Chapter 2-3 Take Home Test Chemical Context of Life & Water

1) About 25 of the 92 natural elements are known to be essential to life. Which four of these 25 elements make up approximately 96% of living matter?  A) carbon, sodium, chlorine, nitrogen  B) carbon, sulfur, phosphorus, hydrogen   C) oxygen, hydrogen, calcium, sodium D) carbon, hydrogen, nitrogen, oxygen

2)  Trace elements are those required by an organism in only minute quantities. Which of the following is a trace element that is required by humans and other vertebrates?   A) nitrogen B) calcium  C) iodine D) sodium  

3)  Which of the following statements is *false*?

A)  Atoms of the various elements differ in their number of subatomic particles.

B)  All atoms of a particular element have the same number of protons in their nuclei.

C)  The neutrons and protons present in the nucleus of an atom are almost identical in  mass; each has a mass of about 1 dalton.

D)  Protons and electrons are electrically charged particles. Protons have one unit of  negative charge, and electrons have one unit of positive charge.

4)  Each element is unique and different from other elements because of the number of protons in the nuclei of its atoms. Which of the following indicates the number of protons in an atomʹs nucleus?   A) atomic mass B) atomic weight  C) atomic number D) mass weight    

5)  The mass number of an element can be easily approximated by adding together the number of \_\_\_\_\_\_\_\_\_\_ in an atom of that element.  A) protons and neutrons B) energy levels   C) protons and electrons D) neutrons and electrons

6)  What is the approximate atomic mass of an atom with 16 neutrons, 15 protons, and 15 electrons?   A) 15 daltons B) 16 daltons C) 30 daltons D) 31 daltons

7)  Oxygen has an atomic number of 8 and a mass number of 16. Thus, the atomic mass of an oxygen atom is   A) exactly 8 grams. B) exactly 8 daltons.   C) approximately 16 grams. D) approximately 16 daltons.  

8)  The nucleus of a nitrogen atom contains 7 neutrons and 7 protons. Which of the following is a *correct* statement concerning nitrogen?

A)  The nitrogen atom has a mass number of approximately 7 daltons and an atomic mass of 14.

B)  The nitrogen atom has a mass number of approximately 14 daltons and an atomic mass of 7.

C)  The nitrogen atom has a mass number of 14 and an atomic mass of 7 grams.

D)  The nitrogen atom has a mass number of 7 grams and an atomic number of 14.

E)  The nitrogen atom has a mass number of 14 and an atomic mass of approximately 14 daltons.

9)  Calcium has an atomic number of 20 and an atomic mass of 40. Therefore, a calcium atom must have  A) 20 protons. B) 40 electrons. C) 40 neutrons.  D) A and B only

10)  An atom with an atomic number of 9 and a mass number of 19 would have an atomic mass of approximately   A) 9 daltons. B) 9 grams.  C) 10 daltons. D) 19 daltons.

11)  Different atomic forms of an element contain the same number of protons but a different number of neutrons. What are these different atomic forms called?   A) ions  B) isotopes   C) neutronic atoms D) isomers

12)  How do isotopes of the same element differ from each other? A) number of protons   B) number of electrons  C) number of neutrons  D) valence electron distribution

  13) The atomic number of carbon is 6. Carbon-14 is heavier than carbon-12 because the atomic nucleus of carbon-14 contains \_\_\_\_\_ neutrons.

A) 7 B) 8 C) 12 d) 14

14) The atomic number of neon is 10. Therefore, which of the following is *correct* about an atom of neon?

A) It has 8 electrons in its outer electron shell. B) It is inert.

C)It has an atomic mass of 10 daltons. D) A and B only

15) How many electrons does phosphorus have in its valence shell? A) 1 B)2 C) 3 D) 5

16) How many neutrons are present in the nucleus of a phosphorus atom? A) 8 B)15 C) 16 D) 31

17) How many electrons does an atom of sulfur have in its valence shell? A) 4 B) 6 C) 8 D) 16

18) Based on electron configuration, which of these elements would exhibit chemical behavior most like that of oxygen?

A) carbon B)hydrogen C) nitrogen D) sulfur

19) How many electrons would be expected in the outermost electron shell of an atom with atomic number 12?

A)1 B) 2 C) 4 D) 6

20) What is the valence of an atom with six electrons in its outer electron shell? A) 1 B)2 C) 3 D)4

21) Fluorine has an atomic number of 9 and a mass number of 19. How many electrons are needed to complete the valence shell of a fluorine atom?

A)1 B) 3 C) 5 D) 7

22) What is the maximum number of electrons in the 1s orbital of an atom? A) 1 B)2 C) 3 D) 4

23) What is the maximum number of electrons in a 2p orbital of an atom? A) 1 B)2 C) 3 D) 4

24)  Which of the following describes any reaction that has reached chemical equilibrium? A)  The concentration of the reactants equals the concentration of the products.   B)  The rate of the forward reaction is equal to the rate of the reverse reaction.   C)  All of the reactants have been converted to the products of the reaction.   D)  All of the products have been converted to the reactants of the reaction.

25)  A group of molecular biologists is trying to synthesize a new artificial compound to mimic the effects of a known hormone that influences sexual behavior. They have turned to you for advice. Which of the following compounds is most likely to mimic the effects of the hormone?   A) a compound with the same number of carbon atoms as the hormone  B) a compound with the same molecular mass (measured in daltons) as the hormone   C) a compound with the same three-dimensional shape as part of the hormone D) a compound with the same number of orbital electrons as the hormone  

26)  In a single molecule of water, two hydrogen atoms are bonded to a single oxygen atom by A) hydrogen bonds.   B) nonpolar covalent bonds. C) polar covalent bonds.  D) ionic bonds

27)  The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called?   A) a covalent bond B) a hydrogen bond   C) an ionic bond  D) a hydrophilic bond  

28)  An example of a hydrogen bond is the bond between A) C and H in methane (CH4).   B) the H of one water molecule and the O of another water molecule.   C) Na+and Cl- in salt.  D) the two hydrogen atoms in a molecule of hydrogen gas (H2).

29)  Water is able to form hydrogen bonds because A) oxygen has a valence of 2.   B) the water molecule is shaped like a tetrahedron.  C) the bonds that hold together the atoms in a water molecule are polar covalent bonds. D) the oxygen atom in a water molecule has a weak positive charge.

30)  What gives rise to the cohesiveness of water molecules? A) hydrophobic interactions   B) nonpolar covalent bonds C) ionic bonds  D) hydrogen bonds

31)  Which of the following effects is produced by the high surface tension of water? A)  Lakes donʹt freeze solid in winter, despite low temperatures.   B)  A water strider can walk across the surface of a small pond.   C)  Organisms resist temperature changes, although they give off heat due to chemical  reactions.   D)  Water can act as a solvent.

32)  Which of the following takes place as an ice cube cools a drink? A) Molecular collisions in the drink increase.   B) Kinetic energy in the drink decreases.  C) A calorie of heat energy is transferred from the ice to the water of the drink. D) The specific heat of the water in the drink decreases.

33)  Which of the following statements correctly defines a kilocalorie?  A) the amount of heat required to raise the temperature of 1 g of water by 1°F B) the amount of heat required to raise the temperature of 1 g of water by 1°C   C) the amount of heat required to raise the temperature of 1 kg of water by 1°F D) the amount of heat required to raise the temperature of 1 kg of water by 1°C    

34)  The nutritional information on a cereal box shows that one serving of a dry cereal has 200 kilocalories. If one were to burn one serving of the cereal, the amount of heat given off would be sufficient to raise the temperature of 20 kg of water how many degrees Celsius?   A) 0.2°C B) 1.0°C C) 2.0°C   D) 10.0°C E) 20.0°C  

35)  Waterʹs high specific heat is mainly a consequence of the A) small size of the water molecules.   B) high specific heat of oxygen and hydrogen atoms.  C) absorption and release of heat when hydrogen bonds break and form. D) fact that water is a poor heat conductor.

36)  Which type of bond must be broken for water to vaporize? A) ionic bonds   B) nonpolar covalent bonds C) polar covalent bonds  D) hydrogen bonds  E) covalent bonds

37)  Temperature usually increases when water condenses. Which behavior of water is most directly responsible for this phenomenon?   A) the change in density when it condenses to form a liquid or solid B) reactions with other atmospheric compounds   C) the release of heat by the formation of hydrogen bonds D) the release of heat by the breaking of hydrogen bonds  

38)  At what temperature is water at its densest? A) 0°C   B) 4°C C) 32°C D) 100°C

39)  Why does ice float in liquid water? A)  The liquid water molecules have more kinetic energy and thus support the ice.   B)  The ionic bonds between the molecules in ice prevent the ice from sinking.   C)  Ice always has air bubbles that keep it afloat.   D)  Hydrogen bonds stabilize and keep the molecules of ice farther apart than the water  molecules of liquid water.

40)  Hydrophobic substances such as vegetable oil are  A) nonpolar substances that repel water molecules.   B) nonpolar substances that have an attraction for water molecules. C) polar substances that repel water molecules.  D) polar substances that have an affinity for water.  

41)  Organic chemistry is a science based on the study of A) functional groups.   B) vital forces interacting with matter.  C) carbon compounds.  D) water and its interaction with other kinds of molecules.

42)  Early 19th-century scientists believed that living organisms differed from nonliving things as a result of possessing a ʺlife forceʺ that could create organic molecules from inorganic matter. The term given to this belief is   A) organic synthesis. B) vitalism.   C) mechanism.  D) organic evolution.

43)  The experimental approach taken in current biological investigations presumes that A)  simple organic compounds can be synthesized in the laboratory from inorganic  precursors, but complex organic compounds like carbohydrates and proteins can only  be synthesized by living organisms.   B)  a life force ultimately controls the activities of living organisms and this life force  cannot be studied by physical or chemical methods.   C)  although a life force, or vitalism, exists in living organisms, this life force cannot be  studied by physical or chemical methods.     D)  living organisms can be understood in terms of the same physical and chemical laws  that can be used to explain all natural phenomena.

44)  One of the following people set up a closed system to mimic Earthʹs early atmosphere and discharged electrical sparks through it. A variety of organic compounds common in organisms were formed. Who did this?   A) Stanley Miller B) Jakob Berzelius   C) Friedrich Wohler D) Hermann Kolbe

45) How many electron pairs does carbon share in order to complete its valence shell? A) 1 B)2 C) 3 D) 4

46) A carbon atom is most likely to form what kind of bond(s) with other atoms? A) ionic B) hydrogen C)covalent D)A and B only

47) Which of the following statements best describes the carbon atoms present in all organic molecules?

A) They were incorporated into organic molecules by plants. B) They were processed into sugars through photosynthesis.

C) They are ultimately derived from carbon dioxide. D) A, B, and C are correct.

48) Why are hydrocarbons insoluble in water?

A) The majority of their bonds are polar covalent carbon-to-hydrogen linkages.

B) The majority of their bonds are nonpolar covalent carbon-to-hydrogen linkages. C) They are hydrophilic.

D) They exhibit considerable molecular complexity and diversity.

49) A compound contains hydroxyl groups as its predominant functional group. Which of the following statements is true concerning this compound?

A) It lacks an asymmetric carbon, and it is probably a fat or lipid. B) It should dissolve in water.

C) It should dissolve in a nonpolar solvent. D) It wonʹt form hydrogen bonds with water.

50) Which is the best description of a carbonyl group?

A) an oxygen joined to a carbon by a single covalent bond

B) a nitrogen and two hydrogens joined to a carbon by covalent bonds C) a carbon joined to two hydrogens by single covalent bonds

D) a carbon atom joined to an oxygen by a double covalent bond

51) Which of the following contains nitrogen in addition to carbon, oxygen, and hydrogen? A) an alcohol such as ethanol

B) a monosaccharide such as glucose C) a steroid such as testosterone

D) an amino acid such as glycine

52) Which of the following is a false statement concerning amino groups? A) They are basic in pH.

B) They are found in amino acids. C) They contain nitrogen.

D) They are nonpolar.

53) Which two functional groups are always found in amino acids? A) ketone and aldehyde

B) carbonyl and carboxyl

C) carboxyl and amino

D) phosphate and sulfhydryl

54) Amino acids are acids because they always possess which functional group? A) amino B) carbonyl C) carboxyl D) sulfhydryl

55) A carbon skeleton is covalently bonded to both an amino group and a carboxyl group. When placed in water it

A) would function only as an acid because of the carboxyl group. B) would function only as a base because of the amino group.

C) would function as neither an acid nor a base. D) would function as both an acid and a base.

56) A chemist wishes to make an organic molecule less acidic. Which of the following functional groups should be added to the molecule in order to do so?

A)carboxyl B) sulfhydryl

C) hydroxyl D) amino

57) Which functional groups can act as acids? A) amine and sulfhydryl

B)carbonyl and carboxyl C) carboxyl and phosphate D) hydroxyl and aldehyde