

1. Potassium Ferricyanide has chemical formula  $K_3Fe(CN)_6$ <sup>1</sup>. Thus, the following computations can be performed:

$$1.55 \text{ ppm } K_3Fe(CN)_6 = \frac{1.55 \text{ g } K_3Fe(CN)_6}{10^6 \text{ g solution}} \times \frac{1 \text{ g solution}}{1 \text{ mL solution}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol } K_3Fe(CN)_6}{3 \times 39.098 \text{ g K} + 55.845 \text{ g Fe} + 6 \times (12.011 \text{ g C} + 14.007 \text{ g N})} \times \frac{1 \text{ mol } Fe(CN)_6}{1 \text{ mol } K_3Fe(CN)_6} = 4.71 \times 10^{-6} \text{ M ferricyanide}$$

$$1.55 \text{ ppm } K_3Fe(CN)_6 = \frac{1.55 \text{ g } K_3Fe(CN)_6}{10^6 \text{ g solution}} \times \frac{1 \text{ g solution}}{1 \text{ mL solution}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{3 \text{ mol K}}{1 \text{ mol } K_3Fe(CN)_6} = 1.41 \times 10^{-5} \text{ M potassium}$$

2. Assuming that the solvent is water, or has approximately the same density as water:

$$\frac{0.1 \text{ mg cadmium}}{1 \text{ L water}} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mL water}}{1 \text{ g water}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times 10^6 \text{ ppm} = 0.1 \text{ ppm cadmium}$$

$$\frac{0.1 \text{ mg cadmium}}{1 \text{ L water}} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mL water}}{1 \text{ g water}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times 10^9 \text{ ppm} = 100 \text{ ppb cadmium}$$

$$\frac{0.1 \text{ mg cadmium}}{1 \text{ L water}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol cadmium}}{112.41 \text{ g cadmium}} = 9 \times 10^{-7} \text{ M cadmium}$$

3.  $C_0V_0 = C_1V_1 \Rightarrow 0.100 \text{ M} \times 10 \text{ mL} = C_1 \times 250 \text{ mL} \Rightarrow C_1 = 4.00 \times 10^{-3} \text{ M}$

$$C_1V_1 = C_2V_2 \Rightarrow 4.00 \times 10^{-3} \text{ M} \times 15 \text{ mL} = C_2 \times 100 \text{ mL} \Rightarrow C_2 = 6.00 \times 10^{-4} \text{ M}$$

$$C_2V_2 = C_3V_3 \Rightarrow 6.00 \times 10^{-4} \text{ M} \times 20 \text{ mL} = C_3 \times 250 \text{ mL} \Rightarrow C_3 = 4.80 \times 10^{-5} \text{ M}$$

7. a)  $C_0V_0 = C_1V_1 \Rightarrow 0.240 \text{ M} \times 20.0 \text{ mL} = C_1 \times 500 \text{ mL} \Rightarrow C_1 = 9.60 \times 10^{-3} \text{ M}$

b)  $C_0V_0 = C_1V_1 \Rightarrow C_0 \times 2.0 \text{ mL} = 3.42 \text{ ppm} \times 100 \text{ mL} \Rightarrow C_0 = 17 \text{ ppm}$

$$17.1 \text{ ppm} \times 2 \text{ L} \times \frac{1}{10^6 \text{ ppm}} \times \frac{1 \text{ g}}{1 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 0.34 \text{ mg } Ca^{2+}$$

11.  $C_0 = \frac{V_1}{V_0} \times C_1 = \frac{V_1}{V_0} \times \frac{V_2}{V_1'} \times C_2 = \frac{10 \text{ mL}}{2.5 \text{ mL}} \times \frac{10 \text{ mL}}{2.5 \text{ mL}} \times 0.236 \text{ ppb} = 3.8 \text{ ppb}$   
 $\frac{10 \text{ mL}}{2.5 \text{ mL}} \times \frac{10 \text{ mL}}{2.5 \text{ mL}} \times 0.236 \text{ ppb} \times \frac{1 \text{ g benzene}}{10^9 \text{ g water}} \times \frac{1 \text{ g water}}{1 \text{ mL water}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol benzene}}{78.113 \text{ g benzene}} = 48 \text{ nM}$   
 This is below  $PEL_{\max}$ .

12. a) 4, the digits in the exponent are not significant, but the digits in the mantissa are.

b) 4, all digits are significant because trailing zeros are significant

c) 2, only the 1 and the trailing 0 are significant

13. a) 31.3 because in this calculation, the smallest place value for which all addends have a significant figure is the tenths place, so our answer will be rounded to the tenths place.

b)  $1.2 \times 10^4$  because in this calculation, the factors and divisors have 3, 2, and 3 significant figures respectively, so the answer will have the minimum which is 2 significant figures.

c) 4.683 because we can split the logarithm into the sum of the logarithms of the characteristic and the mantissa, which produces  $0.683 + 4$  where the 4 is exact and infinite precision, thus we have significant figures in every addend up to the thousandths place.

d) 1.71 because there are three significant figures in the argument

end

## Bibliography

- (1) *Ferricyanide*. <https://en.wikipedia.org/wiki/Ferricyanide> (accessed 2025-01-15)