Answer on Question #77933, Chemistry / General Chemistry

what mass of aluminum oxide will be produced when 500.0 dm^3 of oxygen at STP react with aluminum?

Solution

$4Al + 3O_2 = 2Al_2O_3$

Find amount of substance of oxygen.

$n=V/V_m$;

where n- amount of substance of a gas, mol

V- volume of a gas, dm^3

V_m – volume of one mole of a gas at STP, $V_m = 22.4\ dm^3/mol$

$n(O_2)= 500.0/22.4 =22.3$ (mol)

According to equation 3 moles of O_2 give 2 moles of Al_2O_3

We have 22.3 mol of O_2 that give x mol of Al_2O_3

Solve the proportion: $\frac{3}{22.3} = \frac{2}{x}$

$x= 14.9$

$n(Al_2O_3)= 14.9$ mol

Find mass of aluminum oxide:

$m=M\cdot n$,

where n – amount of substance,

M= molar mass of a substance

m- mass of a substance

$Mr(Al_2O_3)= Ar(Al)\cdot 2 + Ar(O)\cdot 3= 27\cdot 2 +16\cdot 3=102$

Mr=M

$M(Al_2O_3)= 102$ g/mol

$m(Al_2O_3)= 102\cdot 14.9= 1519.8$ (g)

Answer: 1519.8 g