Registration form

SURFACE WATER PRODUCTION

48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $50.00

Start and Finish Dates: _____
You will have 90 days from this date in order to complete this course

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

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

Address_____

City_____State_____Zip_____

Email_____ Fax (_____) _____

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

Operator ID #_____Exp. Date_____

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

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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 $169.95 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.

CERTIFICATION OF COURSE PROCTOR

Technical Learning College requires that our students who takes a correspondence or home study program course must pass a proctored course reading, quiz and final examination. The proctor must complete and provide to the school a certification form approved by the commission for each examination administered by the proctor.

Instructions. When a student completes the course work, fill out the blanks in this section and provide the form to the proctor with the examination.

Name of Course:_____

Name of Licensee:_____

Instructions to Proctor. After an examination is administered, complete and return this certification and examination to the school in a sealed exam packet or in pdf format.

I certify that:

1. I am a disinterested third party in the administration of this examination. I am not related by blood, marriage or any other relationship to the licensee which would influence me from properly administering the examination.
2. The licensee showed me positive photo identification prior to completing the examination.
3. The enclosed examination was administered under my supervision on _____. The licensee received no assistance and had no access to books, notes or reference material.
4. I have not permitted the examination to be compromised, copied, or recorded in any way or by any method.
5. Provide an estimate of the amount of time the student took to complete the assignment.

Time to complete the entire course and final exam. _____

Notation of any problem or concerns:

Name and Telephone of Proctor (please print):

_____

_____

Signature of Proctor

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

69. A B
70. A B
71. A B C D
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196. A B C D
197. A B
198. A B C D
199. A B C D
200. A B C D

201. A B C D	226. A B C D	251. A B C D	276. A B C D
202. A B C D	227. A B C D	252. A B C D	277. A B C D
203. A B C D	228. A B C D	253. A B C D	278. A B C D
204. A B C D	229. A B	254. A B C D	279. A B C D
205. A B C D	230. A B	255. A B	280. A B C D
206. A B C D	231. A B	256. A B C D	281. A B C D
207. A B	232. A B	257. A B C D	282. A B C D
208. A B C D	233. A B	258. A B C D	283. A B C D
209. A B C D	234. A B C D	259. A B	284. A B C D
210. A B	235. A B	260. A B	285. A B
211. A B	236. A B	261. A B	286. A B C D
212. A B C D	237. A B	262. A B C D	287. A B C D
213. A B	238. A B	263. A B C D	288. A B C D
214. A B	239. A B	264. A B C D	289. A B C D
215. A B C D	240. A B	265. A B	290. A B C D
216. A B	241. A B	266. A B	291. A B
217. A B	242. A B C D	267. A B	292. A B C D
218. A B	243. A B C D	268. A B C D	293. A B
219. A B	244. A B C D	269. A B C D	294. A B
220. A B	245. A B C D	270. A B	295. A B C D
221. A B C D	246. A B C D	271. A B	296. A B C D
222. A B	247. A B C D	272. A B	297. A B C D
223. A B	248. A B C D	273. A B	298. A B C D
224. A B	249. A B C D	274. A B	299. A B C D
225. A B	250. A B C D	275. A B	300. 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 not hold TLC liable for any errors, injury, death or non-compliance with rules. I will abide with all federal and state rules and rules found on page 2. 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

When Finished with Your Assignment...

REQUIRED DOCUMENTS
Please scan the **Registration Page, Answer Key, Proctoring report, Survey and Driver's License** and email these documents to info@TLCH2O.com.

IPhone Scanning Instructions
If you are unable to scan, take a photo of these documents with your **iPhone** and send these photos to TLC, info@TLCH2O.com.

FAX
If you are unable to scan and email, please fax these documents to TLC, if you fax, call to confirm that we received your paperwork. **(928) 468-0675**

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

SURFACE WATER PRODUCTION 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.
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How did you hear about this Course? _____

What would you do to improve the Course?

_____

_____

Any other concerns or comments.

_____

_____

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.

Surface Water Production CEU Training Course Assignment

The Surface Water Production CEU course assignment is available in Word on the Internet for your convenience, please visit www.ABCTLC.com and download the assignment and e-mail it back to TLC.

You will have 90 days from 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.

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. Approximately 18,000 water systems
A. TNCWS C. NTNCWSs
B. CWSs D. None of the above

2. Approximately 85,000 systems
A. TNCWS C. NTNCWSs
B. CWSs D. None of the above

3. Provides water to the same population year-round for example: homes, apartment buildings.
A. TNCWS C. NTNCWSs
B. CWSs D. None of the above

Water Quality Section
Surface (Raw) Water Introduction
4. Water passes runoffs and infiltrates the ground during precipitation; this runoff acquires a wide variety of _____that intensely alters its usefulness.
A. Excess nutrients C. Dissolved or suspended impurities
B. Biological actions D. None of the above

5. Operators need to appropriately treat surface water is never pure of_____, it. Most of the earth's water sources obtain their water supplies through precipitation.
A. Excess nutrients C. Pollution
B. Biological actions D. None of the above

6. 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

7. 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

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

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

10. 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

11. 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

12. 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 C. Powdered activated carbon and chlorine
B. Sulfides or acids D. None of the above

13. 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 C. Arsenic
B. Colloids D. None of the above

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

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

15. _____ is a substance that can give up a hydrogen ion (H^+); a base is a substance that can accept H^+.

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

16. 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 C. Alkalinity
B. Base D. None of the above

Alkalinity
17. 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

18. Alkalinity measurements are used in the interpretation and control of water and wastewater treatment processes
A. True B. False

Turbidity Introduction
19. 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

20. 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

21. 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 C. Total Dissolved Solids (TDS)
B. Colloids D. None of the above

22. Low _____waters can be very difficult to coagulate due to the difficulty in inducing collision between the colloids.
A. Turbidity C. Total Dissolved Solids (TDS)
B. Colloids D. None of the above

23. _____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 C. Total Dissolved Solids (TDS)
B. Organic colloids D. None of the above

Turbidity MCL
24. 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

25. 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
26. 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

27. Thermal stratification is possible as water becomes less dense when heated, meaning water weighs less per unit volume. Therefore, warmer water will be lighter and colder water will be heavier. Due to this, there will always be a level of "self-induced" _____ in a water storage.
A. Saturation level(s) C. Permanent hardness
B. Thermal stratification D. None of the above

Objections to Hard Water
Scale Formation
28. Hard water forms scale, usually_____, which causes a variety of problems. Left to dry on the surface of glassware and plumbing fixtures, including showers doors, faucets, and sink tops; hard water leaves unsightly white scale known as water spots.
A. Magnesium carbonate C. Calcite
B. Calcium carbonate D. None of the above

Secondary Standard
29. 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

Langelier Saturation Index
30. 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

31. 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

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

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

33. Which of the following rules will reduce potential cancer and reproductive and developmental health risks from disinfection byproducts?

A. Stage 1 DBPR
B. Stage 2 DBPR
C. Long Term 2 Enhanced Surface Water Rule
D. None of the above

What are Disinfection Byproducts (DBPs)?

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

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

Are THMs and HAAs the only disinfection byproducts?

35. 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:

36. Chorine 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

Public Health Concerns

37. 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

38. 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

39. _____is unquestionably the most important step in the treatment of water for drinking water supplies.

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

Controlling Disinfection Byproducts

40. 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
B. Turbidity (particle)
C. Disinfectants and DBPs
D. None of the above

41. 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

Absorption
42. Activated carbon can be used to absorb _____ that react with disinfectants to form byproducts.
A. Inorganic coagulants C. Soluble organics
B. Most contaminants D. None of the above

Membrane Technology
43. Membranes, used historically to desalinate brackish waters, have also demonstrated excellent removal of _____.
A. THMs and HAAs C. Natural organic matter
B. Optimization of pH D. None of the above

44. EPA predicted that most water systems will be able to achieve compliance with new DBP regulations through the use of one or more of these relatively low cost methods (EPA, 1998). Water system managers may also consider switching from chlorine to alternative disinfectants to reduce formation of _____.
A. THMs and HAAs C. Natural organic matter
B. Optimization of pH D. None of the above

Organisms Descriptors and Meanings
45. Photo means...
A. Feed or nourish C. Light
B. Other (Organic carbon) D. None of the above

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

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

Contaminants that may be present in sources of drinking water include:
48. 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 C. Inorganic contaminants
B. Pesticides and herbicides D. Microbial contaminants

49. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?
A. Radioactive contaminants C. Inorganic contaminants
B. Pesticides and herbicides D. Microbial contaminants

50. 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 C. Inorganic contaminants
B. Pesticides and herbicides D. All of the above

Background
51. 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
52. 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

Routine Sampling Requirements
53. Total coliform samples must be collected by PWSs at sites that 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

54. 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

55. Each total coliform-positive (TC+) routine sample must be tested for the presence of heterotrophic bacteria.
A. True B. False

56. 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

Dangerous Waterborne Microbes
57. 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

58. Which of the following are not necessarily agents of disease, may indicate the presence of disease-carrying organisms?
A. Fecal coliform bacteria C. Shigella dysenteriae
B. Cryptosporidium D. None of the above

59. 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 C. Protozoa
B. Cryptosporidium D. None of the above

60. Which of the following is a species of the rod-shaped bacterial genus Shigella?
A. Fecal coliform bacteria C. Shigella dysenteriae
B. Cryptosporidium D. None of the above

61. 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 C. Giardia lamblia
B. Cryptosporidium D. None of the above

62. 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 C. Shigella dysenteriae
B. Cryptosporidium D. None of the above

Bacteriological Monitoring Introduction
63. 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 C. Viruses
B. Amoebas D. None of the above

64. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?
A. Cryptosporidium C. Escherichia coli (E. coli)
B. Protozoa D. None of the above

65. According to the text, the routine microbiological analysis of your water is for?
A. Contamination C. Coliform bacteria
B. Colloids D. None of the above

Bacteria Sampling
66. Water samples for _____must always be collected in a sterile container.
A. Amoebas C. Viruses
B. Bacteria tests D. None of the above

Methods
67. 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 C. Total coliform analysis
B. Coliform D. None of the above

Microbial Regulations

68. 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

69. 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

Basic Types of Water Samples

70. It is important to properly identify the type of sample you are collecting.

A. True B. False

The three (3) types of samples are:

71. 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 C. Routine
B. Special D. None of the above

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

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

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

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

74. 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 C. All of the above
B. Trigger: Level 2 Assessment D. None of the above

75. Noncommunity and nontransient, noncommunity water systems with less than 10,000 daily population and groundwater as a source will sample on an annual basis.

A. True B. False

Maximum Contaminant Levels (MCLs)

76. State and federal laws establish standards for drinking water quality. Under normal circumstances when these standards are being met, the water is safe to drink with no threat to human health. These standards are known as maximum contaminant levels (MCL). When a particular contaminant exceeds its MCL a potential health threat may occur.

A. True B. False

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

Positive or Coliform Present Results

77. 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

78. With a positive total coliform sample and 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 C. Corrective measures
B. Repeat sampling immediately D. None of the above

Heterotrophic Plate Count HPC

79. 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)

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

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

Total Coliforms

81. 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

The following are acute violations:

82. Which determines a violation of nitrate?

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

Revised Total Coliform Rule (RTCR) Summary

83. 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

84. 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

85. 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

86. 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

87. 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

88. 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

89. 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

90. 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. None of the above

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

92. 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
93. The RTCR requires 99.99% or 4 log inactivation of _____ .
A. Enteric viruses C. Giardia lamblia cysts
B. Crypto D. None of the above

94. The RTCR requires 99% or 2 log inactivation of _____ .
A. Enteric viruses C. Giardia lamblia cysts
B. Crypto D. None of the above

Waterborne Pathogen Section - Introduction
Pathogen Section
95. 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 C. Will cause fatalities
B. Are mild in nature D. None of the above

How Diseases are Transmitted.

96. Waterborne pathogens are primarily spread by the?

A. Fecal-oral, or feces-to-mouth route
C. Oral to fecal route
B. Dermal to fecal route
D. None of the above

Protozoan Caused Diseases

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

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

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

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

Giardia lamblia

99. 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
C. Giardiasis
B. Cryptosporidiosis
D. None of the above

100. 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
C. Hepatitis A
B. Giardiasis
D. None of the above

Primary Waterborne Diseases Section

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

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

102. 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

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

A. True
B. False

104. 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
C. Typhoid fever
B. Yellow fever
D. None of the above

105. 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

106. Humans are the reservoir for the Norovirus. Prevention strategies for this pathogen include?
A. Internal protection C. Containment protection
B. Source protection D. None of the above

107. 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

108. 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

109. Giardia prevention strategies for this pathogen include _____; filtration, coagulation, and halogenation of drinking water.
A. Internal protection C. Containment protection
B. Source protection D. None of the above

Waterborne Bacterial Diseases
110. 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

Viruses
Coronavirus
111. It looks like the COVID-19 coronavirus is not able to live in water.
A. True B. False

Chain of Custody Procedures
112. 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

113. 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
114. 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

115. 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

116. As _____ are used, contact times may be reduced.
A. Chlorine concentration C. Higher strength chlorine solutions
B. Temperature D. None of the above

Water Treatment Section - Preliminary Treatment Process
Preliminary Treatment
117. Weeds, leaves, and trash, if not removed, these will cause problems to the treatment plant's pumps and equipment, the best way to protect the plant is?
A. Screening C. Change source
B. Super settling D. None of the above

118. According to the text, wire mesh screens need maintenance and require?
A. Manual cleaning C. No cleaning
B. PM cleaning D. None of the above

119. Mechanical bar screens vary in size and use some type of horizontal raking mechanism that travels horizontally down the bars to scrap the debris off.
A. True B. False

Pre-Sedimentation
120. Sand and grit will damage plant equipment and pipes, so it must be removed with either rectangular or round shaped basin are called?
A. Filtration basin(s) C. Sedimentation basin(s)
B. Coagulation basin(s) D. None of the above

121. Which of the following treatment terms is used after the flocculation process?
A. Filtration basin(s) C. Sedimentation basin(s)
B. Coagulation basin(s) D. None of the above

122. Scrapers on the bottom move the settled sludge to one or more hoppers at the influent end of the tank, it may have a _____or traveling bridge used to collect the sludge.
A. Screw conveyor C. Manual skimmer
B. Conveyor belts D. None of the above

123. Most clarifiers will have baffles to prevent backflow from entering the effluent.
A. True B. False

Flights and Chains
124. Flights and chains remove the scum from the _____ of the basin.
A. Scum box C. Armature
B. Surface D. None of the above

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

125. The flights are usually concrete flights mounted on parallel chains and the motor shaft is connected through a shaft which turns the gear.
A. True B. False

Circular Clarifiers
126. The common type of circular clarifier has a center pier or column.
A. True B. False

127. Which of the following systems use graded silica sand filter media?
A. Traditional filter systems C. Chemical pretreatment
B. Reconditioning cycle D. None of the above

128. Filtration occurs only within the last few inches of the coarser materials at the bottom of the bed.
A. True B. False

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

130. Which of the following processes uses alum and cationic polymer to neutralize the charge of colloidal particles?
A. Filtration C. Flocculation
B. Reconditioning D. None of the above

131. Which of the following compounds combines with alkalinity in the raw water to form a white precipitate that neutralizes suspended particles' electrical charge?
A. Activated sodium C. Alum
B. PAC D. None of the above

132. Which of the following terms may increase filtered water clarity, measured in NTU, by 90% compared with filtration alone?
A. Chemical pretreatment C. Fast rinse
B. Reconditioning cycle D. None of the above

133. Water treatment systems use settling tanks unit to allow for_____.
A. Gravity C. Settling time
B. Particle(s) D. Sedimentation and settling

134. The main aim of tube settlers is to minimize the _____that a small floc particle must settle before agglomerating into larger particles.
A. Gravity C. Settling time
B. Vertical distance D. Solids

135. Water treatment is a major requirement both for raw water for drinking and wastewater management, both have particles that need to sediment in order to obtain clear water.
A. True B. False

136. Tube settler design reduces the depth significantly compared to the conventional clarifier. This helps in reduction of _____.
A. Gravity C. Settling time
B. Particle(s) D. Solids

137. Tube settler collects solids into a compact mass and slides it down the tube channel. When using tube settlers water flow is upward through the tubes and the solids slide down against the current using _____.
A. Gravity C. Settling time
B. Pressure D. Filters

138. Tube settler design involves the use of _____ at an angle of 60 degrees and adjacent to each other. This helps in increasing the settling area effectively.
A. Weirs C. Multiple tubular channels sloping
B. Uptakes D. Filters

Conventional Water Treatment Process Introduction
139. _____ along with pre-chlorination for removal of dissolved iron when present with small amounts relative of manganese
A. Disinfection C. Pre-treatment
B. Coagulation D. Aeration

140. _____to remove particles from water either by passage through a sand bed that can be washed and reused or by passage through a purpose- designed filter that is washable.
A. Disinfection C. Pre-treatment
B. Coagulation D. Filtration

141. _____ for killing bacteria viruses and other pathogens.
A. Disinfection C. Pre-treatment
B. Coagulation D. Aeration along with pre-chlorination

142._____or slow-sand filtration
A. Disinfection C. Pre-treatment
B. Coagulation D. Coagulation or flocculation

Treatment Design and Plant Operation
143. SCADA (Supervisory Control and Data Acquisition) automation of water treatment is common in the US. Source water quality through the seasons, scale, and environmental impact can dictate capital costs and operating costs. End use of the treated water dictates the necessary quality monitoring technologies.
A. True B. False

SWTR Rule
144. Turbidity is caused by particles suspended in water. These particles scatter or reflect light rays, making the water appear cloudy.
A. True B. False

145. Turbidity is expressed in nephelometric turbidity units (ntu) and a reading in excess of 5 ntu is generally noticeable to water system customers.
A. True B. False

146. Besides the appearance of turbidity being unpleasant to customers, turbidity in water is significant from a public health standpoint because suspended particles could shelter microorganisms from the disinfectant and allow them to still be viable when they reach the customer.
A. True B. False

Zeta Potential Introduction
147. Zeta potential is a physical property exhibited by all solid-liquid and liquid-liquid colloidal systems. Surrounding the surface of all dispersed particles is a thick layer of ions that have the same charge of the particle's surface called the ATP layer.
A. True B. False

148. The zeta potential is defined as the voltage at the edge of the slipping (shear) plane with respect to the bulk-dispersing medium, where ions, molecules and other agents are no longer associated with a particle's surface.
A. True B. False

Solubility of Substances in Water
149. Water is an excellent solvent for many compounds. Some dissolve in it as molecules while others, called electrolytes, dissociate and dissolve not as neutral molecules but as charged species called ions.
A. True B. False

150. Compounds which exist as solid ionic crystals dissolve in water as ions, and most of them are highly soluble in water. "Highly soluble" is a somewhat elastic description, but generally means soluble to at least the extent of forming 0.1 to 1.0 molar aqueous solutions.
A. True B. False

Purpose of Coagulation
151. Chemical Coagulation in the water/wastewater treatment is the process of bringing suspended matter in untreated water together for the purpose of settling and for the preparation of the water for filtration.
A. True B. False

Turbidity Particles
152. The ability of particles to remain suspended in water is a function of hydrogen ion activity.
A. True B. False

153. Turbidity particles can range in size from molecular to 50 microns (a tremendous range).
A. True B. False

154. Particles that are greater than one micron in diameter are considered silt, and settle out due to their relatively large size and density in a matter of days with the need to coagulation.
A. True B. False

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

Olation

155. Olation involves the bridging of two or more of these large molecules to form even larger, positively charged ions. A typical molecule can contain eight aluminum ions, twenty hydroxide ions, and will have a +4 charge.

A. True B. False

Zeta Potential

156. The Zeta Potential is reduced to zero in order for coagulation to occur, because the forces of attraction are predominant.

A. True B. False

Coagulants – Alum and Ferric

Aluminum Sulfate (Alum)

157. Aluminum Sulfate is also known as alum, filter alum, and alumina sulfate. Alum is the most widely used coagulant. Alum is available in dry form as a powder or in lump form. It can also be purchased and fed as a liquid.

A. True B. False

158. Alum has an exact formula due to the constant water molecules of hydration that may be attached to the aluminum sulfate molecule.

A. True B. False

159. Once in water, alum can react with hydroxides, carbonates, bicarbonates, and other anions to form _____.

A. pH C. Large, positively charged molecules
B. Alkalinity D. None of the above

160. Carbon dioxide and sulfate are generally byproducts of these reactions. During the reactions, alum acts as _____to reduce the pH and alkalinity of the water supply. It is important that sufficient alkalinity be present in the water supply for the various reactions to occur.

A. Inorganic coagulant(s) C. Byproducts of these reactions
B. An acid D. None of the above

161. The aluminum ions become soluble rather than insoluble and do not participate in the hydration and _____ necessary to make the alum effective as a coagulant. In these instances the plant may experience higher than normal filtered water turbidities, and much of the aluminum will pass through the filters.

A. Post filtration alum coagulation C. Byproducts of these reactions
B. Olation reaction(s) D. None of the above

162. When the pH level of the water is above 7.8 after the addition of the alum, the aluminum ions again become soluble, and the efficiency of coagulation is decreased. Under these conditions, aluminum ions again penetrate the filters, and _____can occur in the clear well and in the distribution system in some cases.

A. Post filtration alum coagulation C. Byproducts of these reactions
B. Olation reaction(s) D. None of the above

Ferric Chloride (Ferric)

163. Ferric chloride is becoming more extensively used as a coagulant due partially to the fact that the material can be purchased as a liquid.

A. True B. False

164. Ferric chloride may also be purchased as an anhydrous solid. Liquid ferric chloride is highly corrosive, and must be isolated from all corrodible metals.
A. True B. False

165. Like ferric sulfate, ferric chloride exhibits a wide _____ range for coagulation, and the ferric ion does not easily become soluble.
A. pH C. Olation
B. Alkalinity D. None of the above

166. As a result, many plants are replacing alum with ferric chloride to eliminate the penetration of aluminum ions through the plant filters. Ferric chloride also reacts as an acid in water to reduce _____.
A. pH C. Olation
B. Alkalinity D. None of the above

167. _____are available, such as potash alum, ammonia alum, ferrous sulfate (copperas), and chlorinated copperas.
A. Other inorganic coagulants C. Byproducts of these reactions
B. Olation reaction(s) D. None of the above

168. Typical dosages of the inorganic coagulants range from 50 pounds per million gallons of water treated under ideal conditions to as high as 800 to 1000 pounds per million gallons of water treated under _____ conditions.
A. Worst case C. Increased
B. Decreased D. None of the above

Factors Influencing Coagulation
Effects of pH
169. The pH range in which a coagulation process occurs may be the single most important factor in _____coagulation. The vast majority of coagulation problems are related to improper pH levels.
A. Improper C. Proper
B. Optimum D. None of the above

170. Whenever possible, coagulation should be conducted in_____ . When this is not done, lower coagulation efficiency results, generally resulting in a waste of chemicals and a lowered water quality.
A. The optimum pH zone C. Collision between the colloids
B. The coagulation process D. None of the above

171. Each of the inorganic salt coagulants has its own characteristic _____ pH range.
A. Improper C. Little or no effect
B. Optimum D. None of the above

172. In many plants, it is necessary to adjust the pH level in the coagulation process. In most cases, this involves the addition of lime, caustic soda, or soda ash to maintain a minimum pH level. In some cases, however, acids may be necessary to raise or lower the pH level to an _____ range.
A. Improper C. Little or no effect
B. Optimum D. None of the above

173. In some water plants, the acidic reactions of the inorganic salts are taken advantage of when the raw water pH levels are_____. In these instances, overfeed of the coagulant is intentionally induced in order for the coagulation process to occur in the optimum range.
A. Improper C. Higher than desired
B. Optimum D. None of the above

Effects of Salts
174. Since no natural waters are completely pure, each will have various levels of cations and anions such as calcium, sodium, magnesium, iron, manganese, sulfate, chloride, phosphate, and others. Some of these ions may affect the efficiency of _____.
A. All chemical reactions C. Collision between the colloids
B. The coagulation process D. None of the above

175. Trivalent cations do not have an adverse effect on the process in most instances. In fact, significant concentrations of naturally occurring iron in a water supply has resulted in the ability to feed _____dosages of inorganic salt coagulants.
A. Improper C. Lower than normal
B. Optimum D. None of the above

Nature of Turbidity
176. Generally, higher turbidity levels require higher coagulant dosages. However, seldom is the relationship between turbidity level and coagulant dosage linear. Usually, the additional coagulant required is _____when turbidities are much higher than normal due to higher collision probabilities of the colloids during high turbidities.
A. Improper C. Relatively small
B. Optimum D. None of the above

177. Conversely, low turbidity waters can be very difficult to coagulate due to the difficulty in inducing _____. In this instance, floc formation is poor, and much of the turbidity is carried directly to the filters.
A. All chemical reactions C. Collision between the colloids
B. The coagulation process D. None of the above

178. Organic colloids may be present in a water supply due to pollution, and these colloids can be difficult to remove in the coagulation process. In this situation, _____coagulant dosages are generally required.
A. Improper C. Slowly
B. Higher D. None of the above

Water Temperature
179. Cold water temperatures can cause two factors which add to the difficulty of the coagulation process. As water temperatures approach freezing, almost all chemical reactions occur more _____.
A. Improper C. Slowly
B. Higher D. None of the above

180. It can be difficult to evenly disperse the coagulants into the water. In addition, floc settling characteristics become poor due to the higher density of the water during near freezing temperatures. As a result, the coagulant process becomes less efficient, and higher coagulant dosages are generally used to compensate for these effects.
A. True B. False

Mixing Effects

181. Poor or inadequate mixing results in an uneven dispersion of the coagulant. Unfortunately, many older plants were designed with mixing facilities which generally do not accomplish mixing in the most efficient manner. As a result, it becomes necessary to use higher than necessary dosages of coagulant to achieve an optimum level of efficiency in the process.

A. True B. False

182. The effects of high turbidity and warm water temperatures can tend to aggravate the lack of adequate mixing facilities in some plants.

A. True B. False

Effect of the Coagulant

183. The choice of the proper coagulant for the given conditions is of critical importance in maintaining an efficient coagulation scheme under widely varying conditions. The chemicals most commonly used in the coagulation process are Aluminum Sulfate, Ferric Chloride, Ferric Sulfate, and Cationic Polymers.

A. True B. False

Corrosion Control Introduction

184. Corrosion is the deterioration of a substance by chemical action. Lead, cadmium, zinc, copper and iron might be found in water when metals in water distribution systems corrode. Drinking water contaminated with certain metals (such as _____) can harm human health.

A. Lead C. Lead and cadmium
B. Lead and copper D. None of the above

185. Corrosion also reduces the useful life of water distribution systems and can promote the growth of microorganisms, resulting in disagreeable tastes, odors, slimes and further corrosion. Because it is widespread and highly toxic, lead is the corrosion product of greatest concern.

A. True B. False

186. The EPA has banned the use of lead solders, fluxes and pipes in the installation or repair of any public water system. In the past, solder used in plumbing has been _____.

A. 60% lead and 40% tin C. 50% copper and 50% lead
B. 50% tin and 50% lead D. None of the above

187. Using lead-free solders, such as _____is a key factor in lead corrosion control.

A. 20% lead and 80% tin C. Lead and cadmium
B. Silver-tin and antimony-tin D. None of the above

188. The highest level of lead in consumers' tap water will be found in water that has been standing in the pipes after periods of usage (Mid-afternoon). This is because running water tends to leach lead or copper out of the metals in the distribution system more readily than does moving water.

A. True B. False

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

Cathodic Protection

189. Sacrificial anodes are pieces of metal more electrically active than the steel piping system. Because these anodes are more active, the corrosive current will exit from them rather than the piping system.

A. True B. False

190. Sacrificial anodes can be attached to the existing piping system or coated steel for a pre-engineered cathodic protection system. An asphalt coating is not considered a suitable dielectric coating.

A. True B. False

191. Depleted anodes must be replaced for continued Cathodic protection of the system.

A. True B. False

Coagulation and Flocculation Summary

Rapid Sand Filtration

192. Which terms is the most prevalent form of water treatment technology in use today?

A. Conventional technology C. Rapid Sand filtration
B. Sedimentation process D. None of the above

193. Rapid Sand filtration process employs a combination of _____in order to achieve maximum effectiveness.

A. Filtration C. Physical and chemical processes
B. Sedimentation process D. None of the above

Coagulation

194. At the Water Treatment Plant, alum is added to the water in the "flash mix" to cause microscopic impurities in the water to clump together.

A. True B. False

195. The alum and the water are mixed rapidly by the?

A. Cationic polymers C. Shaker
B. Flash mixer D. None of the above

196. What is the process of joining together particles in water to help remove organic matter called?

A. Cationic binding C. Flocculation
B. Coagulation D. None of the above

197. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment.

A. True B. False

198. Fine particles must be coagulated, or "stuck together" to form larger particles that can be filtered, this is achieved through the use of?

A. Sedimentation chemicals C. Flocculation chemicals
B. Coagulant chemicals D. None of the above

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

199. Which of the following terms are required since colloidal particles by themselves have the tendency to stay suspended in water and not settle out?
A. Sedimentation chemicals C. Flocculation chemicals
B. Coagulant chemicals D. None of the above

200. Which of the following terms are so small, their charge per volume is significant?
A. Aluminum Sulfate molecules C. Colloidal particles
B. Coagulant chemicals D. None of the above

Flocculation
201. Flocculation is the process of bringing together destabilized or coagulated particles to form larger masses which can be settled and/or filtered out of the water being treated.
A. True B. False

202. Flocculation is the process where the suspended particles can collide, _____, and form heavier particles called “floc”.
A. Equalization C. Destabilized or coagulated particles
B. Agglomerate D. None of the above

203. Gentle _____ and appropriate detention times (the length of time water remains in the basin) help facilitate the flocculation process.
A. Equalizing C. Settling
B. Agitation of the water D. None of the above

204. Inside the contact chambers, water is slowly mixed allowing the coagulated particles, called "floc," and the particles become larger and stronger.
A. True B. False

205. Which of the following happens in the water when bacteria and other microorganisms are caught in the floc structure?
A. Equalize the basin C. Agitate the water
B. Floc particles mix D. None of the above

Pre-Sedimentation
206. Contingent on the quality of the source water, some plants have pre-sedimentation, which allows larger _____ in a reservoir or lake reducing solid removal loads.
A. Equalization of the basin C. Floc particles mix
B. Particles time to settle D. None of the above

Sedimentation
207. Sedimentation is the process of destabilizing coagulated particles in water.
A. True B. False

Water Filtration Key Terms
Declining Rate Filters
208. The filter flow rate will vary with?
A. Head loss C. Effluent control
B. Uniform media D. None of the above

209. Declining Rate Filters system often requires _____ to provide adequate media submergence.
A. Head loss C. Effluent control structure
B. Uniform media D. None of the above

Detention Time
210. Detention time is actual time required for a small amount of water to pass through a Sedimentation basin at a given rate of flow, or the calculated time required for a small amount of liquid to pass through a tank at a given rate of flow.
A. True B. False

Disinfection
211. Chlorine kills or “inactivates” harmful microorganisms in water.
A. True B. False

212. Chlorine is added again after filtration for?
A. Residual C. Post-disinfection
B. Contact time D. None of the above

Jar Testing
213. Jar testing traditionally has been done on an infrequent basis in most water treatment plants to control THMs.
A. True B. False

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

215. According to the text, which of the following has a pH between 6.0 and 8.5?
A. Acids C. Natural water
B. Disinfectants D. None of the above

Caustic
216. A strong chemical - NaOH is used in the treatment process to neutralize acidity, and to lower the pH value.
A. True B. False

Polymer
217. Polymer is a water treatment chemical that when combined with other types of coagulants, aids in binding small suspended particles to larger particles to help in the settling and filtering processes.
A. True B. False

Post-Chlorine
218. The operator should make sure that the chlorinated water holds a residual in the distribution system.
A. True B. False

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

Pre-Chlorination
219. Before the filtration process, chlorination helps control fish and vegetation.
A. True B. False

Hydrofluosilicic Acid
220. H_2SiF_6 a clear fuming corrosive gas, with a pH ranging from 8 to 9 and used in water treatment to fluoridate drinking water.
A. True B. False

Taste and Odor Control
221. Which of the following is occasionally added for taste and odor control?
A. Turbidity powder C. Powdered activated carbon (PAC)
B. Fluoride D. None of the above

Water Quality
222. Water quality testing needs to be conducted throughout the water treatment process.
A. True B. False

Chemical Feed and Rapid Mix
223. To improve the subsequent treatment processes, chemicals may be added to the water, and may include pH adjusters and coagulants.
A. True B. False

224. Alum is a coagulant chemical, that neutralize negative charges on small particles, allowing them to stick together and form larger particles that are more easily removed by sedimentation or filtration.
A. True B. False

Short-Circuiting
225. Short-Circuiting is a condition that occurs in tanks or basins when some of the water travels faster than the rest of the flowing water.
A. True B. False

226. Short-Circuiting is usually undesirable, since it may result in shorter contact, reaction, or settling times in comparison with the?
A. Presumed detention times C. Modification of the conventional process
B. Sedimentation/clarification process D. None of the above

Tube Settlers
227. Tube settlers are a modification of the conventional process contains many metal "tubes" that are normally placed in?
A. Flocculation basin C. An up-flow clarifier
B. Sedimentation basin or clarifier D. None of the above

228. The slope of the tube settlers facilitates gravity settling of the solids to the bottom of the basin, where they can be?
A. Adjusted for detention times C. Collected and removed
B. Modified D. None of the above

Adsorption Clarifiers
229. Cleaning of the clarifier is initiated less often than filter backwashing because the clarifier removes less solids.
A. True B. False

230. In the tube-settler type of package plant, the Sedimentation/clarification process is followed by mixed-media filtration and disinfection to complete the water treatment.
A. True B. False

Clearwell
231. The clearwell provides temporary storage for the treated water, which is the final step in the conventional treatment process.
A. True B. False

Sampling
232. Care should be taken not to disturb the bottom of the water source or along the sides. So as not to stir up any settled solids. This would create erroneous results. There are different techniques for both bacteriological and disinfection byproduct samplings. Collect the water sample at least 6 inches under the surface by plunging the container mouth down into the water and turning the mouth towards the current by dragging the container slowly horizontal.
A. True B. False

Filtration Overview
233. Filtration is a water treatment process step used to remove turbidity, dissolved organics, odor, taste and color.
A. True B. False

234. According to the text, the filter is periodically cleaned by a reversal of flow and the _____ into a drain.
A. Activated carbon filters C. Rapid-sand filters
B. Anthracite coal D. None of the above

Anthracite Coal or Activated Carbon
235. Water is normally filtered at a rate of between 10 and 2 gpm per square foot, the water is filtered through an approximate 36" depth of graded sand.
A. True B. False

236. Sodium hydroxide may also be included in the sand to improve the filtration process, especially for the removal of organic contaminants and taste and odor problems.
A. True B. False

237. Rapid sand filters were widely used in large municipal water systems by the 1920s, because they required smaller land areas compared to slow sand filters.
A. True B. False

EPA Filter Backwash Rule- Introduction

238. The U.S. Environmental Protection Agency (EPA) has finalized the Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule (LT1FBR) to increase protection of finished drinking water supplies from contamination by Cryptosporidium and other microbial pathogens.

A. True B. False

Background

239. If finished water supplies contain microbiological contaminants, disease outbreaks may result. Disease symptoms may include diarrhea, cramps, nausea, possibly jaundice, headaches and fatigue.

A. True B. False

240. The EPA has set enforceable drinking water treatment requirements to reduce the risk of waterborne disease outbreaks. Treatment technologies such as filtration and disinfection remove or inactivate microbiological contaminants.

A. True B. False

LT1FBR Required

241. The LT1FBR provisions does not apply to public water systems using surface water or ground water under the direct influence of surface water systems.

A. True B. False

Turbidity

242. Which of the following must comply with specific combined filter effluent turbidity requirements?

A. Watershed C. Conventional and Direct filtration systems
B. Disinfection profile D. None of the above

Disinfection Benchmarking

243. Public water systems will be required to develop a _____unless they perform applicability monitoring which demonstrates their disinfection byproduct levels are less than 80% of the maximum contaminant levels.

A. Disinfection profile C. Disinfection benchmark
B. Direct filtration system D. None of the above

244. According to the text, if a system considers making a significant change to their disinfection practice they must develop a(n) _____and receive State approval for implementing the change.

A. Disinfection profile C. Disinfection benchmark
B. Direct filtration systems D. None of the above

245. Which of the following that practice direct recycle, employ 20 or fewer filters to meet production requirements during a selected month, and recycle spent filter backwash water, thickener supernatant, and/or liquids from the dewatering process within the treatment process must perform a one month, one-time recycle self-assessment?

A. Recycle systems C. Direct filtration systems
B. Conventional systems D. None of the above

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

246. Which of the following will be required to return spent filter backwash water, thickener supernatant, and liquids from the dewatering process prior to the point of primary coagulant addition unless the State specifies an alternative location?
A. Recycle systems C. Direct filtration systems
B. Conventional systems D. None of the above

247. Which of the following recycling to the treatment process must provide detailed recycle treatment information to the State, which may require that modifications to the recycle practice be made?
A. Recycle systems C. Direct filtration systems
B. Conventional systems D. None of the above

Filtration Process- Detailed
248. Removal of _____ plays an important role in the natural treatment of groundwater as it percolates through the soil.
A. Suspended solids by filtration C. Coagulation and flocculation processes
B. Serious problems in filter operation D. None of the above

249. According to the text, since surface water sources are subject to run-off and do not undergo natural filtration, it must be filtered to?
A. Remove particles and impurities
B. Filtration process can be compared to a sieve or microstrainer
C. Suspended particles can easily pass
D. None of the above

250. Which of the following traps suspended material between the grains of filter media?
A. Remove particles and impurities
B. Filtration process can be compared to a sieve or microstrainer
C. Suspended particles can easily pass
D. None of the above

251. Which of the following will easily pass through the spaces between the grains of the filter media, making straining the least important process in filtration?
A. Remove particles and impurities
B. Filtration process can be compared to a sieve or microstrainer
C. Suspended particles can easily pass
D. None of the above

252. Adsorption is the process of particles sticking onto the surface of the individual filter grains or onto the previously deposited materials. The forces that attract and hold the particles to the grains are the same as those that work in _____.
A. Coagulation and flocculation C. Flocculation
B. Filter operation D. None of the above

253. Which of the following may occur in the filter bed will happen especially if coagulation and flocculation of the water before filtration was not properly controlled?
A. Coagulation and flocculation C. Flocculation
B. Filter operation D. None of the above

Direct Filtration Plant vs. Conventional Plant

254. The primary difference between Direct Filtration Plant vs. Conventional Plant is that the _____or step is omitted from the Direct Filtration plant.

A. Sedimentation process
B. Reconditioning cycle
C. Fast rinse
D. None of the above

Types of Filters

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

A. True B. False

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

A. Schmutzdecke
B. Zoological growth
C. Mud balls
D. None of the above

257. Most water filters are classified by filtration rate, type of _____, or type of operation.

A. Schmutzdecke
B. Backwash capabilities
C. Filter media
D. None of the above

Rapid Sand Filters

258. Rapid sand filters can accommodate filter rates 40 times more than?

A. Fixed film
B. Slow sand filters
C. Mixed media
D. None of the above

259. Filters in large water treatment plants are usually constructed next to each other in a row, allowing the piping from the Sedimentation basins to feed the filters from a central pipe gallery.

A. True B. False

Filter Sand

260. The filter sand used in rapid sand filters is normally play sand.

A. True B. False

261. In a filter the gravel supports the filter sand and is usually graded in three to five layers, each generally 6-18 inches in thickness, depending on the type of underdrain used.

A. True B. False

262. Which of the following will contain 24-30 inches of sand, but some newer filters are deeper?

A. Rapid sand filters
B. Slow rate filters
C. Sedimentation basins
D. None of the above

263. The coarser sand in the _____ has larger voids that do not fill as easily.

A. Rapid filters
B. Backwash trough
C. Sedimentation basin
D. None of the above

False floor
264. The false floor design of a _____ is used together with a porous plate design or with screens that retain the sand when there is no undergravel layer.
A. Backwash system C. Filter underdrain
B. Leopold system D. None of the above

Filtration Processes
265. Conventional filtration success is due partially to the high quality raw water that precedes filtration steps.
A. True B. False

High Rate Filters
266. Multi-media or mixed-media filters use three or four different materials, sand, anthracite coal, and garnet.
A. True B. False

Pressure Sand Filters
267. Filtration rates are twice as good as gravity filters.
A. True B. False

Declining Rate
268. According to the text, which of the following methods of control is used where the largest head loss occurs in the filtration process?
A. Declining Rate C. Fast sand
B. Gravity filters D. None of the above

Loss of Head Indicator
269. Which of the following is required to force the water through the filter?
A. Filter run C. Head loss
B. Force D. None of the above

In-line Turbidimeter
270. Continuous turbidity monitors provide information about when the filter is approaching this point so that the operators can start the backwash before the turbidity is too great.
A. True B. False

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

Back Washing
272. A normal backwash rate is between 1.2 to 1.5 gpm per square foot of filter surface area.
A. True B. False

Backwashing Process
273. The normal method for opening the filter backwash valve involves draining the water level above the filter to a point six inches above the filter media.
A. True B. False

Disposal of Filter Backwash Water
274. Water from the filter backwash can be returned directly to the environment.
A. True B. False

Filter to Waste
275. When filtration is started after backwash, suspended material remains in the filter media until the turbidity in the effluent meets standards. Depending on the type of filter, this may last from 20-40 minutes.
A. True B. False

Filter Aids
276. Which of the following terms expresses that the polymer strengthens the bonds and prevents the shearing forces in the filter from breaking the floc apart when used?
A. Filter media C. Filter aid
B. Lime D. None of the above

Advanced Water Treatment Section
277. Water contains _____ of which impart a quality known as hardness?
A. TDS C. Various amounts of dissolved minerals
B. Conductivity D. None of the above

Occurrence of Hard Water
278. Which of the following is caused by soluble, divalent, metallic cations, (positive ions having valence of 2)?
A. Hard water C. Carbonate hardness
B. Permanent hardness D. None of the above

Types of Hardness
279. Hardness can be categorized by either of two methods: calcium versus magnesium hardness and?
A. Carbonate hardness C. Carbonate versus non-carbonate hardness
B. Temporary hardness D. None of the above

Carbonate-Noncarbonate Distinction
280. According to the text, the carbonate-noncarbonate distinction, is based on hardness from either the bicarbonate salts of calcium or the _____involved in causing water hardness.
A. $CaCO_3$ C. Normal salts of calcium and magnesium
B. Water hardness D. None of the above

281. Which of the following is a measure of calcium and magnesium salts other than carbonate and bicarbonate salts?
A. Hardness ions C. Noncarbonate hardness
B. Permanent hardness D. None of the above

Nanofiltration
282. Nanofiltration (NF) process has been used primarily for water softening and reduction of?
A. Process liquid C. Total dissolved solids (TDS)
B. Bacterial and protozoan life D. None of the above

Reverse Osmosis

283. RO membranes have very low MWC pore size that can reject ions at very high rates, including?

A. Process liquid
C. Bacterial and protozoan life
B. Chloride and sodium
D. None of the above

Reverse Osmosis Process Section

284. Which of the following is determined by the total dissolved solids content of the saline solution, or contaminated solution on one side of the membrane?

A. This pressure differential
C. Higher molecular weights
B. Osmotic pressure
D. None of the above

Water Laboratory Analysis Section
pH Testing Section

285. 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

286. 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

287. 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

Disinfection Section
Chlorine's Appearance and Odor

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

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

289. Prolonged exposures to chlorine gas may result in?

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

Chlorine Gas
Pathophysiology

290. The odor threshold for chlorine gas is approximately?

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

Chlorination Chemistry

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

A. True
B. False

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

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

294. Hypochlorous acid is a strong acid but a weak disinfecting agent. The amount of hypochlorous acid depends on the pH and temperature of the water.
A. True B. False

Chlorine DDBP
295. These terms mean that chlorine is present as Cl, HOCl, and OCl^- is called _____, and that which is bound but still effective is _____.
A. Free available chlorine and Total
B. Free and Residual
C. Free available chlorine and Combined Chlorine
D. None of the above

296. Chloramines are formed by reactions with?
A. Acid and Cl_2 C. Folic Acid and Cl2
B. Ammonia and Cl_2 D. None of the above

Types of Residual
297. Which of the following is all chlorine that is available for disinfection?
A. Chlorine residual C. Total chlorine
B. Chlorine demand D. None of the Above

Chlorine Exposure Limits
298. What is OSHA's PEL?
A. 10 PPM C. 1,000 PPM
B. 1 PPM D. None of the above

299. Liquid chlorine is about _____ times heavier than water
A. 1.5 C. 2.5
B. 10 D. None of the above

Ozone
300. When determining Ozone CT (contact time) values must be determined for the ozone basin alone; an accurate _____ must be obtained for the contact chamber, and residual levels.
A. Residual C. Contact time
B. T10 value D. None of the above