

Exam II Key

① see notes + text

② $SR = \text{signal ratio} = \frac{I_{\text{analyte}}}{I_{IS}}$

$CR = \text{concentration ratio} = \frac{[analyte]}{[IS]}$

$$\frac{(SR)_{unk}}{(SR)_{known}} = \frac{(CR)_{unk}}{(CR)_{known}}$$

$$\frac{533/368}{252/376} = \frac{\left(\frac{z \text{ ng}}{25.00 \text{ mL}}\right) / A}{\left(\frac{(5.00 \text{ mL})(10.00 \text{ ng/mL})}{25.00 \text{ mL}}\right) / A}$$

$$2.161 = \frac{z}{50.0} \Rightarrow z = 108.05 \text{ ng}$$

$$\Rightarrow [\text{benzene}] = \frac{108.05 \text{ ng}}{5.00 \text{ mL}} = \boxed{21.6 \text{ ppb}}$$

Let $z = \text{ng benzene in } 5.00 \text{ mL of water sample}$

Let $A = [\text{toluene}]$ in both known + unknown

③

Concentration of standard: $M_1 = \frac{(1264g) \left(\frac{1 \text{ mol}}{181g} \right)}{.100L} = 0.006983 M$

Then a dilution: $M_1 V_1 = M_2 V_2$

$$(0.006983 M)(10.00 \text{ mL}) = M_2 (250.0 \text{ mL})$$

$$M_2 = 0.0002793 M$$

Now find ϵ :

$$A = \epsilon b c$$

$$0.473 = \epsilon (1.00 \text{ cm})(0.0002793 M)$$

$$\Rightarrow \epsilon = 1693 \text{ M}^{-1} \text{ cm}^{-1}$$

Unknown:

$$A = \epsilon b c$$

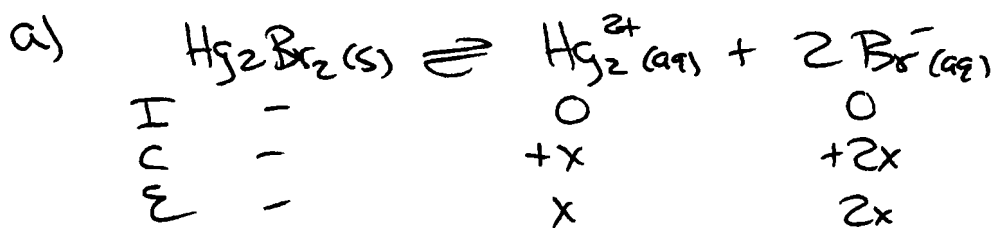
$$.118 = 1693 (2.00) c$$

$$\Rightarrow c = 3.484 \times 10^{-5} M$$

$$(3.484 \times 10^{-5} \text{ mol/L})(.2500L) \left(\frac{181g}{1 \text{ mole}} \right) = .001577 \text{ g}$$

$$\Rightarrow \frac{.001577}{.2162} \times 100 = \boxed{0.7299\%}$$

4



$$\begin{aligned}K_{sp} &= [\text{Hg}_2^{2+}][\text{Br}^-]^2 \\ &= (x)(2x)^2 = 4x^3 \\ &= 4(2.44 \times 10^{-8})^3 = \boxed{5.81 \times 10^{-23}}\end{aligned}$$

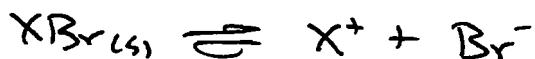
$$x = [\text{Hg}_2^{2+}] = 2.44 \times 10^{-8} \text{ M}$$

b) Precipitate 99% of Hg_2^{2+} : $.10 \text{ M} - .99(.10 \text{ M}) = .0010 \text{ M } \text{Hg}_2^{2+}$
left over

$$5.81 \times 10^{-23} = [\text{Hg}_2^{2+}][\text{Br}^-]^2$$

$$[\text{Br}^-] = \left(\frac{5.81 \times 10^{-23}}{.0010} \right)^{1/2} = 2.41 \times 10^{-10} \text{ M}$$

K_{sp} for imaginary salt:



$$K_{sp} = [\text{X}^+][\text{Br}^-] = (.20)(2.41 \times 10^{-10}) = \boxed{4.8 \times 10^{-11}}$$