

*Registration form*

**Water Chemistry 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*

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

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

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

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

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

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

Wastewater Collection \_\_\_\_\_ Wastewater Treatment \_\_\_\_\_ Distribution \_\_\_\_\_

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

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

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*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.*

## **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.

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

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

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

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

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

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

## **Rush Grading Service**

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

## Water Chemistry Answer Key

Name \_\_\_\_\_

Phone# \_\_\_\_\_

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

*No refunds*

*Method of Course acceptance confirmation. Please fill this section*

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

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

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

*You can use Adobe Acrobat DC to complete your assignment.*

*You are responsible to ensure that TLC receives the Assignment and Registration Key.*

*Please call us to ensure that we received it.*

*Please write down any questions that cannot be found or has problems*

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

*A felt tipped pen works best.*

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

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|-------------|--------------|--------------|--------------|
| 49. A B C D | 80. A B C D  | 111. A B C D | 142. A B C D |
| 50. A B C D | 81. A B C D  | 112. A B C D | 143. A B C D |
| 51. A B C D | 82. A B C D  | 113. A B C D | 144. A B C D |
| 52. A B C D | 83. A B C D  | 114. A B C D | 145. A B C D |
| 53. A B C D | 84. A B C D  | 115. A B C D | 146. A B C D |
| 54. A B C D | 85. A B C D  | 116. A B C D | 147. A B C D |
| 55. A B C D | 86. A B C D  | 117. A B C D | 148. A B C D |
| 56. A B C D | 87. A B C D  | 118. A B C D | 149. A B C D |
| 57. A B C D | 88. A B C D  | 119. A B C D | 150. A B C D |
| 58. A B C D | 89. A B C D  | 120. A B C D | 151. A B C D |
| 59. A B C D | 90. A B C D  | 121. A B C D | 152. A B C D |
| 60. A B C D | 91. A B C D  | 122. A B C D | 153. A B C D |
| 61. A B C D | 92. A B C D  | 123. A B C D | 154. A B C D |
| 62. A B C D | 93. A B C D  | 124. A B C D | 155. A B C D |
| 63. A B C D | 94. A B C D  | 125. A B C D | 156. A B C D |
| 64. A B C D | 95. A B C D  | 126. A B C D | 157. A B C D |
| 65. A B C D | 96. A B C D  | 127. A B C D | 158. A B C D |
| 66. A B C D | 97. A B C D  | 128. A B C D | 159. A B C D |
| 67. A B C D | 98. A B C D  | 129. A B C D | 160. A B C D |
| 68. A B C D | 99. A B C D  | 130. A B C D | 161. A B C D |
| 69. A B C D | 100. A B C D | 131. A B C D | 162. A B C D |
| 70. A B C D | 101. A B C D | 132. A B C D | 163. A B C D |
| 71. A B C D | 102. A B C D | 133. A B C D | 164. A B C D |
| 72. A B C D | 103. A B C D | 134. A B C D | 165. A B C D |
| 73. A B C D | 104. A B C D | 135. A B C D | 166. A B C D |
| 74. A B C D | 105. A B C D | 136. A B C D | 167. A B C D |
| 75. A B C D | 106. A B C D | 137. A B C D | 168. A B C D |
| 76. A B C D | 107. A B C D | 138. A B C D | 169. A B C D |
| 77. A B C D | 108. A B C D | 139. A B C D | 170. A B C D |
| 78. A B C D | 109. A B C D | 140. A B C D | 171. A B C D |
| 79. A B C D | 110. A B C D | 141. A B C D | 172. A B C D |

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|--------------|--------------|--------------|--------------|
| 173. A B C D | 180. A B C D | 187. A B C D | 194. A B C D |
| 174. A B C D | 181. A B C D | 188. A B C D | 195. A B C D |
| 175. A B C D | 182. A B C D | 189. A B C D | 196. A B C D |
| 176. A B C D | 183. A B C D | 190. A B C D | 197. A B C D |
| 177. A B C D | 184. A B C D | 191. A B C D | 198. A B C D |
| 178. A B C D | 185. A B C D | 192. A B C D | 199. A B C D |
| 179. A B C D | 186. A B C D | 193. A B C D | 200. A B C D |

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

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

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

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**Signature**

***Please write down any questions that cannot be found or has problems***

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

**Rush Grading Service**

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

**WATER CHEMISTRY  
CEU TRAINING COURSE**

**CUSTOMER SERVICE RESPONSE CARD**

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

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

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

1. Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? \_\_\_\_\_

5. What would you do to improve the Course?

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How about the price of the course?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

How was your customer service?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

Any other concerns or comments.

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## Water Chemistry CEU Training Course Assignment

You will have 90 days from the start of this assignment to successfully complete it with a score of 70%. If you should need any assistance, please call or e-mail the Student Service Department, please fax or e-mail all concerns and the final test to TLC.

***You are expected to circle the correct answer on the enclosed answer key. Please include your name and address on your exam. The answer key is in the front.***

***There are no intentional trick questions. Only one answer per question.***

***You can e-mail or fax your Answer Key along with the Registration Form to TLC.***

### pH Section

- Pure water has a pH very close to \_\_\_\_\_.  
A. 5      C. 7.7  
B. 7      D. None of the above
- 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      C. Arrhenius  
B. Lord Calvin's      D. None of the above
- What is a substance that has the ability to reduce other substances and is said to be reductive in nature?  
A. Oxidizer      C. Reducing agents, reductants, or reducers  
B. An electron donor      D. None of the above
- Mathematically speaking, pH is the negative logarithm of the activity of the (solvated) hydronium ion, often expressed as the measurement of \_\_\_\_\_.  
A. Electrons      C. Cation measurement(s)  
B. Hydronium ion concentration      D. None of the above
- 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      C. Brønsted–Lowry acid–base theory  
B. (Solvated) hydronium ion      D. None of the above
- Commercial standard buffer solutions usually comes with information about value and a correction factor to be applied for what temperature?  
A. 4 °C      C. 10 °C  
B. 25 °C      D. None of the above
- Because the pH scale is logarithmic, therefore pH is \_\_\_\_\_.  
A. Universal indicator      C. Excess of Ion concentrations  
B. A dimensionless quantity      D. None of the above

8. What is the new pH scale is referred to as?  
 A. Total scale      C. pH<sub>3</sub>  
 B. POH              D. None of the above
9. 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
10. While the general case requires the pH solution of?  
 A. The solution of a linear equation      C. A set of non-linear simultaneous equations  
 B. The solution of a squared equation      D. None of the above
11. 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              C. Borates, phosphates, silicates  
 B. Caustics          D. None of the above
12. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a \_\_\_\_\_ fold difference in hydrogen ion concentration  
 A. 1              C. 10  
 B. 5              D. None of the above

### **Inorganic Chemical Introduction**

13. Which of the following in biological systems includes or incorporates carbohydrates into the molecular structure?  
 A. Organic Chemicals (SOCs)      C. Organic compounds  
 B. Organic matter                      D. None of the above
14. Which of the following are rather simple chemicals present in groundwater?  
 A. Presence of a carbon atom      C. Inorganic compounds  
 B. Minerals                              D. None of the above
15. Which of the following are dissolved from the rock/soil that make up the aquifer or water-bearing rock formations below the soil surface?  
 A. Presence of a carbon atom      C. Inorganic compounds  
 B. Minerals                              D. None of the above
16. Organic chemists usually refer to any molecule containing carbon as an organic compound and by default this means that \_\_\_\_\_ deals with molecules lacking carbon.  
 A. Organic chemistry      C. Carbon  
 B. Inorganic chemistry      D. None of the above
17. Which of the following that have been metabolically incorporated into living tissues persist in decomposing tissues?  
 A. Organic Chemicals (SOCs)      C. Organic compounds  
 B. Organic matter                      D. None of the above

18. The difference 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 CO<sub>2</sub> as?

- A. Compounds
- B. An organic compound
- C. Inorganic compound
- D. None of the above

19. Which of the following may be introduced into groundwater by human activities?

- A. Compounds
- B. Minerals
- C. Calcium
- D. None of the above

20. Water purveyors shall test for 30 different \_\_\_\_\_ including all arsenic, barium, cadmium, lead, mercury, selenium, and thallium

- A. Compounds
- B. An organic compound
- C. Inorganic compounds
- D. None of the above

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

- A. Compounds
- B. Organic compounds
- C. Inorganic compounds
- D. None of the above

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

- A. Compounds
- B. Organic compounds
- C. Inorganic compounds
- D. None of the above

### **Inorganic Chemistry**

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

- A. Inorganic compounds
- B. Some metals
- C. Inorganic and organometallic compounds
- D. None of the above

24. 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. Electrically neutral
- C. Organometallic chemistry
- D. None of the above

### **Subdivisions of Inorganic Chemistry**

25. Many inorganic compounds are ionic compounds, consisting of \_\_\_\_\_ joined by ionic bonding.

- A. Myriad organic compounds
- B. Inorganic compounds
- C. Cations and anions
- D. None of the above

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

- A. An inorganic salt
- B. Electrically neutral
- C. Electrically positive
- D. None of the above

27. Important classes of inorganic salts are the \_\_\_\_\_, the sulfates and the halides.

- A. Oxides, the carbonates
- B. Electrically neutral cations
- C. Sulfites
- D. None of the above

28. Many inorganic compounds are characterized by high melting points. Inorganic salts typically are poor conductors in the?

- A. Myriad
- B. Solid state
- C. Ionic compound
- D. None of the above

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

- A. And ease of crystallization
- B. Electrically neutral
- C. Sub-discipline of organometallic chemistry
- D. None of the above

30. In redox reactions one reactant, the oxidant, lowers its \_\_\_\_\_ and the reductant, has its oxidation state increased.

- A. Redox state
- B. Oxidation state
- C. Electron affinity (anions)
- D. None of the above

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

- A. Crystallization
- B. Electrically neutral charges
- C. Electron exchange
- D. None of the above

32. Soil may contain iron sulfide as pyrite or?

- A. Calcium sulfate
- B. Nature-made inorganic compounds
- C. Man-made inorganic compounds
- D. None of the above

33. Which of the following was ammonium nitrate for soil fertilization through the Haber process?

- A. Man-made inorganic compounds
- B. Classification of compounds
- C. Nature-made inorganic compounds
- D. None of the above

### **Descriptive Inorganic Chemistry**

34. Descriptive inorganic chemistry focuses on the \_\_\_\_\_ based on their properties.

- A. Man-made inorganic compounds
- B. Classification of compounds
- C. Nature-made inorganic compounds
- D. None of the above

35. 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. Structural similarities
- D. None of the above

36. 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. Coordination complexes
- B. Classification of compounds
- C. Solid state properties
- D. None of the above

### **Coordination Compounds**

37. Which of the following almost all organic and inorganic compounds can be used as ligands?

- A. Supramolecular coordination chemistry
- B. Inorganic compounds
- C. Modern coordination compounds
- D. None of the above

38. 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. Man-made inorganic compound
- D. None of the above

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

- A. Supramolecular coordination chemistry
- B. Classical coordination chemistry
- C. Bathtub chemistry
- D. None of the above

### Main Group Compounds

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

- A. Coordination colors
- B. Elements
- C. Minerals
- D. None of the above

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

- A. Main group compounds
- B. Organometallic compounds
- C. Metal-metal bonded dimetallic complexes
- D. None of the above

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

- A. Diatomic gases
- B. Stoichiometric ratios
- C. Transition metal compounds
- D. None of the above

43. According to the text, main group compounds are  $\text{SiO}_2$ ,  $\text{SnCl}_4$ , and  $\text{N}_2\text{O}$ . Many main group compounds can also be classed as?

- A. Transition metals
- B. Organometallic
- C. Metal carbonyls and even metal alkoxides
- D. None of the above

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

- A. Inorganics
- B. Organometallic compounds
- C. Organic compounds
- D. None of the above

### Transition Metal Compounds

45. 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. Carbonyls compounds
- D. None of the above

46. Transition metal compounds show a rich coordination chemistry, varying from tetrahedral for titanium (e.g.,  $\text{TiCl}_4$ ) to square planar for some nickel complexes to octahedral for \_\_\_\_\_ of cobalt.

- A. Organometallic complexes
- B. Organometallic compounds
- C. Coordination complexes
- D. None of the above

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

- A. Transition metals                      C. Metal complexes  
B. Organometallic complexes        D. None of the above

### Organometallic Compounds

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

- A. Transition metal compound        C. Metal-metal bonded dimetallic complex  
B. Transition metal                      D. None of the above

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

- A. An important diatomic gas            C. Transition metal compounds  
B. An organometallic compound        D. None of the above

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

- A. Transition metal compounds        C. Metal-metal chemistry  
B. Organometallic chemistry            D. None of the above

51. Which of the following has the ability to manipulate complexes in solvents of low coordinating power, enabled the exploration of very weakly coordinating ligands such as hydrocarbons?

- A. Synthetic gas methodology        C. Transition metal compounds  
B. Synthetic methodology                D. None of the above

### Cluster Compounds

52. Clusters can be found in all classes of?

- A. Transition metal compounds        C. Chemical compounds  
B. Organometallic compounds        D. None of the above

53. Which of the following are considered organometallic chemistry, main group chemistry, and bioinorganic chemistry?

- A. Transition metals                      C. Metal carbonyls and even metal alkoxides  
B. Inorganic systems                      D. None of the above

54. 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        C. Metal-metal bonded dimetallic complexes  
B. Cadmium selenide clusters            D. None of the above

### Bioinorganic Compounds

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

- A. Symmetry to spectroscopy        C. Medicinal inorganic chemistry  
B. Qualitative approach                D. None of the above

### **Solid State Compounds**

56. Which of the following 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. Solid state inorganic chemistry
- C. Computational chemistry
- D. None of the above

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

- A. Theoretical calculations
- B. Qualitative approach
- C. Solid state chemistry
- D. None of the above

### **Bioinorganic Compounds**

58. The phosphates in DNA, and 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. Biological macromolecules
- B. Inter alia
- C. Molecular symmetry
- D. None of the above

### **Solid State Compounds**

59. Which of the following 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. Solid state inorganic chemistry
- C. Theoretical chemistry
- D. None of the above

### **Theoretical Inorganic Chemistry**

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

- A. Crystallography
- B. Bohr model of the atom
- C. Theoretical chemistry and computational chemistry
- D. None of the above

61. Which of the following the province of inorganic chemistry?

- A. Symmetry
- B. Qualitative approaches
- C. Quantum mechanical descriptions
- D. None of the above

### **Qualitative Theories**

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

- A. VSEPR theory
- B. Inter alia theory
- C. Molecular symmetry theory
- D. None of the above

### **Molecular Symmetry Group Theory**

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

- A. VSEPR theory
- B. Inter alia theory
- C. Molecular symmetry
- D. None of the above

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

- A. Mathematical group theory
- B. Theoretical theory
- C. Evolutionary theory
- D. None of the above

### Synthetic Inorganic Chemistry

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

- A. Species
- B. Organisms
- C. Inorganic species
- D. None of the above

66. Which of the following are prepared using methods of organic synthesis, for metal-containing compounds that are reactive toward air?

- A. Soluble inorganic compounds
- B. Products and reactants
- C. Carcinogens
- D. None of the above

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

- A. Gas and Chains
- B. Volatile compounds and gases
- C. Inorganic species
- D. None of the above

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

- A. Compounds
- B. Products and reactants
- C. Carcinogens
- D. None of the above

### IOC Sample Collection – Things to Remember

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

- A. Collect samples
- B. Request sample instructions
- C. Do not change the flow
- D. None of the above

### Some general practices to remember:

70. Samples should be collected at \_\_\_\_\_ after all treatment (finished water).

- A. Homes
- B. All systems
- C. The entry point to the distribution system
- D. None of the above

71. Select a sampling faucet that does NOT have an aerator (sampling must be done with?)

- A. Sample instructions
- B. Minimum aeration
- C. Laboratory performance requirements
- D. None of the above

72. The owner or operator of a water supply must maintain chemical analysis reports (results) or a summary of those reports for at least \_\_\_\_\_ years

- A. 3
- B. 10
- C. 5
- D. None of the above

### Antimony

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

- A. Analytical element
- B. Sulfide mineral stibnite ( $Sb_2S_3$ )
- C. Stibnite with iron
- D. None of the above

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

- A. Gray allotrope of arsenic
- B. Antimony compounds
- C. Metallic antimony
- D. None of the above



75. The industrial methods to produce antimony are roasting and subsequent carbothermal reduction or direct reduction of?
- A. Copper                      C. Lead  
B. Stibnite with iron        D. None of the above

**What are EPA's drinking water regulations for antimony?**

76. 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                      C. MCLs  
B. EPA                        D. None of the above
77. Which of the following 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                      C. MCLs  
B. EPA                        D. None of the above
78. EPA has set an enforceable regulation for antimony, called a \_\_\_\_\_, at 0.006 mg/L or 6 ppb.
- A. MCLG                      C. Emergency Planning and Community Right to Know Act (EPCRA)  
B. MCL                        D. None of the above

**Applications**

79. Which of the following with antimony improves the properties of the alloys that are used in solders, bullets and plain bearings?
- A. Gray allotrope of arsenic        C. Metallic antimony  
B. Alloying lead and tin            D. None of the above
80. Which of the following are prominent additives for chlorine- and bromine-containing fire retardants found in many commercial and domestic products?
- A. Gray allotrope of arsenic        C. Prominent additives  
B. Antimony compounds            D. None of the above
81. Antimony is in the nitrogen group (group 15) and it is \_\_\_\_\_, and less electronegative than tellurium or arsenic.
- A. A gray allotrope of arsenic        C. More electronegative than tin or bismuth  
B. A metallic antimony              D. None of the above
82. Pure antimony is?
- A. Very hard                            C. Not used to make hard objects  
B. Highly chemical reactive        D. None of the above
83. Four allotropes of antimony are known, a stable metallic form and \_\_\_\_\_, explosive, black and yellow.
- A. Gray                                  C. Liquid  
B. Three metastable forms        D. None of the above

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

- A. In a trigonal cell
- B. Nitrogen group (group 15)
- C. Metallic
- D. None of the above

### Barium

85. Which of the following providing alternative drinking water supplies, may be required to prevent serious risks to public health?

- A. MCLG
- B. MFL
- C. Additional actions
- D. None of the above

86. Which of the following the regulation for barium, became effective in 1993?

- A. Phase IIB Rule
- B. Safe Drinking Water Act
- C. EPA
- D. None of the above

87. Major sources of barium in drinking water are discharge of drilling wastes; \_\_\_\_\_; and erosion of natural deposits.

- A. Discharge from metal refineries
- B. Barium carbonate,  $\text{BaCO}_3$
- C. Soluble barium compounds
- D. None of the above

88. Which of the following rule regulates facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals?

- A. MCLG Rule
- B. EPA
- C. Emergency Planning and Community Right to Know Act (EPCRA)
- D. None of the above

### Barium Explained

89. The most common naturally occurring minerals of barium are barite (barium sulfate,  $\text{BaSO}_4$ ) and witherite (\_\_\_\_\_), both being insoluble in water.

- A. Baryta
- B. Barium carbonate,  $\text{BaCO}_3$
- C. Highly reactive chemical
- D. None of the above

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

- A. Beryllium
- B. Barium
- C. Soluble barium compound
- D. None of the above

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

- A. Beryllium
- B. Barium
- C. Soluble barium compound
- D. None of the above

92. Barium is a \_\_\_\_\_ with symbol **Ba** and atomic number 56.

- A. Erosion of natural deposits
- B. Chemical element
- C. Soluble compounds
- D. None of the above

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

- A. Baryta
- B. Barium carbonate,  $\text{BaCO}_3$
- C. Highly reactive chemical
- D. None of the above

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

- A. Barium
- B. Barium carbonate, BaCO<sub>3</sub>
- C. Barium compounds
- D. None of the above

95. 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. Baryta
- C. Soluble barium compounds
- D. None of the above

### **Beryllium**

96. Which of the following terms is regulating for beryllium at 0.004 mg/L or 4 ppb?

- A. MCLG
- B. Notice level
- C. Action level
- D. None of the above

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

97. 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. MCL
- B. Public action level
- C. SDWA limit
- D. None of the above

### **Beryllium Explained**

98. 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. It is a relatively rare element
- C. Hard and resistant to corrosion
- D. None of the above

99. As a free element, Beryllium is \_\_\_\_\_, lightweight and brittle alkaline earth metal.

- A. A divalent element
- B. A steel-gray, strong
- C. Hard and resistant to corrosion
- D. None of the above

100. Beryllium increases \_\_\_\_\_ when alloyed to aluminum, cobalt, copper (notably beryllium copper), iron and nickel.

- A. A divalent element
- B. Coal based
- C. Hardness and resistance to corrosion
- D. None of the above

### **Cadmium**

101. The MCLG for cadmium is?

- A. .002
- B. 1.3
- C. 0.005 mg/L or 5 ppb
- D. None of the above

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

- A. .002
- B. 1.3
- C. 0.005 mg/L or 5 ppb
- D. None of the above

103. 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. .002
- B. 1.3
- C. 0.005 mg/L or 5 ppb
- D. None of the above

#### How does cadmium get into my drinking water?

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

- A. Brittle alkaline earth metal
- B. Coal and fuel oil combustion
- C. Discharge from metal refineries
- D. None of the above

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

105. 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
- B. MCL
- C. SDWA limit
- D. None of the above

#### How will cadmium be removed from my drinking water?

106. 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. .002
- B. 1.3
- C. 0.005 mg/L or 5 ppb
- D. None of the above

#### Characteristics

##### Physical Properties

107. As a bulk metal, cadmium is?

- A. Insoluble in water and is not flammable
- B. Normal industrial waste disposal practices
- C. It may burn and release toxic fumes
- D. None of the above

#### Chromium

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

- A. Making steel and other alloys
- B. Industrial processes
- C. Chemistry
- D. None of the above

109. Chromium is?

- A. An odorless and tasteless metallic element
- B. Normally found in industrial waste disposal
- C. Flammable
- D. None of the above

#### What are Chromium's Health Effects?

110. People who use water containing total chromium in excess of the \_\_\_\_\_ over many years could experience allergic dermatitis.

- A. Teir
- B. MCL
- C. Rule
- D. None of the above

### What are EPA's drinking water regulations for Chromium?

111. Which of the following 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. EPCRA
- D. None of the above

112. Which of the following represents total chromium at 0.1 mg/L or 100 parts per billion (ppb)?

- A. MCLG
- B. Teir
- C. Rule
- D. None of the above

### Chromium Description

113. Chromium is the first element in?

- A. Group 6
- B. Group 5
- C. Group 7
- D. None of the above

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

- A. Adding copper
- B. Adding Aluminum
- C. Roasting and leaching processes
- D. None of the above

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

- A. Adding trivalent chromium
- B. Adding Aluminum
- C. Its high corrosion resistance and hardness
- D. None of the above

116. 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. Toxic chromium
- C. Part of the leaching processes
- D. None of the above

117. The most prominent example of toxic chromium is \_\_\_\_\_. Abandoned chromium production sites often require environmental cleanup.

- A. Stainless steel
- B. Toxic chromium
- C. Hexavalent chromium (Cr(VI))
- D. None of the above

### Copper

#### What are Copper's Health Effects?

118. 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. Action level
- D. None of the above

#### What are EPA's Drinking Water Regulations for Copper?

119. Which of the following for copper is 1.3 mg/L or 1.3 ppm?

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

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

- A. MCL
- B. MCLG
- C. MCLs are set as close to the MCLGs
- D. None of the above

121. 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
- B. MCL
- C. Milligrams per Liter (mg/L)
- D. None of the above

122. Which of the following promulgated the Lead and Copper Rule in 1991, and revised the regulation in 2000 and in 2007?

- A. SDWA
- B. EPA
- C. Emergency Planning and Community Right to Know Act (EPCRA)
- D. None of the above

### **Copper Explained**

123. Pure copper is?

- A. Related to turquoise
- B. A liquid like Mercury
- C. Soft and malleable
- D. None of the above

124. 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
- B. Salts
- C. A mixture of gold and copper
- D. None of the above

### **Cyanide - Inorganic Contaminant 0.2 mg/L MCL**

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

- A. Organic and inorganic compounds
- B. Carbon-nitrogen chemicals
- C. Salts
- D. None of the above

### **Uses for Cyanide.**

126. The most commonly used form, \_\_\_\_\_, is mainly used to make compounds and other synthetic fibers and resins.

- A. Copper (II) salts
- B. Cyanide (II)
- C. Hydrogen cyanide
- D. None of the above

### **What are EPA's Drinking Water Regulations for Cyanide?**

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

- A. MCLG
- B. Tier
- C. Standard
- D. None of the above

128. Which of the following are any physical, chemical, biological or radiological substances or matter in water?

- A. Naked contaminants
- B. Contaminants
- C. Solutions of inorganic contaminants
- D. None of the above

### Cyanide Explained

129. A cyanide is a chemical compound that contains the \_\_\_\_\_, which consists of a carbon atom triple-bonded to a nitrogen atom.

- A. Halides
- B. Cyano group
- C. Cyanides
- D. None of the above

130. Cyanides most commonly refer to \_\_\_\_\_ which is isoelectronic with carbon monoxide and with molecular nitrogen.

- A. Salts of the anion  $\text{CN}^-$
- B. Carbon-nitrogen chemical
- C. Cyanides solutions
- D. None of the above

### Fluoride

131. The \_\_\_\_\_ for fluoride is 4.0 mg/L or 4.0 ppm.

- A. MCLG
- B. Action response
- C. Standard
- D. None of the above

132. 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
- B. MCL
- C. Secondary standard (SMCL)
- D. None of the above

133. Which of the following 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. Fluoride
- C. Solutions of inorganic fluorides
- D. None of the above

134. In the case for Fluoride the \_\_\_\_\_, because analytical methods or treatment technology do not pose any limitation.

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

135. EPA has also set a \_\_\_\_\_ for fluoride at 2.0 mg/L or 2.0 ppm.

- A. MCLG
- B. MCL
- C. Secondary standard (SMCL)
- D. None of the above

### Fluoride Explained

136. Structurally Fluoride and to some extent chemically, the \_\_\_\_\_ resembles the hydroxide ion.

- A. Naked fluoride
- B. Fluoride ion
- C. Solutions of inorganic fluorides
- D. None of the above

### Occurrence

137. When relatively unsolvated, fluoride anions are called?

- A. Naked
- B. Fluoride
- C. Solutions of inorganic fluorides
- D. None of the above

138. Which of the following is a very strong Lewis base?  
A. Naked fluoride                      C. Solutions of inorganic fluorides  
B. Fluoride                              D. None of the above

#### **Natural Occurrence**

139. Which of the following are known of paramount commercial importance are fluorite and fluorapatite?

- A. Halides                                  C. Fluorite and fluorapatite  
B. Many fluoride minerals              D. None of the above

140. Which of the following is usually found naturally in low concentration in drinking water and foods. The concentration in seawater averages 1.3 parts per million (ppm)?

- A. Halides                      C. Fluorite and fluorapatite  
B. Fluoride                      D. None of the above

141. Fresh water may contains dangerously high levels of \_\_\_\_\_, leading to serious health problems.

- A. Naked fluoride                      C. Solutions of inorganic fluorides  
B. Fluoride                              D. None of the above

#### **Mercury - Inorganic Contaminant**

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

- A. Aluminum                              C. Other elements  
B. Cinnabar (mercuric sulfide)        D. None of the above

#### **Uses for Mercury**

143. 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. Mercury                                  C. Lead  
B. Cinnabar (mercuric sulfide)        D. None of the above

#### **How will Mercury be removed from my Drinking Water?**

144. 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                      C. Lime softening  
B. Backwash carbon                      D. None of the above

#### **Mercury Explained**

145. The red pigment vermilion is mostly obtained by?

- A. Aluminum                                  C. Mercury-aluminum amalgam  
B. Reduction from cinnabar              D. None of the above

146. 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. Water-soluble forms                      C. Reduction from cinnabar  
B. Cinnabar (mercuric sulfide)              D. None of the above



147. 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
- B. Machinery
- C. Galinstan-filled, digital, or thermistor-based instruments
- D. None of the above

148. 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. Ultraviolet light
- B. Cinnabar (mercuric sulfide)
- C. Phosphor
- D. None of the above

### Amalgams

149. 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
- B. Cinnabar (mercuric sulfide)
- C. Sodium amalgam
- D. None of the above

150. Mercury readily combines with aluminum to form a \_\_\_\_\_ when the two pure metals come into contact.

- A. Aluminum amalgam
- B. Cinnabar (mercuric sulfide)
- C. Mercury-aluminum amalgam
- D. None of the above

151. Amalgam destroys the \_\_\_\_\_which protects metallic aluminum from oxidizing in-depth.

- A. Aluminum oxide layer
- B. Cinnabar (mercuric sulfide)
- C. Sodium amalgam
- D. None of the above

### Nitrate (Measured as Nitrogen)

152. EPA regulates \_\_\_\_\_in drinking water to protect public health.

- A. Nitrates and nitrites
- B. Nitrate
- C. Nitrates are converted to nitrites
- D. None of the above

### What is Nitrate?

153. Nitrates and nitrites are \_\_\_\_\_which combine with various organic and inorganic compounds.

- A. Nitrogen-oxygen chemical units
- B. Nitrate
- C. Nitrates are converted to nitrites
- D. None of the above

### Uses for Nitrate.

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

- A. Nitrates and nitrites
- B. Nitrate
- C. Nitrites
- D. None of the above

### Nitrate Explained

155. The nitrate ion is a polyatomic ion with the \_\_\_\_\_ and a molecular mass of 62.0049 g/mol.

- A. Nitrates and nitrites
- B. Nitrate
- C. Molecular formula  $\text{NO}_3^-$
- D. None of the above

### Structure

156. This results from a combination formal charge 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 formal charge of the \_\_\_\_\_.

- A. Nitrates and nitrites
- B. Nitrate
- C. Polyatomic nitrate ion
- D. None of the above

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

157. 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. EPA
- C. Emergency Planning and Community Right to Know Act (EPCRA)
- D. None of the above

### What is Nitrite?

158. Nitrates and nitrites are \_\_\_\_\_ which combine with various organic and inorganic compounds.

- A. Nitrogen-oxygen chemical units
- B. Nitrate
- C. Nitrates are converted to nitrites
- D. None of the above

### Uses for Nitrite.

159. Once taken into the body, \_\_\_\_\_ are converted to nitrites.

- A. Nitrate ions
- B. Nitrates
- C. Various organic and inorganic compounds
- D. None of the above

### What are EPA's Drinking Water Regulations for Nitrite?

160. Which of the following is the regulation for nitrite, became effective in 1992?

- A. MCLs
- B. The Phase II Rule
- C. The Phase III Rule
- D. None of the above

### How does Nitrite get into my Drinking Water?

161. 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
- C. Nitrogen ions
- D. None of the above

### Selenium- Inorganic Contaminant 0.05 mg/L MCL

162. 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. Drinking water
- B. Minerals
- C. Human nutrition
- D. None of the above

163. 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. Selenide or selenate compounds
- B. Minerals
- C. Selenium in ground water
- D. None of the above

164. Which of the following is also a by-product of copper mining / smelting.

- A. Selenium
- B. Selenium in water
- C. Selenide or selenate compounds
- D. None of the above

165. 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.

- A. Selenide or selenate compounds
- B. Minerals
- C. High levels of selenium in water
- D. None of the above

### Selenium Explained

166. Commercially, selenium is produced as \_\_\_\_\_ in the refining of these ores, most often during copper production.

- A. Natural deposits
- B. Antioxidant enzymes
- C. Byproduct
- D. None of the above

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

- A. Natural deposits
- B. Selenium
- C. Fluorescent quantum dot
- D. None of the above

168. 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. Selenium salts
- C. Large amounts
- D. None of the above

### Thallium- Inorganic Contaminant 0.002 mg/L MCL

169. Thallium is a metal found in natural deposits such as ores containing \_\_\_\_\_.

- A. Natural deposits
- B. Selenium
- C. Other elements
- D. None of the above

### Thallium Explained

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

- A. Nonselective
- B. When isolated
- C. Like Potassium ores
- D. None of the above

171. 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. Selenium
- C. Potassium ions ( $K^+$ )
- D. None of the above

172. 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. Thallium 111
- B. Thallium 3
- C. Thallium-201
- D. None of the above

### **SOC Section**

#### **SOC Introduction**

173. SOCs are identified carcinogens (cancer causing). EPA has set Maximum Contaminant Levels (MCL) for 30 \_\_\_\_\_ under the Safe Drinking Water Act.

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Maximum Contaminant Levels (MCL)
- D. None of the above

174. 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. Maximum Contaminant Levels (MCL)
- D. None of the above

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

- A. Volatile Organic Compounds (VOCs)
- B. Synthetic Organic Chemicals (SOCs)
- C. Maximum Contaminant Levels (MCL)
- D. None of the above

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

- A. Methemoglobinemia
- B. Most contaminants
- C. Elevated levels of Chlorofluorocarbons
- D. None of the above

177. All public water systems must monitor for?

- A. Valuable Organic Compounds (VOCs)
- B. Nitrate and Nitrite)
- C. Maximum Constant Levels (MCL)
- D. None of the above

### **Volatile Organic Compounds (VOCs)**

#### **VOCs Explained**

178. Which of the following 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. Maximum Contaminant Levels (MCL)
- D. None of the above

179. Which of the following \_\_\_\_\_ are of VOCs?.

- A. Most scents or odors
- B. Five contaminant groups
- C. Substances
- D. None of the above

180. Which of the following are regulated by law, especially indoors, where concentrations are the highest?

- A. Anthropogenic VOCs
- B. VOCs
- C. Benzene
- D. None of the above

### Specific Components

#### Paints and Coatings

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

- A. Solvents
- B. VOC
- C. Cleaning products
- D. None of the above

#### Chlorofluorocarbons and Chlorocarbons

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

- A. VOC
- B. Benzene
- C. Chlorofluorocarbons
- D. None of the above

#### Benzene

183. One VOC that is a known human carcinogen?

- A. VOC
- B. Benzene
- C. Chlorofluorocarbons
- D. None of the above

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

- A. VOC
- B. Benzene
- C. Chlorofluorocarbons
- D. None of the above

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

- A. VOC
- B. Benzene
- C. Chlorofluorocarbons
- D. None of the above

#### Methylene Chloride

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

- A. Solvent
- B. Benzene
- C. Methylene chloride
- D. None of the above

#### Perchloroethylene

187. To avoid exposure to perchloroethylene: Be careful if a \_\_\_\_\_ is coming from clothing when picked up from the dry cleaner.

- A. Fume
- B. Plume
- C. Strong chemical odor
- D. None of the above

#### MTBE

188. MTBE was used as an octane booster and?

- A. Formaldehyde
- B. FDE
- C. Oxygenated-additive
- D. None of the above

#### Formaldehyde

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

- A. Organic chemicals
- B. Some organics
- C. Formaldehyde
- D. None of the above

### Health Risks

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

- A. MT
- B. VOCs
- C. Organic chemicals
- D. None of the above

### Health effects include:

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

- A. Organic chemicals
- B. Some organics
- C. Formaldehyde
- D. None of the above

### Reducing Exposure

192. Use products with \_\_\_\_\_ in well ventilated areas.

- A. MTBE
- B. VOCs
- C. Organic chemicals
- D. None of the above

193. The exhaled human breath contains a few hundred volatile organic compounds and is used in breath analysis to serve as a \_\_\_\_\_ biomarker to test for diseases such as lung cancer.

- A. MTBE
- B. VOC
- C. Organic chemicals
- D. None of the above

194. 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. Some chemical elements
- D. None of the above

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

- A. Allotropes
- B. Molecular formulae
- C. Metalloids
- D. None of the above

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

- A. Allotropy
- B. Molecular formulae
- C. Polymorphism
- D. None of the above

### Aluminum Sulfate

197. Aluminum sulfate, alternatively spelt either aluminum or sulfate, is a chemical compound with the formula \_\_\_\_\_.

- A.  $AB(SO_4)_2 \cdot 12H_2O$
- B.  $Al_2(SO_4)_3$
- C.  $Al_2(SO_4)_3 \cdot 18H_2O$
- D. None of the above

198. Aluminum sulfate is sometimes referred to as a type of alum. Alums are a class of related compounds typified by \_\_\_\_\_.

- A.  $AB(SO_4)_2 \cdot 12H_2O$
- B.  $Al_2(SO_4)_3$
- C.  $Al_2(SO_4)_3 \cdot 18H_2O$
- D. None of the above

199. The anhydrous form occurs naturally as a \_\_\_\_\_, found e.g. in volcanic environments and on burning coal-mining waste dumps.

- A. Aluminum sulfite
- B. Rare mineral millosevichite
- C. Anhydrous salt
- D. None of the above

200. Aluminum sulfate forms a number of different hydrates, of which the hexadecahydrate \_\_\_\_\_ and octadecahydrate  $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$  are the most common.

- A.  $\text{Al}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$
- B.  $\text{Al}_2(\text{SO}_4)_3$
- C.  $\text{Al}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$
- D. None of the above