

LECTURES 3 & 4 – BASIC CHEMISTRY I & II
QUESTIONS TO TRY FOR PRACTICE

1. Which of the following is a trace element that is essential to humans?
 - a. nitrogen
 - b. calcium
 - c. iodine
 - d. carbon
 - e. oxygen

2. The shape of a molecule
 - a. determines its biological function
 - b. is determined by orbital positions of its atoms
 - c. determines how molecules recognize and respond to each other
 - d. may aid in the formation of bonds
 - e. all of the above

3. Which of the following best describes the relationship between the atoms described below?

$^{31}_{15}\text{P}$

$^{32}_{15}\text{P}$

 - a. They are both radioactive.
 - b. They are both phosphorous cations.
 - c. They are both phosphorous anions.
 - d. They are both isotopes of phosphorous.
 - e. They contain 31 and 32 protons respectively.

4. The formation of ice during colder weather helps temper the seasonal transition to winter. This is mainly because:
 - a. the formation of hydrogen bonds releases heat.
 - b. the formation of hydrogen bonds absorbs heat.
 - c. there is less evaporative cooling of lakes.
 - d. ice melts each autumn afternoon.
 - e. ice is warmer than the winter air

5. What would be the pH of a solution with a hydroxide ion concentration of $10^{-10} M$?
 - a. 2
 - b. 4
 - c. 8
 - d. 10
 - e. 14

6. It is correct to say that the action of buffers
- is of relatively little significance in living systems
 - tends to prevent great fluctuations in pH
 - depends on the formation of a great number of hydrogen ions
 - depends on the presence of many electron donors
 - is to remove hydroxyl ions from organic acids
7. The mass number of an element can be easily approximated by adding together the number of
- protons and neutrons.
 - electron orbitals in each energy level.
 - protons and electrons.
 - neutrons and electrons.
 - isotopes of the atom.
8. From its atomic number of 15, it is possible to predict that the phosphorus atom has
- 15 neutrons.
 - 15 protons.
 - 15 electrons.
 - Only B and C are correct.
 - A, B, and C are correct.
9. What does the reactivity of an atom depend upon?
- The number of valence shells in the atom.
 - The number of orbitals found in the atom.
 - The number of electrons in each orbital in the atom.
 - The presence of unpaired electrons in the valence shell of the atom.
 - The presence of hybridized orbitals in the atoms.
10. When two atoms are equally electronegative, they will interact to form
- equal numbers of isotopes.
 - ions.
 - polar covalent bonds.
 - nonpolar covalent bonds.
 - ionic bonds.

11. Results from an unequal sharing of electron(s) between atoms.
- nonpolar covalent bond
 - polar covalent bond
 - ionic bond
 - hydrogen bond
 - hydrophobic interaction
12. Nitrogen (N) is much more electronegative than hydrogen (H). Which of the following statements is correct about the atoms in ammonia (NH₃)?
- Each hydrogen atom has a partial positive charge.
 - The nitrogen atom has a strong positive charge.
 - Each hydrogen atom has a slight negative charge.
 - The nitrogen atom has a partial positive charge.
 - There are covalent bonds between the hydrogen atoms.
13. Which of the following best describes chemical equilibrium?
- Reactions continue with no effect on the concentrations of reactants and products.
 - Concentrations of products are high.
 - Reactions have stopped.
 - Reactions stop only when all reactants have been converted to products.
 - There are equal concentrations of reactants and products.
14. The ability to sweat or pant is considered an adaptation. Why?
- It allows a body to release excess water.
 - It allows a body to absorb heat, due to water's high specific heat.
 - It cools a body off, due to water's high heat of vaporization.
 - It is an important signal to others that an individual is too hot.
15. Which of the following represents the carboxyl functional group?
- NH₂
 - COOH
 - COH
 - SH
 - None of the above.

16. Which of the following is possible due to the surface tension of water?
- a. Lakes don't freeze solid in the winter, despite low temperatures.
 - b. A waterstrider can walk across a small pond.
 - c. Organisms resist temperature changes although they give off heat due to chemical reactions.
 - d. Water can act as a solvent.
 - e. The pH remains neutral.
17. Molecules with an “-SH” functional group are called _____.
- a. ketones
 - b. thiols
 - c. alcohols
 - d. aldehydes
 - e. ethers
18. What would be the pH of a solution with a hydrogen ion concentration $[H^+]$ of $10^{-8}M$?
- a. pH 2
 - b. pH 4
 - c. pH 6
 - d. pH 8
 - e. pH 10
19. If the pH of a solution is decreased from 7 to 6, it means that the
- a. concentration of H^+ has decreased to 10 times of what it was at pH 7.
 - b. concentration of H^+ has increased to 10 times what it was at pH 7.
 - c. concentration of OH^- has increased to 10 times what it was at pH 7.
 - d. concentration of OH^- has decreased 10 times what it was at pH 7.
 - e. Both B and D are correct.
20. Which of the following statements is true about buffer solutions? They
- a. will always have a pH of 7.
 - b. tend to maintain a relatively constant pH.
 - c. maintain a constant pH when bases are added to them but not when acids are added to them.
 - d. cause a lowering of pH when acids are added to them.
 - e. are rarely found in living systems.

21. Carbon is an important element for biology because

- a. of the variety of carbon skeletons and functional groups that can be built on them.
- b. it has very high electronegativity and forms highly stable bonds.
- c. carbon is so rare that organisms conserve it highly.
- d. it has the ability to form six covalent bonds.

22. Match the type of chemical bond on the left with the statement on the right by placing the appropriate number in the blank. (Some or all of the numbers will be used more than once)

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|---------------------------|---|
| 1. Hydrogen bond | _____ results from transfer of electron(s) between atoms |
| 2. Double covalent bond | _____ results from unequal sharing of electrons between atoms |
| 3. Nonpolar covalent bond | _____ bonds within water molecules |
| 4. Ionic bond | _____ bonds between water molecules |
| 5. Covalent bond | _____ is easily disrupted in the presence of water |
| 6. Polar covalent bond | _____ results from equal sharing of electrons |
| | _____ bond between sodium and chlorine atoms |
| | _____ bond between 2 O atoms |
| | _____ bond between H ₂ O and NH ₃ |
| | _____ when 2 atoms share a pair of valence electrons |