

**Registration form**

**BACTERIOLOGICAL DISEASES II \$250.00**  
**48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

**Start and Finish Dates:** \_\_\_\_\_

*You will have 90 days from this date in order to complete this course*

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

**Name** \_\_\_\_\_ **Signature** \_\_\_\_\_

*I have read and understood the disclaimer notice on page 2. Digitally sign XXX*

**Address** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Email** \_\_\_\_\_ **Fax ( )** \_\_\_\_\_

**Phone:**  
**Home ( )** \_\_\_\_\_ **Work ( )** \_\_\_\_\_

**Operator ID #** \_\_\_\_\_ **Exp. Date** \_\_\_\_\_

**Class/Grade** \_\_\_\_\_

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

Water Treatment \_\_\_ Water Distribution \_\_\_ Other \_\_\_\_\_

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

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

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

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

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

## **DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I 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 or neglect or damage caused by this CEU education training or course material suggestion or error. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

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

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

## **State Approval Listing URL...**

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

*You can obtain a printed version of the course manual from TLC for an additional \$129.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

## **Rush Grading Service**

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

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

## Bacteriological Diseases II Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

Did you check with your State agency to ensure this course is accepted for credit?

You are responsible to ensure this course is accepted for credit. No refunds.  
Method of Course acceptance confirmation. Please fill this section

Website \_\_\_ Telephone Call \_\_\_ Email \_\_\_ Spoke to \_\_\_\_\_

Did you receive the approval number, if applicable? \_\_\_\_\_

What is the course approval number, if applicable? \_\_\_\_\_

*You can electronically complete this assignment in Adobe Acrobat DC.*

Please Circle, Bold, Underline or X, one answer per question. A **felt tipped pen** works best.

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 1. A B C D  | 19. A B     | 37. A B     | 55. A B C D |
| 2. A B C D  | 20. A B C D | 38. A B C D | 56. A B C D |
| 3. A B C D  | 21. A B     | 39. A B C D | 57. A B C D |
| 4. A B      | 22. A B C D | 40. A B C D | 58. A B C D |
| 5. A B C D  | 23. A B C D | 41. A B C D | 59. A B C D |
| 6. A B C D  | 24. A B C D | 42. A B     | 60. A B C D |
| 7. A B C D  | 25. A B     | 43. A B     | 61. A B C D |
| 8. A B C D  | 26. A B C D | 44. A B     | 62. A B C D |
| 9. A B C D  | 27. A B C D | 45. A B     | 63. A B     |
| 10. A B C D | 28. A B C D | 46. A B     | 64. A B     |
| 11. A B C D | 29. A B C D | 47. A B     | 65. A B     |
| 12. A B     | 30. A B C D | 48. A B C D | 66. A B C D |
| 13. A B     | 31. A B C D | 49. A B C D | 67. A B C D |
| 14. A B C D | 32. A B C D | 50. A B C D | 68. A B C D |
| 15. A B C D | 33. A B     | 51. A B C D | 69. A B C D |
| 16. A B C D | 34. A B C D | 52. A B C D | 70. A B     |
| 17. A B C D | 35. A B C D | 53. A B C D | 71. A B     |
| 18. A B C D | 36. A B C D | 54. A B C D | 72. A B C D |

73. A B  
74. A B C D  
75. A B C D  
76. A B C D  
77. A B C D  
78. A B  
79. A B C D  
80. A B C D  
81. A B C D  
82. A B C D  
83. A B C D  
84. A B C D  
85. A B C D  
86. A B  
87. A B C D  
88. A B C D  
89. A B C D  
90. A B  
91. A B C D  
92. A B  
93. A B C D  
94. A B C D  
95. A B C D  
96. A B C D  
97. A B C D  
98. A B C D  
99. A B C D  
100. A B C D  
101. A B C D  
102. A B C D  
103. A B C D  
104. A B C D  
105. A B C D  
106. A B C D  
107. A B C D  
108. A B  
109. A B C D  
110. A B  
111. A B C D  
112. A B C D  
113. A B  
114. A B C D  
115. A B  
116. A B C D  
117. A B C D  
118. A B C D  
119. A B C D  
120. A B C D  
121. A B  
122. A B C D  
123. A B C D  
124. A B C D  
125. A B C D  
126. A B C D  
127. A B C D  
128. A B C D  
129. A B C D  
130. A B C D  
131. A B  
132. A B  
133. A B  
134. A B  
135. A B  
136. A B C D  
137. A B C D  
138. A B C D  
139. A B C D  
140. A B C D  
141. A B C D  
142. A B C D  
143. A B C D  
144. A B C D  
145. A B C D  
146. A B C D  
147. A B C D  
148. A B C D  
149. A B C D  
150. A B C D  
151. A B C D  
152. A B C D  
153. A B C D  
154. A B C D  
155. A B C D  
156. A B C D  
157. A B C D  
158. A B C D  
159. A B C D  
160. A B C D  
161. A B C D  
162. A B C D  
163. A B C D  
164. A B C D  
165. A B C D  
166. A B C D  
167. A B C D  
168. A B C D  
169. A B C D  
170. A B C D  
171. A B C D  
172. A B C D  
173. A B C D  
174. A B C D  
175. A B  
176. A B  
177. A B  
178. A B  
179. A B  
180. A B  
181. A B  
182. A B  
183. A B  
184. A B  
185. A B C D  
186. A B C D  
187. A B C D  
188. A B C D  
189. A B C D  
190. A B C D  
191. A B C D  
192. A B C D  
193. A B C D  
194. A B C D  
195. A B C D  
196. A B C D  
197. A B C D  
198. A B C D  
199. A B  
200. A B  
201. A B  
202. A B  
203. A B C D  
204. A B C D

205. A B C D      238. A B C D      271. A B C D      304. A B C D  
206. A B C D      239. A B C D      272. A B C D      305. A B C D  
207. A B C D      240. A B C D      273. A B C D      306. A B C D  
208. A B C D      241. A B C D      274. A B C D      307. A B C D  
209. A B C D      242. A B C D      275. A B C D      308. A B  
210. A B      243. A B C D      276. A B C D      309. A B  
211. A B      244. A B      277. A B C D      310. A B  
212. A B      245. A B C D      278. A B      311. A B  
213. A B C D      246. A B C D      279. A B      312. A B  
214. A B      247. A B      280. A B      313. A B  
215. A B C D      248. A B      281. A B C D      314. A B  
216. A B      249. A B      282. A B C D      315. A B  
217. A B C D      250. A B C D      283. A B C D      316. A B  
218. A B C D      251. A B      284. A B      317. A B  
219. A B      252. A B C D      285. A B      318. A B  
220. A B      253. A B      286. A B      319. A B C D  
221. A B      254. A B      287. A B      320. A B C D  
222. A B C D      255. A B C D      288. A B C D      321. A B  
223. A B C D      256. A B      289. A B C D      322. A B  
224. A B C D      257. A B      290. A B C D      323. A B  
225. A B      258. A B      291. A B      324. A B  
226. A B      259. A B      292. A B      325. A B  
227. A B C D      260. A B C D      293. A B C D      326. A B  
228. A B C D      261. A B C D      294. A B C D      327. A B  
229. A B C D      262. A B C D      295. A B C D      328. A B  
230. A B C D      263. A B C D      296. A B C D      329. A B  
231. A B      264. A B C D      297. A B C D      330. A B  
232. A B      265. A B C D      298. A B C D      331. A B  
233. A B C D      266. A B C D      299. A B C D      332. A B C D  
234. A B C D      267. A B C D      300. A B C D      333. A B  
235. A B C D      268. A B C D      301. A B C D      334. A B  
236. A B C D      269. A B C D      302. A B      335. A B C D  
237. A B C D      270. A B C D      303. A B C D      336. A B C D

- |              |              |              |              |
|--------------|--------------|--------------|--------------|
| 337. A B C D | 353. A B C D | 369. A B C D | 385. A B     |
| 338. A B C D | 354. A B C D | 370. A B C D | 386. A B C D |
| 339. A B C D | 355. A B C D | 371. A B     | 387. A B C D |
| 340. A B C D | 356. A B C D | 372. A B     | 388. A B C D |
| 341. A B C D | 357. A B C D | 373. A B     | 389. A B     |
| 342. A B C D | 358. A B C D | 374. A B C D | 390. A B     |
| 343. A B C D | 359. A B C D | 375. A B C D | 391. A B C D |
| 344. A B C D | 360. A B C D | 376. A B C D | 392. A B C D |
| 345. A B C D | 361. A B C D | 377. A B     | 393. A B C D |
| 346. A B C D | 362. A B C D | 378. A B     | 394. A B C D |
| 347. A B C D | 363. A B C D | 379. A B     | 395. A B C D |
| 348. A B C D | 364. A B C D | 380. A B     | 396. A B C D |
| 349. A B C D | 365. A B     | 381. A B     | 397. A B C D |
| 350. A B C D | 366. A B     | 382. A B C D | 398. A B C D |
| 351. A B C D | 367. A B     | 383. A B C D | 399. A B C D |
| 352. A B C D | 368. A B C D | 384. A B C D | 400. A B C D |

*I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored.*

*I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.*

**Please Sign that you understand and will abide with TLC's Rules.**

---

**Signature**

***Please write down any questions you were not able to find the answers or that have errors.***

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

**BACTERIOLOGICAL DISEASES II CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

E-MAIL \_\_\_\_\_ PHONE \_\_\_\_\_

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

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?

\_\_\_\_\_

\_\_\_\_\_

Any other concerns or comments.

\_\_\_\_\_

\_\_\_\_\_

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

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

**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 course contains general EPA's SDWA federal rule requirements. Please be aware that each state implements water / sampling procedures/ safety / environmental / SDWA regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to be in compliance with your regulatory agencies and do not follow this course for any compliance concerns.*



## Bacteriological Diseases II CEU Training Course Assignment

The Bacteriological Diseases II CEU course assignment is available in Word on the Internet for your convenience, please visit [www.abctlc.com](http://www.abctlc.com) and download the assignment and e-mail it back to TLC.

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (PDHs) or Continuing Education Unit (CEU). A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email or fax all concerns and the completed ANSWER KEY to [info@tlch2o.com](mailto:info@tlch2o.com).

Select one answer per question. Please utilize the answer key. (s) on the answer will indicate either plural and singular tenses.

### Hyperlink to the Glossary and Appendix

<http://www.abctlc.com/downloads/PDF/WTGlossary.pdf>

### Three Types of Public Water Systems

1. Provides water to the same people at least six months a year, but not all year for example: schools, factories, churches, office buildings that have their own water system)

- A. TNCWS    C. NTNCWSs
- B. CWSs    D. None of the above

2. Approximately 18,000 water systems

- A. TNCWS    C. NTNCWSs
- B. CWSs    D. None of the above

3. Approximately 52,000 systems serving the majority of the U.S. population

- A. TNCWS    C. NTNCWSs
- B. CWSs    D. None of the above

### Water Quality Section

#### Surface (Raw) Water Introduction

4. Raw water generally contains varying amounts of dissolved minerals including calcium, magnesium, sodium, chlorides, sulfates and bicarbonates, depending on its source.

- A. True    B. False

#### Surface Water Properties

5. Water is accepted as the \_\_\_\_\_ because will dissolve most substances that comes in contact.

- A. Universal solvent    C. Surface water
- B. Water quality    D. None of the above

6. Depending on the region, some lakes and rivers receive \_\_\_\_\_ from sewer facilities or defective septic tanks.

- A. Excess nutrients    C. Discharge
- B. Biological actions    D. None of the above

7. Runoff could produce mud, leaves, decayed vegetation, and human and animal refuse. The discharge from industry could increase \_\_\_\_\_. Some lakes and reservoirs may experience seasonal turnover.

- A. Volatile organic compounds
- B. Water quality
- C. Excess nutrients
- D. None of the above

8. Adjustments in the dissolved oxygen, algae, temperature, suspended solids, turbidity, and carbon dioxide will change because of \_\_\_\_\_.

- A. Excess nutrients
- B. Biological actions
- C. Discharge
- D. None of the above

### Managing Water Quality at the Source

9. Contingent upon the region, source water may have several restrictions of use as part of a Water Shed Management Plan. In some areas, it may be restricted from recreational use, discharge or runoff from agriculture, or \_\_\_\_\_.

- A. Excess nutrients
- B. Biological actions
- C. Industrial and wastewater discharge
- D. None of the above

10. Algae can be controlled in the water supply by using chemicals such as \_\_\_\_\_.

- A. pH and alkalinity
- B. Copper sulfate
- C. Powdered activated carbon and chlorine
- D. None of the above

11. Contingent upon federal regulations and the amount of copper found natural in water, operators have used \_\_\_\_\_, powdered activated carbon and chlorine to control algae blooms.

- A. pH and alkalinity
- B. Metals, and non-metals
- C. Potassium permanganate
- D. None of the above

12. Another characteristic of quality control is aquatic plants. The ecological equilibrium in lakes and reservoirs plays a natural part in purifying and sustaining the life of the lake. Certain vegetation removes the excess nutrients that would promote the growth of algae. Too much algae will imbalance the lake and kill fish.

- A. True
- B. False

13. Algae growth is supplied by the energy of the sun. As algae absorbs this energy, it converts carbon dioxide to oxygen. Algae and rooted aquatic plants are essential in the food chain of fish and birds. Algae growth is the result of photosynthesis.

- A. True
- B. False

### Physical Characteristics of Water

14. \_\_\_\_\_ is a substance that can give up a hydrogen ion ( $H^+$ ); a base is a substance that can accept  $H^+$ .

- A. Acid
- B. Base
- C. Acidic or alkaline
- D. None of the above

15. The more acidic a solution the greater the hydrogen ion concentration and the lower the pH; a pH of 7.0 indicates neutrality, a pH of less than 7 indicates acidity, and a pH of more than 7 indicates \_\_\_\_\_.

- A. Acid
- B. Base
- C. Alkalinity
- D. None of the above

16. Physical characteristics are the elements found that are considered alkali, metals, and non-metals such as carbonates, fluoride, \_\_\_\_\_. The consumer relates it to scaling of faucets or staining.

- A. pH and alkalinity
- B. Sulfides or acids
- C. Powdered activated carbon and chlorine
- D. None of the above

17. Total Dissolved Solids (TDS) is not a primary pollutant; it is a gauge of appealing water characteristics such as hardness and an indication of an assortment of chemical contaminants that might be present, such as?

- A. Turbidity
- B. Colloids
- C. Arsenic
- D. None of the above

18. pH is the negative logarithm of the hydrogen ion concentration,  $[H^+]$ , a measure of the degree to which a solution is \_\_\_\_\_.

- A. Alkalinity
- B. Acidic or alkaline
- C. Hydrogen ion ( $H^+$ )
- D. None of the above

### Alkalinity

19. Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the end-point pH used.

- A. True
- B. False

### Turbidity Introduction

20. One physical feature of water is turbidity. A measure of the cloudiness of water caused by \_\_\_\_\_. The cloudy appearance of water caused by the presence of tiny particles.

- A. Suspended particles
- B. Variations
- C. Temperature fluctuation
- D. None of the above

21. High levels of turbidity may inhibit with proper water treatment and monitoring. If high quality raw water is low in turbidity, there will be a reduction in water treatment costs. Turbidity is unwanted because it causes health hazards.

- A. True
- B. False

22. Usually, the extra coagulant required is relatively small when turbidities are much higher than normal due to higher collision probabilities of the \_\_\_\_\_ during high turbidities.

- A. Turbidity
- B. Colloids
- C. Total Dissolved Solids (TDS)
- D. None of the above

23. Low \_\_\_\_\_ waters can be very difficult to coagulate due to the difficulty in inducing collision between the colloids.

- A. Turbidity
- B. Colloids
- C. Total Dissolved Solids (TDS)
- D. None of the above

24. \_\_\_\_\_ may be existing in a water supply due to pollution, and these colloids can be difficult to remove in the coagulation process. In this situation, higher coagulant dosages are generally required.

- A. Turbidity
- B. Organic colloids
- C. Total Dissolved Solids (TDS)
- D. None of the above

25. When heavy rains transpire, runoff into streams, rivers, and reservoirs occurs, causing turbidity levels to increase. In most cases, the particle sizes are relatively large and settle relatively quickly in both the water treatment plant and the source of supply. However, in some instances, fine, colloidal material may be present in the supply, which may cause some difficulty in the coagulation process.

- A. True      B. False

26. Generally, higher turbidity levels require higher coagulant dosages. However, seldom is the relationship between turbidity level and \_\_\_\_\_ linear.

- A. Coagulant dosage      C. Temperature  
B. Total Dissolved Solids (TDS)      D. None of the above

### **Turbidity MCL**

27. An MCL for turbidity established by the EPA because \_\_\_\_\_ interferes with disinfection. This characteristic of water changes the most rapidly after a heavy rainfall.

- A. Conductivity      C. Temperature  
B. Turbidity      D. None of the above

28. The temperature variation of a sample, a scratched or unclean sample tube in the nephelometer and selecting an incorrect wavelength of a light path may be conditions caused by an inaccurate \_\_\_\_\_ measurement.

- A. Conductivity      C. Temperature  
B. Turbidity      D. None of the above

### **Dissolved Oxygen**

29. The level of dissolved oxygen in natural waters is often a direct indication of quality, since aquatic plants produce oxygen, while microorganisms generally consume it as they feed on \_\_\_\_\_.

- A. Pollutants      C. E. coli bacteria  
B. Organic matter      D. None of the above

30. At low temperatures, the \_\_\_\_\_ is increased, so that in winter, concentrations as high as 20 ppm may be found in natural waters; during summer, saturation levels can be as low as 4 or 5 ppm.

- A. Dissolved oxygen      C. Solubility of oxygen  
B. Thermal stratification      D. None of the above

31. \_\_\_\_\_ is essential for the support of fish and other aquatic life and aids in the natural decomposition of organic matter.

- A. Dissolved oxygen      C. Solubility of oxygen  
B. Thermal stratification      D. None of the above

### **Secondary Standard**

32. TDS is most often measured in parts per million (ppm) or milligrams per liter of water (mg/L). The normal TDS level ranges from \_\_\_\_\_.

- A. 50 ppm to 1,000 ppm      C. 50 ppm to 100 ppm  
B. 5 ppm to 10 ppm      D. None of the above

33. The Environmental Protection Agency (EPA), which is responsible for drinking water regulations in the United States, has identified TDS as a secondary standard, meaning that it is a voluntary guideline. While the United States set legal standards for many harmful substances, TDS, along with other contaminants that cause aesthetic, cosmetic, and technical effects, has only a guideline.

- A. True      B. False

### Langelier Saturation Index

34. The Langelier Saturation index (LSI) is an evenness scale derived from the theoretical concept of saturation and provides an indicator of the degree of saturation of water with respect to calcium carbonate. It can be shown that the Langelier saturation index (LSI) approximates the base 10 logarithm of the \_\_\_\_\_ saturation level.

- A. Magnesium carbonate      C. Calcite  
B. Calcium carbonate      D. None of the above

35. The Langelier saturation level approaches the concept of saturation using pH as a main variable. The LSI can be interpreted as the pH change required to bring water to \_\_\_\_\_.

- A. Saturation level(s)      C. Equilibrium  
B. Stratification      D. None of the above

### More on the Stage 2 DBP Rule

36. 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 DBP rule      C. Long Term 2 Enhanced Surface Water Treatment Rule  
B. Stage 1 DBPR      D. None of the above

37. Safe Drinking Water Act (SDWA) has been highly effective in protecting public health and has evolved to respond to new and emerging threats to safe drinking water.

- A. True      B. False

38. Which of the following is one of the major public health advances in the 20th century?

- A. Disinfection of drinking water      C. Amendments to the SDWA  
B. Water distribution      D. None of the above

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

- A. Cryptosporidium      C. Protozoa  
B. E. coli host culture      D. None of the above

### What are Disinfection Byproducts (DBPs)?

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

- A. Chloramines      C. Disinfection byproducts (DBPs)  
B. Humic and fulvic acids      D. None of the above

41. Total trihalomethanes and haloacetic acids are widely occurring \_\_\_\_\_ formed during disinfection with chlorine and chloramine.

- A. Gases      C. Classes of DBPs  
B. Substances      D. None of the above

### **Are THMs and HAAs the only disinfection byproducts?**

42. The presence of TTHM and HAA5 is representative of the occurrence of many other chlorination DBPs; thus, an increase of TTHM and HAA5 generally indicates an increase of DBPs from chlorination.

- A. True      B. False

### **All disinfectants form DBPs in one of two reactions:**

43. Chlorine and chlorine-based compounds (halogens) react with organics in water causing the hydrogen atom to substitute other atoms, resulting in halogenated by-products.

- A. True      B. False

44. Secondary by-products are also formed when multiple disinfectants are used.

- A. True      B. False

45. The EPA Surface Water Treatment Rule (SWTR) requires systems using public water supplies from either surface water or groundwater under the direct influence of surface water to disinfect.

- A. True      B. False

### **Public Health Concerns**

46. Results from toxicology studies have shown several DBPs (e.g., bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate) to be inert to laboratory animals.

- A. True      B. False

47. Other DBPs (e.g., chlorite, bromodichloromethane, and certain haloacetic acids) have also been shown to cause adverse mutations (extra chromosomes) in laboratory animals.

- A. True      B. False

### **Disinfection Byproduct Research and Regulations Summary**

48. \_\_\_\_\_ is unquestionably the most important step in the treatment of water for drinking water supplies.

- A. DBP(s)                      C. Disinfection  
B. Turbidity (particle)      D. None of the above

49. The \_\_\_\_\_ should not be compromised because of concern over the potential long-term effects of disinfectants and DBPs.

- A. DBP(s)                      C. Microbial quality of drinking water  
B. Turbidity (particle)      D. None of the above

### **Controlling Disinfection Byproducts**

50. Treatment techniques are available that provide water suppliers the opportunity to maximize potable water safety and quality while minimizing the risk of \_\_\_\_\_.

- A. DBP risks                      C. Disinfectants and DBPs  
B. Turbidity (particle)      D. None of the above

51. Generally, the best approach to reduce \_\_\_\_\_ is to remove natural organic matter precursors prior to disinfection.

- A. DBP(s)                      C. DBP formation  
B. Turbidity (particle)      D. None of the above

**The EPA guidance discusses three processes to effectively remove natural organic matter prior to disinfection: Coagulation and Clarification**

52. Most treatment plants optimize their coagulation process for \_\_\_\_\_ removal.

- A. Inorganic coagulants
- B. Most contaminants
- C. Turbidity (particle)
- D. None of the above

53. Coagulation processes can also be optimized for natural organic matter removal with higher doses of \_\_\_\_\_ (such as alum or iron salts), and optimization of pH.

- A. THMs and HAAs
- B. Inorganic coagulants
- C. Natural organic matter
- D. None of the above

**Absorption**

54. Activated carbon can be used to absorb \_\_\_\_\_ that react with disinfectants to form byproducts.

- A. Inorganic coagulants
- B. Most contaminants
- C. Soluble organics
- D. None of the above

**Water Microbiology Section**

55. Who was the famous German scientist with the British surgeon Joseph Lister that developed techniques for growing cultures of single organisms that allowed the assignment of specific bacteria to specific diseases?

- A. Louis Pasteur
- B. Martinus Beijerinck
- C. Robert Koch
- D. None of the above

56. The first experimental transmission of a viral infection was accomplished by which German scientist when he demonstrated that extracts from infected tobacco leaves could transfer tobacco mosaic disease to a new plant, causing spots on the leaves?

- A. Louis Pasteur
- B. Adolf Mayer
- C. Wendell Meredith Stanley
- D. None of the above

57. Who was the French-Canadian scientist who discovered that viruses of bacteria, which he named bacteriophage, could make holes in a culture of bacteria?

- A. Louis Pasteur
- B. Félix H. d'Hérelle
- C. Walter Reed
- D. None of the above

58. In 1900, the American bacteriologist \_\_\_\_\_ and colleagues recognized yellow fever virus as the first human filterable agent.

- A. Walter Reed
- B. Wendell Meredith Stanley
- C. Louis Pasteur
- D. None of the above

59. Viruses were once referred to as filterable agents, and gradually the term virus (Latin for "\_\_\_\_\_ " or "poison") was employed strictly for this new class of infectious agents.

- A. Slimy liquid
- B. Bacteriophages
- C. Macroorganisms
- D. None of the above

60. Through the 1940s and 1950s, many critical discoveries were made about viruses through the study of \_\_\_\_\_ because of the ease with which the bacteria they infect could be grown in the laboratory.

- A. Cell culture systems
- B. Bacteriophages
- C. Macroorganisms
- D. None of the above

61. Two German biologists \_\_\_\_\_ and Theodore Schwann proposed the "Cell theory" in 1838. According to this theory, all living things are composed of cells.
- A. Robert Hooke                      C. Rudolph Virchow  
B. Matthias Schleiden                D. None of the above
62. \_\_\_\_\_ completed the cell theory with the idea that all cells must arise from preexisting cells.
- A. Theodore Schwann                C. Rudolph Virchow  
B. Matthias Schleiden                D. None of the above

### **Bacteria**

63. In the world of bacteria, there is even a species of *Deinococcus radiodurans*—that can withstand blasts of radiation 10 times greater than would kill a human being.
- A. True                      B. False
64. "Bacteria" is a plural word. The singular for this word is "bacterium" (bacter = rod, staff).
- A. True                      B. False
65. Bacteria are prokaryotes (Kingdom Monera), which means that they have No true nucleus. They do have one chromosome of double-stranded DNA in a ring.
- A. True                      B. False
66. There are some bacteria relatives that can do photosynthesis--they don't have chloroplasts, but their \_\_\_\_\_ and other needed chemicals are built into their cell membranes.
- A. Chlorophyll                      C. Cellulose  
B. An organelle                      D. None of the above
67. Bacteria consist of only \_\_\_\_\_?
- A. A single cell                      C. Double-stranded DNA  
B. An organelle                      D. None of the above
68. Pathogens have been found that can live in temperatures above the boiling point and in cold that would freeze your blood. They "eat" everything from sugar and starch to sunlight, sulfur and iron.
- A. True                      B. False

### **Prokaryotes**

69. The only prokaryotes are Bacteria and archaea all other life forms are \_\_\_\_\_ creatures whose cells have nuclei.
- A. Bacteria                      C. Eukaryotes  
B. Microorganism                      D. None of the above

### **Early Origins**

70. Bacteria, are basically one of three different shapes, some are rod - or stick-shaped and called Bacilli. Others are shaped like little balls and called cocci (cox-eye).
- A. True                      B. False
71. Bacterial cells exist as cluster together to form pairs, chains, squares or other groupings.
- A. True                      B. False
72. The mitochondria that make energy for your body cells is one example of?
- A. Chloroplasts                      C. Chemical battery  
B. Cellulose                      D. None of the above



73. A single teaspoon of topsoil may contain more than a billion (1,000,000,000) bacteria.

- A. True      B. False

### Peptidoglycan

74. The amount and location of the \_\_\_\_\_ are different in the two possible types of cell walls, depending on the species of bacterium.

- A. Capsule                      C. Cytoplasmic granules  
B. Peptidoglycan              D. None of the above

75. Penicillin, inhibit the formation of the chemical cross linkages needed to make?

- A. Bacteria                      C. Cytoplasmic granules  
B. Peptidoglycan              D. None of the above

76. If a person stops an antibiotic, any living bacteria could start making \_\_\_\_\_, grow, and reproduce.

- A. Bacteria                      C. Cytoplasmic granules  
B. Peptidoglycan              D. None of the above

### Gram Stain

77. Two possible types of \_\_\_\_\_ may have more peptidoglycan than the other.

- A. Bacteria                      C. Bacterial cell walls  
B. Chemical cross linkages   D. None of the above

78. In the Gram process, the amount of peptidoglycan in the cell walls of the bacteria under study will determine how those bacteria absorb the dyes with which they are stained; thus, bacterial cells can be Gram<sup>+</sup> or Gram<sup>-</sup>.

- A. True      B. False

79. Which type of bacteria have simpler cell walls with lots of peptidoglycan, and stain a dark purple color?

- A. Aerobic                      C. Gram<sup>+</sup>  
B. Gram<sup>-</sup>                      D. None of the above

80. Which type of bacteria have more complex cell walls with less peptidoglycan, thus absorb less of the purple dye used and stain a pinkish color?

- A. Aerobic                      C. Gram<sup>+</sup>  
B. Gram<sup>-</sup>                      D. None of the above

81. Which type of bacteria often incorporate toxic chemicals into their cell walls, and thus tend to cause worse reactions in our bodies?

- A. Aerobic                      C. Gram<sup>+</sup>  
B. Gram<sup>-</sup>                      D. None of the above

### Two types of cells- Prokaryotes and Eukaryotes

82. Which of the following exhibits all the characteristics of life but it lacks the complex system of membranes and organelles?

- A. Prokaryotic cell              C. Coliform bacteria  
B. Enteric-like bacteria        D. None of the above

### Structure of a Eukaryotic Cell

83. Cell Membrane: The cell is enclosed and held intact by the cell membrane/plasma membrane/cytoplasmic membrane and is composed of large molecules of proteins and?

- A. Cytoplasmic granules
- B. Cell wall
- C. Phospholipids
- D. None of the above

84. Which of the following is selectively permeable?

- A. Cytoplasmic granules
- B. DNA and proteins
- C. Cellular membrane
- D. None of the above

### Nucleus

85. Which of the following is enclosed in the nuclear membrane and contains chromosomes?

- A. Chromosomes
- B. Nucleus
- C. Macromolecular polymer-peptidoglycan
- D. None of the above

86. A single circular DNA molecule consists of many genes. A gene is a coiled unit made up of Cytoplasmic granules and proteins that code for or determine a particular characteristic of an individual organism.

- A. True
- B. False

### Cytoplasm

87. Cytoplasm is comprised of a semifluid gelatinous nutrient matrix and cytoplasmic organelles including endoplasmic reticulum, ribosomes, Golgi complex, mitochondria, \_\_\_\_\_, microtubules, lysosomes and vacoules.

- A. Chromosomes
- B. Procaryotes
- C. Centrioles
- D. None of the above

### Cilia and Flagella

88. Which of the following reflect cells that possess relatively long and thin structures called Flagella?

- A. Eukaryotic
- B. Paramecium
- C. Prokaryotic
- D. None of the above

89. Which of the following are organs of locomotion but are shorter and more numerous?

- A. Cytoplasmic granules
- B. Cilia
- C. Flagellin
- D. None of the above

### Structure of a Procaryotic Cell

90. All bacteria are prokaryotes and are simple cells and they divide by binary fission.

- A. True
- B. False

### Chromosome

91. The chromosome of a prokaryotic cell normally consists of a single circular \_\_\_\_\_ and serves as the control center of the bacterial cell.

- A. Cytoplasmic granules
- B. DNA molecule
- C. Singular circular DNA molecule
- D. None of the above

92. A characteristic bacterial chromosome contains approximately 10,000 genes.

- A. True
- B. False

### Cytoplasm

93. Which of the following is a semi-liquid that surrounds the chromosome and is contained within the plasma membrane?
- A. Eukaryotic cell membrane                      C. Macromolecular polymer-peptidoglycan  
B. Cytoplasm    D. None of the above

### Capsules

94. Some bacteria have a layer of material outside the?
- A. Capsule    C. Membrane/cytoplasmic membrane  
B. Cell wall    D. None of the above
95. Which of the following terms consist of complex sugars or polysaccharides combined with lipids and proteins?
- A. Capsule    C. Membrane/cytoplasmic membrane  
B. Cell wall    D. None of the above

### Flagella

96. Amphitrichous bacteria-bacteria with \_\_\_\_\_.
- A. One flagellum                                      C. One flagellum at each end  
B. A single polar flagellum                      D. None of the above
97. Monotrichous bacteria-bacteria with \_\_\_\_\_.
- A. One flagellum                                      C. Flagella over the entire surface  
B. A single polar flagellum                      D. None of the above
98. Flagella are \_\_\_\_\_ that enable the bacteria to move.
- A. Forming spores                                      C. False feet  
B. Cilia    D. None of the above
99. Which term is motile while non-flagellated bacteria are generally non-motile?
- A. Bacteria    C. Flagellated bacteria  
B. Peptidoglycan                                      D. None of the above
100. Peritrichous bacteria- possess?
- A. One flagellum                                      C. Flagella over the entire surface  
B. A single polar flagellum                      D. None of the above
101. Lophotrichous bacteria-possess at one or both ends?
- A. One flagellum                                      C. Flagella over the entire surface  
B. Tuft of flagella                                      D. None of the above

### Pili or Fimbriae

102. Pili or Fimbriae allow the bacteria to attach to other bacteria or to membrane surfaces such as intestinal linings or?
- A. Chromosomes                                      C. Pili or Fimbriae  
B. RBC    D. None of the above
103. Which of the following terms is used to transfer genetic material from one bacteria cell to another?
- A. Chromosomes                                      C. Pili or Fimbriae  
B. RBC    D. None of the above

### Spores

104. Which of the following is enclosed in several protein coats that are resistant to heat, drying and most chemicals?
- A. Spores
  - B. Genetic material
  - C. Spore formation
  - D. None of the above

### Bacterial Nutrition

105. Which of the following is needed in substantial quantities, but some seem to need it in trace amounts?
- A. Iron, Zinc, Cobalt
  - B. Nitrogen
  - C. Calcium
  - D. None of the above

### Fastidious

106. Which of the following may synthesize every complex molecule they need from the basic minerals?
- A. Viruses
  - B. Bacteria
  - C. Centrioles
  - D. None of the above

### What in the World is an Eukaryote?

107. Which of the following terms represents animals, plants, and fungi, which are mostly multicellular, as well as various other groups called protists, many of which are unicellular?
- A. Eukaryote(s)
  - B. Bacteria
  - C. Prokaryote(s)
  - D. None of the above

108. The eukaryotes share a common origin, and are treated formally as a super kingdom, empire, or domain.
- A. True
  - B. False

### Eukaryotic Cells

109. According to the text, Eukaryotic cells are generally much larger than \_\_\_\_\_, typically with a thousand times their volumes.

- A. Macroorganisms
- B. Bacteria
- C. Prokaryote(s)
- D. None of the above

110. Many cells ingest food and other materials through a process of osmosis, where the outer membrane invaginates and then pinches off to form a Flagella.
- A. True
  - B. False

111. Which of the following is surrounded by a double membrane with pores that allow material to move in and out?

- A. The nucleus
- B. Flagella
- C. Cilia
- D. None of the above

### Protozoan Reservoirs of Disease

112. Which of the following represents the causative organism of Legionnaires' disease?

- A. Amoebae
- B. Viruses
- C. Bacterium Legionella pneumophila
- D. None of the above

113. The presence of bacteria in the cytoplasm of protozoa is well known, whereas that of viruses is less frequently reported. Most of these reports simply record the presence of bacteria or viruses and assume some sort of symbiotic relationship between them and the Protozoa.

- A. True
- B. False

114. Which of the following were shown to not only survive but also to multiply in the cytoplasm of free-living, nonpathogenic protozoa?

- A. Human pathogens
- B. Marine protozoa
- C. Freshwater protozoan
- D. None of the above

115. Protozoa are the natural habitat for certain pathogenic bacteria.

- A. True
- B. False

### Symbionts

116. Which of the following terms inhabit the rumen and reticulum of ruminates and the cecum and colon of equids?

- A. Ciliates
- B. Marine protozoa
- C. Freshwater protozoan
- D. None of the above

### Data on Protozoa

117. Most ecologists who include \_\_\_\_\_ in their studies of aquatic habitats do not identify them, even if they do count and measure them for biomass estimates.

- A. Protozoa
- B. Marine protozoa
- C. Freshwater protozoan
- D. None of the above

118. Which of the following terms represents an organism of humans, domestic animals, and wildlife are better known although no attempt has been made to compile this information into a single source?

- A. Protozoa
- B. Marine protozoa
- C. Parasitic protozoa
- D. None of the above

### Ecological Role of Protozoa

119. Which of the following terms represents an organism that is frequently overlooked, these play an important role in many communities where they occupy a range of trophic levels?

- A. Protozoa
- B. Marine protozoa
- C. Parasitic protozoa
- D. None of the above

120. According to the text, these are predators of unicellular or filamentous algae, \_\_\_\_\_, and microfungi, protozoa play a role both as herbivores and as consumers in the decomposer link of the food chain.

- A. Ciliates
- B. Bacteria
- C. Freshwater protozoan
- D. None of the above

121. The ecological role of Foraminifera in the transfer of bacterial and algal production to successive trophic levels is important.

- A. True
- B. False

### Factors Affecting Growth and Distribution

122. Which of the following reproduce by cell division?

- A. Most free-living protozoa
- B. Parasites
- C. Zygotes
- D. None of the above

### Protozoa

123. When protozoa are in the form of \_\_\_\_\_, they actively feed and grow.

- A. Cysts
- B. Trophozoites
- C. Apicomplexans
- D. None of the above

124. Which of the following play a role both as herbivores and as consumers in the decomposer link of the food chain?
- A. Protozoa                      C. Trophozoites and cysts  
B. Microinvertebrates        D. None of the above
125. Which of the following are an important food source for microinvertebrates?
- A. Meiofauna                    C. Microinvertebrates  
B. Protozoa                      D. None of the above
126. According to the text, the process by which the protozoa takes its cyst form is called encystation, while the process of transforming back into \_\_\_\_\_ is called excystation.
- A. Cysts                          C. Apicomplexans  
B. Trophozoite                  D. None of the above
127. Protozoa occupy a range of trophic levels, as predators, they prey upon unicellular or filamentous algae, bacteria, and?
- A. Microfungi                  C. Trophozoites and cysts  
B. Parasites                      D. None of the above
128. Most protozoa exist in 5 stages of life which are in the form of \_\_\_\_\_.
- A. Zygotes                        C. Trophozoites and cysts  
B. Parasites                      D. None of the above
129. Which of the following can survive harsh conditions, such as exposure to extreme temperatures and harmful chemicals, or long periods without access to nutrients, water, or oxygen for a period of time.
- A. Meiofauna                    C. Microinvertebrates  
B. Protozoa                      D. None of the above
130. An individual protozoan is?
- A. Apicomplexans              C. Hermaphroditic  
B. Trophozoite                  D. None of the above

### Classification

131. Protozoa were usually grouped in the kingdom of Protista together with the plant-like algae and fungus-like water molds and slime molds. In the 21st-century systematics, protozoans, along with ciliates, mastigophorans, and apicomplexans, are arranged as animal-like protists.

- A. True                      B. False

132. Protozoans are neither Animalia nor Metazoa.

- A. True                      B. False

### Bacteriophage

133. Bacteriophages are much larger than the bacteria they destroy.

- A. True                      B. False

134. Phages are estimated to be the most widely distributed and diverse entities in the biosphere.

- A. True                      B. False

135. Phages are not usually found in all reservoirs populated by bacterial hosts, such as soil or the intestine of animals.

- A. True      B. False

### **Amoebas**

136. Pseudopods are used to capture prey; they simply engulf the food. They can detect the kind of prey and use different?

- A. Cells                      C. Engulfing tactics  
B. Cytoplasm                D. None of the above

### **Protozoa Information**

137. Which of the following have been documented from almost every type of soil and in every kind of environment, from the peat-rich soil of bogs to the dry sands of deserts?

- A. Soil-dwelling protozoa      C. Soil-loving Amoeba  
B. Protozoan fauna            D. None of the above

138. In freshwater habitats, the foraminifera and radiolaria common in marine environments are absent or low in numbers while \_\_\_\_\_ exist in greater numbers.

- A. Microsporidia                C. Protozoan fauna  
B. Testate amoebae            D. None of the above

### **Environmental Quality Indicators**

139. Polluted waters often have a rich and characteristic?

- A. Microsporidia                C. Protozoan fauna  
B. Testate amoebae            D. None of the above

### **Symbiotic Protozoa**

#### **Parasites**

140. Which term means a unique group of obligate, intracellular parasitic protozoa?

- A. Microsporidia                C. Protozoan fauna  
B. Testate amoebae            D. None of the above

141. There are four different genera of microsporidia (Encephalitozoon, Nosema, Pleistophora, and \_\_\_\_\_).

- A. Foraminifera                C. Enterocytozoon  
B. Protozoan fauna            D. None of the above

142. The presence of bacteria in \_\_\_\_\_ is well known, whereas that of viruses is less frequently reported.

- A. Foraminifera                C. Cytoplasm of protozoa  
B. Protozoan fauna            D. None of the above

143. The presence of bacteria or viruses and assume some sort of symbiotic relationship between them and the?

- A. Protozoa                      C. Free-living amoebae  
B. Bacteria or viruses        D. None of the above

144. Some human pathogens were shown to not only survive but also to multiply in the cytoplasm of free-living?

- A. Beneficial symbionts        C. Nonpathogenic protozoa  
B. Organisms                    D. None of the above

145. To date, the focus of attention has been on the \_\_\_\_\_, the causative organism of Legionnaires' disease; these bacteria live and reproduce in the cytoplasm of some free-living amoebae.

- A. Free-living amoebae
- B. Bacteria or viruses
- C. Bacterium Legionella pneumophila
- D. None of the above

### Symbionts

146. According to the text, which of these creatures are harmless or even beneficial symbionts?

- A. Protozoa
- B. Viruses
- C. Bacterium Legionella pneumophila
- D. None of the above

### Contractile Vacuoles

147. Many protozoa have \_\_\_\_\_, which collect and expel excess water, and extrusomes, which expel material used to deflect predators or capture prey.

- A. Flagella
- B. Contractile vacuoles
- C. Vacuole or tonoplast
- D. None of the above

148. In higher plants, most of a cell's volume is taken up by a central vacuole or tonoplast, which maintains its?

- A. Kinetosome or centriole
- B. Vacuole or tonoplast
- C. Osmotic pressure
- D. None of the above

149. Which of the following have slender motile projections, usually called flagella when long and cilia when short?

- A. Eukaryote(s)
- B. Bacteria
- C. Prokaryote(s)
- D. None of the above

150. Which bug/creature/organism are entirely distinct from prokaryotic flagella?

- A. Eukaryote(s)
- B. Bacteria
- C. Prokaryote(s)
- D. None of the above

151. Flagella also may have hairs or mastigonemes, scales, connecting membranes, and internal rods, their interior is continuous with the?

- A. Flagella
- B. Haptonema
- C. Cell's cytoplasm
- D. None of the above

### Centrioles

152. Centrioles are often present even in cells and groups that do not have flagella. They generally occur in groups of one or two, called \_\_\_\_\_ that give rise to various microtubular roots.

- A. Kinetosome or centriole
- B. Kinetids
- C. Beneficial symbionts
- D. None of the above

153. These form a primary component of the \_\_\_\_\_, and are often assembled over the course of several cell divisions, with one flagellum retained from the parent and the other derived from it.

- A. Centrioles
- B. Haptonema
- C. Cytoskeletal structure
- D. None of the above

154. Which of the following may also be associated in the formation of a spindle during nuclear division?

- A. Centrioles
- B. Haptonema
- C. Cytoskeletal structure
- D. None of the above



155. Which of the following produces axopodia that is used in flotation or to capture prey, and the haptophytes, which have a peculiar flagellum-like organelle called the haptonema?

- A. Paramecium
- B. Haptonema
- C. Radiolaria and heliozoa
- D. None of the above

### **Paramecium**

156. Which of the following are single-celled, freshwater organisms in the kingdom Protista?

- A. Paramecium
- B. Bacteria
- C. Prokaryote(s)
- D. None of the above

157. Paramecium exist in an environment in which the osmotic concentration in their external environment is much lower than that in their?

- A. Contractile vacuoles
- B. Haptonema
- C. Cytoplasm
- D. None of the above

158. If Paramecium is to maintain \_\_\_\_\_, water must be continually pumped out of the cell at the same rate at which it moves in.

- A. Life
- B. Happiness
- C. Homeostasis
- D. None of the above

159. Osmoregulation, is carried out by two organelles in Paramecium known as?

- A. Kinetosome or centriole
- B. Vacuole or tonoplast
- C. Contractile vacuoles
- D. None of the above

## **Bacteriological Monitoring Section**

### **Organisms Descriptors and Meanings**

160. Organo means...

- A. Rock
- B. Organic
- C. Light
- D. None of the above

161. Photo means...

- A. Feed or nourish
- B. Other (Organic carbon)
- C. Light
- D. None of the above

162. Troph means...

- A. Feed or nourish
- B. Other (Organic carbon)
- C. Light
- D. None of the above

163. Litho means...

- A. Rock
- B. Organic
- C. Light
- D. None of the above

164. Auto means...

- A. Without air
- B. With air
- C. Self (Inorganic carbon)
- D. None of the above

165. Facultative means...

- A. Without air
- B. With air or without air
- C. Self (Inorganic carbon)
- D. None of the above

166. Aerobic means...

- A. Without air
- B. With air
- C. Self (Inorganic carbon)
- D. None of the above

167. Chemo means...
- A. Rock
  - B. Organic
  - C. Chemical
  - D. None of the above

168. Hetero means...
- A. Feed or nourish
  - B. Other (Organic carbon)
  - C. Light
  - D. None of the above

169. Anaerobic means...
- A. Without air
  - B. With air
  - C. Self (Inorganic carbon)
  - D. None of the above

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

170. Which of the following like salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

171. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

172. Which of the following, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife?

- A. Microbial contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

173. Which of the following can be synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can come from gas stations, urban stormwater run-off, and septic systems?

- A. Organic chemical contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

174. Which of the following can be naturally occurring or be the result of oil and gas production and mining activities?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

**Background**

175. Coliform bacteria and chlorine residual are the only routine sampling and monitoring requirements for small ground water systems with chlorination. The coliform bacteriological sampling is governed by the Coliform Reduction amendment of the SDWA.

- A. True
- B. False

**TCR**

176. The TCR recommends most of the Public Water Systems (PWS) to monitor their distribution system for bacteria according to the written sample sitting plan for that system.

- A. True
- B. False

177. The sample sitting plan identifies sampling frequency and locations throughout the distribution system that are selected to be representative of conditions in the entire system.

- A. True      B. False

178. Coliform contamination may occur anywhere in the system, possibly due to problems such as; high-pressure conditions, line fluctuations, or wells, and therefore routine monitoring is required.

- A. True      B. False

### **Routine Sampling Requirements**

179. Total coliform samples must be collected by PWSs at sites which are representative of water quality throughout the distribution system according to a written sample siting plan subject to state review and revision.

- A. True      B. False

180. For PWSs collecting more than one sample per month, collect total coliform samples at regular intervals throughout the month, except that ground water systems serving 4,900 or fewer people may collect all required samples on a single day if the samples are taken from different sites.

- A. True      B. False

181. Each total coliform-positive (TC+) routine sample must be tested for the presence of heterotrophic bacteria.

- A. True      B. False

182. If any TC+ sample is also E. coli-positive (EC+), then the EC+ sample result must be reported to the state by the end of the month that the PWS is notified.

- A. True      B. False

183. If any routine sample is TC+, repeat samples are required. – PWSs on quarterly or annual monitoring must take a minimum of one additional routine samples (known as additional routine monitoring) the quarter following a TC+ routine or repeat sample.

- A. True      B. False

184. Reduced monitoring is general available for PWSs using only surface water and serving 1,000 or fewer persons that meet certain additional PWS criteria.

- A. True      B. False

### **Dangerous Waterborne Microbes**

185. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. The disease can be severe or fatal for people with severely weakened immune systems.

- A. Coliform Bacteria    C. Giardia lamblia  
B. Cryptosporidium    D. None of the above

186. Which of the following are not necessarily agents of disease, fecal coliform bacteria may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria.

- A. Fecal coliform bacteria    C. Shigella dysenteriae  
B. Cryptosporidium          D. None of the above

(S) Means the answer can be plural or singular in nature

187. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, and cramps)?

- A. Coliform Bacteria
- B. Cryptosporidium
- C. Protozoa
- D. None of the above

188. Which of the following is a species of the rod-shaped bacterial genus *Shigella*?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. *Shigella dysenteriae*
- D. None of the above

189. Which of the following can cause bacillary dysentery?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. *Shigella*
- D. None of the above

190. Which of the following are Gram-negative, non-spore-forming, facultatively anaerobic, non-motile bacteria?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. *Shigellae*
- D. None of the above

191. Which of the following are microscopic organisms that live in the intestines of warm-blooded animals? They also live in the waste material, or feces, excreted from the intestinal tract. When fecal coliform bacteria are present in high numbers in a water sample, it means that the water has received fecal matter from one source or another.

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. *Shigella dysenteriae*
- D. None of the above

192. Which of the following are common in the environment and are generally not harmful? However, the presence of these bacteria in drinking water are usually a result of a problem with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.

- A. Coliform Bacteria
- B. Cryptosporidium
- C. *Giardia lamblia*
- D. None of the above

193. Which of the following are bacteria whose presence indicates that the water may be contaminated with human or animal wastes? Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.

- A. Fecal Coliform and *E. coli*
- B. Cryptosporidium
- C. *Shigella dysenteriae*
- D. None of the above

### **Bacteriological Monitoring Introduction**

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

- A. Indicator bacteria
- B. Amoebas
- C. Viruses
- D. None of the above

195. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?

- A. Cryptosporidium
- B. Protozoa
- C. *Escherichia coli* (*E. coli*)
- D. None of the above

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

- A. Contamination
- B. Colloids
- C. Coliform bacteria
- D. None of the above

## Bacteria Sampling

197. Water samples for \_\_\_\_\_ must always be collected in a sterile container.
- A. Amoebas
  - B. Bacteria tests
  - C. Viruses
  - D. None of the above

## Methods

198. The MMO-MUG test, a product marketed as \_\_\_\_\_, is the most common. The sample results will be reported by the laboratories as simply coliforms present or absent.
- A. Colilert
  - B. Coliform
  - C. Total coliform analysis
  - D. None of the above

## Microbial Regulations

199. One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter pathogens in drinking water is the Surface Water Treatment Rule.
- A. True
  - B. False

200. Among Surface Water Treatment Rule provisions, the rule requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of protozoa and coliform bacteria by at least 99.9% and 99.99%, respectively.
- A. True
  - B. False

201. The Surface Water Treatment Rule suggests treatment criteria to assure that these performance recommendations are met; they may include turbidity limits, disinfectant residual and disinfectant contact time conditions.
- A. True
  - B. False

## Basic Types of Water Samples

202. It is important to properly identify the type of sample you are collecting.
- A. True
  - B. False

## The three (3) primary types of samples are:

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

- A. Repeat
- B. Special
- C. Routine
- D. None of the above

204. A PWS fails to take every required repeat sample after any single TC+ sample

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

205. A PWS incurs an E. coli MCL violation.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

206. A PWS collecting fewer than 40 samples per month has 2 or more TC+ routine/ repeat samples in the same month.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

207. A PWS collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are TC+.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

208. A PWS has a second Level 1 Assessment within a rolling 12-month period.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

209. A PWS on state-approved annual monitoring has a Level 1 Assessment trigger in 2 consecutive years.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

210. Noncommunity and nontransient noncommunity public water systems will sample at the same frequency as a like sized community public water system if:

1. It has more than 1,000 daily population and has ground water as a source, or
2. It serves 25 or more daily population and utilizes surface water as a source or ground water under the direct influence of surface water as its source.

- A. True
- B. False

### Maximum Contaminant Levels (MCLs)

211. There are two types of MCL violations for coliform bacteria. The first is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli.

- A. True
- B. False

### Positive or Coliform Present Results

212. If you are notified of a positive coliform test result you need to contact either the Drinking Water Program or your local county health department within 72 hours, or by the next business day after the MCL compliance violation

- A. True
- B. False

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

- A. Perform routine procedures
- B. Repeat sampling immediately
- C. Corrective measures
- D. None of the above

### Heterotrophic Plate Count HPC

214. Heterotrophic Plate Count (HPC) --- formerly known as the Bac-T plate, 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

### Heterotrophic Plate Count (Spread Plate Method)

215. Which of the following provides a technique to quantify the bacteriological activity of a sample?

- A. Colonies
- B. Agar
- C. Heterotrophic Plate Count
- D. None of the above

(S) Means the answer can be plural or singular in nature

### Total Coliforms

216. 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

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

- A. 40            C. 200  
B. 100          D. None of the above

### The following are acute violations:

218. Which determines a violation of nitrate?

- A. Presence    C. MCLG  
B. MCL        D. None of the above

### Revised Total Coliform Rule (RTCR) Summary

219. EPA published the Revised Total Coliform Rule (RTCR) in the Federal Register (FR) on February 13, 2013 (78 FR 10269). It is the revision to the 1989 Total Coliform Rule (TCR).

- A. True      B. False

220. The RTCR upholds the purpose of the 1989 TCR to protect public health by ensuring the duplicity of the drinking water distribution system and monitoring for the absence of microbial contamination.

- A. True      B. False

221. The RTCR establishes criteria for systems to qualify for and stay on for special increased monitoring, which could reduce water system problems for better system operation.

- A. True      B. False

222. The water provider shall develop and follow a sample-siting plan that designates the PWS's collection schedule. This includes location of \_\_\_\_\_.

- A. Routine and repeat water samples      C. Microbial contamination  
B. Reduced monitoring                      D. Repeat water samples

223. The water provider shall collect \_\_\_\_\_ on a regular basis (monthly, quarterly, annually). Have samples tested for the presence of total coliforms by a state certified laboratory.

- A. Routine water samples    C. Microbial contamination  
B. Reduced monitoring      D. Repeat water samples

224. PN is required for violations incurred. Within required timeframes, the PWS must use the required health effects language and notify the public if they did not comply with certain requirements of the RTCR. The type of \_\_\_\_\_ depends on the severity of the violation.

- A. CCR(s)    C. MCL violation  
B. PN        D. TC+ routine or repeat sample

225. The RTCR requires public water systems that are vulnerable to microbial contamination to identify and fix problems.

- A. True      B. False

226. The water provider shall collect repeat samples (at least 3) for each TC+ positive routine sample.

- A. True      B. False

227. For PWSs on quarterly or annual routine sampling, collect additional routine samples (at least 3) in the month after a \_\_\_\_\_.

- A. CCR(s)      C. Total coliform positive samples  
B. PN      D. TC+ routine or repeat sample

228. PWSs incur violations if they do not comply with the requirements of the RTCR. The violation types are essentially the same as under the TCR with few changes. The biggest change is no acute or monthly MCL violation for \_\_\_\_\_ only.

- A. CCR(s)      C. Total coliform positive samples  
B. PN      D. TC+ routine or repeat sample

229. Community water systems (CWSs) must use specific language in their CCRs when they must conduct an assessment or if they incur \_\_\_\_\_.

- A. CCR(s)      C. An E. coli MCL violation  
B. PN      D. TC+ routine or repeat sample

230. The water provider shall analyze all \_\_\_\_\_ that are total coliform positive (TC+) for E. coli.

- A. Routine or repeat water samples      C. Microbial contamination  
B. Reduced monitoring      D. Repeat water samples

231. The RTCR requires public water systems (PWSs) to meet a legal limit for E. coli, as demonstrated by required monitoring.

- A. True      B. False

232. The RTCR suggests the frequency and timing of required microbial testing based on, public water type and source water type.

- A. True      B. False

### Disinfection Key

233. The RTCR requires 99.99% or 4 log inactivation of \_\_\_\_\_.

- A. Enteric viruses      C. Giardia lamblia cysts  
B. Crypto      D. None of the above

234. The RTCR requires 99% or 2 log inactivation of \_\_\_\_\_.

- A. Enteric viruses      C. Giardia lamblia cysts  
B. Crypto      D. None of the above

235. The RTCR requires 99.9% or 3 log inactivation of \_\_\_\_\_.

- A. Enteric viruses      C. Giardia lamblia cysts  
B. Crypto      D. None of the above

236. The RTCR requires the chlorine residual leaving the plant must be = or \_\_\_\_\_ mg/L and measurable throughout the system.

- A. > 0.2      C. 0.2  
B. 2.0      D. None of the above



## Waterborne Pathogen Section

### Pathogen Section

237. 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. Cause intestinal illness
- B. Are mild in nature
- C. Will cause fatalities
- D. None of the above

### How Diseases are Transmitted.

238. 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. None of the above

### Protozoan Caused Diseases

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

- A. Hepatitis A
- B. E.coli
- C. Protozoan pathogens
- D. None of the above

240. Some of the parasites enter the environment in a dormant form, with a protective cell wall, called a?

- A. Lamblia
- B. Shell
- C. Cyst
- D. None of the above

### Giardia lamblia

241. Which of the following bugs has been responsible for more community-wide outbreaks of disease in the U.S. than any other, and drug treatment are not 100% effective?

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Giardiasis
- D. None of the above

242. All of these diseases, with the exception of \_\_\_\_\_, have one symptom in common: diarrhea. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact.

- A. HIV infection
- B. Giardiasis
- C. Hepatitis A
- D. None of the above

### Primary Waterborne Diseases Section

243. Humans are the reservoir for the Salmonella typhi pathogen, which causes diarrheal illness, and also known as?

- A. Campylobacter
- B. Shigella dysenteriae
- C. Typhoid fever
- D. None of the above

244. Vibrio cholerae, the basics. It's a virus. It causes diarrheal illness, also known as cholera. It is typically associated with aquatic environments, shell stocks, and human. Vibrio cholerae has also been associated with ship ballast water.

- A. True
- B. False

245. Legionnaire's disease, which causes a severe pneumonia, and the second, \_\_\_\_\_, which is a non-pneumonia illness; it's typically an influenza-like illness, and it's less severe.

- A. Pontiac fever
- B. Yellow fever
- C. Typhoid fever
- D. None of the above

246. Legionella, prevention. Legionella in water systems. Hot water in tanks should be maintained between \_\_\_\_\_ degrees Centigrade.

- A. 81 to 100
- B. 110 to 210
- C. 71 and 77
- D. None of the above

247. Shigella species, in the United States two-thirds of the shigellosis in the U.S. is caused by Shigella dysenteriae and the remaining one-third is caused by Shigella Campylobacter.

- A. True
- B. False

248. Campylobacter, the basics. It's a bacterium. It causes diarrheal illness.

- A. True
- B. False

249. Campylobacter is primarily associated with poultry, animals, and humans.

- A. True
- B. False

250. Which of the following is typically associated with soil and water?

- A. Hepatitis A virus
- B. Legionella
- C. Pseudomonas
- D. None of the above

251. Hepatitis A virus is resistant to combined chlorines, so it is important to have an adequate free chlorine residual. Fecal matter can shield Hepatitis A virus from chlorine.

- A. True
- B. False

252. Humans are the reservoir for the Norovirus. Prevention strategies for this pathogen include?

- A. Internal protection
- B. Source protection
- C. Containment protection
- D. None of the above

253. Cryptosporidium is typically associated with animals and humans, and it can be acquired through consuming fecally contaminated food, contact with fecally contaminated soil and water.

- A. True
- B. False

254. Cryptosporidium, prevention. Prevention strategies for this pathogen include source protection. A CT value of 50 is required when dealing with fecally accidents. CT equals a concentration, in parts per million, while time equals a contact time in minutes.

- A. True
- B. False

255. Giardia prevention strategies for this pathogen include \_\_\_\_\_; filtration, coagulation, and halogenation of drinking water.

- A. Internal protection
- B. Source protection
- C. Containment protection
- D. None of the above

### **Waterborne Bacterial Diseases**

256. Campylobacteriosis outbreaks have most often been associated with food, especially chicken and un-pasteurized milk, as well as un-chlorinated water. These organisms are also an important cause of "travelers' diarrhea." Medical treatment generally is not prescribed for campylobacteriosis because recovery is usually rapid.

- A. True
- B. False

257. Cholera, Legionellosis, salmonellosis, shigellosis, yersiniosis, are other bacterial diseases that can be transmitted through water. All bacteria in water are readily killed or inactivated with chlorine or other disinfectants.

- A. True
- B. False

258. Campylobacteriosis is the most common diarrheal illness caused by bacteria. Other symptoms include abdominal pain, malaise, fever, nausea and vomiting; and begin three to five days after exposure. The illness is frequently over within two to five days and usually lasts no more than 10 days.

- A. True      B. False

### Viruses - Coronavirus

259. It looks like the COVID-19 coronavirus is not able to live in water.

- A. True      B. False

### Chain of Custody Procedures

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

- A. TC Plan                      C. Samples transfer possession  
B. Sample siting plan      D. None of the above

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

- A. Shipping invoices      C. Sample siting plan  
B. Chain of custody release      D. None of the above

### Factors in Chlorine Disinfection: Concentration and Contact Time

262. Based on the work of several researchers, 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 \_\_\_\_\_ required to achieve disinfection of water at a given temperature.

- A. Chlorine concentration      C. Higher strength chlorine solutions  
B. Chlorine contact time      D. None of the above

263. The CXT formula demonstrates that if an operator chooses to decrease the chlorine concentration, the required \_\_\_\_\_ must be lengthened.

- A. Chlorine concentration      C. Contact time  
B. Temperature      D. None of the above

264. As \_\_\_\_\_ are used, contact times may be reduced.

- A. Chlorine concentration      C. Higher strength chlorine solutions  
B. Temperature      D. None of the above

## Escherichia Coli Section

### Fecal Coliform Bacteria

265. Fecal Coliform Bacteria live in the waste material, or feces, excreted from the intestinal tract. When fecal coliform bacteria are present in high numbers in a water sample, it means that the water has received \_\_\_\_\_ from one source or another.

- A. Bacteria levels      C. Enrichment concentrations  
B. Fecal matter      D. None of the above

266. Although not necessarily agents of disease, \_\_\_\_\_ may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria.

- A. Paramecium      C. Fecal coliform bacteria  
B. Bacteria      D. None of the above

### Reasons for Natural Variation

267. Which of the following is dependent on specific conditions for growth, and these conditions change quickly, fecal coliform bacteria counts are not easy to predict?

- A. Fecal matter
- B. Fecal coliform bacteria
- C. Bacterial concentrations
- D. None of the above

268. Winter rains may wash more \_\_\_\_\_ from urban areas into a stream; cool water temperatures may cause a major die-off.

- A. Fecal matter
- B. Fecal coliform bacteria
- C. Bacterial concentrations
- D. None of the above

### Expected Impact of Pollution

269. The primary sources of \_\_\_\_\_ to fresh water are wastewater treatment plant discharges, failing septic systems, and animal waste.

- A. Bacteria levels
- B. New sources of bacteria
- C. Fecal coliform bacteria
- D. None of the above

270. Bacteria levels do not necessarily decrease as a watershed develops from rural to urban. Instead, urbanization usually generates?

- A. Bacteria levels
- B. New sources of bacteria
- C. Fecal coliform bacteria concentrations
- D. None of the above

271. Farm animal manure and septic systems are replaced by domestic pets and leaking sanitary sewers. In fact, stormwater runoff in urbanized areas has been found to be surprisingly high in?

- A. Bacteria levels
- B. New sources of bacteria
- C. Fecal coliform bacteria concentrations
- D. None of the above

### Indicator Connection Varies

272. General coliforms, E. Coli, and Enterococcus bacteria are the " \_\_\_\_\_ " organisms generally measured to assess microbiological quality of water.

- A. Pathogens
- B. Fecal coliforms
- C. Indicator
- D. None of the above

### E. coli O157:H7

273. Symptoms of E. coli O157:H7 (bacterium) vary with type caused \_\_\_\_\_.

- A. Gastroenteritis
- B. Bacterium
- C. E. coli
- D. None of the above

274. Which of the following is an emerging cause of foodborne illness?

- A. Shigella dysenteriae
- B. Most illnesses
- C. E. coli O157:H7
- D. None of the above

275. Which of the following have been associated with eating undercooked, contaminated ground beef?

- A. Shigella dysenteriae
- B. Most illnesses
- C. E. coli O157:H7
- D. None of the above

276. Which term is used to express that in families and childcare centers are an important mode of transmission and that infection can also occur after drinking raw milk and after swimming in or drinking sewage-contaminated water?

- A. Preventive measures
- B. Person-to-person contact
- C. A cause of illness
- D. None of the above

277. Consumers can prevent \_\_\_\_\_ infection by thoroughly cooking ground beef, avoiding unpasteurized milk, and washing hands carefully.

- A. *Shigella dysenteriae*
- B. Some illness
- C. *E. coli* O157:H7
- D. None of the above

### What is *Escherichia coli* O157:H7?

278. Systems serving 25 to 1,000 people typically take one sample per month. Some states reduce this frequency to quarterly for ground water systems if a recent sanitary survey shows that the system is free of sanitary defects.

- A. True
- B. False

279. Larger types of systems can qualify for five samples a month.

- A. True
- B. False

280. Systems using surface water, rather than ground water, are required to take extra steps to protect against bacterial contamination because surface water sources are more vulnerable to such contamination.

- A. True
- B. False

281. Which of the following is a normal occupant of the intestines of all animals, including humans?

- A. *Shigella dysenteriae*
- B. *E. coli* O157:H7
- C. Bacterium
- D. None of the above

282. Under the Safe Drinking Water Act, the EPA requires public water systems to monitor for ?

- A. Indicators
- B. Five samples a month
- C. Coliform bacteria
- D. None of the above

283. Systems analyze first for total coliform, any time that a sample is positive for total coliform, the same sample must be analyzed for either \_\_\_\_\_.

- A. Total coliform
- B. Sanitary survey
- C. Fecal coliform or *E. coli*
- D. None of the above

284. Smaller systems must take at least five samples a month unless the state has conducted a sanitary survey – a survey in which a state inspector examines system components and ensures they will protect public health – at the system within the last five years.

- A. True
- B. False

285. *E. coli* O157:H7 is one of hundreds of strains of the *Enterococcus* bacteria.

- A. True
- B. False

286. *E. coli* O157:H7 was first recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea; the outbreak was traced to contaminated hamburgers. Since then, most infections have come from eating undercooked ground beef.

- A. True
- B. False

287. The combination of letters and numbers in the name of the bacterium refers to the specific markers found on its surface and distinguishes it from other types of *E. coli*.

- A. True      B. False

288. Currently, there are four recognized classes of \_\_\_\_\_ (collectively referred to as the EEC group) that cause gastroenteritis in humans.

- A. Total coliform      C. Fecal coliform or *E. coli*  
B. Enterovirulent *E. coli*      D. None of the above

### How is *E. coli* O157:H7 spread?

289. The \_\_\_\_\_ can be found on a small number of cattle farms and can live in the intestines of healthy cattle. Meat can become contaminated during slaughter, and organisms can be thoroughly mixed into beef when it is ground.

- A. Organism(s)      C. Hemorrhagic colitis  
B. Bacteria      D. None of the above

### Giardiasis *Giardia lamblia* Section

290. According to the text, *Giardia lamblia* (intestinalis) is a single celled animal, i.e., a protozoa, that moves with the aid of five flagella. In Europe, it is sometimes referred to as?

- A. *Lambia* intestines      C. *Lamblia* intestinalis  
B. *Giardia* intestinalis      D. None of the above

291. Giardiasis is the most frequent cause of non-bacterial diarrhea in North America. *Giardia duodenalis*, cause of giardiasis, is a one-celled, Microscopic parasite that can live in the intestines of animals and people.

- A. True      B. False

292. *Giardia* is found in every region throughout the world and has become recognized as one of the most common causes of waterborne (and occasionally foodborne) illness often referred to as "Beaver Fever."

- A. True      B. False

293. Approximately one week after ingestion of the \_\_\_\_\_, prolonged, greasy diarrhea, gas, stomach cramps, fatigue, and weight loss begin.

- A. Intestinal flora      C. Degrees of symptoms  
B. *Giardia* cysts      D. None of the above

294. Giardiasis disease runs its course in a week or two, although in some cases, the disease may linger for months, causing severe illness and weight loss. Nonetheless, the basic biology of this \_\_\_\_\_--including how it ravages the digestive tract--is poorly understood.

- A. Intestinal flora      C. Parasite  
B. *Giardia* cysts      D. None of the above

295. Which of the following uses these mitosomes in the maturation of iron-sulfur proteins rather than in ATP synthesis as is the case in mitochondria-possessing eukaryotes?

- A. Intestinal flora      C. Microaerophilic *Giardia*  
B. *Giardia* cysts      D. None of the above

### Nature of Disease

296. Which of the following may involve diarrhea within 1 week of ingestion of the cyst, which is the environmental survival form and infective stage of the organism?

- A. Human giardiasis      C. Immune deficiencies  
B. The disease mechanism      D. None of the above

297. Chronic cases, both those with defined \_\_\_\_\_ and those without, are difficult to treat.

- A. Human giardiasis
- B. The disease mechanism
- C. Immune deficiencies
- D. None of the above

298. Which of the following is unknown, with some investigators reporting that the organism produces a toxin while others are unable to confirm its existence?

- A. Human giardiasis
- B. The disease mechanism
- C. Immune deficiencies
- D. None of the above

299. Which of the following of the absorptive surface of the intestine has been proposed as a possible pathogenic mechanism, as has a synergistic relationship with some of the intestinal flora?

- A. Intestinal flora
- B. Mechanical obstruction
- C. Various degrees of symptoms
- D. None of the above

300. Which of the following have been isolated and described through analysis of their proteins and DNA; type of strain, however, is not consistently associated with disease severity?

- A. Several strains of *G. lamblia*
- B. The microaerophilic *Giardia*
- C. Human giardiasis
- D. None of the above

301. Different individuals show various degrees of symptoms when infected with the same strain, and the symptoms of an individual may vary during the \_\_\_\_\_.

- A. Course of the disease
- B. The disease mechanism
- C. Immune deficiencies
- D. None of the above

### Diagnosis of Human Illness

302. *Giardia lamblia* is frequently diagnosed by visualizing the organism, either the trophozoite (active reproducing form) or the cyst (the resting stage that is resistant to adverse environmental conditions) in stained preparations or unstained wet mounts with the aid of a microscope.

- A. True
- B. False

303. Which of the following terms that detects excretory secretory products of the organism is also available?

- A. Bac-T
- B. Lab array
- C. An enzyme linked immunosorbant assay (ELISA)
- D. None of the above

### Relative Frequency of Disease

304. Which of the following is more prevalent in children than in adults, possibly because many individuals seem to have a lasting immunity after infection?

- A. Infective cysts
- B. Acute outbreaks
- C. Giardiasis
- D. None of the above

305. Which of the following terms is implicated in 25% of the cases of gastrointestinal disease and may be present asymptotically, the overall incidence of infection is estimated at 2% of the population.

- A. Infective cysts
- B. Acute outbreaks
- C. Giardiasis
- D. None of the above

306. Which of the following terms appear to be common with infants and is not usually associated with water but is related to child care and diaper changing hygiene procedures.

- A. Infective cysts
- B. Acute outbreaks
- C. Intestinal flora
- D. None of the above

307. Which of the following terms in immunodeficient and normal individuals are frequently refractile to drug treatment?

- A. Infective cysts
- B. Giardiasis
- C. Chronic cases of giardiasis
- D. None of the above

### Target Populations

308. Chronic symptomatic giardiasis is more common in adults than children are.

- A. True
- B. False

### Cryptosporidiosis Section

309. Until 1993, when over 400,000 people in Milwaukee became ill with diarrhea after drinking water contaminated with the parasite, few people had heard of *Cryptosporidium parvum*, or the disease it causes, cryptosporidiosis.

- A. True
- B. False

310. Transmission is also common from ingestion of food or water contaminated with stool, including water in the recreational water park and swimming pool settings.

- A. True
- B. False

311. Persons at increased risk for contracting cryptosporidiosis include child care workers; diaper-aged children who attend child care centers; persons exposed to human feces by sexual contact; and caregivers who might come in direct contact with feces while caring for a person infected with cryptosporidiosis.

- A. True
- B. False

312. Transmission is by an oral-fecal route, including hand contact with the stool of infected humans or animals or with objects contaminated with stool.

- A. True
- B. False

### Cholera -*Vibrio cholerae* Section

313. Cholera, which is derived from a Greek term meaning "Running to the bathroom," is caused by *Vibrio cholerae* and is the most feared epidemic diarrheal disease because of its severity. Dehydration and death can occur within a matter of minutes of infection.

- A. True
- B. False

314. In 1883, Louis Pasteur discovered *V. cholerae* during a cholera outbreak in Egypt.

- A. True
- B. False

315. Cholera has been very common in industrialized nations for the last 100 years.

- A. True
- B. False

316. Cholera is always life-threatening, it is easily prevented and treated with chloramines.

- A. True
- B. False

317. In the United States, because of advanced water and sanitation systems, cholera is not a major threat; however, everyone, especially travelers, should be aware of how the disease is transmitted and what can be done to prevent it.

- A. True
- B. False



318. Cholera (also called Asiatic flu) is a disease of the respiratory tract caused by the *Vibrio cholerae* bacterium. These bacteria are typically ingested by drinking water contaminated by improper sanitation or by eating improperly cooked fish, especially shellfish.

- A. True      B. False

319. The \_\_\_\_\_ of *V. cholerae* are shared with many water vibrios and therefore are of no use in distinguishing strains causing epidemic cholera.

- A. Serotypes                      C. Bacterium  
B. Flagellar antigens          D. None of the above

320. O antigens, however, do distinguish strains of *V. cholerae* into 139 known \_\_\_\_\_.

- A. Serotypes                      C. Bacterium  
B. Flagellar antigens          D. None of the above

## **Related Diseases and Associated Illnesses Section**

### **Amebic Meningoencephalitis PAM Section *Naegleria fowleri***

321. Primary Amebic Meningoencephalitis (PAM) is a common and usually deadly disease caused by infection with the ameba (a multi-celled organism that maintains the original shape).

- A. True      B. False

322. Following an incubation period of 2-15 days, there is a relatively sudden start of severe meningitis-like symptoms, which begin with fever and headache. These are rapidly followed by sensitivity to light, nausea, projectile vomiting, stiff neck, and, in many cases, disturbances to taste and smell. Changes in behavior and seizures may also be present. As conditions worsen the patient falls into a coma. Death usually occurs 3-7 days after the onset of symptoms.

- A. True      B. False

323. The ameba that causes the infection lives in soil and in freshwater ponds, lakes, rivers, poorly or non-chlorinated pools, discharge or holding basins, and hot springs throughout the world. *Naegleria* thrives in warm, stagnant bodies of fresh water when temperatures are high, usually above 80 degrees.

- A. True      B. False

324. Although the ameba is commonly found in the environment, PAM is very rare. In the last 30 years, only a few hundred cases have been reported worldwide.

- A. True      B. False

325. The ameba is believed to enter the body through the mouth and travel to the stomach. The disease is easily spread from person to person.

- A. True      B. False

### **Noroviruses Section**

326. Noroviruses (genus *Norovirus*, family *Caliciviridae*) are a group of related, single-stranded RNA, nonenveloped viruses that cause acute gastroenteritis in humans. Norovirus was recently approved as the official genus name for the group of viruses provisionally described as "Norwalk-like viruses" (NLV).

- A. True      B. False

327. The symptoms of norovirus illness usually include nausea, vomiting, diarrhea, and some stomach cramping. Sometimes people additionally have a low-grade fever, chills, headache, muscle aches, and a general sense of tiredness. The illness often begins suddenly, and the infected person may feel very sick. The illness is usually brief, with symptoms lasting only about 1 or 2 days. In general, children experience more vomiting than adults. Most people with norovirus illness have both of these symptoms.

A. True      B. False

328. Persons who are infected with norovirus should not prepare food while they have symptoms and for 3 weeks after they recover from their illness. Food that may have been contaminated by an ill person can be eaten.

A. True      B. False

329. Illness caused by norovirus infection has several names, including stomach flu – this “stomach flu” is **not** related to the flu (or influenza), which is a respiratory illness caused by influenza virus.

A. True      B. False

330. Noroviruses are found in the stool or vomit of infected people. People can become infected with the virus in several ways, including eating food or drinking liquids that are contaminated with norovirus; touching surfaces or objects contaminated with norovirus, and then placing their hand in their mouth; having direct contact with another person who is infected and showing symptoms (for example, when caring for someone with illness, or sharing foods or eating utensils with someone who is ill).

A. True      B. False

331. Persons working in day-care centers or nursing homes should pay special attention to children or residents who have norovirus illness. This virus is very contagious and can spread rapidly throughout such environments.

A. True      B. False

## Water Laboratory Analysis Section

### pH Testing Section

332. When an atom loses \_\_\_\_\_ and thus has more protons than electrons, the atom is a positively-charged ion or cation.

A. A proton              C. An electron  
B. Charge                D. None of the above

333. Measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators like strip test paper.

A. True      B. False

334. In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH greater than 7 are said to be acidic and solutions with a pH less than 7 are basic or alkaline.

A. True      B. False

335. Pure water has a pH very close to?

A. 7              C. 7.7  
B. 7.5            D. None of the above

336. \_\_\_\_\_ are determined using a concentration cell with transference, by measuring the potential difference between a hydrogen electrode and a standard electrode such as the silver chloride electrode.
- A. Primary pH standard values      C. pH measurement(s)  
 B. Alkalinity      D. None of the above
337. Mathematically, pH is the negative logarithm of the activity of the (solvated) hydronium ion, more often expressed as the measure of the?
- A. Electron concentration      C. Hydronium ion concentration  
 B. Alkalinity concentration      D. None of the above
338. Which of the following terms for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators?
- A. Primary sampling      C. Determining values  
 B. Measurement of pH      D. None of the above
339. The pH scale is logarithmic and therefore pH is?
- A. An universal indicator      C. An excess of alkaline earth metal concentrations  
 B. A dimensionless quantity      D. None of the above
340. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It is one of the best measures of the sensitivity of the stream to acid inputs. There can be long-term changes in the \_\_\_\_\_ of rivers and streams in response to human disturbances.
- A. Acid      C. pH measurement(s)  
 B. Alkalinity      D. None of the above
341. pH is defined as the decimal logarithm of the reciprocal of the \_\_\_\_\_,  $a_{H^+}$ , in a solution.
- A. Hydrogen ion activity      C. Brønsted–Lowry acid–base theory  
 B. Acid-base behavior      D. None of the above
342. Which of the following terms may be used to measure pH, by making use of the fact that their color changes with pH?
- A. Indicators      C. A set of non-linear simultaneous equations  
 B. Spectrophotometer      D. None of the above
343. Alkalinity is the name given to the quantitative capacity of an aqueous solution to neutralize an?
- A. Acid      C. Bond formation  
 B. Base      D. None of the above
344. Which of the following terms of the color of a test solution with a standard color chart provides a means to measure pH accurate to the nearest whole number?
- A. Universal indicator      C. Visual comparison  
 B. Colorwheel measurement      D. None of the above
345. Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the?
- A. End-point pH      C. pH measurement(s)  
 B. Alkalinity      D. None of the above

346. For strong acids and bases no calculations are necessary except in extreme situations. The pH of a solution containing a weak acid requires the solution of a quadratic equation. The pH of a solution containing a weak base may require the?
- A. Solution of a cubic equation                      C. Excess of alkaline earth metal concentrations  
 B. Non-linear simultaneous equations              D. None of the above
347. Alkalinity is a measure of this missing term and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.
- A. Universal indicator                                  C. Excess of alkaline earth metal concentrations  
 B. An aggregate property of water              D. None of the above
348. Alkalinity in excess of which term is significant in determining the suitability of water for irrigation?
- A. 8                      C. Alkaline earth metal concentrations  
 B. pH of 7              D. None of the above
349. The calculation of the pH of a solution containing acids and/or bases is an example of a \_\_\_\_\_ calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution
- A. Chemical speciation                      C. Visual comparison  
 B. Spectrophotometer                      D. None of the above
350. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to \_\_\_\_\_ difference in hydrogen ion concentration
- A. 1    C. 10  
 B. .1    D. None of the above
351. Which of the following terms measurements is used in the interpretation and control of water and wastewater treatment processes?
- A. Acid                      C. Hydrogen bond formation  
 B. Alkalinity                      D. None of the above
352. Which of the following terms are compounds that, for practical purposes, are completely dissociated in water.
- A. Strong acids and bases    C. Strong bases and weak acids  
 B. Chemical ions in chains    D. None of the above
353. The pH of a solution containing a \_\_\_\_\_ may require the solution of a cubic equation.
- A. Strong acids and bases    C. Weak base  
 B. Strong base                      D. None of the above
354. Sodium hydroxide, NaOH, is an example of a?
- A. Weak base                      C. Strong acid  
 B. Strong base                      D. None of the above

### Turbidity Testing Sub-Section

These QA/QC questions ensure that you have read the questions. These questions may seem to be repeats, but are necessary for your comprehension and evaluation.

355. Turbidity is measured to evaluate the performance of \_\_\_\_\_.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Colloidal to coarse dispersions
- D. None of the above

356. Turbidity is caused by wide variety of suspended matter that range in size from colloidal to coarse dispersions, depending upon the \_\_\_\_\_, and ranges from pure inorganic substances to those that are highly organic in nature.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Degree of turbulence
- D. None of the above

357. Turbid waters are undesirable from \_\_\_\_\_ of view in drinking water supplies.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Colloidal to coarse dispersions
- D. None of the above

### Surface Water (SW) System Compliance

358. Sample the \_\_\_\_\_ at the clear well

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

359. 0.34 NTU in \_\_\_\_\_, never to exceed 1.0 NTU spike

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

360. Sample turbidity at each \_\_\_\_\_

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

### Disinfection Key

361. 99.9% or 3 log inactivation of \_\_\_\_\_

- A. Crypto
- B. Enteric viruses
- C. Giardia lamblia cysts
- D. None of the above

362. 99.99% or 4 log inactivation of \_\_\_\_\_

- A. Crypto
- B. Enteric viruses
- C. Giardia lamblia cysts
- D. None of the above

363. 99% or 2 log inactivation of \_\_\_\_\_

- A. Crypto
- B. Enteric viruses
- C. Giardia lamblia cysts
- D. None of the above

364. The chlorine residual leaving the plant must be = or > 0.2 mg/L and measurable throughout the system.

- A. > 0.2
- B. ≤ 0.2
- C. < 0.2
- D. None of the above

### Turbidity Key

365. Turbidity is normally measured in mg/L and its size is measured in multimeters.

- A. True
- B. False

366. Turbidity can be particles in the water consisting of finely divided solids, larger than bacteria, visible by the naked eye; ranging in size from 10 to 150mm.

- A. True      B. False

### Cloudy Water

367. In order to have gravity affect these particles, we must somehow make them larger, somehow have them come together (agglomerate); in other words, somehow make them “stick” together, thereby increasing their size and mass.

- A. True      B. False

### Method 1623 - Cryptosporidium and Giardia Analysis

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

- A. Total Organisms      C. Indicator bugs  
B. Cryptosporidium and Giardia      D. None of the above

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

- A. Sodium thiosulfate      C. Sodium hypochlorite solution  
B. Sulfuric acid      D. None of the above

370. 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. Cryptosporidium      C. Cholera, polio, typhoid, hepatitis  
B. Indicator organisms      D. None of the above

### Cryptosporidium and Giardia Analysis

371. For Cryptosporidium and Giardia analysis by Method 1623 (U.S. Environmental Protection Agency, 1999c), collect 10 L of streamwater for each protozoan pathogen using standard sampling techniques described in Myers and Sylvester (1997). Special sterilization procedures are needed for equipment used in the collection of samples for Cholera, polio, typhoid, hepatitis. Autoclaving is not effective in neutralizing the epitopes on the surfaces of the oocysts and cysts that will react with the antibodies used for detection.

- A. True      B. False

372. Submerge the equipment in a vessel containing 12 percent hypochlorite solution for 30 minutes. Wash the equipment free of residual sodium thiosulfate solution with three rinses of filter-sterilized water; do not de-chlorinate the equipment using Dibromochloromethane.

- A. True      B. False

373. 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 Cholera, polio, typhoid, hepatitis analysis. The sample does not have to be kept on ice during transport.

- A. True      B. False

### Virions

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

- A. A virion      C. Myovirus bacteriophages  
B. Phage's host range      D. None of the above

375. If the cell was burst unnaturally, 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. Viral genome
- C. Genetic material
- D. None of the above

376. According to the text, biomolecules found in virions: genetic material, \_\_\_\_\_, single or double stranded, nucleoprotein capsid.

- A. Either DNA or RNA
- B. Phage's host range
- C. Phage lambda of E. coli
- D. None of the above

## Laboratory Analysis

### Sample Procedures

377. Samples need to be kept on ice and shipped to a central laboratory for analysis of coliphage, C. perfringens, Cryptosporidium, Giardia, and enteric viruses by the current analytical methods. The single-agar layer (SAL), direct plating method with induction of streptomycin and ampicillin is recommended for detection of somatic and F-specific coliphage in streamwater samples.

- A. True
- B. False

378. In this method, 100-mL sample volumes are mixed with an agar medium, E. coli host culture, chemicals that induce the streptomycin and ampicillin enzymes, and appropriate antibiotics. The mixtures are poured into four 150- x 15-mm plates and incubated at 35°C.

- A. True
- B. False

379. Upon infection by coliphage in the water sample, the E. coli host cells are lysed and stable indolyl product that is dark blue is visible within each plaque.

- A. True
- B. False

380. Viral plaques are easily identified and enumerated by the distinct blue circle. Because of contamination by naturally occurring bacteria in streamwater samples, antibiotic-resistant host-culture strains, E. coli CN-13 (resistant to nalidixic acid) and E. Coli F-amp (resistant to streptomycin and ampicillin) are used as hosts for somatic and F-specific coliphage, respectively.

- A. True
- B. False

381. Large sample volumes, such as 1-L volumes or greater, are recommended for detection of coliphage in ground water.

- A. True
- B. False

382. Standard MF techniques are used, and \_\_\_\_\_ are incubated anaerobically for 24 hours at 44.5°C.

- A. Oocyst(s)
- B. The plates
- C. Large sample volumes
- D. None of the above

383. After incubation, the plates are exposed to ammonium hydroxide, and all straw-colored colonies that turn dark pink to magenta are counted as \_\_\_\_\_.

- A. Enteric virus(es)
- B. E. coli host culture)
- C. C. perfringens
- D. None of the above

384. Which type of analyses is done with 100-, 30-, and 10-mL volumes of streamwater? In the case of a high-flow or high-turbidity streamwater sample, lower sample volumes may be plated.

- A. Coliphages
- B. C. perfringens
- C. Large sample volumes
- D. None of the above

385. Method 1623 (U.S. Environmental Protection Agency, 1999c) is recommended for detection of *Cryptosporidium* oocysts and *Giardia* cysts in water. The oocysts are concentrated on a capsule filter from a 10-L water sample, eluted from the capsule filter with buffer, and concentrated by centrifugation. Immunomagnetic separation (IMS) is used to separate the oocysts from other particulates in the sample.

- A. True
- B. False

386. In IMS, the \_\_\_\_\_ are magnetized by attachment of magnetic beads conjugated to an antibody and then are separated from sediment and debris by means of a magnet.

- A. Oocyst(s)
- B. C. perfringens
- C. *Cryptosporidium* oocysts and *Giardia* cysts
- D. None of the above

387. Fluorescently labeled antibodies and vital dye were used to make the final microscopic identification of?

- A. Enteric virus(es)
- B. Oocyst(s)
- C. Oocysts and cysts
- D. None of the above

388. To prepare samples for RT-PCR and cell culture, \_\_\_\_\_ are eluted from a 1MDS filter with beef extract (pH 9.5), concentrated using celite (pH 4.0), and eluted with sodium phosphate (pH 9.5).

- A. Oocyst(s)
- B. C. perfringens
- C. Attached viruses
- D. None of the above

### QA/QC Activities and Measures

389. QA/QC activities and measures to take to reduce contamination.

Use a sterilization indicator, such as autoclave tape, in preparing Viral plaques and other equipment for collection of microbiological samples to determine whether adequate temperatures and pressures have been attained during autoclaving.

- A. True
- B. False

390. Prepare a separate set of *E. coli* host cultures for microbiological sampling at each site.

- A. True
- B. False

### Field personnel should do the following:

391. Prepare \_\_\_\_\_, a 50- to 100-mL aliquot of sterile buffered water plated before the sample—for every sample by field personnel for total coliform, *E. coli*, and enterococci analyses to determine the sterility of equipment and supplies.

- A. Reagent water quality
- B. An environmental sample
- C. An MF equipment blank
- D. None of the above

392. Prepare a \_\_\_\_\_, a 50- to 100-mL aliquot of sterile buffered water plated after the sample—for every fourth sample to measure the effectiveness of the analyst's rinsing technique or presence of incidental contamination of the buffered water.

- A. Equipment blank(s)
- B. MF procedure blank(s)
- C. Sterile working surface
- D. None of the above



393. If contamination from a MF equipment or \_\_\_\_\_ is found, results are suspect and are qualified or not reported.

- A. Procedure blank
- B. An environmental sample
- C. An MF equipment blank
- D. None of the above

394. \_\_\_\_\_ for this type of analyses are different from the MF equipment blanks for bacterial analysis.

- A. Equipment blank(s)
- B. MF procedure blank(s)
- C. Appropriate laboratory equipment
- D. None of the above

395. Which are the same as equipment blanks except that they are generated under actual field conditions?

- A. Reagent water quality
- B. Microbiological sampling
- C. Field blanks
- D. None of the above

### **Quality Assurance and Quality Control in the Laboratory**

396. According to the text, microbiology laboratories must follow good laboratory practices—cleanliness, safety practices, procedures for \_\_\_\_\_, specifications for reagent water quality—as set forth by American Public Health Association.

- A. Reagent water quality
- B. Microbiological sampling
- C. Media preparation
- D. None of the above

### **Disinfection Section**

#### **Chlorine's Appearance and Odor**

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

- A. -29.2 degrees
- B. - 100 degrees
- C. 29 degrees
- D. None of the above

398. Prolonged exposures to chlorine gas may result in?

- A. Moisture, steam, and water
- B. Odor thresholds
- C. Olfactory fatigue
- D. None of the above

#### **Chlorine Gas**

399. The odor threshold for chlorine gas is approximately?

- A. 0.3-0.5 parts per million (ppm)
- B. 3 parts per million (ppm)
- C. 3-5 parts per million (ppm)
- D. None of the above

400. 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
- B. Ratio of hypochlorous acid
- C. "CT" disinfection concept
- D. None of the above