Answer on Question #61188 - Chemistry - General Chemistry

Question:

1. A train is carrying three cars of concentrated phosphoric acid (assume that it is 85% by weight) to deliver it in a manufacturing plant. The train got into an accident and all of the acid were spilled due to derailment. If 150,000 lbs of potassium hydroxide was used to neutralize the acid, what is the amount (in kg) of concentrated phosphoric acid that was spilled due to derailment?
H3PO4 + KOH -> K3PO4 + H2O
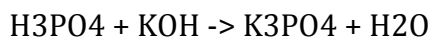
Solution:

1) Balance the proposed reaction equation:

$H_3PO_4 + 3KOH \rightarrow K_3PO_4 + 3H_2O$
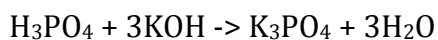
Equation shows that the acid and the alkali react in molar ratio 1:3

2) Calculate the mass ratio from the molar ratio (rounded to integer):

1 mole of $H_3PO_4$ = 3*1+31+4*16 = 98 g

3 moles of KOH = 3* (39+16+1) = 168 g

So 98 g of $H_3PO_4$ is completely neutralized with 168 g of KOH (or 98 kg to 168 kg).

3) Convert amount of alkali to kilograms:

1 lb = 0.4536 kg.

150,000 lbs = 150,000 * 0.4536 = 68,040 kg.

4) From the ratio found on step 2) calculate the mass of the pure acid (m) in solution:

m = (68,040 * 98)/168 = 39,690 kg.

5) Calculate total mass (M) of phosphoric acid solution:

M = m / (% concentration/100) = 39,690/(85/100) = 46,694 kg.

**Answer:**

The amount of concentrated phosphoric acid that was spilled due to derailment is **46,694 kg**