Question #62986, Chemistry / General Chemistry

For the following reaction, 66.3 grams of barium hydroxide are allowed to react with 41.8 grams of sulfuric acid.
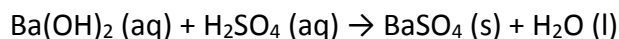
barium hydroxide (aq) + sulfuric acid (aq) barium sulfate (s) + water (l)

What is the maximum amount of barium sulfate that can be formed? grams

What is the FORMULA for the limiting reagent?

What amount of the excess reagent remains after the reaction is complete? grams

Solution:
$Ba(OH)_2$ (aq) + H_2SO_4 (aq) $\rightarrow$ $BaSO_4$ (s) + H_2O (l)
$M_r(Ba(OH)_2)$ = 171.34 g/mol
$M_r(H_2SO_4)$ = 98.079 g/mol
$M_r(BaSO_4)$ = 233.43 g/mol

According to the above equation, amount of sulfuric acid required to react with 1 mol of barium hydroxide is 1 mol.

$$n(Ba(OH)_2) = \frac{m(Ba(OH)_2)}{M_r(Ba(OH)_2)} = \frac{66.3\ g}{171.34\frac{g}{mol}} = 0.387\ mol$$

$$n(H_2SO_4) = \frac{m(H_2SO_4)}{M_r(H_2SO_4)} = \frac{41.8\ g}{98.079\frac{g}{mol}} = 0.426\ mol$$

the limiting reagent is $Ba(OH)_2$!
the maximum amount of barium sulfate that can be formed is:

$$n(BaSO_4) = n(Ba(OH)_2) = 0.387\ mol$$
$$m(BaSO_4) = n(BaSO_4) \times M_r(BaSO_4)$$
$$m(BaSO_4) = 0.387\ mol \times 233.43\frac{g}{mol} = 90.34\ g$$

amount of the excess reagent remains after the reaction is complete is:

$$m(H_2SO_4) = \Delta n(H_2SO_4) \times M_r(H_2SO_4) = (0.426\ mol - 0.387\ mol) \times 98.079\frac{g}{mol}$$
$$= 3.83\ g$$

Answer:
the limiting reagent is $Ba(OH)_2$!
the maximum amount of barium sulfate that can be formed is 90.34 g!
the amount of the excess reagent remains after the reaction is complete is 3.83 g