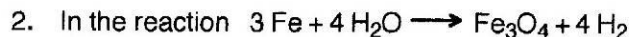
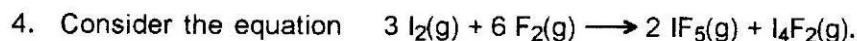
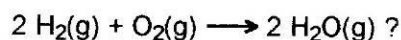


- how many oxygen molecules react with 6 molecules of  $\text{C}_2\text{H}_6$ ?
- how many  $\text{H}_2\text{O}$  molecules are produced when 12 molecules of  $\text{C}_2\text{H}_6$  react?
- how many moles of oxygen molecules are needed to produce 18 mol of  $\text{CO}_2$ ?
- how many moles of  $\text{CO}_2$  are produced when 13 mol of  $\text{C}_2\text{H}_6$  are used up?



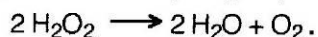
- how many molecules of  $\text{Fe}_3\text{O}_4$  are produced when 12 atoms of Fe react?
- how many moles of Fe are required to produce 16 mol of  $\text{H}_2$ ?
- how many  $\text{H}_2$  molecules are made when 40 molecules of  $\text{Fe}_3\text{O}_4$  are produced?
- how many moles of  $\text{H}_2\text{O}$  are required to react with 14.5 mol of Fe?

3. How many moles of  $\text{H}_2\text{O}(\text{g})$  are produced when 9.6 mol of  $\text{O}_2(\text{g})$  react according to the equation

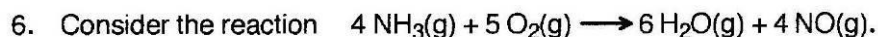


- How many moles of  $\text{I}_4\text{F}_2(\text{g})$  are produced by 5.40 mol of  $\text{F}_2(\text{g})$ ?
- How many moles of  $\text{F}_2(\text{g})$  are required to produce 4.50 mol of  $\text{IF}_5(\text{g})$ ?
- How many moles of  $\text{I}_2(\text{g})$  are required to react with 7.60 mol of  $\text{F}_2(\text{g})$ ?

5. CARE! A student decomposes some hydrogen peroxide,  $\text{H}_2\text{O}_2$ , according to the equation



If a total of 0.125 mol of reactants and products are involved in the reaction, how many moles of  $\text{O}_2$  are produced?

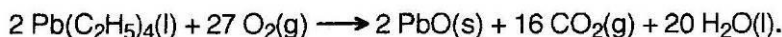


- What mass of  $\text{NO}(\text{g})$  is produced when 2.00 mol of  $\text{NH}_3(\text{g})$  are reacted with excess  $\text{O}_2(\text{g})$ ?
- What mass of  $\text{H}_2\text{O}(\text{g})$  is produced when 4.00 mol of  $\text{O}_2(\text{g})$  are reacted with excess  $\text{NH}_3(\text{g})$ ?
- What volume of  $\text{NH}_3(\text{g})$  at STP is required to react with 3.00 mol of  $\text{O}_2(\text{g})$ ?
- What volume of  $\text{NH}_3(\text{g})$  at STP is required to produce 0.750 mol of  $\text{H}_2\text{O}(\text{g})$ ?



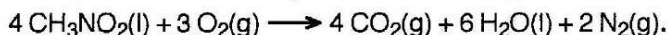
- What mass of  $\text{CO}_2(\text{g})$  is produced when 100.0 g of  $\text{C}_5\text{H}_{12}(\text{l})$  is burned?
- What mass of  $\text{O}_2(\text{g})$  is required to produce 60.0 g of  $\text{H}_2\text{O}(\text{l})$ ?
- What mass of  $\text{C}_5\text{H}_{12}(\text{l})$  is required to produce 90.0 L of  $\text{CO}_2(\text{g})$  at STP?
- What volume of  $\text{O}_2(\text{g})$  at STP is required to produce 70.0 g of  $\text{CO}_2(\text{g})$ ?
- What volume of  $\text{O}_2(\text{g})$  at STP is required to produce 48.0 L of  $\text{CO}_2(\text{g})$  at STP?
- What mass of  $\text{H}_2\text{O}(\text{l})$  is made when the burning of  $\text{C}_5\text{H}_{12}$  gives 106 L of  $\text{CO}_2(\text{g})$  at STP?

8. Tetraethyl lead,  $\text{Pb}(\text{C}_2\text{H}_5)_4$ , is an "antiknock" ingredient which was added to some gasolines. Tetraethyl lead burns according to the equation



- What volume of  $\text{O}_2(\text{g})$  at STP is consumed when 100.0 g of  $\text{PbO}(\text{s})$  are formed?
- How many molecules of  $\text{CO}_2$  are formed when  $1.00 \times 10^{-6}$  g of tetraethyl lead is burned?
- How many molecules of  $\text{H}_2\text{O}$  are formed when 135 molecules of  $\text{O}_2$  react?
- What volume of  $\text{O}_2(\text{g})$  at STP, in millilitres, is required to react with  $1.00 \times 10^{15}$  molecules of tetraethyl lead?

9. Nitromethane, a fuel occasionally used in some drag racers, burns according to the reaction

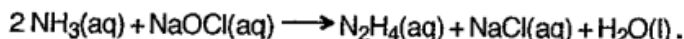


- a) What mass of  $\text{H}_2\text{O}$  is produced when 0.150 g of  $\text{CH}_3\text{NO}_2$  is burned?  
b) What combined volume of gas at STP is produced if 0.316 g of  $\text{CH}_3\text{NO}_2$  is burned?  
c) What volume of  $\text{O}_2(\text{g})$  at STP is required to produce 0.250 g of  $\text{CO}_2$ ?  
d) What mass of  $\text{H}_2\text{O}$  is produced when 0.410 g of  $\text{CO}_2$  is produced?
10. A sample of high purity silicon is prepared by strongly heating a mixture of hydrogen and silicon tetrachloride in a sealed tube:



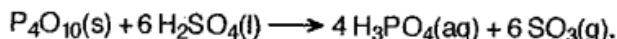
If exactly 1.00 g of silicon is required, what mass of each of  $\text{SiCl}_4$  and  $\text{H}_2$  must react?

11. Hydrazine,  $\text{N}_2\text{H}_4$ , is a rocket fuel which is prepared according to the reaction



$\text{NaOCl}$  is common "bleach" and  $\text{NH}_3(\text{aq})$  is produced by passing  $\text{NH}_3(\text{g})$  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?

12. One of the most efficient drying agents known is  $\text{P}_4\text{O}_{10}$ . In fact,  $\text{P}_4\text{O}_{10}$  will even remove water from pure  $\text{H}_2\text{SO}_4$  to produce  $\text{SO}_3$ :



Pure  $\text{H}_2\text{SO}_4(\text{l})$  has a density of 1.84 g/mL. If 25.0 mL of  $\text{H}_2\text{SO}_4(\text{l})$  react, what mass of  $\text{P}_4\text{O}_{10}$  also reacts and what volume of  $\text{SO}_3(\text{g})$  at STP is produced?

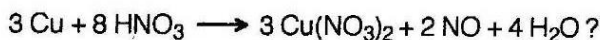
18. What volume of 0.250 M  $\text{HCl}$  is required to completely neutralize 25.0 mL of 0.318 M  $\text{NaOH}$ ? [Hint: what is the balanced equation for the reaction between  $\text{HCl}$  and  $\text{NaOH}$ ?]

26. What mass of  $\text{CS}_2$  is produced when 17.5 g of  $\text{C}$  are reacted with 39.5 g of  $\text{SO}_2$  according to the equation



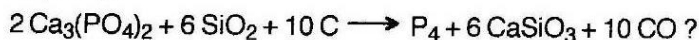
What mass of the excess reactant will be left over?

27. What mass of  $\text{NO}$  is produced when 87.0 g of  $\text{Cu}$  are reacted with 225 g of  $\text{HNO}_3$  according to the equation



What mass of the excess reactant will be left over?

28. What mass of  $\text{P}_4$  is produced when 41.5 g of  $\text{Ca}_3(\text{PO}_4)_2$ , 26.5 g of  $\text{SiO}_2$  and 7.80 g of  $\text{C}$  are reacted according to the equation



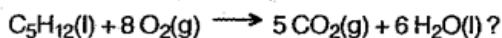
How many grams of each excess reactant will remain unreacted?

29. What mass of  $\text{Br}_2$  is produced when 25.0 g of  $\text{K}_2\text{Cr}_2\text{O}_7$ , 55.0 g of  $\text{KBr}$  and 60.0 g of  $\text{H}_2\text{SO}_4$  are reacted according to the equation

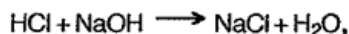


How many grams of each excess reactant will remain unreacted?

30. What volume of  $\text{CO}_2(\text{g})$  at STP can be made when 0.0250 L of  $\text{C}_5\text{H}_{12}(\text{l})$  (density = 626.0 g/L), is reacted with 40.0 L of  $\text{O}_2(\text{g})$  at STP, according to the equation



31. If 50.0 mL of 0.100 M  $\text{HCl}$  is allowed to react with 30.0 mL of 0.200 M  $\text{NaOH}$  according to the reaction



which reactant is in excess?

32. If 0.250 g of  $\text{Ba}(\text{OH})_2$  is mixed with 15.0 mL of 0.125 M  $\text{HBr}$ , what mass of  $\text{BaBr}_2$  can be formed?

