Math and Other Murky Stuff

CSM
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This activity is designed to introduce you to a variety of quantification skills you will use in this class. Most of the activities you have probably experienced in one form or another in your academic or life experience. The activities are designed to show you the types of measurements you may make in physiology, and give you experience with the units of measure. In addition we want to begin learning the skills involved in understanding complex relationships and solving problems. We will start by doing activities relating to some common units of measure and their conversions into other units. You will also practice problems involving body solutions and their concentration, drug and IV calculations.

Metric Units

Length:
1 kilometer (km) = 0.62 miles (mi.)
1 kilometer = 1,000 meters (m) = 100,000centimeters (cm)
1 centimeter (cm) = 1/100 m = 10 millimeters (mm) = 0.3937 inches (in), 1 in = 2.54 cm
1 millimeter (mm) = 1/1000 m = 1/10 cm = 1,000 micron or micrometer (μm)
1 micron or micrometer (μm) = $1/10^6$ m
Temperature:
1 Celcius degree = 1.8 Fahrenheit degrees
˚C = (˚F - 32) x .556

Volume:
1 ml = 1/1000 L = 1000microliters (ul)
1 liter (L) = 1000 ml = 1.05 quart (q)
1q = 4 cups = 1/4 gallon
1 oz = 28.35g
8 fluid oz = 1 cup = 1/2 lb.
1 tsp = 5ml
1 fluid oz. = 30 ml

Weight:
1 kilogram (kg) = 1000 g = 2.2 pounds lb.

Concentration of Solutions:

Percent solutions - The percent solution simply means parts in 100. The percent solution is the number of grams of a particular solute in 100 ml. of water. For example a 12% solution means there is 12g solute in 100 ml of water. So 500 ml of a 12% solution would have 60 g of solute.

Molar Solutions - A 1 molar (M) solution contains 1 mole of solute in 1L of solution. A mole of a substance is a measure of quantity, i.e. 1 mole = 6 x 10^{23} particles. So solutions with the same molarity have the same number of particles in them, regardless of how much the substance weighs (molecular weight). Each substance in the periodic table has a different atomic weight, that is, a mole of that substance will weigh a unique amount. For molecules, the molecular weight is simply the sum of the atomic weights of the substances in the molecule. For example the molecular weight of salt, NaCl is 58.5 g per mole because the atomic weight of sodium is 23g and the atomic weight of chloride is 35.5 g, 23 g + 35.5 g = 58.5g. So if you want to make a 1 Molar (1M) solution of NaCl you should take 58.5 g of NaCl and add water to make 1L.

Osmolar Solutions - The measure of osmolarity is used to express the osmotic effect of a solution. As you probably remember osmosis is the movement of water across a membrane from an area of high water concentration (low solute conc.) to an area of low water concentration (high solute concentration). If one solution, containing only water (0 M), sits across a membrane from another solution, this one containing a 1M solution of glucose, water will move from the water side to the glucose side. The glucose solution is said to have an osmolarity of 1 Osm, because in water each particle of glucose exerts an osmotic force of 1. Compare this to a 1M solution of NaCl. In water, NaCl dissociates into Na^+ and Cl^- to form 2 osmotically active particles for each NaCl molecule originally put in. So a 1M solution of NaCl will have an osmolarity of 2 Osm. For another example, $CaCl_2$ will dissociate into three ions in solution, so it's osmolarity will always be three times it's molar concentration in solution. In physiology soltuions include blood and plasma, as well as interstitial fluid and intracellular fluid. Many times the concentrations are expressed as mg/dl.

Questions/Problems

1. What is your height in inches? _____ **2.** Convert this to centimeters._____ **3.** How many meters is this? _____ **4.** How many microns (μm) is this?_____

Weight:

5. What is your weight in lbs._____ **6.** How many kilograms is this?_____ **7.** How many grams is this? _____

8. How many microliters is 9ml? _____

9a. To make 150ml of a 0.8% Nacl solution, how much salt do you need to add to the 150ml of water?

_____

9b. To make 50 ml of a 5% sucrose solution, how much sucrose do you add to the 50ml of water?

_____

9c. Is the osmolarity of the salt solution greater, less than, or equal to the osmolarity of the sucrose solution? Use calculation of osmolarity to compare.

10. One patient's temperature is 38.6ºC. Convert to Fahrenheit. _____

11. Another patient's temperature is 103.2ºF. Convert to Celsius. _____

12. Convert: 48mg/dL = _____ mg/L

13. 32 mg/L = _____ mg/ml = _____ug/L

14. 1600ug/L = _____ ug/mL

15. Convert the following:

one kilo meter = _____ meters

one deciliter = _____liters

200 microliter = _____ ml

5 centimeters = _____ meters

3200 milliliters = _____liters

16. A female weighs 120 lb.. She has 14 cups of blood in her body. What is her weight in

kilograms? _____ How much blood does she have in ml?_____What percentage of her body

weight is her blood? _____

17. How many grams of glucose would you need to make 500 ml of an .15M solution? Show your work.

18. A patient's hematology test shows 4,800,000 red blood cells per microliter (10^{-6}L). If the total blood volume is 5.2 liters, how many red blood cells are in the entire circulatory system? Use scientific notation. _____

19. A 27% solution of KCl would have what osmolarity? _____

20. The recommended dosage of a drug is 8.5mg per kg per day. If this daily dose is to be given in four equally divided doses, how large is each dose for a child who weighs 68 lb? _____

21. The doctor orders 50 mg of Dilantin TID (three times per day). The drug comes in a liquid form with 125mg/5ml of liquid. How many mls should you give with each dose? Show work.

22. The doctor order reads "Infuse 125ml/hr saline". You set up an IV bag with tubing. The tubing kit has a drop factor of 15 drops/ml. What is the drip rate in drops/min that you should use? Show work.

23. You want to make 500 ml of an isoosmotic glucose solution to infuse into the blood of a patient. Let's assume an isosomotic solution is 300 mOsm. Describe the components of this solution.

24. What is the total serum osmolarity of a patient with the following laboratory values? (hint: none of these particles dissociate in water).

Sodium, 136mmol/L	Bicarbonate, 21mmol/L
Potassium, 3.2mmol/L	Glucose, 6.4mmol/L
Chloride, 100mmol/L	Blood Urea Nitrogen (BUN), 9.5mmol/L

_____

25. Describe what is meant by a milliequivalent.

Other resources:

IV drip rates - http://home.hiwaay.net/~theholt1/NURS1100/iv-calc.htm

Drug calculations - http://www.testandcalc.com/quiz/testtab.htm

Molarity and Osmolarity quiz - http://ths.sps.lane.edu/chemweb/unit6/problems/molarity/