

## Practice Problems: Topics 1-7

### 1. Metric System conversions

$$\text{Convert 12 cm to mm: } \frac{12 \text{ cm}}{1} \times \frac{1 \text{ m}}{100 \text{ cm}} \times \frac{1000 \text{ mm}}{1 \text{ m}} = \boxed{120 \text{ mm}}$$

$$\text{Convert 12 cm to } \mu\text{m: } \frac{12 \text{ cm}}{1} \times \frac{1 \text{ m}}{100 \text{ cm}} \times \frac{1 \times 10^6 \mu\text{m}}{1 \text{ m}} = \boxed{120,000 \mu\text{m} \text{ or } 1.2 \times 10^5 \mu\text{m}}$$

$$\text{Convert 111 nm to } \mu\text{m: } \frac{111 \text{ nm}}{1} \times \frac{1 \text{ m}}{1 \times 10^9 \text{ nm}} \times \frac{1 \times 10^6 \mu\text{m}}{1 \text{ m}} = \boxed{0.111 \mu\text{m}}$$

$$\text{Convert 111 nm to mm: } \frac{111 \text{ nm}}{1} \times \frac{1 \text{ m}}{1 \times 10^9 \text{ nm}} \times \frac{1000 \text{ mm}}{1 \text{ m}} = \boxed{0.000111 \text{ mm} \text{ or } 1.11 \times 10^{-4} \text{ mm}}$$

### 2. Preparing solutions

Prepare 1 L of a 1 M solution of NaCl:  $\rightarrow$  MW of NaCl = 22.99 + 35.45 = 58.44 g/mole

$\rightarrow$  (MW) (M) (Volume in Liters) = (58.44 g/mole) (1 M) (1 L) = 58.44 grams NaCl

$\rightarrow$  Weigh out 58.44 grams NaCl, add enough water to bring volume to 1 L.

Prepare 100 ml of a  $1 \times 10^{-4}$  M solution of  $\text{Na}_2\text{CO}_3$ :

$\rightarrow$  MW of  $\text{Na}_2\text{CO}_3$  = (22.98 x 2) + (12.01) + (16 x 3) = 105.97 g/mole

$\rightarrow$  (MW) (M) (Volume in Liters) = (105.97 g/mole) ( $1 \times 10^{-4}$  M) (0.1 L) =  $1.06 \times 10^{-3}$  grams  $\text{Na}_2\text{CO}_3$

$\rightarrow$  Weigh out  $1.06 \times 10^{-3}$  grams  $\text{Na}_2\text{CO}_3$ , add enough water to bring volume to 0.1 L.

Prepare 25 ml of a 0.2 M solution of  $\text{KH}_2\text{PO}_4$ :

$\rightarrow$  MW of  $\text{KH}_2\text{PO}_4$  = (39.1) + (1 x 2) + (30.97) + (16 x 4) = 136.07 g/mole

$\rightarrow$  (MW) (M) (Volume in Liters) = (136.07 g/mole) (0.2 M) (0.025 L) = 0.680 grams

$\rightarrow$  Weigh out 0.680 grams  $\text{KH}_2\text{PO}_4$ , add enough water to bring volume to 0.025 L

### 3. Dilutions

Start with a 1 M solution of NaCl and prepare 100 ml of a  $1 \times 10^{-3}$  M solution:

$$\frac{\text{desired conc.}}{\text{stock conc.}} \times \text{final vol.} \rightarrow \frac{1 \times 10^{-3} \text{ M}}{1 \text{ M}} \times 100 \text{ ml} = \boxed{0.1 \text{ ml of the } 1 \text{ M NaCl} + 99.9 \text{ ml of H}_2\text{O}}$$

Start with a 0.25 M solution of glucose and prepare 50 ml of a 0.1 M solution:

$$\begin{array}{l} \text{desired conc.} \times \text{final vol.} \rightarrow 0.1 \text{ M} \times 50 \text{ ml} = \boxed{20 \text{ ml of 0.25 M Glucose} + 30 \text{ ml of H}_2\text{O}} \\ \text{stock conc.} \qquad \qquad \qquad 0.25 \text{ M} \end{array}$$

#### 4. Transmittance / Absorbance

$$\text{Convert 25\% T to Abs} \rightarrow \text{Abs.} = -\log \%T \qquad \rightarrow \text{Abs} = -\log (0.25) \qquad \rightarrow \text{Abs.} = 0.602$$

$$\text{Convert 95\% T to Abs} \rightarrow \text{Abs.} = -\log \%T \qquad \rightarrow \text{Abs} = -\log (0.95) \qquad \rightarrow \text{Abs.} = 0.0222$$

#### 5. Electrophoresis

If a protein has a MW of 63,500 dal., what weight would it have according to a  $\log_{10}$  scale?

$$\boxed{= 4.80}$$

If a protein has a  $\log_{10}$  MW of 4.66, what weight would it have on a linear scale?

$$\boxed{= 45,708.9 \text{ dal.}}$$

If  $m = -0.042$   $b = 44,000$  and  $x = 32$ , what is the value of  $y$ ?

$$y = mx + b \rightarrow y = (-0.042)(32) + 44,000 \qquad \rightarrow \boxed{y = 43,998.7}$$

If  $m = 217$   $b = 16$  and  $y = 115$ , what is the value of  $x$ ?

$$X = \frac{y - b}{m} \rightarrow x = \frac{115 - 16}{217} \qquad \rightarrow \boxed{x = 0.456}$$

6. Chromatography ( if the solution is nonpolar like petroleum ether and acetone)

$$\text{Rf of solute A} = 4 \text{ cm} / 10 \text{ cm} = 0.4$$

$$\text{Rf of solute B} = 4.5 \text{ cm} / 10 \text{ cm} = 0.45$$

Solute A is the most polar because it moved the least in a nonpolar solution. Solute B is the most nonpolar because it moved further in a nonpolar solution.