Identification of ions will involve the use of the following tests:

- **Precipitation**: Formation of an insoluble solid formed in a solution by a chemical reaction.
- **Complexation**: Formation of a soluble complex ion.
- **Gas Evolution**: Formation and release of gas bubbles (bubbling) from the reaction mixture.
- **Flame**: Appearance of a characteristic color when heated in a non-luminous flame.

Some tests will involve a change in the clarity of a sample. Clarity or appearance of a solution can be categorized as follows:

- **Clear or transparent**: Visibility through solution with no distortion (No precipitate is present).
- **Hazy or translucent**: Visibility through solution is possible, but slight distortion occurs.
- **Opaque or non-transparent**: "Milky" or white opaque solution. No visibility through the solution.
- **Turbid**: Non-uniform opaqueness with separate particles not being visible in the mixture.
## CHM1033 Lab Chemistry for Health Sciences
### Exp No. 3: Physiologically Important Ions

Summary of cations (metal and polyatomic) that are to be tested on Experiment 3:

<table>
<thead>
<tr>
<th>Cation</th>
<th>Known Solution</th>
<th>Positive Identification</th>
<th>Reagent or test to be used for ID</th>
<th>Procedure (Refer to CHM 1033 Lab manual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe +3</td>
<td>FeCl₃ Iron (III) Chloride 5% Solution</td>
<td>Formation of a blood-red colored complex upon reaction with ammonium thiocyanate</td>
<td>NH₄SCN (10% Solution) Ammonium thiocyanate</td>
<td>1) Place about 2 ml of 5% Iron (III) Chloride (FeCl₃) solution in a test tube 2) Add 10% ammonium thiocyanate drop wise until deep red color appear 3) Mix gently 4) Formation of blood-red ppt Fe(SCN)₃ confirms presence of Fe +3 ion.</td>
</tr>
<tr>
<td>Na +1</td>
<td>NaCl Sodium Chloride 10% Solution</td>
<td>Intense yellow color produced in a flame test</td>
<td>Wire loop dipping / burner flame test</td>
<td>1) Adjust burner flame to blue non-luminous 2) Clean wire loop by repeadtedly by dipping it in conc HCl and heating it into the flame until it glows and gives off no characteristic color 3) Dip clean wire loop into NaCl solution and place it in the flame</td>
</tr>
<tr>
<td>K +1</td>
<td>KCl Potassium Chloride 10% Solution</td>
<td>Violet color produced in a flame test</td>
<td>Wire loop dipping / burner flame test</td>
<td>1) Adjust burner flame to blue non-luminous 2) Clean wire loop by repeadtedly by dipping it in conc HCl and heating it into the flame until it glows and gives off no characteristic color 3) Dip clean wire loop into KCl solution and place it in the flame</td>
</tr>
<tr>
<td>Ca +2</td>
<td>Ca(NO₃)₂ Calcium Nitrate 0.1 M Solution</td>
<td>Formation of calcium oxalate white precipitate upon reaction with sodium oxalate</td>
<td>Na₂C₂O₄ Sodium Oxalate (0.1 M Solution)</td>
<td>1) Place about 1 ml of 0.1 M calcium nitrate Ca(NO₃)₂ into a test tube 2) Add a few drops of 0.1 M sodium oxalate solution Na₂C₂O₄ 3) Warm mixture gently in a water bath for a few minutes and mix well 4) Cool to room temp and allow to stand in test tube rack for at least 5 min 5) Presence of white precipitate CaC₂O₄ confirms calcium ion</td>
</tr>
<tr>
<td>Ca +2</td>
<td>Ca(NO₃)₂ Calcium Nitrate 0.1 M Solution</td>
<td>Orange-red color produced in a flame test</td>
<td>Wire loop dipping / burner flame test</td>
<td>1) In a test tube, mix 1 ml of 0.1 M calcium nitrate Ca(NO₃)₂ solution with a few drops of 6 M Hydrochloric acid solution HCl 2) Clean the wire loop and perform flame test as referenced above</td>
</tr>
<tr>
<td>Zn +2</td>
<td>Zn(NO₃)₂ Zinc (II) Nitrate 0.1 M Solution</td>
<td>Formation of zinc sulfide (ZnS) precipitate, white, opaque, fine, slow-form The only white insoluble sulfide precipitate</td>
<td>Ammonium hydroxide (6 M Sltn) NH₄OH Thioacetamide (1 M Sltn) C₂H₄NS</td>
<td>1) Place 1 ml Zinc (II) Nitrate (0.1 M Solution) Zn(NO₃)₂ into a test tube 2) Add several drops of ammonium chloride (6 M solution) NH₄Cl 3) Add 1 drop of ammonium hydroxide (6 M solution) NH₄OH 4) Add a few drops of thioacetamide (1M solution) C₂H₄NS 5) Heat gently in a water bath for 1 – 2 minutes. Observe white precipitate.</td>
</tr>
<tr>
<td>NH₄ (+1)</td>
<td>NH₄NO₃ Ammonium nitrate 0.1 M Solution</td>
<td>NaOH converts NH₄ (+1) into ammonia NH₃. NH₃ vapors turn moist red litmus paper to blue (Also characteristic odor)</td>
<td>NaOH (6 M Solution) Red litmus paper</td>
<td>1) Place 2 ml Ammonium nitrate (0.1 M Solution) NH₄NO₃ in a test tube 2) Add a few drops Sodium hydroxide (6M solution) NaOH. 3) Moisten a red litmus paper and hold it at the entrance of the test tube 4) Gently heat the test tube while agitating it. Do not allow solution to boil 5) When litmus paper turns blue, cautiously smell the vapors coming out of the test tube to detect ammonia odor (See Instructor for precautions)</td>
</tr>
</tbody>
</table>
# CHM1033 Lab Chemistry for Health Sciences
## Exp No. 3: Physiologically Important Ions

### Summary of anions (nonmetal and polyatomic) that are to be tested on Experiment 3:

<table>
<thead>
<tr>
<th>Anion</th>
<th>Known Solution</th>
<th>Positive Identification</th>
<th>Reagent or test to be used for ID</th>
<th>Procedure (Refer to CHM 1033 Lab manual)</th>
</tr>
</thead>
</table>
| Cl (-1)| NaCl (Sodium Chloride 0.1 M Solution)   | Formation of a white precipitate upon reaction with silver nitrate   | Silver Nitrate AgNO₃ (0.1 M Solution) | 1) Place 1 ml sodium chloride solution (0.1 M NaCl) in a test tube  
2) Add a few drops of silver nitrate (0.1 M solution, AgNO₃). Observe ppt formation.  
3) Verify presence of chloride ion by adding NH₄OH (6 M solution) in 2-3 drop increments until the precipitate dissolves.  
4) Re-precipitate the silver chloride by adding Nitric Acid (6M Solution, HNO₃) in 2–3 drop increments until solution is acid to litmus paper (turns blue Litmus paper to red). Observe AgCl white ppt forms again. |
| PO₄ (-3)| Na₃PO₄ (Sodium Phosphate 0.1 M Solution) | Formation of yellow precipitate of ammonium phosphomolybdate upon reaction with ammonium molybdate | Nitric Acid (6M solution, HNO₃) [NH₄]₆Mo₇O₂₄ | 1) Place 1 ml of sodium phosphate (0.1 M sltn, Na₃PO₄) in a test tube  
2) Add 1 ml nitric acid (6M solution, HNO₃)  
3) Add 1 ml ammonium molybdate (0.5 M solution) [NH₄]₆Mo₇O₂₄  
4) Mix thoroughly. Place test tube in a beaker of boil water for 5 minutes  
5) Remove test tube and allow to stand in rack for at least 10 minutes.  
6) Yellow precipitate that identifies the phosphate ion forms quite slowly. |
| SO₄ (-2)| Na₂SO₄ (Sodium Sulfate 0.1 M Solution) | Formation of a white precipitate upon reaction with barium chloride | Hydrochloric acid (6M solution, HCl) BaCl₂ (0.1 M solution) | 1) Place 1 ml of sodium sulfate (0.1 M solution, Na₂SO₄) in a test tube  
2) Add 1 ml hydrochloric acid (6M solution, HCl)  
3) Add 3-4 drops of barium chloride (0.1 M solution, BaCl₂). Mix gently.  
4) Warm test tube in water bath for several minutes.  
5) Place test tube in rack. Cool to room temp. Allow to stand for 5 minutes  
6) Presence of white precipitate (BaSO₄) confirms presence of sulfate ion. |
| CO₃ (-1)| Na₂CO₃ (Solid) | Carbonate and bicarbonate ions produce gassing upon reaction with conc acids | Hydrochloric Acid (Concentrated, HCl) | 1) Place a small portion of sodium carbonate in a test tube.  
2) Place test tube in a test tube rack  
3) Add 3-4 drops of conc. hydrochloric acid (HCl) to just cover the solid.  
4) Allow the test tube to stand and observe.  
5) Carbon dioxide gas CO₂ is released as fizzing occurs. |

Record all observations on the CHM 1033 Lab manual data sheets.