15.00 g aluminum sulfide and 10.00 g water react until the limiting reagent is used up. Here is the balanced equation for the reaction:

Al2S3 + 6 H2O ---> 2Al(OH)3 + 3 H2S

(A) Which is the limiting reagent?  
(B) What is the maximum mass of H2S which can be formed from these reagents?  
(C) How much excess reagent remains after the reaction is complete?

**(A) Solution for limiting reagent**

Determine the moles of Al2S3 and H2O

aluminum sulfide: 15.00 g ÷ 150.158 g/mol = 0.099895 mol  
water: 10.00 g ÷ 18.015 g/mol = 0.555093 mol

Divide each mole amount by equation coefficient

aluminum sulfide: 0.099895 mol ÷ 1 mol = 0.099895  
water: 0.555093 mol ÷ 6 mol = 0.0925155

The water is the lesser amount; it is the limiting reagent.

**(B) Solution for mass of H2S formed**

Now that we know the limiting reagent is water, this problem becomes "How much H2S is produced from 10.00 g of H2O and excess aluminum sulfide?"

Determine moles of 10.00 g of H2O

water: 10.00 g ÷ 18.015 g/mol = 0.555093 mol

Use molar ratios to determine moles of H2S produced from above amount of water.

(a) the H2O/H2S ratio is 6/3, a 2/1 ratio.  
(b) water is associated with the two. This means the H2S amount is one-half the water value = 0.2775465 mol.

Convert moles of H2S to grams.

0.2775465 mol x 34.0809 g/mol = 9.459 g

**(C) Solution for excess reagent remaining**

We will use the amount of water to calculate how much Al2S3 reacts, then subtract that amount from 15.00 g.

Determine moles of 10.00 g of H2O

water: 10.00 g ÷ 18.015 g/mol = 0.555093 mol

Use molar ratios to determine moles of Al2S3 that reacts with the above amount of water.

(a) the Al2S3/H2O ratio is 1/6  
(b) water is associated with the 6. This means the Al2S3 amount is one-sixth the water value = 0.09251447 mol

Convert moles of Al2S3 to grams.

0.09251447 mol x 150.158 g/mol = 13.891943 g

However, we are not done. We were asked for the amount remaining and the answer just above is the amount which was used up, so the final step is:

15.00 g - 13.891943 g = 1.108 g