

Exercise 12.3a(H)

Percentages, PPM, & PPB

Name: _____

Date: _____ Per: _____

Percentage by Mass/Percentage by Volume

To find either the percent by mass or percent by volume, simply divide the amount of solute by the amount of solution and multiply by 100 to express the fraction as a percentage:

$$\frac{\text{mass or volume solute}}{\text{mass or volume solution}} \times 100 = \% \text{ by mass or volume}$$

To work backward from a percentage to find the mass or volume of solute or total mass or volume of the solution, write the percent concentration as a fraction (percent/100) and use proportions:

Example: Find the mass of solute needed to make 400. g of a 3.50 % solution.

$$\frac{3.5g}{100g} = \frac{x}{400g}$$

DIRECTIONS: Calculate the following:

- The percentage by mass of 120. g NaCl dissolved in 200. g water.
- The mass of solute in a 4.50 % solution with a mass of 1500. g.
- The mass of 6.00 % solution where the solute has a mass of 60.0 grams.
- The percentage by mass of 20.0 g KBr dissolved in 380. g water.
- The mass of solute in a 10.0 % LiCl solution with a mass of 200. g.
- The mass of solute in a 15.0 % KNO₃ solution with a mass of 3.50 kg.
- The percentage by volume of 14.0 ml ethanol dissolved in 45.0 ml of water.
- The volume of solute in a 5.00 % solution with a total volume of 150. ml.
- The percentage by volume of 30.0 ml ethanol dissolved in 600.0 ml of water.
- The volume of a 12.0 % solution where the solute has a volume of 300. ml.
- The mass of solute in a 15.0 % solution with a mass of 1000. g.
- The volume of solute in a 30.0 % solution with a total volume of 750. ml.

Exercise 12.3a(H)

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PPM & PPB

In situations where very small amounts of a solute need to be considered significant the measures *parts per million* (PPM) or *parts per billion* (PPB) may be used. These measures are essentially the same as percentages since a percentage is simply a statement of “*parts per hundred*”. To find either the parts per million (or billion), simply replace the 100 in the following with 1 000 000 for PPM (or 1 000 000 000 for PPB).

$$\frac{\text{mass or volume solute}}{\text{mass or volume solution}} \times 1\,000\,000 = \text{PPM by mass or volume}$$

DIRECTIONS: Calculate the following:

- Calculate the concentration of sodium chloride in parts per million (PPM) if 0.0225 grams are dissolved in 500. grams of solution.
- If 0.0200 L of ethyl alcohol are dissolved in 750.0 mL of water, what is its concentration in parts per million?
- 1.75 grams of chlorine is dissolved in 200. L of water. What is the concentration in parts per billion?
- During the drinking water crisis in Flint, Michigan a few years ago, lead levels reached 20. parts per billion by mass. Find the mass of lead that would have been present in 2.00 liters of water. Convert the mass to moles.
- The concentration of a solution is 120 000 PPM. How many grams of solute are contained in 1.00 liter of solution?
- Healthy water should generally have a dissolved oxygen concentration above 6.5 – 8 PPM by mass. What mass of oxygen must be dissolved in 100.0 liters of water to meet the minimum threshold for a sample of water to be considered healthy? At STP, what volume of oxygen would this be?