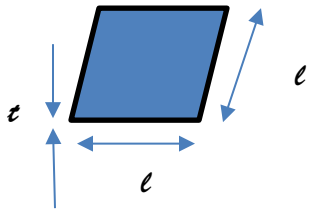
CHEMISTRY 31
Quiz 2 - 10 minutes
Sept. 21
KEY

1. A student prepares an Al^{3+} solution by dissolving an Al foil square into hydrochloric acid. After dissolution, the solution is transferred to a 50.0±0.1 mL volumetric flask and diluted to the line. The square is measured to have a length of 1.00±0.04 cm and a thickness of 0.173±0.008 mm. Given that Al has a density of 2.699 g cm^{-3}, **determine the concentration in g/L and the absolute uncertainty in g/L of the solution**. Give the final answers with the correct number of significant figures.



Vol = $\ell^2 t$

Conc. = mass Al/(vol sol'n) where mass Al = (vol metal)(density) = $l^2 t \cdot$density/(vol sol'n)
Conc. = (1.00 cm)^2(0.173 mm)(1 cm/10 mm)(2.699 g cm^{-3})(1000 mL/L)/(50.0 mL)
Conc. = 0.9339 g/L
For propagation of uncertainty, this is a mixed operation problem with exponent (l^2) and multiplication division in it (the rest)
Unc(l^2)/(l^2) = 2(Unc(l))/l) = 2(0.04/1.00) = 0.08 (note: this is a relative unc and can be transferred directly as such to the second equation)
Unc(Conc)/Conc = $\{[Unc(l^2)/(l^2)]^2 + [Unc(t)/t]^2 + [Unc(vol)/Vol]^2\}^{0.5}$
= $[(0.08)^2 + (0.008/0.173)^2 + (0.1/50.0)^2]^{0.5}$ = 0.092
Absolute unc. In conc. = (0.092)(0.9339 g/L) = 0.086
Conc. ± unc = 0.93 ± 0.09 g/L