

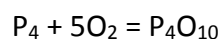
## Answer on Question #43920 - Chemistry - Inorganic Chemistry

### Task:

What is the theoretical yield (in grams) of  $P_4O_{10}$  if 35.8 g of  $P_4$  are reacted with 40.0 g of  $O_2$ ?

### Solution:

1. The chemical equation for the reaction is



2. The number of moles of  $P_4$  is

$$n(P_4) = \frac{m(P_4)}{M(P_4)} = \frac{35.8 \text{ g}}{31 \frac{\text{g}}{\text{mol}} \cdot 4} = 0.289 \text{ mol}$$

3. The number of moles of  $O_2$  is

$$n(O_2) = \frac{m(O_2)}{M(O_2)} = \frac{40.0 \text{ g}}{16 \frac{\text{g}}{\text{mol}} \cdot 2} = 1.25 \text{ mol}$$

4. According to the equation the ratio of number of moles is  $n(P_4) : n(O_2) = 1 : 5$

$n(P_4) = n(O_2)/5 = 1.25/5 = 0.25 \text{ mol}$ , but we have more  $P_4$  than we need according to the equation. That means that  $O_2$  is limiting reagent and we have to use  $n(O_2)$  for calculations.

5. The number of moles of  $P_4O_{10}$  is

$$n(P_4O_{10}) = \frac{n(O_2)}{5} = \frac{1.25 \text{ mol}}{5} = 0.25 \text{ mol}$$

6. The mass of  $P_4O_{10}$  is

$$m(P_4O_{10}) = n(P_4O_{10}) \cdot M(P_4O_{10}) = 0.25 \cdot 284 = 71 \text{ g}$$

### Answer:

$$m(P_4O_{10}) = 71 \text{ g}$$