COMPUTE

$$500.\ \text{g}\ \cancel{\text{CH}_4} \times \frac{1\ \text{mol}\ \cancel{\text{CH}_4}}{16.05\ \text{g}\ \cancel{\text{CH}_4}} \times \frac{2\ \text{mol}\ \cancel{\text{H}_2\text{O}}}{1\ \text{mol}\ \cancel{\text{CH}_4}} \times \frac{18.02\ \text{g}\ \text{H}_2\text{O}}{1\ \text{mol}\ \cancel{\text{H}_2\text{O}}} = 1.12 \times 10^3\ \text{g}\ \text{H}_2\text{O}$$

EVALUATE

Are the units correct?

Yes; mass of H_2O was required, and units canceled to give grams H_2O.

Is the number of significant figures correct?

Yes; three significant figures is correct because the mass of CH_4 was given to three significant figures.

Is the answer reasonable?

Yes; CH_4 and H_2O have similar molar masses, and twice as many moles of H_2O are produced as moles CH_4 burned. So, you would expect to get a little more than 1000 g of H_2O.

Practice

1. Calculate the mass of silver bromide produced from 22.5 g of silver nitrate in the following reaction:

$$2AgNO_3(aq) + MgBr_2(aq) \rightarrow 2AgBr(s) + Mg(NO_3)_2(aq)$$ **ans: 24.9 g AgBr**

2. What mass of acetylene, C_2H_2, will be produced from the reaction of 90. g of calcium carbide, CaC_2, with water in the following reaction?

$$CaC_2(s) + 2H_2O(l) \rightarrow C_2H_2(g) + Ca(OH)_2(s)$$ **ans: 37 g C_2H_2**

3. Chlorine gas can be produced in the laboratory by adding concentrated hydrochloric acid to manganese(IV) oxide in the following reaction:

$$MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + 2H_2O(l) + Cl_2(g)$$

a. Calculate the mass of MnO_2 needed to produce 25.0 g of Cl_2. **ans: 30.7 g MnO_2**

b. What mass of $MnCl_2$ is produced when 0.091 g of Cl_2 is generated? **ans: 0.16 g $MnCl_2$**