Answer on Question #68947, Physics / Other

If 1 gram HCl and 1 gram MnO₂ is burned, what will be the maximum weight of free Cl₂ gas?

Solution:

The balanced equation for this reaction is

$$4HCl + MnO_2 \rightarrow 2H_2O + Cl_2 + MnCl_2$$

Convert 1 g HCl to moles. To do this, we need to calculate the molecular mass of HCl: H=1.00794g/mol and Cl = 35.453 g/mol, so the molecular mass = 36.46094 g /mol.

To convert grams to moles, we divide the number of grams of substance by the molecular weight, so in this case we have:

$$\frac{1g}{36.46094 \, g/mol} = 0.0274 \, moles \, HCl.$$

Based on the ratios above, we know that the number of moles of Cl_2 produced is 1/4 the number of moles of HCl put in to the reaction, so moles Cl_2 =moles HCl/4

$$= 0.0274/4 = 0.00685$$
 moles

Convert 1 g MnO₂ to moles.

The molecular mass of MnO₂ = 54.938049 + 15.9994*2= 86.936 g/mol

To convert grams to moles, we divide the number of grams of substance by the molecular weight, so in this case we have:

$$\frac{1g}{86.936 \ g/mol} = 0.0115 \ moles \ MnO_2.$$

We can assume all of the HCl will be used up in the reaction, so HCl will be the limiting factor.

So, this reaction will produce 0.00685 moles of Cl₂

 $m = 0.00685 \cdot 35.453 \cdot 2 = 0.4857 \ g \approx 0.49 \ g$

Answer: 0.486 *g*

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