CONCEPT: PARTS PER MILLION (PPM)

- Extremely dilute solution concentrations are expressed in *parts per* _____ (*ppm*) or *parts per* _____ (*ppb*).
 - □ Units can be mass or volume based.

Parts per Million (ppm)

- Represents the number of parts (_____ or ____) per one million (106) parts.
 - \Box In aqueous solutions: 1 ppm = 1 mg/L.

ppm = $\frac{\text{of solute}}{\text{of solution}} \times 10^{6}$

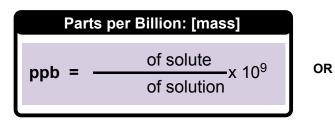
Parts per Million: [volume]
$$ppm = \frac{\text{of solute}}{\text{of solution}} \times 10^{6}$$

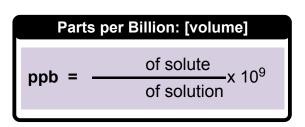
EXAMPLE: What is the concentration in parts per million of DDT (nonbiodegradable pesticide) in 2.0 mg in 1.0 kg needlefish tissue?

OR

Parts per Billion (ppb)

- Represents the number of parts (grams or mL) per one billion (109) parts.
 - \Box In aqueous solutions: 1 ppb = 1 μ g/L.





EXAMPLE: A 2.4 L sample of an aqueous solution contains 0.012 mL of NH₃. What is the concentration of NH₃ in the solution, expressed as parts per billion?

- A) 1500 ppb
- B) 5000 ppb
- C) 2000 ppb
- D) 500 ppb

CONCEPT: PARTS PER MILLION (PPM)

PRACTICE: A 5.12 L sample of solution contains 0.230 g of potassium sulfate, K₂SO₄. Determine the concentration of K₂SO₄ in ppm if the density of the solution is 1.30 g/mL.

a. 34.6 ppm

b. 28.9 ppm

c. 22.3 ppm

d. 43.6 ppm

PRACTICE: Calculate the concentration in parts per billion of the following aqueous solution: 0.91 mg of caffeine in a total volume of 131 mL.

a. 0.14 ppb

- b. 0.0069 ppb
- c. 140 ppb

d. 6900 ppb

PRACTICE: Glucose makes up about 0.102% by mass of human blood. Calculate this concentration in ppm.

a. 102 ppm

b. 0.102 ppm

- c. 0.00102 ppm
- d. 1020 ppm

CONCEPT: PARTS PER MILLION (PPM)

PRACTICE: The average human body contains about 5,000 grams of blood. What mass of arsenic is present in the body if the amount in blood is 0.86 ppb?

- a. $5.8 \times 10^{12} \, \mathrm{g}$
- b. 4.3 x 10¹² g
- c. 4.3 x 10⁻⁶ g
- d. 5.8 x 10⁻⁶ g

PRACTICE: A water sample contains the pollutant chlorobenzene with a concentration of 16 ppm (by volume). What volume of this water contains 5.01×10² mL of chlorobenzene?

- a. $3.1 \times 10^7 \text{ mL}$
- b. 3.2 x 10⁴ mL
- c. 1.6 x 10⁶ mL
- d. 8.0 x 10¹⁰ mL