

Exp. 1 Report
Reaction Rate of an Iodine Clock

Name: _____

A. Concentration and Reaction Rate

Mixture	(HSO ₃ ⁻) mol/L	(IO ₃ ⁻) mol/L	(H ⁺) mol/L	Time, s run 1	Time, s run 2	Time, s average	Rate* mol/L·s
1				240	32	136	
2				21	15	18	
3				28.5	13	20.5 _s	
4				10	8	9	
5				15	10	12.5 _s	

* Use eq. 2.

rate 2/rate 1 = _____ m = _____ ≈ _____ (integer)

rate 3/rate 1 = _____ p = _____ ≈ _____ (integer)

rate 4/rate 1 = _____ n = _____ ≈ _____ (integer)

k = _____, _____, _____, _____, _____
 mixture 1 mixture 2 mixture 3 mixture 4 average

Predicted rate for mixture 5 (eq. 1) = _____ mol/L·s

B. Temperature and Reaction Rate

Temperature, °C	Time, s	Rate, mol/L·s	k ₀
0.0			

k₀ / k₁ = _____ (Obtain k₁ from Section A, mixture 1.)

E_a (eq.3) = _____ kJ/mol

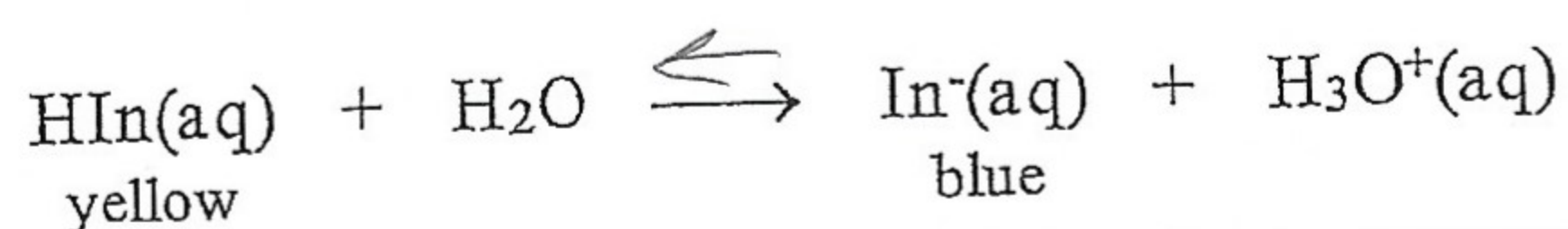
k at 35°C (eq. 3) = _____

Exp. 2 Report
 Chemical Equilibrium Shifts

Name:

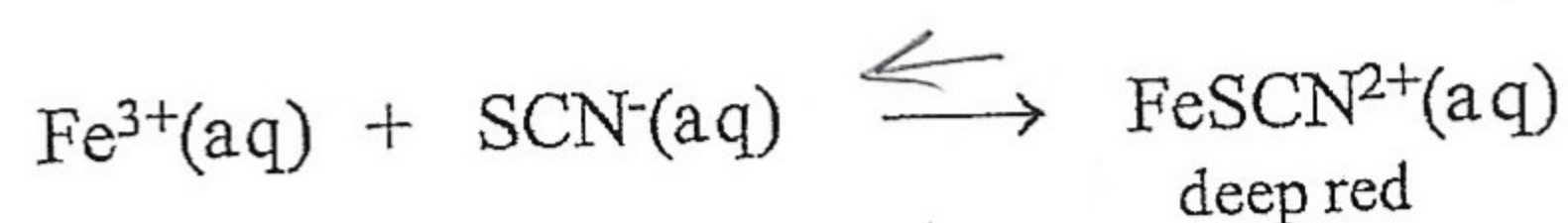
In the following, indicate whether the concentration of each species increases or decrease and whether the equilibrium shifts forward or backward. Denote increase by \uparrow and decrease by \downarrow . Denote forward by \rightarrow and backward by \leftarrow .

A. Bromocresol green



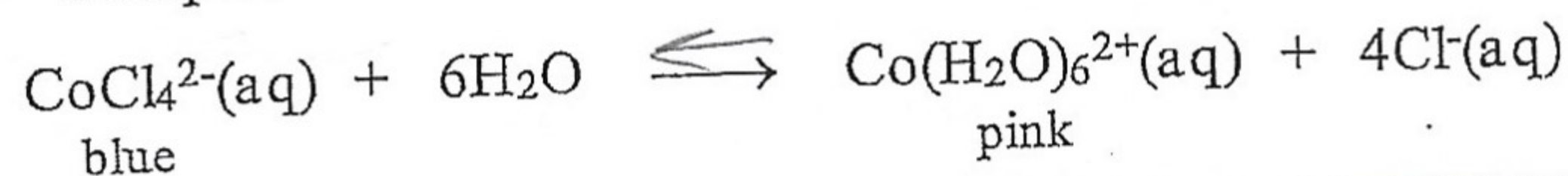
	Color change	[HIn]	[In ⁻]	[H ₃ O ⁺]	Equilibrium Shift
Adding HCl	Green	\downarrow	\downarrow	\downarrow	\leftarrow
Adding NaOH	Blue	\downarrow	\uparrow	\uparrow	\rightarrow

B. FeSCN²⁺ Complex



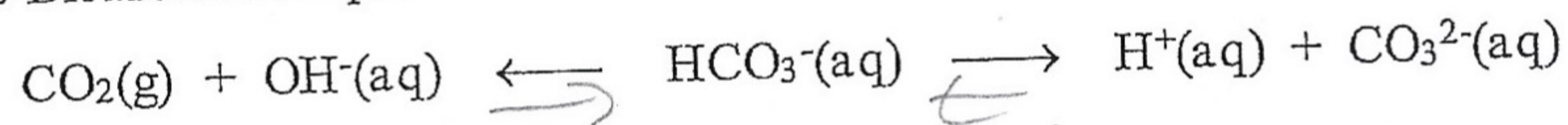
	Color Change	[Fe ³⁺]	[SCN ⁻]	[FeSCN ²⁺]	Equilibrium Shift
Adding Fe(NO ₃) ₃	Dark red	\downarrow	\downarrow	\uparrow	\rightarrow
Adding KSCN	Brown	\downarrow	\downarrow	\uparrow	\rightarrow
Adding Na ₂ HPO ₄	white	\uparrow	\uparrow	\downarrow	\leftarrow

C. CoCl₄²⁻ - Co(H₂O)₆²⁺ Complexes



	Color Change	[CoCl ₄ ²⁻]	[Co(H ₂ O) ₆ ²⁺]	Equilibrium Shift	ΔH (+ or -)	K _c (\uparrow or \downarrow)
Adding HCl	pink	\uparrow	\downarrow	\leftarrow		
Adding H ₂ O	light pink	\downarrow	\uparrow	\rightarrow		
Hot bath	/	/	/	/	/	/
Cold bath	/	/	/	/	/	/

D. Carbonate-Bicarbonate Equilibria



	Color change	[CO ₂]	[OH ⁻]	[CO ₃ ²⁻]	Equilibrium Shift
Adding Ca(NO ₃) ₂	/	/	/	/	/
Heating	/	/	/	/	/
Degassing	/	/	/	/	/

Exp 3 Report
pH of Salt Solutions

Name: t

A. Colors of Acid-Base Indicators

Indicator	pK	Transition pH	Acid Color	Base Color	Transition Color
1 thymolblue	1.65	1.2 - 1.8	magenta		orange
2 methylorange	3.46	3.1 - 4.4	light pink		yellow
3 methylred	5.00	4.2 - 6.3	pink		green
4 bromthymolblue	7.10	6.0 - 7.6	light yellow	green	light blue
5 thymolblue	8.96	8.0 - 9.0	—	blue	blue

B. pH by Color Indicators

0.10 M Solution	thymolblue	methylorange	methylred	bromthymol blue	pH range
NaHSO ₄	magenta	light pink	pink	light yellow	1 - 5
AlCl ₃	light orange	"	"	"	3 - 5
NH ₄ Cl	"	orange	light orange	green	3 - 7
NaCl	dark yellow	"	yellow	green	8
CH ₃ COONa	"	"	"	light blue	8
NaHCO ₃	gray	"	"	blue	8 - 9

C. pH by pH Meter

0.10 M Solution	pH _{measd}	Ionization Equation
NaHSO ₄	8.82	
AlCl ₃	3.02	
NH ₄ Cl	5.5	
NaCl	5.96	
CH ₃ COONa	7.23	
NaHCO ₃	8.73	

Question

- An aqueous solution shows yellow with thymol blue, methyl red, and bromthymol blue. Estimate the pH range of the solution.
- What is the accuracy in pH measurement of color indicators? Of pH meter?

Exp. 8 Report
Solubility of Ionic Precipitates

Name.

A. Solubility. Common Ion Effect

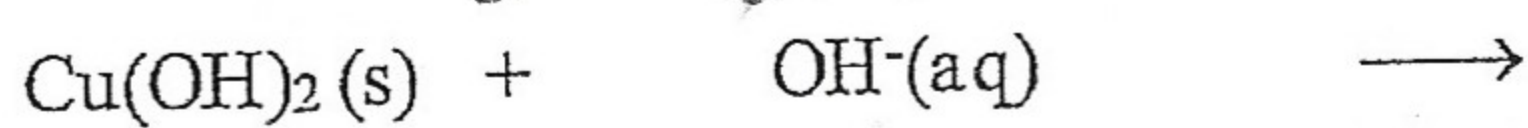
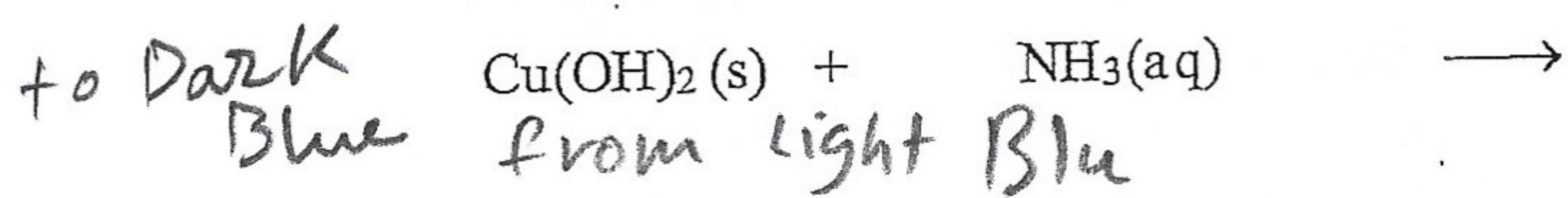
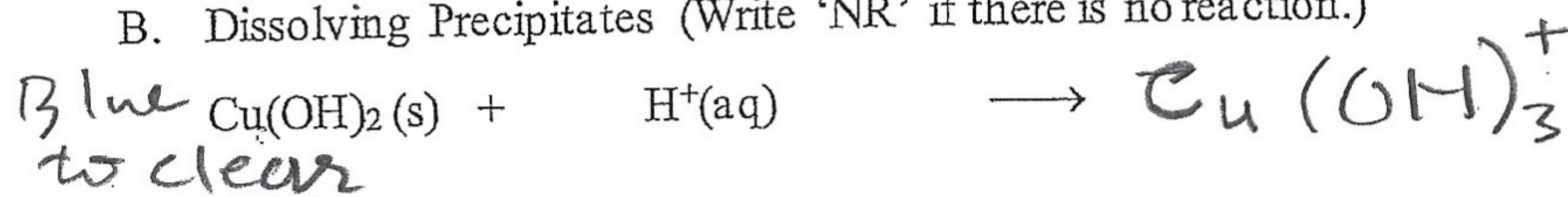
0.2 M Pb(NO ₃) ₂ drops	0.4 M HCl drops	V _f mL	[Pb ²⁺]	[Cl ⁻]	s mol/L	K _{sp}
5	5	1	0.035	0.07	0.035	1.72 × 10 ⁻⁵
10	5	2	0.07	0.07	0.035	0.000343
5	10	2	0.035	0.14	0.035	0.000686

0.035 (0.07)

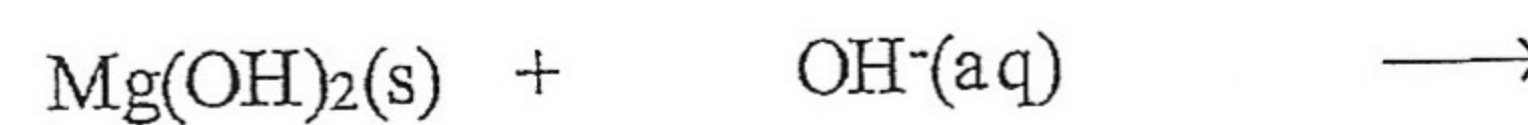
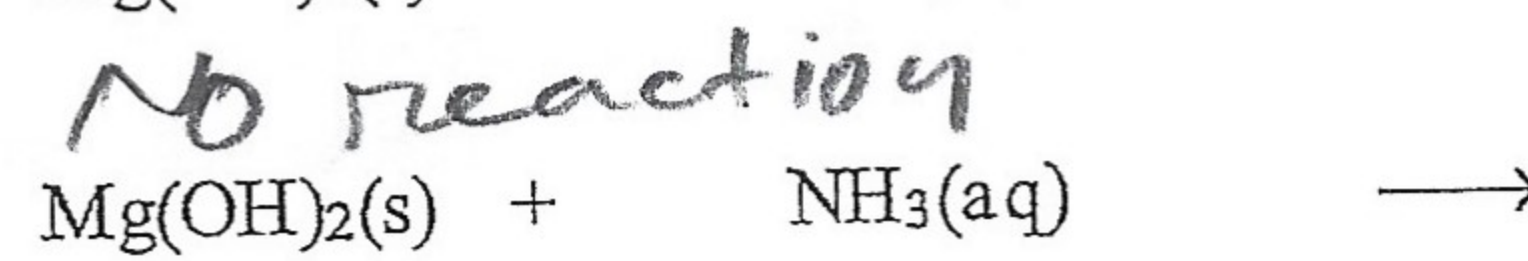
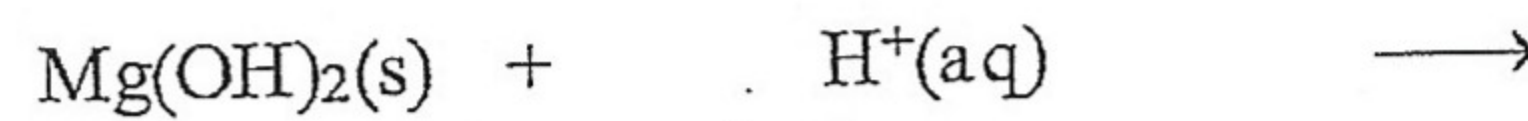
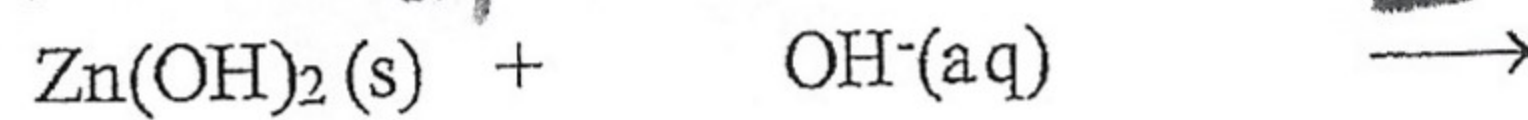
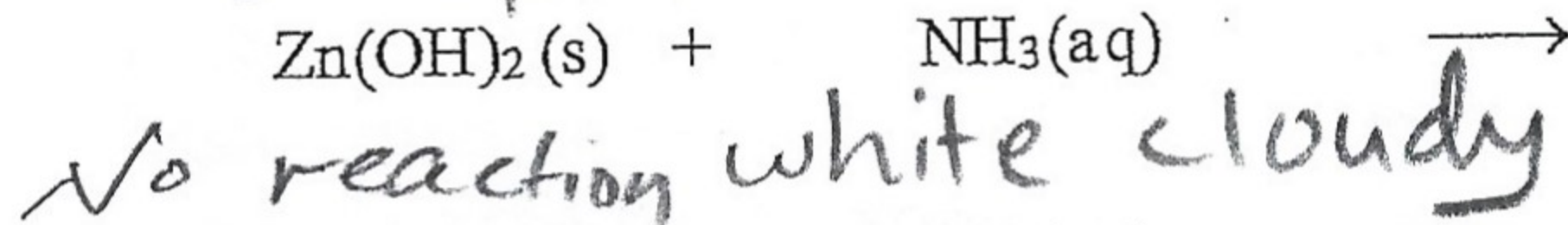
_____ mL/drop for 0.200 M Pb(NO₃)₂

_____ mL/drop for 0.400 M HCl

B. Dissolving Precipitates (Write 'NR' if there is no reaction.)



Blue to clear we can see through it



Question

- From Part A, does solubility increase or decrease in the presence of common ions compared to solubility in pure water? Why?
- Tell what you observe when ammonia is added drop by drop to an aqueous solution of cupric sulfate.

Exp. 11 Report
 Voltaic Cell Measurements

Nam

A. Cell Voltage

Cell	E_{cell} measured	Anode	E°_{ox}	Cathode	E°_{red}	E_{cell} calculated
1	155 v	Pb	v	Zn	v	v
2	370 v	Pb	v	Cu	v	v
3	350 v	Zn	v	Cu	v	v

B. Concentration of Free Cupric Ions

E°_{cell} _____ v E_{cell} _____ v $[\text{Cu}^{2+}]$ _____ mol/L

C. Concentration Cell

$E_{\text{cell, measured}}$ _____ v $E_{\text{cell, calculated}}$ _____ v

Cell notation _____

Anodic reaction _____

Cathodic reaction _____

Cell reaction _____

Question

1. Taking the standard reduction potential of $\text{Pb}^{2+}|\text{Pb}$ as zero volt, what are the relative standard reduction potentials of $\text{Zn}^{2+}|\text{Zn}$ and $\text{Cu}^{2+}|\text{Cu}$?

2. Calculate % Cu^{2+} remained in the $\text{Cu}(\text{NH}_3)_4^{2+}$ solution for Part B.