# REPORT

**EXPERIMENT 1: CHEMICAL REACTIONS**

Group: 3 Class: IELS22IU41 Date: 04/01/2023

Group members:

|  | Full name | Student ID | Declaration of Contribution | Signature |
| --- | --- | --- | --- | --- |
| 1 | Phan Minh Ẩn | ITITSB22028 | H2O2 and Al3+ reactions |  |
| 2 | Nguyễn Thành Trí | IELSIU22112 | Fe2+ and Fe3+ reactions |  |
| 3 | Đỗ Minh Duy | ITITSB22029 | Silver halides and KMnO4 reactions |  |
| 4 | Nguyễn Phan Tuấn Anh | BTFTIU22164 | Introduction, Materials and Methods |  |

Total score: \_\_\_\_\_\_\_/100

**Part 1. Introduction**

Chemical reactions are the transformations of one or more chemicals known as reactants into one or more other compounds known as products. Products can change color, solidify, release gas, or generate heat and light. The experiment allows us to carry out and then observe many chemical reactions to see how the chemical changes result in the formation of products that appear and perform differently from the original ingredients. We may also learn to identify various chemical processes and products, as well as become acquainted with laboratory equipment. This report illustrates the progression, reactions, and results of many chemical processes.

**Part 2. Materials and Methods**

Materials:

- Lab equipment: Test tubes, test tube track, test tube holders, beakers, bunsen burner, looped wire….

- Materials: distilled water, 0.5M CuSo4, 2M NaOH, 6M NaOH, 2M NH4OH, 0.5M KCl, 0.1M AgNO3, 0.5M KBr, 2M H2SO4, 0.1M KI, 3% H2O2, MnO2, 0.5M Na2SO3, 0.1M KMnO4, 0.5M FeCl3, 2M KOH, 0.5M FeSO4, 0.5M Al2(SO4)3, 2M HCl….

Methods:

**1. Reaction of Cu2+:**

Step 1: Prepare 2 test tubes with 10 drops of 0.5M CuSO4 in each

Step 2: Drop 10 drops of 2M NaOH into tube #1, 10 drops of 2M NH4OH into tube #2

Step 3: Mix tubes gently and observe

Step 4: Drop 10 drops of 2M NaOH into tube #1, 10 drops of 2M NH4OH into tube #2

Step 5: Mix tubes gently and observe the reactions

Step 6: Record the result and clean up

**2. Reactions of silver halides:**

a. Section 1: Reactions of Potassium Chloride (KCl):

Step 1: Prepare 2 test tubes with 10 drops of 0.5M KCl in each

Step 2: Drop 10 drops of 0.1M AgNO3 into both tubes

Step 3: Drop 10 drops of 2M NH4OH into tube #2

Step 4: Mix tubes gently and wait at least 2 minutes, observe the reactions

Step 5: Record the result and clean up

**b. Section 2: Reactions of Potassium Bromide (KBr):**

Step 1: Prepare 2 test tubes with 10 drops of 0.5M KBr in each

Step 2: Drop 10 drops of 0.1M AgNO3 into both tubes

Step 3: Drop 10 drops of 2M NH4OH into tube #2

Step 4: Mix tubes gently and wait at least 2 minutes, observe the reactions

Step 5: Record the result and clean up

**3. Reaction of H2O2 :**

Step 1: Prepare 3 test tubes with 1 drops of 0.1M KMnO4 in tube #1, 5 drops of 0.1M KI in tube #2, 10 drops of 3% H2O2 in tube #3

Step 2: Drop 5 drops of 2M H2SO4 into tube #1 and #2, put a pinch of MnO2 into tube #3

Step 3: Drop 5 drops of 3% H2O2 into tube #1 and #2

Step 4: Mix tubes gently and wait at least 2 minutes, observe the reactions

Step 5: Record the result and clean up

**4. Reactions of KMnO4:**

Step 1: Prepare 3 test tubes with 10 drops of 0.5M Na2SO3 in each

Step 2: Drop 5 drops of 2M H2SO4 into tube #1, 5 drops of 6M NaOH into tube #2, and 5 drops of distilled water into tube #3

Step 3: Drop 5 drops of 0.1M of KMnO4 into all tubes.

Step 4: Mix tubes gently and wait at least 2 minutes, observe the reactions

Step 5: Record the result and clean up

**5. Reactions of Fe2+ and Fe3+:**

a. Section 1: Ferric ion (Fe3+):

Step 1: Prepare 2 test tubes with 10 drops of 0.5M FeCl3 in each

Step 2: Drop 5 drops of 2M KOH into tube #1, 5 drops of 2M NH4OH into tube #2

Step 3: Mix tubes gently and observe the reactions

Step 4: Record the result and clean up

**b. Section 2: Ferrous ion (Fe2+):**

Step 1: Prepare 2 test tubes with 10 drops of 0.5M FeSO4 in each

Step 2: Drop 5 drops of 2M KOH into tube #1, 5 drops of 2M NH4OH into tube #2

Step 3: Mix tubes gently and observe the reactions

Step 4: Record the result and clean up

**6. Reactions of Al3+:**

Step 1: Prepare 2 test tubes with 10 drops of 0.5M Al2(SO4)3 in each

Step 2: Drop 5 drops of 2M NaOH into all tubes

Step 3: Mix tubes gently and observe the reactions

Step 4: Drop 20 drops of 2M HCl into tube #1, 20 drops 2M NaOH into tube #2

Step 5: Mix tubes gently and observe the reactions

Step 6: Record the result and clean up

**7. Flame test:**

Step 1: Light the Busen burner.

Step 2: Clean the loop with distilled water

Step 3: Dip the loop into the tested solution

Step 4: Hold the loop in the flame

Step 5: Record the dominant flame colour

Step 6: Clean the looped wire for the next solution

**Part 3. Results and Discussion**

**1. REACTIONS OF Cu2+**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M CuSO4**  **+ 2M NaOH** | From a blue-coloured liquid (CuSO4), it turned into a blue precipitate. | **CuSO4 + 2NaOH → Cu(OH)2↓ + Na2SO4** |
| **0.5M CuSO4**  **+ 2M NH4OH** | From a blue-coloured liquid (CuSO4), it turned into a light blue precipitate. | **CuSO4 + 2NH3 + 2H2O → Cu(OH)2↓ + (NH4)2SO4** |

**Discussion:** Cation Cu2+ reacts with anion OH- to form Cu(OH)2 precipitate.

**2. REACTIONS OF SILVER HALIDES**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M KCl**  **+ 0.1M AgNO3** | We mix silver nitrate and potassium chloride, we form a white precipitate of silver chloride. | **KCl + AgNO3 → KNO3 + AgCl (↓)** |
| **0.5M KCl**  **+ 0.1M AgNO3**  **+ 2M NH4OH** | This test tube has one state, after putting in the AgNO3 the substance turns white. After putting in NH4OH, we observe yellowish colour | **AgNO3 + KCl → AgCl↓ + KNO3**  **AgCl↓ + 2NH4OH → 2H2O + Ag(NH3)2Cl** |
|  |  |  |
| **0.5M KBr**  **+ 0.1M AgNO3** | After putting in AgNO3, the substance turns white, creating precipitation. | **KBr + AgNO3 → KNO3 + AgBr (↓)** |
| **0.5M KBr**  **+ 0.1M AgNO3**  **+ 2M NH4OH** | Precipitate forms as the material turns yellowish. | **AgNO3 + KBr → AgBr↓ + KNO3**  **AgBr+2NH4OH→2H2O+Ag(NH3)2Br** |

**Discussion:** Since the halogen group combines with the silver (Ag) to form precipitate and perform an "exchange reaction," this results in precipitate in the majority of our test cases.

**3. REACTIONS OF H2O2**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.1M KMnO4**  **+ 2M H2SO4**  **+ H2O2** | Deep purple colour disappeared after it was combined with acid and had air bubbles. | **2KMnO4 + 3H2SO4 + 5H2O2→ 8H2O + K2SO4 + 2MnSO4 + 5O2↑** |
| **0.1M KI**  **+ 2M H2SO4**  **+ H2O2** | After adding reactant, a grey solid substance was formed and then dissolved in H2O to create an orange colour liquid. | **2KI + H2SO4 + H2O2 → K2SO4 + 2H2O + I2↓** |
| **H2O2**  **+ MnO2** | After adding MnO2 (black), H2O2 created lots of air bubbles. | **2H2O2 -(MnO2)-> 2H2O + O2** |

**Discussion:** H2O2 is a reactive substance which react intensely with other chemical solutes and releasing O2

**4.** **REACTIONS OF KMnO4**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M Na2SO3**  **+ 2M H2SO4**  **+ 0.1M KMnO4** | Deep purple of KMnO4 disappeared and turned into a clear colour. | **2KMnO4 + 5Na2SO3 + 3H2SO4 → K2SO4 + 2MnSO4 + 5Na2SO4 + 3H2O** |
| **0.5M Na2SO3**  **+ 6N NaOH**  **+ 0.1M KMnO4** | It had solid substance, and the solution also turned reddish-brown. | **Na2SO3 + 2NaOH + 2KMnO4 → Na2MnO4 + Na2SO4 + K2MnO4 + H2O** |
| **0.5M Na2SO3**  **+ H2O**  **+ 0.1M KMnO4** | The solution turned dark-brownish and created a solid substance. | **2KMnO4 + 3Na2SO3 + H2O → 2MnO2 + 3Na2SO4 + 2KOH** |

**Discussion:**

- The chemical reaction between Na2SO3 and H2SO4 and KMnO4 with the solution turns clear liquid.

- The reaction of Na2SO3 after reacting with NaOH and KMnO4 respectively will give a reddish-brown solution and solid substance.

- The reaction of Na2SO3 and H2O and KMnO4 creates a dark-brownish solution mixture and solid substance after reacting.

**5. A. REACTIONS OF Fe3+**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M FeCl3**  **+ 2M KOH** | -Before:  FeCl3: black brown  KOH: colourless  After:  Precipitation: red brown | FeCl3 + 3KOH → Fe(OH)3 ↓ + 3KCl |
| **0.5M FeCl3**  **+ 2M NH4OH** | -Before:  FeCl3: black brown  NH4OH: colourless  After:  Precipitation: red brown | **FeCl3 + 3NH4OH → Fe(OH)3↓ + 3NH4Cl** |

**Discussion: Fe(OH)3 is the combined precipitate from 2 ions, Fe3+ and OH- ions.**

**5. B. REACTIONS OF Fe2+**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M FeSO4**  **+ 2M KOH** | Before:  FeSO4, KOH: colourless  After:  Precipitation: cupid blue | **FeSO4 + 2KOH → K2SO4 + Fe(OH)2↓** |
| **0.5M FeSO4**  **+ 2M NH4OH** | Before:  FeSO4, NH4OH: colourless  After:  Precipitation: cupid blue | **FeSO4 + 2NH4OH → Fe(OH)2↓ + (NH4)2SO4** |

**Discussion: Fe(OH)2 is a combined precipitate from 2 ions, Fe2+ and OH- ions.**

**6. REACTIONS OF Al3+**

| **Reaction** | **Observation** | **Chemical Equation** |
| --- | --- | --- |
| **0.5M Al2(SO4)3**  **+ 2N NaOH**  **+ 2M HCl** | A glue-like substance formed and then got dissolved | **Al2(SO4)3 + 6NaOH → 3Na2SO4 + 2Al(OH)3 ↓**  **Al(OH)3 + 3HCl → AlCl3 + 3H2O** |
| **0.5M Al2(SO4)3**  **+ 2M NaOH**  **+ 2M NaOH** | A glue-like substance formed and then got dissolved | **Al2(SO4)3 + 6NaOH → 3Na2SO4 + 2Al(OH)3 ↓**  **Al(OH)3 + NaOH → NaAlO2 + 2H2O** |

**Discussion:** The two ions Al3+ and OH- combined to form Al(OH)3 and this is an amphoteric substance that can react to both NaOH and HCl.

**7. FLAME TEST**

| **Solution** | **Dominant flame colour** | **Wavelength (nm)** | **Frequency**  **(s−1)** | **Photon energy (J)** |
| --- | --- | --- | --- | --- |
| **LiCl** | Red | 701 | 4.28 x 1014 | 2.84 x 10-19 |
| **NaCl** | Yellow | 597 | 5.03 x 1014 | 3.33 x 10-19 |
| **KCl** | Lilac | 455 | 6.6 x 1014 | 4.37 x 10-19 |
| **CaCl2** | Yellowish-red | 622 | 4.82 x 1014 | 3.2 x 10-19 |
| **BaCl2** | Light green | 577 | 5.2 x 1014 | 3.45 x 10-19 |

**Discussion**:

*Explanation:*

*Table of wavelength information*

| **Dominant color** | **Approximate wavelength (nm)** |
| --- | --- |
| Red | 701 |
| Orange | 622 |
| Yellow | 597 |
| Green | 577 |
| Blue-violet | 455 |

* 1nm = 10-9 m
* Use the figures in the table (2) to write out the table (1).
* The relationship between the wavelength, frequency, and speed of an electromagnetic wave is given by the equation: *C= 𝜆 x 𝓋*

*With:*

C = 3 x 108 (m.s-1) : the speed of light

𝜆: the wavelengths (m)

𝓋: the frequency (s-1)

* And the energy per photon (in Joules) is given by the equation: *Ephoton = h x 𝓋*

*With:*

h =6.626 x 10-34 J.s

Follow the table (2) and equations, we can write out the table (1), then find the result.

*Comparing the result with the given information, we see some differences. Occurring these differences may be from the concentration of the solution. That is not the big influence on the result, so the numbers in the result table can be accepted.*

**Part 4. Conclusions**

Finally, all of the experiments allow us make explicit observations about typical chemical processes that we have learned about through illustrations in textbooks. To demonstrate, each reaction has distinct phenomena such as evaporation, precipitate synthesis, decomposition, single displacement, double displacement, combustion, acid-base, complex compound formation, flame test color, and oxidation-reduction processes, all of which aid in the definition of chemical properties. Furthermore, completing several experiments not only makes the learning atmosphere less monotonous, but it also teaches pupils traits such as shyness, patience, and group work. During the lecture, the group setup functioned nicely, with two members carrying out each experiment to ensure that the procedure occurred continually. The implementation of obtaining a solution, producing a datasheet, and seeing color was satisfactory.

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