

Registration form

**Chlorination 505 CEU Training Course \$300.00
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 _____

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

Water Treatment _____ Distribution _____ Collection _____

Wastewater Treatment _____ Other _____

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

**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# _____

Purchase Order #, Please invoice _____

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

DISCLAIMER NOTICE

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

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

State Approval Listing Link, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. Do not solely trust our list for it may be outdated. It is your sole responsibility to ensure this course is accepted for credit.

State Approval Listing URL...

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

You can obtain a printed version of the course from TLC for an additional \$79.95 plus shipping charges.

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

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

A second certificate of completion for a second State Agency \$50 processing fee.

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

All downloads are electronically tracked and monitored for security purposes.

Chlorination 505 CEU Course Answer Key

Name _____ Telephone # _____

It is your sole responsibility to ensure this course is accepted for credit in your State. Did you check with your State agency to ensure this course is accepted for credit?

Method of Course acceptance confirmation. Please fill this section

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

Website ___ Telephone Call ___ Email ___ Spoke to _____

Did you receive the approval number, if applicable? _____

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. No refunds.

You can also fill this assignment out electronically in Adobe Acrobat DC

Please circle, underline, bold or X only one correct answer

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

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

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

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

337. A B C D E F 369. A B C D E F 401. A B C D E F
338. A B C D E F 370. A B C D E F 402. A B C D E F
339. A B C D E F 371. A B C D E F 403. A B C D E F
340. A B C D E F 372. A B C D E F 404. A B C D E F
341. A B C D E F 373. A B C D E F 405. A B C D E F
342. A B C D E F 374. A B C D E F 406. A B C D E F
343. A B C D E F 375. A B C D E F 407. A B C D E F
344. A B C D E F 376. A B C D E F 408. A B C D E F
345. A B C D E F 377. A B C D E F 409. A B C D E F
346. A B C D E F 378. A B C D E F 410. A B C D E F
347. A B C D E F 379. A B C D E F 411. A B C D E F
348. A B C D E F 380. A B C D E F 412. A B C D E F
349. A B C D E F 381. A B C D E F 413. A B C D E F
350. A B C D E F 382. A B C D E F 414. A B C D E F
351. A B C D E F 383. A B C D E F 415. A B C D E F
352. A B C D E F 384. A B C D E F 416. A B C D E F
353. A B C D E F 385. A B C D E F 417. A B C D E F
354. A B C D E F 386. A B C D E F 418. A B C D E F
355. A B C D E F 387. A B C D E F 419. A B C D E F
356. A B C D E F 388. A B C D E F 420. A B C D E F
357. A B C D E F 389. A B C D E F 421. A B C D E F
358. A B C D E F 390. A B C D E F 422. A B C D E F
359. A B C D E F 391. A B C D E F 423. A B C D E F
360. A B C D E F 392. A B C D E F 424. A B C D E F
361. A B C D E F 393. A B C D E F 425. A B C D E F
362. A B C D E F 394. A B C D E F 426. A B C D E F
363. A B C D E F 395. A B C D E F 427. A B C D E F
364. A B C D E F 396. A B C D E F 428. A B C D E F
365. A B C D E F 397. A B C D E F 429. A B C D E F
366. A B C D E F 398. A B C D E F 430. A B C D E F
367. A B C D E F 399. A B C D E F 431. A B C D E F
368. A B C D E F 400. A B C D E F 432. A B C D E F

433. A B C D E F 457. A B C D E F 481. A B C D E F
434. A B C D E F 458. A B C D E F 482. A B C D E F
435. A B C D E F 459. A B C D E F 483. A B C D E F
436. A B C D E F 460. A B C D E F 484. A B C D E F
437. A B C D E F 461. A B C D E F 485. A B C D E F
438. A B C D E F 462. A B C D E F 486. A B C D E F
439. A B C D E F 463. A B C D E F 487. A B C D E F
440. A B C D E F 464. A B C D E F 488. A B C D E F
441. A B C D E F 465. A B C D E F 489. A B C D E F
442. A B C D E F 466. A B C D E F 490. A B C D E F
443. A B C D E F 467. A B C D E F 491. A B C D E F
444. A B C D E F 468. A B C D E F 492. A B C D E F
445. A B C D E F 469. A B C D E F 493. A B C D E F
446. A B C D E F 470. A B C D E F 494. A B C D E F
447. A B C D E F 471. A B C D E F 495. A B C D E F
448. A B C D E F 472. A B C D E F 496. A B C D E F
449. A B C D E F 473. A B C D E F 497. A B C D E F
450. A B C D E F 474. A B C D E F 498. A B C D E F
451. A B C D E F 475. A B C D E F 499. A B C D E F
452. A B C D E F 476. A B C D E F 500. A B C D E F
453. A B C D E F 477. A B C D E F
454. A B C D E F 478. A B C D E F
455. A B C D E F 479. A B C D E F
456. A B C D E F 480. A B C D E F

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

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. Thank you...

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

**CHLORINATION 505 CEU TRAINING COURSE
CUSTOMER SERVICE RESPONSE CARD**

NAME: _____

E-MAIL _____ PHONE _____

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

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the subject matter on the exam to your actual field or work.

Very Similar 0 1 2 3 4 5 Very Different

How did you hear about this Course? _____

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.

Chlorination 505 CEU Course Assignment

The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit www.ABCTLIC.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.**

More on the Revised Hazard Communication Standard

1. This update will also help reduce trade barriers and result in productivity improvements for American businesses that regularly handle, store, and use hazardous chemicals while providing cost savings for American businesses that periodically update - which missing term - covered under the hazard communication standard.

- A. SDS/MSDS
- B. Safety data sheets
- C. Specific criteria
- D. Hazard communication elements
- E. Safety data sheets and labels for chemicals
- F. None of the Above

Rationale

2. In order to ensure - which missing term- in the workplace, information about the identities and hazards of the chemicals must be available and understandable to workers.

- A. OSHA's HazCom rule
- B. Hazard information
- C. Identities and hazards
- D. Hazardous chemicals
- E. Chemical safety
- F. None of the Above

3. Chemical manufacturers and importers are required to evaluate the _____ they produce or import, and prepare labels and safety data sheets to convey the hazard information to their downstream customers.

- A. SDS/MSDS
- B. Safety data sheets and labels
- C. Specific criteria
- D. Hazard communication elements
- E. Hazards of the chemicals
- F. None of the Above

4. All employers with - which missing term- in their workplaces must have labels and safety data sheets for their exposed workers, and train them to handle the chemicals appropriately.

- A. OSHA's HazCom rule
- B. Hazard information
- C. Identities and hazards
- D. Hazardous chemicals
- E. Right to understand
- F. None of the Above

Major changes to the Hazard Communication Standard

5. Which of the following terms provides specific criteria for classification of health and physical hazards, as well as classification of mixtures?

- A. SDS/MSDS
- B. Safety data sheets and labels
- C. Hazard classification
- D. Hazard communication elements
- E. Hazard Communication Standard (HCS)
- F. None of the Above

6. Labels: Chemical manufacturers and importers will be required to provide a label that includes a harmonized signal word, pictogram, and hazard statement for each?

- A. Specific, detailed criteria
- B. Standardized label elements
- C. HCS
- D. Hazard class and category
- E. GHS
- F. None of the Above

7. Safety Data Sheets: Will now have a specified 16-section format.

Information and training: Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate?

- A. Recognition and understanding
- B. Model regulation
- C. GHS
- D. The Purple Book
- E. Hazard Communication Standard (HCS)
- F. None of the Above

What is the Globally Harmonized System?

What Hazard Communication Standard provisions are unchanged in the revised HCS?

8. The revised Hazard Communication Standard is a modification to the existing standard. The parts of the standard that did not relate to the _____ remained largely unchanged.

- A. Specific, detailed criteria
- B. Standardized label elements
- C. HCS
- D. Hazard classes and hazard categories
- E. GHS
- F. None of the Above

How will chemical hazard evaluation change under the revised Hazard Communication Standard?

9. The hazard classification approach in the _____ is quite different.

- A. Revised HCS
- B. Model regulation
- C. GHS
- D. The Purple Book
- E. Hazard Communication Standard (HCS)
- F. None of the Above

10. It also establishes both hazard classes and hazard categories—for most of the effects; the classes are divided into categories that reflect the?

- A. Specific, detailed criteria
- B. Standardized label elements
- C. HCS
- D. Hazard classes and hazard categories
- E. Relative severity of the effect
- F. None of the Above

11. Which of the following terms does not include categories for most of the health hazards covered, so this new approach provides additional information that can be related to the appropriate response to address the hazard?

- A. Revised HCS
- B. Model regulation
- C. GHS
- D. Current HCS
- E. Hazard Communication Standard (HCS)
- F. None of the Above

United Nations Globally Harmonized System of Classification and Labeling of Chemicals

1.0 Background

12. The purpose of this document is to describe the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS), why it was developed, and how it relates to the?

- A. Earth Summit
- B. Several U.S. regulatory agencies
- C. Regulatory authorities in countries
- D. National, regional and international levels
- E. The widespread use of chemicals
- F. None of the Above

1.1 What is the GHS?

13. The GHS is a system for - which missing term- the classification and labeling of chemicals. It is a logical and comprehensive approach to: Defining health, physical and environmental hazards of chemicals;

- A. Cradle to grave
- B. Hazards to human health
- C. Multiple safety data sheets
- D. Standardizing and harmonizing
- E. Hazardous properties of chemicals
- F. None of the Above

14. Creating classification processes that use available data on chemicals for comparison with the defined?

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. Hazard criteria
- E. Hazards associated
- F. None of the Above

15. Communicating hazard information, as well as _____ on labels and Safety Data Sheets (SDS).

- A. Cradle to grave
- B. Hazards to human health
- C. Multiple safety data sheets
- D. Protective measures
- E. Hazardous properties of chemicals
- F. None of the Above

1.7 What are the benefits?

16. The basic goal of _____ is to ensure that employers, employees and the public are provided with adequate, practical, reliable and comprehensible information.

- A. Achieve a global approach
- B. The regulatory changes
- C. GHS
- D. Preventive and protective measures
- E. Hazard communication
- F. None of the Above

2.3 How will the GHS impact existing regulations?

17. To the extent that countries adopt the GHS into their systems, - which missing term- would be binding for covered industries.

- A. Achieve a global approach
- B. Regulatory changes
- C. GHS
- D. Protective measure for their health and safety
- E. Be exposed (workplaces), and in transport
- F. None of the Above

18. For countries with existing systems, it is expected that _____ will be applied within the framework/infrastructure of existing hazard communication regulatory schemes.

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. GHS components
- E. Hazards associated
- F. None of the Above

3.0 What is Classification?

19. Classification is - which missing term- for hazard communication. It involves the identification of the hazard(s) of a chemical or mixture by assigning a category of hazard/danger using defined criteria.

- A. A global approach
- B. The regulatory changes
- C. The starting point
- D. Preventive and protective measure for their health and safety
- E. Be exposed (workplaces), and in transport
- F. None of the Above

20. The GHS is designed to be consistent and transparent. It draws a clear distinction between classes and categories in order to allow for "self-classification". For many hazards a decision tree approach is provided in?

- A. Self-classification
- B. Hazards of a substance or mixture
- C. The data used for classification
- D. The GHS Document
- E. Existing hazard communication systems
- F. None of the Above

21. For several hazards - which missing term- are semi-quantitative or qualitative. Expert judgment may be required to interpret these data.

- A. The global approaches
- B. The regulatory changes
- C. The GHS criteria
- D. Preventive and protective measure for their health and safety
- E. All of the Above
- F. None of the Above

Hazard Classification

22. Which of the following terms is used to indicate that only the intrinsic hazardous properties of substances and mixtures are considered?

- A. Self-classification
- B. Hazards of a substance or mixture
- C. The data used for classification
- D. GHS labels and/or Safety Data Sheets
- E. Hazard classification
- F. None of the Above

23. Subsequent review of those data to ascertain the hazards associated with the?

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. Existing hazard communication regulatory schemes
- E. Substance or mixture
- F. None of the Above

24. A decision on whether the substance or mixture will be classified as a hazardous substance or mixture and the - which missing term-, where appropriate, by comparison of the data with agreed hazard classification criteria.

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. Existing hazard communication regulatory schemes
- E. Hazards associated
- F. None of the Above

25. Which of the following terms may be obtained from tests, literature, and practical experience?

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. Data used for classification
- E. Hazards associated
- F. None of the Above

26. Tests that determine hazardous properties conducted according to internationally recognized scientific principles can be used for purposes of?

- A. Hazard classification
- B. Safety Data Sheets
- C. Degree of hazard
- D. Existing hazard communication regulatory schemes
- E. Hazards associated
- F. None of the Above

3.1 What are the GHS Physical Hazards?

27. Which of the following terms - developed by the ILO and UNCETDG, were largely based on the existing criteria used by the UN Model Regulation on the Transport of Dangerous Goods?

- A. Physical hazards classification
- B. GHS criteria
- C. Liquid or a gas
- D. GHS physical hazard criteria
- E. Scope of the GHS includes all target audiences
- F. None of the Above

28. Which of the following terms provides specific references to approved test methods and criteria for classification?

- A. Physical hazards classification process
- B. GHS criteria
- C. Liquid or a gas
- D. GHS physical hazard criteria
- E. Scope of the GHS includes all target audiences
- F. None of the Above

29. Which of the following terms for physical hazards are quantitative or semi-quantitative with multiple hazard levels within an endpoint. This is different from several of the existing systems that currently have qualitative criteria for various physical hazards.

- A. Physical hazards classification
- B. GHS criteria
- C. GHS more consistent
- D. GHS physical hazard criteria
- E. Scope of the GHS includes all target audiences
- F. None of the Above

30. In developing GHS criteria for _____ it was necessary to define physical states.

- A. Physical hazards classification
- B. GHS criteria
- C. Physical hazards
- D. GHS physical hazard criteria
- E. Scope of the GHS includes all target audiences
- F. None of the Above

31. Which of the following terms is not a gas and which has a melting point or initial melting point of 20°C or less at standard pressure of 101.3 kPa?

- A. Physical hazards classification
- B. GHS criteria
- C. Liquid or a gas
- D. A liquid is a substance or mixture
- E. A solid is a substance or mixture
- F. None of the Above

32. Which of the following terms - that does not meet the definitions of a liquid or a gas?

- A. Physical hazards classification
- B. A liquid is a substance or mixture
- C. Liquid or a gas
- D. GHS physical hazard criteria
- E. A solid is a substance or mixture
- F. None of the Above

3.1.4 Oxidizing Gases

33. Which of the following terms - means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does?

- A. Aerosols
- B. Single hazard category
- C. Flammable gas
- D. Ignition
- E. Oxidizing gas
- F. None of the Above

34. Which of the following terms of this hazard class are assigned to a single hazard category on the basis that, generally by providing oxygen, they cause or contribute to the combustion of other material more than air does?

- A. Aerosols
- B. Single hazard category
- C. Flammable gas means a gas
- D. Substances and mixtures
- E. Oxidizers
- F. None of the Above

35. Currently, several workplace hazard communication systems cover oxidizers as?

- A. Aerosols
- B. Single hazard category
- C. Flammable gas means a gas
- D. A class of chemicals
- E. Oxidizers
- F. None of the Above

3.1.5 Gases under Pressure

36. Which of the following terms - under pressure are gases that are contained in a receptacle at a pressure not less than 280 Pa at 20°C or as a refrigerated liquid?

- A. Flammable solids
- B. Substances and mixtures
- C. Gases
- D. Physical state or compressed gases
- E. Substances and mixtures of this hazard class
- F. None of the Above

37. For this group of gases, the following information is required: vapor pressure at 50°C; physical state at 20°C at standard ambient pressure?

- A. Combustion of other material
- B. Readily combustible solids
- C. Basis of the flash point
- D. Explosive, organic peroxides or as oxidizing
- E. Critical temperature
- F. None of the Above

3.1.6 Flammable Liquids

38. Which of the following terms - means a liquid having a flash point of not more than 93°C?

- A. Flammable liquid
- B. Readily combustible solids
- C. Flammable solids
- D. Explosive, organic peroxides or as oxidizing
- E. Critical temperature
- F. None of the Above

3.1.7 Flammable Solids

39. Which of the following terms - are solids that are readily combustible, or may cause or contribute to fire through friction?

- A. Flammable liquid
- B. Readily combustible solids
- C. Flammable solids
- D. Explosive, organic peroxides or as oxidizing
- E. Critical temperature
- F. None of the Above

40. Which of the following terms - are powdered, granular, or pasty substances that are dangerous if they can be easily ignited by brief contact with an ignition source?

- A. Flammable liquid
- B. Readily combustible solids
- C. Flammable solids
- D. Explosive, organic peroxides or as oxidizing
- E. Critical temperature
- F. None of the Above

41. Which of the following terms are assigned to one of two hazard categories on the basis of the outcome of the UN Test N.1?

- A. Flammable solids
- B. Substances and mixtures
- C. Ignition or pressure
- D. Physical state or compressed gases
- E. Substances and mixtures of this hazard class
- F. None of the Above

3.1.8 Self-Reactive Substances

42. Which of the following terms - are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen?

- A. Combustion of other material
- B. Readily combustible solids
- C. Basis of the flash point
- D. Explosive, organic peroxides or as oxidizing
- E. Self-reactive substances
- F. None of the Above

3.1.12 Substances which on Contact with Water Emit Flammable Gases

43. Substances that, in contact with water, emit flammable gases are solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off _____ in dangerous quantities.

- A. Flammable solids
- B. Substances and mixtures
- C. Flammable gases
- D. Physical state or compressed gases
- E. Substances and mixtures of this hazard class
- F. None of the Above

3.1.13 Oxidizing Liquids

44. Which of the following terms - is a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material?

- A. Combustible liquid
- B. Readily combustible liquid
- C. Basis of the flash point
- D. Explosive liquid
- E. An oxidizing liquid
- F. None of the Above

45. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results which measure ignition or pressure rise time compared to?

- A. Flammable solids
- B. Substances and mixtures
- C. Ignition
- D. Physical state or compressed gases
- E. Substances and mixtures of this hazard class
- F. None of the Above

3.1.14 Oxidizing Solids

46. An oxidizing solid is a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the?

- A. Combustion of other material
- B. Readily combustible solids
- C. Basis of the flash point
- D. Explosive, organic peroxides or as oxidizing
- E. Critical temperature
- F. None of the Above

47. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results which measure mean burning time and?

- A. Flammable solids
- B. Substances and mixtures
- C. Ignition or pressure
- D. Physical state or compressed gases
- E. Substances and mixtures of this hazard class
- F. None of the Above

48. Currently, several workplace hazard communication systems cover - which missing term - as a class of chemicals.

- A. Oxidizers
- B. Readily combustible solids
- C. Flash points
- D. Explosives
- E. Critical temperatures
- F. None of the Above

3.1.15 Organic Peroxides

49. An organic peroxide is an organic liquid or solid which contains the _____ and may be considered a derivative of hydrogen peroxide.

- A. Substances and mixtures
- B. Harmonized odors
- C. Chemical actions
- D. Structure/activity or structure property
- E. Organic radicals
- F. None of the Above

50. The term also includes organic peroxide formulations, such substances and mixtures may: be liable to- which missing term-; burn rapidly; be sensitive to impact or friction; react dangerously with other substances.

- A. Melt
- B. Decompose
- C. Corrode
- D. Explosive decomposition
- E. Burn
- F. None of the Above

3.1.16 Substances Corrosive to Metal

51. A substance or a mixture that by- which missing term- will materially damage, or even destroy, metals is termed 'corrosive to metal'.

- A. Substances and mixtures
- B. Harmonized approach
- C. Chemical action
- D. Structure/activity or structure property
- E. Organic radicals
- F. None of the Above

52. The concern in this case is the protection of metal equipment or installations in case of leakage, not _____ between the container/tank and the product. This hazard is not currently covered in all systems.

- A. Not currently covered
- B. Analysis of existing
- C. Corrosive
- D. Health and environmental criteria
- E. Material compatibility
- F. None of the Above

3.2 What are the GHS Health and Environmental Hazards?

53. The work at the OECD to develop the GHS criteria included: A thorough analysis of existing classification systems, including the _____ its rationale and an explanation of the mode of use;

- A. Not currently covered
- B. Analysis of existing
- C. Corrosive
- D. Health and environmental criteria
- E. Scientific basis for a system and its criteria
- F. None of the Above

54. For some categories the harmonized approach was easy to develop because the existing systems had similar approaches. In cases where the approach was different, a compromise _____ developed.

- A. Consensus proposal
- B. Harmonized approach
- C. Harmonized chemical action
- D. Structure/activity or structure property
- E. Harmonizing
- F. None of the Above

55. Which of the following terms were established for substances and mixtures?

- A. Health criteria
- B. Analysis of existing
- C. Corrosive
- D. Health and environmental criteria
- E. Competent Authorities
- F. None of the Above

3.2.2 Skin Corrosion

56. Which of the following terms - means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours?

- A. Skin corrosion
- B. Harmonized approach
- C. Chemical action
- D. Structure/activity or structure property
- E. Organic radicals
- F. None of the Above

57. Substances and mixtures in this _____ are assigned to a single harmonized corrosion category.

- A. Hazard class
- B. Harmonized approach
- C. Chemical class
- D. Structure/activity or structure property
- E. Organic class
- F. None of the Above

58. For Competent Authorities, such as transport packing groups, needing more than one designation for corrosivity, up to three subcategories are provided within the?

- A. Class
- B. Analysis
- C. Corrosive class
- D. Health and environmental criteria
- E. Corrosive category
- F. None of the Above

59. Several factors should be considered in determining the _____ before testing is initiated: Human experience showing irreversible damage to the skin;

- A. Corrosion potential
- B. Harmonized approach
- C. Chemical potential
- D. Structure/activity or structure property
- E. Organic radicals
- F. None of the Above

60. Structure/activity or structure _____ to a substance or mixture already classified as corrosive;

- A. Substances and mixtures
- B. Harmonized approach
- C. Chemical action
- D. Property relationship
- E. Organic relationship
- F. None of the Above

3.2.3 Skin Irritation

61. Which of the following terms means the production of reversible damage to the skin following the application of a test substance for up to 4 hours?

- A. Chemical action
- B. Analysis of existing
- C. Corrosive
- D. Health and environmental criteria
- E. Skin irritation
- F. None of the Above

62. Substances and mixtures in this hazard class are assigned to a single irritant category. For those authorities, such as pesticide regulators, wanting more than one designation for skin irritation, an additional?

- A. Substances and mixtures
- B. Harmonized approach
- C. Chemical action
- D. Structure/activity or structure property
- E. Mild irritant category is provided
- F. None of the Above

63. Which of the following terms should be considered in determining the irritation potential before testing is initiated: Human experience or data showing reversible damage to the skin following exposure of up to 4 hours?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. Substances and mixtures in this hazard class
- E. Hypersensitivity
- F. None of the Above

64. Structure/activity or structure property relationship to a substance or mixture already classified as?

- A. Test substance
- B. An irritant
- C. Skin sensitizer
- D. Pesticide regulators
- E. Serious physical decay
- F. None of the Above

3.2.4 Eye Effects

65. Which of the following terms should be considered in determining the serious eye damage or eye irritation potential before testing is initiated?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. Substances and mixtures in this hazard class
- E. Hypersensitivity
- F. None of the Above

66. Structure/activity or structure property relationship to a - which missing term- already classified; pH extremes like ≤ 2 and ≥ 11.5 that may produce serious eye damage.

- A. Test substance
- B. pH extreme
- C. Contact sensitizer
- D. Substance or mixture
- E. Hypersensitivity
- F. None of the Above

67. Serious eye damage means the _____ or serious physical decay of vision, following application of a test substance to the front surface of the eye.

- A. Test substance
- B. An irritant
- C. Skin sensitizer
- D. Pesticide regulators
- E. Serious physical decay
- F. None of the Above

68. Which of the following terms in this hazard class are assigned to a single harmonized category?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. Substances and mixtures
- E. Hypersensitivity
- F. None of the Above

3.2.5 Sensitization

69. Which of the following terms - means a substance that induces hypersensitivity of the airways following inhalation of the substance?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. Respiratory sensitizer
- E. Hypersensitivity
- F. None of the Above

70. Substances and mixtures in this hazard class are assigned to?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. One hazard category
- E. Hypersensitivity
- F. None of the Above

71. Skin sensitizer means a substance that will induce an allergic response following skin contact. The definition for "skin sensitizer" is equivalent to?

- A. Contact sensitizer
- B. An irritant
- C. Skin sensitizer
- D. Reproductive and developmental effects
- E. Serious physical decay
- F. None of the Above

72. Substances and mixtures in this hazard class are assigned to?

- A. One hazard category
- B. An irritant
- C. Skin sensitizer
- D. Reproductive and developmental effects
- E. Serious physical decay
- F. None of the Above

73. Consideration should be given to classifying substances which cause immunological contact urticaria as?

- A. Several factors
- B. pH extremes
- C. Contact sensitizer
- D. Substances and mixtures in this hazard class
- E. Hypersensitivity
- F. None of the Above

3.2.10 Aspiration Hazard

74. Which of the following terms is the entry of a liquid or solid directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system?

- A. Death following aspiration
- B. An aspiration hazard in humans
- C. Aspiration
- D. Reproductive and developmental effects
- E. Non-lethal target organ/systemic toxicity class
- F. None of the Above

75. Some hydrocarbons and certain chlorinated hydrocarbons have been shown to pose an _____ in humans.

- A. Death following aspiration
- B. Aspiration hazard in humans
- C. Aspiration hazard
- D. Reproductive and developmental effects
- E. Non-lethal target organ/systemic toxicity class
- F. None of the Above

76. Primary alcohols, and ketones have been shown to pose an _____ only in animal studies.

- A. Death following aspiration
- B. Aspiration hazard in humans
- C. Aspiration hazard
- D. Reproductive and developmental effects
- E. Non-lethal target organ/systemic toxicity class
- F. None of the Above

77. Substances and mixtures of _____ - which missing term- are assigned to one of two hazard categories this hazard class on the basis of viscosity.

- A. This hazard class
- B. An aspiration hazard in humans
- C. The basis of viscosity
- D. Reproductive and developmental effects
- E. Non-lethal target organ/systemic toxicity class
- F. None of the Above

3.3 Environmental Hazards

3.3.1 Hazardous to the Aquatic Environment

78. The harmonized criteria are _____ for packaged goods in both supply and use in multi-modal transport schemes.

- A. Considered suitable
- B. A single exposure
- C. Known or presumed
- D. Only in animal studies
- E. Complex substance
- F. None of the Above

79. Which of the following terms may be used for bulk land transport and bulk marine transport under MARPOL insofar as this uses aquatic toxicity?

- A. The harmonized criteria
- B. A single exposure
- C. Known or presumed
- D. Only in animal studies
- E. Complex substance
- F. None of the Above

3.3.1.1 Acute Aquatic Toxicity

80. Which of the following terms - means the intrinsic property of a material to cause injury to an aquatic organism in a short-term exposure?

- A. Acute aquatic toxicity
- B. An aspiration hazard in humans
- C. Complex substance
- D. Reproductive and developmental effects
- E. Chronic aquatic toxicity
- F. None of the Above

81. Substances and mixtures of this hazard class are assigned to one of three toxicity categories on the basis of acute toxicity data: LC₅₀ or EC₅₀ or ErC₅₀. In some regulatory systems these acute toxicity categories may be subdivided or?

- A. The harmonized criteria
- B. A single exposure
- C. Known or presumed
- D. Degradation/bioaccumulation
- E. Extended for certain sectors
- F. None of the Above

3.3.1.2 Chronic Aquatic Toxicity

82. Which of the following terms means the potential or actual properties of a material to cause adverse effects to aquatic organisms during exposures that are determined in relation to the lifecycle of the organism?

- A. Acute aquatic toxicity
- B. An aspiration hazard in humans
- C. Complex substance
- D. Reproductive and developmental effects
- E. Chronic aquatic toxicity
- F. None of the Above

83. Which of the following terms are assigned to one of four toxicity categories on the basis of acute data and environmental fate data: LC₅₀ or EC₅₀ or ErC₅₀?

- A. Cutoff value/concentration limits
- B. Potential or actual properties
- C. Hazards
- D. Substances and mixtures in this hazard class
- E. Two or more substances
- F. None of the Above

84. While experimentally derived test data are preferred, where no experimental data are available, validated Quantitative Structure Activity Relationships for aquatic toxicity and log KOW may be used in the?

- A. GHS
- B. Classification process
- C. Potential or actual properties
- D. Complex substance
- E. Stability of the substance or changing its composition
- F. None of the Above

3.4 What is the GHS approach to classifying mixtures?

85. For consistency and understanding _____ the GHS defines certain terms.

- A. Cutoff value/concentration limits
- B. Provisions for classifying mixtures
- C. Hazards
- D. Degradation/bioaccumulation
- E. Two or more substances
- F. None of the Above

86. Substance: Chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting which missing term or changing its composition?

- A. GHS
- B. No experimental data
- C. Potential or actual properties
- D. Complex substance
- E. Stability of the substance
- F. None of the Above

87. Mixture: Mixtures or solutions composed of which missing term in which they do not react?

- A. Cutoff value/concentration limits
- B. Potential or actual properties
- C. Hazards
- D. Degradation/bioaccumulation
- E. Two or more substances
- F. None of the Above

88. Alloy: An alloy is a metallic material, which missing term, consisting of two or more elements so combined that they cannot be readily separated by mechanical means?

- A. Homogeneous on a macroscopic scale
- B. Hazardous properties of chemicals
- C. Potential or actual properties
- D. Complex substance
- E. Stability of the substance composition
- F. None of the Above

89. Where impurities, additives or individual constituents of a substance or mixture have been identified and are themselves classified, they should be taken into account during classification if they exceed the cutoff value/concentration limit for a?

- A. Cutoff value/concentration limit
- B. Given hazard class
- C. Hazards
- D. Degradation/bioaccumulation
- E. Hazardous properties of chemicals
- F. None of the Above

3.5 What are bridging principles?

90. Which of the following terms are an important concept in the GHS for classifying untested mixtures?

- A. GHS
- B. Bridging principles
- C. Potential or actual properties
- D. Complex substance
- E. Stability of the substance or changing its composition
- F. None of the Above

91. Dilution: If a mixture is diluted with a diluent that has an equivalent or lower toxicity, then the hazards of the new mixture are assumed to?

- A. Cutoff value/concentration limit
- B. GHS
- C. Hazards
- D. Be equivalent to the original
- E. Two or more substances
- F. None of the Above

92. Batching: If a batch of a complex substance is produced under which missing term then the hazards of the new batch are assumed to be equivalent to the previous batches?

- A. GHS
- B. Degradation/bioaccumulation
- C. Potential or actual properties
- D. Controlled process
- E. Stability of the substance or changing its composition
- F. None of the Above

93. Concentration of Highly Toxic Mixtures: If a mixture is severely hazardous, then a concentrated mixture is also assumed to?

- A. Cutoff value/concentration limit
- B. Be severely hazardous
- C. Hazards
- D. Degradation/bioaccumulation
- E. Two or more substances
- F. None of the Above

4.0 Hazard Communication

94. As in existing systems, labels and which missing term are the main tools for chemical hazard communication. They identify the hazardous properties of chemicals that may pose a health, physical or environmental hazard during normal handling or use.

- A. GHS
- B. Environmental hazards
- C. Chemical products
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

95. _____ is to identify the intrinsic hazards found in chemical substances and mixtures, and to convey information about these hazards?

- A. GHS
- B. Environmental hazards
- C. Chemical products
- D. The goal of the GHS
- E. Hazardous properties of chemicals
- F. None of the Above

96. The international mandate for the GHS included the development of a harmonized hazard communication system, including labeling, Safety Data Sheets and easily understandable symbols, based on the classification criteria developed for the?

- A. GHS
- B. Environmental hazards
- C. Chemical products
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

4.1 What factors influenced development of the GHS communication tools?

97. Early in the process of developing _____ several significant issues were recognized.

- A. GHS communication tools
- B. Environmental hazards
- C. Chemical products
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

98. One of the most important was comprehensibility of the information provided. After all, the aim of the system is to present hazard information in a manner that the intended audience can easily understand and that will thus minimize the possibility of adverse effects resulting from?

- A. Exposure
- B. Environmental hazards
- C. Chemical products
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

99. The GHS identifies some guiding principles to assist in this process: Information should be conveyed in more than one way, e.g.?

- A. Text and symbols
- B. Environmental hazards
- C. Chemical products
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

100. The comprehensibility of the components of the system should take account of existing studies and literature as well as any evidence gained from?

- A. GHS
- B. Environmental hazards
- C. Testing
- D. Safety Data Sheets
- E. Hazardous properties of chemicals
- F. None of the Above

Waterborne Viruses Introduction

101. Which of the following terms does treatment processes and watershed management strategies designed on the basis of bacteriological criteria do not necessarily protect against?

- A. F-specific coliphages
- B. Indicators of fecal contamination
- C. Enteric viruses
- D. Viruses
- E. Viral infection
- F. None of the Above

102. Because of their smaller size, viruses (0.023 to 0.080 μm) are transported further in ground water than bacteria (0.5 to 3 μm) or _____ (4 to 15 μm).

- A. Protozoan pathogens
- B. Indicators of fecal contamination
- C. Enteric viruses
- D. Viruses
- E. Microorganisms
- F. None of the Above

103. Which is the current method for culturing _____ under the ICR (U.S. Environmental Protection Agency, 1996c) is recognized as being difficult to implement?

- A. Protozoan pathogens
- B. Indicators of fecal contamination
- C. Enteric viruses
- D. Viruses
- E. Microorganisms
- F. None of the Above

104. Which term is found in environmental samples presumably come from warm-blooded animals or sewage?

- A. F-specific coliphages
- B. Indicators of fecal contamination
- C. Enteric viruses
- D. Viruses
- E. Microorganisms
- F. None of the Above

105. This term represents coliphage is representative of the survival and transport of?

- A. Enteric viruses
- B. F-specific coliphages
- C. Viruses
- D. Indicators of viral contamination
- E. Coliphages are bacteriophages
- F. None of the Above

Sampling Procedures

Streamwater Sample Collection

106. Consider that the spatial and temporal distribution of microorganisms in surface water can be as variable as the distribution of _____ because microorganisms are commonly associated with solid particles.

- A. Suspended sediment
- B. Indicators of fecal contamination
- C. Enteric viruses
- D. Viruses
- E. Microorganisms
- F. None of the Above

107. The standard samplers used in by the majority of samplers can be used to collect streamwater samples for bacterial and viral indicators, _____ providing that the equipment coming in contact with the water is properly cleaned and sterilized.

- A. Cryptosporidium, and Giardia
- B. Indicator organisms
- C. Cholera, polio, typhoid, hepatitis
- D. Cryptosporidium
- E. Giardia
- F. None of the Above

Cryptosporidium and Giardia Analysis

108. Special sterilization procedures are needed for equipment used in the collection of samples for?

- A. Total Organisms
- B. Indicator bugs
- C. Cholera, polio, typhoid, hepatitis
- D. Oocysts
- E. Cryptosporidium and Giardia
- F. None of the Above

109. Washing the equipment free of residual sodium hypochlorite solution with three rinses of filter-sterilized water; do not de-chlorinate the equipment using?

- A. Dibromochloromethane
- B. Bromoform
- C. Cl₂ and HOCl
- D. Sodium hypochlorite solution
- E. Sodium thiosulfate
- F. None of the Above

110. According to the text, composite the sample in a 10-L cubitainer that is pre-sterilized by the manufacturer. The cubitainer is sent in a cardboard box to laboratory for _____ analysis.

- A. Total Coliform (TC)
- B. Indicator organisms
- C. Cholera, polio, typhoid, hepatitis
- D. Cryptosporidium
- E. Giardia
- F. None of the Above

Understanding Bacteriophage

111. Bacteriophages may have a lytic cycle or a lysogenic cycle, such as the T4 phage, _____ are broken open (lysed) and destroyed after immediate replication of the virion.

- A. Lysogenic cycle
- B. Bacterial cells
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

112. Which of the following is an example of a virus that remains dormant until host conditions deteriorate, perhaps due to depletion of nutrients; then it become active.

- A. Lysogenic cycle
- B. Endogenous phages
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

113. Which of the following is an example of a bacteriophage known to follow the lysogenic cycle and the lytic cycle is the?

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of E. coli
- E. Viral genome
- F. None of the Above

114. Which of the following terms is an example is the conversion of a harmless strain of a phage that can cause cholera?

- A. Lysogenic cycle
- B. The virus
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

Understanding Bacteriophage

115. Their viral genome will integrate with _____ and replicate along with it harmlessly, or may even become established as a plasmid.

- A. Podoviruses
- B. Phage's host range
- C. Host DNA
- D. Phage lambda of E. coli
- E. Viral genome
- F. None of the Above

116. The virus remains dormant until host conditions deteriorate, perhaps due to depletion of nutrients; then, the _____ become active.

- A. Lysogenic cycle
- B. Endogenous phages
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

117. An example of a bacteriophage known to follow the lysogenic cycle and the lytic cycle is the?

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of E. coli
- E. Viral genome
- F. None of the Above

118. An eminent example is the conversion of a harmless strain of _____ by a phage into a highly virulent one, which causes cholera.

- A. Lysogenic cycle
- B. The virus
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

119. Which of the following terms undergo a phenomenon known as lysis inhibition, where completed phage progeny will not immediately lyse out of the cell if extracellular phage concentrations are high?

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of E. coli
- E. Lytic phages
- F. None of the Above

Attachment and Penetration

120. As _____ do not move independently, they must rely on random encounters with the right receptors when in solution (blood, lymphatic circulation, irrigation, soil water, etc.).

- A. Lysogenic cycle
- B. The virus
- C. Vibrio cholerae
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

121. _____ use a hypodermic syringe-like motion to inject their genetic material into the cell. After making contact with the appropriate receptor, the tail fibers flex to bring the base plate closer to the surface of the cell; this is known as reversible binding.

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of E. coli
- E. Viral genome
- F. None of the Above

122. Once attached completely, irreversible binding is initiated and the tail contracts, possibly with the help of ATP present in the tail, injecting _____ through the bacterial membrane.

- A. Lysogenic cycle
- B. Genetic material
- C. *Vibrio cholerae*
- D. Phage virions
- E. Myovirus bacteriophages
- F. None of the Above

123. Which of the following terms lack an elongated tail sheath similar to that of a myovirus, so they instead use their small, tooth-like tail fibers to enzymatically degrade a portion of the cell membrane before inserting their genetic material?

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of *E. coli*
- E. Viral genome
- F. None of the Above

Virions

124. Which of the following terms is a complete functional virus that has the capacity to infect living tissue?

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Phage lambda of *E. coli*
- E. A virion
- F. None of the Above

125. If the cell was burst artificially, then these virus particles cannot be called virion because they will lack certain proteins that will make them infectious even though the _____ is present.

- A. Podoviruses
- B. Phage's host range
- C. Myovirus bacteriophages
- D. Genetic material
- E. Viral genome
- F. None of the Above

Chlorine Gas

126. 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 (OCl⁻)
- F. None of the Above

127. 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

128. 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 (OCl⁻)
- F. None of the Above

129. The combination of high chlorine demand in process-contaminated systems and the dissociation process in alkaline systems creates the need for greater chlorine feed to obtain the same microbial efficacy. This results in a higher concentration of HCl in the cooling system.

- A. True B. False

130. Which of the following terms removes alkalinity, pH depression and system corrosion could occur?

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

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

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

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

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

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

Pathophysiology

134. 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 D. Water solubility
B. Vapor from Chlorine gas E. The odor threshold for chlorine
C. Effects of Hydrochloric acid F. None of the Above

135. 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 D. The chemical species produced
B. Chlorine gas E. Plasma exudation
C. The gas F. None of the Above

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

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

Mechanism of Activity

137. 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

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

- A. True B. False

Solubility Effects

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

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

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

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

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

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

Early Response to Chlorine Gas

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

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

143. 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

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

Pathological Findings

145. Chlorine is a highly reactive gas.

- A. True B. False

154. According to the text, chlorine is also incompatible with?

- A. Air
- B. Ammonia
- C. Sodium Chloride
- D. Hydrogen sulfide
- E. Moisture, steam, and water
- F. None of the Above

Flammability

155. Keep unnecessary people away; isolate the hazard area and deny entry. For a massive fire in a cargo area, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from the area and let the fire burn. Emergency personnel should stay out of low areas and ventilate closed spaces before entering.

- A. True
- B. False

Disinfection Essentials

156. Selecting the right _____ requires understanding several factors governing the particular site and the water or wastewater to be treated.

- A. Operating costs
- B. Disinfection weapon
- C. UV device
- D. Operating method
- E. Net-positive environmental benefit
- F. None of the Above

157. If the disinfection system is complex it may require additional staff time to ensure that it operates within the?

- A. Disinfectant system
- B. Narrow tolerance
- C. Desired parameters
- D. Net-positive environmental benefit
- E. Acceptable standards
- F. None of the Above

158. Environmental/Adverse Effects. Some systems may need to have additional treatment of the disinfected effluent in order to render it benign when released, while other systems may provide a net-positive environmental benefit through increased?

- A. Operating costs
- B. Other than chlorine
- C. Safeguards
- D. Breathing apparatus and protective clothing
- E. Oxygenation of the receiving waters
- F. None of the Above

159. Flow and Water Characteristics. If your system cannot adjust for dry or wet weather flow rates of the receiving water body, _____ may also affect the system's appropriateness for your application.

- A. Off-site concerns
- B. Narrow tolerance
- C. Desired parameters
- D. Net-positive environmental benefit
- E. Acceptable standards
- F. None of the Above

160. Other than chlorine, there are primarily four basic disinfection systems currently available—chlorination, ozone gas, ultraviolet radiation, and Chemical treatment.

- A. True
- B. False

161. An operator of an onsite water or wastewater treatment plant needs to consider some of the safeguards that need to be in place as well. One decision to install a system could be the result of local concerns and potential to mitigate health risks, as well as?

- A. Improved community relations
- B. Narrow tolerance
- C. Desired parameters
- D. Net-positive environmental benefit
- E. Acceptable standards
- F. None of the Above

162. Safety. A system will often require significant safety protection—such as use of breathing apparatus and protective clothing—as well as high levels of operator training, it may be advisable to explore other, _____.

- A. Disinfectant systems
- B. Narrow tolerance
- C. Desired parameters
- D. Less intensive systems
- E. Acceptable standards
- F. None of the Above

163. Which of the following terms should be made for the effects of both intentional and unintentional releases to the environment even if the disinfectant is considered relatively safe to use.

- A. Operating costs
- B. Other than chlorine
- C. Considerations
- D. Dosage
- E. Net-positive environmental benefit
- F. None of the Above

164. An operator's treatment intent should be to reduce the levels of pathogens to acceptable standards and understanding how effective the disinfectant system is in achieving?

- A. Target levels
- B. Narrow tolerance
- C. Desired parameters
- D. Net-positive environmental benefit
- E. Acceptable standards
- F. None of the Above

Chlorine Basics

165. By dropping a few drops of hydrochloric acid onto a piece of manganese dioxide, Steele had discovered?

- A. Halogens
- B. Ammonia
- C. Chlorine
- D. Manganese dioxide
- E. H₂SO₄
- F. None of the Above

What Happens to Chlorine When it Enters the Environment?

166. When chlorine is released to soil, chlorine will react with moisture forming?

- A. Free oxygen radicals
- B. Chlorine gas
- C. Hydrochloric acid
- D. A greenish-yellow, noncombustible gas
- E. Hypochlorous acid and hydrochloric acid
- F. None of the Above

167. According to the text, chlorine does not accumulate in the?

- A. Food chain
- B. Bacteria and viruses
- C. In air
- D. Water
- E. Treatment filter
- F. None of the Above

168. When released to air, chlorine will react with water to form hypochlorous acid and hydrochloric acid, which are removed from the atmosphere by generation of free oxygen radicals.

- A. True
- B. False

169. Chlorine reacts with water to form hypochlorous acid and hydrochloric acid. The hypochlorous acid breaks down rapidly. The hydrochloric acid also breaks down; its breakdown products will raise the pH of the water (makes it more basic).

- A. True
- B. False

Disinfectant Qualities

170. Chlorine is so important in poultry processing that the US Department of Agriculture requires an almost constant chlorine rinse for much of the cutting equipment. In fact, no proven economical alternative to chlorine disinfection exists for use in Meat and poultry processing facilities.

- A. True B. False

Chlorine's Effectiveness

171. There are several factors when considering chlorine residual. The effectiveness of chlorination depends on the _____ of the water, the concentration of the chlorine solution added, the time that chlorine is in contact with the organism, and water quality.

- A. Chlorine residual D. Chlorination
B. Color change E. Required contact time
C. Chlorine demand F. None of the Above

172. Sometimes chlorine is not available for disinfection because _____ in the water (like iron, manganese, hydrogen sulfide, and ammonia).

- A. pH increases D. Required contact time
B. Chlorine level and water quality E. Part of it combines with other chemicals
C. Free chlorine residual F. None of the Above

173. The amount of chlorine required to achieve disinfection and that reacts with the other chemicals is the?

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

174. Which of the following terms is used to disinfect decreases, as the concentration of the chlorine increases?

- A. pH increases D. Required contact time
B. Chlorine level and water quality E. Not available for disinfection
C. Free chlorine residual F. None of the Above

175. Chlorination is more effective as?

- A. Chlorine residual D. Water cools down
B. Colors change E. Water temperature increases
C. Chlorine demand F. None of the Above

176. Chlorination becomes more alkaline and is less effective as the?

- A. Water's pH increases D. Required contact time is maximized
B. Water quality increases E. Contact time
C. Free chlorine residual drops F. None of the Above

177. Chlorination is less effective in?

- A. Clear water D. Daytime
B. Color change E. Cloudy (turbid) water
C. Warm temps F. None of the Above

178. By adding a little more chlorine to what is already sufficient, this action will generally result in _____ that can be measured easily.

- A. pH increases
- B. Chlorine level and water quality
- C. Chlorine demand
- D. Required contact time
- E. A free chlorine residual
- F. None of the Above

Chlorination Equipment Requirement Section

179. Which of the following 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

180. 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

181. Chlorine gas under pressure shall not be permitted outside the chlorine room. 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

182. 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

Standby Provision

183. 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

184. 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

185. 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

186. 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

187. 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
- B. Corrosion resistant
- C. Securely positioned
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

188. 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

189. 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

190. 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

191. Which of the following related chlorine alarm equipment should be connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation?
A. The chlorinator
B. The facility
C. All chlorine cylinders
D. The chlorine gas leakage
E. Chlorine leak detection equipment
F. None of the Above

192. 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
B. Corrosion resistant
C. Leak detection equipment
D. Automatic chlorine leak detection
E. Chlorine room ventilation system
F. None of the Above

193. 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

194. 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

195. 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

196. Which chlorine safety related equipment term 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

197. 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

198. 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

199. 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

Storage of Chlorine Cylinders

200. 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

201. 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

202. 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

203. Which term 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 Health Hazard Section

204. Which term expresses low levels of chlorine results in eye, nose, and throat irritation, sneezing, Excessive salivation, general excitement, and restlessness?

- A. Rambling
- B. Inhalation
- C. Acute exposure
- D. Chronic exposure
- E. Immediate attention after inhalation
- F. None of the Above

205. Which term expresses low levels of chlorine gas can result in a dermatitis known as chloracne, tooth enamel corrosion, coughing, sore throat, hemoptysis and increased susceptibility to tuberculosis?

- A. Rambling
- B. Inhalation
- C. Acute exposure
- D. Chronic exposure
- E. Immediate attention after inhalation
- F. None of the Above

Inhalation

206. Which term expresses coughing, sneezing, shortness of breath, sensation of tightness in the chest, as well as severe restlessness or Anxiety, nausea, and vomiting?

- A. Rambling
- B. Inhalation
- C. Acute exposure
- D. Chronic exposure
- E. Immediate attention after inhalation
- F. None of the Above

207. The nose and throat may become irritated; a stinging and Burning sensation may be experienced. Immediate fatalities can occur as a result of suffocation. Delayed fatalities can occur as a result of pulmonary edema (fluid in the lungs). For this reason, rest and immediate attention after inhalation is important.

- A. True
- B. False

208. If breathing has stopped, give artificial respiration; if breathing is difficult, give oxygen if equipment and trained personnel are available. If exposed person is breathing, place in a comfortable position.

- A. True
- B. False

Eye/Skin Contact

209. Liquid and concentrated gas could produce severe?

- A. Burns and injury on contact
- B. Plasma exudation
- C. General excitement
- D. Chronic exposure to low levels of chlorine gas
- E. Inhalation due to stress
- F. None of the Above

Eye

210. If you get chlorine in the eye, pour a gentle stream of _____ through the affected eye for at least 15 minutes. Contact the poison control center, emergency room or physician right away, as further treatment will be necessary.

- A. Liquid
- B. Warm water
- C. Milk
- D. Salt water
- E. Cold water
- F. None of the Above

Skin

211. If you get chlorine on the skin, run _____ over the affected area for 15 minutes.

- A. A gentle stream of water
- B. Warm water
- C. Milk
- D. Salt water
- E. Cold water
- F. None of the Above

Chronic

212. Repeated exposures to chlorine gas can result in a loss of ability to detect the odor of chlorine. Long-term exposures may cause damage to teeth and inflammation or?

- A. Chlorine gas toxicity
- B. Plasma exudation
- C. Pulmonary edema
- D. Ulceration of the nasal passages
- E. Noncardiogenic pulmonary edema
- F. None of the Above

Pre-hospital Management

213. Rescue personnel are at low risk of noncardiogenic pulmonary edema contamination from victims who have been exposed only to gases released from hypochlorite solutions. However, clothing or skin soaked with industrial-strength bleach or similar solutions may be corrosive to rescuers and may release harmful gases.

- A. True
- B. False

214. Ingestion of hydrochlorite solutions rarely causes pain in the mouth or throat, dysphagia, stridor, drooling, odynophagia, and vomiting.

- A. True
- B. False

215. Chronic exposure to gases released from ammonia solutions can cause coughing, eye and nose irritation, lacrimation, and a burning sensation in the chest.

- A. True
- B. False

Hot Zone

216. Which term is the area that rescuers should be trained and appropriately attired before entering?

- A. Support Zone
- B. Warm zone
- C. Chemical-protective clothing area
- D. Decontamination area
- E. Hot Zone
- F. None of the Above

Rescuer Protection

217. Which of the following terms is irritating to the skin and eyes and in some cases may release toxic gases?

- A. Hydrothromine
- B. Hypochlorite
- C. Chloramine
- D. Sodium dichloroisocyanurate (NaDCC)
- E. Ammonia
- F. None of the Above

218. Positive-pressure, self-contained breathing apparatus (SCBA) is recommended in response to situations that involve exposure to potentially unsafe levels of?

- A. Chlorine tablet(s)
- B. Hypochlorite
- C. Chlorine gas
- D. Solid hypochlorite or concentrated solutions
- E. Hypochlorous Acid
- F. None of the Above

219. Chemical-protective clothing should be worn due to the risk of skin irritation and burns from direct contact with?

- A. Chlorine tablet(s)
- B. Hypochlorite
- C. Chlorine gas
- D. Solid hypochlorite or concentrated solutions
- E. Hypochlorous Acid
- F. None of the Above

ABC Reminders

220. If a person is over taken with chlorine gas exposure, quickly establish a _____, ensure adequate respiration and pulse.

- A. Support Zone
- B. Patient airway
- C. Chemical-protective clothing
- D. Delay decontamination
- E. Hot Zone to the Decontamination Zone
- F. None of the Above

Victim Removal

221. During the chlorine evacuation, if victims can walk, lead them out of the?

- A. Decontamination area
- B. Hot Zone
- C. Chemical-free zone
- D. Chemically contaminated zone
- E. Hot Zone to the Decontamination Zone
- F. None of the Above

ABC Reminders

222. Quickly establish a _____, ensure adequate respiration and pulse.

- A. Support Zone
- B. Patient airway
- C. Hot Zone
- D. Decontamination zone
- E. Chemical-protective clothing dressing area
- F. None of the Above

Basic Decontamination

223. During a chlorine leak, _____ is critical.

- A. Decontamination
- B. Hot Zone
- C. Chemical-protective clothing
- D. Rapid decontamination
- E. Hot Zone to the Decontamination Zone
- F. None of the Above

224. During a chlorine leak, victims who are conscious and able to swallow should be given 4 to 8 ounces of?

- A. Liquid
- B. Warm water
- C. Milk only
- D. Water or milk
- E. Cold water
- F. None of the Above

225. During a chlorine leak, consider appropriate _____ of chemically contaminated children at the exposure site. Provide reassurance to the child during decontamination, especially if separation from a parent occurs.

- A. Decontamination
- B. Hot Zone
- C. Chemical-protective clothing
- D. Management
- E. Hot Zone to the Decontamination Zone
- F. None of the Above

Understanding Disinfection

Wastewater Disinfection

226. According to the text, there are a number of chemicals and processes that will _____, but none are universally applicable.

- A. Limit the effects of organic material
- B. Numerous alternative disinfection processes
- C. Residual level of disinfection
- D. Disinfect wastewater
- E. Limit the travel of pathogens
- F. None of the Above

227. Aerobic treatment processes reduce pathogens, but not enough to qualify as?

- A. As necessary
- B. Disinfection process
- C. Environmental impact
- D. Primary methods used for the disinfection
- E. Economical and versatile chemicals
- F. None of the Above

228. Chlorination/dechlorination has been the most widely used disinfection technology in the U.S.; ozonation and UV light are emerging technologies." Each of these three methods have different considerations for the?

- A. Disinfection of wastewater
- B. Disinfection process
- C. Environmental and regulatory impact
- D. The primary methods for disinfection
- E. Economical and versatile chemicals
- F. None of the Above

Water Disinfection

229. Disinfection is usually the final stage in the _____ in order to limit the effects of organic material, suspended solids and other contaminants.

- A. Limit the effects of organic material
- B. Numerous alternative disinfection processes
- C. Residual level of disinfection
- D. Water treatment process
- E. Limit the travel of pathogens
- F. None of the Above

230. The primary methods used for the _____ in very small (25-500 people) and small (501-3,300 people) treatment systems are ozone, ultraviolet irradiation (UV) and chlorine.

- A. Chlorates are powerful oxidizers
- B. Adverse health effects
- C. Disinfection of water
- D. Microbiological contamination
- E. Sodium chloride
- F. None of the Above

Chlorate Ion

231. Which of the following terms is predicted by VSEPR, about chlorate anions?

- A. Acid/base balance
- B. Stable perchlorates
- C. Formula ClO₃⁻
- D. Trigonal pyramidal structures
- E. Chemical formula CaCl₂
- F. None of the Above

Chloride Ion

232. Which of the following compounds is an example of table salt, which is sodium chloride with the chemical formula?

- A. Chemical formula CaCl_2
- B. NaCl
- C. Chlorite ion is ClO_2^- .
- D. Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. Chlorine dioxide
- F. None of the Above

233. Which of the following compounds or element is also the prosthetic group present in the amylase enzyme. Another example is calcium chloride with the chemical formula CaCl_2 .

- A. Chemical formula CaCl_2
- B. A chloride ion
- C. Chlorite ion is ClO_2^- .
- D. Corresponding anions Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. Chlorine dioxide
- F. None of the Above

234. Which of the following compounds is used for maintaining unpaved roads and for sanite fortifying roadbases for new construction?

- A. Chemical formula CaCl_2
- B. Calcium chloride
- C. Chlorite ion is ClO_2^- .
- D. Corresponding anions Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. Chlorine dioxide
- F. None of the Above

235. Which of the following compounds are a closely monitored constituent of the mud system?

- A. Chemical formula CaCl_2
- B. Chloride
- C. Chlorite ion is ClO_2^- .
- D. Chlorides
- E. Chlorine dioxide
- F. None of the Above

236. Which of the following terms is also a useful and reliable chemical indicator of river / groundwater fecal contamination, as chloride is a non-reactive solute and ubiquitous to sewage & potable water?

- A. Chemical formula CaCl_2
- B. Chloride
- C. Chlorite ion is ClO_2^- .
- D. Corresponding anions Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. Chlorine dioxide
- F. None of the Above

Chlorite Ion

237. The chlorite ion is?

- A. Chemical formula CaCl_2
- B. Chloride
- C. ClO_2^-
- D. Corresponding anions Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. Chlorine dioxide
- F. None of the Above

Chlorine Dioxide

238. Chlorine dioxide is a chemical compound with the formula?

- A. Chemical formula CaCl_2
- B. Chloride
- C. Chlorite ion is ClO_2^- .
- D. Corresponding anions Cl^- , ClO^- , ClO_2^- , ClO_3^- , or ClO_4^-
- E. ClO_2
- F. None of the Above

Haloacetic Acids

239. What type of substances are Haloacetic acids in which a halogen atom takes the place of a hydrogen atom in acetic acid?

- A. An anti-bonding orbital
- B. A single halogen
- C. Hypochlorite compounds
- D. Carboxylic acids
- E. Calcium hypochlorite
- F. None of the Above

Contaminants in Drinking Water

240. Which of the following terms expresses an exposure to such substances in drinking water has been associated with a number of health outcomes by epidemiological studies, although the putative agent in such studies has not been identified?

- A. An anti-bonding orbital
- B. A single halogen
- C. Hypochlorite compounds
- D. Disinfection by-products
- E. Calcium hypochlorite
- F. None of the Above

Hypochlorites

241. The same residuals are obtained as with gas chlorine, but the effect on the _____ of the treated water is different.

- A. High-test calcium hypochlorite(s)
- B. Calcium hypochlorite tablets
- C. Hypochlorous acid
- D. Negative charge
- E. pH
- F. None of the Above

Disinfection Byproducts

242. Which term represents when disinfectants used in water treatment plants react with bromide and/or natural organic matter present in the source water?

- A. Disinfection byproducts
- B. Other disinfectants
- C. Naturally occurring bromide
- D. Occurring organic and inorganic matter in water
- E. Most prevalent THM
- F. None of the Above

243. Which term represents which regulations have been established have been identified in drinking water, including trihalomethanes, haloacetic acids, bromate, and chlorite?

- A. Chlorine dioxide
- B. HAA5
- C. Trihalomethanes
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Disinfection byproducts
- F. None of the Above

Trihalomethanes (THM)

244. Which term represents a group of four chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic and inorganic matter in water?

- A. Disinfection byproducts
- B. Other disinfectants
- C. Naturally occurring bromide
- D. Occurring organic and inorganic matter in water
- E. Trihalomethanes (THM)
- F. None of the Above

Haloacetic Acids (HAA5)

245. Bromate is a chemical that is formed when this term is used to disinfect drinking water reacts with naturally occurring bromide found in source water?

- A. Disinfection byproducts
- B. Other disinfectants
- C. Naturally occurring bromide
- D. Occurring organic and inorganic matter in water
- E. Ozone
- F. None of the Above

246. Which term represents a byproduct formed when chlorine dioxide is used to disinfect water?

- A. Chlorite
- B. HAA5
- C. Trihalomethanes
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Chloroform
- F. None of the Above

Sodium Chlorate

247. Sodium Chlorate can also be synthesized by passing _____ into a hot sodium hydroxide solution. It is then purified by crystallization.

- A. Chlorate
- B. Oxygen
- C. Chlorine gas
- D. Sodium metaborate or ammonium phosphates
- E. The free acid, chlorous acid, HClO_2
- F. None of the Above

Potent Germicide

248. Chlorine disinfectants can reduce the level of _____ in drinking water to almost immeasurable levels.

- A. Cryptosporidium parvum and Giardia lamblia
- B. Many disease-causing microorganisms
- C. Nitrogenous compounds
- D. Sodium hypochlorite solution
- E. Chlorine disinfectants
- F. None of the Above

249. Chlorine is added to drinking water to destroy pathogenic (disease-causing) organisms. It can be applied in several forms: _____, sodium hypochlorite solution (bleach) and dry calcium hypochlorite.

- A. Cryptosporidium parvum and Giardia lamblia
- B. Many disease-causing microorganisms
- C. Elemental chlorine (chlorine gas)
- D. Sodium hypochlorite solution
- E. Chlorine disinfectants
- F. None of the Above

Taste and Odor Control

250. Chlorine disinfectants reduce many disagreeable tastes and odors. Chlorine oxidizes many naturally occurring substances such as _____, sulfides and odors from decaying vegetation.

- A. Cryptosporidium parvum and Giardia lamblia
- B. Many disease-causing microorganisms
- C. Nitrogenous compounds
- D. Sodium hypochlorite solution
- E. Foul-smelling algae secretions
- F. None of the Above

Biological Growth Control

251. Chlorine disinfectants eliminate _____ that commonly grow in water supply reservoirs, on the walls of water mains and in storage tanks.

- A. Cryptosporidium parvum and Giardia lamblia
- B. Many disease-causing microorganisms
- C. Nitrogenous compounds
- D. Slime bacteria, molds and algae
- E. Chlorine disinfectants
- F. None of the Above

Chemical Control

252. Chlorine disinfectants destroy _____ (which has a rotten egg odor) and remove ammonia and other nitrogenous compounds that have unpleasant tastes and hinder disinfection. They also help to remove iron and manganese from raw water.

- A. Cryptosporidium parvum and Giardia lamblia
- B. Many disease-causing microorganisms
- C. Nitrogenous compounds
- D. Hydrogen sulfide
- E. Chlorine disinfectants
- F. None of the Above

253. Every day, approximately 170,000 _____ treat and convey billions of gallons of water through approximately 880,000 miles of distribution system piping to U.S. homes, farms and businesses.

- A. Chlorine residual
- B. Public water systems
- C. Chemical or biological contamination
- D. Low levels of color and turbidity (cloudiness)
- E. Distribution system piping
- F. None of the Above

254. Surface water usually presents a greater treatment challenge than groundwater, which is naturally filtered as it percolates through?

- A. Chlorine residual
- B. Sediments
- C. Chemical or biological contamination
- D. Low levels of color and turbidity (cloudiness)
- E. Distribution system piping
- F. None of the Above

255. Surface water is laden with organic and mineral particulate matter, and may harbor protozoan parasites such as?

- A. Total Coliform (TC)
- B. Indicator organisms
- C. Cholera, polio, typhoid, hepatitis
- D. Cryptosporidium parvum and Giardia lamblia
- E. Giardia
- F. None of the Above

Water Distribution

256. In the event of a significant intrusion of pathogens resulting, for example, from a broken water main, the level of the average “_____” will be insufficient to disinfect contaminated water.

- A. Chlorine residual
- B. Potential threats
- C. Chemical or biological contamination
- D. Low levels of color and turbidity
- E. Distribution system piping
- F. None of the Above

The Challenge of Disinfection Byproducts

257. Which of the following terms is when chlorine and other disinfectants react with natural organic matter in water?

- A. Microbial contamination
- B. Potential threats
- C. Critical assets
- D. Chemical compounds formed unintentionally
- E. Cost-effective methods
- F. None of the Above

258. While the available evidence does not prove that _____ in drinking water cause adverse health effects in humans, high levels of these chemicals are certainly undesirable. Cost-effective methods to reduce DBP formation are available and should be adopted where possible.

- A. Microbial contamination
- B. Potential threats
- C. Critical assets
- D. Vulnerability assessments
- E. DBPs
- F. None of the Above

Chlorine and Water System Security

259. The prospect of a terrorist attack has forced all water systems, large and small, to re-evaluate and upgrade?

- A. Chlorine residual
- B. Existing security measures
- C. Chemical or biological contamination
- D. Low levels of color and turbidity
- E. Vulnerability assessments
- F. None of the Above

260. With passage of the Public Health Security and Bioterrorism Response Act of 2002, Congress required community water systems to assess their vulnerability to a terrorist attack and other intentional acts. As part of these vulnerability assessments, systems assess?

- A. Contamination
- B. Potential threats
- C. Critical assets
- D. The transportation, storage and use of treatment chemicals
- E. Cost-effective methods
- F. None of the Above

261. These chemicals are both critical assets and?
- | | |
|----------------------------|------------------------------|
| A. Microbial contamination | D. Vulnerability assessments |
| B. Potential threats | E. Potential vulnerabilities |
| C. Critical assets | F. None of the Above |

Understanding Cryptosporidiosis

262. Cryptosporidium is _____ because its transmission has increased dramatically over the past two decades.
- | | |
|---------------------------------|---|
| A. Cryptosporidium | D. An emerging parasitic protozoan pathogen |
| B. Chlorine-based disinfectants | E. Emerging waterborne pathogen |
| C. Giardia lamblia | F. None of the Above |

Understanding Giardia lamblia

263. Which of the following terms was discovered approximately 20 years ago, is another emerging waterborne pathogen?
- | | |
|---------------------------------|---|
| A. Cryptosporidium | D. An emerging parasitic protozoan pathogen |
| B. Chlorine-based disinfectants | E. Emerging waterborne pathogen |
| C. Giardia lamblia | F. None of the Above |

264. From the 1960's to the 1980's this sequence of events culminated in the recognition of _____ as a cause of gastroenteritis.
- | | |
|---------------------------------|---|
| A. Cryptosporidium | D. An emerging parasitic protozoan pathogen |
| B. Chlorine-based disinfectants | E. Emerging waterborne pathogen |
| C. Giardia lamblia | F. None of the Above |

Understanding Waterborne Diseases

265. The CDC and the U.S. Environmental Protection Agency collaborate to track _____ of both microbial and chemical origins.
- | | |
|--|---------------------------------------|
| A. Waterborne disease outbreaks | D. Amounts of disinfection byproducts |
| B. Diagnosed cases of waterborne illness | E. Waterborne disease outbreaks |
| C. Treatment measures | F. None of the Above |

Chlorine (DDBP)

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

267. A typical chlorine residual is 2 ppm for this type of chlorine residual?
- | | |
|--------------------------------------|--|
| A. Free available chlorine and Total | D. Combined Chlorine |
| B. Residual | E. Combined chlorine and Readily available |
| C. Break point and Free | F. None of the Above |

Chlorine By-Products

268. The most common chlorination by-products found in U.S. drinking water supplies are?
- | | |
|---|----------------------|
| A. Chlorate and Chlorite | D. Ammonia and THMS |
| B. CO ₂ and H ₂ SO ₄ | E. Chloramines |
| C. Trihalomethanes (THMs) | F. None of the Above |

The Principal Trihalomethanes are:

269. 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

Health Effects

270. 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

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

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

272. _____ 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.

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

273. 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 D. Chlorine Dioxide
B. UV E. Chloramines
C. Chlorite F. None of the Above

Chemistry of Chlorination

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

- A. True B. False

275. 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

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

- A. True B. False

277. 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
- B. The amount of chlorine
- C. Chlorine Demand
- D. Total chlorine
- E. pH value and temperature
- F. None of the Above

278. If all other things were equal, _____ and a lower pH are more conducive to chlorine disinfection.

- A. Lower pH
- B. Hypochlorous acid
- C. Higher water temperatures
- D. Lower water temperature
- E. The hypochlorite ion
- F. None of the Above

279. The disassociation of chlorine gas

(OCI -): HOCl \rightarrow H⁺ + OCl⁻ Also expressed HOCl \rightarrow H⁺ + OCl⁻
(hypochlorous acid) (hydrogen) (hypochlorite ion)

- A. True
- B. False

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

- A. True
- B. False

281. 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

282. 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

283. 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

284. Which of the following term is all 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

285. 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

286. In water, there are always other substances (interfering agents) such as iron, manganese, turbidity, etc., which will combine chemically with the chlorine, this is called the?

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

287. According to the text, once chlorine molecules are combined with these interfering agents, they are not capable of disinfection. _____ is much more effective as a disinfecting agent.

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

288. 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

289. 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

290. Which of the following term = 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

291. 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

292. 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

293. 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

294. 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

295. 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

296. Which 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 Review

297. What term describes the minimum amount of Chlorine needed to react in a water purification system; used as a monitoring measurement by system operators?

- A. Chlorine Demand
- B. Liquid
- C. Total chlorine
- D. Monitoring measurement
- E. Ammonia or organic amines
- F. None of the Above

298. What term describes the concentration of chlorine in the water after the chlorine demand has been satisfied?

- A. Chlorine Residual
- B. Chlorine Demand
- C. Combined
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

299. What term describes the amount of chlorine used up in a water purification system; used as a monitoring measurement by system operators.

- A. Chlorine Residual
- B. Chlorine Demand
- C. Combined Chlorine Residual
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

300. Operator may add _____ to chlorinated public water supplies to provide inorganic chloramines.

- A. Combined chlorine
- B. Liquid
- C. Total chlorine
- D. Ammonia
- E. Organic amines
- F. None of the Above

301. What term describes the concentration of residual chlorine in water present as dissolved gas (Cl_2), hypochlorous acid (HOCl), and/or hypochlorite ion (OCl^-)?

- A. Chlorine Demand
- B. Chlorine total
- C. Free Chlorine
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

302. What term describes the residual chlorine existing in water in chemical combination with ammonia or organic amines that can be found in natural or polluted waters?

- A. Chlorine Residual
- B. Chlorine Demand
- C. Combined Chlorine Residual
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

303. Which of the following terms of at least 1.0 mg/L should be maintained in the clear well or distribution reservoir immediately downstream from the point of post-chlorination and .2 mg/L in the distribution system to guard against backflow?

- A. Chlorine Demand
- B. Chlorine total
- C. Free chlorine residual
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

304. What term describes the total of free residual and combined residual chlorine in a water purification system; and used as a monitoring measurement by system operators?

- A. Chlorine Demand
- B. Chlorine total
- C. Total Chlorine Residual
- D. Total combined chlorine
- E. Residual chlorine
- F. None of the Above

305. What term describes the total chlorine is essentially equal to free chlorine since the concentration of ammonia or organic nitrogen compounds will be very low?

- A. Chlorine Demand
- B. Chlorine total
- C. Combined chlorine
- D. Total chlorine
- E. Residual chlorine
- F. None of the Above

306. The correct procedure to follow in changing a chlorine cylinder, hook up the Chlorinator to the container or cylinder with the chlorine valve turned on. Use the liquid side not the gas if using a 1-ton container. Remove the cylinder valve outlet cap and check the valve face or damage.

- A. True
- B. False

307. When changing the Cl₂ cylinder, check the inlet face of the _____ and clean if necessary.

- A. Fusible plug
- B. Chlorine cylinder
- C. Chlorinator
- D. Chlorine valve
- E. Yoke
- F. None of the Above

308. Place a new lead gasket on the chlorinator inlet, place the chlorinator on the cylinder valve, install the yoke clamp and slowly tighten the Yoke clamp until the two faces are against the lead gasket. Tighten the yoke, compressing the gasket one-half to three quarters turn, do not over tighten. Replace the lead gasket with every change out.

- A. True
- B. False

309. What is the best term that describes chlorine addition of chlorine at the plant headworks or prior to other water treatment or groundwater production processes and mainly used for disinfection and control of tastes, odors, and aquatic growth?

- A. Chlorination
- B. Post-chlorination
- C. Chlorine Demand
- D. Demand
- E. Pre-chlorination
- F. None of the Above

310. What term best describes the sum of free and combined chlorine?
- A. Organic amine(s) D. Breakpoint chlorination
 B. Disinfection E. Total Chlorine
 C. Free chlorine F. None of the Above
311. When chlorinating most potable water supplies, total chlorine is essentially equal to _____ since the concentration of ammonia or organic nitrogen compounds will be very low.
- A. Chlorination D. Total chlorine
 B. The amount of chlorine E. Free chlorine
 C. Chlorine Demand F. None of the Above
312. What term best describes the residual chlorine existing in water in chemical combination with ammonia or organic amines that can be found in natural or polluted waters.
- A. Combined chlorine D. Breakpoint chlorination
 B. Disinfection E. Total chlorine residual
 C. Free chlorine F. None of the Above
313. Ammonia is sometimes deliberately added to chlorinated public water supplies to provide?
- A. Chlorination D. Flavor
 B. Inorganic chloramines E. Increase pH value
 C. Chlorine Demand F. None of the Above
314. What term best describes the concentration of residual chlorine in water present as dissolved gas (Cl_2), hypochlorous acid (HOCl), and/or hypochlorite ion (OCl^-).
- A. Organic amine(s) D. Breakpoint chlorination
 B. Disinfection E. Total chlorine residual
 C. Free chlorine F. None of the Above
315. What term best describes the minimum amount of chlorine needed to react in a water purification system; used as a monitoring measurement by system operators?
- A. Chlorination D. Total chlorine
 B. The amount of chlorine E. Disinfection
 C. Chlorine Demand F. None of the Above
316. What term best describes the concentration of chlorine in the water after the chlorine demand has been satisfied?
- A. Chlorine Residual D. Breakpoint chlorination
 B. Disinfection E. Total chlorine residual
 C. Free chlorine F. None of the Above
317. What term best describes this missing term, which includes both the free and combined or chemically bound chlorine residuals?
- A. Chlorine Residual D. Chlorine Demand
 B. Disinfection E. Total chlorine residual
 C. Free chlorine F. None of the Above

318. What term best describes the addition of chlorine after a process or adding chlorine downstream to meet a Demand in the system?

- A. Chlorination
- B. Post-chlorination
- C. Chlorine Demand
- D. Demand
- E. Pre-chlorination
- F. None of the Above

319. Solid chlorine is about 1.5 times heavier than water and gaseous chlorine is about 2.5 times heavier than air. Atomic number of chlorine is 17. Cl is the elemental symbol and Cl₂ is the chemical formula.

- A. True
- B. False

320. Which of the following term reacts with bacteria as if it was very corrosive and burns the skin or covering killing the bacteria?

- A. Chlorine tablet(s)
- B. Chlorine
- C. Solid chlorine
- D. Sodium and calcium hypochlorite
- E. Calcium hypochlorite
- F. None of the Above

321. What term best describes the killing of everything.

- A. Sterilization
- B. Disinfection
- C. Free chlorine
- D. Breakpoint chlorination
- E. Total chlorine meltdown
- F. None of the Above

322. Physical and chemical properties of chlorine: A yellowish green, nonflammable and liquefied gas with an unpleasant and irritating smell.

- A. True
- B. False

323. Hook up the chlorinator to the container or cylinder with the chlorine valve turned off. Use the _____ not the liquid if using a 1-ton container.

- A. Cylinder valve outlet cap
- B. Cylinder valve
- C. Yoke
- D. Safety device
- E. Gas side
- F. None of the Above

324. Check the valve face for damage after removing the _____ and clean with wire brush if necessary. If the valve face is smooth, clean proceed with hooking up the cylinder.

- A. Cylinder valve outlet cap
- B. Cylinder valve
- C. Yoke
- D. Safety device
- E. Lead gasket
- F. None of the Above

325. According to the text, always check the _____ of the chlorinator and clean if necessary.

- A. Cylinder valve outlet cap
- B. Cylinder valve
- C. Yoke
- D. Inlet face
- E. Gasket
- F. None of the Above

326. Tighten the _____, compressing the gasket one-half to three quarters turn, do not over tighten. Replace the lead gasket with every change out.

- A. Cylinder valve outlet cap
- B. Cylinder valve
- C. Yoke
- D. Safety device
- E. Lead gasket
- F. None of the Above

Chlorine Exposure Limits

327. OSHA PEL?

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

328. Physical and chemical properties: A yellowish green, nonflammable and liquefied gas with an unpleasant and irritating smell.

- A. Cl₃
- B. Chlorine
- C. HOCl and OCl⁻
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

329. This can be readily compressed into a clear, amber-colored liquid, a _____, and a strong oxidizer.

- A. Cl₂
- B. Cl
- C. HOCl and OCl⁻
- D. Combined Available Chlorine
- E. Noncombustible gas
- F. None of the Above

330. Solid chlorine is about _____ times heavier than water and gaseous chlorine is about 2.5 times heavier than air.

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

331. Cl₂ IDLH?

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

332. Cl₂ Fatal Exposure Limit?

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

333. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for chlorine is 10 PPM (3 milligrams per cubic meter (mg/m³)) as a ceiling limit. A worker's exposure to chlorine shall at no time exceed this ceiling level.

- A. True
- B. False

334. When using chlorine gas: In addition to protective clothing and goggles, chlorine gas should be used only in a well-ventilated area so that _____ cannot concentrate.

- A. Chlorine exposure
- B. Connection
- C. Leak area
- D. Any leaking gas
- E. Several safety precautions
- F. None of the Above

335. What are the two main chemical species formed by chlorine in water and they are known collectively as _____ and the _____?

- A. Hypochlorous acid, Cl₂
- B. Hypochlorous acid, Hypochlorite ion
- C. HOCl₂ and OCl₂
- D. Combined Available Chlorine, Total
- E. Monochloramine, Cl₂
- F. None of the Above

336. Which of the following terms when added to water, rapidly hydrolyzes, the chemical equations best describe this reaction is $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{Cl}^- + \text{HOCl}$?

- A. Chlorine gas
- B. Cl
- C. HOCl and OCl-
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

337. Which of the following substances is the most germicidal of the chlorine compounds with the possible exception of chlorine dioxide?

- A. Hydrochlorous acid
- B. Sulfuric acid
- C. Hypochlorous acid
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

Halogen Section - Halides

338. Halide ions combined with single hydrogen atoms form the hydrohalic acids (i.e., HF, HCl, HBr, HI), a series of particularly strong acids, one being?

- A. HCl
- B. HOCl
- C. Hydrastatic acid
- D. Chlorine gas
- E. The hypochlorite ion (OCl-)
- F. None of the Above

339. Many synthetic organic compounds such as plastic polymers, and a few natural ones, contain halogen atoms; these are known as halogenated compounds or?

- A. Organic halides
- B. Free radicals
- C. Diatomic Compound
- D. Many synthetic organic compounds
- E. Neither fluorine nor bromine
- F. None of the Above

340. What is the negative ion often referred to as?

- A. Salts
- B. A halide proton
- C. A halide ion
- D. Free radical
- E. Diatomic Compound
- F. None of the Above

341. Which of the following terms contains ions known as halides?

- A. Salts
- B. CXT values
- C. Primary disinfectant
- D. Many synthetic organic compounds
- E. Neither fluorine nor bromine
- F. None of the Above

Chlorine

342. Only halogen is needed in relatively large amounts (as chloride ions) by humans?

- A. Chlorine
- B. Chlorine dioxide
- C. Iodine
- D. Halogen(s)
- E. Inhibitory transmitter GABA
- F. None of the Above

343. This halogen is needed only in very small amounts for the production of thyroid hormones such as thyroxine?

- A. Chlorine
- B. Chlorine dioxide
- C. Iodine
- D. Halogen(s)
- E. Inhibitory transmitter GABA
- F. None of the Above

344. On the other hand, neither fluorine nor bromine are believed to be really essential for humans, although small amounts of _____ can make tooth enamel resistant to decay.

- A. Salts
- B. Iodine
- C. Chlorine
- D. Synthetic organic compounds
- E. Fluoride
- F. None of the Above

Halogens

345. All Halogens have 7 electrons in their outer shells, giving them an oxidation number of -1. The halogens exist, at room temperature, in all three states of matter:

- A. True
- B. False

Bromate

346. The EPA has established the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate _____ at annual average of 10 parts per billion in drinking water.

- A. Chlorine dioxide
- B. Bromate
- C. Trihalomethanes
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Disinfection byproducts
- F. None of the Above

347. Which standard became effective for large public water systems by December 2001 and for small surface water and _____ back in December 2003?

- A. Waterborne disease outbreaks
- B. Diagnosed cases of waterborne illness
- C. Treatment measures
- D. Amounts of disinfection byproducts
- E. All ground public water systems
- F. None of the Above

Microbes

348. Coliform bacteria are common in the environment and are considered harmful.

- A. True
- B. False

349. The presence of these bacteria in drinking water indicates that the water may be contaminated with germs that can cause disease.

- A. True
- B. False

350. Microbes in human wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms and are caused by _____.

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

351. What is the bacteria whose presence indicates that the water may be contaminated with human or animal wastes?

- A. Fecal Coliform and E coli
- B. Protozoa
- C. Thermophilic
- D. Bac-T
- E. Coliform bacteria
- F. None of the Above

352. What is the parasite that enters lakes and rivers through sewage and animal waste? It causes cryptosporidiosis, a mild gastrointestinal disease.

- A. Fecal Coliform and E coli
- B. Giardia lamblia
- C. Microorganisms
- D. Cryptosporidiosis
- E. Cryptosporidium
- F. None of the Above

353. *Giardia lamblia* is a parasite that enters lakes and rivers through sewage and animal waste. It causes?

- A. Fecal Coliform and E coli
- B. Gastrointestinal illness
- C. Microorganisms
- D. Cryptosporidiosis
- E. Coliform bacteria
- F. None of the Above

Advanced Disinfection Supplement

Factors in Chlorine Disinfection: Concentration and Contact Time

354. CXT values [final free chlorine concentration (mg/L) multiplied by minimum contact time (minutes)], offer water operators guidance in computing an effective combination of chlorine concentration and chlorine contact time required to achieve disinfection of water at a given temperature.

- A. True
- B. False

355. The CXT formula demonstrates that if an operator chooses to decrease the chlorine concentration, the required contact time must be lengthened. Similarly, as higher strength chlorine solutions are used, contact times may be reduced.

- A. True
- B. False

Chloramines

356. What are chemical compounds formed by combining a specific ratio of chlorine and ammonia in water?

- A. Chlorine dioxide
- B. Bromate
- C. Chloramines
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Disinfection byproducts
- F. None of the Above

357. Which term provides a durable residual, and are often used as a secondary disinfectant for long distribution lines and where free chlorine demand is high?

- A. Chlorine dioxide
- B. Bromate
- C. Chloramines
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Disinfection byproducts
- F. None of the Above

358. Which term represents a compound that may be used instead of chlorine in order to reduce chlorinated byproduct formation and to remove some taste and odor problems?

- A. Chlorine dioxide
- B. Bromate
- C. Chloramines
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. Disinfection byproducts
- F. None of the Above

Chlorine Dioxide

359. Which term represents a compound that may be generated on-site at water treatment facilities?

- A. Chlorine dioxide (ClO₂)
- B. Bromate
- C. Chloramine
- D. Ozone
- E. Disinfection compounds
- F. None of the Above

360. Chlorine dioxide characteristics are quite different from chlorine. In solution, it is a dissolved gas, which makes it largely unaffected by pH but volatile and relatively easily stripped from?

- A. Chlorine
- B. Sodium hypochlorite
- C. Chlorine dioxide
- D. Chlorine gas
- E. Solution
- F. None of the Above

361. Chlorine dioxide is also a strong disinfectant and a selective oxidant. While chlorine dioxide does produce?

- A. Chlorine
- B. Sodium hypochlorite
- C. Chlorine dioxide
- D. Chlorine gas
- E. A residual it is only rarely used for this purpose
- F. None of the Above

362. In most generators _____ and elemental chlorine are mixed in solution, which almost instantaneously forms chlorine dioxide.

- A. Sodium chlorite
- B. Bromate
- C. Chloramine
- D. Ozone
- E. Disinfection compounds
- F. None of the Above

363. In solution, Chlorine dioxide it is a dissolved gas, which makes it largely unaffected by pH but volatile and relatively easily stripped from?

- A. Chlorine
- B. Sodium hypochlorite
- C. Chlorine dioxide
- D. Chlorine gas
- E. Solution
- F. None of the Above

364. Which of the following does chlorine dioxide produce?

- A. CO₂ and H₂SO₄
- B. Sodium hypochlorite
- C. Bromate
- D. Trihalomethanes, haloacetic acids, bromate, and chlorite
- E. A residual it is only rarely used for this purpose
- F. None of the Above

EPA's Drinking Water Regulations for Disinfectants

365. Chlorine is the most widely used water disinfectant due to its effectiveness and cost. Using chlorine as a drinking water disinfectant has prevented millions of water borne diseases, such as typhoid, cholera, dysentery, and diarrhea. Most states require community water systems to use chlorination.

- A. True
- B. False

366. All disinfectants form DBPs in one of two reactions: Chlorine and chlorine-based compounds react with organics in water causing the chlorine atom to substitute other atoms resulting in?

- A. Chlorine
- B. Organic sulfide(s)
- C. Calcium carbonate
- D. Halogenated by-products
- E. HOCl
- F. None of the Above

367. Which products are also formed when multiple disinfectants are used?

- A. Carbon
- B. Surface water
- C. Compounds
- D. Chlorine and chlorine-based compounds (halogens)
- E. Secondary by-products
- F. None of the Above

368. Which of the following rules requires systems using public water supplies from either surface water or groundwater under the direct influence of surface water to disinfect?

- A. TTHM and HAA5 Rule
- B. DBP MCLs Rule
- C. A community water system (CWS)
- D. Disinfection byproducts (DBPs) Rule
- E. Surface Water Treatment Rule (SWTR)
- F. None of the Above

369. The maximum contaminant level (MCL) for the SWTR disinfection set by EPA. At this time, an MCL is set for only _____, and proposed for additional disinfection byproducts.

- A. TTHM and HAA5 Rule
- B. DBP MCLs Rule
- C. A community water system (CWS)
- D. Disinfection byproducts (DBPs) Rule
- E. Total Trihalomethanes
- F. None of the Above

370. Which of the following rules apply to all community and non-community water systems using a disinfectant such as chlorine, chloramines, ozone and chlorine dioxide?

- A. TTHM and HAA5 Rule
- B. DBP MCLs Rule
- C. A community water system (CWS)
- D. Disinfection byproducts (DBPs) Rule
- E. Disinfectants and Disinfection Byproducts (DBP)
- F. None of the Above

371. The Long Term 2 Enhanced Surface Water Treatment Rule (LT2) rule applies to all water systems using _____ under the influence of a surface water, as well as groundwater/surface water blends.

- A. Surface water, groundwater
- B. DBP MCLs Rule
- C. A community water system (CWS)
- D. Disinfection byproducts (DBPs) Rule
- E. Total Trihalomethanes
- F. None of the Above

372. Which of the following rules began in 2006 with the characterization of raw water *Cryptosporidium* and *E. coli* levels?

- A. DBPs requirements
- B. Disinfectants requirements
- C. SDWA in 1996
- D. Stage 1 Disinfectant and Disinfection Byproduct Rule
- E. The LT2 requirements
- F. None of the Above

373. The Stage 1 Disinfectants and Disinfection Byproducts Rule and _____, announced in December 1998, are the first of a set of rules under the 1996 SDWA Amendments.

- A. Groundwater Rule
- B. Compliance
- C. SDWA in 1996
- D. Long Term 2 Enhanced Surface Water Treatment Rule (LT2)
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

Public Health Concerns

374. While disinfectants are effective in controlling many microorganisms, they react with natural organic and inorganic matter in source water and distribution systems to form?

- A. DBPs
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. Ultraviolet light
- F. None of the Above

375. Which of the following terms have been shown to cause adverse reproductive or developmental effects in laboratory animals?

- A. DBPs
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. Ultraviolet light
- F. None of the Above

376. More than 200 million people consume water that has been disinfected. Because of the large population exposed, health risks associated with _____, even if small, need to be taken seriously.

- A. DBPs
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. Ultraviolet light
- F. None of the Above

377. Which of the following rules and Disinfection Byproducts Rule applies to all community and nontransient non-community water systems that treat their water with a chemical disinfectant?
A. Groundwater Rule (GWR) D. Long Term 2 Enhanced Surface Water Treatment Rule
B. The Stage 1 Disinfectants E. Interim Enhanced Surface Water Treatment Rule
C. SDWA in 1996 F. None of the Above

378. Which of the following rules and Disinfection Byproduct Rule updates and supersedes the 1979 regulations for total trihalomethanes?
A. DBPs D. Stage 1 Disinfectant and Disinfection Byproduct Rule
B. The Stage 1 Disinfectant E. The LT2 requirements
C. SDWA in 1996 F. None of the Above

Stage 2 DBP Rule Federal Register Notices

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

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

381. 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 D. UV source
B. The open-channel system E. UV radiation
C. UV rather than ozone F. None of the Above

382. Which of the following rules has been highly effective in protecting public health and has evolved to respond to new and emerging threats to safe drinking water?
A. Stage 2 DBPR D. Long Term 2 Enhanced Surface Water Treatment Rule
B. DBP exposure E. Safe Drinking Water Act (SDWA)
C. The Stage 2 DBP rule F. None of the Above

383. Which of the following terms is one of the major public health advances in the 20th century?
A. Major public health advances D. Amendments to the SDWA in 1996
B. The Stage 2 DBPR E. Primary or residual disinfectant
C. Disinfection of drinking water F. None of the Above

384. Which of the following terms strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes and haloacetic acids?

- 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

385. 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

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

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

387. 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

388. 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, 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

389. 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?

390. 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

391. Which of the following terms 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

392. 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

What are Disinfection Byproducts (DBPs)?

393. Which of the following terms form when disinfectants used to treat drinking water react with naturally occurring materials in the water?

- A. TTHM and HAA5
- B. DBP MCLs
- C. DBPs from chlorination
- D. Disinfection byproducts (DBPs)
- E. Trihalomethanes and haloacetic acids
- F. None of the Above

Are THMs and HAAs the only disinfection byproducts?

394. Which of the following terms typically occur at higher levels than other known and unknown DBPs?

- A. TTHM and HAAs
- B. DBP MCLs
- C. Classes of DBPs
- D. Disinfection byproducts (DBPs)
- E. Trihalomethanes and haloacetic acids
- F. None of the Above

395. The presence of _____ is representative of the occurrence of many other chlorination DBPs; thus, a reduction in the TTHM and HAA5 generally indicates a reduction of DBPs from chlorination.

- 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

Stage 2 DBP Rule Federal Register Notices

396. Chlorine and its _____ are neutrally charged and therefore easily penetrate the negatively charged surface of pathogens. It is able to disintegrate the lipids that compose the cell wall and react with intracellular enzymes and proteins, making them nonfunctional. Microorganisms then either die or are no longer able to multiply.

- A. Halogen
- B. Water chlorination
- C. Chlorine as a disinfectant
- D. Hydrolysis product hypochlorous acid
- E. Hypochlorous acid
- F. None of the Above

397. In the past 30 years, the Safe Drinking Water Act (SDWA) has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water.

- A. Cryptosporidium
- B. Sodium hypochlorite
- C. Bromoform
- D. Emerging threats to safe drinking water
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

398. Disinfection of drinking water is one of the major public health advances in the 20th century. One hundred years ago, _____ were common through American cities; disinfection was a major factor in reducing these epidemics.

- A. Epidemics
- B. Waterborne disease
- C. Microorganisms
- D. Oxidation of organic molecules
- E. Typhoid and cholera epidemics
- F. None of the Above

399. There are specific microbial pathogens, such as _____, which can cause illness and is resistant to traditional disinfection practices.

- A. Cryptosporidium
- B. Sodium hypochlorite
- C. Bromoform
- D. Emerging threats to safe drinking water
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

pH Scale

400. Alkalinity is the capacity of water to increase acids. This increase is caused by the water's content of carbonate, bicarbonate, hydroxide and occasionally borate, silicate and phosphate.

- A. True
- B. False

401. pH is an expression of the intensity of the basic or acid condition of a liquid. EPA has a suggested range of 5.5 to 7.5 for pH (called a primary maximum contaminant level or MCL).

- A. True
- B. False

402. Alkalinity and pH are similar because water is never strongly basic (high pH) to have a natural alkalinity.

- A. True
- B. False

Chlor-Alkali Membrane Process

403. The electrolysis occurs in a cell containing electrodes submerged in solutions called electrolytes. One electrode is referred to as the anode and is submerged in?

- A. Chlorination
- B. Caustic soda
- C. Chlorine ion
- D. Chlor-alkali membrane process
- E. A salt water solution
- F. None of the Above

404. The second electrode is the cathode and is submerged in a _____ solution.

- A. Oxidizing chemical(s)
- B. A salt water solution
- C. Sodium
- D. Sodium hydroxide (caustic soda)
- E. Sodium and chlorine ions
- F. None of the Above

405. Which of the following terms is used to keep the two different solutions from mixing?

- A. A membrane
- B. Caustic soda
- C. Chlorine ion
- D. Chlor-alkali membrane process
- E. Required contact time
- F. None of the Above

406. When a low voltage direct current power supply is applied to the electrodes in the cell, the _____ in the brine are attracted in opposite directions to the polarized electrodes.

- A. Oxidizing chemical(s)
- B. Sodium and chlorine ions
- C. Sodium
- D. Caustic soda
- E. Sodium and chlorine
- F. None of the Above

407. Which of the following terms passes across an ion selective membrane leaving the chlorine ion to combine with a second chlorine ion, which makes a chlorine gas bubble at the anode?

- A. Chlorination
- B. Caustic soda
- C. Chlorine ion
- D. Chlor-alkali membrane process
- E. The sodium ion
- F. None of the Above

408. The hydroxyl ion originates from the dissolution of water at the cathode where _____ also develops.

- A. Hydrogen gas
- B. Chlorination
- C. Sodium
- D. Caustic soda
- E. Sodium and chlorine ions
- F. None of the Above

409. The membrane in the cell keeps the two solutions separate; otherwise, the chlorine gas bubble would immediately combine with the caustic soda forming?

- A. Chlorination
- B. Caustic soda
- C. Chlorine ion
- D. Chlor-alkali membrane process
- E. Sodium hypochlorite or bleach
- F. None of the Above

Sodium Hypochlorite Exposure

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

- A. True
- B. False

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

- A. True
- B. False

Routes of Exposure - Inhalation

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

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

Ingestion

413. Metabolic acidosis is rare, but has been reported following the ingestion of?

- A. Hypochlorous Acid (HOCl)
- B. Residual disinfectant
- C. Higher levels of chlorine
- D. Sodium and calcium
- E. Household bleach
- F. None of the Above

Sources/Uses

414. According to the text, these compounds are manufactured by the chlorination of sodium hydroxide or lime.

- A. Sodium hypochlorite
- B. Chlorine gas
- C. Sodium and calcium hypochlorite
- D. Hypochlorous acid
- E. Hypochlorite solutions, powder, or concentrated vapor
- F. None of the Above

Calcium Hypochlorite Section

415. Which of the following substances comes in two forms: powder and tablets?

- A. Calcium hypochlorite
- B. Hypochlorous Acid (HOCl)
- C. Sodium hypochlorite
- D. Chlorine
- E. Hypochlorite
- F. None of the Above

416. Which of the following substances is generally available as a white powder, pellets, or flat plates; sodium hypochlorite is usually a greenish yellow, aqueous solution. Although not flammable, they may react explosively.

- A. Chlorine tablet(s)
- B. HCL powder
- C. Solid chlorine
- D. Sodium and calcium hypochlorite
- E. Calcium hypochlorite
- F. None of the Above

417. Which substance decomposes in water to release chlorine and oxygen; sodium hypochlorite solutions can react with acids or ammonia to release chlorine or chloramine?

- A. Calcium hypochlorite
- B. Hypochlorous Acid (HOCl)
- C. Oxygen and chlorine
- D. Chlorine tablet(s)
- E. Hypochlorite ion
- F. None of the Above

Description

418. Solid chlorine stands alone as the safest form of chlorine disinfection. Requiring only minimal safety equipment for handling, users can breathe easy knowing our tablets are safe for both people and the environment. The elimination of costly scrubbers, containment, or hazard response capability, guarantees lower initial costs and reduced operating expense.

- A. True
- B. False

419. Sodium hypochlorite is generally available as a white powder, pellets, or flat plates. It decomposes readily in water or when heated, releasing oxygen and chlorine. It has a strong chlorine odor, but odor may not provide an adequate warning of hazardous concentrations.

- A. True
- B. False

Accuracy

420. According to the text, this answer is an accurate dose, always yielding the stated level of available chlorine in water or very slightly over, never under.

- A. Chlorine tablet(s)
- B. Household bleach
- C. Hypochlorous Acid (HOCl)
- D. Sodium hypochlorite
- E. Calcium hypochlorite
- F. None of the Above

Effectiveness

421. Liquid Sodium hypochlorite and chlorine tablets produce Hypochlorous Acid (HOCl) and?

- A. Calcium hypochlorite
- B. Hydrochlorous Acid (HOCl)
- C. Oxygen
- D. Hypochlorite ion (OCI-) in solution
- E. Hypochlorite ion
- F. None of the Above

Safety

422. Which of the following can affect eyes, skin and mucous membranes; it is easily splashed and rots clothing?

- A. Chlorine tablet(s)
- B. Hypochlorite
- C. Chloramine
- D. Sodium dichloroisocyanurate (NaDCC)
- E. Liquid chlorine
- F. None of the Above

Corrosion

423. Which of the following are much less corrosive than liquid chlorine, which is highly corrosive to most metals?

- A. Sodium hypochlorite
- B. Hypochlorous Acid (HOCl)
- C. Oxygen and chlorine
- D. Chlorine tablet(s)
- E. Hydrochlorite
- F. None of the Above

Comparison

424. Which substance is comparable to Sodium dichloroisocyanurate (NaDCC) is their neutralization by organic matter.

- A. Chlorine tablet(s)
- B. Hypochlorite
- C. Chloramine
- D. Sodium hypochlorite (NaOCl)
- E. Hypochlorous Acid
- F. None of the Above

Health Effects

425. Ingestion and skin contact produces injury to any exposed tissues. Exposure to gases released from _____ may cause burning of the eyes, nose, and throat; cough as well as constriction and edema of the airway and lungs can occur.

- A. Hypochlorite
- B. Hypochlorous Acid (HOCl)
- C. Oxygen and chlorine
- D. Sodium dichloroisocyanurate (NaDCC)
- E. Hydrochlorite ion
- F. None of the Above

Acute Exposure

426. According to the text, the toxic effects of this compound are primarily due to the corrosive properties of the hypochlorite moiety.

- A. Calcium hypochlorite
- B. Hypochlorous Acid (HOCl)
- C. Oxygen and chlorine
- D. Sodium and calcium hypochlorite
- E. Hypochlorite ion
- F. None of the Above

Sodium Hypochlorite Solutions

427. Sodium hypochlorite solutions liberate the Toxic gases chlorine or chloramine if mixed with acid or ammonia (this can occur when bleach is mixed with another cleaning product). Thus, exposure to hypochlorite may involve exposure to these gases.

- A. True
- B. False

Potential Sequelae

428. Exposure to toxic gases generated from hypochlorite solutions can lead to reactive airways dysfunction syndrome (RADS), a chemical irritant-induced type of asthma. Chronic complications following ingestion of hypochlorite include esophageal obstruction, pyloric stenosis, squamous cell carcinoma of the esophagus, and vocal cord paralysis with consequent airway obstruction.

- A. True
- B. False

Chronic Exposure

429. Because chronic dermal can cause dermal irritation due to exposure to this substance.

- A. Chlorine tablet(s)
- B. Hypochlorite
- C. Chloramine
- D. Sodium dichloroisocyanurate (NaDCC)
- E. Hypochlorous Acid
- F. None of the Above

Chloramine Section

430. _____: $\text{NH}_3 + \text{HOCl} \rightarrow \text{NH}_2\text{Cl} + \text{H}_2\text{O}$

- A. Free chlorine
- B. Trichloramine
- C. Dichloramine
- D. Monochloramine
- E. Ammonia and chlorine compounds
- F. None of the Above

431. _____: $\text{NHCl}_2 + 3\text{HOCl} \rightarrow \text{NHCl}_3 + 3\text{H}_2\text{O}$

- A. Free chlorine
- B. Trichloramine
- C. Dichloramine
- D. Monochloramine
- E. Ammonia and chlorine compounds
- F. None of the Above

432. Which of the following terms are an effective disinfectant against bacteria but not against viruses. As a result, it is necessary to add more chlorine to the wastewater to prevent the formation of chloramines and form other stronger forms of disinfectants?

- A. Free chlorine
- B. Chloramine(s)
- C. Dichloramine
- D. Monochloramine and dichloramine
- E. Ammonia and chlorine compounds
- F. None of the Above

Post Chlorination

433. Post chlorination is usually done in water treatment, but can be replaced with chlorine dioxide or chloramines. In this stage, chlorine is fed to the drinking water stream which is then sent to the chlorine contact basin to allow the chlorine a long enough detention time to kill all viruses, bacteria, and protozoa that were not removed and rendered inactive in the prior stages of treatment.

- A. True
- B. False

434. Drinking water requires a large addition of chlorine because there must be a residual amount of chlorine in the water that will carry through the system until it reaches the tap of the user. After Post chlorination, the water is retained in a clear well prior to distribution.

- A. True
- B. False

Chloramine Disadvantages

435. Which residual in tap water can pass through membranes in dialysis machines and directly induce oxidant damage to red blood cells?

- A. Free chlorine
- B. Chloramine
- C. Dichloramine
- D. Monochloramine
- E. Ammonia and chlorine compounds
- F. None of the Above

Chlorine Dioxide Section

436. ClO_2 generation uses _____ and chlorine gas.

- A. Chlorine dioxide (ClO_2)
- B. Sodium chlorite (NaClO_2)
- C. Hypochlorous acid
- D. NaOCl and HCl in place of chlorine gas
- E. Ozone
- F. None of the Above

437. Chlorine gas is educted into a motive water stream in a ClO_2 generator forming?

- A. Hypochlorous acid
- B. HOCl and HCl
- C. Chlorine dioxide
- D. Sodium chlorate (NaClO_3) and sulfuric acid
- E. Sodium thiosulfate
- F. None of the Above

438. This compound is pumped into the stream and allowed to react in a generating column to produce ClO_2 ?

- A. Hypochlorous acid
- B. HOCl and HCl
- C. Chlorine dioxide
- D. Sodium chlorite
- E. Sodium thiosulfate
- F. None of the Above

439. Which of the following compound(s) does not hydrolyze in water as chlorine does and with it, no dissociation of ClO_2 . It remains fully active in a pH range far broader than chlorine or sodium hypochlorite.

- A. Sodium chlorite (NaClO_2)
- B. Chlorine gas
- C. Chlorine dioxide or ClO_2
- D. Sodium chlorate (NaClO_3)
- E. NaOCl and HCl
- F. None of the Above

440. Which of the following compound(s) remains a gas in water, it does not have the corrosive tendencies of chlorine gas?

- A. Sodium chlorite (NaClO_2)
- B. Chlorine gas
- C. Chlorine dioxide or ClO_2
- D. Sodium chlorate (NaClO_3)
- E. NaOCl and HCl
- F. None of the Above

441. Which of the following compound(s) is a dissolved gas in water, there is no mineral acid or caustic soda formation as happens when using HOCl .

- A. ClO_2
- B. Sodium chlorite (NaClO_2)
- C. Hypochlorous acid
- D. NaOCl and HCl in place of chlorine gas
- E. Heavily pH-dependent
- F. None of the Above

442. Which of the following compound(s) tends to be much less, if not totally non-reactive, with many organic and inorganic compounds.

- A. ClO_2
- B. Sodium chlorite (NaClO_2)
- C. Hypochlorous acid
- D. NaOCl and HCl in place of chlorine gas
- E. Heavily pH-dependent
- F. None of the Above

443. Which of the following compound(s), can be in fact, be two-and-one-half times more reactive than chlorine?

- A. ClO_2
- B. Sodium chlorite (NaClO_2)
- C. Hypochlorous acid
- D. NaOCl and HCl in place of chlorine gas
- E. Sodium chlorate (NaClO_3) and sulfuric acid
- F. None of the Above

444. Which of the following terms as a water disinfectant increased in the 1970s when it was discovered that it did not promote THM formation?

- A. Sulfur Dioxide
- B. Chlorine gas
- C. Chlorine dioxide
- D. Sodium chlorate (NaClO_3) and sulfuric acid
- E. UV
- F. None of the Above

445. This compound was used in the paper industry, has been an acceptable and effective alternative to chlorination in cooling systems?

- A. Chlorine dioxide (ClO_2)
- B. Sodium chlorite (NaClO_2)
- C. Hypochlorous acid
- D. NaOCl and HCl in place of chlorine gas
- E. Sodium thiosulfate
- F. None of the Above

446. Which compound is a yellow-green gas with an irritating odor not unlike Chlorine?

- A. Sodium thiosulfate
- B. Chlorine
- C. Chlorine dioxide
- D. Sodium chlorate (NaClO_3) and sulfuric acid
- E. Ozone
- F. None of the Above

447. Which compound cannot be compressed and shipped in a container, so it must be generated on site?

- A. Sodium thiosulfate
- B. Chlorine
- C. Chlorine dioxide
- D. Sodium chlorate (NaClO_3) and sulfuric acid
- E. Ozone
- F. None of the Above

Alternative Methods for Water Disinfection

Ultraviolet Disinfection

448. The microorganisms spend maximum time and contact with the outside of the quartz tube and the source of the?

- A. Sterilizer
- B. UV rays
- C. UV disinfection
- D. UV reactor
- E. Electromagnetic energy
- F. None of the Above

449. The basic design flow of water of certain UV units is in the order of _____ for each inch of the lamp, the units are designed so that the contact or retention time of the water in the unit is not less than _____.

- A. 2.0 gpm - 60 seconds
- B. 20 gpm - 15 seconds
- C. 2.0 gpm - 100 seconds
- D. 1.5 gpm - 60 seconds
- E. 2.0 gpm - 15 seconds
- F. None of the Above

450. A disinfection process involves exposing water to _____, which inactivates various microorganisms. The technique has enjoyed increased application in wastewater treatment but very limited application in potable water treatment.

- A. Sterilizer
- B. UV rays
- C. UV disinfection
- D. Ultraviolet (UV) radiation
- E. Electromagnetic energy
- F. None of the Above

451. In UV, quartz is often used in this case since the quartz absorbs practically none of the UV rays, ordinary glass cannot be used since it will absorb the _____, leaving little for disinfection.

- A. Bromine
- B. UV rays
- C. UV disinfection
- D. UV reactor
- E. Chemical process
- F. None of the Above

452. According to the text, the _____ will consist of a various number of lamps and tubes, depending upon the quantity of water to be treated.

- A. UV sterilizer
- B. UV rays
- C. UV disinfection
- D. UV reactor
- E. Electromagnetic energy
- F. None of the Above

453. Ensuring that the _____ maintains good contact with the water requires control of the water level within the channel to ensure that the UV is making total contact at the designed depths.

- A. UV
- B. Contact
- C. Channel
- D. UV reactor
- E. Ballasts and shields
- F. None of the Above

454. Heat is generated by the electric components of the UV system, adequate ventilation and cooling must be applied to the _____ to reduce heat build-up, otherwise the ballasts could fail.

- A. UV arrays
- B. UV rays
- C. UV disinfection
- D. UV reactor
- E. Electromagnetic energy
- F. None of the Above

455. Because of the great electrical consumption of this system, combined with the cost of routine replacement of _____, should be considered against other systems.

- A. UV capacitor
- B. UV Flux
- C. UV disinfection
- D. UV reactor
- E. Ballasts and shields
- F. None of the Above

456. The germicidal effect of UV is thought to be associated with its reduction by various inorganic components essential to the cell's functioning.

- A. True
- B. False

457. Which term represents the transfer of electromagnetic energy from a mercury arc lamp to a pathogen's DNA material, thus affecting its ability to replicate itself.

- A. UV radiation
- B. UV rays
- C. UV disinfection
- D. UV reactor
- E. Electromagnetic energy
- F. None of the Above

Strongest Oxidizing Agent

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

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

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

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

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

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

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

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

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

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

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

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

464. Each water has its own _____, in the order of 0.5 ppm to 5.0 ppm. Contact time, temperature, and pH of the water are factors to be determined.

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

Alternate Disinfectants Section Summary - Chloramines

465. This 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

466. 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

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

- A. Post disinfectant
- B. ClO₂/chlorite/chlorate
- C. An oxidant
- D. Total residual oxidants
- E. A pre-disinfectant
- F. None of the Above

468. 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. ClO₂/chlorite/chlorate
- C. An oxidant
- D. Chlorine dioxide and chlorite
- E. 25% aqueous solution of sodium chlorite (NaClO₂)
- F. None of the Above

469. 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

470. 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

471. 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

Ozone

472. Which term must be determined for the ozone basin alone; an accurate T10 value must be obtained for the contact chamber, residual levels measured through the chamber and an average ozone residual calculated?

- A. Ozone CT (Contact time)
- B. Free and/or combined chlorine
- C. Residual levels
- D. Contact time
- E. Strongest oxidizing agent
- F. None of the Above

473. Ozone does not provide a _____ and should be used as a primary disinfectant only in conjunction with free and/or combined chlorine.

- A. Ozone CT
- B. Free and/or combined chlorine
- C. Residual level(s)
- D. System residual
- E. Risk
- F. None of the Above

474. Ozone does not produce this term but it may cause an increase in such byproduct formation if it is fed ahead of free chlorine; ozone may also produce its own oxygenated byproducts such as aldehydes, ketones, or carboxylic acids.

- A. Carcinogens
- B. Organics
- C. Carboxylic acids
- D. Oxygen and nascent oxygen
- E. Chlorinated byproducts
- F. None of the Above

475. Ozone may also be used as _____ for removal of taste and odor, or may be applied as a pre-disinfectant.

- A. An oxidant
- B. Free and/or combined chlorine
- C. Residual levels
- D. System residual
- E. Strongest oxidizing agent
- F. None of the Above

Waterborne Pathogens Section

The reason we disinfect.

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

- A. True
- B. False

477. 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
- B. Are mild in nature
- C. Cause intestinal illness
- D. Will cause fatalities
- E. Limit the travel of pathogens
- F. None of the Above

How Diseases Are Transmitted.

478. 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

Protozoan Caused Diseases

479. 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

480. 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

481. 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

482. Which of the following bugs 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

483. 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

Safe Drinking Water Act (SDWA) Review

484. The states are expected to administer and enforce these regulations for public water systems (systems that either have 25 or more service connections or regularly serve an average of 50 or more people daily for at least 60 days each year).

- A. True
- B. False

Bacteriological Monitoring Section

485. 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

486. Water samples for this process 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

Repeat Sampling

487. 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

Sampling Procedures

488. Which 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

Maximum Contaminant Levels (MCLs)

489. 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

Chain of Custody Procedures

490. 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

Positive or Coliform Present Results

491. 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

492. 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

Heterotrophic Plate Count HPC

493. 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

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

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

Total Coliforms

495. 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

496. For systems that collect fewer than _____ samples per month, no more than one sample per month 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)

497. 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

Public Notice

498. 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

Conclusion (Microorganism Appendix)

499. Because of emerging waterborne diseases, a new dimension to the global epidemiology of cholera-an ancient scourge-was provided by the emergence of?

- A. Cholera
- B. Legionella pneumophila
- C. Shigellosis
- D. Vibrio cholerae O139
- E. Campylobacter
- F. None of the Above

500. Water authorities are reassessing the adequacy of current water-quality regulations because of outbreaks of chlorine-resistant?

- A. Campylobacter
- B. Pathogen
- C. Pontiac fever
- D. Cryptosporidium
- E. Shigella dysenteriae
- F. None of the Above