

Registration form

Chemical Contaminants 201 CEU Training Course \$200.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00

Start and finish dates: _____

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

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

Name _____ **Signature** _____

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

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

Wastewater Collection _____ Wastewater Treatment _____ Distribution _____

Water Treatment _____ Other _____

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DISCLAIMER NOTICE

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

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

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

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

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

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

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

All downloads are electronically tracked and monitored for security purposes.

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

Chemical Contaminants 201 Answer Key

Name _____

Phone# _____

You are solely responsible in ensuring that this course is accepted for credit by your State. No refunds. Did you check with your State agency to ensure this course is accepted for credit?

Method of Course acceptance confirmation. Please fill this section

Website __ Telephone Call __ Email ____ Spoke to _____

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What is the course approval number, if applicable? _____

PA DEP Students are required to complete the original version of the text. _____
Please initial

You can use Adobe Acrobat DC to complete your assignment.

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

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**Please fax the answer key to TLC
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Rush Grading Service

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

**CHEMICAL CONTAMINANTS 201
CEU TRAINING COURSE**

CUSTOMER SERVICE RESPONSE CARD

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

1. Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

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Chemical Contaminants 201 CEU Training Course Assignment

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

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

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

Inorganic Chemical Introduction

- Which of the following terms in biological systems incorporates carbohydrates into the molecular structure?
 - Volatile Organic Compounds (VOCs)
 - Synthetic Organic Chemicals (SOCs)
 - Polychlorinated Biphenyls (PCBs)
 - Maximum Contaminant Levels (MCL)
 - Organic compounds
 - None of the Above
- Which of the following terms - are rather simple chemicals present in ground water?
 - Volatile Organic Compounds (VOCs)
 - Synthetic Organic Chemicals (SOCs)
 - Polychlorinated Biphenyls (PCBs)
 - Maximum Contaminant Levels (MCL)
 - Organic compounds
 - None of the Above
- Which of the following terms are dissolved from the rock/soil which make up the aquifer or water-bearing rock formations below the soil surface?
 - Presence of a carbon atom
 - Atmospheric CO₂
 - Typical examples
 - Inorganic compounds
 - Minerals
 - None of the Above
- Organic chemists traditionally refer to any molecule containing carbon as an organic compound and by default this means that _____ deals with molecules lacking carbon.
 - Presence of a carbon atom
 - Atmospheric CO₂
 - Inorganic chemistry
 - Inorganic compounds
 - Carbon
 - None of the Above
- Which of the following terms have been metabolically incorporated into living tissues persist in decomposing tissues?
 - Volatile Organic Compounds (VOCs)
 - Synthetic Organic Chemicals (SOCs)
 - Polychlorinated Biphenyls (PCBs)
 - Organic matter
 - Organic compounds
 - None of the Above

6. The distinction between inorganic and organic compounds is not always clear when dealing with open and closed systems, some view the open environment (i.e., the ecosphere) as an extension of life and from this perspective may consider atmospheric CO₂ as?

- A. Presence of a carbon atom
- B. An organic compound
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

7. Which of the following terms may be introduced into ground water by human activities?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Compounds
- F. None of the Above

8. Water purveyors need to test for 30 different _____ including all arsenic, barium, cadmium, lead, mercury, selenium, and thallium

- A. Presence of a carbon atom
- B. Atmospheric CO₂
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

9. Which of the following terms once living, or are living and can bring life to cells?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

10. Which of the following terms were never living, without carbon and cannot bring life to cells?

- A. Presence of a carbon atom
- B. Atmospheric CO₂
- C. Typical examples
- D. Inorganic compounds
- E. Carbon
- F. None of the Above

SOC Section -SOC Introduction

11. EPA has set Maximum Contaminant Levels for 30 _____ under the Safe Drinking Water Act.

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

12. The Safe Drinking Water Act requires that all water sources of all public water systems be periodically monitored for regulated?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

13. Which of the following terms are very persistent in the environment, whether in soil or water?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

14. Which of the following terms or "blue baby syndrome" from ingestion of elevated levels of nitrate or nitrite?

- A. Methemoglobinemia
- B. Most contaminants
- C. Three contaminant groups
- D. Elevated levels of nitrate or nitrite
- E. Chemical compounds
- F. None of the Above

15. All public water systems must monitor for?

- A. Valuable Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Constant Levels (MCL)
- E. Nitrate and Nitrite
- F. None of the Above

Volatile Organic Compounds (VOCs)

VOCs Explained

16. Which of the following terms are organic chemicals that have a high vapor pressure at ordinary, room-temperature conditions?

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Polychlorinated Biphenyls (PCBs)
- D. Maximum Contaminant Levels (MCL)
- E. Organic compounds
- F. None of the Above

17. Which of the following terms - _____ are of VOCs?.

- A. 3 organic chemicals
- B. Most scents or odors
- C. Five contaminant groups
- D. Elevated odors
- E. Substances
- F. None of the Above

18. Which of the following terms are regulated by law, especially indoors, where concentrations are the highest.

- A. Anthropogenic VOCs
- B. Aqueous solvents
- C. VOCs
- D. Benzene
- E. Methylene chloride
- F. None of the Above

Specific Components - Paints and Coatings

19. Which of the following terms are required to spread a protective or decorative film. Approximately 12 billion liters of paints are produced annually?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. None of the Above

Chlorofluorocarbons and Chlorocarbons

20. Which of the following terms - which are banned or highly regulated, were widely used cleaning products and refrigerants?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. None of the Above

Benzene

21. One VOC that is a known human carcinogen?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon
- F. None of the Above

22. Which of the following terms evaporates into the air quickly and the vapor of benzene is heavier than air allowing the compound to sink into low-lying areas?

- A. Solvents
- B. VOC
- C. Benzene
- D. Cleaning products
- E. Carbon monoxide
- F. None of the Above

23. Which of the following terms has also been known to contaminate food and water and if digested can lead to vomiting, dizziness, sleepiness, rapid heartbeat?

- A. Mother-in-law
- B. Aqueous solvents
- C. TOCs
- D. Benzene
- E. Sodium chloride
- F. None of the Above

Methylene Chloride

24. Which of the following terms is converted to carbon monoxide and a person will suffer the same symptoms as exposure to carbon monoxide?

- A. Solvent
- B. VOC
- C. Benzene
- D. Methylene chloride
- E. Carbon monoxide
- F. None of the Above

Perchloroethylene

25. Perchloroethylene is a volatile organic compound that has been linked to causing cancer in animals. It is also suspected to cause many of the breathing related symptoms of exposure to VOC's.

- A. True
- B. False

26. To avoid exposure to perchloroethylene, if a _____ is coming from clothing when picked up from the dry cleaner.

- A. Perchloroethylene
- B. Organic chemical
- C. VOC
- D. Strong chemical odor
- E. Furry creature
- F. None of the Above

MTBE

27. MTBE was used as an octane booster and?

- A. Formaldehyde
- B. FDE
- C. VOCs
- D. Oxygenated-additive
- E. Organic chemicals
- F. None of the Above

Formaldehyde

28. Many building materials such as paints, adhesives, wallboards, and ceiling tiles slowly emit?

- A. Perchloroethylene
- B. Organic chemicals
- C. VOCs
- D. Sounds
- E. Formaldehyde
- F. None of the Above

Health Risks

29. Which of the following terms are important in the creation of smog?

- A. Formaldehyde
- B. MT
- C. VOCs
- D. Perchloroethylene
- E. Organic chemicals
- F. None of the Above

Health effects include:

30. Which of the following terms can cause cancer in animals; some are suspected or known to cause cancer in humans?

- A. Perchloroethylene
- B. Organic chemicals
- C. VOCs
- D. Some organics
- E. Water
- F. None of the Above

Reducing Exposure

31. Use products with _____ in well-ventilated areas.

- A. Formaldehyde
- B. MTBE
- C. VOCs
- D. Perchloroethylene
- E. Organic chemicals
- F. None of the Above

32. Architects and engineers implement best practices in ventilation and mechanical systems, the owner must maintain good _____ thereafter.

- A. Perchloroethylene free homes
- B. Organic chemicals free homes
- C. VOCs free clothes
- D. Dinner parties
- E. Relationships
- F. None of the Above

33. Allotropy or allotropism is the property of _____ to exist in two or more different forms, known as allotropes of these elements.

- A. Allotropy
- B. Allotropes
- C. Molecular formulae
- D. Some chemical elements
- E. Metalloids
- F. None of the Above

34. Which of the following terms are different structural modifications of an element; the atoms of the element are bonded together in a different manner?

- A. Allotropy
- B. Allotropes
- C. Molecular formulae
- D. Some elements
- E. Metalloids
- F. None of the Above

35. The term allotropy is used for elements only, not for compounds. The more general term, used for any crystalline material, is?

- A. Allotropy
- B. Allotrope
- C. Molecular formulae
- D. Polymorphism
- E. Metalloid
- F. None of the Above

List of Allotropes

36. Which of the following terms are typically more noticeable in non-metals (excluding the halogens and the noble gases) and metalloids?

- A. Allotropy
- B. Allotropes
- C. Molecular formulae
- D. Some elements
- E. Metalloids
- F. None of the Above

37. Which of the following terms are capable of variable coordination number and/or oxidation states tend to exhibit greater numbers of allotropic forms?

- A. Allotropy
- B. Allotropes
- C. Molecular formulae
- D. Elements
- E. Metalloids
- F. None of the Above

Bioinorganic Compounds

38. The phosphates in DNA, and also metal complexes containing ligands that range from _____, commonly peptides, to ill-defined species such as humic acid, and to water (e.g., coordinated to gadolinium complexes employed for MRI).

- A. Crystallography
- B. Biological macromolecules
- C. Inter alia
- D. Theoretical chemistry
- E. Molecular symmetry
- F. None of the Above

Solid State Compounds

39. Which of the following terms uses techniques such as crystallography to gain an understanding of the properties that result from collective interactions between the subunits of the solid?

- A. Crystallography
- B. VSEPR theory
- C. Solid state inorganic chemistry
- D. Theoretical chemistry
- E. Molecular symmetry
- F. None of the Above

Theoretical Inorganic Chemistry

40. _____ using the tools and models of theoretical chemistry and computational chemistry, expands into bonding in simple and then more complex molecules.

- A. Crystallography
- B. VSEPR theory
- C. Bohr model of the atom
- D. Theoretical chemistry and computational chemistry
- E. Molecular symmetry
- F. None of the Above

41. Which of the following terms is the province of inorganic chemistry?

- A. Symmetry
- B. Theoretical calculations
- C. Qualitative approaches
- D. Quantum mechanical descriptions
- E. Solid state chemistry
- F. None of the Above

Qualitative Theories

42. Which of the following terms predicts, or at least rationalizes, the structures of main group compounds?

- A. Crystallography theory
- B. VSEPR theory
- C. Inter alia theory
- D. Theoretical chemistry theory
- E. Molecular symmetry theory
- F. None of the Above

Molecular Symmetry Group Theory

43. A central construct in inorganic chemistry is the theory of?

- A. Crystallography theory
- B. VSEPR theory
- C. Inter alia theory
- D. Theoretical chemistry and computational chemistry
- E. Molecular symmetry
- F. None of the Above

44. Which of the following terms provides the language to describe the shapes of molecules according to their point group symmetry?

- A. Mathematical group theory
- B. Theoretical theory
- C. Qualitative approach
- D. Evolutionary theory
- E. Solid theory
- F. None of the Above

Synthetic Inorganic Chemistry

45. Which of the following terms can be obtained in pure form from nature, most are synthesized in chemical plants and in the laboratory?

- A. Maximum Contaminant Level (MCL)
- B. Species
- C. Organisms
- D. (MCLG)
- E. Inorganic species
- F. None of the Above

46. Which of the following terms are prepared using methods of organic synthesis?

- A. Soluble inorganic compounds
- B. Methemoglobinemia
- C. Products and reactants
- D. Carcinogens
- E. Chemicals
- F. None of the Above

47. Which of the following terms are manipulated in "vacuum manifolds" consisting of glass piping interconnected through valves?

- A. Maximum corrections
- B. Chain of custody procedures
- C. Volatile compounds and gases
- D. Maximum odors
- E. Inorganic species
- F. None of the Above

Small Water Filters

48. Water filters are used for " _____ " drinking water, that is, to filter out harmful or unwanted particles before the water is used for human consumption.

- A. A carbon filter
- B. Backwash carbon
- C. Activated carbon
- D. Man-made filter
- E. Point of use
- F. None of the Above

49. Reverse osmosis works by forcing the water through a _____ that stops certain particles from passing through.

- A. Semi-permeable membrane
- B. Activated carbon
- C. Process
- D. Recommend treatment
- E. Carbon filter or system
- F. None of the Above

50. Portable water filters work using a cartridge containing activated carbon and?

- A. A carbon filter
- B. Backwash carbon
- C. Activated carbon
- D. Ion exchange resin
- E. Organic matter
- F. None of the Above

Activated Carbon Filtration

51. According to the text, which of the following terms has been used for many years to solve water problems?

- A. Osmosis
- B. Activated carbon
- C. The adsorption process
- D. Money
- E. Government
- F. None of the Above

52. According to the text, which of the following terms quickly and effectively removes chlorine from water?

- A. A carbon filter
- B. Robots
- C. Activated carbon
- D. Man-made organics
- E. Organic matter
- F. None of the Above

53. According to the text, _____ takes time, so service rates should be limited to 5 gpm/ft (12m/hr) or less for these applications?

- A. Reverse Osmosis
- B. Activated carbon
- C. The adsorption process
- D. Sand filter
- E. A carbon filter or system
- F. None of the Above

Synthetic Organic Chemicals

54. Synthetic organic chemicals (SOC) include all?

- A. Carbon based units
- B. Carbon atoms
- C. Re-activated carbon
- D. Man-made organics
- E. Organic matter
- F. None of the Above

55. According to the text, which of the following terms can substantially reduce many VOCs such as benzene, trichlorethane and carbon tetrachloride?

- A. Reverse Osmosis
- B. Activated carbon
- C. The adsorption process
- D. Fire
- E. A carbon filter or system
- F. None of the Above

56. According to the text, which of the following terms also removes SOC's such as Alachlor, EDB and toluene?

- A. A carbon filter
- B. Backwash carbon
- C. Activated carbon
- D. Man-made machines
- E. Organic filters
- F. None of the Above

57. Before recommending _____, water suspected of containing any of these and other substances must be analyzed to determine their concentrations and whether they exceed the EPA standards.

- A. Reverse Osmosis
- B. Activated carbon
- C. The adsorption process
- D. Treatment
- E. A carbon filter or system
- F. None of the Above

58. When operating _____ on turbid water supplies, remove suspended particles with a depth filter before treating it with activated carbon.

- A. Reverse Osmosis process
- B. Activated carbon filters
- C. The adsorption process
- D. A boat
- E. A carbon filter or system
- F. None of the Above

59. According to the text, which of the following terms typically backwashes at 10 gpm/ft (25 m/hr) for about 10 minutes, followed by a 5 minute downflow rinse?

- A. A carbon filter
- B. Backwash carbon filter
- C. Activated carbon process
- D. Man
- E. Organic matter filtering
- F. None of the Above

60. Over a period of several months to two years, the carbon's adsorption capacity diminishes. The exhausted _____ should be replaced with fresh carbon. The old carbon should be hauled to an approved disposal facility.

- A. Reverse Osmosis
- B. Activated carbon
- C. Adsorption process
- D. Carbon bed
- E. A carbon filter or system
- F. None of the Above

Membrane Filtration Processes

61. According to the text, which of the following terms - a process in which water from a dilute solution will naturally pass through a porous membrane into a concentrate solution?

- A. Reverse osmosis
- B. A porous membrane
- C. Potable water
- D. RO membranes
- E. Osmosis
- F. None of the Above

62. It wasn't until the late 1950s that membranes were produced that could be used for what is known as?

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

63. _____ water is forced to move through a membrane from a concentrate solution to a dilute solution.

- A. Reverse osmosis
- B. A porous membrane
- C. Potable water
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

64. According to the text, which of the following terms are membranes have been used for desalinization, removal of dissolved inorganic and organic chemicals, water softening, and removal of the fine solids?

- A. Direct filtration process
- B. Potable water treatment
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

65. According to the text, which of the following terms enables some water systems having contaminated water sources to meet new, more stringent regulations?

- A. Reverse osmosis
- B. A porous membrane
- C. Potable water
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

66. There is great potential for the continuing wide use of this method in potable water treatment, especially as technology improves and costs are reduced.

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

Microfiltration

67. Microfiltration (MF) is a process in which water is forced under pressure through?

- A. Reverse osmosis
- B. A porous membrane
- C. Potable water
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

68. Membranes with a pore size of $0.45\mu\text{m}$ are normally used; this size is relatively large compared with the other?

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

69. This process has not been generally applicable to drinking water treatment because it either does not remove substances or the problem substances can be removed more economically using?

- A. Reverse osmosis
- B. A porous membrane
- C. Other processes
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

70. According to the text, which of the following terms is by industries to remove very fine particles from process water?

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

71. According to the text, which of the following terms are susceptible to clogging or filter binding unless the water being processed is already quite clean?

- A. Reverse osmosis filters
- B. Porous membranes
- C. Probable water filters
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

72. Microfiltration has been proposed as a filtering method for particles resulting from the?

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

73. According to the text, _____ has used the injection of coagulants such as alum or polymers into the raw water stream to remove turbidity such as clay or silts?

- A. Direct filtration process
- B. MF
- C. Desalinization
- D. Membrane filtration processes
- E. Reverse osmosis
- F. None of the Above

74. The formed particles were then removed by?

- A. Reverse osmosis
- B. A porous membrane
- C. Portable water filter
- D. RO membranes
- E. Rapid sand filters
- F. None of the Above

Ultrafiltration

75. According to the text, which of the following terms is a process that uses a membrane with a pore size generally below 0.1 μm .

- A. EDR
- B. RO
- C. ED
- D. NF
- E. XF
- F. None of the Above

76. According to the text, _____ can be designed to pass material that weigh less than or equal to a certain molecular weight?

- A. Demineralizing compartments
- B. UF
- C. Processes for this service
- D. Direct electric current applied to the solution
- E. Membrane process
- F. None of the Above

77. According to the text, which of the following terms does not generally work well for removal of salt or dissolved solids, it can be used effectively for removal or most organic chemicals?

- A. Electrodialysis Reversal (EDR)
- B. An important RO process
- C. These RO membranes
- D. NF
- E. UF
- F. None of the Above

Nanofiltration

78. Nanofiltration (NF) is a process using membranes that will reject even smaller molecules than?

- A. DO
- B. UF
- C. UFO
- D. ET
- E. Membrane process
- F. None of the Above

79. NF's capability will undoubtedly increase the use of _____ for potable water treatment.

- A. EDR
- B. RO process
- C. These RO membranes
- D. NF
- E. UF
- F. None of the Above

Reverse Osmosis

80. RO is a membrane process that has the highest rejection capability of all the?

- A. Demineralizing compartments
- B. UF
- C. Processes for this service
- D. Machines
- E. Membrane processes
- F. None of the Above

81. Which of the following terms have very low MWC pore size that can reject ions at very high rates, including chloride and sodium?

- A. Electrodialysis Reversal (EDR) membranes
- B. RO process
- C. These RO membranes
- D. NF
- E. UF
- F. None of the Above

82. Water from this _____ is very pure due to the high reject rates. A. Demineralizing process

- B. UF
- C. Service
- D. Device
- E. System
- F. None of the Above

83. Industrial water uses such as semiconductor manufacturing is also an important _____.

- A. Purpose
- B. RO process
- C. RO membranes
- D. Function
- E. UF
- F. None of the Above

Electrodialysis

84. Electrodialysis (ED) is a process in which ions are transferred through _____ as a result of direct electric current applied to the solution.

- A. Demineralizing compartments
- B. A membrane
- C. Processes for this service
- D. The solution
- E. Membrane process
- F. None of the Above

Electrodialysis Reversal

85. Electrodialysis Reversal (EDR) is a process similar to _____, except that the polarity of the direct current is periodically reversed.

- A. ED
- B. An important RO process
- C. RO membranes
- D. NF
- E. UF
- F. None of the Above

86. The reversal in polarity reverses the flow of ions _____ compartments, which provides automatic flushing of scale-forming materials from the membrane surface.

- A. Between demineralizing
- B. In the UF
- C. In the processing
- D. Direct electric current applied to the solution
- E. Breakdown
- F. None of the Above

87. Which of the following terms and EDR have been used at only a few locations for drinking water treatment.

- A. ED
- B. An important RO process
- C. These RO membranes
- D. NF
- E. UF
- F. None of the Above

Inorganic Chemistry

88. Inorganic chemistry is the study of the synthesis and behavior of?

- A. Myriad organic compounds
- B. Inorganic compounds
- C. Some metals
- D. Ionic compounds
- E. Inorganic and organometallic compounds
- F. None of the Above

89. The distinction between the two disciplines is far from absolute, and there is much overlap, most importantly in the sub-discipline of?

- A. Crystallization
- B. Inorganic salts
- C. Electrically neutral
- D. Organometallic chemistry
- E. Lead, mercury, and arsenic
- F. None of the Above

Key Concepts

90. Many inorganic compounds are ionic compounds, consisting of _____ joined by ionic bonding.

- A. Myriad organic compounds
- B. Inorganic compounds
- C. Some metals
- D. Cations and anions
- E. Electron affinity (anions)
- F. None of the Above

91. In any salt, the proportions of the ions are such that the electric charges cancel out, so that the bulk compound is?

- A. A shiny crystal
- B. An inorganic salt
- C. Electrically neutral
- D. A sub-discipline of organometallic chemistry
- E. Electrically positive
- F. None of the Above

92. The ions are described by their oxidation state and their ease of formation can be inferred from the ionization potential or from the electron affinity.

- A. True
- B. False

93. Important classes of inorganic salts are the _____, the sulfates and the halides.

- A. Crystals
- B. Oxides, the carbonates
- C. Electrically neutral cations
- D. Sub-discipline of organometallic chemistry like
- E. Sulfites
- F. None of the Above

94. Inorganic salts typically are poor conductors in the?

- A. Myriad
- B. Inorganic compound mixture
- C. Customer's coffee
- D. Ionic compound
- E. Solid state
- F. None of the Above

95. Another important feature is their solubility in water, e.g?

- A. And ease of crystallization
- B. Inorganic salts
- C. Electrically neutral
- D. Sub-discipline of organometallic chemistry
- E. Ionic compound
- F. None of the Above

96. In redox reactions one reactant, the oxidant, lowers its _____ and the reductant, has its oxidation state increased.

- A. pH
- B. Redox state
- C. Oxidation state
- D. Ionic count
- E. Electron affinity (anions)
- F. None of the Above

97. Which of the following terms can occur indirectly as well, e.g., in batteries, a key concept in electrochemistry?

- A. Crystallization
- B. Inorganic salts
- C. Electrically neutral charges
- D. Electron exchange
- E. Regeneration
- F. None of the Above

98. When one reactant contains hydrogen atoms, a reaction can take place by exchanging protons in acid-base chemistry. In a more general definition, an acid can be any chemical species capable of binding to electron pairs is called a Lewis acid; conversely any molecule that tends to donate an electron pair is referred to as a Lewis base.

- A. True
- B. False

99. Soil may contain iron sulfide as pyrite or _____.

- A. Often similar reactivity
- B. Coordination complexes
- C. Classification of compounds
- D. Man-made inorganic compounds
- E. Nature-made inorganic compounds
- F. None of the Above

100. Inorganic compounds are also found multitasking as biomolecules: as electrolytes, in energy storage (ATP) or in construction.

- A. True
- B. False

101. _____ was ammonium nitrate for soil fertilization through the Haber process.

- A. Compound
- B. Complexed mineral
- C. Cation
- D. Man-made inorganic compound
- E. Nature-made inorganic compounds
- F. None of the Above

102. Subdivisions of inorganic chemistry are active areas of research in inorganic chemistry, aimed toward new catalysts, superconductors, and therapies.

A. True B. False

Descriptive Inorganic Chemistry

103. Descriptive inorganic chemistry focuses on the _____ based on their properties.

- A. Classification of reactivity
B. Classification of coordination complexes
C. Classification of compounds
D. Classification of inorganic compound
E. Classification of nature
F. None of the Above

104. Partly the classification focuses on the position in the periodic table of the heaviest element in the compound, partly by grouping compounds by their?

- A. Supramolecular similarities
B. Classical coordination compounds
C. Inorganic compounds similarities
D. Structural similarities
E. Organometallic chemistry similarities
F. None of the Above

105. When studying inorganic compounds, one often encounters parts of the different classes of inorganic chemistry; an organometallic compound is characterized by its coordination chemistry, and may show interesting?

- A. Often similar reactivity
B. Coordination complexes
C. Classification of compounds
D. Man-made inorganic compound
E. Solid state properties
F. None of the Above

Different classifications are:

Coordination Compounds

106. _____ almost all organic and inorganic compounds can be used as ligands.

- A. Supramolecular coordination chemistry
B. Classical coordination compounds
C. Inorganic compounds
D. Modern coordination compounds
E. Organometallic chemistry
F. None of the Above

107. The "metal" usually is a metal from the groups 3-13, as well as the trans-lanthanides and trans-actinides, all chemical compounds can be described as?

- A. Reactivity
B. Coordination complexes
C. Classification of compounds
D. Man-made inorganic compound
E. Small nuclear explosions
F. None of the Above

108. The stereochemistry of coordination complexes can be a topical theme within this specialization is?

- A. Supramolecular coordination chemistry
B. Classical coordination chemistry
C. Inorganic chemistry
D. Bath tub chemistry
E. Organometallic chemistry
F. None of the Above

Main Group Compounds

109. Which of the following terms from groups 1, 2 and 13-18 (excluding hydrogen) of the periodic table?

- A. Often similar flavors
- B. Coordination colors
- C. Elements
- D. Man-made inorganic compounds
- E. Minerals
- F. None of the Above

110. Which of the following terms have been known since the beginnings of chemistry, e.g., elemental sulfur and the distillable white phosphorus?

- A. Main group compounds
- B. Organometallic chemistry
- C. Organometallic compounds
- D. Metal-metal bonded dimetallic complexes
- E. Organic compounds
- F. None of the Above

111. Experiments on oxygen, by Lavoisier and Priestley not only identified an important diatomic gas, but opened the way for describing compounds and reactions according to?

- A. Transition metals
- B. Diatomic gases
- C. Stoichiometric ratios
- D. Metal carbonyls
- E. Transition metal compounds
- F. None of the Above

112. The discovery of a practical synthesis of ammonia using iron catalysts by Carl Bosch and Fritz Haber in the early 1900s deeply impacted mankind, demonstrating the significance of?

- A. Transition metal synthesis
- B. Organometallic chemistry synthesis
- C. Organometallic synthesis
- D. Metal-metal synthesis
- E. Inorganic chemical synthesis
- F. None of the Above

113. According to the text, main group compounds are SiO_2 , SnCl_4 , and N_2O . Many main group compounds can also be classed as?

- A. Transition metals
- B. An important diatomic gas
- C. Organometallic
- D. Metal carbonyls and even metal alkoxides
- E. Transition metal compounds
- F. None of the Above

114. Which of the following terms such as the fullerenes, buckytubes and binary carbon oxides?

- A. Transition metal compounds
- B. Organometallic chemistry
- C. Organometallic compounds
- D. Metal-metal bonded dimetallic complexes
- E. Organic compounds
- F. None of the Above

Transition Metal Compounds

115. Compounds with a metal from group 3 or 12 are sometimes also incorporated into this group, but also often classified as?

- A. Transition metal compounds
- B. Main group compounds
- C. Organometallic compounds
- D. Carbonyls compounds
- E. Transition metal compounds
- F. None of the Above

116. Transition metal compounds show a rich coordination chemistry, varying from tetrahedral for titanium (e.g., TiCl_4) to square planar for some nickel complexes to octahedral for _____ of cobalt.

- A. Transition metal compounds
- B. Organometallic complexes
- C. Organometallic compounds
- D. Metal-metal bonded dimetallic complexes
- E. Coordination complexes
- F. None of the Above

117. Which of the following terms can be found in biologically important compounds, such as iron in hemoglobin?

- A. Transition metals
- B. Complexes
- C. Organometallic complexes
- D. Metal complexes
- E. Transition metal compounds
- F. None of the Above

Organometallic Compounds

118. Usually, M-C-H group the metal (M) in these species can either be a main group element or a?

- A. Transition metal compound
- B. Transition metal
- C. Organometallic compound
- D. Metal-metal bonded dimetallic complex
- E. Organic compound
- F. None of the Above

119. Which of the following terms is more relaxed to include also highly lipophilic complexes such as metal carbonyls and even metal alkoxides?

- A. Transition metals
- B. An important diatomic gas
- C. An organometallic compound
- D. Metal carbonyls and even metal alkoxides
- E. Transition metal compounds
- F. None of the Above

120. Which of the following terms employs more specialized preparative methods than was traditional in Werner-type complexes?

- A. Transition metal compounds
- B. Organometallic chemistry
- C. Organometallic compounds
- D. Metal-metal chemistry
- E. Organic chemistry
- F. None of the Above

121. _____, especially the ability to manipulate complexes in solvents of low coordinating power, enabled the exploration of very weakly coordinating ligands such as hydrocarbons.

- A. Transition metals
- B. Synthetic gas methodology
- C. Synthetic methodology
- D. Synthetic carbonyl and even metal alkoxides
- E. Transition metal compounds
- F. None of the Above

Cluster Compounds

122. Clusters can be found in all classes of?

- A. Transition metal compounds
- B. Organometallic chemistry
- C. Organometallic compounds
- D. Chemical compounds
- E. Organic compounds
- F. None of the Above

123. _____ organometallic chemistry, main group chemistry, and bioinorganic chemistry.

- A. Transition metals
- B. Inorganic systems
- C. Organometallic systems
- D. Metal carbonyls and even metal alkoxides
- E. Transition metal compounds
- F. None of the Above

124. The interface is the chemical basis of nanoscience or nanotechnology and specifically arise from the study of quantum size effects in _____.

- A. Transition metal compounds
- B. Organometallic chemistry
- C. Organometallic compounds
- D. Metal-metal bonded dimetallic complexes
- E. Organic compounds
- F. None of the Above

Bioinorganic Compounds

125. By definition, these compounds occur in nature, but the subfield includes anthropogenic species, such as pollutants (e.g., methylmercury) and drugs (e.g., Cisplatin). The field, which incorporates many aspects of biochemistry, includes many kinds of compounds, e.g., the phosphates in DNA, and metal complexes containing ligands that range from biological macromolecules, commonly peptides, to ill-defined species such as humic acid, and to water (e.g., coordinated to gadolinium complexes employed for MRI).

- A. True
- B. False

126. Which of the following terms includes the study of both non-essential and essential elements with applications to diagnosis and therapies?

- A. Symmetry to spectroscopy
- B. Theoretical calculations
- C. Qualitative approach
- D. Medicinal inorganic chemistry
- E. Solid state chemistry
- F. None of the Above

Solid State Compounds

127. Which of the following terms uses techniques such as crystallography to gain an understanding of the properties that result from collective interactions between the subunits of the solid?

- A. Crystallography
- B. VSEPR theory
- C. Solid state inorganic chemistry
- D. Computational chemistry
- E. Molecular symmetry
- F. None of the Above

128. Which of the following terms are metals and their alloys or intermetallic derivatives?

- A. Symmetry to spectroscopy
- B. Theoretical calculations
- C. Qualitative approach
- D. Precise quantum mechanical descriptions
- E. Solid state chemistry
- F. None of the Above

Theoretical Inorganic Chemistry

129. Which of the following terms using the tools and models of theoretical chemistry and computational chemistry, expands into bonding in simple and then more complex molecules?

- A. Crystallography
- B. VSEPR theory
- C. Bohr model of the atom
- D. Theoretical chemistry and computational chemistry
- E. Molecular symmetry
- F. None of the Above

130. _____ the province of inorganic chemistry has spawned many semi-quantitative or semi-empirical approaches including molecular orbital theory.

- A. Symmetry
- B. Theoretical calculations
- C. Qualitative approaches
- D. Quantum mechanical descriptions
- E. Solid state chemistry
- F. None of the Above

Qualitative Theories

131. Which of the following terms powerfully predicts, or at least rationalizes, the structures of main group compounds?

- A. Crystallography theory
- B. VSEPR theory
- C. Inter alia theory
- D. Theoretical chemistry theory
- E. Molecular symmetry theory
- F. None of the Above

132. For the transition metals, crystal field theory allows one to understand the magnetism of many simple complexes, such as why $[\text{Fe}^{\text{III}}(\text{CN})_6]^{3-}$ has only one unpaired electron, whereas $[\text{Fe}^{\text{III}}(\text{H}_2\text{O})_6]^{3+}$ has five. A particularly powerful qualitative approach to assessing the structure and reactivity begins with classifying molecules according to electron counting, focusing on the numbers of valence electrons, usually at the central atom in a molecule.

- A. True
- B. False

Molecular Symmetry Group Theory

133. A central construct in inorganic chemistry is the theory of?

- A. Crystallography theory
- B. VSEPR theory
- C. Inter alia theory
- D. Theoretical chemistry and computational chemistry
- E. Molecular symmetry
- F. None of the Above

134. Which of the following terms provides the language to describe the shapes of molecules according to their point group symmetry?

- A. Mathematical group theory
- B. Theoretical theory
- C. Qualitative approach
- D. Evolutionary theory
- E. Solid theory
- F. None of the Above

135. Knowledge of the crystallography properties of the ground and excited states allows one to predict the numbers and intensities of absorptions in vibrational and electronic spectra.

- A. True
- B. False

136. The most common applications of precise quantum mechanical description to spectroscopy involve vibrational and electronic spectra.

- A. True
- B. False

137. Which of the following terms highlights commonalities and differences in the bonding of otherwise disparate species, such as WF_6 and $\text{Mo}(\text{CO})_6$ or CO_2 and NO_2 ?

- A. Group theory
- B. Theoretical calculation
- C. Qualitative approach
- D. Precise quantum mechanical description
- E. Solid state chemistry
- F. None of the Above

Synthetic Inorganic Chemistry

138. Which of the following terms can be obtained in pure form from nature, most are synthesized in chemical plants and in the laboratory?

- A. Maximum Contaminant Level (MCL)
- B. Species
- C. Organisms
- D. Maximum Contaminant Level Goals (MCLG)
- E. Inorganic species
- F. None of the Above

139. Which of the following terms are prepared using methods of organic synthesis. For metal-containing compounds that are reactive toward air?

- A. Soluble inorganic compounds
- B. Methemoglobinemia
- C. Products and reactants
- D. Carcinogens
- E. Chemicals
- F. None of the Above

140. Which of the following terms are manipulated in “vacuum manifolds” consisting of glass piping interconnected through valves?

- A. Corrections
- B. Gas and Chains
- C. Volatile compounds and gases
- D. Maximum odors
- E. Inorganic species
- F. None of the Above

141. Which of the following terms are condensed using liquid nitrogen or other cryogenes?

- A. Compounds
- B. Methemoglobinemia
- C. Products and reactants
- D. Carcinogens
- E. Chemicals
- F. None of the Above

142. Solids are typically prepared using tube furnaces, the reactants and products being sealed in containers, often made of fused silica (amorphous SiO_2) but sometimes more specialized materials such as welded Ta tubes or Pt “boats”. Products and reactants are transported between temperature zones to drive reactions.

- A. True
- B. False

Regulated Chemical Contaminants

143. This series of rules are known as the Chemical Phase Rules define regulations for three contaminant groups: _____, Synthetic Organic Chemicals (SOC), and Volatile Organic Chemicals (VOC).

- A. Inorganic Chemicals (IOC)
- B. IOUs and UFOs
- C. Products and reactants
- D. Carcinogens
- E. Chemical Phase Rules
- F. None of the Above

144. Non-Detects (ND) - laboratory analysis indicates that the constituent is not present.

- A. True
- B. False

145. Parts per million (ppm) or Milligrams per liter (mg/L) - one part per million corresponds to ten minutes in one year or a single penny in \$1,000.

- A. True
- B. False

146. The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow is called the “Action level” .

- A. True
- B. False

147. Maximum Contaminant Level - the "Maximum Allowed" (MCL) is the lowest level of a contaminant that is allowed in drinking water.

- A. True B. False

148. Maximum Contaminant Level Goal - the "Goal" (MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

- A. True B. False

149. Parts per billion (ppb) or Micrograms per liter (ug/L) - one part per billion corresponds to one minute in 10,000 years, or a single penny in \$10,000.

- A. True B. False

150. Picocuries per liter (pCi/L) - picocuries per liter is a measure of the radioactivity in water.

- A. True B. False

Chain of Custody Procedures

151. Which of the following terms are used to maintain and document sample possession from the time the sample is collected until it is introduced as evidence?

- A. Samples D. Chain of custody procedures
B. Seal E. Chain of custody record
C. Evidence tape F. None of the Above

152. _____ of a sample, have it in view, or have physically secured it to prevent tampering then it is defined as being in "custody."

- A. Physical possession D. Physical evidence
B. A taste E. Chain of custody record
C. Evidence tape F. None of the Above

Wastewater Priory Pollutants Section

Wastewater/Pretreatment Sampling General Information

153. In accordance with the Clean Water Act and _____, the POTW conducts a variety of sampling activities which must be closely coordinated.

- A. General Pretreatment Program Regulations D. Priority Pollutants within
B. Each site user and E. Characteristics of the wastes
C. All industrial users and F. None of the Above

Permit Application Policy Example

154. All industrial users that require a permit must be sampled to determine the characteristics of the _____ to be discharged into the POTW's sewer system.

- A. SROG D. Priority Pollutants
B. Local limits E. Wastes
C. Outer limits F. None of the Above

155. Prior to the issuance of a permit for existing industrial users, the POTW samples the user's effluent, and performs the analyses required by the applicable discharge standards (i.e., Categorical standards or?

- A. Taste test
- B. Local limits
- C. SDWA
- D. Priority Pollutants
- E. Characteristics of the wastes
- F. None of the Above

156. For new industrial users, estimates of the _____ to be discharged into the POTW's sewer system must be submitted along with the permit application.

- A. Wastes
- B. CWA
- C. Odor
- D. Priority Pollutants
- E. Characteristics of the wastes
- F. None of the Above

157. No sampling would be performed at these new facilities, since they do not presently discharge wastes into the?

- A. POTWs
- B. Sewer system
- C. CMOM
- D. Priority system
- E. Interceptor
- F. None of the Above

158. A four-day sampling program is usually conducted at _____ to collect both composite and grab (for pollutants not amenable to composite sampling) samples as needed.

- A. POTWs
- B. Each site
- C. All industrial users
- D. The interceptor
- E. The manhole
- F. None of the Above

Wastewater Priory Pollutants

159. The concentrations of various substances in _____ in dissolved, colloidal or suspended form are typically low but vary considerably.

- A. POTWs
- B. These 126 pollutants
- C. New industrial users
- D. Priority Pollutants
- E. Water
- F. None of the Above

160. Priority Pollutants refer to a list of 126 specific pollutants that includes heavy metals and specific organic chemicals. The priority pollutants are a subset of " _____ " as defined in the Clean Water Act (USA).

- A. POTWs
- B. Toxic pollutants
- C. Friendly pollutants
- D. Priority Pollutants
- E. Safe contaminants
- F. None of the Above

161. Which of the following terms were assigned a high priority for development of water quality criteria and effluent limitation guidelines because they are frequently found in wastewater?

- A. POTW managers
- B. These 126 pollutants
- C. Safe contaminants
- D. Priority Pollutants
- E. The concentrations of various substances
- F. None of the Above

162. _____ with an approved pretreatment program must develop local limits for arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver and zinc.

- A. Each POTW
- B. Each city
- C. All industrial users
- D. Priority pollutant producers
- E. Home owners
- F. None of the Above

163. The POTW must also identify all _____ and evaluate the need for limits for these pollutants.

- A. Other pollutants of concern
- B. 126 pollutants
- C. New industrial users
- D. Priority Pollutants
- E. Concentrations of various substances
- F. None of the Above

164. Concentrations of various substances is defined as any pollutant limited in the POTW's NPDES permit or found in the collection system in sufficient quantity to have a reasonable potential to cause pass through or interference at the treatment plant, pose a threat to worker health and safety, or to cause other problems within the collection system or at the treatment plant, such as explosions or obstruction of wastewater flow.

- A. True
- B. False

165. The priority pollutant scans performed periodically by POTWs with approved pretreatment programs are useful in identifying?

- A. Pollutants of concern
- B. These 126 pollutants
- C. New industrial users
- D. Priority Pollutants
- E. The concentrations of various substances
- F. None of the Above

166. POTWs with multiple plants may wish to develop _____ for each plant or after calculating the limits for each plant choose the most stringent as uniform local limits across all plants.

- A. Local limits
- B. Headworks
- C. Industrial users
- D. Priority Pollutants
- E. Characteristics of the wastes
- F. None of the Above

167. Local limits are most often associated with the control of toxic pollutants. However, if a POTW has experienced violations of their?

- A. POTWs
- B. Surcharge programs
- C. Industrial users
- D. NPDES permit effluent limits for conventional pollutants
- E. Local limits
- F. None of the Above

168. Many POTWs have surcharge programs for?

- A. POTWs
- B. Conventional pollutants
- C. All industrial users
- D. Priority Pollutants
- E. Local limits
- F. None of the Above

169. A POTW should set absolute upper limits for _____ in its sewer use ordinance (SUO) or industrial user (IU) permits, based on total plant capacity.

- A. Conventional pollutants
- B. Surcharge programs
- C. All industrial users
- D. Priority Pollutants
- E. Local limits
- F. None of the Above

170. Which of the following terms can stimulate the growth of algae and other aquatic plants?

- A. Excess nutrients
- B. Industrial discharges
- C. Heavy Metal
- D. Carbon, nitrogen and phosphorus
- E. Agricultural runoff
- F. None of the Above

171. When these plants die and decompose, they may reduce the amount of _____ in the water.

- A. Nutrients
- B. Oxygen
- C. Heavy Metal
- D. Carbon, nitrogen and phosphorus
- E. Agricultural runoff
- F. None of the Above

172. Which of the following terms can also get into wastewater from industrial discharges, common household detergents and cleaners, runoff from streets and lawns and air pollutants that fall to the ground?

- A. Nutrients
- B. Industrial discharges
- C. Heavy Metal
- D. Carbon, nitrogen and phosphorus
- E. Agricultural runoff
- F. None of the Above

173. Treatment plants cannot remove all _____ from the wastewater.

- A. Nutrients
- B. Industrial discharges
- C. Heavy Metal
- D. Carbon, nitrogen and phosphorus
- E. Agricultural runoff
- F. None of the Above

174. "Heavy Metal" in the water treatment field refers to heavy, dense, _____ that occur only at trace levels in water, but are very toxic and tend to accumulate.

- A. Nutrients
- B. Industrial discharges
- C. Heavy Metal
- D. Metallic elements
- E. Agricultural runoff
- F. None of the Above

175. Which of the following terms include DDT, Aldrin, Chlordane, Endosulfan, Endrin, Heptachlor, and Diazinon. Surprisingly, concentrations of pesticides in urban runoff may be equal or greater than the pesticides in agricultural runoff?

- A. Nutrients
- B. Industrial discharges
- C. Heavy Metal
- D. Typical pesticides and herbicides
- E. Agricultural runoff
- F. None of the Above

176. Which of the following terms spilled or released petroleum products and combustion products that are found in urban runoff?

- A. PAHs
- B. Priority Pollutants
- C. Chemical standards
- D. Open-ended groups of pollutants
- E. Inorganics
- F. None of the Above

177. Polychlorinated biphenyls are organic chemicals that formerly had widespread use in electrical transformers and hydraulic equipment. This class of chemicals is extremely persistent in the environment and has been proven to bioconcentrate in the food chain, thereby leading to environmental and human health concerns in areas such as the Great Lakes.

- A. True
- B. False

178. The Priority Pollutants are a set of _____ EPA regulates, and for which EPA has published analytical test methods.

- A. Combustion products
- B. Chemical pollutants
- C. Chemical standards
- D. Open-ended groups of pollutants
- E. Sampling requirements for inorganics
- F. None of the Above

179. _____ list is more practical for testing and for regulation in that chemicals are described by their individual chemical names.

- A. Organics
- B. Preservatives
- C. Priority Pollutant
- D. List of toxic pollutants more usable
- E. Environmental and human health concerns
- F. None of the Above

180. Which of the following terms contains hundreds of compounds; there is no test for the group as a whole, nor is it practical to regulate or test for all of these compounds.

- A. Combustion products
- B. Priority Pollutants
- C. Chemical standard
- D. Open-ended groups of pollutants
- E. The list of toxic pollutants
- F. None of the Above

Proper Sample Handling

181. The proper handling of _____ also includes wearing gloves.

- A. Containers and preservatives
- B. Water quality samples
- C. The most common preservatives
- D. Pre-preserved bottles
- E. Samples in the shade
- F. None of the Above

182. Gloves not only protect field personnel, but also prevent potential contamination to the water sample. Always wear powderless, disposable gloves.

- A. True
- B. False

183. When sampling for organics, wear latex gloves.

- A. True
- B. False

184. Nitrile gloves are not appropriate for organics.

- A. True
- B. False

185. Use chain-of-custody procedures when coolers and containers are prepared, sealed and shipped. They will remain sealed until used in the field.

- A. True
- B. False

186. When making arrangements with the laboratory, make sure you request enough containers, including those for blank and duplicate samples. Order extra sample bottles to allow for breakage or contamination in the field.

- A. True
- B. False

187. Some samples require _____ and/or preservation with chemicals to maintain their integrity during shipment and before analysis in the laboratory.

- A. Containers and preservatives
- B. Low-temperature storage
- C. The most common preservatives
- D. Pre-preserved bottles
- E. Samples in the shade
- F. None of the Above

188. Which of the following terms are hydrochloric, nitric, sulfuric and ascorbic acids, sodium hydroxide, sodium thiosulfate, and biocides?

- A. Containers and preservatives
- B. Low-temperature storage
- C. Preservatives
- D. Pre-preserved bottles
- E. Samples
- F. None of the Above

189. Some federal and state agencies allow the use of _____, some may require either cool temperatures or added preservatives in the field.

- A. Appropriate for organics
- B. Preservatives
- C. Pre-preserved sample containers
- D. List of toxic pollutants more usable
- E. Environmental and human health concerns
- F. None of the Above

190. Which of the following terms are received from the laboratory, check to see that none have leaked?

- A. Containers and preservatives
- B. Paperwork
- C. Most common preservatives
- D. Pre-preserved bottles
- E. Donuts
- F. None of the Above

191. Make sure you can tell which containers are a one-time inorganic chemical analysis because extra care must be taken not to overfill them when collecting samples in the field.

- A. True
- B. False

192. Check with the laboratory about field parameters procedures when using pre-preserved bottles.

- A. True
- B. False

Field Parameters

193. Measure and record the _____ of temperature, electrical conductivity, pH and dissolved oxygen in an undisturbed section of streamflow.

- A. Process
- B. Optimal effects
- C. Current
- D. Grab samples
- E. Field parameters
- F. None of the Above

Chemical Monitoring

194. The final federal rules regarding Phase II and V contaminants were promulgated by the U.S. EPA in 1992 and initial monitoring began in January 1993. This group of contaminants consists of Inorganic Chemicals (IOC), Volatile Organic Chemicals (VOC) and Synthetic Organic Chemicals (SOC) and the rule applies to all?

- A. Contamination
- B. Mix surface and ground water
- C. Gross alpha activity
- D. Promulgated by the U.S. EPA in 1992
- E. A one-time inorganic chemical analysis
- F. None of the Above

Inorganic Chemical Monitoring

195. The one-time inorganic chemical analysis sample is to be collected at _____ to the distribution system representative of each source after any application of treatment.

- A. Contamination sources
- B. Areas of surface and ground water
- C. Signs of gross alpha activity
- D. Entry points (POE)
- E. Water main breaks
- F. None of the Above

Nitrates

196. Nitrate is an organic chemical that occurs unnaturally in some groundwater but most often is introduced into ground and surface waters by man.

- A. True B. False

197. At high levels (over 100 mg/l) it can cause the “blue baby” syndrome in young infants, which can lead to serious illness and even death. It is regarded as an “Chronic health risk” because it can quickly cause illness.

- A. True B. False

198. Every water system must test for Nitrate at least yearly, systems that use _____ must test yearly.

- A. Contamination
B. Mix surface and ground water
C. Ground water only
D. Water
E. A one-time inorganic chemical analysis
F. None of the Above

199. A surface water system may go to yearly testing if community and nontransient noncommunity water must do quarterly monitoring whenever they exceed 5 mg/l in a test.

- A. True B. False

200. After 4 quarters of testing and the results show that the nitrate level is not going up, they may go back to yearly testing.

- A. True B. False

Radiological Contaminants

201. Some of the community water systems may monitor for gross beta activity every four years for each source.

- A. True B. False

202. Depending on your state rules, compliance will be based on the annual composite of 4 consecutive quarters or _____.

- A. Sample instructions
B. Established action levels
C. Minimum aeration
D. Laboratory performance requirements
E. Average annual concentration
F. None of the Above

203. If the average annual concentration is less than one tenth the MCL, an analysis of a single sample may be substituted for the quarterly sampling procedure.

- A. True B. False

Total Trihalomethanes (TTHM)

204. All community water systems serving a population of 10,000 or more and which add a disinfectant in any part of the drinking water treatment process shall monitor for total trihalomethanes (TTHM).

- A. True B. False

205. The MCL is 0.1 mg/l and consists of a calculation of _____ of the concentrations of bromodichloromethane, di-bromochloromethane, bromoform and chloroform.

- A. Water treatment process
- B. Optimal corrosion control
- C. Surface water system
- D. Some groundwater
- E. The running average of quarterly analyses of the sum
- F. None of the Above

Lead and Copper Rule

206. The Lead and Copper Rule applies to all community and nontransient, noncommunity water systems and _____ for these two contaminants at the consumer's tap.

- A. Sample instructions
- B. Establishes action levels
- C. Establishes MCL levels
- D. Laboratory performance requirements
- E. Average annual concentration
- F. None of the Above

207. Lead and Copper Rule establishes maximum contaminant level goals (MCLGs) for lead and copper, treatment technique requirements for optimal corrosion control, _____, public education and lead service line replacement.

- A. Drinking water treatment process
- B. Source water treatment
- C. A surface water system
- D. Some groundwater
- E. All systems
- F. None of the Above

208. The Lead and Copper Rule also includes the best available technology (BAT) for complying with the treatment technique requirements, mandatory health effects language for public notification of violations and analytical methods and _____.

- A. Sample instructions
- B. Establishes action levels
- C. An action level is exceeded
- D. Laboratory performance requirements
- E. The action level for the system
- F. None of the Above

IOC Sample Collection – Things to Remember

209. If the laboratory fails to include sample instructions, contact the laboratory and?

- A. Collect samples
- B. Run
- C. Request sample instructions
- D. Do not change the flow
- E. Maintain chemical analysis reports
- F. None of the Above

Some general practices to remember:

210. Samples should be collected at _____ after all treatment (finished water).

- A. Homes
- B. SNAFU
- C. Sample locations
- D. The entry point to the distribution system
- E. At water storage tanks
- F. None of the Above

211. Select a sampling faucet that does not have an aerator (sampling must be done with?

- A. Sample instructions
- B. Proper action levels
- C. Minimum aeration
- D. Laboratory performance requirements
- E. Average flow
- F. None of the Above

Some general practices to remember:

212. Samples should be collected at _____ after all treatment.
- A. Homes
 - B. SNAFU
 - C. Sample locations
 - D. The entry point to the distribution system
 - E. At water storage tanks
 - F. None of the Above

Antimony

213. Antimony is a toxic chemical element with symbol **Sb** and atomic number 51.
- A. True
 - B. False

214. Antimony is a lustrous gray metalloid; it is found in nature mainly as the?

- A. Contaminant
- B. Analytical element
- C. Sulfide mineral stibnite (Sb_2S_3)
- D. Subsequent element
- E. Stibnite with iron
- F. None of the Above

215. Which of the following terms have been known since ancient times and were used for cosmetics?

- A. Gray allotrope of arsenic
- B. Four allotropes
- C. Nitrogen group (group 15)
- D. Metallic antimony
- E. Antimony compounds
- F. None of the Above

216. The industrial methods to produce antimony are roasting and subsequent carbothermal reduction or direct reduction of?

- A. Sulfide mineral stibnite (Sb_2S_3)
- B. Copper
- C. Stibnite with iron
- D. Heat
- E. Lead
- F. None of the Above

What are EPA's drinking water regulations for antimony?

217. Contaminants are _____ or matter in water.

- A. Contaminants
- B. Analytical problems
- C. Commonly found
- D. Organic and inorganic
- E. Prominent additives
- F. None of the Above

218. The Phase VI Rule, the regulation for antimony, became effective in 2001.

- A. True
- B. False

219. The Safe Drinking Water Act requires _____ to periodically review the national primary drinking water regulation for each contaminant and revise the regulation, if appropriate.

- A. OSHA
- B. MCLs
- C. States
- D. Emergency Planning and Community Right to Know Act (EPCRA)
- E. EPA
- F. None of the Above

220. Which of the following terms - reviewed antimony as part of the Six Year Review and determined that the 0.006 mg/L or 6 ppb MCLG and 0.006 mg/L or 6 ppb MCL for antimony?

- A. OSHA
- B. MCLs
- C. States
- D. Emergency Planning and Community Right to Know Act (EPCRA)
- E. EPA
- F. None of the Above

221. EPA has set an enforceable regulation for antimony, called a _____, at 0.006 mg/L or 6 ppb.
- A. MCLG
 - B. MCL
 - C. CWA
 - D. Emergency Planning and Community Right to Know Act (EPCRA)
 - E. EPA
 - F. None of the Above

Applications

222. _____ with antimony improves the properties of the alloys which are used in solders, bullets and plain bearings.

- A. Gray allotrope of arsenic
- B. Four allotropes
- C. Nitrogen group (group 15)
- D. Metallic antimony
- E. Alloying lead and tin
- F. None of the Above

223. Which of the following terms are prominent additives for chlorine- and bromine-containing fire retardants found in many commercial and domestic products?

- A. Contaminants
- B. Gray allotrope of arsenic
- C. Antimony compounds
- D. Metallic antimony
- E. Prominent additives
- F. None of the Above

224. Antimony is in the nitrogen group (group 15) and it is _____, and less electronegative than tellurium or arsenic.

- A. A gray allotrope of arsenic
- B. Has four allotropes
- C. In the Nitrogen group
- D. A metallic antimony
- E. More electronegative than tin or bismuth
- F. None of the Above

225. Antimony is stable in air at room temperature, but reacts with oxygen if heated to form antimony trioxide, Sb_2O_3 .

- A. True
- B. False

226. Antimony is a silvery, lustrous gray metal that has a Mohs scale hardness of 7.

- A. True
- B. False

227. Black antimony is formed upon rapid cooling of vapor derived from metallic antimony. It has the same crystal structure as red phosphorus and black arsenic; it oxidizes in air and may ignite spontaneously.

- A. True
- B. False

228. At 70 °C, antimony gradually transforms into the stable form.

- A. True
- B. False

229. The yellow allotrope of antimony is the most unstable. It has only been generated by oxidation of stibine (SbH_3) at -90 °C.

- A. True
- B. False

230. Pure antimony is?

- A. High chemical reactivity
- B. Analytical methods
- C. High chemical reactivity
- D. A metallic antimony
- E. Not used to make hard objects
- F. None of the Above

231. Four allotropes of antimony are known, a stable metallic form and _____, explosive, black and yellow.

- A. Gray
- B. Three metastable forms
- C. In the Nitrogen group
- D. Liquid
- E. Its high chemical reactivity
- F. None of the Above

232. Metallic antimony is a brittle, silver-white shiny metal. When molten antimony is slowly cooled, metallic antimony crystallizes?

- A. In a trigonal cell
- B. Four allotropes
- C. Nitrogen group (group 15)
- D. Metallic
- E. Its high chemical reactivity
- F. None of the Above

233. A rare explosive form of antimony can be formed from the electrolysis of antimony (III) trichloride.

- A. True
- B. False

Asbestos

234. EPA has set an enforceable regulation for asbestos, called a maximum contaminant level (MCL), at .07 MFL.

- A. True
- B. False

235. EPA reviewed asbestos as part of the Six Year Review and determined that the .07 MFL MCLG.

- A. True
- B. False

Barium

236. The MCLG for barium is 20 mg/L or 20 ppm

- A. True
- B. False

237. When routine monitoring indicates that barium levels are above the MCL; your water supplier must take steps to reduce the amount of barium so that it is below that level.

- A. True
- B. False

238. _____ such as providing alternative drinking water supplies, may be required to prevent serious risks to public health.

- A. MCLG
- B. MCL equals the MCLG
- C. MFL
- D. Additional actions
- E. 2 mg/L or 2 ppm
- F. None of the Above

239. _____ the regulation for barium, became effective in 1993.

- A. MCLG
- B. Phase IIB Rule
- C. Safe Drinking Water Act
- D. EPCRA
- E. EPA
- F. None of the Above

240. Major sources of barium in drinking water are discharge of drilling wastes; _____; and erosion of natural deposits.

- A. Discharge from metal refineries
- B. Barium
- C. Barium carbonate, BaCO₃
- D. Soluble barium compounds
- E. Its high chemical reactivity
- F. None of the Above

241. Which of the following terms requires facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals?

- A. MCLG Rule
- B. Phase II Rule
- C. SDWA
- D. Emergency Planning and Community Right to Know Act (EPCRA)
- E. EPA
- F. None of the Above

Barium Explained

242. The most common naturally occurring minerals of barium are barite and witherite (_____), both being insoluble in water.

- A. A natural deposit
- B. Baryta
- C. Barium carbonate, BaCO_3
- D. A soluble compound
- E. Highly reactive chemical
- F. None of the Above

243. Which of the following terms was identified as a new element in 1774, but not reduced to a metal until 1808?

- A. Beryllium
- B. Barium
- C. Barium carbonate, BaCO_3
- D. Soluble barium compound
- E. Its high chemical reactivity
- F. None of the Above

244. Which of the following terms has only a few industrial applications. The metal has been historically used to scavenge air in vacuum tubes?

- A. Beryllium
- B. Barium
- C. Barium carbonate, BaCO_3
- D. Soluble barium compound
- E. Its high chemical reactivity
- F. None of the Above

245. Barium is a _____ with symbol **Ba** and atomic number 56.

- A. Erosion of natural deposits
- B. Chemical element
- C. Carbonate, BaCO_3
- D. Soluble compounds
- E. Highly reactive chemical
- F. None of the Above

246. Barium is the fifth element in Group 3, a hard silvery metallic alkaline earth metal.

- A. True
- B. False

247. Because of its high chemical reactivity barium is easily found in nature as a free element.

- A. True
- B. False

248. Barium's hydroxide was known in pre-modern history as?

- A. A natural deposit
- B. Baryta
- C. Barium carbonate, BaCO_3
- D. A soluble compound
- E. Highly reactive chemical
- F. None of the Above

249. Which of the following terms are added to fireworks to impart a green color?

- A. Beryllium
- B. Barium
- C. Barium carbonate, BaCO_3
- D. Soluble barium compound
- E. Barium compounds
- F. None of the Above

250. Which of the following terms are poisonous due to release of the soluble barium ion, and therefore have been used as rodenticides?

- A. Beryllium
- B. Barium
- C. Barium carbonate, BaCO₃
- D. Soluble barium compounds
- E. Its high chemical reactivity
- F. None of the Above

Beryllium

251. Which of the following terms -for beryllium is 0.004 mg/L or 4 ppb.

- A. MCLG
- B. MCL
- C. EPA
- D. SDWA
- E. 2 mg/L or 2 ppm
- F. None of the Above

How does Beryllium get into my Drinking Water?

252. Beryllium naturally enters surface water and ground water through the weathering of rocks and soils or from industrial wastewater discharges.

- A. True
- B. False

How will I know if Beryllium is in my Drinking Water?

253. When routine monitoring indicates that beryllium levels are above the _____, your water supplier must take steps to reduce the amount of beryllium so that it is below that level.

- A. MCLG
- B. MCL equals the MCLG
- C. EPA
- D. SDWA
- E. 2 mg/L or 2 ppm
- F. None of the Above

254. Water suppliers must notify their customers as soon as practical, but no later than 90 days after the system learns of the violation. Additional actions, such as providing alternative drinking water supplies, may be required to prevent serious risks to public health.

- A. True
- B. False

Beryllium Explained

255. Beryllium is the chemical element with the symbol **Be** and atomic number 4. Because any beryllium synthesized in stars is short-lived, _____ in both the universe and in the crust of the Earth.

- A. It is a divalent element
- B. Brittle alkaline earth metal
- C. Is a relatively abundant element
- D. Hard and resistant to corrosion
- E. It is a relatively rare element
- F. None of the Above

256. As a free element, Beryllium is _____, lightweight and brittle alkaline earth metal.

- A. A divalent element
- B. A steel-gray, strong
- C. Coal based
- D. Hard and resistant to corrosion
- E. Shiny
- F. None of the Above

257. Beryllium increases _____ when alloyed to aluminum, cobalt, copper (notably beryllium copper), iron and nickel.

- A. A divalent element
- B. A steel-gray, strong
- C. Coal based
- D. Hard and resistance to corrosion
- E. Shiny
- F. None of the Above

258. Beryllium is a quality aerospace material for high-speed aircraft, missiles, space vehicles and communication satellites.

- A. True B. False

Cadmium

259. The MCLG for cadmium is?

- A. 4.0 D. .015
B. .002 E. 0.005 mg/L or 5 ppb
C. 1.3 F. None of the Above

260. EPA has set an enforceable regulation for cadmium, called a maximum contaminant level (MCL), at?

- A. 4.0 D. .015
B. .002 E. 0.005 mg/L or 5 ppb
C. 1.3 F. None of the Above

261. EPA reviewed cadmium as part of the Six Year Review and determined that the _____ MCLG and 0.005 mg/L or 5 ppb MCL for cadmium are still protective of human health.

- A. 4.0 D. .015
B. .002 E. 0.005 mg/L or 5 ppb
C. 1.3 F. None of the Above

How does cadmium get into my drinking water?

262. The major sources of cadmium in drinking water are corrosion of galvanized pipes; erosion of natural deposits; _____; runoff from waste batteries and paints.

- A. It is a divalent element D. It may burn and release toxic fumes
B. Brittle alkaline earth metal E. Discharge from metal refineries
C. Coal and fuel oil combustion F. None of the Above

How will I know if cadmium is in my drinking water?

263. When routine monitoring indicates that cadmium levels are above the _____, your water supplier must take steps to reduce the amount of cadmium so that it is below that level.

- A. MCLG D. SDWA limit
B. MCL E. 2 mg/L or 2 ppm
C. EPA standard F. None of the Above

How will cadmium be removed from my drinking water?

264. The following treatment method(s) have proven to be effective for removing cadmium to below _____: coagulation/filtration, ion exchange, lime softening, and reverse osmosis.

- A. 4.0 D. .015
B. .002 E. 0.005 mg/L or 5 ppb
C. 1.3 F. None of the Above

Characteristics

Physical Properties

265. Cadmium is a soft, malleable, ductile, bluish-white divalent metal. It is similar in many respects to zinc but forms complex compounds.

A. True B. False

266. Like other metals, cadmium is subject to corrosion.

A. True B. False

267. As a bulk metal, cadmium is?

- | | |
|---|--|
| A. Insoluble in water and is not flammable | D. It may burn and release toxic fumes |
| B. Is in making steel and other alloys | E. Reduces the amount of cadmium sulfate |
| C. Normal industrial waste disposal practices | F. None of the Above |

Chromium

268. Chromium is?

- | | |
|--|----------------------|
| A. An odorless and tasteless metallic element | D. Flammable |
| B. Used for making steel and other alloys | E. Fun to play with |
| C. Normally found in industrial waste disposal | F. None of the Above |

269. Chromium is found naturally in rocks, plants, soil and volcanic dust, humans and animals. The most common forms of chromium that occur in natural waters in the environment are trivalent chromium (chromium-3), and hexavalent chromium (chromium-6).

A. True B. False

270. Chromium-5 is an essential human dietary element.

A. True B. False

271. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits but it can also be produced by?

- | | |
|----------------------------------|--------------------------------------|
| A. Reverse osmosis | D. Burning and releasing toxic fumes |
| B. Making steel and other alloys | E. Chemistry |
| C. Industrial processes | F. None of the Above |

272. There are demonstrated instances of chromium being released to the environment by leakage, poor storage, or inadequate industrial waste disposal practices.

A. True B. False

What are Chromium's Health Effects?

273. Chromium has relatively high toxicity and would be a concern in drinking water only at very high levels of contamination.

A. True B. False

274. Chromium-6 is less toxic and poses potential health risks.

A. True B. False

275. People who use water containing total chromium in excess of the _____ over many years could experience allergic dermatitis.

- A. MCLG
- B. MCL
- C. Limit
- D. Rule
- E. Standard
- F. None of the Above

What are EPA's drinking water regulations for Chromium?

276. Which of the following terms requires EPA to determine the level of contaminants in drinking water at which no adverse health effects are likely to occur?

- A. Safe Drinking Water Act
- B. OSHA
- C. CWA
- D. EPCRA
- E. EPA
- F. None of the Above

277. Which of the following terms for total chromium is 0.1 mg/L or 100 parts per billion?

- A. MCLG
- B. MCL
- C. Limit
- D. Rule
- E. Standard
- F. None of the Above

278. EPA has set an enforceable regulation for total chromium, called a maximum contaminant level (MCL), at 10 mg/L or 1000 ppb.

- A. True
- B. False

Chromium Description

279. Chromium is a chemical element that has the symbol **Cr** and atomic number 24.

- A. True
- B. False

280. Chromium is the first element in?

- A. Group 6
- B. Trivalent chromium (Cr(III)) ion
- C. Toxic chromium classification
- D. The roasting and leaching processes
- E. Forming stainless steel
- F. None of the Above

281. Chromium metal and ferrochromium alloy are commercially produced from chromite by silicothermic or aluminothermic reactions, or by?

- A. Adding copper
- B. Adding trivalent chromium
- C. Adding Aluminum
- D. Roasting and leaching processes
- E. Adding metallic chromium to form stainless steel
- F. None of the Above

282. Chromium metal has proven of high value due to?

- A. Group 6 treatments
- B. Adding trivalent chromium
- C. Adding Aluminum
- D. Roasting and leaching processes
- E. Its high corrosion resistance and hardness
- F. None of the Above

283. Which of the following terms along with chrome plating currently comprise 85% of the commercial use for the element?

- A. Group 6 treatments
- B. Adding trivalent chromium
- C. Adding Aluminum
- D. Roasting and leaching processes
- E. Its high corrosion resistance and hardness
- F. None of the Above

284. Trivalent chromium (Cr(III)) ion is possibly required in trace amounts for sugar and lipid metabolism, although the issue remains in debate. In larger amounts and in different forms, chromium can be_____.

- A. Toxic and carcinogenic
- B. Trivalent chromium (Cr(III)) ion
- C. Toxic chromium
- D. Part of the leaching processes
- E. Metallic chromium
- F. None of the Above

285. The most prominent example of toxic chromium is_____. Abandoned chromium production sites often require environmental cleanup.

- A. Stainless steel
- B. Trivalent chromium (Cr(III)) ion
- C. Toxic chromium
- D. Hexavalent chromium (Cr(VI))
- E. Metallic chromium
- F. None of the Above

Copper

What are Copper's Health Effects?

286. Some people who drink water containing copper in excess of the _____ may, with short term exposure, experience gastrointestinal distress, and with long-term exposure may experience liver or kidney damage.

- A. MCLG
- B. MCL
- C. Limit
- D. Standard
- E. Action level
- F. None of the Above

287. People with Zackery's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level.

- A. True
- B. False

What are EPA's Drinking Water Regulations for Copper?

288. Which of the following terms - for copper is 1.3 mg/L or 1.3 ppm?

- A. MCLG
- B. MCL
- C. Limit
- D. Standard
- E. Action level
- F. None of the Above

289. Which of the following terms - as feasible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies?

- A. MCLG
- B. MCL
- C. Limit
- D. Standard
- E. MCLs are set as close to the MCLGs
- F. None of the Above

290. An action technique is a guideline procedure or level of technological performance which water systems must follow to ensure control of a contaminant.

- A. True
- B. False

291. The treatment technique regulation for copper (referred to as the Lead and Copper rule) requires water systems to control the corrosivity of the water.

- A. True
- B. False

292. The regulation also requires systems to collect piping samples from sites served by the system that are more likely to have plumbing materials containing plastic.

- A. True B. False

293. If more than 10 percent of tap water samples exceed the copper action level of 1.3 _____, water systems must take additional steps to reduce corrosiveness.

- A. MCLG D. Milligrams per Liter (mg/L)
B. MCL E. Action level
C. Limit F. None of the Above

294. _____ promulgated the Lead and Copper Rule in 1991, and revised the regulation in 2000 and in 2007.

- A. CWA D. Emergency Planning and Community Right to Know Act (EPCRA)
B. SDWA E. EPA
C. OSHA F. None of the Above

Copper Explained

295. Pure copper is?

- A. Known also as Lead D. Related to turquoise
B. Soft and malleable E. A liquid like Mercury
C. A carbon-nitrogen chemical F. None of the Above

296. Its compounds are commonly encountered as _____, which often impart blue or green colors to minerals such as turquoise and have been widely used historically as pigments.

- A. Copper (II) salts D. A mixture of gold and copper
B. Element E. Salts
C. Carbon-nitrogen chemical F. None of the Above

Cyanide - Inorganic Contaminant 0.2 mg/L MCL

297. Cyanide is a carbon-nitrogen chemical unit which combines with many?

- A. Copper (II) salts D. Nitrogen atoms
B. Organic and inorganic compounds E. Salts
C. Carbon-nitrogen chemicals F. None of the Above

Uses for Cyanide.

298. The most commonly used form, _____, is mainly used to make compounds and other synthetic fibers and resins.

- A. Copper (II) salts D. The nitrogen atom
B. Cyanide (II) E. Salts of the anion CN^-
C. Carbon-nitrogen chemical F. None of the Above

What are EPA's Drinking Water Regulations for Cyanide?

299. Which of the following terms - for cyanide is 0.2 mg/L or 200 ppb?

- A. MCLG D. Standard
B. MCL E. MCLs are set as close to the MCLGs
C. Limit F. None of the Above

300. EPA has set this level of protection based on the best available science to prevent potential health problems. EPA has set an enforceable regulation for cyanide, called a maximum contaminant level (MCL), at 0.2 mg/L or 200 ppb.
A. True B. False

301. Which of the following terms are any physical, chemical, biological or radiological substances or matter in water?
A. Naked contaminants D. Solutions of inorganic contaminants
B. Halides E. Cyanides
C. Contaminants F. None of the Above

Cyanide Explained

302. A cyanide is a chemical compound that contains the _____, which consists of a carbon atom triple-bonded to a nitrogen atom.
A. Naked contaminants D. Solutions of inorganic contaminants
B. Halides E. Cyanides
C. Contaminants F. None of the Above

303. Cyanides most commonly refer to _____ which is isoelectronic with carbon monoxide and with molecular nitrogen.
A. Cyanide salts D. Solutions of salts of the anion CN^- ,
B. Salts of the anion CN^- , E. Cyanides solutions
C. Carbon-nitrogen chemical F. None of the Above

304. Most cyanides are not toxic.
A. True B. False

Fluoride

305. The _____ for fluoride is 4.0 mg/L or 4.0 ppm.
A. MCLG D. Standard
B. MCL E. MCLs are set as close to the health goals as possible
C. Limit F. None of the Above

306. EPA has set an enforceable regulation for fluoride, called a maximum contaminant level (MCL), at 4.0 mg/L or 4.0 ppm.
A. True B. False

307. The secondary standard of 4.0 mg/L is intended as a guideline for an upper bound level in areas which have high levels of naturally occurring fluoride.
A. True B. False

308. The level of the _____ was set based upon a balancing of the beneficial effects of protection from tooth decay and the undesirable effects of excessive exposures leading to discoloration.
A. MCLG D. Secondary standard (SMCL)
B. MCL E. MCL equals the MCLG
C. Limit F. None of the Above

309. Which of the following terms is voluntarily added to some drinking water systems as a public health measure for reducing the incidence of cavities among the treated population?

- A. Naked fluoride
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

310. In the case for Fluoride the _____, because analytical methods or treatment technology do not pose any limitation.

- A. MCLG
- B. MCL
- C. Limit
- D. Standard
- E. MCL equals the MCLG
- F. None of the Above

311. EPA has also set a _____ for fluoride at 2.0 mg/L or 2.0 ppm.

- A. MCLG
- B. MCL
- C. Limit
- D. Secondary standard (SMCL)
- E. MCL equals the MCLG
- F. None of the Above

312. Tooth strengthening is caused by excess fluoride exposures during the formative period prior to eruption of the teeth in children.

- A. True
- B. False

Fluoride Explained

313. Structurally Fluoride and to some extent chemically, the _____ resembles the hydroxide ion.

- A. Naked fluoride
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluoride ion
- F. None of the Above

314. Fluoride is the cation F^+ , the reduced form of fluorine when as an ion and when bonded to another element. Inorganic fluorine containing compounds are called fluorides.

- A. True
- B. False

315. Fluoride, like other halides, is a monovalent ion (-1 charge). Its compounds often have properties that are distinct relative to other halides.

- A. True
- B. False

316. The presence of fluoride and its compounds can be detected by F NMR spectroscopy.

- A. True
- B. False

Occurrence

317. According to the text, solutions of inorganic fluorides in water contain F^- and bifluoride HF_2^- .

- A. True
- B. False

318. Few inorganic fluorides are soluble in water without undergoing significant hydrolysis. In terms of its reactivity, fluoride differs significantly from chloride and other halides, and is more strongly solvated due to its smaller radius/charge ratio. Its closest chemical relative is hydroxide.

- A. True
- B. False

319. When relatively unsolvated, fluoride anions are called?

- A. Naked
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

320. Which of the following terms is a very strong lewis base?

- A. Naked fluoride
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

Natural Occurrence

321. Which of the following terms are known, but of paramount commercial importance are fluorite and fluorapatite?

- A. Naked fluoride
- B. Halides
- C. Many fluoride minerals
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

322. Which of the following terms is usually found naturally in low concentration in drinking water and foods?

- A. Naked fluoride
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

323. Fresh water may contains dangerously high levels of _____, leading to serious health problems.

- A. Naked fluoride
- B. Halides
- C. Fluoride
- D. Solutions of inorganic fluorides
- E. Fluorite and fluorapatite
- F. None of the Above

Mercury - Inorganic Contaminant

324. Mercury is a liquid metal found in natural deposits such as ores containing?

- A. Aluminum
- B. Ultraviolet light
- C. Cinnabar (mercuric sulfide)
- D. Mercury-aluminum amalgam
- E. Other elements
- F. None of the Above

Uses for Mercury

325. According to the text, electrical products such as dry-cell batteries, fluorescent light bulbs, switches, and other control equipment account for 50 percent of?

- A. Aluminum
- B. Mercury
- C. Cinnabar (mercuric sulfide)
- D. Mercury-aluminum amalgams
- E. Lead
- F. None of the Above

What are Mercury's Health Effects?

326. Some people who drink water containing mercury well in excess of the maximum contaminant level (MCL) for many years could experience liver damage.

- A. True
- B. False

What are EPA's Drinking Water Regulations for Mercury?

327. The MCLG for mercury is 0.002 mg/L or 2 ppb. EPA has set this level of protection based on the best available science to prevent potential health problems.

- A. True B. False

328. EPA reviewed mercury as part of the Six Year Review and determined that the 0.002 mg/L or 2 ppb MCLG and 0.002 mg/L or 2 ppb MCL for mercury are still protective of human health.

- A. True B. False

How will Mercury be removed from my Drinking Water?

329. The following treatment method(s) have proven to be effective for removing mercury to below 0.002 mg/L or 2 ppb: coagulation/filtration, granular activated carbon, _____, and reverse osmosis.

- A. A carbon filter D. Lime softening
B. Backwash carbon E. Point of use
C. Activated carbon F. None of the Above

Mercury Explained

330. Mercury occurs in deposits throughout the world mostly as cinnamon.

- A. True B. False

331. The red pigment vermilion is mostly obtained by?

- A. Aluminum D. Mercury-aluminum amalgam
B. Water-soluble forms E. Reduction from cinnabar
C. Cinnabar (mercuric sulfide) F. None of the Above

332. Mercury poisoning can also result from exposure to _____ of mercury (such as mercuric chloride or methylmercury), inhalation of mercury vapor, or eating seafood contaminated with mercury.

- A. Aluminum D. Mercury-aluminum amalgam
B. Water-soluble forms E. Reduction from cinnabar
C. Cinnabar (mercuric sulfide) F. None of the Above

333. Mercury is used in thermometers, barometers, manometers, sphygmomanometers, though concerns about the element's toxicity have led to mercury thermometers and sphygmomanometers being largely phased out in clinical environments in favor of alcohol-filled, _____.

- A. Bottles D. Galinstan-filled, digital, or thermistor-based instruments
B. Ultraviolet light E. Sphygmomanometers
C. Machinery F. None of the Above

334. Mercury is used in lighting: electricity passed through mercury vapor in a phosphor tube produces short-wave ultraviolet light which then causes the _____ to fluoresce, making visible light.

- A. Aluminum D. Mercury-aluminum
B. Ultraviolet light E. Phosphor
C. Cinnabar (mercuric sulfide) F. None of the Above

Amalgams

335. Mercury dissolves to form amalgams with gold, zinc and many other metals.

- A. True B. False

336. Copper is an exception; copper flasks have been traditionally used to trade mercury.

- A. True B. False

337. Other metals that do not form amalgams with mercury include tantalum, tungsten and platinum. _____ is a common reducing agent in organic synthesis, and is also used in high-pressure sodium lamps.

- A. Aluminum amalgam D. Mercury-aluminum amalgam
B. Ultraviolet amalgam E. Sodium amalgam
C. Cinnabar (mercuric sulfide) F. None of the Above

338. Mercury readily combines with aluminum to form a _____ when the two pure metals come into contact.

- A. Aluminum amalgam D. Mercury-aluminum amalgam
B. Ultraviolet amalgam E. Sodium amalgam
C. Cinnabar (mercuric sulfide) F. None of the Above

339. Amalgam destroys the _____ which protects metallic aluminum from oxidizing in-depth.

- A. Aluminum amalgam D. Mercury-aluminum amalgam
B. Aluminum oxide layer E. Sodium amalgam
C. Cinnabar (mercuric sulfide) F. None of the Above

340. Mercury is not allowed aboard an aircraft under most circumstances because of the risk of it forming an amalgam with exposed aluminum parts in the aircraft unless it is in a copper pot.

- A. True B. False

Nitrate (Measured as Nitrogen)

341. EPA regulates _____ in drinking water to protect public health.

- A. Nitrates and nitrites D. Nitrates are converted to nitrites
B. Nitrate ion E. Various organic and inorganic compounds
C. Nitrate F. None of the Above

342. Nitrate may cause health problems if present in public or private water supplies in amounts greater than the drinking water standard set by EPA.

- A. True B. False

What is Nitrate?

343. Nitrates and nitrites are _____ which combine with various organic and inorganic compounds.

- A. Nitrogen-oxygen chemical units D. Nitrates are converted to nitrites
B. Nitrate ion E. Various organic and inorganic compounds
C. Nitrate F. None of the Above

Uses for Nitrate.

344. According to the text, once taken into the body, nitrates are converted to?

- A. Nitrates and nitrites
- B. Nitrate ion
- C. Nitrate
- D. Nitrites
- E. Various organic and inorganic compounds
- F. None of the Above

What are EPA's Drinking Water Regulations for Nitrate?

345. The MCLG for nitrate is 50 mg/L or 50 ppm. EPA has set this level of protection based on the best available science to prevent potential health problems.

- A. True
- B. False

346. EPA has set an enforceable regulation for nitrate, called a maximum contaminant level (MCL), at 50 mg/L or 50 ppm.

- A. True
- B. False

How will I know if Nitrate is in my Drinking Water?

347. Water suppliers must notify their customers as soon as practical, but no later than 24 hours after the system learns of the violation.

- A. True
- B. False

348. Additional actions, such as providing alternative drinking water supplies, may be required to prevent serious risks to public health.

- A. True
- B. False

Nitrate Explained

349. The nitrate ion is a polyatomic ion with the _____ and a molecular mass of 62.0049 g/mol.

- A. Nitrates and nitrites
- B. Nitrate ion
- C. Nitrate
- D. Molecular formula NO_3^-
- E. Various organic and inorganic compounds
- F. None of the Above

Structure

350. It is the conjugate base of nitric acid, consisting of one central nitrogen atom surrounded by three identically bonded oxygen atoms in a trigonal planar arrangement. The nitrate ion carries a formal charge of -1.

- A. True
- B. False

351. This results from a combination of formal charges in which each of the three oxygens carries a $-\frac{2}{3}$ charge, whereas the nitrogen carries a +1 charge, all these adding up to a formal charge of the _____.

- A. Nitrates and nitrites
- B. Nitrate ion
- C. Nitrate
- D. Polyatomic nitrate ion
- E. Various organic and inorganic compounds
- F. None of the Above

Nitrite (Measured as Nitrogen) - Inorganic Contaminant 1 mg/L MCL

352. EPA regulates nitrite in drinking water to protect public health. Nitrite may cause health problems if present in public or private water supplies in amounts greater than the drinking water standard set by _____.

- A. MCLG
- B. Water supplier
- C. Cops
- D. Emergency Planning and Community Right to Know Act (EPCRA)
- E. EPA
- F. None of the Above

What is Nitrite?

353. Nitrates and nitrites are _____ which combine with various organic and inorganic compounds.

- A. Nitrogen-oxygen chemical units
- B. Nitrate ion
- C. Nitrate
- D. Nitrates are converted to nitrites
- E. Various organic and inorganic compounds
- F. None of the Above

Uses for Nitrite.

354. Once taken into the body, _____ are converted to nitrites.

- A. Nitrites
- B. Nitrate ions
- C. Nitrates
- D. Nitrogen ions
- E. Various organic and inorganic compounds
- F. None of the Above

What are EPA's Drinking Water Regulations for Nitrite?

355. The MCLG for nitrite is 1 mg/L or 1 ppm. EPA has set this level of protection based on the best available science to prevent potential health problems.

- A. True
- B. False

356. _____ the regulation for nitrite, became effective in 1992.

- A. MCLG
- B. MCLs
- C. The Phase II Rule
- D. EPCRA
- E. CWA
- F. None of the Above

How does Nitrite get into my Drinking Water?

357. The major sources of _____ in drinking water are runoff from fertilizer use; leaching from septic tanks, sewage; and erosion of natural deposits.

- A. Nitrites
- B. Nitrate ion
- C. Nitrate
- D. Nitrogen ions
- E. Various organic and inorganic compounds
- F. None of the Above

Selenium- Inorganic Contaminant 0.05 mg/L MCL

358. Selenium (Se) is an essential element for _____, with the majority of our intake coming from foods such as nuts, cereals, meat, fish, and eggs.

- A. Vitamins
- B. Drinking water
- C. Minerals
- D. Selenide or selenate compounds
- E. Human nutrition
- F. None of the Above

359. The concentration of Selenium in drinking water is usually high, and comes from natural minerals.

- A. True
- B. False

360. In soils, selenium often occurs in soluble forms such as selenate, which are leached into rivers very easily by runoff increasing the amount of?

- A. Selenium
- B. Selenium in drinking water
- C. Minerals
- D. Selenide or selenate compounds
- E. An essential element
- F. None of the Above

361. Which of the following terms is also a by-product of copper mining / smelting?

- A. Selenium
- B. Selenium in water
- C. Minerals
- D. Selenide or selenate compounds
- E. An essential element for human nutrition
- F. None of the Above

362. Acute toxicity caused by _____ or other sources of intake has been observed in laboratory animals and in animals grazing in areas where high selenium levels exist in the soil. The US EPA has established the MCL for selenium in water at 0.05 mg/l.

- A. Selenium
- B. Selenium in drinking water
- C. Minerals
- D. Selenide or selenate compounds
- E. High levels of selenium in water
- F. None of the Above

363. Selenium is also used in photoelectric devices because its electrical conductivity varies with light.

- A. True
- B. False

Selenium Explained

364. Selenium is found impurely in metal sulfide ores, where it partially replaces the oxygen.

- A. True
- B. False

365. Commercially, selenium is produced as _____ in the refining of these ores, most often during copper production.

- A. Metal sulfide ores
- B. Natural deposits
- C. Antioxidant enzymes
- D. Silicon
- E. Glutathione peroxidase
- F. None of the Above

366. Minerals that are pure selenide or selenate compounds are known, but are?

- A. Selenium based
- B. Found in drinking water
- C. Minerals
- D. Compounds
- E. An essential element for human nutrition
- F. None of the Above

367. Selenium continues to be used in a few types of DC power surge protectors and one type of?

- A. Metal sulfide ores
- B. Natural deposits
- C. Selenium
- D. Silicon semiconductor devices
- E. Fluorescent quantum dot
- F. None of the Above

368. Selenium salts are toxic in _____, but trace amounts are necessary for cellular function in many organisms, including all animals.

- A. The poisoner's poison
- B. Pharmaceutical industry
- C. Selenium salts
- D. Large amounts
- E. A heavy layer of oxide
- F. None of the Above

Thallium- Inorganic Contaminant 0.002 mg/L MCL

369. Thallium is a metal found in natural deposits such as ores containing_____.

- A. Metal sulfide ores
- B. Natural deposits
- C. Selenium
- D. Silicon
- E. Other elements
- F. None of the Above

Uses for Thallium.

370. The greatest use of _____is in specialized electronic research equipment.

- A. Nonselective toxicity
- B. Thallium
- C. Selenium
- D. Potassium ores
- E. This soft gray poor metal
- F. None of the Above

What are Thallium's Health Effects?

371. Some people who drink water containing thallium well in _____ for many years could experience hair loss, changes in their blood, or problems with their kidneys, intestines, or liver problems.

- A. MCLG
- B. MCLs
- C. The Phase II Rule
- D. MCLGs are set as close to the health goals as possible
- E. Excess of the maximum contaminant level (MCL)
- F. None of the Above

Thallium Explained

372. Thallium is a chemical element with symbol **Tl** and atomic number 81.

- A. True
- B. False

373. Thallium is soft gray poor metal is not found free in nature._____, it resembles tin, but discolors when exposed to air.

- A. Nonselective toxicity
- B. When observed
- C. When isolated
- D. Like Potassium ores
- E. This soft gray poor metal
- F. None of the Above

374. Thallium tends to oxidize to the +3 and +1 oxidation states as ionic salts. The +3 state resembles that of the other elements in thallium's group.

- A. True
- B. False

375. The +1 state, which is far more prominent in thallium than the elements above it, recalls the chemistry of alkali metals, and thallium(I) ions are found geologically mostly in potassium-based ores, and (when ingested) are handled in many ways like _____by ion pumps in living cells.

- A. Metal sulfide ores
- B. Natural deposits
- C. Selenium
- D. Potassium ions (K⁺)
- E. Antioxidant enzymes
- F. None of the Above

376. Which of the following is used in small, nontoxic amounts as an agent in a nuclear medicine scan, during one type of nuclear cardiac stress test?

- A. Nonselective ion
- B. Thallium 111
- C. Thallium 3
- D. Potassium ore
- E. Soluble chloride TlCl
- F. None of the Above

377. Soluble thallium salts are highly toxic in quantity, and were historically used in?

- A. Nonselective ion
- B. Thallium 111
- C. Thallium 3
- D. Rat poisons and insecticides
- E. Soluble chloride TlCl
- F. None of the Above

378. Thallium poisoning notably results in tooth loss.

- A. True
- B. False

379. Thallium has gained notoriety as "the poisoner's poison" and "_____"
(alongside arsenic).

- A. Inheritance powder
- B. Pharmaceutical powder
- C. Saltpeter powder
- D. Soluble sleeping powder
- E. Sleeping powder
- F. None of the Above

pH Section

380. What is the theory that states that an acid is a substance that produces Hydronium ions when it is dissolved in water, and a base is one that produces hydroxide ions when dissolved in water?

- A. Newton's
- B. Alkalinity
- C. Lord Calvin's
- D. Amadeus
- E. Arrhenius
- F. None of the Above

381. What is the term associated with a charged species, an atom or a molecule, that has lost or gained one or more electrons?

- A. A proton
- B. Ion
- C. Anti-matter
- D. An electron
- E. A cation
- F. None of the Above

382. What is a substance that has the ability to reduce other substances and is said to be reductive in nature?

- A. Protons
- B. An electron donor
- C. Anti-matter
- D. Electrons
- E. Cations
- F. None of the Above

383. Pure water has a pH very close to _____.

- A. 5
- B. 6
- C. 7
- D. 7.7
- E. 7.5
- F. None of the Above

384. According to the text, which of the following parameter/methods/measurements determine a parameter using a concentration cell with transference by measuring the potential difference.

- A. Primary pH standard values
- B. Alkalinity
- C. pH
- D. pH measurement(s)
- E. Measurement of pH
- F. None of the Above

385. Mathematically speaking, pH is the negative logarithm of the activity of the (solvated) hydronium ion, often expressed as the measurement of _____.

- A. Electrons
- B. Alkalinity
- C. Hydronium ion concentration
- D. Cation measurement(s)
- E. Ions
- F. None of the Above

386. When measuring alkalinity in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater, this measurement can be one of the best measures of the sensitivity of the stream to acid inputs.

- A. True
- B. False

387. One definition of pH is that it is defined as the decimal logarithm of the reciprocal of the _____, a_{H^+} , in a solution.

- A. Hydrogen ion activity
- B. Ion-selective electrode(s)
- C. (Solvated) hydronium ion
- D. Brønsted–Lowry acid–base theory
- E. Acid-base behavior
- F. None of the Above

388. Commercial standard buffer solutions usually comes with information about value and a correction factor to be applied for what temperatures?

- A. 4 °C
- B. 25 °C
- C. 39 °F
- D. 10 °C
- E. 70 °F
- F. None of the Above

389. Because the pH scale is logarithmic, therefore pH is? _____.

- A. Universal indicator
- B. A dimensionless quantity
- C. A Spectrophotometer
- D. Excess of Ion concentrations
- E. A set of non-linear equations
- F. None of the Above

390. What is the new pH scale is referred to as?

- A. Total scale
- B. POH
- C. P3H
- D. Ph₃
- E. POE
- F. None of the Above

391. Alkalinity is able to neutralize _____ and is measured in a quantitative capacity in an aqueous solution.

- A. Acid
- B. Base
- C. pH
- D. pH measurement(s)
- E. Bond formation
- F. None of the Above

392. When using a visual comparison of the test solution with a standard color chart, measuring pH values should be done to the?

- A. Universal indicator
- B. Colorwheel measurement
- C. Nearest whole number
- D. Spectrophotometer Example
- E. Lab test
- F. None of the Above

393. According to the manual, this device/method/calculation consists of a mixture of indicators that shows a continuous color change from pH 2 to pH 10.

- A. Universal indicator
- B. Colorimeter of spectrophotometer
- C. Spectrophotometer
- D. Excess of alkaline earth metal concentrations
- E. A set of non-linear simultaneous equations
- F. None of the Above

394. A(n) _____ is an example of a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution.

- A. Universal indicator
- B. pH log
- C. A set of linear equations
- D. A chemical speciation calculation
- E. A set of non-linear simultaneous equations
- F. None of the Above

395. According to the manual, under normal circumstances, strong acids and bases are compounds that, for practical purposes, are completely dissociated in water; this means that the concentration of hydrogen ions in acidic solution can be taken to be equal to the concentration of the acid. The pH is then equal to minus the logarithm of _____.

- A. The concentration value
- B. The pH
- C. The Spectrophotometer
- D. End-point pH
- E. A set of non-linear simultaneous equations
- F. None of the Above

396. The sum of all the titratable bases is the Alkalinity of water and its acid-neutralizing capacity. What would cause the measured value to vary significantly?

- A. Acid
- B. Alkalinity
- C. pH
- D. pH measurement(s)
- E. End-point pH
- F. None of the Above

397. 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.

- A. True
- B. False

398. While the general case requires the pH solution of?

- A. The solution of a cubic equation
- B. The solution of a linear equation
- C. The solution of a squared equation
- D. A set of linear simultaneous equations
- E. A set of non-linear simultaneous equations
- F. None of the Above

399. Because alkalinity is significant in many uses and treatments of natural waters and wastewaters. The measured values also may include contributions from _____ or other bases if these are present.

- A. Acids
- B. Light metals
- C. Rare earths
- D. Borates, phosphates, silicates
- E. Caustics
- F. None of the Above

400. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a _____ difference in hydrogen ion concentration

- A. 1
- B. 2
- C. 5
- D. 10
- E. 100
- F. None of the Above