Example Questions for Quiz 7 – Solutions

Chapter 11 – Water and Solutions

Here are some questions that are similar to what will be on Quiz 7.
The quiz will have a total of 20 points selected from these possibilities.
You may use your equation and symbol sheets as well as your Periodic Table of Elements.

1. (2 points) The property of water that makes it so effective as a solvent is its very large **__dipole__ __moment__**.

2. (2 points) In Roman times, pipes and many drinking goblets were made of **__lead____** which has been found to leach into the drink causing nerve and brain damage.

3. (5 points) **_Hydrogen_** bonds are weak attractions between a **_hydrogen__** atom of one molecule and an oxygen or nitrogen atom of another molecule. These bonds hold water molecules to each other to form **__ice____**, stick adjacent cellulose polymers together to form **__wood___** , and hold the pairs of nucleotides together in **___DNA___**.

4. (6 points) When we made fatty acids in the lab, they had a long **_hydrogen_ - _carbon_** chain with a COOH group at one end. The pioneers made **__soap__** from fats and lye (water washed through ashes). The lye contains abundant (**Na+ and K+**, ~~O^{--} and Cl^{-}~~) ions causing the fatty acids to release the lightly-bound H from its COOH end. Within the water, the long chain clings to grime (**_grease_** + **__dirt__**) while the water molecules pull on the charged COO^{-} end. This let the water pull off the grime that it otherwise could not attach to.

5. (2 points) When a small amount of salt is placed in a beaker of water, it disappears. It is said to **_dissolve__**.

6. (2 points) When a sufficiently large amount of salt has been added to water so that some salt remains visible no matter how much it is stirred or how long one waits, the fluid in the beaker is said to have become a **__saturated__** solution of the salt.

7. (2 points) The number of grams of salt dissolved in 1000 grams of salty water is called the **__salinity__** of the water. It is expressed with the symbol ‰ (per thousand) to distinguish it from the symbol % (per cent).

8. (2 points) The maximum amount of salt divided by the amount of water is said to be the **_solubility__** of the salt in water. It is expressed in units of g/100 mL or as g/L.

9. (2 points) The number of moles of a substance dissolved in 1 L of water is called the **__molarity_** of the solution. It is expressed in units of mol/L.

10. (2 points) When salts are dissolved in water, the solution conducts electricity and is called an **_electrolyte_**.

11. (2 points) To make our explosion, we added electrical energy to water to produce the H_2 and O_2 gases, but pure water does not conduct electricity very well so we added some Epsom salt $MgSO_4$ which dissolved into Mg^{++} and SO_4^{--} ions. This made the water into an **_electrolyte__** that would conduct our electrical current and allow the demonstration to proceed.

12. (2 points) Adding salt to ice on a road causes the ice to melt because salty water has a lower **_freezing__** point than pure water.

13. (2 points) Adding sugar to water raises the **_boiling__** point of the water above that of pure water.

14. (4 points) Substances that easily release H^+ ions when placed in water are called (**acids**, ~~bases~~) and have a (~~high~~, **low**) pH value.

15. (4 points) Substances that easily release OH^- ions when placed in water are called (~~acids~~, **bases**) and have a (**high**, ~~low~~) pH value.

16. (2 points) When an acid and a base are mixed in suitable proportions, a **__salt___** is produced.

17. (5 points) Complete the following chemical equation for the following acid-base reaction:

$$HCl + \mathbf{\_\_1\_\_}\ NaOH \Leftrightarrow \mathbf{\_1\_\_}\ \mathbf{\_\_NaCl\_\_} + \mathbf{\_1\_}\ \mathbf{\_\_}\ \mathbf{H_2O}\ \mathbf{\_\_}$$

18. (5 points) Complete the following chemical equation for the following acid-base reaction:
(Hint: SO_4^{--} is a unit.)

$$H_2SO_4 + \mathbf{\_\_2\_}\ NaOH \Leftrightarrow \mathbf{\_1\_}\ \mathbf{\_\_}\ \mathbf{Na_2SO_4}\ \mathbf{\_\_} + \mathbf{\_2\_}\ \mathbf{\_\_}\ \mathbf{H_2O}\ \mathbf{\_\_}$$

19. (5 points) Complete the following chemical equation for the following acid-base reaction:
(Hint: CH_3COO^- is a unit.)

$$CH_3COOH + \mathbf{\_1\_}\ NaOH \Leftrightarrow \mathbf{\_1\_}\ \mathbf{\_}\ \mathbf{CH_3COONa}\ \mathbf{\_} + \mathbf{\_1\_}\ \mathbf{\_\_}\ \mathbf{H_2O}\ \mathbf{\_\_}$$

20. (4 points) The acetic acid in vinegar causes it to have a pH of 3.0, what is the molarity of the acetic acid?

$$\mathbf{[H_3O^+] = 10^{-(+3.0)}\ mol/L = 1.0 \times 10^{-3}\ mol/L = 10^{-3}\ mol/L}$$

21. (4 points) The pH of a sodium bicarbonate solution is 8.4, what is its molarity?

$$\mathbf{[H_3O^+] = 10^{-(+8.4)}\ mol/L = 4.0 \times 10^{-9}\ mol/L}$$

22. (2 points) What is the pH of pure water? **7.00**

23. (3 points) What is the molarity of H_3O^+ in pure water which has a pH of 7?

$$\mathbf{[H_3O^+] = 10^{-7.00}\ mol/L = 1.0 \times 10^{-7}\ mol/L}$$

24. (4 points) The molarity of a solution is $6.3 \times 10^{-4}\ mol/L$, what is its pH?

$$\mathbf{pH = -\log_{10}[6.3 \times 10^{-4}\ mol/L] = +3.2}$$

25. (4 points) The molarity of a solution is $4.0 \times 10^{-9}\ mol/L$, what is its pH?

$$\mathbf{pH = -\log_{10}[4.0 \times 10^{-9}\ mol/L] = +8.4}$$