HYDRATE Experiment

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, $MgSO_4 \cdot 7\ H_2O$. 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.

After completing the heating and data form for your unknown, calculate the % water in the following samples.
Show your calculations 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?

Post-Lab Question:
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.

Solve the problem and attach your clearly written calculation/solution to your report form to turn-in.

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 (1st heating)	
Mass, crucible + lid + anhydrous product (2nd heating)	
Mass, crucible + lid + product (3rd 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:

   $CoSO_4 \cdot 6\ H_2O$

   $MgCl_2 \cdot 6\ H_2O$

   $CuSO_4 \cdot 5\ H_2O$

2) Write formulas for the following hydrates:

   Sodium dihydrogenphosphate nonahydrate

   Potassium chromate tetrahydrate

   Lead (II) acetate trihydrate