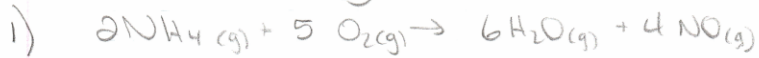


Particles, Mass, Volume, Molarity &
Energy Problems



a) $112\text{L NH}_4 \left(\frac{1\text{mol}}{22.4\text{L}} \right) \left(\frac{6\text{mol H}_2\text{O}}{2\text{mol NH}_4} \right) \left(\frac{22.4\text{L}}{1\text{mol}} \right) = 336\text{L}$

or $112\text{L NH}_4 \left(\frac{6\text{L H}_2\text{O}}{2\text{L NH}_4} \right) = 336\text{L H}_2\text{O}$

since they are all gases.

b) $8.96\text{L NH}_4 \left(\frac{5\text{L O}_2}{2\text{L NH}_4} \right) = 22.4\text{L O}_2$

c) $134\text{L H}_2\text{O} \left(\frac{2\text{L NH}_4}{6\text{L H}_2\text{O}} \right) = 44.7\text{L NH}_4$

d) $1.20 \times 10^{24}\text{ mcl NO} \left(\frac{5\text{O}_2}{4\text{ mcl NO}} \right) = 1.50 \times 10^{24}\text{ mcl O}_2$

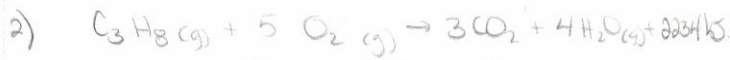
e) $224\text{L O}_2 \left(\frac{4\text{L NO}}{5\text{L O}_2} \right) \left(\frac{1\text{mol NO}}{22.4\text{L}} \right) \left(\frac{30\text{g}}{1\text{mol}} \right) = 240.0\text{g NO}$

f) $34.1\text{g NH}_4 \left(\frac{1\text{mol NH}_4}{18.0\text{g}} \right) \left(\frac{6\text{mol H}_2\text{O}}{2\text{mol NH}_4} \right) \left(\frac{6.02 \times 10^{23}\text{ mcl}}{1\text{mol}} \right) = 3.42 \times 10^{24}\text{ mcl H}_2\text{O}$

g) $6.02 \times 10^{24}\text{ mcl NH}_4 \left(\frac{\text{mol}}{6.02 \times 10^{23}\text{ mcl}} \right) \left(\frac{22.4\text{L}}{1\text{mol}} \right) = 448\text{L}$

$360.\text{g O}_2 \left(\frac{\text{mol}}{32.0\text{g}} \right) \left(\frac{22.4\text{L}}{2\text{mol}} \right) = 202\text{L}$

1st is more.



$$a) 5.60 \text{ L C}_3\text{H}_8 \left(\frac{5 \text{ L O}_2}{1 \text{ L C}_3\text{H}_8} \right) \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) = 1.25 \text{ mol O}_2$$

$$b) 0.800 \text{ mol C}_3\text{H}_8 \left(\frac{5 \text{ mol O}_2}{1 \text{ mol C}_3\text{H}_8} \right) \left(\frac{6.02 \times 10^{23} \text{ mcl}}{1 \text{ mol}} \right) = 2.41 \times 10^{24} \text{ mcl}$$

$$c) 6.00 \text{ L C}_3\text{H}_8 \left(\frac{3 \text{ L CO}_2}{1 \text{ L C}_3\text{H}_8} \right) = 18.0 \text{ L CO}_2$$

$$d) 3.60 \times 10^{22} \text{ mcl H}_2\text{O} \left(\frac{5 \text{ mcl O}_2}{4 \text{ mcl H}_2\text{O}} \right) = 4.50 \times 10^{22} \text{ mcl O}_2$$

$$e) 1.17 \times 10^3 \text{ kJ} \left(\frac{1 \text{ mol C}_3\text{H}_8}{2234 \text{ kJ}} \right) = 0.524 \text{ mol C}_3\text{H}_8$$

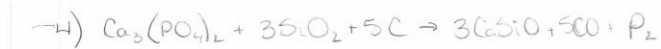
$$f) 280.0 \text{ L O}_2 \left(\frac{2234 \text{ kJ}}{5 \text{ L O}_2} \right) = 1.251 \times 10^5 \text{ kJ}$$

$$g) 4.92 \times 10^3 \text{ kJ} \left(\frac{1 \text{ mol C}_3\text{H}_8}{2234 \text{ kJ}} \right) \left(\frac{44.0 \text{ g}}{1 \text{ mol C}_3\text{H}_8} \right) = 96.9 \text{ g C}_3\text{H}_8$$

$$h) 89.6 \text{ L} \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) \left(\frac{3 \text{ mol CO}_2}{1 \text{ mol C}_3\text{H}_8} \right) \left(\frac{6.02 \times 10^{23} \text{ mcl}}{1 \text{ mol CO}_2} \right) = \frac{1.62 \times 10^{26} \text{ mcl}}{7.22 \times 10^{24} \text{ mcl}}$$



$$50.0 \text{ L} \left(\frac{6.6 \text{ mol C}_8\text{H}_{18}}{1 \text{ L}} \right) \left(\frac{16 \text{ mol CO}_2}{2 \text{ mol C}_8\text{H}_{18}} \right) \left(\frac{44.0 \text{ g}}{1 \text{ mol CO}_2} \right) = 1.16 \times 10^5 \text{ g} = 116 \text{ kg}$$



$$- a) 75 \text{ atoms C} \left(\frac{1 \text{ mol C}}{1 \text{ atom C}} \right) \left(\frac{1 \text{ mol P}}{5 \text{ mol C}} \right) \left(\frac{2 \text{ atoms P}}{1 \text{ mol P}} \right) = 30 \text{ atoms P}$$

$$- b) 186 \text{ g P} \left(\frac{1 \text{ mol}}{68.0 \text{ g}} \right) \left(\frac{5 \text{ mol C}}{1 \text{ mol P}} \right) = 15.0 \text{ mol C}$$

$$- c) 224 \text{ L CO} \left(\frac{1 \text{ mol CO}}{22.4 \text{ L}} \right) \left(\frac{1 \text{ mol Ca}_3(\text{PO}_4)_2}{5 \text{ mol CO}} \right) \left(\frac{310.3 \text{ g}}{1 \text{ mol}} \right) = 681 \text{ g}$$

$$- d) 3.00 \times 10^{25} \text{ atoms C} \left(\frac{1 \text{ mol C}}{1 \text{ atom C}} \right) \left(\frac{1 \text{ mol C}}{6.02 \times 10^{23} \text{ atoms C}} \right) \left(\frac{3 \text{ mol CaSiO}_3}{5 \text{ mol C}} \right) \left(\frac{116 \text{ g}}{1 \text{ mol CaSiO}_3} \right) = 370 \text{ g CaSiO}_3$$

$$- e) 7.20 \times 10^{20} \text{ atoms C} \left(\frac{1 \text{ mol C}}{1 \text{ atom C}} \right) \left(\frac{5 \text{ mol CO}}{5 \text{ mol C}} \right) = 7.20 \times 10^{20} \text{ mol CO}$$



$$a) 1.25 \text{ L O}_2 \left(\frac{25 \text{ L CO}_2}{38 \text{ L O}_2} \right) = 0.822 \text{ L CO}_2$$

$$b) 1.00 \text{ g C}_{25}\text{H}_{52} \left(\frac{1 \text{ mol C}_{25}\text{H}_{52}}{352.0 \text{ g}} \right) \left(\frac{38 \text{ mol O}_2}{1 \text{ mol C}_{25}\text{H}_{52}} \right) \left(\frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \right) = 2.42 \text{ L O}_2$$

$$a) \text{ mol} = M \times L \\ = .5M(.05L) = 0.0250 \text{ mol HCl}$$

$$0.025 \text{ mol HCl} \left(\frac{2 \text{ mol Fe}}{6 \text{ mol HCl}} \right) \left(\frac{55.8 \text{ g}}{1 \text{ mol Fe}} \right) = \boxed{0.465 \text{ g Fe}}$$

$$b) \text{ mol} = 6M(.01L) = 0.06 \text{ mol HCl}$$

$$0.0600 \text{ mol HCl} \left(\frac{3 \text{ mol H}_2}{6 \text{ mol HCl}} \right) \left(\frac{22.4 \text{ L H}_2}{1 \text{ mol H}_2} \right) = \boxed{0.672 \text{ L H}_2}$$

$$c) 11.2 \text{ g Fe} \left(\frac{1 \text{ mol Fe}}{55.8 \text{ g Fe}} \right) \left(\frac{6 \text{ mol HCl}}{2 \text{ mol Fe}} \right) = 0.602 \text{ mol HCl}$$

$$M = \frac{\text{mol}}{L} = \frac{0.602 \text{ mol}}{0.020 \text{ L}} = \boxed{30.1 \text{ M HCl}}$$

$$d) 1.20 \times 10^{25} \text{ mld H}_2 \left(\frac{6 \text{ mld HCl}}{3 \text{ mld H}_2} \right) \left(\frac{1 \text{ mol HCl}}{6.02 \times 10^{23} \text{ mld}} \right) = 39.9 \text{ mol HCl}$$

$$L = \frac{\text{mol}}{M} = \frac{39.9 \text{ mol}}{1.00 \text{ M}} = \boxed{39.9 \text{ L HCl}} \rightarrow 39,900 \text{ mL}$$

$$e) \text{ mol} = 120M(.025L) = 0.00300 \text{ mol HCl}$$

$$0.003 \text{ mol HCl} \left(\frac{2 \text{ mol FeCl}_3}{6 \text{ mol HCl}} \right) \left(\frac{162.3 \text{ g}}{1 \text{ mol FeCl}_3} \right) = \boxed{0.162 \text{ g FeCl}_3}$$

$$f) 16.2 \text{ g FeCl}_3 \left(\frac{1 \text{ mol FeCl}_3}{162.3 \text{ g}} \right) \left(\frac{3 \text{ mol H}_2}{2 \text{ mol FeCl}_3} \right) \left(\frac{22.4 \text{ L H}_2}{1 \text{ mol H}_2} \right) \\ = \boxed{3.35 \text{ L H}_2}$$