

Answer on Question #62394 - Chemistry - General Chemistry

Question:

Problem 4.111 (Chapter 4)

The average concentration of gold in seawater is 100 fM (femtomolar).

1) Given that the price of gold is \$1764.20 per troy ounce (1 troy ounce = 31.103 g), how many liters of seawater would you need to process to collect \$6000 worth of gold, assuming your processing technique captures only 50 % of the gold present in the samples?

Solution:

- 1) Let's find the target amount of gold to collect: if price of gold is \$1764.20 per troy ounce than we need $\$6000 / \1764.20 per troy ounce = 3.4 troy ounces.
Convert to grams: 3.4 troy ounces * 31.103 g/ounce = 105.750 g
- 2) Considering the yield of processing to be 50%, we need amount of seawater containing $(105.750\text{g} / 50\%)*100\% = 211.500$ g of gold for processing
- 3) Calculate concentration of gold in seawater in g/L: "femto-" means 10^{-15} multiplier. So we have $100*10^{-15}$ mol/L or $1*10^{-13}$ mol/L of gold. Atomic weight of gold is 197, so 1 mole of gold is 197 g.
Convert mol/L to g/L: $1*10^{-13}$ mol/L = $197 * 1*10^{-13}$ g/L = $1.97*10^{-11}$ g/L
- 4) Calculate necessary amount of seawater: $211.5 \text{ g} / (1.97*10^{-11} \text{ g/L}) = 107*10^{11} \text{ L} = 1.07*10^{13} \text{ L}$

Answer:

We need to process $1.07*10^{13}$ L of seawater