Water of crystallisation

1   The value of x in $MgSO_4 \cdot xH_2O$ can be found by heating it.

mass of crucible / g	30.34
mass of crucible + $MgSO_4 \cdot xH_2O$ / g	32.80
mass of crucible + $MgSO_4$ / g	31.54

(a)   Both hydrated and anhydrous magnesium sulfate are white/colourless solids. Explain how you could confirm that all the water has been given off in this experiment.   [3]

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(b)   Calculate the number of moles of $MgSO_4$ left at the end of the experiment   [2]

(c)   Calculate the number of moles of water given off when the $MgSO_4 \cdot xH_2O$ is heated.   [3]

(d)   Calculate the value of x.   [2]

2   Calculate the value of x in the formula $Na_2S_2O_3 \cdot xH_2O$ if 2.48 g of hydrated sodium thiosulfate produces 1.58 g of anhydrous sodium thiosulfate ($Na_2S_2O_3$).   [4]

Moles of $Na_2S_2O_3$ …………………………………………………

Mass of water   …………………………………………………..
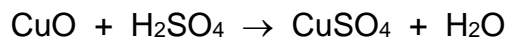
Moles of water   …………………………………………………..

Value of x   ……………………

3   The formula of hydrated copper sulphate is $CuSO_4 \cdot 5H_2O$.   How much anhydrous copper sulphate is obtained when 5.00 g of hydrated copper sulphate is heated?   [3]

Water of crystallisation

4   Calculate the mass of 0.12 mol $Na_2CO_3.10H_2O$ [2]

5   A class of students is asked to prepare some copper(II) sulfate by reacting sulfuric acid with copper(II) oxide. The equation for the reaction is:

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

The students carry out this reaction by adding excess copper(II) oxide to 50.0 cm^3 of 1.00 mol/dm^3 sulfuric acid, which is 0.0500 mol.

The students filter off the copper(II) oxide and allow crystals of hydrated copper(II) sulfate, $CuSO_4.5H_2O$, to form. They then dry them in the oven

(a)   (i)   Write an equation including state symbols for the crystallisation reaction.   [2]

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       (ii)   Calculate the maximum mass of crystals that could be formed.   [2]

(b)   (i)   Rosalie obtained 10.20 g of crystals. Calculate the percentage yield.   [2]

       (ii)   Molly obtained 12.80 g of crystals. Explain why this value tells you that something went wrong with her experiment and suggest what could have caused this.   [2]

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6   Iron(II) sulfate crystals ($FeSO_4.7H_2O$) can be made by reacting iron wire with dilute sulfuric acid. Calculate the maximum amount of crystals that could be made from 5.00 g of iron wire.[3]