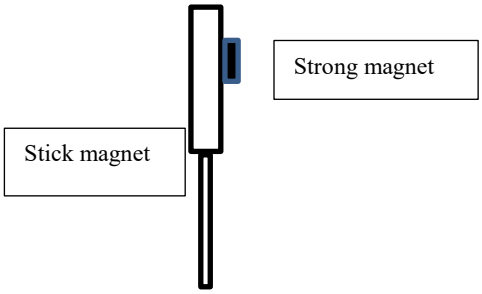
Paramagnetic and Diamagnetic Salts



Chemicals and Equipment Needed

- Paramagnetic and Diamagnetic Salt set-up
  – **on top of R (flammables cabinet)**
  - Ringstand and buret clamps
  - Meter stick
  - Micro test tubes of $MnSO_4$, $FeSO_4$, $NiSO_4$, $ZnSO_4$
- Stick Magnet with neodymium magnet on it – **M2**

Preparation

- Place all items on the lab bench

Presentation

- Place the set-up so the students can see the salts in the order Mn-Fe-Ni-Zn. Make sure the test tubes are still and not swaying.
- Bring the magnet close to $MnSO_4$ tube. When the magnet is within a few millimeters of the tube, the test tube will begin to sway or precess in the presence of the magnetic field. The magnet is strong enough that you may be able to pull the test tube several millimeters away from its rest position.
- After perturbing the tube of $MnSO_4$, bring the magnet close to the other tubes, one by one. The effect of $FeSO_4$ will be somewhat smaller than the effect on $MnSO_4$. The effect on $NiSO_4$ will be smaller yet, and the tube of $ZnSO_4$ will show no response at all.

Discussion

- A paramagnetic substance is attracted weakly by a strong magnetic field. The attraction results from interactions of the magnetic field with the unpaired electrons in the substance. Manganese (II), iron (II), nickel (II), and zinc (II) contain 5, 4, 2, and 0 unpaired electrons, respectively.
- Thus $MnSO_4$, $FeSO_4$, $NiSO_4$ all respond to the magnetic field, but the attraction decreases as the number of unpaired electrons decreases.
- The tube of $ZnSO_4$ shows no response to the magnetic field because it has 0 unpaired electrons, and is therefore diamagnetic.

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AMM