1. Molarity is _____.

(A) the number of moles of solute dissolved in a liter of solvent
(B) the number of moles of solute dissolved in a liter of solution
(C) the number of moles of solute dissolved in 1 kilogram of solvent
(D) the number of moles of solute dissolved in 1 kilogram of solution

Hint: There is no name for moles of solute dissolved in a liter of solvent, or for moles of solute dissolved in a kilogram of solution.

2. Molality is _____.

(A) the number of moles of solute dissolved in a liter of solvent
(B) the number of moles of solute dissolved in a liter of solution
(C) the number of moles of solute dissolved in 1 kilogram of solvent
(D) the number of moles of solute dissolved in 1 kilogram of solution

Hint: Molality is the moles of solute per kilogram of solvent, so even if the temperature of the solution changes, the molality of the solution doesn't change.

Since heat can increase the volume of a solution, heating a solution can reduce its molarity slightly.

3. To make a 1 molar solution, you dissolve 1 mole of solvent in _____.

(A) 1 liter of solvent
(B) less than 1 liter of solution and then add solvent to the 1 liter mark
(C) 1 kilogram of solvent
(D) 1 kilogram of solvent and then add solvent to the 1 liter mark

Hint: Adding a mole of solvent into a kilogram of solvent gives a 1 molal solution.

4. What is the molarity of a solution of 0.395 g of $KMnO_4$ (molecular weight 158) dissolved in enough water to make 250 ml total solution?

(A) 0.1 M
(B) 0.01 M
(C) 0.0001 M
(D) 0.00001 M

Hint: If 158 grams of $KMnO_4$ equals 1 mole, then 0.395 grams of $KMnO_4$ equals X moles.

Cross multiplying, X = 0.0025 moles.

0.0025 moles dissolved in 250ml of solution is the same concentration as 4 x 0.0025 moles in 1 liter of solution.

4 x 0.0025 is 0.01 moles in 1 liter of solution.

5. What is the molarity of a solution of NaCl when 6 moles of NaCl are dissolved in 2 liters of solution?

(A) 2
(B) 3
(C) 4
(D) 6

Hint: 6 moles dissolved in 2 liters is the same concentration as 3 moles dissolved in 1 liter.

6. Two immiscible substances, that would normally separate from each other when left to settle out, can be prevented from separating by making them into an emulsion or a colloid. Emulsions are a form of colloid, the only restriction being that in an emulsion _____.

(A) one mixture is a gas and other a liquid
(B) both mixtures are solids
(C) both mixtures are liquids
(D) one mixture is a liquid and the other a solid

Hint: In a colloid, one substance is dispersed as fine droplets in another substance.

Because gas molecules, being non polar, can always mix in among other gas molecules, two gases do not form colloids.

7. What do solutes do to the freezing and boiling points?

(A) They raise the freezing point and lower the boiling point.
(B) They raise both the freezing point and the boiling point.
(C) They lower both the freezing point and the boiling point.
(D) They lower the freezing point and raise the boiling point.

Hint: Solutes almost never become gases, so when they reach the surface of the solvent they are dissolved in, they don't evaporate.

Because some of the surface of the solvent is occupied by molecules of solute, the solvent has to work harder to increase its vapor pressure to that of the atmosphere.

That means it needs more heat than usual to boil, meaning it boils at a higher temperature.

8. The lowering of the freezing point of water by salt is an example of salt's _____ properties.

(A) colloidal
(B) colligative
(C) emulsive
(D) covalent

Hint: Colligative means that only the number of particles is important, not the properties of those particles.

Any atom or molecule, regardless of its properties can get in the way of ice crystals forming.

9. The pH of water is 7.0. The pH of acids is _____.

(A) more than 7.0
(B) less than 7.0

Hint: Bases, or alkaline substances, have pH's above 7.0.

10. A difference of 1 pH unit means that one solution is _____ times more or less acidic than the other solution.

(A) 2
(B) 5
(C) 10
(D) 100

Hint: pH refers to the log of the hydrogen ion concentration -- when the concentration is described in terms of 10 to some exponent.

Increasing the exponent by 1 whole number increases the number being represented by the exponent tenfold.

11. A molecule that accepts electrons is a Lewis _____.

(A) acid
(B) base

Hint: Speaking electrically, giving up a proton is analogous to gaining an electron.

12. If 50 ml of a HCl solution is neutralized by 150 ml of 0.5 M NaOH solution, what is the molarity of the HCl solution?

(A) 1.0 M
(B) 1.5 M
(C) 0.1 M
(D) 0.15 M

Hint: If a 0.5 molar NaOH solution contains 0.5 moles in 1 liter, then 150ml must contain X moles, or 150/1000 x 0.5 moles, or 0.075 moles.

Since it took 0.075 moles of OH ions to neutralize 50ml of a hydrogen ion containing solution, then there must have been 0.075 moles of hydrogen ions in 50ml, or 20 times that (1000/50) in 1 liter.

1000/50 x 0.075 moles is 1.5 moles in 1000 ml of the HCl solution.

13. What is the pH of a 2.5×10^{-4} M solution of HCl? (The log of 2.5 is 0.4.)

(A) 2.8
(B) 3.2
(C) 3.4
(D) 3.6

Hint: To multiply numbers displayed with exponents, add the exponents.

So $10^{0.4} \times 10^{-4} = 10^{-3.6}$.

pH is the negative of this exponent, or 3.6.

14. 400 ml of a 2 M solution contains _____ moles of solute.

(A) 0.4
(B) 0.6
(C) 0.8
(D) 1.2

Hint: In a 2 molar solution, 1000 ml contain 2 moles, so 400 ml contains X moles.

$\frac{1000 \text{ ml}}{400 \text{ ml}} = \frac{2 \text{ moles}}{X \text{ moles}}$

X = 0.8 moles.