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1. Potassium Ferricyanide has chemical formula $K_3Fe(CN)_6$[1]. Thus, the following computations can be performed:
$$1.55 \text{ ppm } K_3\text{Fe(CN)}_6 = \frac{1.55 \text{ g } K_3\text{Fe(CN)}_6}{10^6 g \text{ solution}} \times \frac{1 \text{ g solution}}{1 \text{ mL solution}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol } K_3\text{Fe(CN)}_6}{3{\times}39.098 \text{ g K} + 55.845 \text{ g Fe} + 6{\times}(12.011 \text{ g C} + 14.007 \text{ g N})} \times \frac{1 \text{ mol Fe(CN)}_6}{1 \text{ mol } K_3\text{Fe(CN)}_6} = 4.71 \times 10^{-6} \text{ M ferricyanide}$$
$$1.55 \text{ ppm } K_3\text{Fe(CN)}_6 = \frac{1.55 \text{ g } K_3\text{Fe(CN)}_6}{10^6 g \text{ solution}} \times \frac{1 \text{ g solution}}{1 \text{ mL solution}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol } K_3\text{Fe(CN)}_6}{3{\times}39.098 \text{ g K} + 55.845 \text{ g Fe} + 6{\times}(12.011 \text{ g C} + 14.007 \text{ g N})} \times \frac{3 \text{ mol K}}{1 \text{ mol } K_3\text{Fe(CN)}_6} = 1.41 \times 10^{-5} \text{ M potassium}$$

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) 1.2×10^4 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)