

## Chem 108: Lab

Week 6

Sign in: Roster @ front of lab

Pick up Papers &amp; Handout

Write down your group number from the roster.

## Exp. 3 – Classification of Matter and Chemical Change

- Report Forms: *One form for each lab partner are both to be turned in; stapled together. Neatest one on top.*
- Check sig figs are correct and units included

- Show example of each type of calculation

- Answer questions legibly in complete sentences.

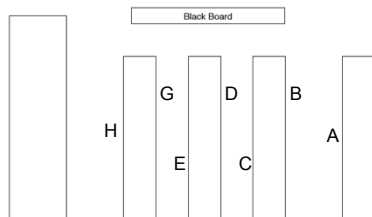
Individually complete on-line post-lab questions and submit:

<http://www.chemconnections.org/general/chem108/Physical%20Properties.html>  
DUE Today

## Chem 108: Lab

Week 6

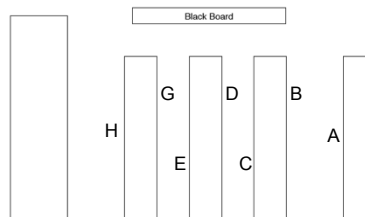
Using your group number from the roster, consult the Lab Map for your location, move to that area on the map and introduce yourself to your team members. Read today's handouts. Each of you, pick one partner who is in your group.



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Pick up one unknown for you & your partner  
( 2 unknowns per group )

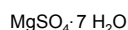


## Hydrates

Handout: Replace page #29 in Lab Manual  
PERCENT WATER IN A HYDRATE

A hydrate is a solid substance, which contains water bound within the crystal lattice of a salt. Water molecules are present in definite proportions in hydrates. Epsom salts, also known as the mineral *epsomite*, is pure magnesium sulfate heptahydrate,  $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$ . There are seven water molecules present for every one molecule of the salt. Magnesium sulfate heptahydrate can react to produce other hydrates with one, two, three and six molecules of water respectively for each magnesium sulfate. The common name, Epsom salts, comes from the name of a small town in England where in the early 1600s the town's well water was regarded as being curative. Today, it is still regarded as being able to treat splinters, scrapes, insect bites, minor sprains and bruises, to produce lush, healthy lawns, vibrant plants and vegetables as well as a smoother softer skin, and to provide relief from everyday stress. In Shakespeare's 17th century, no one understood the therapeutic mystery of the town's water, and it wasn't until many, many decades later that modern chemistry identified the active mineral component as this particular hydrate.

magnesium sulfate heptahydrate



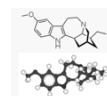
## Chemical Formulas and Unambiguous Names

<http://www.chemconnections.org/general/chem108/Nomenclature.htm>

- Molecular Formula:
- Elements' Symbols = atoms
- Subscripts = relative numbers of atoms
- How are compounds named?



$\text{C}_{20}\text{H}_{26}\text{N}_2\text{O}$   
(Ibogaine)  
Tabernaemontana iboga



### Experiment 4 Lab Manual pp. 26-27

#### Hydrates

##### Background

It is common for salts (ionic compounds) to be hydrated; that is, to have specific amounts of water bonded to the ions in the salt. This water is called water of hydration or water of crystallization. Some examples of hydrated salts are:  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ ,  $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ ,  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ ,  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ . In the formula a dot precedes the number of moles of water per mole of anhydrous (without water) compound. The water molecules are usually not strongly held and often can be removed by heating.



If a weighed hydrate sample is heated and then weighed again, the mass of water released can be determined and the percent water calculated. For example if a 10.00 g sample of a hydrate is found to have a mass of 8.53 g after heating, then the mass of water released can be calculated as follows:

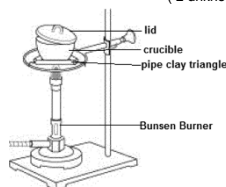
$$10.00 \text{ g} - 8.53 \text{ g} = 1.47 \text{ g}$$

and the percent water is:

$$\frac{1.47 \text{ g}}{10.00 \text{ g}} = 14.7 \%$$

This experiment is in two parts. In the first part you will verify that when a hydrate is heated, water is produced. The presence of water can be detected by using paper saturated with anhydrous cobalt (II) chloride.  $\text{CoCl}_2$ , which is blue, reacts with water to form  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ .

### One unknown for you & your partner ( 2 unknowns per group )

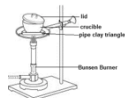


Unknown number	
Mass, crucible + lid + hydrate sample	
Mass, crucible + lid	
Mass, hydrate sample*	
Mass, crucible + lid + anhydrous product (2nd heating)	
Mass, crucible + lid + anhydrous product (3rd heating)	
Mass, crucible + lid + product (2nd heating if necessary)	
Mass, water lost*	
Percent water in hydrate*	

Show the calculations for each of the entries in the Data Table marked with \* on the calculations page.



Using your unknown, complete the procedure, and accurately record all data on your individual Report Form.



#### Determination of Percent Water in a Hydrate

Unknown number	
Mass, crucible + lid + hydrate sample	
Mass, crucible + lid	
Mass, hydrate sample*	
Mass, crucible + lid + anhydrous product (2nd heating)	
Mass, crucible + lid + anhydrous product (3rd heating)	
Mass, crucible + lid + product (2nd heating if necessary)	
Mass, water lost*	
Percent water in hydrate*	

Show the calculations for each of the entries in the Data Table marked with \* on the calculations page.

##### 1) Name the following hydrates:



##### 2) Write formulas for the following hydrates:



Report Form - Hydrates

29

Show completed pg. 29 data & questions (both sides except Post-Lab Question) on individual Reports to Dr. R. before leaving lab.

### Hydrates

#### Page #29 Handout: Opposite side from Data Table

After completing the heating and data form for your unknown, calculate the % water in the following samples. Show your calculations on your individual handout page to Dr. R. before leaving lab.

An "Epsom" salt sample (A) of 10.00 g was heated and re heated until it reached a "constant" mass of 5.70 g. What is the % water in the sample?

An "Epsom" salt sample (B) of 10.00 g was heated and re heated until it reached a "constant" mass of 4.88 g. What is the % water in the sample?

### Nomenclature

#### Unambiguous Chemical Names

<http://www.chemconnections.org/general/chem108/Nomenclature.htm>

Group is to complete Lab manual pages 109-114.

1 Set of pages per group  
DUE Next Lab

##### Post-Lab Question:

##### Handout

Spectroscopic satellite analysis of the composition of the moon was completed during the Clementine and subsequent NASA missions. The data indicates that water is present on the moon and there may be enough to allow human colonization. The water is tied up in rock (hydrates) and as ice. A notable hydrate for its high water content is Glauber's salt, sodium sulfate decahydrate. If a human were to require the equivalent of 2 liters of water per day, how many kilograms of Glauber's salt would need to be processed per month to meet one person's need. Assume a month is 30 days and that all of the water in the salt is recovered in the process. Glauber's Salt is 56% water by weight.

Include answer plus calculation on individual Lab Reports  
DUE Next Lab