

Chemical Level of Organization  
Chapter Two Study Guide  
Tortora & Derrickson

1. What is matter?
2. What is an atom?
3. What is an element?
4. What is the difference between the atomic weight and atomic number?  
Significance?
5. What is the significance of the “Periodic Table of Elements”?
6. What atom is the “key” building block for life?
7. What are the three “atomic particles”? Their characteristics?
8. How are the particles of an atom arranged?
9. What term describes the particles at the center of the atom?
10. How many electrons fit into the first orbit around the nucleus?
11. How many electrons fit into the second orbit?
12. What is the significance of the octet rule?
13. What do we call the electrons in the outer orbit?
14. What atomic particle determines the atom type and the physical properties of the element?
15. What atomic particle determines how atoms may form compounds?
16. What is a molecule?
17. What holds molecules together?
18. What determines if it is possible to form a chemical bond between two atoms?
19. What is the difference between an ionic, covalent, polar covalent, and hydrogen bond?
20. What type of chemical bond does not hold atoms together but may hold molecules together? Explain using water and proteins.
21. What is an isotope?
22. What is an ion?
23. What do we call an atom that loses an electron?
24. What do we call an atom that gains an electron?
25. What is a “hydration shell”? Explain using sodium chloride (ie. Table salt)
26. Can a macromolecule be “ionized”?
27. What are electrolytes? How is this related to an EKG?
28. What is a free radical? (Use oxygen in this answer) How are free radicals produced? Are they good or bad? Why?
29. How do “antioxidants” protect us from free radicals?
30. What is the classic antioxidant? What molecule consumed as a breakfast drink may be used to “re-energize” the classic antioxidant?
31. Why are glucose and fructose isomers?
32. What is a mixture? How are mixtures classified?
33. What does it mean to be a semi permeable membrane? What is the significance of a semi-permeable membrane that separates a colloid mixture and a solution mixture?
34. What type of bond holds water molecules together?

35. What do we call substances that readily dissolve in water? Give an example.
36. What do we call substances that do not readily dissolve in water? Give an example.
37. When water evaporates off our skin, what is the net effect? (one milliliter of perspiration evaporating = loss of 500 cal of heat) Do you think it is a good idea to wipe perspiration from your skin after vigorous exercise? Explain.
38. What is a salt? Example:
39. What is an acid? Example:
40. What is a base? Example:
41. Pure water is a mixture of H<sub>2</sub>O molecules plus equal amounts of H<sup>+</sup> and OH<sup>-</sup> ions. Why is pure water not an acid or a base?
42. What is the pH scale? What is measured to determine pH? What is the significance of pH 0 vs pH 14?
43. What is a buffer?
44. What is energy?
45. What is the difference between potential and kinetic energy? Is heat potential or kinetic energy?
46. One of the most fundamental chemical reaction in human physiology is  

$$\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+$$

Please memorize this formula and the name of the compounds (carbon dioxide + water join together to form carbonic acid which dissociates into bicarbonate ion plus a hydrogen ion). You will see this formula used repeatedly by cells in many different organ systems. It explains how your stomach makes acid, how oxygen dissociates from hemoglobin, how acid is “excreted” by our respiratory system, and many other physiologic mechanisms.

47. What is the significance of the “law of mass action”?
48. What is a catalyst? Biocatalyst?
49. What is an oxidation reaction?
50. What is reduction reaction?
51. Why do oxidation and reduction reactions occur together?
52. How is oxidation-reduction reactions related to catabolism and anabolism?
53. What can we tell about the energy of a molecule by comparing the relative number of carbons, oxygens, and hydrogen atoms?
54. Organic chemistry is the study of the compounds with carbon and hydrogen.
55. What are the four primary macromolecules? Their primary function?
56. What are the monomers of the four primary macromolecules?
57. What are nucleic acids? How are they used in our body?
58. What molecule is stored in adipocytes and is the primary source of energy when you are at rest?
59. *What is the basic structure of the most important macromolecules? (See “Know Your Molecules” PowerPoint posted on Web site)*
60. How do lipids react in water? Why?
61. How do phospholipids react in water? What are two possible outcomes? Why?
62. How do proteins react in water?
63. What are three glucose polymers? Significance of each?

64. The yolk of an egg contains the phospholipid lecithin. When you bake a cake, why do we add the yolk of an egg to the batter?
65. What are proteoglycans? Where are they in our body?
66. What is a gel state? Where are gel states found in the human body?
67. What happens to a protein when it is denatured?
68. How are proteins denatured?
69. What is an enzyme? Another name for this molecule?
70. What is ATP? Explain its function. Nickname for this molecule?
71. What term describes the transition from a polymer into a monomer? Role of water?
72. What term describes the transition from a monomer into a polymer? Role of water?
73. What two metabolic pathways catabolize glucose to form ATP? Characteristics of each pathway? End products? Is oxygen required? Explain.