Experiment 2.
Periodic Table and Periodic Law

Summary of Experimental Procedure

SAFETY WARNING !
STRONG ACIDS AND BASES, HALOGENS

Wear safety glasses and gloves when handling with chemicals in a laboratory.

DISPOSAL:

Dispose of the waste water / halogen mixtures
in the Waste Halogens container in the chemical hood.

CLEANUP:

Rinse the test tubes with copious amounts of tap water
And twice with distilled water. Discard the rinses in the container.

PART A. Periodic Trends in Physical Properties (Dry Lab)

The periodic trends for the elements are analyzed through a series of questions on the ***Report Sheet***.

Figure 11.1: Ionization energy (KJ/mol)
Figure 11.2: Atomic radii (pm)
Figure 11.3: Electron Affinities (KJ/mol)
Figure 11.4: Density (Kg/m^3)

PART B. The Appearance of Some Representative Elements

Prepare a hot water bath for PART B-3.

B-1. Sample of elements

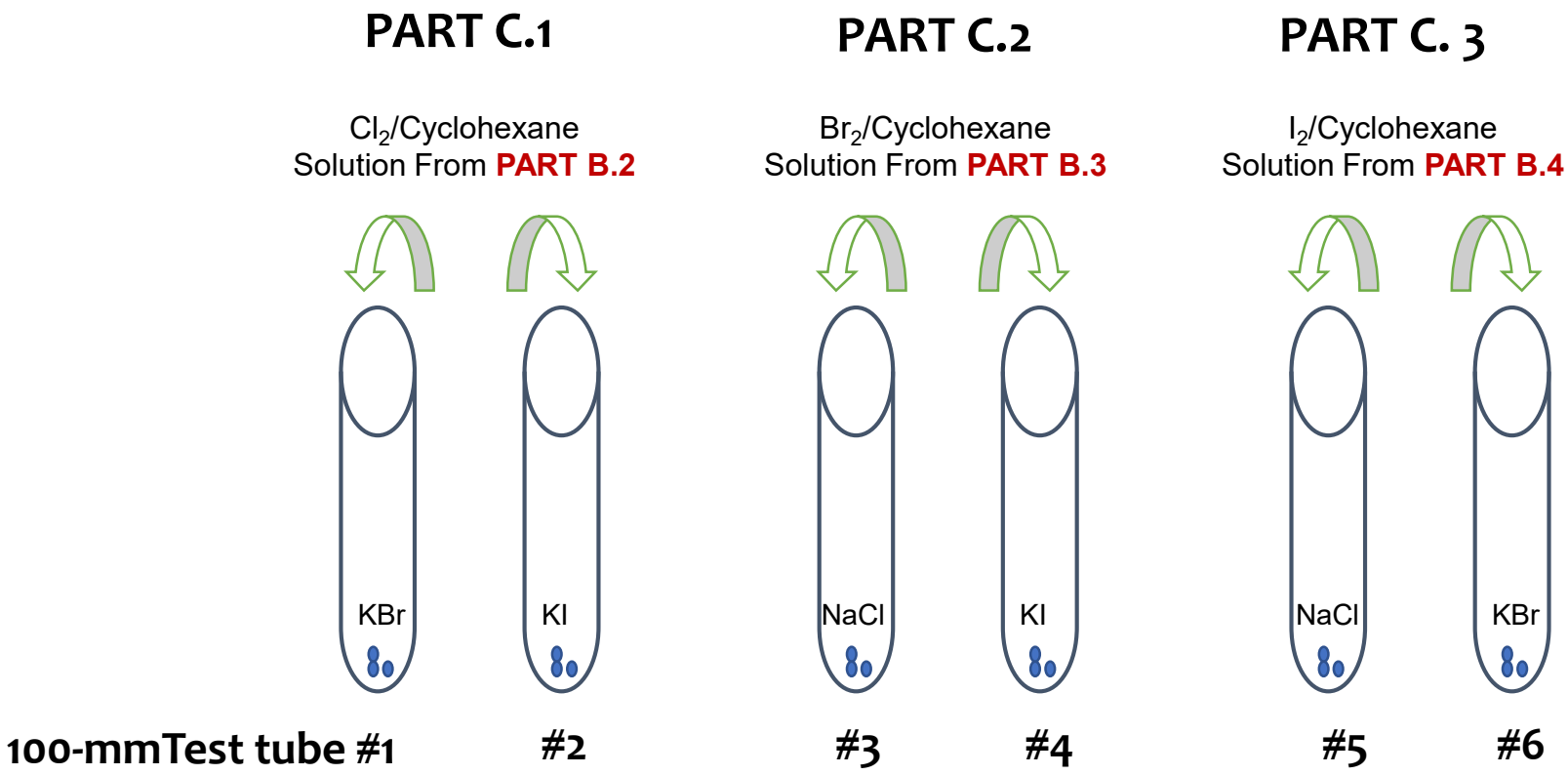
Na, Mg, Al, Si, S

Record your Observations on the Report Sheet.

Conduct this PART experiments in the fume hood or near the mouth of movable arm hood.

Part #	PART B.2	PART B.3	PART B.4
Preparation of Halogen	Preparation of Cl_2	Preparation of Br_2	Preparation of I_2
150-mm test tube #	#1	#2	#3
Steps	**Step 1**: In a clean test tube, Add 2 mL of 5% NaOCl solution and 10 drops of cyclohexane (Agitate the mixture) and 10 drops of 6M HCl **Step 2**: Swirl or agitate it **Step3**: Record your observation.(★1)	**Step 1**: In a clean test tube, Add 2 mL of 3M KBr and 10 drops of cyclohexane and 5-10 drops of 8M HNO_3 **Step 2**: Swirl or agitate it. **Step 3**: Place the test tube in a hot water **Step4**: Record your observation (★2)	**Step1**: In a clean test tube, Add 2 mL 3M KI and 10 drops of cyclohexane and 5-10 drops of 8M HNO_3 **Step2**: Swirl or agitate it. **Step3**: Place the test tube in a hot water **Step4**: Record your observation. (★3)
	Do not discard ! **Save for PART C.1**	*Do not discard !* **Save for PART C.2**	*Do not discard !* **Save for PART C.3**

PART C. The Chemical Properties of the Halogens



Step1. Add a pinch of solid
Step2: Add an equal portion of the halogen/cyclohexane solution
Step3: Swirl the solution, observe, and record.

Write appropriate net ionic equations. (★4)(★5)(★6)

PART D. The Chemical Properties of the Halides

1. The reactions of the halides with various metal ions

Reactions	**PART D.1-a**) Slowly add 10 drops of 2 M $Ca(NO_3)_2$. (Vary the color of the background of the test tubes for observation)	**PART D.1-b)** Add slowly 10 drops of 0.1 M $AgNO_3$. After 1min, add 10 drops of 3 M NH_3.	**PART D.1-c)** Add 1 drop of 6 M HNO_3 and slowly add 10 drops of 0.1M $Fe(NO_3)_3$.
NaF + 10 drops of distilled water	100-mm test tube # 1	#2	#3
NaCl + 10 drops of distilled water	#4	#5	#6
KBr + 10 drops of distilled water	#7	#8	#9
KI + 10 drops of distilled water	#10	#11	#12

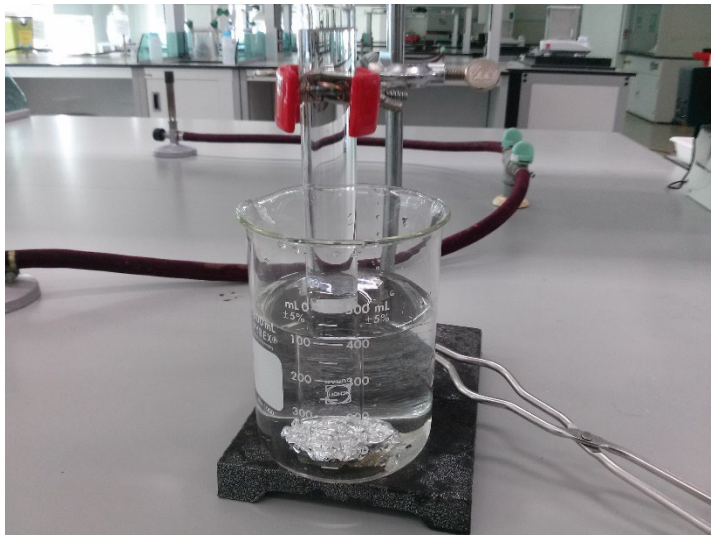
Step 1: Add a pinch of solid + 10 drops of distilled water
Step 2: Add drops of the metal ion solution to each test tubes
Step 3: Observe closely and over a period of time. (★7) (★8) (★9)
Step 4: Record and summarize your observations of chemical activity with the halides with the Ca^{2+}, Ag^{+}, and Fe^{3+} ions.

E. Chemical Reactivity of Some Representative Elements

E.1. Na

TA Demonstration Only

Test the gas by holding the mouth of the inverted test tube over a Bunsen flame.
(★10) Account for the appearance of the color change in the solution.



E.2. Mg and Al

Reactions	**PART E.2-a)** With Acid	**PART E.2-b)** With Base
Mg	clean 100-mm test tube # 1	#1
Al	#2	#2
Steps	**Step 1**: Cut 5-mm pieces and place them into separate small test tubes. **Step 2**: Add 1 mL of 6 M HCl to each tube. Which metal reacts more rapidly? **(★12)** What is the gas that is evolved? **(★13)** Record your observation.	**Step 1:** Add (count) drops of 6 M NaOH to the test tube with Al ion solution until precipitate appears. **Step 2**: Add the same number of drops to the test tube containing the Mg ion solution. Record your observations. **(★14)** Step 3. Add drops of 6 M NaOH until both solutions are again colorless. Observe closely as each drop is added. Record and explain.

E.3. Solubilities of Alkaline-earth cations

Solubility	0.1 M $MgCl_2$	0.1 M $CaCl_2$	0.1 M $Sr(NO_3)_2$
PART E.3-a)	test tube # 1 (+ 5 drops of 0.10M NaOH + 1 ~ 2 drops of 1.0 M NaOH)	#2 (+ 5 drops of 0.10M NaOH + 1 ~ 2 drops of 1.0 M NaOH)	#3 (+ 5 drops of 0.10M NaOH + 1 ~ 2 drops of 1.0 M NaOH)
PART E.3-b)	#4 (+5 drops of 0.10 M Na_2SO_4 + a pinch of solid Na_2SO_4)	#5 (+5 drops of 0.10 M Na_2SO_4 + a pinch of solid Na_2SO_4)	#6 (+5 drops of 0.10 M Na_2SO_4 + a pinch of solid Na_2SO_4)

Step 1: Place 10 drops of each cation in three separate, clean 100-mm test tubes.

Step 2: Count and add 5 drops of 0.10 M NaOH or 0.10 M Na_2SO_4 until a cloudiness appears in each test tube. You can observe a change in appearance about one of three cations.

Step 3: Add 1 ~ 2 drops of 1.0 M NaOH or a pinch of solid Na_2SO_4 to determine the order of one of two cations.

Step 4: Predict the trend in the solubility of the hydroxides (★15) and the sulfates (★16) of the Group 2A cations.

E.4. Sulfurous acid and sulfuric acid (In a hood or near arm hood)

Solubility	5 drops of 6 M HCl
PART E.4-a) Na_2SO_3	#1
PART E.4-b) Na_2SO_4	#2

Step 1: Place a double pinch of each solid in two separate, clean 100-mm test tubes.

Step 2: Add 5 drops of 6 M HCl.

Step 3: Test the evolved gas with wet blue litmus paper. Write a balanced equation for the reaction. **(★17)**

Step 4: Account for any differences or similarities in your observations. **(★18)**

DISPOSAL:

Dispose of the waste water / halogen mixtures
in the Waste Halogens container in the chemical hood.

CLEANUP:

Rinse the test tubes with copious amounts of tap water
And twice with distilled water. Discard the rinses in the container.