SOLUTIONS: Practice problems 2012

1. How would you prepare 400 ml of a 0.24 M NaCl solution (MW = 58.44 g/mole)?

[V x C x MW) 0.4 L x 0.24 moles/L x 58.44 g/mole = 5.61 g NaCl dissolved in/brought up to 400 ml water

2. How would you prepare 750 ml of a 0.35 M Na_2PO_4 solution (MW = 141.96 g/mole)?

0.75 L x 0.35 moles/L x 141.96 g/mole = 37.265 g Na_2PO_4 *dissolved in/brought up to 750 ml water*

3. How would you prepare 225 ml of a 0.15 M citric acid solution (453.6 g/mole)?

0.225 L x 0.15 moles/L x 453.6g/mole = 15.309 g citric acid dissolved in/brought up to 225 ml water

4. What volume of stock 0.24 M NaCl is needed to prepare 75 ml of 0.1 M NaCl?

(cv=cv) (0.24 M)(V_1)= (0.1 M)(75 ml) → V_1=(0.1 M)(75 ml)/ (0.24 M) = 31.25 ml of stock NaCl

5. What volume of stock 0.35 M Na_2PO_4 is needed to prepare 150 ml of 0.2 M Na_2PO_4?

V_1=(0.2 M)(150 ml)/ (0.35 M) = 85.714 ml of stock Na_2PO_4

6. What volume of stock 0.15 M citric acid is needed to prepare 230 ml of $2.5x10^{-3}$ M citric acid?

V_1=(0.0025 M)(230 ml)/ (0.15 M) = 3.833 ml of stock citric acid

7. How much (ml) $3x10^{-3}$ M Na_2PO_4 can be prepared from 20 ml of 0.2 M Na_2PO_4?

[cv=cv] solve for V_2: V_2 = (0.2 M)(20 ml)/0.003 M = 1333.33 ml

8. If you have 35 ml of 0.1 M NaCl, is it enough to prepare 200 ml of 0.06 M NaCl?

[cv=cv] solve for V_1: V_1 = ((0.06 M)(200 ml)/(0.1 M) = 120 ml, so no, you do not have enough stock., OR, using a different approach,

Solve for V_2: V_2 = ((0.1 M)(35 ml)/(0.06 m) = 58.333 ml stock needed to make this amount.

9. For each of the following, indicate the mass (g) of reagent needed to prepare 125 ml of the indicated percent solution:

Reagent	Molecular weight	Percent solution needed (125 ml)	Mass of reagent (g)
NaCl	58.44	10 %	*(0.1 g/ml)(125 ml)= 12.5 g*
Na_2PO_4	141.96	4.5 %	*(0.045 g/ml)(125 ml)=5.625 g*
Citric acid	453.6	2.5 %	*(0.025 g/ml)(125 ml) = 3.125 g*

Percent concentration is a straight mass/volume (g/ml) calculation and doesn't need the MW. 1 g/ml = 100% solution.

10. You have 200 ml of 50X TAE. What volume of the 50X TAE is needed to prepare 25 ml of 10X TAE?

Cv=cv: solve for V_1: V_1 = ((10X)(25 ml)/(50X) = 5 ml of 50X TAE stock

11. A protocol calls for using a working concentration of 1.5 $X10^{-4}$ M boric acid. To save shelf space, you decide to make up a 20X stock solution. What will be the molarity of that stock solution?

20 x 1.5 $x10^{-4}$ M = 3.0 x 10^{-3} M

12. You make up 1000 ml of a buffer containing 300 ml citric acid and 700 ml disodium phosphate (Na_2PO_4). If the citric acid stock solution is 0.15 M and the Na_2PO_4 stock solution is 0.35 M, what are the working concentrations of these two components in the buffer?

Citric acid = (300 ml/1000ml)x(0.15 M) = 0.045 M or 4.5 x 10^{-2} M

Na_2PO_4 = (700 ml/1000 ml)x(0.35 M) = 0.245 M or 2.45 x 10^{-1} M

13. You prepare a crude extract of alpha amylase from 2.7 g of germinated barley seed in 10 ml of buffer solution. What is the extract concentration in terms of milligrams of tissue extracted per milliliter of buffer?

2.7 g / 10 ml = 0.27 g/ml or 270 mg/ml

14. You use 0.5 ml of the extract prepared in # 13 in a total reaction volume of 6 ml. What is the working concentration of the extract in the reaction?

(0.5 ml)(270 mg/ml)/ 6 ml = 22.5 mg/ml

15. In a plate count analysis of *E. coli* cell density in a water sample you find 57 colonies on an LB agar plate inoculated with 100 ul of 10^{-4} diluted water sample. What is the cell density (#cells/ml) of *E. coli* in the water sample?

Given: 1 colony arises from 1 cell

(57 cells/ 100 ul) x 10 = 570 cells/ml in the 10^{-4} dilution (this normalizes to cells/ml)

570 cells/ml x 10^4 = 5.7 x 10^6 cells/ml = the original cell density in the water sample.