Le Chatelier's principle

Lab 2

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1 Prelab

1. When a solution reaches equlibrium, all of the macroscopic properties remain constant, this means that color of a solution at equlibrium does not change. So the solution that is not changing color is at equlibrium.

2a. When the potassium bromide was added to the solution, it ionized into potassium ions and bromide ions. These bromide ions reacted with the dissoved hydrated copper ions to produce a higher concentration of copper bromide ions.

2b. The solution changed color due to the higher concentration of copper bromide. Since copper bromide ions are blueish, it changed the overall apperarence of the test tube.

2c. The reaction to produce copper bromide ions is endothermic, therefore, it will absorb the thermal energy from the environment, leaving the test tube cold to the touch.

3. The unknown checical was an acid which caused a newtralization reaction with magnesium hydroxide producing water and aqueous salts. Therefore leaving the cloudy test tube clear.

4. The removal of methanol would induce a complete reaction as there would be no product to preform a reverse reaction. In other words, it would force the equlibrium as far right as to use up all carbon monoxide and hydrogen to make the methanol.

2 Experiment

Note: "**s**" represents stress. The stress indicates how the system was affected, and all other values is how the system responded to the stress.

$$\mathrm{CoCl_4}^{2-}\,(blue) + 6\,\mathrm{H_2O} \rightleftharpoons \mathrm{Co\,(H_2O)_6}^{2+}\,(red) + 4\,\mathrm{Cl^-} + \mathrm{Heat}$$

Addition	$CoCl_4^{2-}$	H_2O	shift	$Co(H_2O)^{2+}$	Cl^-	Heat	Color
Heat	increase	increase	left	decrease	decrease	decrease **s** ↑	blue
Cool	decreases	decreases	right	increase	increase	increase **s** ↓	red
$AgNO_{3(aq)}$	increase	increase	left	increase	decrease **s** ↑	decrease	blue
$H_2O_{(l)}$	decrease	decrease **s** ↑	right	increase	increase	increase	red

$$\mathrm{Heat} + \mathrm{NH_4}^+ + \mathrm{OH^-} \rightleftharpoons \mathrm{NH_3} + \mathrm{H_2O}$$

Addition	Heat	NH_4^+	OH^-	shift	NH_3	H_2O	Color
$NH_4Cl_{(aq)}$	decrease	decrease **s** ↑	decrease	right	increased	increased	colorless
$HCl_{(aq)}$	increase	increase	increase **s** ↓	left	decrease	decrease **s** ↑	colorless
$NaOH_{(aq)}$	decrease	decrease	decrease **s** ↑	right	increase	increase	purple

$$\mathrm{Fe^{+3}}(paleyellow) + \mathrm{SCN^-} \rightleftharpoons \mathrm{FeSCN^{+2}}\,(red) + \mathrm{Heat}$$

Addition	Fe^{+3}	SCN^-	shift	$FeSCN^{+2}$	Heat	Color
$KSCN$	decrease	decrease **s** ↑	right	increase	increase	red
$Fe(NO_3)_3$	decrease **s** ↑	decrease	right	increase	increase	red
Heat	increase	increase	left	decrease	decrease **s** ↑	yellow
Na_2HPO_4	increase **s** ↓	increase	left	decrease	decrease	yellow

$$2\,\mathrm{CrO_4}^{-2}\,(yellow) + 3\,\mathrm{H^+} \rightleftharpoons \mathrm{Cr_2O_7}^{-2}\,(red) + \mathrm{H_2O}$$

Addition	CrO_4^{-2}	H^+	shift	$Cr_2O_7^{-2}$	H_2O	Color
$HCl_{(aq)}$	decrease	decrease **s** ↑	right	increase	increase	red
$NaOH$	increase	increase **s** ↓	left	decrease	decrease	yellow

$$2\,\mathrm{NO_2}\,(\textit{brown}) \rightleftharpoons \mathrm{N_2O_4}\,(\textit{colorless}) + \mathrm{Heat}$$

Addition	NO_2	shift	N_2O_4	Heat	Color
Cool	decrease	right	increase	increase **s** $\downarrow$	colorless
Heat	increase	left	decrease	decrease **s** $\uparrow$	brown

$$\mathrm{CuSO_4 \cdot 5\,H_2O} + \mathrm{Heat} \rightleftharpoons \mathrm{CuSO_4} + 5\,\mathrm{H_2O}$$

Addition	$CuSO_4 \cdot 5H_2O$	Heat	shift	$CuSO_4$	$5H_2O$	Color
Heat	decrease	decrease **s** $\uparrow$	right	increase	increase	brown

3 Postlab

1. The addition of heat in the ammounium reaction would cause the equilibrium to shift to the right.

2. Ammonia was added to the copper solution to produce the dark blue solution of copper ammonia ions. In order to get the light blue solution, you would be required to add an excess of copper ammonia in order to force equlibrium to the left as to produce more copper ions which are light blue in color.

3. The equilibrium would be shifted to the right, as to produce more barium sulfate. This would mean that solution produced would be less toxic to be used for the ingestion.

4. Removing the patient to an area of fresh air would decrease the concentration of carbon monoxide in the environment, this would shift the equilibrium to the left displacing the carbon monoxide attached to the hemoglobin cells. Suppling the patient with pure oxygen would have a stronger effect with the same result.