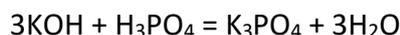


Answer on Question#61226 – Chemistry – Organic chemistry

Question: 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?

Solution:

Reaction between acid and hydroxide:



Mass of potassium hydroxide:

$$m(\text{KOH}) = 150,000 \text{ lbs} = 68,039 \text{ kg} \quad (1\text{lbs} = 0.453592 \text{ kg}) = 68,039,000 \text{ g}$$

Molar mass of potassium hydroxide:

$$M(\text{KOH}) = 56.11 \text{ g/mol}$$

Amount of substance of potassium hydroxide:

$$n(\text{KOH}) = \frac{m(\text{KOH})}{M(\text{KOH})} = \frac{68,039,000 \text{ g}}{56.11 \text{ g/mol}} = 1,212,600 \text{ mol}$$

Amount of substance of phosphoric acid (from reaction):

$$n(\text{H}_3\text{PO}_4) = \frac{1}{3}n(\text{KOH}) = 404,200 \text{ mol}$$

Molar mass of phosphoric acid:

$$M(\text{H}_3\text{PO}_4) = 97.99 \text{ g/mol}$$

Mass of phosphoric acid:

$$m(\text{H}_3\text{PO}_4) = n(\text{H}_3\text{PO}_4) \cdot M(\text{H}_3\text{PO}_4) = 404,200 \text{ mol} \cdot 97.99 \text{ g/mol} = 39,607,558 \text{ g}$$

Mass of concentrated phosphoric acid:

$$m(\text{concentrated phosphoric acid}) = \frac{m(\text{H}_3\text{PO}_4)}{w(\text{H}_3\text{PO}_4)} = \frac{39,607,558 \text{ g}}{0.85} = 46,597,127 \text{ g} = 46,597 \text{ kg}$$

Answer:

46,597 kg of concentrated phosphoric acid.