Coagulants
- C. Suspended particles
- D. Color
- E. Solids
- F. None of the Above

77. The operator should make sure that the chlorinated water holds a residual in the distribution system.

- A. True
- B. False

78. Before the filtration process, chlorination will help: control fish and vegetation.

- A. True
- B. False

79.  $\text{H}_2\text{SiF}_6$  a clear \_\_\_\_\_, with a pH ranging from 1 to 1.5 and used in water treatment to fluoridate drinking water.

- A. Gas
- B. But colored liquid
- C. Fluoridating drinking water liquid
- D. Fuming corrosive liquid
- E. Dark pleasant liquid
- F. None of the Above

80. The pH of the water is adjusted with \_\_\_\_\_.

- A. Acid
- B. Sodium carbonate
- C. Fluoride acid
- D. Subsequent treatment processes
- E. Ozone
- F. None of the Above

81. Which of the following terms is fed into the water after filtration?

- A. Acid
- B. Sodium Chloride
- C. Fluoride acid
- D. Subsequent treatment processes
- E. Soda ash
- F. None of the Above

82. Which of the following terms is occasionally added for taste and odor control?

- A. Turbidity powder
- B. Powdered activated carbon (PAC)
- C. Fluoride
- D. HOCL
- E. All of the Above
- F. None of the Above

### Water Quality

83. Water quality testing needs to be conducted throughout the water treatment process.

- A. True
- B. False

### Chemical Feed and Rapid Mix

84. To improve the subsequent treatment processes, chemicals are added to the water, and may include pH adjusters and coagulants.

- A. True
- B. False

### Short-Circuiting

85. Short-Circuiting is a condition that occurs in tanks or basins when some of the water travels faster than the rest of the flowing water.

- A. True
- B. False

### Tube Settlers

86. Tube settlers are a modification of the conventional process contains many metal "tubes" that are placed in \_\_\_\_\_.

- A. Clearwell
- B. Sedimentation basin or clarifier
- C. Flocculation basin
- D. An up-flow clarifier
- E. Filter
- F. None of the Above

### Adsorption Clarifiers

87. In the sedimentation/clarification process, turbidity is \_\_\_\_\_ of the coagulated and flocculated solids onto the adsorption media and onto the solids already adsorbed onto the media.

- A. Increased by adsorption
- B. Reduced by adsorption
- C. Destroyed
- D. Decreased
- E. A modification of the conventional process
- F. None of the Above

88. The clearwell provides temporary storage for the treated water, which is the final step in the conventional filtration process.

- A. True
- B. False

### EPA Filter Backwash Rule- Introduction

89. The U.S. Environmental Protection Agency has finalized the Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule to \_\_\_\_\_ from contamination by Cryptosporidium and other microbial pathogens.

- A. Enforce standards to protect
- B. Increase filtration and disinfection
- C. Increase protection of finished drinking water supplies
- D. Remove
- E. All of the Above
- F. None of the Above

90. Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule will apply to public water systems using surface water or ground water under?

- A. Enforceable standards
- B. Filtration and disinfection rules
- C. Influence of surface water
- D. Groundwater
- E. All of the Above
- F. None of the Above

91. The EPA has determined that the presence of microbiological contaminants is a health concern. If finished water supplies contain \_\_\_\_\_, disease outbreaks may result.

- A. Disease symptoms
- B. Cryptosporidium
- C. Waterborne diseases
- D. Microbiological contaminants
- E. All of the Above
- F. None of the Above

92. \_\_\_\_\_ must comply with specific combined filter effluent turbidity requirements.

- A. Watershed control
- B. Raw water control
- C. Disinfection profile
- D. Disinfection benchmark
- E. Conventional and Direct filtration systems
- F. None of the Above

### Disinfection Benchmarking

93. Public water systems will be required to develop a(n) \_\_\_\_\_ unless they perform applicability monitoring which demonstrates their disinfection byproduct levels are less than 80% of the maximum contaminant levels.

- A. Updated watershed control
- B. Direct filtration system
- C. Disinfection profile
- D. Disinfection benchmark
- E. A and D
- F. None of the Above

### Other Requirements

94. Finished water reservoirs for which construction begins after the effective date of the rule must be covered; and unfiltered systems must comply with \_\_\_\_\_ requirements that add Cryptosporidium as a pathogen of concern.

- A. Updated watershed control
- B. Direct filtration system
- C. Disinfection profiling
- D. Disinfection benchmarking
- E. A and D
- F. None of the Above

### The Filtration Process

95. Groundwater that has been softened or treated through iron and manganese removal will require filtration to remove floc created by?

- A. Coagulation and flocculation
- B. Coagulation or oxidation processes
- C. Serious problems in filter operation
- D. A combination of complex physical and chemical mechanisms
- E. Suspension
- F. None of the Above

96. According to the text, since surface water sources are subject to run-off and do not undergo natural filtration, it must be filtered to?

- A. Aid the coagulation and flocculation processes
- B. Provide coagulation or oxidation processes
- C. Remove particles and impurities
- D. Retain the combination of complex physical and chemical mechanisms
- E. Standards
- F. None of the Above

97. Filtration primarily depends on a \_\_\_\_\_, the most important being adsorption.

- A. Coagulation and flocculation process
- B. Coagulation or oxidation processes
- C. Serious problems in filter operation
- D. Combination of complex physical and chemical mechanisms
- E. A and D
- F. None of the Above

98. Adsorption is the process of particles sticking onto the surface of the individual filter grains or onto the previously deposited materials. The forces that attract and hold the particles to the grains are the same as those that work in \_\_\_\_\_.

- A. Coagulation and flocculation
- B. Coagulation or oxidation processes
- C. Main filter
- D. Complex physical and chemical mechanisms
- E. A and B
- F. None of the Above

99. Which of the following terms will happen especially if coagulation and flocculation of the water before filtration was not properly controlled?

- A. Coagulation and flocculation may occur in the filter bed
- B. Coagulation or oxidation processes will work
- C. No problems in filter operation
- D. Physical and chemical mechanisms will improve
- E. A and B
- F. None of the Above

### Types of Filters

100. The oldest water filters developed were the slow sand filters, these have filter rates of around 0.05 gpm/ft<sup>2</sup> of surface area. This type of filter requires large filter areas.

- A. True
- B. False

101. What is the term for the mass of growing material that collects on the surface of the filter?

- A. Schmutzdecke
- B. Water moss
- C. Backwash
- D. Mud balls
- E. Zoological growth
- F. None of the Above

102. Most water filters are classified by filtration rate, type of \_\_\_\_\_, or type of operation.

- A. Schmutzdecke
- B. Slow rate filtration
- C. Backwash capabilities
- D. Filter media
- E. Filter size
- F. None of the Above

### Rapid Sand Filters

103. Rapid sand filters can accommodate filter rates 40 times more than \_\_\_\_\_.

- A. Fixed film
- B. Slow sand filters
- C. Mixed media
- D. Activated carbon beds
- E. Without sand
- F. None of the Above

104. The filter sand used in rapid sand filters is normal play sand for the purpose of water filtration.

- A. True
- B. False

105. The gravel installed under the sand layer(s) in the filter prevents the \_\_\_\_\_ from being lost during the operation.

- A. Rapid filters
- B. Filter sand
- C. Backwash trough
- D. Sedimentation basin
- E. Mixed media
- F. None of the Above

### False floor

106. The false floor design of a \_\_\_\_\_ is used together with a porous plate design or with screens that retain the sand when there is no undergravel layer.

- A. Rapid sand filter system
- B. Slow rate filtration system
- C. Backwash system
- D. Filter underdrain
- E. Leopold system
- F. None of the Above

107. Underdrains allows the jet action or open space under the floor to act as the collection area for the filtered water and of the filter backwash water.

- A. True
- B. False

### Leopold System

108. According to the text, the Leopold system consists of a series of clay or plastic blocks that form the channels to remove the filtered water from the filter and distribute the?

- A. Backwash water
- B. Surface wash system
- C. Media
- D. Backwashing of the filter or backwash cycle
- E. Removed filtered water
- F. None of the Above

### Washwater Troughs

109. During the operation of a filter, the upper six-to-ten inches of the filter media remove most of the suspended material, this layer is thoroughly cleaned during the?

- A. Rinsing cycle
- B. Method of agitation
- C. Washing
- D. Backwash cycle
- E. Filtered water cycle
- F. None of the Above

110. In most cases, backwashing does not clean this layer completely; some \_\_\_\_\_ is needed to break up the top layers of the filter and to help the backwash water remove any material caught there.

- A. Rinsing cycle
- B. Method of agitation
- C. Washing
- D. Backwash cycle
- E. Surface wash
- F. None of the Above

111. Which of the following terms uses compressed air to mix the upper layer and loosen the particles from the sand so that the backwash water can remove the particles more easily?

- A. Rinsing cycle
- B. Method of agitation
- C. Washing
- D. Backwash cycle
- E. Surface wash
- F. None of the Above

112. Washwater troughs placed above the filter media collect the \_\_\_\_\_ and carry it to the drain system.

- A. Backwash water
- B. Raw water
- C. Media
- D. Rinsing of the filter or backwash cycle
- E. Rinsate
- F. None of the Above

113. Which of the following processes are constructed from concrete, plastic, fiberglass, or other corrosion-resistant materials?

- A. Backwash troughs
- B. Surface wash system piping
- C. False floor
- D. Trap door
- E. Center stand
- F. None of the Above

### **Filtration Processes**

114. The traditional design for many years is conventional filtration; this method provides effective treatment for just about any range of?

- A. Raw-water turbidity
- B. Costs
- C. Microorganisms
- D. Increase plant capacity
- E. All of the Above
- F. None of the above

115. Conventional filtration success is due partially to the sedimentation that precedes filtration and follows the coagulation and flocculation steps.

- A. True
- B. False

116. Many treatment plants have converted rapid sand filters in to multi-media filters in an attempt to \_\_\_\_\_.

- A. Control raw-water turbidity
- B. Lower capital cost
- C. Kill microorganisms
- D. Increase plant capacity
- E. All of the Above
- F. None of the Above

117. In the other type of filtration process called "direct filtration" no sedimentation follows the coagulation phase.

- A. True
- B. False

118. Which of the following water treatment terms is designed to filter water with an average turbidity of less than 25 NTU?

- A. Direct Filtration
- B. Dual and multi-media filtration
- C. Conventional Filtration
- D. Flocculation
- E. Pressure Sand Filtration
- F. None of the Above

### High Rate Filters

119. Multi-media or mixed-media filters use three or four different materials, sand, anthracite coal, and garnet.

- A. True            B. False

120. Finer sand grains are at the \_\_\_\_\_ farther down into the filter, in rapid sand filters.

- A. Bottom of the sand layer with larger grains            D. End of the sand layer with larger grains  
B. Top of the sand layer with larger grains            E. Top of the sand layer with finer grains  
C. Front of the sand layer with larger grains            F. None of the Above

### Pressure Sand Filters

121. Pressure filtration rates are twice as good as gravity filters.

- A. True   B. False

122. Which type of filter is used extensively in iron and manganese removal plants?

- A. Slow sand/RO            D. Fast sand  
B. Gravity filters            E. Conventional  
C. Pressure sand filter            F. None of the Above

123. Which of the following terms or methods cracking of the filter bed can occur quite easily, allowing the iron and manganese particles to go straight through the filter?

- A. Slow sand/RO            D. Fast sand  
B. Gravity filters            E. Conventional  
C. Pressure filters            F. None of the Above

### Filtration Operation

124. Filtration operation is divided into three steps: filtering, backwashing, and?

- A. Filter run            D. Drying  
B. Filtering to waste            E. Rinsate  
C. Return to waste            F. None of the Above

### Declining Rate

125. According to the text, \_\_\_\_\_ or methods of control is used where the head loss through the plant is quite large?

- A. Slow sand/RO            D. Fast sand  
B. Gravity filters            E. Declining Rate  
C. Pressure filters            F. None of the Above

### Loss of Head Indicator

126. Which of the following terms is measured in the difference by a piezometer connected to the filter above the media and the effluent line?

- A. Filter run            D. Head loss  
B. Filtering to waste            E. Head  
C. Flow tube controller            F. None of the Above

### In-line Turbidimeter

127. Continuous turbidity monitors provide information about when the filter is approaching this point so that the operators can start the backwash before the turbidity is too great.

- A. True   B. False

128. Which of the following terms in water is caused by small suspended particles that scatter or reflect light?

- A. Shelter bacteria
- B. Suspended material
- C. Turbidity
- D. Flocc
- E. Breakthrough
- F. None of the Above

### Filtration Process

129. A rapid sand filter will have a flow of two-to-three gpm/square foot of filter area. The high rate filter may have four-to-six gpm/square foot applied to the surface.

- A. True
- B. False

130. Water from the source or from pre-treatment processes is applied to the top of the filter; it then flows downward. The water level above the filter bed is usually kept at two-to-six feet.

- A. True
- B. False

131. When the filtration is started after being backwashed, there will be great head loss.

- A. True
- B. False

132. Which of the following terms in water is restricted during this time in filters with a control valve installed on the filter effluent pipe?

- A. Shelter bacteria
- B. Suspended material
- C. Turbidity
- D. Filter flow
- E. All of the above except D
- F. None of the Above

133. The control valve prevents filter surges, which could disturb the media and force \_\_\_\_\_ through the filter.

- A. Flow
- B. Suspended material
- C. Dissolved solids
- D. Flocc
- E. Breakthrough
- F. None of the Above

134. Which of the following terms in water rate on a filter depends on the type of filter?

- A. Flow
- B. Suspended material
- C. Turbidity
- D. Flocc
- E. Breakthrough
- F. None of the Above

135. Which of the following terms is almost fully closed when a filter is clean so that the desired water level on top of the filter is maintained?

- A. Headloss valve
- B. Constant rate flow valve
- C. Flow restrictor
- D. Backwash cycle valve
- E. Variable declining rate flow control
- F. None of the Above

136. As the filter becomes dirty, the valve opens gradually until the increase in the water level above the filter indicates that the filter needs?

- A. Headloss correction
- B. Constant rate flow
- C. Flow restrictor adjusting
- D. Filtration
- E. Backwashing
- F. None of the Above

137. Which of the following terms regulates the filters are allowed to take on as much water as they can handle?

- A. Headloss valve
- B. Constant rate flow valve
- C. Flow restrictor
- D. Backwash cycle valve
- E. Variable declining rate flow control
- F. None of the Above

138. As the filter becomes dirty, the flow through the filter becomes less and, if the plant has more than one filter, additional \_\_\_\_\_ across the other filters.

- A. Headloss
- B. Flow redistributes
- C. Flow restricting
- D. Backwash cycle
- E. Media
- F. None of the Above

139. \_\_\_\_\_ is placed in the filter effluent pipe to prevent a filter inflow that is too great for the filter.

- A. Headloss
- B. Flow redistributes
- C. Flow
- D. Backwash cycle
- E. Flow restrictor
- F. None of the Above

140. The filter eventually fills with suspended material, usually after 15 to 30 hours, it will need to be \_\_\_\_\_ to clean the media.

- A. Bumped
- B. Jetted
- C. Air scoured
- D. Backwashed
- E. Flow restrictor
- F. None of the Above

### Back Washing

141. A normal backwash rate is between 1.2 to 1.5 gpm per square foot of filter surface area.

- A. True
- B. False

142. Proper backwashing is a very important step in the operation of a filter.

- A. True
- B. False

143. The filter will eventually develop additional operational problems, if the filter is not \_\_\_\_\_ completely,

- A. Bumped
- B. Jetted
- C. Air scoured
- D. Backwashed
- E. Flow restrictor
- F. None of the Above

144. The filter must be cleaned before the next filter run, treated water from storage is used for the backwash cycle. This treated water is taken from elevated storage tanks or pumped in from the raw water reservoir.

- A. True
- B. False

145. Which of the following terms must be expanded to clean the filter during the backwash?

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash cycle
- E. Media
- F. None of the Above

146. Filter expansion causes the filter grains to rub violently against each other, dislodging the \_\_\_\_\_ from the media.

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash cycle
- E. Media
- F. None of the Above

147. The filter media needs to be agitated by the filter backwash to expand and agitate and suspend the \_\_\_\_\_ in the water for removal.

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash cycle
- E. Media
- F. None of the Above

148. Which of the following filter terms if is too high, the media will be washed from the filter into the troughs and out of the filter?

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash rate
- E. Media
- F. None of the Above

149. During filter backwash, the media expands upwards and around the washing arms.

- A. True
- B. False

150. According to the text, a newer method of surface wash involves using \_\_\_\_\_ before the water wash.

- A. Headloss calculation
- B. Floc(s) scouring
- C. Air scour
- D. Backwash cycle
- E. Air washing
- F. None of the Above

151. Which of the following terms needs two-to-five cubic feet of air per square foot of filter area?

- A. Headloss calculation
- B. Floc(s) scouring
- C. Air scour
- D. Backwash cycle
- E. Air washing
- F. None of the Above

152. \_\_\_\_\_ is so high that the filter will no longer produce water at the desired rate.

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash rate
- E. Flow rate
- F. None of the Above

153. Which of the following terms starts to break through the filter and the turbidity in the filter effluent increases; and/or a filter run reaches a given hour of operation?

- A. Headloss
- B. Floc(s)
- C. Flow
- D. Backwash rate
- E. Media
- F. None of the Above

154. If a filter is taken out of service for some reason, it does not need to be backwashed prior to be putting on line.

- A. True
- B. False



164. The filter expansion needed will depend on how much agitation is needed to suspend the filter media to?

- A. Control headloss
- B. Crust on the filter
- C. Expand the bed
- D. Some means of controlling the media carryover
- E. Remove to suspended material trapped in the filter
- F. None of the Above

165. According to the text, with a multi-media filter, the rate must be high enough to scrub the interface between the coal and the sand, where the highest amount of suspended solids will be removed from the media.

- A. True
- B. False

166. The best way to determine how long the filter should be washed is to measure the turbidity of the?

- A. Backwash water is used
- B. Backwash water leaving the filter
- C. Raw water flow entering the plant
- D. Too much backwash water is used
- E. Serious damage to the filter underdrain
- F. None of the Above

167. Which of the following terms must be treated after use, backwash valves must be opened slowly?

- A. Backwash water is used
- B. Backwash water leaving the filter
- C. Raw water flow entering the plant
- D. Too much backwash water is used
- E. Serious damage to the filter underdrain
- F. None of the Above

168. Opening the valves too rapidly can cause \_\_\_\_\_, filter gravel, and filter media.

- A. Backwash water is used
- B. Backwash water leaving the filter
- C. Raw water flow entering the plant
- D. Too much backwash water is used
- E. Serious damage to the filter underdrain
- F. None of the Above

### **Disposal of Filter Backwash Water**

169. Water from the filter backwash can be returned directly to the environment.

- A. True
- B. False

170. The supernatant is then pumped back to the head of the treatment plant at a rate not exceeding ten percent of the \_\_\_\_\_.

- A. Daily flow
- B. Backwash water
- C. Eliminates the need to obtain
- D. Raw water flow entering the plant
- E. Amount of solids that must be removed
- F. None of the Above

171. The settled material is pumped to a sewer or is treated in the solids-handling process, this conserves most of the backwash water and \_\_\_\_\_ a pollution discharge permit.

- A. Daily flow
- B. Backwash water
- C. Eliminates the need to obtain
- D. Raw water flow entering the plant
- E. Amount of solids that must be removed
- F. None of the Above

172. Backwash is a very high flow operation, the surges that are created from the backwash coming from the filter?

- A. Daily flow
- B. Backwash water
- C. Return
- D. Raw water flow entering the plant
- E. Must not be allowed to enter the head of the plant
- F. None of the Above

173. According to the text, the spent backwash water must be stored in storage tanks and returned slowly to the treatment process.

A. True B. False

### Filter to Waste

174. When filtration is started after backwash, suspended material remains in the filter media until the turbidity in the effluent meets standards. Depending on the type of filter, this may last from 20-40 minutes.

A. True B. False

175. According to the text, wasting is needed as some \_\_\_\_\_ following the backwash.

A. Daily flow D. Suspended material remains in the filter media  
B. Backwash water E. Filtration should always be started  
C. Return F. None of the Above

176. Which of the following terms should be done slowly after a backwash to prevent breakthrough of suspended material?

A. Daily flow D. Suspended material  
B. Backwash water E. Filtration should always be started  
C. Return F. None of the Above

### Filter Aids

177. A normal dose of polymer for filter aiding will be less than 0.1 ppm, but the exact dose will be decided by the result of a jar test and by experimentation in the treatment plant.

A. True B. False

178. \_\_\_\_\_ have very high molecular weight and cause the floc to coagulate and flocculate quickly.

A. Filter medias D. Filter aids  
B. Sand E. Floc  
C. Filters F. None of the Above

179. Which of the following terms reflects filter use of large volumes of backwash water to be able to remove the floc that has penetrated deeply into the filter bed?

A. Filter backwashing D. Too much backwash water is used  
B. Backwash water leaving the filter E. Serious damage to the filter underdrain  
C. Raw water flow entering the plant F. None of the Above

180. \_\_\_\_\_ reflects a material that adds strength to the floc and prevents its breakup?

A. Filter backwashing D. Too much backwash water is used  
B. Backwash water leaving the filter E. Filter aid  
C. Raw water flow entering the plant F. None of the Above

181. Which of the following terms are water soluble, organic compounds that can be purchased in either wet or dry form?

A. Filter medias D. Filter aids  
B. Activated Carbon E. Floc  
C. Filters F. None of the Above

182. Which of the following terms expresses that the polymer strengthens the bonds and prevents the shearing forces in the filter from breaking the floc apart when used?

- A. Filter media
- B. Lime
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

183. \_\_\_\_\_ should be added just ahead of the filter.

- A. Filter media
- B. Polymer
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

184. Which of the following terms if too much is added will cause the bonds to become too strong, which may then cause the filter to plug?

- A. Filter media
- B. Polymer
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

### Filter Operating Problems

185. According to the text, there are three major types of filter problems. They can be caused by chemical treatment before the filter, \_\_\_\_\_, and backwashing of filters.

- A. Filter aid
- B. Control of filter flow rate
- C. Filter media process
- D. Turbidity breakthrough
- E. Coagulation and flocculation stages
- F. None of the above

### Chemical Treatment before the Filter

186. Which of the following terms of the water treatment must be monitored continuously?

- A. Filter aid
- B. Control of filter flow rate
- C. Filter media process
- D. Turbidity breakthrough
- E. Coagulation and flocculation stages
- F. None of the above

187. Adjustments in the amount of coagulant added must be made frequently to prevent the filter from becoming overloaded, this may cause the filter to prematurely reach its?

- A. Filter aid
- B. Control of filter flow rate
- C. Maximum headloss
- D. Turbidity breakthrough
- E. Coagulation and flocculation stages
- F. None of the above

188. If there is early turbidity breakthrough in the filter effluent, more coagulant may have to be added to the coagulation process.

- A. True
- B. False

189. There may be a need for better mixing during the coagulation or the addition of more?

- A. Filter aid
- B. Control of filter flow rate
- C. Filter media process
- D. Turbidity
- E. Coagulation and flocculation
- F. None of the above

190. If there is a rapid increase in filter head loss, too much coagulant may be clogging the filter.

- A. True
- B. False

### Control of Filter Flow Rate

191. When a filter is subjected to rapid changes in flow rate, the turbidity of the effluent will not be affected; the dirtier the coagulation and flocculation stages, the greater the effect.

- A. True            B. False

192. According to the text, addition of filter aids may also reduce the impact on the filter effluent.

- A. True            B. False

193. Backwashing a filter temporarily takes it out of service, the remaining filter(s) must pick up the additional flow, this can cause a change in flow that will cause?

- A. Turbidity breakthrough            D. Filter aid breakthrough  
B. Backwash storage basin            E. Coagulation and flocculation stages  
C. Filter media breakthrough        F. None of the Above

194. If the plant has a \_\_\_\_\_, this will also prevent surges to the filters.

- A. Turbidity breakthrough            D. Filter aid breakthrough  
B. Backwash storage basin            E. Coagulation and flocculation stages  
C. Filter media breakthrough        F. None of the Above

195. If the plant is not operated continuously, and the start-up at the beginning of the day will cause a?

- A. Basin to catch the overflow    D. Turbidity breakthrough  
B. Surge to the filter(s)            E. Effluent  
C. Filter media breakthrough        F. None of the Above

### Hard Water Section- Topic 3

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

- A. Water hardness                      D. Calcium (Ca) and magnesium (Mg)  
B. Carbonate hardness                E. Dissolved minerals  
C. The calcium-magnesium distinction F. None of the Above

### Occurrence of Hard Water

197. 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                      D. Calcium (Ca) and magnesium (Mg)  
B. Metallic cations                    E. Noncarbonate hardness  
C. Carbon dioxide (CO<sub>2</sub>)            F. None of the Above

### Membrane Filtration Processes

198. \_\_\_\_\_ enables some water systems having contaminated water sources to meet new, more stringent regulations.

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

### Description of Membrane Filtration Processes

199. 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

200. 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

201. 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

202. 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

203. 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

204. 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

205. 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

206. UF does not generally work well for removal of \_\_\_\_\_, it can be used effectively for removal or 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**

207. 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**

208. 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

209. Which process works with most organic chemicals, and radionuclides and microorganisms?

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

### **Microfiltration Specific Process**

210. 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

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

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

212. 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

### **Reverse Osmosis Process Section**

213. 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

214. 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

215. 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

216. 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

217. 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

218. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of \_\_\_\_\_ would have to be applied to the seawater side of the membrane.
- A. 36,000 PPM
  - B. A pressure of 10 PSI
  - C. Osmotic pressure(s)
  - D. 1.68 Bar
  - E. 376 PSI
  - F. None of the Above

### Brine Channel

219. Concentrated raw water is called the reject stream or concentrate stream, it may also be called brine if it is coming from a?
- A. Each sheet of membrane material
  - B. Microporous support layer
  - C. Salt water source
  - D. Amount of permeate or product water
  - E. Concentrations of TDS
  - F. None of the Above

220. Which of the following terms when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional?
- A. Pressure differential
  - B. Osmotic pressure
  - C. Higher molecular weights
  - D. The concentrate
  - E. Waste (concentrate)
  - F. None of the Above

221. The membrane material itself is a special thin film composite (TFC) polyamide material, cast in a microscopically thin layer on another, thicker cast layer of Polysulfone called?
- A. Membrane material
  - B. Microporous support layer
  - C. Brine material
  - D. Amount of permeate or product water
  - E. Concentrations of TDS
  - F. None of the Above

222. Each sheet of membrane material is inspected at special light tables to ensure the quality of the membrane coating, before being assembled into the?
- A. Spiral wound element design
  - B. Microporous support layer
  - C. Brine channel
  - D. Amount of permeate or product water
  - E. Concentrations of TDS
  - F. None of the Above

223. To achieve reverse osmosis, the \_\_\_\_\_ pressure is generally doubled.
- |                                    |  |
|------------------------------------|--|
| A. Each sheet of membrane material | D. Amount of permeate or product water |
| B. Osmotic                         | E. Concentrations of TDS               |
| C. Brine channel                   | F. None of the Above                   |
224. The inverse occurs with lower temperatures, in that salt passage decreases (reducing the \_\_\_\_\_ in the permeate or product water), while operating pressures increase.
- |                                |                      |
|--------------------------------|----------------------|
| A. TDS                         | D. Salt              |
| B. Raw water                   | E. Concentrate       |
| C. Seawater and brackish water | F. None of the Above |
225. The rejection rate is the percentage of \_\_\_\_\_ rejected, or prevented from passing through the membrane.
- |                                |                      |
|--------------------------------|----------------------|
| A. Percentage of permeate      | D. Dissolved solids  |
| B. Raw water                   | E. Concentrate       |
| C. Seawater and brackish water | F. None of the Above |
226. 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      | D. Dissolved solids  |
| B. Raw water                   | E. Concentrate       |
| C. Seawater and brackish water | F. None of the Above |
227. 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      | D. TDS               |
| B. Raw water                   | E. Concentrate       |
| C. Seawater and brackish water | F. None of the Above |
228. Typically, starting with seawater of 36,000 PPM, standard rejection membranes produce?
- |                                    |  |
|------------------------------------|--|
| A. Each sheet of membrane material | D. Amount of permeate or product water |
| B. Permeate below 500 PPM          | E. Concentrations of TDS               |
| C. Brine                           | F. None of the Above                   |
229. 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    | D. Amount of permeate or product water |
| B. Microporous support layer | E. Concentrations of TDS               |
| C. Brine channel             | F. None of the Above                   |
230. 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 | D. Amount of permeate or product water |
| B. Microporous support layer       | E. Concentrations of TDS               |
| C. Multi-media filtration          | F. None of the Above                   |

### Clean in Place" (CIP) System

231. \_\_\_\_\_ 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

232. 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

233. \_\_\_\_\_ 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

234. Which of the following terms delivers product water or permeate having essentially the same temperature as the raw water source?

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

235. R/O Systems can be designed to deliver virtually any?

- A. Each sheet of membrane material
- B. Microporous support layer
- C. Required product water quality
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

236. Reverse osmosis, also known as \_\_\_\_\_ .

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

237. Reverse osmosis is used to purify water and remove salts and other impurities in order to improve the color, taste, or properties of the?

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Fluid
- E. Concentrate
- F. None of the Above

238. RO can be used to purify fluids such as ethanol and glycol, which will pass through the reverse osmosis membrane, while rejecting?

- A. Percentage of permeate
- B. Raw water
- C. Ions and contaminants
- D. Salt
- E. Concentrate
- F. None of the Above

239. RO is used to produce \_\_\_\_\_ that are currently in place.

- A. Permeate
- B. Raw water
- C. Water
- D. Water that meets the most demanding specifications
- E. Concentrate
- F. None of the Above

240. Reverse osmosis technology uses a process known as \_\_\_\_\_ to allow the membrane to continually clean itself.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Cross-flow
- E. Concentrate
- F. None of the Above

241. Which of the following terms passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane?

- A. Some of the fluid
- B. The higher the pressure
- C. A driving force
- D. Purify fluid(s)
- E. Cross-flow
- F. None of the Above

242. According to the text, the process of reverse osmosis \_\_\_\_\_ through the membrane, and the most common force is pressure from a pump.

- A. Percentage of permeate
- B. Raw water
- C. A driving force to push the fluid
- D. Salt
- E. Concentrate
- F. None of the Above

243. \_\_\_\_\_ 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

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

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

245. This compound is a light blue gas at room temperature.

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

246. Ozone has a \_\_\_\_\_ similar to that sometimes noticed during and after heavy electrical storms. In use, ozone breaks down into oxygen and nascent oxygen.

- A. Self-policing pungent odor
- B. THMs
- C. Light blue gas
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

247. Ozone does not form chloramines or \_\_\_\_\_, and while it may destroy some THMs, it may produce others when followed by chlorination.

- A. Carcinogens
- B. THMs
- C. Complete disinfectant
- D. Oxygen and nascent oxygen
- E. Flocculation and coagulation
- F. None of the Above

248. Ozone falls into the same category as other disinfectants in that it can produce?

- A. Carcinogens
- B. THMs
- C. DBPs
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

249. This compound is very unstable and can readily explode. As a result, it is not shipped and must be manufactured on-site.

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

250. Each water has its own \_\_\_\_\_, 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. Carcinogens
- B. THMs
- C. Ozone demand
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

### **Bacteriological Monitoring Section – Topic 5**

251. Which of the following are usually harmless, occur in high densities in their natural environment and are easily cultured in relatively simple bacteriological media?

- A. Indicator bacteria
- B. Bacteria tests
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

252. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and \_\_\_\_\_.

- A. Sample container
- B. Bacteria tests
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

253. According to the text, the routine microbiological analysis of your water is for?

- A. Indicator bacteria
- B. Bacteria tests
- C. Contamination
- D. Coliform bacteria
- E. Presence of an indicator
- F. None of the Above

254. \_\_\_\_\_ is used as an indicator organism to determine the biological quality of your water.

- A. Microbiological analysis
- B. Bac-T
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Presence of an indicator
- F. None of the Above

255. The presence of an indicator or \_\_\_\_\_ in your drinking water is an important health concern.

- A. Indicator bacteria
- B. Pathogenic bacteria
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

256. \_\_\_\_\_ is used to signal possible fecal contamination, and therefore, the potential presence of pathogens.

- A. Indicator bacteria
- B. Pathogenic bacteria
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

### **Bacteria Sampling**

257. Water samples for \_\_\_\_\_ must always be collected in a sterile container.

- A. Indicators
- B. Bacteria tests
- C. Contamination
- D. pH analysis
- E. Presence of an indicator
- F. None of the Above

258. Refrigerate the sample and transport it to the testing laboratory within eight hours (in an ice chest). Many labs will accept bacteria samples on Friday. Mailing Indicator bacteria is not recommended because laboratory analysis results are not as reliable.

- A. True
- B. False

259. Which bug forms an obvious slime on the inside of pipes and fixtures. A water test is not needed for identification. Check for a reddish-brown slime inside a toilet tank or where water stands for several days.

- A. Colonies
- B. Algae
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

260. Which of the following are common in the environment and are generally not harmful, but the presence of these bacteria in drinking water is usually a result of a problem with the treatment system or the pipes.

- A. Diseases
- B. Germs
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

### **Laboratory Procedures**

261. The laboratory may perform the \_\_\_\_\_ in one of four methods approved by the U.S. EPA and your local environmental or health division.

- A. Colilert
- B. Coliform
- C. Sample time
- D. Total coliform analysis
- E. Pathogen test
- F. None of the Above

### **Methods**

262. The MMO-MUG test, a product marketed as \_\_\_\_\_, is very common. The sample results will be reported by the laboratories as simply coliforms present or absent.

- A. Colilert
- B. Coliform
- C. Sample stuff
- D. Total coliform analysis
- E. Pathogen media
- F. None of the Above

263. If coliforms are present, the laboratory will analyze the sample further to determine if these are \_\_\_\_\_ and \_\_\_\_\_ and report their presence or absence.

- A. Colilert, E. coli
- B. Coliforms, E. coli
- C. Fecal coliforms, E. coli
- D. Total coliform analysis, Pathogens
- E. Pathogens, Total coliform analysis
- F. None of the Above

### **Types of Water Samples**

264. It is important to properly identify the type of \_\_\_\_\_ you are collecting.

- A. Colilert
- B. Coliforms
- C. Sample
- D. Total coliform analysis
- E. Pathogens
- F. None of the Above

**The three (3) types of samples are:**

265. Samples collected following a coliform present' routine sample. The number of repeat samples to be collected is based on the number of \_\_\_\_\_ samples you normally collect.

- A. Repeat
- B. Special
- C. QA QC
- D. Total coliform analysis
- E. Routine
- F. None of the Above

266. \_\_\_\_\_ can be collected for other reasons? Examples would be a sample collected after repairs to the system.

- A. Repeat
- B. Special
- C. Sample
- D. Total coliform analysis
- E. Routine
- F. None of the Above

267. What type of samples can be collected on a routine basis to monitor for contamination? Collection should be in accordance with an approved sampling plan.

- A. Repeat
- B. Special
- C. Sample
- D. Total coliform analysis
- E. Routine
- F. None of the Above

268. Which of the following terms is total coliform or fecal coliform present, a set of repeat samples must be collected within 24 hours after being notified by the laboratory?

- A. MCL compliance
- B. Distribution system
- C. Routine sample
- D. Original sampling location
- E. Repeat sample(s)
- F. None of the Above

**The follow-up for repeat sampling is:**

269. If only one \_\_\_\_\_ per month or quarter is required, four (4) repeat samples must be collected.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

270. For systems collecting two (2) or more routine samples per month, three (3) \_\_\_\_\_ must be collected.

- A. Compliance sample
- B. Distribution sample
- C. Routine sample
- D. QA/QC Split
- E. Repeat sample(s)
- F. None of the Above

271. Repeat samples must be collected from: Within five (5) service connections upstream from the \_\_\_\_\_.

- A. MCL compliance
- B. Distribution system
- C. Routine sample
- D. Original sampling location
- E. Repeat sample(s)
- F. None of the Above

272. Repeat samples must be collected from: Within five (5) service connections downstream from the?

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

273. Repeat samples must be collected from: If the system has only one service connection, the \_\_\_\_\_ must be collected from the same sampling location over a four-day period or on the same day.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

274. Repeat samples must be collected from: All \_\_\_\_\_ are included in the MCL compliance calculation.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

275. What must be followed and all operating staff must be clear on how to follow the sampling plan?

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

276. Staff must be aware of how often sampling must be done, the \_\_\_\_\_ to be used for collecting the samples, and the proper procedures for identification, storage and transport of the samples to an approved laboratory.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Proper procedures and sampling containers
- E. Sampling containers
- F. None of the Above

277. In addition, proper procedures must be followed for repeat sampling whenever a routine sample result is?

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

### Maximum Contaminant Levels (MCLs)

278. State and federal laws establish standards for drinking water quality. Under normal circumstances when these guidelines are being met, the water is somewhat safe to drink with little threat to human health.

- A. True
- B. False

279. EPA had developed standards that are known as maximum contaminant levels (MCL). When a particular contaminant exceeds which missing term, a potential health threat may occur.

- A. Coliform bacteria count
- B. MCL
- C. Standards
- D. HPC
- E. CFU
- F. None of the Above

280. This acronym generally expresses properties of the contaminants, risk assessments and factors, short-term (acute) exposure and long-term (chronic) exposure.

- A. Coliform bacteria
- B. MCLs
- C. Standards
- D. HPC
- E. CFU
- F. None of the Above

281. When you as the operator take samples to ensure your water is in compliance with the MCL, there are two types of \_\_\_\_\_ for coliform bacteria.

- A. Coliform bacteria
- B. MCLs
- C. Standards
- D. MCL violations
- E. CFU
- F. None of the Above

282. Which of the following terms is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli?

- A. Coliform bacteria
- B. MCLs
- C. Standards
- D. MCL violations
- E. CFU
- F. None of the Above

### Chain of Custody Procedures

283. Which of the following terms begins when the sample containers are obtained from the laboratory? From this point on, a chain of custody record will accompany the sample containers.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Chain of custody record
- E. Sampling containers
- F. None of the Above

284. Each custody sample requires a \_\_\_\_\_ record and may require a seal. If you do not seal individual samples, then seal the containers in which the samples are shipped.

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

285. Because a sample is physical evidence, \_\_\_\_\_ procedures are used to maintain and document sample possession from the time the sample is collected until it is introduced as evidence.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. TCR
- E. Chain of custody
- F. None of the Above

286. If both parties involved in the transfer must sign, date and note the time on the chain of custody record, this is known as?

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Samples transfer possession
- E. Sampling containers
- F. None of the Above

287. The recipient will then attach the \_\_\_\_\_ showing the transfer dates and times to the custody sheets. If the samples are split and sent to more than one laboratory, prepare a separate chain of custody record for each sample.

- A. Seal individual samples
- B. Chain of custody
- C. Shipping invoices
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

288. If the samples are delivered to after-hours night drop-off boxes, the custody record should note such \_\_\_\_\_ and be locked with the sealed samples inside sealed boxes.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. TCR
- E. A transfer
- F. None of the Above

### Positive or Coliform Present Results

289. According to the text, if you are notified of a positive test result you need to contact either the Drinking Water Program or your local county health department within 24 hours, or by the next business day after the?

- A. Results are reported to you
- B. Positive violation
- C. Repeat sampling immediately
- D. Sample violation
- E. MCL compliance violation
- F. None of the Above

290. Ideally speaking, your Drinking Water Program Agency should contract with health departments to provide \_\_\_\_\_ to water systems.

- A. Assistance
- B. Harassment
- C. Hostility
- D. Sample help
- E. Compliance calculation
- F. None of the Above

291. Hopefully after you have contacted an agency for assistance, you will be instructed as to the proper repeat sampling procedures and possible corrective measures for solving the problem. It is very important to initiate the \_\_\_\_\_ as the corrective measures will be based on those results.

- A. Storage and distribution
- B. Repeat sampling immediately
- C. Upgrading of the wellhead area
- D. Perform routine procedures
- E. Corrective measures
- F. None of the Above

### Heterotrophic Plate Count HPC

292. Heterotrophic Plate Count (HPC) --- formerly known as the Standard Plate Count, is a procedure for estimating the number of live heterotrophic bacteria and measuring changes during water treatment and distribution in water or in swimming pools.

- A. True
- B. False

293. Colonies may arise from pairs, chains, clusters, or single cells, all of which are included in which term?

- A. Coliform bacteria units
- B. MCLs units
- C. Standards
- D. HPC units
- E. Colony-forming units
- F. None of the Above

### Spread Plate Method

294. During this method, colonies are on the \_\_\_\_\_ where they can be distinguished readily from particles and bubbles.

- A. Agar surface
- B. Surface growth area
- C. Top
- D. Bottom
- E. Material
- F. None of the Above

295. During the Spread Plate Method, colonies can be transferred quickly, and \_\_\_\_\_ easily can be discerned and compared to published descriptions.

- A. Colonies grow
- B. Surface growth
- C. Low counts
- D. Heterotrophic organisms will grow
- E. Colony morphology
- F. None of the Above

#### Membrane Filter Method

296. This method permits testing large volumes of \_\_\_\_\_ and is the method of choice for low-count waters.

- A. Colonies
- B. Surface water
- C. Low-turbidity water
- D. Heterotrophic organisms
- E. MCL
- F. None of the Above

#### Heterotrophic Plate Count (Spread Plate Method)

297. Which of the following terms use inorganic carbon sources, this is in contrast to heterotrophic organisms utilize organic compounds as their carbon source?

- A. Colonies
- B. Surface growth
- C. AGAR
- D. Heterotrophic organisms
- E. Autotrophic organisms
- F. None of the Above

298. \_\_\_\_\_ provides a technique to quantify the bacteriological activity of a sample.

- A. Colonies
- B. Heat
- C. Agar
- D. Heterotrophic Plate Count
- E. MCL
- F. None of the Above

299. The R2A agar provides a medium that will support a large variety of \_\_\_\_\_.

- A. Colonies
- B. Bugs
- C. Germs
- D. Heterotrophic bacteria
- E. MCL
- F. None of the Above

#### Total Coliforms

300. This MCL is based on the presence of total coliforms, and compliance is on a daily or weekly basis, depending on your water system type and state rule.

- A. True
- B. False

301. For systems which collect fewer than \_\_\_\_\_ 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 a MCL violation.

- A. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

302. For systems which collect \_\_\_\_\_ or more samples per month, no more than five (5) percent may be Positive?

- A. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

**The following are acute violations:**

303. Which is violation of nitrate?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

304. Concerning total coliforms - when fecal coliforms or E. coli are present in the distribution system and is a violation of the?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

**Pathogen Section**

305. When infected humans or animals pass the bacteria, viruses, and \_\_\_\_\_ in their stool, pathogens may get into water and spread disease.

- A. Fecal Coliform and E coli
- B. Protozoa
- C. Macroorganisms
- D. Cryptosporidiosis
- E. Bioslime
- F. None of the Above

306. According to the text, \_\_\_\_\_ are spread by secretions that are coughed or sneezed into the air by an infected person.

- A. Fecal Coliform and E coli
- B. Giardia lamblia
- C. Microorganisms
- D. Influenza virus and tuberculosis bacteria
- E. Coliform bacteria
- F. None of the Above

**Protozoan Caused Diseases**

307. Which of the following bugs is larger than bacteria and viruses but still microscopic, they invade and inhabit the gastrointestinal tract?

- A. HIV infections
- B. Symptoms
- C. Giardiasis
- D. Hepatitis A
- E. Protozoan pathogens
- F. None of the Above

308. \_\_\_\_\_ has been responsible for more community-wide outbreaks of disease in the U.S. than any other, drug treatment is not 100% effective.

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

309. The mode of transmission of \_\_\_\_\_ is fecal-oral, either by person-to-person or animal-to-person, there is no specific treatment.

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

310. All of 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.

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

### General Contaminant Information

#### Contaminants that may be present in sources of drinking water include:

311. Which of the following terms including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production?

- A. Viruses and bacteria
- B. Pesticides and herbicides
- C. Radioactive contaminants
- D. Inorganic contaminants
- E. Organic chemical contaminants
- F. None of the Above

312. \_\_\_\_\_ which may come from a variety of sources such as agriculture, urban stormwater run-off and residential uses.

- A. Viruses and bacteria
- B. Pesticides and herbicides
- C. Radioactive contaminants
- D. Inorganic contaminants
- E. Organic chemical contaminants
- F. None of the Above

### Water Quality Key Words

313. Which of the following substances or compounds is manufactured from aluminum hydroxide by dehydroxylating it in a way that produces a highly porous material?

- A. Activated alumina
- B. Fluoride
- C. Activated carbon
- D. Dissolved organic carbon
- E. Aluminum salts
- F. None of the Above

314. The "dissolved" fraction of which compound is considered an operational classification?

- A. Activated alumina
- B. Fluoride
- C. Activated carbon
- D. Organic carbon
- E. Aluminum salts
- F. None of the Above

315. Which of the following substances or compounds forms especially strong complexes with Mn(II), Cu(II), Fe(III), Pb (II) and Co(III)?

- A. Activated alumina
- B. Dissolved organic carbon
- C. Activated carbon
- D. Ethylenediaminetetraacetic acid (EDTA)
- E. B and C
- F. None of the Above

### SDWA Water Quality Information and MCLs

#### Radionuclides

316. Some people who drink water containing this compound/element in excess of the EPA standard over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.

- A. Lead
- B. Fluoride
- C. Copper
- D. Aluminum
- E. Arsenic
- F. None of the Above

317. Some people who drink water containing this compound/element in excess of the EPA standard over many years may have an increased risk of getting cancer.

- A. Radon gas
- B. Beta/photon emitters
- C. Radioactive mineral
- D. Alpha emitters
- E. Combined Radium 226/228
- F. None of the Above

318. Which compound/element/solid/gas can dissolve and accumulate in underground water sources, such as wells, and in the air in your home?

- A. Radon solids
- B. Beta/photon emitters
- C. Radioactive material
- D. Gamma emitters
- E. Combined Isotopes
- F. None of the Above

### EPA Rules

#### Arsenic

319. Long-term exposure of this compound/element/substance in drinking water to a variety of cancers in humans.

- A. Arsenic
- B. Copper
- C. Basalt
- D. THHMMS
- E. Silica
- F. None of the Above

320. The EPA set a standard limit on the amount of \_\_\_\_\_ in drinking water to 10 ppb.

- A. Arsenic
- B. Trihalomethanes
- C. Disinfection
- D. Copper
- E. Disinfection byproducts (DBPs)
- F. None of the Above

321. This compound/element/substance is a chemical that occurs naturally in the earth's crust. When rocks, minerals, and soil erode, they release this compound/element/substance into water supplies.

- A. Arsenic
- B. Trihalomethanes
- C. Disinfection byproducts
- D. Basalt
- E. Granite
- F. None of the Above

### ICR

322. The EPA has collected data required by the Information Collection Rule (ICR) to support future regulation of Microbial contaminants, disinfectants, and disinfection byproducts.

- A. True
- B. False

323. The rule is intended to provide EPA with information on chemical byproducts that form when disinfectants used for microbial control react with chemicals already present in source water (disinfection byproducts (DBPs)); Disease-causing microorganisms (pathogens), including Cryptosporidium; and engineering data to control these contaminants.

- A. True
- B. False

### Stage 2 DBP Rule Federal Register Notices

324. Which of the following rules is part of the Microbial and Disinfection Byproducts Rules, which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts?

- A. Groundwater Rule (GWR)
- B. Compliance
- C. The Stage 2 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

325. Which of the following rules focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens?

- A. Stage 2 DBPR
- B. DBP exposure
- C. The Stage 2 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

326. There are specific microbial pathogens, such as \_\_\_\_\_, which can cause illness, and are highly resistant to traditional disinfection practices.

- A. Enteric virus(es)
- B. Oocyst(s)
- C. Cryptosporidium
- D. C. perfringens
- E. E. coli host culture
- F. None of the Above

327. \_\_\_\_\_ along with the Long Term 2 Enhanced Surface Water Treatment Rule are the second phase of rules required by Congress.

- A. Major public health advances
- B. The Stage 2 DBPR
- C. This final rule
- D. Amendments to the SDWA in 1996
- E. Primary or residual disinfectant
- F. None of the Above

328. Which of the following rules is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs?

- A. Major public health advances
- B. The Stage 2 DBPR
- C. This final rule
- D. Amendments to the SDWA in 1996
- E. Primary or residual disinfectant
- F. None of the Above

329. \_\_\_\_\_ systems will conduct an evaluation of their distribution systems, known as an Initial Distribution System Evaluation.

- A. Stage 2 DBPR
- B. DBP exposure
- C. The Stage 1 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

### **Chlorine Section – Topic 7 Pathophysiology**

330. As far as chlorine safety and respiratory protection, the intermediate \_\_\_\_\_ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.

- A. Generation of free oxygen radicals
- B. Vapor from Chlorine gas
- C. Effects of Hydrochloric acid
- D. Water solubility
- E. The odor threshold for chlorine
- F. None of the Above

331. According to the text, respiratory exposure to \_\_\_\_\_ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.

- A. Hydrochloric acid
- B. Chlorine gas
- C. The gas
- D. The chemical species produced
- E. Plasma exudation
- F. None of the Above

332. Because chlorine gas is so dangerous, the odor threshold for chlorine is approximately?

- A. 1 parts per million (ppm)
- B. 3 parts per million (ppm)
- C. 10 parts per million (ppm)
- D. 3-5 parts per million (ppm)
- E. 0.3-0.5 parts per million (ppm)
- F. None of the Above

## Pathological Findings

333. Chlorine is a highly reactive gas.

A. True B. False

334. According to the text, treatment plants use \_\_\_\_\_ to reduce water levels of microorganisms that can spread disease to humans.

- A. HCl  
B. HOCl  
C. High chlorine concentrations  
D. Chlorine  
E. The hypochlorite ion (OCl<sup>-</sup>)  
F. None of the Above

335. Chlorine gas is greenish yellow in color and very toxic. It is heavier than air and will therefore sink to the ground if released from its container. It is the toxic effect of Chlorine gas that makes it a good disinfectant, but it is toxic to more than just waterborne pathogens; it is also toxic to humans. It is a respiratory irritant and it can also irritate skin and mucus membranes.

A. True B. False

336. Chlorine gas is sold as a compressed liquid, which is amber in color. Chlorine, as a solid, is heavier (less dense) than water. If the chlorine liquid is released from its container it will quickly return back to its liquid state.

A. True B. False

337. Chlorine gas is the most expensive form of chlorine to use. The typical amount of chlorine gas required for water treatment is 1-16 mg/L of water. Different amounts of chlorine gas are used depending on the quality of water that needs to be treated. If the water quality is good, a higher concentration of chlorine gas will be required to disinfect the water if the contact time cannot be increased.

A. True B. False

## Exposure

338. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to sodium hypochlorite. People are exposed to sodium hypochlorite by inhalation of aerosols. This causes coughing and a sore throat. After swallowing sodium hypochlorite, the effects are stomach ache, a burning sensation, coughing, diarrhea, a sore throat and vomiting. Sodium hypochlorite on skin or eyes causes redness and pain.

A. True B. False

339. After prolonged exposure, the skin can become sensitive. Sodium hypochlorite is poisonous for water organisms. It is mutagenic and very toxic when it comes in contact with Ammonium salts.

A. True B. False

## Routes of Exposure

### Inhalation

340. Which of the following can liberate toxic gases such as chlorine?

- A. Air  
B. Hypochlorite solutions  
C. Higher levels of chlorine  
D. Ammonia  
E. Household bleach  
F. None of the Above

341. Chlorine is lighter than air and may cause asphyxiation in poorly ventilated, enclosed, or high-lying areas.  
A. True B. False

### Chemistry of Chlorination

342. The hypochlorite ion is a much weaker disinfecting agent than Hypochlorous acid, about 100 times less effective.  
A. True B. False

343. According to the text, pH and temperature affect the ratio of hypochlorous acid to hypochlorite ions. As the temperature is decreased, the \_\_\_\_\_ increases.  
A. Reduction Ratio D. "CT" disinfection concept  
B. CT actual E. Ratio of hypochlorous acid  
C. Free chlorine residual F. None of the Above

344. Under normal water conditions, hypochlorous acid will also chemically react and break down into the hypochlorite ion.  
A. True B. False

345. Temperature plays a small part in the acid ratio. Although the ratio of \_\_\_\_\_ is greater at lower temperatures, pathogenic organisms are actually harder to kill.  
A. Hypochlorous acid D. Total chlorine  
B. The amount of chlorine E. pH value and temperature  
C. Chlorine Demand F. None of the Above

346. If all other things were equal, \_\_\_\_\_ and a lower pH are more conducive to chlorine disinfection.  
A. Lower pH D. Lower water temperature  
B. Hypochlorous acid E. The hypochlorite ion  
C. Higher water temperatures F. None of the Above

347. In water, there are always other substances (interfering agents) such as iron, manganese, turbidity, etc., which will combine chemically with chlorine, these are called the?  
A. Chlorine residual D. Break-point chlorination  
B. Chlorine demand E. Total chlorine residual  
C. Pathogen reduction F. None of the Above

348. According to the text, once chlorine molecules are combined with these interfering agents, they are not capable of disinfection. \_\_\_\_\_ is much more effective as a disinfecting agent.  
A. Chlorine residual D. Break-point chlorination  
B. Chlorine demand E. Total chlorine residual  
C. Free chlorine F. None of the Above

349. Either a total or a \_\_\_\_\_ can be read when a chlorine residual test is taken.  
A. Chlorine residual D. Break-point chlorination  
B. Chlorine demand E. Total chlorine residual  
C. Free chlorine residual F. None of the Above

350. \_\_\_\_\_ is a much stronger disinfecting agent, therefore, most water regulating agencies will require that your daily chlorine residual readings be of free chlorine residual.

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

### Calculation and Reporting of CT Data

351. Reduction Ratio should be reported, along with the appropriate pH, temperature, and?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. Disinfectant residual
- E. T10 of the process unit
- F. None of the Above

352. Which of the following terms must be greater than 1.0 to be acceptable?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

353. You can also calculate and record actual log reductions. Reduction Ratio = CT actual divide by?

- A. Reduction Ratio
- B. CT
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. CT required
- F. None of the Above

### Chlorine (DDBP)

354. Chloramines are formed by reactions with?

- A. Acid and Cl<sub>2</sub>
- B. Ammonia and Cl<sub>2</sub>
- C. THMS and Cl<sub>2</sub>
- D. Folic Acid and Cl<sub>2</sub>
- E. THMs and Haploidic acid
- F. None of the Above

355. While testing chlorine disinfection process, you'll need to understand one especially important feature is the ease of overdosing to create a "\_\_\_\_\_ " concentration.

- A. Free available chlorine and Total Residual
- B. Residual
- C. Break point and Free
- D. Free available chlorine and Combined Chlorine
- E. Combined chlorine and Readily available
- F. None of the Above

356. According to the text, this type of chlorine residual concentration residuals from 0.1 to 0.5 ppm.

- A. Free available chlorine and Total Residual
- B. Residual
- C. Break point and Free
- D. Free available
- E. Combined chlorine and Readily available
- F. None of the Above

357. A typical chlorine residual is 2 ppm for this type of chlorine residual?

- A. Free available chlorine and Total Residual
- B. Residual
- C. Break point and Free
- D. Combined Chlorine
- E. Combined chlorine and Readily available
- F. None of the Above

### Chlorine By-Products

358. The most common chlorination by-products found in U.S. drinking water supplies are?

- A. Chlorate and Chlorite
- B. CO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

### Capacity

359. Which of the following shall have the capacity to dose enough chlorine to overcome the demand and maintain the required concentration of the "free" or "combined" chlorine.

- A. The chlorinator
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

### Methods of Control

360. Which of the following shall be automatic proportional controlled, automatic residual controlled, or compound loop controlled?

- A. A chlorine feed system
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

361. Which piece of chlorination equipment adjusts the chlorine feed rate automatically in accordance with the flow changes to provide a constant pre-established dosage for all rates of flow?

- A. Manual chlorine feed systems
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

### Chlorine Exposure Limits

362. OSHA PEL?

- A. 10 PPM
- B. 1 PPM
- C. 00.1 PPM
- D. 1,000 PPM
- E. 100 PPM
- F. None of the Above

363. Physical and chemical properties: A yellowish green, nonflammable and liquefied gas with an unpleasant and irritating smell know as \_\_\_\_\_?

- A. Cl<sub>3</sub>
- B. Chlorine
- C. HOCl and OCl-
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

364. This can be readily compressed into a clear, amber-colored liquid, a \_\_\_\_\_, and a strong oxidizer.

- A. Cl<sub>2</sub>
- B. Cl
- C. HOCl and OCl-
- D. Combined Available Chlorine
- E. Noncombustible gas
- F. None of the Above

365. Solid chlorine is about \_\_\_\_\_ times heavier than water and gaseous chlorine is about 2.5 times heavier than air.

- A. 1.5
- B. 1.0
- C. 0.5
- D. 2.5
- E. 3.0
- F. None of the Above

366. Cl<sub>2</sub> IDLH?
- A. 10 PPM
  - B. 1 PPM
  - C. 00.1 PPM
  - D. 1,000 PPM
  - E. 100 PPM
  - F. None of the Above

367. Cl<sub>2</sub> Fatal Exposure Limit?
- A. 10 PPM
  - B. 1 PPM
  - C. 00.1 PPM
  - D. 1,000 PPM
  - E. 100 PPM
  - F. None of the Above

368. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for chlorine is 10 PPM (3 milligrams per cubic meter (mg/m<sup>3</sup>)) as a ceiling limit. A worker's exposure to chlorine shall at no time exceed this ceiling level.
- A. True
  - B. False

369. When using chlorine gas: In addition to protective clothing and goggles, chlorine gas should be used only in a well-ventilated area so that \_\_\_\_\_ cannot concentrate.
- A. Chlorine exposure
  - B. Connection
  - C. Leak area
  - D. Any leaking gas
  - E. Several safety precautions
  - F. None of the Above

### **Pump, Motor and Hydraulic Section – Topic 8 Common Hydraulic Terms**

370. Which of the following definitions is the application of continuous force by one body upon another that it is touching; compression?
- A. Pressure, Absolute
  - B. Pressure
  - C. Hydraulics
  - D. Hydrokinetics
  - E. Pascal's Law
  - F. None of the Above

371. \_\_\_\_\_ is the force per unit area, usually expressed in pounds per square inch?
- A. Pressure, Absolute
  - B. Pressure
  - C. Hydraulics
  - D. Hydrokinetics
  - E. Pascal's Law
  - F. None of the Above

372. Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?
- A. Pressure, Atmospheric
  - B. Pressure, Static
  - C. Hydraulics
  - D. Pressure, Gauge
  - E. Pascal's Law
  - F. None of the Above

373. \_\_\_\_\_ is height of a column or body of fluid above a given point expressed in linear units.
- A. Head, Friction
  - B. Head, static
  - C. Head
  - D. Hydraulics
  - E. Hydrokinetics
  - F. None of the Above

374. Which of the following definitions is often used to indicate gauge pressure?
- A. Head, Friction
  - B. Head, static
  - C. Head
  - D. Hydraulics
  - E. Hydrokinetics
  - F. None of the Above

375. \_\_\_\_\_ is when the pressure is equal to the height times the density of the liquid.

- A. Head, Friction
- B. Head, static
- C. Head
- D. Hydraulics
- E. Hydrokinetics
- F. None of the Above

376. Which of the following definitions is required to overcome the friction at the interior surface of a conductor and between fluid particles in motion?

- A. Head, Friction
- B. Head, static
- C. Head
- D. Hydraulics
- E. Hydrokinetics
- F. None of the Above

377. \_\_\_\_\_ varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics.

- A. Head, Friction
- B. Head, static
- C. Head
- D. Hydraulics
- E. Hydrokinetics
- F. None of the Above

378. Which of the following definitions is pressure above zone absolute, i.e. the sum of atmospheric and gauge pressure?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

379. Sea level pressure is approximately 2.31 pounds per square inch absolute, 1 bar = .433psi.

- A. True B. False

### General Pumping Fundamentals

380. Here are the important points to consider about suction piping when the liquid being pumped is below the level of the pump: Sometimes suction lift is also referred to as 'positive suction head'.

- A. True B. False

381. According to the text, suction lift is when the level of water to be pumped is below the?

- A. Impeller
- B. Suction
- C. Lift water
- D. Centerline of the pump
- E. Bellows
- F. None of the Above

382. According to the text, the ability of the pump to lift water is the result of a partial vacuum created at the?

- A. Partial vacuum
- B. Suction lift
- C. Center of the pump
- D. Pressure differential
- E. Negative suction head
- F. None of the Above

383. The suction side of pipe should be one diameter smaller than the pump inlet.

- A. True B. False

384. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.

- A. True B. False

## Pumps

385. Positive displacement pumps have a piston (or equivalent) moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

A. True B. False

386. More complicated pumps have valves check valves that open to allow \_\_\_\_\_, and close automatically to prevent reverse flow.

A. Pistons D. Passage in one direction  
B. Diaphragms E. Lift pumps  
C. Discharged fluid F. None of the Above

387. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston.

A. True B. False

## Pump Categories

388. The key to understanding a pumps operation is that a pump is to move water and generate the \_\_\_\_\_ we call pressure.

A. Centrifugal pump(s) D. Diaphragm pump(s)  
B. Impeller blade(s) E. Cylindrical pump housing  
C. Delivery force F. None of the Above

389. Pump operation like with a centrifugal pump — pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?

A. Inward force D. Center of the impeller  
B. Head E. Incompressible fluid  
C. Viscous drag pump F. None of the Above

390. According to the text, pumps may be classified based on the application they serve.

A. True B. False

391. According to the text, all pumps may be divided into two major categories: (1) dynamic and (2)\_\_\_\_\_.

A. Centrifugal D. Diaphragm  
B. Impeller E. Rotary  
C. Displacement F. None of the Above

## Basic Water Pump

392. According to the text, the centrifugal pumps work by spinning water around in a circle inside a?

A. Vortex D. Center of the impeller  
B. Cylinder E. Cylindrical pump housing  
C. Viscous drag pump F. None of the Above

393. The pump makes the water spin by pulling it with an impeller.

A. True B. False

394. The blades of this impeller project inward from an axle like the arms of a turnstile and, as the impeller spins, the water moves through it.

A. True B. False

395. In a centrifugal pump, the inward force is provided by high-pressure water near the outer edge of the?

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Pump housing
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

396. In the operation of the pump, the water at the edge of the \_\_\_\_\_ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.

- A. Inward force
- B. Pump pushes
- C. Viscous drag pump
- D. Center of the impeller
- E. Incompressible fluid
- F. None of the Above

397. In the operation of the pump, when water is actively flowing through the pump, arriving through a hole near the center of the impeller and leaving through a \_\_\_\_\_ near the outer edge of the pump housing, the pressure rise between center and edge of the pump is not as large.

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Hole
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

**Venturi (Bernoulli's law):**

398. A venturi is a pipe that has a gradual restriction that opens up into a gradual enlargement.

- A. True
- B. False

**Types of Water Pumps**

399. The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.

- A. True
- B. False

400. Vertical turbine pumps are commonly used in groundwater wells. These pumps are driven by a shaft rotated by a motor on the surface.

- A. True
- B. False