

Registration form

DISTRIBUTION 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 PO Box 3060, Chino Valley, AZ 86323
Toll Free (866) 557-1746 Fax (928) 272-0747 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 we need your e-mail address. We will e-mail the certificate to you, if no e-mail address; we will mail it to you.

DISCLAIMER NOTICE

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I 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.

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

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

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

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.

Rush Grading Service

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00. This fee may not cover postage costs. If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line.

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

Do not solely depend on TLC's Approval list for it may be outdated.

All downloads are electronically tracked and monitored for security purposes.

Distribution 303 Answer Key

Name _____

Phone _____

You are solely responsible to ensure this course is accepted for credit. 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 _____

Do not solely depend on TLC's Approval list for it may be outdated.

What is the course approval number, if applicable? _____

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

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

- | | | |
|------------|------------|------------|
| 1. ABCDEF | 22. ABCDEF | 43. ABCDEF |
| 2. ABCDEF | 23. ABCDEF | 44. ABCDEF |
| 3. ABCDEF | 24. ABCDEF | 45. ABCDEF |
| 4. ABCDEF | 25. ABCDEF | 46. ABCDEF |
| 5. ABCDEF | 26. ABCDEF | 47. ABCDEF |
| 6. ABCDEF | 27. ABCDEF | 48. ABCDEF |
| 7. ABCDEF | 28. ABCDEF | 49. ABCDEF |
| 8. ABCDEF | 29. ABCDEF | 50. ABCDEF |
| 9. ABCDEF | 30. ABCDEF | 51. ABCDEF |
| 10. ABCDEF | 31. ABCDEF | 52. ABCDEF |
| 11. ABCDEF | 32. ABCDEF | 53. ABCDEF |
| 12. ABCDEF | 33. ABCDEF | 54. ABCDEF |
| 13. ABCDEF | 34. ABCDEF | 55. ABCDEF |
| 14. ABCDEF | 35. ABCDEF | 56. ABCDEF |
| 15. ABCDEF | 36. ABCDEF | 57. ABCDEF |
| 16. ABCDEF | 37. ABCDEF | 58. ABCDEF |
| 17. ABCDEF | 38. ABCDEF | 59. ABCDEF |
| 18. ABCDEF | 39. ABCDEF | 60. ABCDEF |
| 19. ABCDEF | 40. ABCDEF | 61. ABCDEF |
| 20. ABCDEF | 41. ABCDEF | 62. ABCDEF |
| 21. ABCDEF | 42. 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. ABCDEF
149. ABCDEF
150. ABCDEF
151. ABCDEF
152. ABCDEF
153. ABCDEF
154. ABCDEF
155. ABCDEF
156. ABCDEF
157. ABCDEF
158. ABCDEF
159. ABCDEF
160. ABCDEF
161. ABCDEF
162. ABCDEF
163. ABCDEF
164. ABCDEF
165. ABCDEF
166. ABCDEF
167. ABCDEF
168. ABCDEF
169. ABCDEF
170. ABCDEF
171. ABCDEF
172. ABCDEF
173. ABCDEF
174. ABCDEF
175. ABCDEF
176. ABCDEF
177. ABCDEF
178. ABCDEF
179. ABCDEF
180. ABCDEF
181. ABCDEF
182. ABCDEF
183. ABCDEF

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

**Please fax the answer key to TLC Western Campus
Fax (928) 272-0747
Backup Fax (928) 468-0675**

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

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

**WATER DISTRIBUTION 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.

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.

Water Distribution 303 CEU Training Course Assignment

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

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

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

Water Distribution Section System Elements

- Storage reservoirs are structures used to store water and _____ the supply or pressure in the distribution system.
 - Increase water pressure
 - Equalize
 - Complete gridiron system
 - Main line isolation
 - Provide a reserve pressure
 - None of the Above
- Booster stations are used to _____ from storage tanks for low-pressure mains.
 - Increase water pressure
 - Equalize
 - Complete gridiron system
 - Boost flow
 - Provide a reserve pressure
 - None of the Above
- Valves control the flow of water in the distribution system by isolating areas for repair or by?
 - Increase water pressure
 - Bypasses
 - Complete gridiron system
 - Main line isolation
 - Regulating system flow or pressure.
 - None of the Above
- Distribution mains function is to carry water from the water source or treatment works to users, these are the pipelines that make up the?
 - Increase water pressure
 - Distribution tree
 - Complete gridiron system
 - Distribution system
 - Arterial system
 - None of the Above
- Arterial mains are interconnected with smaller distribution mains to form a complete gridiron system and are mains for?
 - Increasing water pressure
 - Tree system
 - Complete gridiron system
 - Distribution mains of large size
 - Fire protection
 - None of the Above
- According to the text, gate valves should be used in the _____ for main line isolation.
 - Increase water pressure
 - Distribution tree
 - Complete gridiron system
 - Distribution system
 - Arterial system
 - None of the Above

Water Distribution Valves

7. One purpose of installing shutoff valves in water mains at various locations within the distribution system is to allow sections of the system to be _____ or to provide maintenance without significantly curtailing service over large areas.
- A. Feeders as practical
 - B. Adjust the pressure
 - C. Open or close the valve
 - D. Curtail the service
 - E. Taken out of service for repairs
 - F. None of the Above
8. According to the text, at intersections of distribution mains, the number of valves required is normally one less than the number of?
- A. Ties
 - B. Depends
 - C. Radiating mains
 - D. Throttling purposes
 - E. Standardizes
 - F. None of the Above
9. All buried small- and medium-sized valves should be installed in the sidewalk.
- A. True
 - B. False
10. For large shutoff valves, it may be necessary to surround the valve operator or entire valve within a vault or manhole to allow _____.
- A. Principally
 - B. Dependability
 - C. Repair or replacement
 - D. Minimum flow restriction
 - E. Stops or allows
 - F. None of the Above

Gate Valves

11. In the distribution system, gate valves are used when a straight-line flow of fluid and?
- A. Principally
 - B. Dependability
 - C. Repair or replacement
 - D. Minimum flow restriction
 - E. Stops or allows
 - F. None of the Above
12. In the distribution system, or on a residential job, gate valves are so-named because the part that either _____ flow through the valve acts somewhat like a gate.
- A. Fully drawn up
 - B. Dependability
 - C. Repair or replacement
 - D. Minimum flow restriction
 - E. Stops or allows
 - F. None of the Above
13. If the valve is wide open, the gate is _____ into the valve bonnet.
- A. Fully drawn up
 - B. Dependable
 - C. Repair or replacement
 - D. Minimum flow restriction
 - E. Stops or allows
 - F. None of the Above
14. Gate valves are not suitable for _____.
- A. Copper lines
 - B. Dependability
 - C. PRV
 - D. Throttling purposes
 - E. Pressure drops
 - F. None of the Above
15. The control of flow is easy because of the valve's design.
- A. True
 - B. False

Ball Valves

16. Most ball valves require only a 180-degree turn to either completely open or close the valve.
- A. True
 - B. False

17. According to the text, some ball valves are operated by planetary gears.
A. True B. False

18. Ball valves should be either fully-on or fully-off, some ball valves also contain a swing check located within the ball to give the valve a check valve feature.
A. True B. False

Valve Exercising

19. Valve exercising should be done to locate inoperable due to freezing or build-up of rust or corrosion and done once per year to detect _____ and to prevent valves from becoming

- A. Malfunctioning valves D. Minimum flow restriction
- B. Dependability E. Stops or allows
- C. Repair or replacement F. None of the Above

20. A valve inspection should include drawing valve location maps to show distances to the _____ from specific reference.

- A. Valve(s) D. House
- B. Stoneline E. Telephone pole
- C. Monument F. None of the Above

21. Service connections are used to _____ or other plumbing systems to the distribution system mains.

- A. Be isolated D. Limits the expansion
- B. Connect individual buildings E. Decreases in size
- C. By laying out F. None of the Above

If Excessive Torque is Needed to Work the Valve

22. One cause of a valve failing to open are variations in the temperature and/or pressure of the?

- A. High pressure side D. Valve sealing surfaces
- B. Working fluid E. Length of exposure
- C. Closing torque applied F. None of the Above

23. Depending on the seat and wedge material, _____ and closing torque applied, and thermal binding can occur in high temperature situations.

- A. High pressure side D. Valve sealing surfaces
- B. Working fluid E. Length of exposure
- C. Closing torque applied F. None of the Above

24. Over-pressurization is when a valve can _____ when high pressure enters the cavity and has no way to escape.

- A. Over-pressurization D. Lock in the open position
- B. Positive pressure differential E. Break
- C. Lock in the closed position F. None of the Above

25. According to the text, a single direction sealing gate valve has a nameplate on the side of the valve that has a relief hole or pressure equalizer.

- A. True B. False

26. Tuberculation corrosion is caused by chemical changes produced by?
- A. Closed position
 - B. Hard water
 - C. Chemical changes
 - D. Electricity or electrolysis
 - E. Positive pressure differential
 - F. None of the Above

27. Corrosion will increase the C-Factor and the carrying capacity in a pipe.
- A. True
 - B. False

Common Rotary Valves

28. Globe valve a rotary valve is rare to find in most distribution systems, but can be found at treatment plants.

- A. True
- B. False

29. Most Globes have compact OS & Y type, bolted bonnet, rising stems, with renewable seat rings.

- A. True
- B. False

30. According to the text, Globe valves should usually be installed with the inlet below the bonnet.

- A. True
- B. False

31. For light throttling service, the valve may be installed so that the flow enters over the bottom of the seat and goes up through it.

- A. True
- B. False

32. The globe valve may be installed in other orientations, but any deviation from vertical is a compromise.

- A. True
- B. False

System Layouts

Tree System

33. Newer water systems are frequently expanded with planning and developed into a tree-like system.

- A. True
- B. False

34. The Tree system consists of a single main that _____ as it leaves the source and progresses through the area originally served.

- A. Be isolated
- B. Connect individual buildings
- C. By laying out
- D. Limits the expansion
- E. Decreases in size
- F. None of the Above

35. Smaller pipelines _____ the main and divide again, much like the trunk and branches of a tree.

- A. Branch off
- B. Are manifolded to
- C. Connect
- D. Limit the expansion
- E. Decrease
- F. None of the Above

36. According to the text, there are several advantages gained by laying out water mains in a loop or grid, with feeder and distributor mains interconnecting at roadway intersections and other regular intervals.

- A. True
- B. False

Friction Loss

37. The damaged section can be isolated and the remainder of the system will still carry pressure, water will not be distributed if a single section fails.

- A. True B. False

38. During periods of peak fire flow demand, there will be less impact from _____ in water mains as the velocity within any given section of main.

- A. Carrying capacity D. Static pressure
B. Friction loss E. Total pressure
C. Pressure F. None of the Above

Types of Pipes Used in the Water Distribution Field

Plastic Pipe (PVC)

39. Plastic pipe has seen extensive use available in different lengths and sizes; it is lighter than steel or copper and requires no special tools to install.

- A. True B. False

40. Plastic pipe has complete resistance to corrosion; and, in addition, it can be installed aboveground or below ground. has several advantages over metal pipe: it is flexible; it has superior resistance to?

- A. Ease of installation D. Rupture from freezing
B. An excellent combination E. Complete resistance to corrosion
C. Chemical resistance F. None of the Above

41. PVC pipes are made of tough, strong thermoplastic material that has _____ of physical and chemical properties.

- A. Ease of installation D. Array
B. An excellent combination E. Complete resistance to corrosion
C. Chemical resistance F. None of the Above

42. PVC's chemical resistance and _____ make it an excellent material for application in various mechanical systems.

- A. Ease of installation D. Design strength
B. Greater resistance E. Complete resistance to corrosion
C. Chemical resistance F. None of the Above

43. According to the text, often polyvinyl chloride is further chlorinated to obtain a stiffer design, a higher level of impact resistance, and a _____ to extremes of temperature.

- A. Ease of installation D. Design strength
B. Greater resistance E. Complete resistance to corrosion
C. Chemical resistance F. None of the Above

44. A CPVC pipe can be used only in cold-water systems with temperatures up to 110°F.

- A. True B. False

45. Which of the following terms and economy makes plastic pipe popular for use in either water distribution and supply systems or sewer drainage systems?

- A. Ease of installation D. Stamped on the outside
B. Working pressure E. Complete resistance to corrosion
C. Chemical resistance F. None of the Above

46. You will want to date and collect coupons or tap cut-outs to determine the condition of the pipe or?
- A. Ease of installation
 - B. Measure the corrosion
 - C. Chemical resistance
 - D. Measure the shock load
 - E. Determine the C Factor
 - F. None of the Above

Plastic Pipe (PVC)

47. A main advantage of PVC piping is its lightweight, allowing for _____ .
- A. Easy installation
 - B. Measure the corrosion
 - C. Chemical resistance
 - D. Measure the shock load
 - E. Determine the C Factor
 - F. None of the Above
48. Since PVC is non-metallic, a tracer wire must be installed with the PVC water main so that it can be located after burial.
- A. True
 - B. False
49. The National Sanitation Foundation currently lists most brands of PVC pipe as being acceptable for potable water use, this information should be stamped on the outside of the pipe, along with _____ and temperature, diameter and pipe manufacturer.
- A. Ease of installation
 - B. Working pressure
 - C. Chemical resistance
 - D. Date and time
 - E. Expiration
 - F. None of the Above
50. PVC pipe will have the highest C Factor of all the above pipes, the higher the C factor the?
- A. Long life
 - B. Rougher the interior
 - C. Been in use for a long time
 - D. Smoother the pipe
 - E. Ability to withstand shock loads
 - F. None of the Above

Cast Iron (CIP)

51. CIP can be found in diameters from 3" to 48".
- A. True
 - B. False
52. Advantages of CIP are its long life, ability to withstand shock loads and to withstand working pressures up to 120 psi.
- A. True
 - B. False

Ductile Iron Pipe (DIP)

53. DIP can be purchased in 4" to 45" diameters and lengths of 18' to 20'.
- A. True
 - B. False
54. DIP was developed to _____ associated with cast iron pipe.
- A. Overcome the breakage problems
 - B. Withstand shock loads
 - C. Extend the life
 - D. Provide a High C Factor
 - E. Be nearly indestructible
 - F. None of the Above
55. DIP's main advantage is that it is _____ by internal or external pressures.
- A. Overcome the breakage problems
 - B. Withstand shock loads
 - C. Extend the life
 - D. Provide a High C Factor
 - E. Nearly indestructible
 - F. None of the Above

Backflow/Cross-Connection Section

What is backflow? Reverse flow condition

56. Backflow is the undesirable reversal of flow of nonpotable water or other substances through a _____ and into the piping of a public water system or consumer's potable water system.

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

57. Which of the following terms can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

58. _____ can have two forms-backpressure and backsiphonage.

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

59. The basic mechanism for preventing backflow is a mechanical _____, which provides a physical barrier to backflow.

- A. High hazard installations
- B. Air gap
- C. Backflow preventer
- D. Backflow
- E. Device or method
- F. None of the Above

60. The principal types of mechanical backflow preventers are the reduced-pressure principle assembly, the _____, and the double check valve assembly.

- A. High hazard installations
- B. Air gap
- C. Vacuum breaker
- D. Backflow
- E. Device or method
- F. None of the Above

61. Which of the following terms can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

62. _____ is a type of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in a public water system or consumer's potable water system.

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

63. Which of the following terms is a means or mechanism to prevent backflow?

- A. High hazard installations
- B. Air gap
- C. Backflow preventer
- D. Backflow
- E. Device or method
- F. None of the Above

64. According to the text, basic means of preventing backflow is an _____, which either eliminates a cross-connection or provides a barrier to backflow.

- A. High hazard installations
- B. Air gap
- C. Backflow preventer
- D. Backflow
- E. Device or method
- F. None of the Above

65. Which of the following terms is any temporary or permanent connection between a public water system or consumer's potable water system and any source or system containing nonpotable water or other substances?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

66. _____ is a form of backflow caused by a negative pressure (i.e., a vacuum or partial vacuum) in a public water system or consumer's potable water system.

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

Types of Backflow Prevention Methods and Assemblies

67. Which of the following terms must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

68. The type of device selected for a particular installation depends on several factors.

- A. True
- B. False

69. When the airflow is restricted, such as the case of an air gap located near a wall, the _____ separation must be increased.

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

70. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of an?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

71. Which of the following terms must be at least two times the diameter of the supply pipe and not less than one inch?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

72. According to the text, an air break is a physical separation between the free flowing discharge end of a potable water supply pipeline, and the overflow rim of an open or non-pressure receiving vessel.

- A. True
- B. False

73. According to the text, air gap separations must be vertically orientated a distance of at least twice the inside diameter of the supply, but never less than?

- A. 1 inch
- B. 2 inches
- C. 3 inches
- D. Backflow
- E. Depends
- F. None of the Above

74. An obstruction around or near an _____ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.

- A. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

75. An air gap is acceptable for _____ and is theoretically the most effective protection.

- A. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Low pollutional hazards
- E. High pollutional concerns
- F. None of the Above

Vacuum Breakers

76. Which of the following terms can have two types: atmospheric and pressure?

- A. Downstream piping
- B. Atmospheric vacuum breakers
- C. Vacuum breaker(s)
- D. Hazard application(s)
- E. Backflow preventor(s)
- F. None of the Above

Groundwater Production and Treatment System

Groundwater and Wells

77. According to the text, toxic material spilled or dumped near a well can leach into which of the following terms and contaminate the groundwater drawn from that well?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

Contaminated Wells

78. Which of the following terms can be tested to see what chemicals may be in the well and if they are present in dangerous quantities?

- A. Wells
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Karst
- F. None of the Above

79. Groundwater can be withdrawn from wells to provide water when water is pumped from the ground, which of the following terms change in response to this withdrawal?

- A. Dynamics of groundwater flow
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

80. Which of the following terms flows slowly through water-bearing formations at different rates?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

Aquifer

81. Many terms are used to describe the nature and extent of the groundwater resource, the level below which all the spaces are filled with water is called the?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

82. Above the water table lies the _____ .

- A. Unsaturated zone
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Karst
- F. None of the Above

83. The entire region below the water table is called the saturated zone and water in this saturated zone is called?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

84. Which of the following terms are cracks, joints, or fractures in solid rock, through which groundwater moves?

- A. Fractured aquifer(s)
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Karst
- F. None of the Above

85. Limestone is often located in _____ .

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Fractured aquifer(s)
- E. Aquifer
- F. None of the Above

86. Which of the following terms such as sandstone may become so highly cemented or recrystallized that all of the original space is filled. In this case, the rock is no longer a porous medium?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Porous media
- D. Fractured aquifer(s)
- E. Aquifer
- F. None of the Above

87. Clay has many spaces between its grains, but the spaces are not large enough to permit free movement of water.

- A. True
- B. False

88. _____ usually flows downhill with the slope of the water table.

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

89. Which of the following terms flow in the aquifers underlying springs or surface drainage basins, and does not always mirror the flow of water on the surface?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

90. Which of the following terms may move in different directions below the ground than the water flowing on the surface?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

91. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.

- A. True
- B. False

92. A well in such an aquifer is called an artesian well.

- A. True
- B. False

93. _____ is the level to which the water in an artesian aquifer will rise.

- A. Unconfined aquifer(s)
- B. Piezometric surface
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

Cone of Depression

94. When pumping begins, water begins to flow towards the well in contrast to the natural direction of groundwater movement.

- A. True
- B. False

95. The water level in the well falls below the water table in the?

- A. Water table
- B. Groundwater
- C. Surrounding aquifer
- D. Cone of depression
- E. Well
- F. None of the Above

96. Which of the following terms describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?

- A. Water table
- B. Groundwater
- C. Gravity
- D. Cone of depression
- E. Well
- F. None of the Above

97. _____ is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping.

- A. Water table
- B. Groundwater
- C. Drawdown
- D. Cone of depression
- E. Well
- F. None of the Above

98. When a well is installed in this missing term, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well?

- A. Confined aquifer
- B. Aquifer(s)
- C. Hydrologic cycle
- D. Water table
- E. An unconfined aquifer
- F. None of the Above

99. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, a term that literally means?

- A. Water table
- B. Groundwater
- C. Water bearer
- D. Cone of depression
- E. Well
- F. None of the Above

100. Which of the following terms store water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?

- A. Confined aquifer
- B. Aquifer(s)
- C. Hydrologic cycle
- D. Water table
- E. Unconfined aquifer
- F. None of the Above

101. Which of the following terms is controlled largely by its porosity, or the relative amount of open space present to hold water?

- A. Water table
- B. Groundwater
- C. An aquifer's storage capacity
- D. Cone of depression
- E. Well
- F. None of the Above

102. There are two kinds of aquifers: confined and unconfined.

- A. True
- B. False

103. If the aquifer is sandwiched between layers of relatively impermeable materials, it is called?

- A. Confined aquifer
- B. Aquifer(s)
- C. Hydrologic cycle
- D. Water table
- E. Unconfined aquifer
- F. None of the Above

104. Confined aquifers are not sandwiched between layers of relatively impermeable materials, and their upper boundaries are generally closer to the surface of the land.

- A. True
- B. False

105. Which of the following terms are frequently found at greater depths than unconfined aquifers?

- A. Confined aquifer(s)
- B. Aquifer(s)
- C. Hydrologic cycle
- D. Water table
- E. Unconfined aquifer
- F. None of the Above

Does Ground Water Move?

106. Ground water can move sideways as well as up or down. This movement is in response to gravity, differences in elevation, and?

- A. Synthetic organic chemical(s)
- B. Differences in pressure
- C. Permeable zones
- D. Ground-water contamination
- E. Septic tanks, cesspools, and privies
- F. None of the Above

107. Ground water can move even more rapidly in karst aquifers, which are areas in which missing term and similar rocks where fractures or cracks have been widened by the action of the ground water to form sinkholes, tunnels, or even caves?

- A. Contaminant(s)
- B. Saturated zone
- C. Karst aquifer(s)
- D. Water soluble limestone
- E. Serious contamination source(s)
- F. None of the Above

Ground-Water Quality

108. The layers of soil and particles of sand, gravel, crushed rocks, and larger rocks were thought to act as filters, trapping contaminants before they could reach the ground water.

- A. True
- B. False

Bacteriological Monitoring Section - More on the Stage 2 DBP Rule-

109. 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 (LT2)
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

110. The Stage 1 Disinfectants and Disinfection Byproducts Rule and _____, promulgated in December 1998.

- A. Major public health advances
- B. The Stage 2 DBPR
- C. This final rule
- D. Amendments to the SDWA in 1996
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

111. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) builds upon the _____ to address higher risk public water systems for protection measures beyond those required for existing regulations.

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

112. Which of the following rules and 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

113. Which Rule will reduce potential cancer and reproductive and developmental health risks from disinfection byproducts (DBPs) in drinking water, which form when disinfectants are used to control microbial pathogens?

- A. Stage 3 DBPR
- B. DBP exposure
- C. Stage 2 Disinfection Byproducts
- D. Long Term 2 Enhanced Surface Water
- E. Traditional disinfection practices
- F. None of the Above

114. _____ strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5).

- A. Major public health advances
- B. The Stage 3 DBPR
- C. Stage 2 Disinfection Byproducts
- D. Amendments to the SDWA in 1996
- E. Primary or residual disinfectant
- F. None of the Above

115. Which of the following rules targets systems with the greatest risk and builds incrementally on existing rules?

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

116. _____ 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

117. 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

118. This rule will apply to all community water systems and nontransient non-community water systems that add a primary or residual disinfectant other than _____ or deliver water that has been disinfected by a primary or residual disinfectant other than UV.

- A. Ultraviolet (UV) light
- B. The open-channel system
- C. UV rather than ozone
- D. UV source
- E. UV radiation
- F. None of the Above

119. Which of the following rules has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water?

- A. Stage 2 DBPR
- B. DBP exposure
- C. The Stage 2 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Safe Drinking Water Act (SDWA)
- F. None of the Above

120. _____ is one of the major public health advances in the 20th century.

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

121. 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

What does the rule require?

122. Under this term, 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

123. Compliance with the maximum contaminant levels for two groups of disinfection byproducts (TTHM and HAA5) will be calculated for each monitoring location in the distribution system. This approach is referred to as the?

- A. TTHM and HAA5
- B. DBP MCLs
- C. Locational running annual average (LRAA)
- D. Disinfection byproducts (DBPs)
- E. Trihalomethanes and haloacetic acids
- F. None of the Above

124. Which of the following rules also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results?

- 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

Who must comply with the rule?

125. Entities potentially regulated by the _____ are community and nontransient noncommunity water systems that produce and/or deliver water that is treated with a primary or residual disinfectant other than ultraviolet light.

- A. DBPs from chlorination
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. TTHM and HAA5
- F. None of the Above

126. _____ is a public water system that serves year-round residents of a community, subdivision, or mobile home park that has at least 15 service connections or an average of at least 25 residents.

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

127. Which of the following terms is a water system that serves at least 25 of the same people more than six months of the year, but not as primary residence, such as schools, businesses, and day care facilities?

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

Microbial Regulations

128. One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter pathogens in drinking water is the Surface Water Treatment Rule which requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of Giardia and viruses by at least 99.9% and 99.99%, respectively.

- A. True
- B. False

129. Which rule specifies treatment criteria to assure that these performance requirements are met; they include turbidity limits, disinfectant residual, and disinfectant contact time conditions?

- A. Long Term 1 Rule
- B. Maximum Contaminant Level Goal (MCLG)
- C. Stage 1 Byproducts Rule
- D. Surface Water Treatment Rule
- E. Interim Enhanced Surface Water
- F. None of the Above

130. Which rule was established to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the Stage 1 Disinfectants/Disinfection Byproducts Rule and to control Cryptosporidium?

- A. Long Term 1 Enhanced Surface Water Treatment Rule
- B. Maximum Contaminant Level Goal (MCLG)
- C. Stage 1 Disinfectants/Disinfection Byproducts Rule
- D. Surface Water Treatment Rule
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

131. The EPA established a MCL of 0.0010 for all public water systems and a 99% removal requirement for Cryptosporidium in filtered public water systems that serve at least 100,000 people. The new rule tightened turbidity standards back in December 2001.

- A. True B. False

132. Color is an indicator of the physical removal of particulates, including pathogens.

- A. True B. False

133. Which answer improves physical removal of Cryptosporidium, and to maintain control of pathogens?

- A. Long Term 1 Enhanced Surface Water Treatment Rule
B. Maximum Contaminant Level Goal (MCLG)
C. Stage 1 Disinfectants/Disinfection Byproducts Rule
D. Surface Water Treatment Rule
E. Interim Enhanced Surface Water Treatment Rule
F. None of the Above

Bromate

134. Fill in the missing information in order. _____ is a chemical that is formed when _____ used to disinfect drinking water reacts with naturally occurring _____ found in source water.

- A. Bromate, Ozone, Chlorite D. Hydrogen sulfide, Water, Nitrogen
B. Bromide, Bromate, Ozone E. Bromate, Ozone, Bromide
C. Bromate, Bromate, Bromate F. None of the Above

135. What is the annual average for Bromate that was established in the Stage 1 Disinfectants/Disinfection Byproducts Rule?

- A. 1 part per billion D. 10 parts per million
B. 10 parts per billion E. 500 parts per million
C. 100 parts per billion F. None of the Above

Chlorite

136. According to the Stage 1 Disinfectants/Disinfection Byproducts Rule, what is the monthly average level of chlorite in drinking water.

- A. 1 part per million D. 10 parts per million
B. 10 parts per billion E. 500 parts per million
C. 100 parts per billion F. None of the Above

Waterborne Pathogens and Disease Section

137. Bacteria, viruses and protozoan that cause disease are known as pathogens.

- A. True B. False

138. Most pathogens are generally associated with diseases that _____ and affect people in a relatively short amount of time, generally a few days to two weeks.

- A. Limits the treatment process D. Will cause fatalities
B. Are mild in nature E. Limit the travel of pathogens
C. Cause intestinal illness F. None of the Above

Waterborne Pathogen Section - Introduction

139. Waterborne pathogens are primarily spread by the _____.
- A. Fecal-oral, or feces-to-mouth, route
 - B. Dermal to fecal route
 - C. Oral to fecal route
 - D. Influenza route
 - E. Waterborne mishaps
 - F. None of the Above
140. 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
141. For another person to become infected, he or she must take the pathogen in through the mouth.
- A. True
 - B. False
142. This term means that in nature, it is different from other types of pathogens such as the viruses that cause influenza (the flu) or the bacteria that cause tuberculosis.
- A. Fecal Coliform and E coli
 - B. Giardia lamblia
 - C. Microorganism(s)
 - D. Waterborne Pathogen(s)
 - E. Coliform bacteria
 - F. None of the Above
143. According to the text, this term 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

144. 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
145. A few of the parasites enter the environment in a dormant form, with a protective cell wall, called a?
- A. Lamblia
 - B. Shell
 - C. Case
 - D. Cyst
 - E. Infection
 - F. None of the Above
146. Which of the following terms can survive in the environment for long periods of time and is extremely resistant to conventional disinfectants such as chlorine?
- A. HIV
 - B. Symptoms
 - C. Infection
 - D. Hepatitis A cyst
 - E. Cyst
 - F. None of the Above
147. Which of the following terms is a commonly reported protozoan-caused disease, it has also been referred to as backpacker's disease?
- A. Giardia lamblia
 - B. Giardiasis
 - C. Malaise
 - D. Cryptosporidiosis
 - E. Anti-water Infection
 - F. None of the Above

148. The backpacker's disease incubation period is 5-25 days or longer, with an average of 7-10 days, many infections are _____ (no symptoms).

- A. Total
- B. Weak
- C. Strong
- D. Asymptomatic
- E. Unisymptomatic
- F. None of the Above

149. Which of the following bugs/disease terms occurs worldwide primarily because customers are receiving their drinking water from streams or rivers without adequate disinfection or a filtration system?

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

Giardia lamblia

150. _____ 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

Cryptosporidiosis

151. 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

152. 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

153. _____ is an example of a protozoan disease that is common worldwide, but was only recently recognized as causing human disease.

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

154. Which of the following usually come and go, and end in fewer than 30 days in most cases, the incubation period is 1-12 days, with an average of about seven days?

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

Bacteriological Monitoring Section

155. Which of the following terms is used as an indicator organism that determines 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

156. 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

157. Which of the following terms 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

158. _____ 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

159. 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

160. 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

Bacteria Sampling

161. Water samples for _____ must always be collected in a sterile container.

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

162. 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

163. 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

164. 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 which distribute water, and indicates that the water may be contaminated with germs that can cause disease?

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

Laboratory Procedures

165. 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

166. The MMO-MUG test, a product marketed as _____, is the most 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

167. 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

168. 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:

169. 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

170. What type of samples 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

171. 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

Repeat Sampling

172. 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:

173. 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

174. 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

175. 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

176. 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

177. 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

178. 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

Sampling Procedures

179. 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

180. 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

181. 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)

182. 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

183. EPA had developed standards that are known as maximum contaminant levels (MCL). When a particular contaminant exceeds _____ - a potential health threat may occur.

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

184. Which 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

185. 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

186. 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

187. 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

188. 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

189. 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

190. 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

191. 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

192. 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

193. 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

194. 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

195. 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

196. 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

197. Colonies may arise from pairs, chains, clusters, or single cells, all of which are included in the 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

198. 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

199. 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

200. 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)

201. _____ 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

202. Which of the following terms 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

203. 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

204. 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

205. For systems that 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

206. For systems that collect this amount 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

Acute Risk to Health (Fecal coliforms and E. coli)

207. A(n) _____ to human health violation occurs if either one of the following happens:
- A. Routine analysis
 - B. Drinking violation
 - C. Acute risk
 - D. Human health violation
 - E. Fecal coliform or E. coli is present
 - F. None of the Above

208. A routine analysis shows total coliform present and is followed by a repeat analysis which indicates?
- A. Routine analysis
 - B. Drinking violation
 - C. Water penalty
 - D. Human health violation
 - E. Fecal coliform or E. coli present
 - F. None of the Above

209. A routine analysis shows total and _____ is followed by a repeat analysis which indicates total coliform present.
- A. Routine analysis
 - B. Drinking water violation
 - C. MCL violation
 - D. Human health violations
 - E. Fecal coliform or E. coli present
 - F. None of the Above

210. Which of the following terms requires the water system to provide public notice via radio and television stations in the area?
- A. Routine analysis violation
 - B. Drinking water rule violation
 - C. MCL violation
 - D. Human health violation
 - E. Acute health risk violation
 - F. None of the Above

211. According to the text, the type of contamination can pose an immediate threat to human health and notice must be given as soon as possible, but no later than 24 hours after notification from your laboratory of the test results.
- A. True
 - B. False

Public Notice

212. A public notice is required to be issued by a water system whenever it fails to comply with an applicable MCL or _____, or fails to comply with the requirements of any scheduled variance or permit.

- A. Routine analysis
- B. Drinking water rule
- C. Treatment technique
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

213. Which term best describes what also is required whenever a water system fails to comply with its monitoring and/or reporting requirements or testing procedure?

- A. Routine analysis
- B. Drinking water rule
- C. MCL violation
- D. Public notice
- E. Fecal coliform or E. coli present count
- F. None of the Above

214. There shall be certain information, be issued properly and in a timely manner, and contain certain _____ on the public notice.

- A. Legal analysis
- B. Drinking water rule information
- C. NOVs
- D. Mandatory language
- E. Fecal language
- F. None of the Above

215. If there is a(n) _____ present to users, the timing and place of posting of the public notice may have different priorities.

- A. Routine analysis
- B. Drinking water rule
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

Chlorine Section- Chlorine Gas- Oxidizing Microbicide

216. When chlorine is added into the water stream, chlorine hydrolyzes into?

- A. HCL
- B. Sodium hypochlorite
- C. Bromoform
- D. Chlorine Acid
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

217. When chlorine hydrolyzation occurs, it provides an active toxicant, _____, which is pH-dependent. In alkaline cooling systems, it readily dissociates to form the hypochlorite ion (OCI-).

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. pH of 7.0 than at pH 8.5
- E. the hypochlorite ion (OCI-)
- F. None of the Above

218. In alkaline conditions, this term becomes the predominant species and lacks the biocidal efficacy of the non-dissociated form.

- A. Chlorine
- B. Sodium hypochlorite
- C. OCI-
- D. Chlorine gas
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

219. Considerably more _____ is present at a pH of 7.0 than at pH 8.5.

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. Alkalinity
- E. Hypochlorite ion (OCI-)
- F. None of the Above

220. Chlorine can be non-selective, making it very sensitive to contamination from either cooling water makeup or from in-plant process leaks. _____, organic acids and organic compounds, sulfides, iron and manganese all easily react with HOCl.

- A. Chlorine
- B. Sodium hypochlorite
- C. Ammonia
- D. Chlorine gas
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

221. What is the term that best describes the amount of chlorine needed to react with contamination species and it must be satisfied before active HOCl is available to provide a free chlorine residual?

- A. Chlorine demand
- B. HOCl
- C. High chlorine concentration
- D. Total residual
- E. The hypochlorite ion (OCI-)
- F. None of the Above

Pathophysiology

222. 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

223. 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

224. 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

Mechanism of Activity

225. The mechanisms of cellular injury are believed to result from the oxidation of functional groups in cell components, from reactions with tissue water to form _____, and from the generation of free oxygen radicals.

- A. Generation of free oxygen radicals
- B. Chlorine acid
- C. Hydrochloric acid
- D. A caustic effect
- E. Hypochlorous and hydrochloric acid
- F. None of the Above

226. Chlorine gas feeds out of the cylinder through a gas regulator. The cylinders are on a scale that operators use to measure the amount used each day. The chains are used to prevent the tanks from falling over.

- A. True
- B. False

227. Chlorine gas should be stored in vented rooms that have panic bar equipped doors.

- A. True
- B. False

Solubility Effects

228. Which of the following terms is highly soluble in water?

- A. Hydrochloric acid
- B. H₂SO₄
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

229. Because it is highly water soluble, Hypochlorous acid has an injury pattern similar to?

- A. Hydrochloric acid
- B. H₂SO₄
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

230. Which of the following terms may account for the toxicity of elemental chlorine and hydrochloric acid to the human body?

- A. Hydrochloric acid
- B. H₂SO₄
- C. Hypochloric acid
- D. Hypochlorous acid
- E. Sulfuric Acid
- F. None of the Above

Early Response to Chlorine Gas

231. If you mix ammonia with chlorine gas, this compound reacts to form?

- A. Hypochlorous acid
- B. Chlorine gas
- C. Hydrochloric acid
- D. Sulfuric acid
- E. Chloramine gas
- F. None of the Above

232. The early response to the odor threshold for chlorine depends on the (1) concentration of chlorine gas, (2) duration of exposure, (3) water content of the tissues exposed, and (4) individual susceptibility.

- A. True
- B. False

Immediate Effects

233. Which of the following answers is the best choice for the immediate effects of this substance's toxicity include acute inflammation of the conjunctivae, nose, pharynx, larynx, trachea, and bronchi?

- A. Hydrochloric acid
- B. Chlorine gas
- C. Hypochlorous gas
- D. Sulfuric acid
- E. HOCL
- F. None of the Above

Pathological Findings

234. Chlorine is a highly reactive gas.

- A. True
- B. False

235. 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⁻)
- F. None of the Above

236. 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

237. 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

238. 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

Chemistry of Chlorination

239. The hypochlorite ion is a much weaker disinfecting agent than Hypochlorous acid, about 100 times less effective.

- A. True B. False

240. 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

241. Under normal water conditions, hypochlorous acid will also chemically react and break down into the hypochlorite ion.

- A. True B. False

242. 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

243. 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

244. The disassociation of chlorine gas
(OCI⁻): HOCl H⁺ + OCl⁻ Also expressed HOCl → H⁺ + OCl⁻
(hypochlorous acid) (hydrogen) (hypochlorite ion)

- A. True B. False

245. All three forms of chlorine produce Sodium hypochlorite when added to water.

- A. True B. False

246. Hypochlorous acid is a strong acid but a weak disinfecting agent. The amount of hypochlorous acid depends on the pH and temperature of the water.

- A. True B. False

Types of Residual

247. _____ is all the chlorine that is available for disinfection.

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Break-point chlorination
- E. Total chlorine
- F. None of the Above

248. Total chlorine residual = free + _____.

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Combined chlorine residual
- E. Total chlorine residual
- F. None of the Above

249. Either a total or a _____ can be read when a chlorine residual test is taken,

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine residual
- D. Break-point chlorination
- E. Total chlorine residual
- F. None of the Above

250. Which of the following terms 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

251. Which of the following terms is where the chlorine demand has been satisfied, and any additional chlorine will be considered free chlorine?

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Break-point chlorination
- E. Total chlorine residual
- F. None of the Above

Residual Concentration/Contact Time (CT) Requirements

252. Since monitoring for very low levels of pathogens in treated water is analytically very difficult, utilizing the _____ is recommended to demonstrate satisfactory treatment.

- 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

253. _____ = Concentration (mg/L) x Time (minutes)

- A. CT
- B. The amount of chlorine
- C. Chlorine Demand
- D. Total chlorine
- E. pH value and temperature
- F. None of the Above

254. The effective reduction in pathogens can be calculated by reference to standard tables of required?

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

255. The CT concept as developed by the United States Environmental Protection Agency (uses the combination of disinfectant residual concentration (mg/L) and the effective disinfection contact time (in minutes) to measure effective pathogen reduction.

- A. True
- B. False

Calculation and Reporting of CT Data

256. 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

257. 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

258. 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

259. Which missing term shall be calculated daily, using either the maximum hourly flow and the disinfectant residual at the same time, or by using the lowest CT value if it is calculated more frequently.

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

Chlorine (DDBP)

260. These term means that chlorine is present as Cl , HOCl , and OCl^- is called _____, and that which is bound but still effective is _____.

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

261. Chloramines are formed by reactions with _____.

- A. Acid and Cl_2
- B. Ammonia and Cl_2
- C. THMS and Cl_2
- D. Folic Acid and Cl_2
- E. THMs and Haploidic acid
- F. None of the Above

262. While testing chlorine disinfection process, you will need to understand one especially important feature is the ease of overdosing to create a " _____ " concentration.

- A. Free available chlorine and Total
- 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

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

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

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

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

Chlorine By-Products

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

- A. Chlorate and Chlorite
- B. CO₂ and H₂SO₄
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

The Principal Trihalomethanes are:

266. Chloroform, bromodichloromethane, chlorodibromomethane, and bromoform. Other less common chlorination by-products include the haloacetic acids and haloacetonitriles. The amount of THMs formed in drinking water can be influenced by a number of factors, including the season and the source of the water.

- A. True
- B. False

267. THM concentrations are generally higher in winter than in summer, because concentrations of natural organic matter are greater and more chlorine is required to disinfect at colder temperatures.

- A. True
- B. False

268. THM levels are also low when wells or large lakes are used as the drinking water source, because organic matter concentrations are generally low in these sources. The opposite — high organic matter concentrations and high THM levels — is true when rivers or other surface waters are used as the source of the drinking water.

- A. True
- B. False

Health Effects

269. The available studies on health effects do not provide conclusive proof of a relationship between exposure to THMs and cancer or reproductive effects, but indicate the need for further research to confirm their results and to assess the potential health effects of chlorination by-products other than THMs.

- A. True
- B. False

Risks and Benefits of Chlorine

270. Many cities utilize the use of ozone to disinfect their source water and to reduce formation of this parameter?

- A. Chlorate and Chlorite
- B. CO₂ and H₂SO₄
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

271. _____ is a highly effective disinfectant, it breaks down quickly, so that small amounts of _____ or other disinfectants must be added to the water to ensure continued disinfection as the water is piped to the consumer's tap. 2 part question.

- A. Ozone, Chlorine
- B. UV, Chlorine
- C. Chlorite, Chlorine
- D. Chlorine Dioxide, Chlorine
- E. Chloramines, Chlorine
- F. None of the Above

272. Modifying water treatment facilities to use _____ can be expensive, and _____ treatment can create other undesirable by-products that may be harmful to health if they are not controlled (e.g., bromate).

- A. Ozone
- B. UV
- C. Chlorite
- D. Chlorine Dioxide
- E. Chloramines
- F. None of the Above

273. Which term is a weaker disinfectant than chlorine, especially against viruses and protozoa; however, they are very persistent and, as such, can be useful for preventing re-growth of microbial pathogens in drinking water distribution systems?

- A. Ozone
- B. UV
- C. Chlorite
- D. Chlorine Dioxide
- E. Chloramines
- F. None of the Above

274. Chlorine dioxide can be an effective disinfectant, but it forms?

- A. Chlorate and Chlorite
- B. CO₂ and H₂SO₄
- C. THMS
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

275. It is extremely important that water treatment plants ensure that methods used to control chlorination by-products do not compromise the effectiveness of water disinfection.

- A. True
- B. False

Chlorination Equipment Requirement Section

276. A chlorine room is where chlorine gas cylinders and/or ton containers are?

- A. Under pressure
- B. In this stage
- C. Stored
- D. At the point of solution application
- E. Dosing enough chlorine
- F. None of the Above

277. Which of the following shall also be located inside the chlorine room?

- A. Gas vacuum line
- B. Vacuum regulators
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. Injectors
- F. None of the Above

278. Which of the following, which is the mechanical gas proportioning equipment, may or may not be located inside the chlorine room?

- A. Gas vacuum line
- B. Vacuum regulators
- C. Manual chlorine feed systems
- D. The chlorinator
- E. Injectors
- F. None of the Above

279. _____ should be located to minimize the length of pressurized chlorine solution lines.

- A. Gas vacuum line
- B. Vacuum regulators
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. Injectors
- F. None of the Above

280. Which of the following shall be included in the gas vacuum line between the vacuum regulator(s) and the chlorinator(s) to ensure that pressurized chlorine gas does not enter the gas vacuum lines leaving the chlorine room?

- A. Gas vacuum line
- B. A gas pressure relief system
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. Post chlorination
- F. None of the Above

281. Which of the following shall have positive shutdown in the event of a break in the downstream vacuum lines?

- A. Gas vacuum line
- B. A gas pressure relief system
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. The vacuum regulating valve(s)
- F. None of the Above

282. Anti-siphon valves shall be incorporated in the _____ or in the discharge piping.
- A. Gas vacuum line
 - B. A gas pressure relief system
 - C. Manual chlorine feed systems
 - D. Mechanical gas proportioning equipment
 - E. Pump heads
 - F. None of the Above

Capacity

283. 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

284. 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

285. 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

286. Which piece of chlorination equipment, the feed rate of the chlorinator is controlled by a flow proportional signal and a residual analyzer signal to maintain particular chlorine residual in the water?
- A. Gas vacuum line
 - B. Compound loop control system
 - C. Manual chlorine feed systems
 - D. Mechanical gas proportioning equipment
 - E. After post chlorination
 - F. None of the Above

287. Which piece of chlorination equipment may be installed for groundwater systems with constant flow rates?
- 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

Standby Provision

288. As a safeguard against _____, standby chlorination equipment having the capacity to replace the largest unit shall be provided.
- A. Flow change(s)
 - B. Constant flow rate(s)
 - C. Uninterrupted chlorination
 - D. Malfunction and/or shut-down
 - E. Constant pre-established dosage
 - F. None of the Above

289. For uninterrupted chlorination, _____ shall be equipped with an automatic changeover system. In addition, spare parts shall be available for all chlorinators.
- A. Flow change(s)
 - B. Constant flow rate(s)
 - C. Gas chlorinators
 - D. Automatic proportional controlled
 - E. Constant pre-established dosage
 - F. None of the Above

Weigh Scales

290. Scales for weighing cylinders shall be provided at all plants using chlorine gas to permit an accurate reading of total daily weight of chlorine used. At large plants, scales of the recording and indicating type are recommended. As a minimum, a platform scale shall be provided. Scales shall be of corrosion-resistant material.

- A. True B. False

Securing Cylinders

291. All chlorine cylinders shall be securely positioned to safeguard against movement. Tag the cylinder "empty" and store flat and chained. Ton containers may be stacked.

- A. True B. False

Chlorine Leak Detection

292. Which of the following related chlorine alarm equipment shall be installed at all water treatment plants using chlorine gas? Leak detection shall be provided for the chlorine rooms?

- A. Caustic soda solution reaction tanks D. Automatic chlorine leak detection
B. Corrosion resistant E. Chlorine room ventilation system
C. Securely positioned F. None of the Above

293. _____ should be connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation.

- A. The chlorinator D. The chlorine gas leakage
B. The facility E. Chlorine leak detection equipment
C. All chlorine cylinders F. None of the Above

294. Which of the following related chlorine alarm equipment shall not automatically activate the chlorine room ventilation system in such a manner as to discharge chlorine gas?

- A. Caustic soda solution reaction tanks D. Automatic chlorine leak detection
B. Corrosion resistant E. Chlorine room ventilation system
C. Leak detection equipment F. None of the Above

295. During an emergency, if the chlorine room is occupied, the chlorine gas leakage shall be contained within the chlorine room itself in order to facilitate a proper method of clean-up.

- A. True B. False

296. Consideration should also be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking one-ton cylinders where such cylinders are in use.

- A. True B. False

297. Chlorine leak detection equipment may not be required for very small chlorine rooms with an exterior door (e.g., floor area less than 3m²).

- A. True B. False

298. You can use a spray solution of ammonia or a rag soaked with sulfur dioxide to detect a small Cl₂ leak. If there is a leak, the sulfur dioxide will create a white colored smoke - Sulfuric chloride.

- A. True B. False

Chlorine Room Design Requirements

299. Where gas chlorination is practiced, the gas cylinders and/or the ton containers up to the vacuum regulators shall be housed in a gas-tight, well illuminated, corrosion resistant and _____.

- A. Mechanically ventilated enclosure
- B. Corrosion resistant
- C. Securely positioned
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

300. The chlorinator may or may not be located inside?

- A. The chlorinator
- B. The facility
- C. All chlorine cylinders
- D. The chlorine room
- E. Chlorine leak detection equipment
- F. None of the Above

Ventilation

301. _____ shall have entirely separate exhaust ventilation systems capable of delivering one (1) complete air change per minute during periods of chlorine room occupancy only.

- A. Shut off
- B. The chlorine room
- C. The room
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

302. Which chlorine safety related equipment term should be louvered near the ceiling, the air being of such temperature as to not adversely affect the chlorination equipment.

- A. The ceiling
- B. The chlorine room
- C. Air inlets
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

303. Which chlorine safety related equipment term should be outside the room at all entrance or viewing points, and a clear wire-reinforced glass window shall be installed in such a manner as to allow the operator to inspect from the outside of The room.

- A. Gas chlorine room
- B. The chlorine room
- C. Chlorine room ventilation system
- D. Automatic chlorine leak detection
- E. Separate switches for fans and lights
- F. None of the Above

Heating

304. Chlorine rooms shall have _____, if a forced air system is used to heat the building.

- A. Gas chlorine room
- B. Separate heating systems
- C. The room
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

305. Which chlorine safety related equipment term shall be protected to ensure that the chlorine maintains its gaseous state when entering the chlorinator?

- A. Cylinders or containers
- B. Corrosion resistant
- C. Securely positioned
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

Storage of Chlorine Cylinders

306. If necessary, _____ may be provided to simply store the chlorine gas cylinders, with no connection to the line. The chlorine cylinder storage room shall have access either to the chlorine room or from the plant exterior, and arranged to prevent the uncontrolled release of spilled gas.

- A. Cylinders or containers
- B. The outside of the room
- C. A separate storage room
- D. Uncontrolled release of spilled gas
- E. Air inlets
- F. None of the Above

307. Which chlorine safety related equipment term shall have provision for ventilation at thirty air changes per hour?

- A. A panic button
- B. The chlorine room
- C. Scrubber(s)
- D. The chlorine gas storage room
- E. The chlorine cylinder storage room
- F. None of the Above

308. Sometimes entry in very large facilities, may be through a vestibule from outside in to ?

- A. Cylinders or containers access
- B. The outside of the room
- C. Chlorine rooms
- D. Uncontrolled release of spilled gas
- E. Air inlets
- F. None of the Above

Scrubbers

309. According to the text, facilities located within residential or densely populated areas, consideration shall be given to provide scrubbers for _____.

- A. A panic button
- B. The chlorine room
- C. Scrubber(s)
- D. The chlorine gas storage room
- E. The chlorine cylinder storage room
- F. None of the Above

310. Chlorine combines with a wide variety of materials. These side reactions complicate the use of chlorine for disinfecting purposes. Their _____ must be satisfied before chlorine becomes available to accomplish disinfection.

- A. Combined residual
- B. Free chlorine residual
- C. Demand for chlorine
- D. Total chlorine
- E. Free chlorine
- F. None of the Above

311. _____ means the amount of chlorine required to produce a residual of 0.1 mg/l after a contact time of fifteen minutes as measured by iodometric method of a sample at a temperature of twenty degrees in conformance with Standard methods.

- A. Combined residual
- B. Free chlorine residual
- C. Chlorine Demand
- D. Total chlorine
- E. Break point chlorination
- F. None of the Above

Chlorine's Gas Appearance and Odor

312. Chlorine is a greenish-yellow gas it will condense to an amber liquid at approximately _____ F or at high pressures.

- A. 32 degrees
- B. - 100 degrees
- C. 129 degrees
- D. 29 degrees
- E. -29.2 degrees
- F. None of the Above

313. Prolonged exposures to chlorine gas may result in _____ .

- A. Exposure to chlorine
- B. Odor thresholds
- C. A corrosive material
- D. Olfactory fatigue
- E. Moisture, steam, and water
- F. None of the Above

Disinfection Byproduct Regulations Summary

314. Regulators and the public have focused greater attention on potential health risks from chemical contaminants in drinking water. One such concern relates to disinfection byproducts (DBPs), chemical compounds formed unintentionally when chlorine and other disinfectants react with certain inorganic matter in water.

- A. True
- B. False

315. Water system managers may also consider switching from chlorine to alternative disinfectants to reduce formation of THMs and HAAs.

- A. True B. False

316. All chemical disinfectants form some DBPs. Much less is known about the byproducts of these alternatives than is known about chlorination byproducts. Furthermore, each disinfection method has other distinct advantages and disadvantages.

- A. True B. False

Ozone

317. Which 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 D. Oxygen and nascent oxygen
B. Liquid Ozone E. O₂
C. Ozone F. None of the Above

318. Which compound is a light blue gas at room temperature?

- A. Chloramine D. Oxygen and nascent oxygen
B. Liquid Ozone E. O₂
C. Ozone F. None of the Above

319. 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 D. Oxygen and nascent oxygen
B. THMs E. Strongest oxidizing agent
C. Light blue gas F. None of the Above

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

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

321. Ozone falls into the same category as other disinfectants in that it can produce _____.

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

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

- A. Chloramine D. Oxygen and nascent oxygen
B. Liquid Ozone E. O₂
C. Ozone F. None of the Above

323. 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 D. Oxygen and nascent oxygen
B. THMs E. Strongest oxidizing agent
C. Ozone demand F. None of the Above

Alternate Disinfectants Section Summary

Chloramines

324. Which compound is a very weak disinfectant for Giardia and virus reduction? It is recommended that it be used in conjunction with a stronger disinfectant. It is best utilized as a stable distribution system disinfectant.

- A. Chlorine
- B. Chloramine
- C. Ozone
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

325. In the production of chloramines, the ammonia residuals in the finished water, when fed in excess of stoichiometric amount needed should be limited to inhibit growth of?

- A. Cryptosporidium
- B. Chlorine-based disinfectants
- C. Giardia lamblia
- D. An emerging parasitic protozoan pathogen
- E. Nitrifying bacteria
- F. None of the Above

Chlorine Dioxide

326. Chlorine dioxide may be used for taste and odor control or as?

- A. Post disinfectant
- B. ClO_2 /chlorite/chlorate
- C. An oxidant
- D. Total residual oxidants
- E. A pre-disinfectant
- F. None of the Above

327. Total residual oxidants (including _____, but excluding chlorate) shall not exceed 0.30 mg/L during normal operation or 0.50 mg/L (including chlorine dioxide, chlorite and chlorate) during periods of extreme variations in the raw water supply.

- A. Pre-disinfectant
- B. ClO_2 /chlorite/chlorate
- C. An oxidant
- D. Chlorine dioxide and chlorite
- E. 25% aqueous solution of sodium chlorite (NaClO_2)
- F. None of the Above

328. According to the text, Chlorine Dioxide provides good _____ protection but its use is limited by the restriction on the maximum residual of 0.5 mg/L ClO_2 /chlorite/chlorate allowed in finished water.

- A. Pre-disinfectant
- B. ClO_2 /chlorite/chlorate
- C. Level of
- D. Chlorine residual
- E. Giardia and virus
- F. None of the Above

329. Where chlorine dioxide is approved for use as an oxidant, the preferred method of generation is to entrain chlorine gas into a packed reaction chamber with a _____.

- A. Pre-disinfectant
- B. ClO_2 /chlorite/chlorate
- C. An oxidant
- D. Total residual oxidants
- E. 25% aqueous solution of sodium chlorite (NaClO_2)
- F. None of the Above

330. Because dry sodium chlorite is dangerous and can be _____ in feed equipment if leaking solutions or spills are allowed to dry out.

- A. Prone to fire
- B. Choking risk
- C. An oxidant
- D. Oxidant
- E. Explosive and can cause fires
- F. None of the Above

Pump, Motor and Hydraulic Section
Common Hydraulic Terms

331. Which of the following definitions is the engineering science pertaining to liquid pressure and flow?

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

332. _____ is the engineering science pertaining to the energy of liquid flow and pressure.

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

333. Which of the following definitions is the pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid?

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

334. _____ 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

335. Which of the following definitions 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

336. _____ 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

337. Which of the following definitions 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

338. _____ is often used to indicate gauge pressure.

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

339. Which of the following definitions 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

340. _____ 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

341. Which of the following definitions 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

342. _____ is the pressure in a fluid at rest.

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

343. Which of the following definitions is the height of a column or body of fluid above a given point?

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

344. Bernoulli's principle says that a rise in pressure in a flowing fluid must always be accompanied by a decrease in the speed, and conversely, if an increase (decrease) in, the speed of the fluid results in a decrease in the pressure.

- A. True
- B. False

General Pumping Fundamentals

345. 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

346. 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

347. 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

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

- A. True
- B. False

349. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.
A. True B. False

Pump Introduction

350. Pumps are excellent examples of _____.

- A. Hydrostatics D. Multi-stage pumps
- B. Quasi-static E. Complicated part
- C. Oscillating diaphragm F. None of the Above

351. Pumps are of two general types, _____ or positive displacement pumps, and pumps depending on dynamic forces, such as centrifugal pumps.

- A. Hydrostatic D. Hydrostatic considerations
- B. Quasi-static E. Complicated part
- C. Oscillating diaphragm F. None of the Above

352. 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

353. 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

354. There are many kinds of _____, and can be the most trouble-prone and complicated part of a pump.

- A. Rotors D. Air space
- B. Force pumps E. Valves
- C. Inlets F. None of the Above

355. According to the text, the force pump has _____ in the cylinder, one for supply and the other for delivery.

- A. Two check valves D. Cylinders
- B. Diaphragms E. Lift pumps
- C. Rotors F. None of the Above

356. The supply valve opens when the cylinder _____, the delivery valve when the cylinder volume decreases.

- A. Rotor D. Air space
- B. Force pump E. Volume increases
- C. Volume decreases F. None of the Above

357. According to the text, the lift pump has a _____ and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced.

- A. Supply valve D. Cylinder
- B. Diaphragm E. Lift pumps
- C. Discharged fluid F. None of the Above

358. The delivery in this case is from the upper part of the _____, which the piston does not enter.

- A. Rotor
- B. Force pump
- C. Volume decreases
- D. Air space
- E. Cylinder
- F. None of the Above

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

- A. True
- B. False

360. Which of the following terms can be moved mechanically, or by the pressure of the fluid on one side of the diaphragm?

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Lift pumps
- F. None of the Above

361. Which of the following terms are typically used for water?

- A. Bellows
- B. Force pumps
- C. Volume pumps
- D. Force and lift pumps
- E. Delivery pumps
- F. None of the Above

Pump Categories

362. 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
- B. Head
- C. Viscous drag pump
- D. Center of the impeller
- E. Incompressible fluid
- F. None of the Above

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

- A. True
- B. False

364. According to the text, all pumps may be divided into two major categories: dynamic and?

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

Basic Water Pump

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

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

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

- A. True
- B. False

367. 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

368. In a centrifugal pump, the water pressure at the edge of the turning impeller rises until it is able to keep water circling with the?

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

369. In a centrifugal pump, as water drifts outward between the _____ of the pump, it must move faster and faster because its circular path is getting larger and larger.

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

370. As the water slows down and its kinetic energy decreases, that water's pressure potential energy increases.

- A. True
- B. False

371. As the water spins, the pressure near the outer edge of the pump housing becomes much lower than near the center of the impeller.

- A. True
- B. False

372. The impeller blades cause the water to move faster and faster.

- A. True
- B. False

373. The impellers may be a semi-open or closed type.

- A. True
- B. False

374. According to the text, without an inward force, an object will travel in a straight line and will not complete the?

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

Types of Water Pumps

375. The size and number of stages, horsepower of the motor and _____ are the key components relating to the pump's lifting capacity.

- A. Pumping head
- B. Drive shaft
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

376. Which of the following terms are variable displacement pumps that are by far used the most?

- A. Axial flow
- B. Submersible
- C. Rotary pump
- D. Turbine pump(s)
- E. Centrifugal pumps
- F. None of the Above

377. According to the text, the turbine pump utilizes impellers enclosed in single or multiple bowls or stages to _____.

- A. Lift water
- B. Drive shaft
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

378. 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

379. The shaft turns the impellers within the pump housing while the?

- A. Spider bearing(s) D. Water moves up the column
B. Horsepower turns the shaft E. Desired pumping rate is obtained
C. Impeller(s) F. None of the Above

380. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.

- A. True B. False

381. The size of the _____ are selected based on the desired pumping rate and lift requirements.

- A. Spider bearing(s) D. Column, impeller, and bowls
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

382. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?

- A. Oil tube D. Single or multiple bowls
B. Spider bearings E. Pump's lifting capacity
C. Column pipe F. None of the Above

383. The water passing through the column pipe serves as the lubricant for the bearings.

- A. True B. False

384. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?

- A. Spider bearing(s) D. Roller bearings
B. Keyway E. Lantern rings
C. Impeller(s) F. None of the Above

385. Some vertical turbines are lubricated by oil rather than water. These pumps are essentially the same as _____; only the drive shaft is enclosed within an oil tube.

- A. Oil tube D. Single or multiple bowls
B. Water lubricated units E. Pump's lifting capacity
C. Column pipe F. None of the Above

386. The oil tube is suspended within the column by _____, while the line shaft is supported within the oil tube by brass or redwood bearings.

- A. Oil tube D. Single or multiple bowls
B. Spider flanges E. Pump's lifting capacity
C. Column pipe F. None of the Above

387. A continuous supply of _____ the drive shaft as it proceeds downward through the oil tube.

- A. Spider bearing(s) D. Turbine pump(s)
B. Oil lubricates E. Desired pumping rate
C. Impeller(s) F. None of the Above

388. A small hole located at the top of the _____ allows excess oil to enter the well. This results in the formation of an oil film on the water surface within oil-lubricated wells.

- A. Pump bow unit
- B. Drive shaft
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

389. Careful operation of oil lubricated turbines is needed to ensure that the pumping levels do not drop enough to allow oil to enter the pump.

- A. True
- B. False

390. According to the text, water and oil lubricated turbine pump units can be driven by?

- A. Gears
- B. Drive shaft
- C. Column pipe
- D. Electric or fuel powered motors
- E. Pump's lifting capacity
- F. None of the Above

Motor and Pump Calculations - Suction Head is Measured the Same Way.

391. If the pump is lifting a liquid level from below its centerline, it is a?

- A. Positive suction head
- B. Friction
- C. Friction Loss
- D. Negative suction head
- E. Total Dynamic Head (TDH)
- F. None of the Above

392. If the pump is pumping liquid from a pressurized vessel, you must convert this pressure to a positive suction head.

- A. True
- B. False

393. A vacuum in the tank would be converted to a?

- A. Static head
- B. Pump discharge head
- C. Friction Loss
- D. System or dynamic head
- E. Negative suction head
- F. None of the Above

394. Friction loss is calculated via a formula or a chart, taking into account the pipe diameter and roughness and the fluid flow rate, density, and viscosity.

- A. True
- B. False

395. According to the text, friction in the pipes, fittings, and associated hardware is a?

- A. Positive suction head
- B. Friction
- C. Friction Loss
- D. Negative suction head
- E. Total Dynamic Head (TDH)
- F. None of the Above

Motor, Coupling and Bearing Section

396. The purpose of the bearing house is to hold the shaft firmly in place, yet allow it to rotate.

- A. True
- B. False

397. The pump assembly can only be a vertical set-up.

- A. True
- B. False

398. The power source of the pump is usually an electric motor. The motor is connected by a coupling to the?

- A. Static head
- B. Bearings
- C. Pump assembly
- D. System or dynamic head
- E. Pump shaft
- F. None of the Above

399. An impeller is connected to the_____.
- A. Static head
 - B. Bearings
 - C. Pump assembly
 - D. System or dynamic head
 - E. Shaft
 - F. None of the Above

D-C Motors

400. The important characteristic of the D-C motor is that its speed will not vary with the amount of current used.
- A. True
 - B. False