

Answer Key: Stoich Practice (level 1)

$$1. \frac{32.0 \text{ g S} \quad | \quad 1 \text{ mol S} \quad | \quad 1 \text{ mol Fe} \quad | \quad 55.8 \text{ g Fe}}{32.1 \text{ g S} \quad | \quad 1 \text{ mol S} \quad | \quad 1 \text{ mol Fe}} = \underline{55.6 \text{ g Fe}}$$

$$2. \frac{31.8 \text{ g Zn} \quad | \quad 1 \text{ mol Zn} \quad | \quad 1 \text{ mol H}_2 \quad | \quad 2.0 \text{ g H}_2}{65.4 \text{ g Zn} \quad | \quad 1 \text{ mol Zn} \quad | \quad 1 \text{ mol H}_2} = \underline{0.97 \text{ g H}_2}$$

$$3. \frac{128 \text{ g SO}_2 \quad | \quad 1 \text{ mol SO}_2 \quad | \quad 1 \text{ mol N}_2\text{SO}_3 \quad | \quad 82.1 \text{ g N}_2\text{SO}_3}{64.1 \text{ g SO}_2 \quad | \quad 1 \text{ mol SO}_2 \quad | \quad 1 \text{ mol N}_2\text{SO}_3} = \underline{164 \text{ g N}_2\text{SO}_3}$$

$$4. \frac{34.3 \text{ g NaBr} \quad | \quad 1 \text{ mol NaBr} \quad | \quad 1 \text{ mol AgBr} \quad | \quad 187.8 \text{ g AgBr}}{102.9 \text{ g} \quad | \quad 1 \text{ mol NaBr} \quad | \quad 1 \text{ mol AgBr}} = \underline{62.6 \text{ g AgBr}}$$

$$5. \frac{50.0 \text{ g FeS} \quad | \quad 1 \text{ mol FeS} \quad | \quad 1 \text{ mol H}_2\text{S} \quad | \quad 34.1 \text{ g H}_2\text{S}}{87.9 \text{ g} \quad | \quad 1 \text{ mol FeS} \quad | \quad 1 \text{ mol H}_2\text{S}} = \underline{19.4 \text{ g H}_2\text{S}}$$

$$6. \frac{25.0 \text{ g Mg} \quad | \quad 1 \text{ mol Mg} \quad | \quad 2 \text{ mol HNO}_3 \quad | \quad 63 \text{ g HNO}_3}{24.3 \text{ g Mg} \quad | \quad 1 \text{ mol Mg} \quad | \quad 1 \text{ mol HNO}_3} = \underline{130 \text{ g HNO}_3}$$

$$7. \frac{75.0 \text{ g Cu}_2\text{O} \quad | \quad 1 \text{ mol Cu}_2\text{O} \quad | \quad 2 \text{ mol} \quad | \quad 99.0 \text{ g CuCl}}{143 \text{ g Cu}_2\text{O} \quad | \quad 1 \text{ mol} \quad | \quad 1 \text{ mol}} = \underline{\frac{105}{104} \text{ g CuCl}}$$

$$8. \frac{100.0 \text{ g NaNO}_3 \quad | \quad 1 \text{ mol} \quad | \quad 1 \text{ mol O}_2 \quad | \quad 22.4 \text{ L}}{85.0 \text{ g NaNO}_3 \quad | \quad 2 \text{ mol} \quad | \quad 1 \text{ mol O}_2} = \underline{\frac{13.2}{13.18} \text{ L O}_2}$$

$$9. \frac{75.0 \text{ g H}_2\text{O} \quad | \quad 1 \text{ mol H}_2\text{O} \quad | \quad 1 \text{ mol O}_2 \quad | \quad 22.4 \text{ L}}{18.0 \text{ g H}_2\text{O} \quad | \quad 2 \text{ mol H}_2\text{O} \quad | \quad 1 \text{ mol O}_2} = \underline{46.7 \text{ L O}_2}$$

$$10. \frac{50.0 \text{ L CO} \quad | \quad 1 \text{ mol CO} \quad | \quad 1 \text{ mol CO}_2 \quad | \quad 22.4 \text{ L CO}_2}{22.4 \text{ L} \quad | \quad 2 \text{ mol CO} \quad | \quad 1 \text{ mol CO}_2} = \underline{25.0 \text{ L CO}_2}$$

Answer Key : Stoich Practice (Level 2)



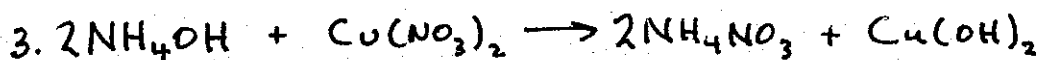
25.0g Al	1 mol	2 mol Al_2O_3	102 g Al_2O_3
	27.0g	4 mol Al	1 mol Al_2O_3

= 47.2g Al_2O_3
47.2



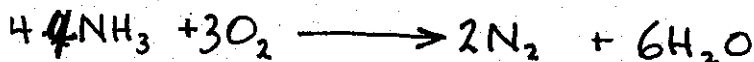
100.0g Fe	1 mol	3 mol	18.0g H_2O
	55.8g	2 mol	1 mol

= ~~48.39~~ 48.4 g H_2O



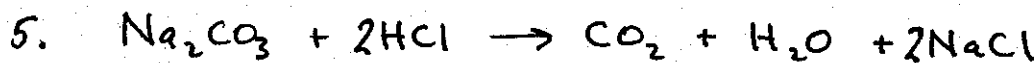
75.0 g $\text{Cu}(\text{NO}_3)_2$	1 mol	2 mol	35 g NH_4OH
	187.5g	1 mol	1 mol NH_4OH

= 28.0 g NH_4OH



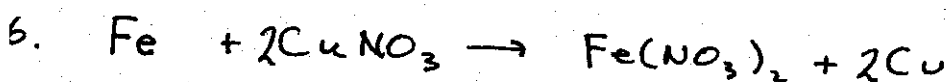
25.0 L O_2	1 mol O_2	4 mol NH_3	22.4 L
	22.4 L	3 mol O_2	1 mol NH_3

= 33.3 L NH_3
16.7 L N_2



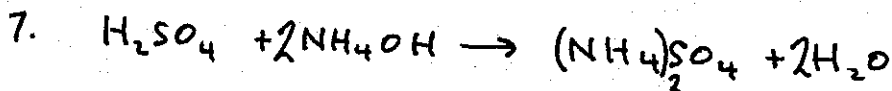
5.0 L CO_2	1 mol CO_2	1 mol Na_2CO_3	106 g Na_2CO_3
	22.4 L	1 mol CO_2	1 mol Na_2CO_3

= 23.7 \approx 24 g Na_2CO_3



30.0g Fe	1 mol Fe	2 mol Cu	63.5 g Cu
	55.8g Fe	1 mol Fe	1 mol Cu

= 68.3 g Cu



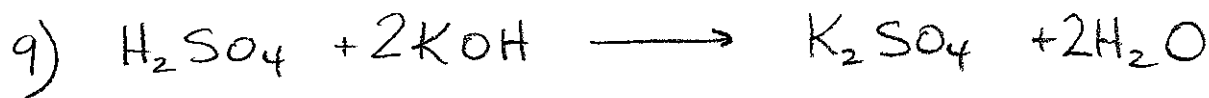
35.5g NH_3	1 mol	1 mol	98.1g
	35.0g	2 mol	1 mol

= ~~3.87~~ 49.8g H_2SO_4

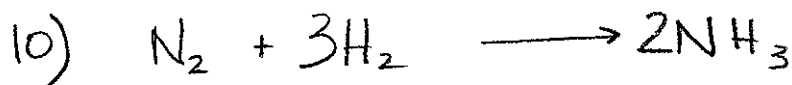
Level 2 Cont'd



$$\frac{85.8 \text{ g KI} \mid 1 \text{ mol KI} \mid 1 \text{ mol Cl}_2 \mid 71.0 \text{ g Cl}_2}{166.0 \text{ g KI} \mid 2 \text{ mol KI} \mid 1 \text{ mol Cl}_2} = \boxed{18.3 \text{ g Cl}_2}$$

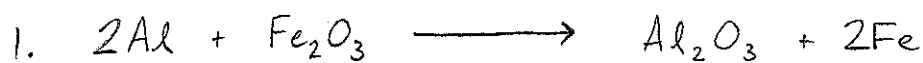


$$\frac{150.0 \text{ g H}_2\text{SO}_4 \mid 1 \text{ mol H}_2\text{SO}_4 \mid 1 \text{ mol K}_2\text{SO}_4 \mid 174.3 \text{ g K}_2\text{SO}_4}{98.1 \text{ g H}_2\text{SO}_4 \mid 1 \text{ mol H}_2\text{SO}_4 \mid 1 \text{ mol K}_2\text{SO}_4} = \boxed{2.67 \times 10^2 \text{ g K}_2\text{SO}_4}$$



$$\frac{150.0 \text{ L H}_2 \mid 1 \text{ mol H}_2 \mid 1 \text{ mol N}_2 \mid 22.4 \text{ L N}_2}{22.4 \text{ L H}_2 \mid 3 \text{ mol H}_2 \mid 1 \text{ mol N}_2} = \boxed{50.0 \text{ L N}_2}$$

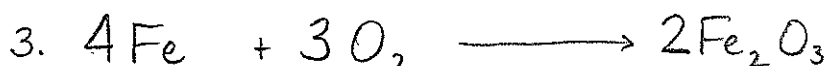
Stoichiometry (Level 3) Key



$$\frac{27.8 \text{ g Fe}_2\text{O}_3}{159.6 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{2 \text{ mol Al}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{27.0 \text{ g Al}}{1 \text{ mol Al}} = \boxed{9.41 \text{ g Al}}$$



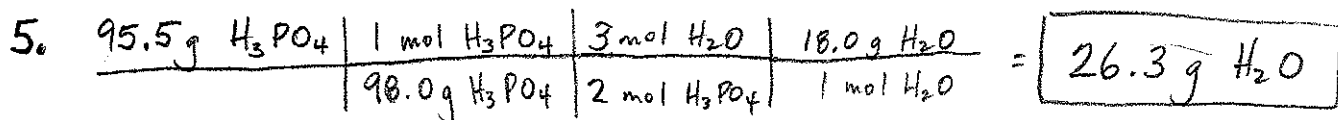
$$\frac{58.9 \text{ g SbCl}_3}{228.3 \text{ g SbCl}_3} \times \frac{1 \text{ mol SbCl}_3}{2 \text{ mol SbCl}_3} \times \frac{3 \text{ mol Cl}_2}{1 \text{ mol SbCl}_3} \times \frac{22.4 \text{ L Cl}_2}{1 \text{ mol Cl}_2} = \boxed{8.67 \text{ L Cl}_2}$$



$$\frac{20.0 \text{ g Fe}_2\text{O}_3}{159.6 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{2 \text{ mol Fe}_2\text{O}_3} \times \frac{4 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{55.9 \text{ g Fe}}{1 \text{ mol Fe}} = \boxed{14.5 \text{ g Fe}}$$



$$\frac{8.75 \text{ g NH}_4\text{Br}}{97.9 \text{ g NH}_4\text{Br}} \times \frac{1 \text{ mol NH}_4\text{Br}}{6 \text{ mol NH}_4\text{Br}} \times \frac{2 \text{ mol AlBr}_3}{1 \text{ mol NH}_4\text{Br}} \times \frac{266.7 \text{ g AlBr}_3}{1 \text{ mol AlBr}_3} = \boxed{7.95 \text{ g AlBr}_3}$$



$$\frac{95.5 \text{ g H}_3\text{PO}_4}{98.0 \text{ g H}_3\text{PO}_4} \times \frac{1 \text{ mol H}_3\text{PO}_4}{2 \text{ mol H}_3\text{PO}_4} \times \frac{1 \text{ mol P}_2\text{O}_5}{1 \text{ mol H}_3\text{PO}_4} \times \frac{142.0 \text{ g P}_2\text{O}_5}{1 \text{ mol P}_2\text{O}_5} = \boxed{69.2 \text{ g P}_2\text{O}_5}$$



moles CO_2 formed:

$$\frac{50.0 \text{ g O}_2}{32.0 \text{ g O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol O}_2} = 1.5625 \text{ mol CO}_2$$

moles CO_2 formed:

$$\frac{25.0 \text{ g C}}{12.0 \text{ g C}} \times \frac{1 \text{ mol C}}{1 \text{ mol C}} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol C}} = 2.0833 \text{ mol CO}_2$$

NOT ENOUGH O_2 (O_2 is LIMITING)

C in excess.

$$\frac{50.0 \text{ g O}_2}{32.0 \text{ g O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol O}_2} \times \frac{12.0 \text{ g C}}{1 \text{ mol C}} = 18.75 \text{ g C used.}$$

$$25.0 \text{ g C (start)} - 18.75 \text{ g C (used)} = \boxed{6.3 \text{ g C left}}$$



moles CO_2 formed:

$$\frac{100.0 \text{ g H}_2\text{SO}_4}{98.1 \text{ g H}_2\text{SO}_4} \times \frac{1 \text{ mol H}_2\text{SO}_4}{1 \text{ mol H}_2\text{SO}_4} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol H}_2\text{SO}_4} = 1.0194 \text{ mol CO}_2 \text{ formed.}$$

moles CO_2 formed:

$$\frac{100.0 \text{ g CaCO}_3}{100.1 \text{ g CaCO}_3} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCO}_3} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol CaCO}_3} = 0.9990 \text{ mol CO}_2 \text{ formed}$$

(CaCO_3 is LIMITING)

$$\frac{0.9990 \text{ mol CO}_2}{1 \text{ mol CO}_2} \times \frac{44.0 \text{ g CO}_2}{1 \text{ mol CO}_2} = \boxed{44.0 \text{ g CO}_2 \text{ formed}}$$



Question is asking: Is the base ($\text{Mg}(\text{OH})_2$) limiting or not?

moles MgCl_2 formed:

$$\frac{5.0 \text{ g HCl} \left| \frac{1 \text{ mol HCl}}{36.5 \text{ g HCl}} \right| \frac{1 \text{ mol MgCl}_2}{2 \text{ mol HCl}}}{=} = 0.06849 \text{ mol MgCl}_2$$

moles MgCl_2 formed:

$$\frac{24.0 \text{ g Mg}(\text{OH})_2 \left| \frac{1 \text{ mol Mg}(\text{OH})_2}{58.3 \text{ g Mg}(\text{OH})_2} \right| \frac{1 \text{ mol MgCl}_2}{1 \text{ mol Mg}(\text{OH})_2}}{=} = 0.41166 \text{ mol MgCl}_2$$

HCl is limiting

YES



moles HCNS formed:

$$\frac{1.000 \text{ mg H}_2\text{S}_2\text{O}_3 \left| \frac{1 \text{ g}}{1000 \text{ mg}} \right| \frac{1 \text{ mol H}_2\text{S}_2\text{O}_3}{114.2 \text{ g H}_2\text{S}_2\text{O}_3} \left| \frac{1 \text{ mol HCNS}}{1 \text{ mol H}_2\text{S}_2\text{O}_3} \right|}{=} = 8.757 \times 10^{-6} \text{ mol HCNS}$$

$\text{H}_2\text{S}_2\text{O}_3$ is limiting

moles HCNS formed:

$$\frac{2.00 \text{ mg HCN} \left| \frac{1 \text{ g}}{1000 \text{ mg}} \right| \frac{1 \text{ mol HCN}}{27.0 \text{ g HCN}} \left| \frac{1 \text{ mol HCNS}}{1 \text{ mol HCN}} \right|}{=} = 7.4074 \times 10^{-5} \text{ mol HCNS}$$

NO, you're in trouble!



moles H_2O formed:

$$\frac{45.0 \text{ L O}_2 \left| \frac{1 \text{ mol O}_2}{22.4 \text{ L O}_2} \right| \frac{2 \text{ mol H}_2\text{O}}{3 \text{ mol O}_2}}{=} = 1.3393 \text{ mol H}_2\text{O}$$

moles H_2O formed:

$$\frac{35.0 \text{ g H}_2\text{S} \left| \frac{1 \text{ mol H}_2\text{S}}{34.1 \text{ g H}_2\text{S}} \right| \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2\text{S}}}{=} = 1.02639 \text{ mol H}_2\text{O}$$

H_2S is limiting.

YES, 45.0 L of O_2 will be enough