Student name:_____

TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.

1) Positron-emission tomography (PET) is an example of how ions are useful in medicine.

- ◎ true
- ◎ false

2) Both radioactive isotopes and stable isotopes contain the same number of electrons and protons.

- ◎ true
- ◎ false

3) When a positively charged hydrogen in a water molecule become attracted to thenegatively charged oxygen in a nearby water molecule, this is called a ionic bond.

- ◎ true
- ◎ false

CHECK ALL THE APPLY. Choose all options that best completes the statement or answers the question.

4) Which of the following is a way that isotopes are useful in medicine? Check all that apply.

A) Radioactive isotopescan be used as tracers to detect molecular changes or to destroy abnormal or infectious cells.

B) Radioactive isotopes can be used to regenerate damaged tissues.

C) Radioactive isotopes can be used to detect Alzheimer's disease.

D) Radioactive isotopes can be used to sterilize medical equipment.

E) Radioactive isotopes can be used to protect against dangerous biological agents.

5) Given the chemical equation: $6\ CO_2 + 6\ H_2O + \text{light} \rightarrow C_6H_{12}O_6 + 6\ O_2$, identify which of the following statements are correct. Check all that apply.

A) CO_2 is a reactant
B) H_2O is a product
C) $C_6H_{12}O_6$ is both a reactant and a product
D) O_2 is a product.
E) There is not enough information to distinguish the reactants from the products.

6) Which of the following properties of water involve hydrogen bonds? Check all that apply

A) cohesion
B) high heat capacity
C) surface tension
D) polarity
E) water expands as it freezes

MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.

7) Which of the following would be considered a trace element in living things?

A) oxygen
B) carbon
C) hydrogen
D) nitrogen
E) zinc

8) Which one of the following is the smallest unit of matter that has all the properties of an element?

A) molecule
B) proton
C) atom
D) compound
E) electron

9) Which of the following statements about atoms is correct?

A) An element may be composed of several types of atoms.
B) The nucleus of an atom contains protons and electrons.
C) The number and arrangement of electrons in an atom governs its chemical activity.
D) The positive charges of an element are carried by the electrons.
E) The neutral charges of an element are carried by the protons.

10) Isotopes of an element differ in their

A) proton number.
B) electron number.
C) neutron number.
D) type of bonds.
E) atomic number.

11) An atom's valence electron shell

A) is filled when it has three electrons.
B) determines its chemical reactivity.
C) determines its atomic mass.
D) is filled with positively charged particles.
E) is filled identically for every element.

12) An atom that has an electrical charge is called a(n)

A) ion.
B) molecule.
C) isotope.
D) element.
E) proton.

13) A covalent bond occurs when

A) protons are transferred from one atom to another.
B) neutrons are shared between two atoms to form an isotope.
C) electrons are shared between two atoms to complete their octets.
D) the hydrogen of one water molecule is attracted to the oxygen of another water molecule.
E) electrons are transferred from one atom to another.

14) The type of bond that would form from the transfer of an electron from one atom to another is a(n) _____ bond.

A) covalent
B) ionic
C) hydrogen
D) atomic
E) isotopic

15) When a sodium atom transfers an electron to a chlorine atom

A) the sodium atom becomes a positively charged ion.
B) the chlorine atom becomes a negatively charged ion.
C) the positive and negative ions will attract each other, forming a crystal if no water is present.
D) the ions will separate in the presence of water.
E) All of the above statements are correct.

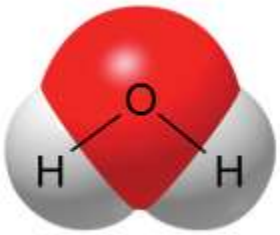
16) Which of the following is a molecule?

A) H_2O
B) O^{2-}
C) NaCl
D) CO_2
E) $MgCl_2$

17) Glucose, $C_6H_{12}O_6$, is best described as a(n)

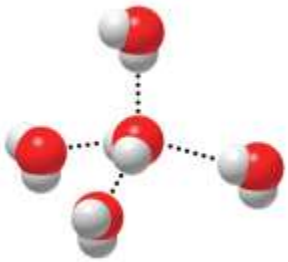
A) element.
B) isotope.
C) compound.
D) ion.
E) atom.

18) A water molecule, as shown here, is polar because of



A) the transfer of electrons.
B) unequal sharing of electrons.
C) its ability to freeze.
D) its hydrogen bonds.
E) the negative charge of the molecule.

19) The figure below is depicting the interaction of water molecules with one another. The weak attractions between water molecules are known as



A) covalent bonds.
B) hydrogen bonds.
C) ionic bonds.
D) postive and negative ions.
E) no chemical bonding.

20) Which of the following is a property of water?

A) water is a good solvent
B) water is cohesive
C) water has a high heat capacity
D) water can be found as a solid, liquid, or gas
E) All of the above are properties of water.

21) Which of the following statements about basic solutions is true?

A) Basic solutions have high concentrations of H^+.
B) Basic solutions have a pH under 7.
C) Basic solutions release OH^-.
D) Basic solutions release both H+ and OH^-.
E) Basic solutions have a neutral pH.

22) The pH scale is a mathematical indicator of the

A) concentration of H^+ present in a solution.
B) concentration of OH^- present in a solution.
C) total amount of all ions in a solution.
D) ability of a solution to buffer.
E) ability to dissolve in water.

23) After drinking a great deal of coffee (pH 5), a human's blood buffering system would need to _____ as the coffee was digested to lower the level of acid present in the blood stream.

A) release OH^-
B) take up H^+
C) release H^+
D) take up OH^-
E) release OH^- and take up H^+

24) A(n) _____ can be defined as asubstance that keeps pH within established limits by taking up excess H^+or OH^- in a solution.

A) equalizer
B) solute
C) buffer
D) acid
E) base

25) Which of the following would be an example of the value of water's heat capacity?

A) Water is able to travel up a 100-foot tree.
B) Water expands as it freezes causing ice to float on the surface of a lake.
C) Living organisms are able to maintain their internal body temperatures because the water in their cells resists changes in temperature.
D) Small insects can walk on water.
E) Water molecules stick together.

26) Which property of water causes sugar to dissolve in coffee?

A) Water has high heat capacity.
B) Water is less dense than ice.
C) Water is a good solvent.
D) Water is cohesive.
E) Water is able to change from a gas to a solid.

27) When water boils

A) hydrogen bonds are broken between neighboring water molecules.
B) covalent bonds are broken between oxygen and hydrogen atoms.
C) ionic bonds are broken when the minerals in water are heated.
D) the bond between one water molecule and another becomes stronger.
E) the hydrogen atoms break away from the oxygen and escape as vapor.

28) Which of the following property of water helps an individual who is exercising vigorously maintain a constant body temperature?

A) Water has high heat capacity.
B) Water is less dense than ice.
C) Water is a good solvent.
D) Water molecules are cohesive.
E) Water moleculesare adhesive.

29) Although Oregon and South Dakota are at similar latitudes, winters in Oregon arewarmer and summers in Oregon are cooler. Which of the following might explain these differences between the climate of Oregon and the climate of South Dakota?

A) South Dakota has fewer trees.
B) The Pacific Ocean makes Oregon temperatures more moderate.
C) Oregon receives more rainfall.
D) South Dakota has fewer lakes and rivers.
E) South Dakota has more prevailing winds from the west.

30) How does a strong acid differ from a weak acid?

A) A strong acid contains fewer H^+ in solution.
B) A weak acid dissociates only partially in water.
C) A strong acid is less likely to remain dissociated.
D) A weak acid dissociates nearly completely in water.
E) A strong acid dissociates only partly in water.

31) Heartburn occurs when stomach acid escapes the stomach and burns the tissues of the esophagus. Baking soda is sometimes used as an antacid. How does baking soda help relieve symptoms of heartburn?

A) The baking soda is serving as a buffer to take up excess H^+ ions from stomach acid.
B) The baking soda is able to coat the lining of the esophagus thereby protecting it from the acid.
C) The baking soda increases the acidity of the stomach.
D) The baking soda releases salt which draws more water into the esophagus thereby diluting the acid.
E) The baking soda relaxes the stomach muscles.

32) What do lemons, tomatoes, and coffee all have in common chemically?

A) They all produce OH^- ions in solution, making them bases.
B) They all produce H^+ ions in solution, making them acids.
C) They all are fruits.
D) They are all neutral in pH.
E) They are all slippery to the touch.

33) Of the following examples, which best demonstrates the property of water cohesion?

A) Water can move up a 100-foot pine tree, from the roots to the leaves.
B) A rock skipping across the surface of a lake.
C) Water requires a great deal of heat to reach the point of vaporizing.
D) A can of soda bursts when it is placed in the freezer.
E) A large body of fresh water takes a long time to warm up after the winter season.

34) Cola has a pH of 3.5. This means that it has an excess of _____ ions and would be called a(n) _____.

A) H^+; acid
B) OH^-; acid
C) H^+; base
D) OH^-; base
E) H^+; neutral solution

35) Isotopes of an atom differ in their

A) atomic number.
B) atomic mass.
C) number of electrons.
D) atomic radius.
E) number of protons.

36) Which of the following is a property of acids?

A) Acids have a sharp or sour taste.
B) Acids feel slippery when touched.
C) Acids taste bitter.
D) Acids release OH^- when dissolved in a liquid.
E) Acids have a pH reading above 7.0.

37) An element has an atomic number of 88. The number of protons and electrons in a neutral atom of the element are

A) 176 protons and 88 electrons.
B) 44 protons and 44 electrons.
C) 0 protons and 88 electrons.
D) 88 protons and 88 electrons.
E) 88 protons and 44 electrons.

38) All atoms of the same element have the same

A) number of neutrons.
B) atomic number.
C) number of electrons.
D) atomic mass.
E) number of ions.

39) In what ways are radioactive isotopes potentially harmful?

A) Unmonitored release into the environment can make changes in a cell's DNA.
B) They are used to trace molecular changes.
C) They are used to destroy abnormal cells.
D) They are used to determine the age of biological specimens.
E) They are used to trace the path of materials throughout the body.

40) The number of neutrons present in the nucleus of an average atom of any given element is best estimated by

A) adding the number of electrons and protons together.
B) subtracting the number of electrons from the number of protons.
C) adding the mass number to the number of electrons.
D) subtracting the number of protons from the mass number.
E) adding the atomic number and atomic mass together.

41) An atom with a neutral charge has

A) equal numbers of neutrons and electrons.
B) more neutrons making it more neutral.
C) the same number of protons and neutrons.
D) equal numbers of protons and electrons.
E) more protons than it does electrons.

42) The atomic structure of water satisfies the octet rule by having

A) electrons shared between the two oxygen atoms.
B) electrons from hydrogen transferred to the oxygen atom.
C) electrons from oxygen transferred to the hydrogen atoms.
D) oxygen share electrons with two hydrogen atoms.
E) electrons shared between the two hydrogen atoms.

43) In the reaction $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ carbon dioxide is one of the

A) reactants.
B) products.
C) enzymes.
D) elements.
E) ions.

44) Cells need buffering agents in order to

A) speed up chemical reactions.
B) carry out life functions in extremely acidic conditions.
C) minimize the changes in pH of their internal environment.
D) help transfer electrons from one atom to another.
E) increase the amount of OH^- in their surroundings.

45) Which of the following is a way in which chemical bonds can be formed?

A) sharing electrons
B) losing electrons
C) gaining electrons
D) attracting opposite charges
E) All of the answers describe ways that chemical bonds can be formed.

46) Sulfur has an atomic number of 16. How many valence shell electrons does it have?

A) One
B) Two
C) Three
D) Four
E) Six

47) Some insects can stride on the surface of water because water

A) has a high specific heat.
B) has lower density when frozen.
C) is a good solvent.
D) has surface tension.
E) resists temperature changes.

48) The pH of pure water is _____ because _____.

A) 7.0; water contains an equal number of H^+ ions and OH^- ions
B) 14.0; water contains more OH^- ions than H^+ ions.
C) 1.0; water contains more H^+ ions than OH^- ions.
D) 7.0; there are no ions formed in pure water
E) 5; because pure water lacks minerals.

49) Which of the following best describes the structure of how water molecules form?

A) Hydrogen atoms covalently bond with each other to create one stable valence shell of electrons. The hydrogen molecule then forms a hydrogen bond with an oxygen atom to create the water molecule.
B) One oxygen atom transfers an electron to each of two hydrogen atoms, forming an ionic bond.
C) The oxygen atom and hydrogen atoms form a covalent bond with one another to create stable valence shells of electrons. The electrons are shared unequally resulting in a polar molecule.
D) Hydrogen bonds are formed between the two hydrogen atoms and the oxygen atom.
E) Because of its strong electronegativity, oxygenremoves one electron from two different hydrogen atoms. This satisfies the valence shell of oxygen. Then hydrogen bonds form between the two hydrogen atoms which keeps them in the vicinity of the oxygen atom.

50) The subatomic particles that are found in the nucleus of an atom are the

A) protons and electrons.
B) neutrons and protons.
C) electrons only.
D) protons only.
E) electrons and neutrons.

51) The reactivity of an atom depends on the number of

A) protons.
B) neutrons.
C) protons plus neutrons.
D) valence electrons.
E) protons and electrons.

52) Chemical bonds involve

A) the giving and taking of electrons.
B) the giving and taking of protons.
C) the giving, taking, or sharing of electrons.
D) the giving, taking, or sharing of protons.
E) the sharing of electrons.

53) The electron arrangement for argon, which has 18 electrons, is

A) 2 in the inner electron shell, 8 in the second electron shell, and 8 in the outer electron shell.

B) 8 in the inner electron shell, 8 in the second electron shell, and 2 in the outer electron shell.

C) 6 in the inner electron shell, 6 in the second electron shell, and 6 in the outer electron shell.

D) 5 in the inner electron shell, 6 in the second electron shell, and 7 in the outer electron shell.

E) 7 in the inner electron shell, 6 in the second electron shell, and 5 in the outer electron shell.

54) An ionic bond forms when

A) an atom gives away or takes in an electron.
B) an atom gives away or takes in a proton.
C) a negatively charged ion is attracted to one with a positive charge.
D) two atoms come close enough to share one or more electrons.
E) two atoms come close enough to share one or more protons.

55) A covalent bond involves the sharing of

A) neutrons.
B) protons.
C) pairs of protons.
D) at least three electrons.
E) pairs of electrons.

Answer Key

Test name: chapter 2

1) FALSE
2) TRUE
3) FALSE
4) [A, C, D, E]
5) [A, D]
6) [A, B, C, E]
7) E
8) C
9) C
10) C
11) B
12) A
13) C
14) B
15) E
16) B
17) C
18) B
19) B
20) E
21) C
22) A
23) B
24) C
25) C
26) C

27) A
28) A
29) B
30) B
31) A
32) B
33) A
34) A
35) B
36) A
37) D
38) B
39) A
40) D
41) D
42) D
43) A
44) C
45) E
46) E
47) D
48) A
49) C
50) B
51) D
52) C
53) A
54) C
55) E