Stoichiometry – Moles, Mass, Molecules and Volume

Name - _____

1.) ___ $NH_{3\,(g)}$ + ___ $O_{2\,(g)}$ → ___ $H_2O_{\,(g)}$ + ___ $NO_{\,(g)}$

a.) What mass of $NO_{\,(g)}$ is produced when $2.00\ mol$ of $NH_{3\,(g)}$ are reacted with excess $O_{2\,(g)}$?

b.) What mass of $H_2O_{\,(g)}$ is produced when $4.00\ mol$ of $O_{2\,(g)}$ are reacted with excess $NH_{3\,(g)}$?

c.) What volume of $NH_{3\,(g)}$ at STP is required to react with $3.00\ mol$ of O_2?

d.) What volume of $NH_{3\,(g)}$ at STP is required to react with $0.750\ mol$ of $H_2O_{\,(g)}$?

2.) ___ $C_5H_{12\,(l)}$ + ___ $O_{2\,(g)}$ → ___ $CO_{2\,(g)}$ + ___ $H_2O_{\,(g)}$

a.) What mass of $CO_{2\,(g)}$ is produced when $100.0\ g$ of $C_5H_{12\,(l)}$ is burned?

b.) What mass of O_2 is required to produce $60.0\ g$ of $H_2O_{\,(l)}$?

c.) What mass of $C_5H_{12\,(l)}$ is required to produce $90.0\ L$ of $CO_{2\,(g)}$ at STP?

d.) What volume of $O_{2\,(g)}$ at STP is required to produce $70.0\ g$ of $CO_{2\,(g)}$?

e.) What volume of $O_{2\,(g)}$ at STP is required to produce $48.0\ L$ of $CO_{2\,(g)}$ at STP?

f.) What mass of $H_2O_{\,(l)}$ is made when the burning of C_5H_{12} gives $106\ L$ of $CO_{2\,(g)}$ at STP?

3.) Tetraethyl lead, $Pb(C_2H_5)_4$, is an "antiknock" ingredient which was added to some gasoline. Tetraethyl lead burns according to this equation

$$2\ Pb(C_2H_5)_{4\ (l)} + 27\ O_{2\ (g)} \rightarrow 2\ PbO_{(s)} + 16\ CO_{2\ (g)} + 20\ H_2O_{(g)}$$

a.) What volume of $O_{2\ (g)}$ at STP is consumed when $100.0\ g$ of $PbO_{(s)}$ are formed?

b.) How many molecules of CO_2 are formed when $1.00 \times 10^{-6}\ g$ of tetraethyl lead are burned?

c.) How many molecules of H_2O are formed when $135\ molecules$ of O_2 react?

d.) What volume of $O_{2\ (g)}$ at STP, in mL, is required to react with $1.00 \times 10^{15}\ molecules$ of tetraethyl lead?

4.) Nitromethane, a dragster fuel, burns according to the following reaction

$$\_\_\_\ CH_3NO_{2\ (l)} + \_\_\_\ O_{2\ (g)} \rightarrow \_\_\_\ CO_{2\ (g)} + \_\_\_\ H_2O_{(g)} + \_\_\_\ N_{2\ (g)}$$

a.) What mass of $H_2O_{(g)}$ is produced when $0.150\ g$ of $CH_3NO_{2\ (l)}$ is burned?

b.) What combined volume of gas at STP is produced if $0.316\ g$ of $CH_3NO_{2\ (l)}$ is burned?

c.) What volume of $O_{2\ (g)}$ at STP is required to produce $0.250\ g$ of $CO_{2\ (g)}$?

d.) What mass of $H_2O_{(l)}$ is produced when $0.410\ g$ of CO_2 is produced?

5.) A sample of high purity silicon is prepared by strongly heating of hydrogen and silicon tetrachloride in a sealed tube: ___ $SiCl_{4\,(g)}$ + ___ $H_{2\,(g)}$ → ___ $Si_{(s)}$ + ___ $HCl_{(g)}$

If exactly $1.00\ g$ of silicon is required, what mass of each of $SiCl_{4\,(g)}$ and $H_{2\,(g)}$ must react?

6.) Hydrazine, N_2H_4, is a rocket fuel which is prepared according to the reaction

___ $NH_{3\,(aq)}$ + ___ $NaOCl_{(aq)}$ → ___ $N_2H_{4\,(aq)}$ + ___ $NaCl_{(aq)}$ + ___ $H_2O_{(l)}$

NaOCl is common "bleach" and $NH_{3\,(aq)}$ is prepared by passing $NH_{3\,(g)}$ into water. If $1.25 \times 10^4\ kg$ of hydrazine is required, how many litres of ammonia gas, at STP, is required in the reaction?

7.) One of the most efficient drying agents known as P_4O_{10} will even remove water from pure H_2SO_4 to produce SO_3 in the manner shown. $P_4O_{10\,(s)}$ + 6 $H_2SO_{4\,(l)}$ → 4 $H_3PO_{4\,(aq)}$ + 6 $SO_{3\,(g)}$

Pure $H_2SO_{4\,(l)}$ has a density of $1.84\frac{g}{mL}$. If 25.0 mL of $H_2SO_{4\,(l)}$ react, what mass of P_4O_{10} also reacts and what volume of $SO_{3\,(g)}$ at STP is produced?

8.) Ozone, O_3, in the upper atmosphere protects the earth from the sun's harmful ultraviolet radiation. One step in the destruction of the ozone layer by chlorine-containing compounds is

___ $Cl_{(g)}$ + ___ $O_{3\,(g)}$ → ___ $ClO_{(g)}$ + ___ $O_{2\,(g)}$

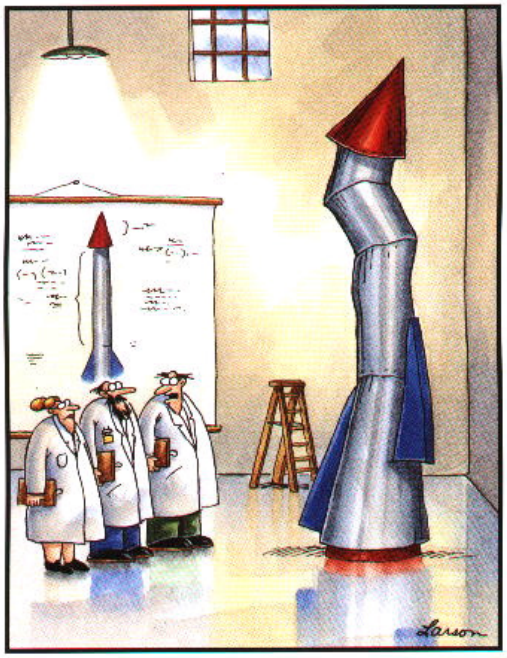
The volume of the ozone is estimated to be $1.5 \times 10^{15}\ L$ at STP. Each Chlorine atom is continually "recycled" so as to be capable of destroying an average of about $1.0 \times 10^5\ molecules$ of ozone. What mass of chlorine atoms would be required to destroy the available ozone if no repair occurred?

9.) What is the molar mass of Q if $0.150\ mol$ of R_4 and $143.8\ g$ of Q_2 react completely to yield RQ_3 as the only product?

10.) Mercury (II) oxide decomposes when heated. ___ $HgO_{(s)}$ → ___ $Hg_{(l)}$ + ___ $O_{2\ (g)}$

What mass of HgO decomposes to yield one-third as many atoms as there are in $100.0\ g$ of neon gas?

11.) When $7.682\ g$ of $XZO_{3\ (s)}$ is heated, $2.208\ g$ of $O_{2\ (g)}$ and $5.474\ g$ of $XZ_{(s)}$ are formed. When XZ is mixed with $AgNO_{3\ (aq)}$, all the XZ reacts to form $8.639\ g$ of $AgZ_{(s)}$. Find the molar masses of X and Z.



"It's time we face reality, my friends. ...
We're not exactly rocket scientists."