

U4 REVIEW

RITCH ①

1. 55.85 AMU

2. $\text{CH}_2\text{Cl}_2 = (1 \cdot 12.01 \text{ AMU}) + (2 \cdot 1.01 \text{ AMU}) + (2 \cdot 35.45 \text{ AMU})$
 $= \underline{84.93 \text{ AMU}}$

3. 16.00 AMU

4. $\text{NaClO} = (1 \cdot 22.99 \text{ AMU}) + (1 \cdot 35.45 \text{ AMU}) + (1 \cdot 16.00 \text{ AMU})$
 $= \underline{74.44 \text{ AMU}}$

5. $\text{CH}_3\text{NH}_2 = (1 \cdot 12.01 \text{ g}) + (3 \cdot 1.01 \text{ g}) + (1 \cdot 14.01 \text{ g}) + (2 \cdot 1.01 \text{ g})$
 $= \underline{31.07 \text{ g}}$

6. $\text{C}_6\text{H}_6 = (6 \cdot 12.01 \text{ g}) + (6 \cdot 1.01 \text{ g})$
 $= \underline{78.12 \text{ g}}$

7. $\text{CuS} = (1 \cdot 63.55 \text{ g}) + (1 \cdot 32.06 \text{ g})$
 $= \underline{95.61 \text{ g}}$

8. $\text{HgCr}_2\text{O}_7 = (1 \cdot 200.59 \text{ g}) + (2 \cdot 52.00 \text{ g}) + (7 \cdot 16.00 \text{ g})$
 $= \underline{416.59 \text{ g}}$

9. $(6.02 \times 10^{23} \text{ ATOMS Al}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ ATOMS}} \right) = 1 \text{ mol Al}$
 $= \underline{26.98 \text{ g Al}}$

10. $(12.04 \times 10^{23} \text{ ATOMS Au}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ ATOMS}} \right) = 2 \text{ mol Au}$
 $= (2 \cdot 196.97 \text{ g}) = \underline{393.94 \text{ g Au}}$

11. $(5.4 \times 10^{23} \text{ ATOMS B}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ ATOMS}} \right) = .897 \dots \text{ mol B}$
 $(.897 \text{ mol B}) \left(\frac{10.81 \text{ g}}{1 \text{ mol}} \right) = 9.6966 \dots \text{ g} = \underline{9.70 \text{ g B}}$

12. $(8.02 \times 10^{22} \text{ ATOMS S}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ ATOMS}} \right) = .13322 \dots \text{ mol S}$
 $(.13322 \text{ mol S}) \left(\frac{32.06 \text{ g}}{1 \text{ mol}} \right) = \underline{4.27 \text{ g S}}$

$$13. (1.5 \text{ mol K}) \left(\frac{39.1 \text{ g}}{\text{mol}} \right) = \boxed{58.65 \text{ g K}}$$

$$14. (0.2550 \text{ mol Pt}) \left(\frac{195.09 \text{ g}}{\text{mol}} \right) = \boxed{4.39 \text{ g Pt}}$$

$$15. (4.25 \text{ mol Cu}) \left(\frac{63.55 \text{ g}}{\text{mol}} \right) = \boxed{270.09 \text{ g Cu}}$$

$$16. (1.37 \text{ mol Ni}(\text{NO}_3)_2) \left(\frac{182.73 \text{ g}}{\text{mol}} \right) = \boxed{250.34 \text{ g Ni}(\text{NO}_3)_2}$$

$$17. (2.25 \times 10^{25} \text{ atoms}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right) = \boxed{37.38 \text{ g}}$$

$\begin{array}{r} 58.71 \\ + (2 \cdot 14.01) \\ + (6 \cdot 16.00) \\ \hline 182.73 \text{ g} \end{array}$

$$18. (50 \text{ molec. Ba}(\text{NO}_3)_2) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec.}} \right) = \boxed{8.3 \times 10^{-23} \text{ mol Ba}(\text{NO}_3)_2}$$

$$19. (5.87 \times 10^{23} \text{ atoms Sn}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right) = \boxed{.98 \text{ mol Sn}}$$

$$20. (4 \times 10^{23} \text{ atoms Ba}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right) = \boxed{.66 \text{ mol Ba}}$$

$$21. (11.5 \text{ g Ca}) \left(\frac{1 \text{ mol}}{40.08 \text{ g}} \right) = \boxed{.29 \text{ mol Ca}}$$

$$22. (.0075 \text{ g N}_2) \left(\frac{1 \text{ mol}}{28.02 \text{ g}} \right) = \boxed{.00027 \text{ mol N}_2} = 2.7 \times 10^{-4} \text{ mol N}_2$$

$$23. (3.25 \times 10^5 \text{ g Cu}(\text{OH})_2) \left(\frac{1 \text{ mol}}{97.57 \text{ g}} \right) = \boxed{3330.94 \text{ mol Cu}(\text{OH})_2}$$

$\begin{array}{r} 63.55 \text{ g} \\ + (2 \cdot 16.00 \text{ g}) \\ + (2 \cdot 1.01 \text{ g}) \\ \hline 97.57 \text{ g} \end{array}$

$$24. (1 \text{ L H}_2\text{O}) \left(\frac{1000 \text{ mL}}{1 \text{ L}} \right) \left(\frac{1 \text{ g}}{1 \text{ mL}} \right) = \boxed{1000 \text{ g H}_2\text{O}}$$

$$25. (1000 \text{ g H}_2\text{O}) \left(\frac{1 \text{ mol}}{18.02 \text{ g}} \right) = 55.4938 \dots \text{ mol H}_2\text{O}$$

$$(55.4938 \text{ mol H}_2\text{O}) \left(\frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \right) = \boxed{110.99 \text{ mol H}}$$

26. Same as ↑ (0005)

$$27. (2 \times 10^{23} \text{ atoms Pt}) \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right) = .3322 \dots \text{ mol Pt}$$

$$(.3322 \text{ mol Pt}) \left(\frac{195.09 \text{ g}}{1 \text{ mol}} \right) = \boxed{64.81 \text{ g Pt}}$$

$$28. (350 \text{ g N}_2\text{S}_3) \left(\frac{1 \text{ mol}}{110.1 \text{ g}} \right) = 3.1789 \dots \text{ mol N}_2\text{S}_3$$

$$\begin{aligned} & (14.01 \text{ g}) \\ & + 3 \cdot (32.06 \text{ g}) \end{aligned}$$

$$(3.1789 \text{ mol N}_2\text{S}_3) \left(\frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 1.9137 \dots \times 10^{24} \text{ molecules N}_2\text{S}_3$$

$$(1.9137 \times 10^{24} \text{ molecules N}_2\text{S}_3) \left(\frac{4 \text{ atoms}}{1 \text{ molecule}} \right) = \boxed{7.65 \times 10^{24} \text{ atoms}}$$

$$29. a) (10 \text{ mol O}_2) \left(\frac{2 \text{ mol H}_2}{1 \text{ mol O}_2} \right) = \boxed{20 \text{ mol H}_2}$$

$$b) (25 \text{ mol H}_2\text{O}) \left(\frac{1 \text{ mol O}_2}{2 \text{ mol H}_2\text{O}} \right) = \boxed{12.5 \text{ mol O}_2}$$

$$c) (25 \text{ mol H}_2\text{O}) \left(\frac{18.02 \text{ g}}{1 \text{ mol}} \right) = \boxed{450.5 \text{ g H}_2\text{O}}$$

$$30. \frac{(7.5 \text{ mol NaOH})(1 \text{ mol Na}_2\text{CO}_3)}{(2 \text{ mol NaOH})} = \boxed{3.75 \text{ mol Na}_2\text{CO}_3}$$

$$\frac{(7.5 \text{ mol NaOH})(1 \text{ mol Ca(OH)}_2)}{(2 \text{ mol NaOH})} = \boxed{3.75 \text{ mol Ca(OH)}_2}$$



$$a) \frac{(1.175 \text{ mol C}_2\text{H}_6)(7 \text{ mol O}_2)}{(2 \text{ mol C}_2\text{H}_6)} = 4.1125 \text{ mol O}_2$$

$$= \boxed{4.11 \text{ mol O}_2}$$

$$b) \frac{(1.175 \text{ mol C}_2\text{H}_6)(4 \text{ mol CO}_2)}{(2 \text{ mol C}_2\text{H}_6)} = \boxed{2.35 \text{ mol CO}_2}$$

$$\frac{(1.175 \text{ mol C}_2\text{H}_6)(6 \text{ mol H}_2\text{O})}{(2 \text{ mol C}_2\text{H}_6)} = \boxed{3.53 \text{ mol H}_2\text{O}}$$



$$b) \frac{(3.95 \text{ mol NaOH})(1 \text{ mol H}_2\text{SO}_4)}{(2 \text{ mol NaOH})} = 1.975 \text{ mol H}_2\text{SO}_4$$

$$= \boxed{1.98 \text{ mol H}_2\text{SO}_4}$$

$$c) \frac{(1.975 \text{ mol H}_2\text{SO}_4)(98.08 \text{ g/mol})}{(1 \text{ mol})} = \boxed{193.71 \text{ g H}_2\text{SO}_4}$$

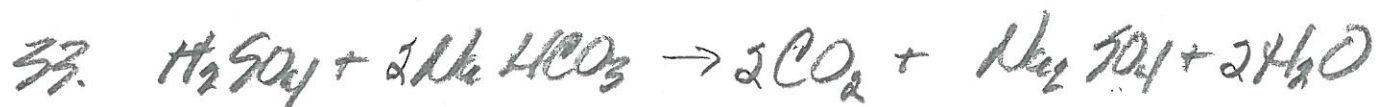
$$d) \frac{(3.95 \text{ mol NaOH})(1 \text{ mol Na}_2\text{SO}_4)}{(2 \text{ mol NaOH})} = 1.975 \text{ mol Na}_2\text{SO}_4$$

$$\frac{(1.975 \text{ mol Na}_2\text{SO}_4)(142.04 \text{ g/mol})}{(1 \text{ mol})} = \boxed{280.53 \text{ g Na}_2\text{SO}_4}$$

$$\frac{(3.95 \text{ mol NaOH})(2 \text{ mol H}_2\text{O})}{(2 \text{ mol NaOH})} = 3.95 \text{ mol H}_2\text{O}$$

$$\frac{(3.95 \text{ mol H}_2\text{O})(18.02 \text{ g/mol})}{(1 \text{ mol})} = \boxed{71.18 \text{ g H}_2\text{O}}$$

$$\begin{array}{r} (2 \cdot 22.99 \text{ g}) \\ + 32.06 \text{ g} \\ + (4 \cdot 16.00 \text{ g}) \\ \hline 142.04 \text{ g} \end{array}$$



$$a) (130\text{g H}_2\text{SO}_4) \left(\frac{1\text{ mol}}{98.08\text{g}} \right) = 1.3254... \text{ mol H}_2\text{SO}_4$$

$$(1.3254... \text{ mol H}_2\text{SO}_4) \left(\frac{2\text{ mol NaHCO}_3}{1\text{ mol H}_2\text{SO}_4} \right) = \boxed{2.65 \text{ mol NaHCO}_3}$$

$$b) (1.3254... \text{ mol H}_2\text{SO}_4) \left(\frac{2\text{ mol CO}_2}{1\text{ mol H}_2\text{SO}_4} \right) = 2.6500... \text{ mol CO}_2$$

$$(2.6500... \text{ mol CO}_2) \left(\frac{44.01\text{g}}{1\text{ mol}} \right) = \boxed{116.66\text{g CO}_2}$$

$$(1.3254... \text{ mol H}_2\text{SO}_4) \left(\frac{1\text{ mol Na}_2\text{SO}_4}{1\text{ mol H}_2\text{SO}_4} \right) = 1.3254... \text{ mol Na}_2\text{SO}_4$$

$$(1.3254... \text{ mol Na}_2\text{SO}_4) \left(\frac{142.04\text{g}}{1\text{ mol}} \right) = \boxed{188.26\text{g Na}_2\text{SO}_4}$$

$$(1.3254... \text{ mol H}_2\text{SO}_4) \left(\frac{2\text{ mol H}_2\text{O}}{1\text{ mol H}_2\text{SO}_4} \right) = 2.650... \text{ mol H}_2\text{O}$$

$$(2.650... \text{ mol H}_2\text{O}) \left(\frac{18.02\text{g}}{1\text{ mol}} \right) = \boxed{47.75\text{g H}_2\text{O}}$$

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$$(5.0 \text{ g CH}_3\text{OH}) \left(\frac{1 \text{ mol}}{32.05 \text{ g}} \right) = .15600 \dots \text{ mol CH}_3\text{OH}$$

$$\begin{array}{r} 12.01 \\ 4.04 \\ \hline 16.00 \\ 32.05 \\ \hline \end{array}$$

(6)

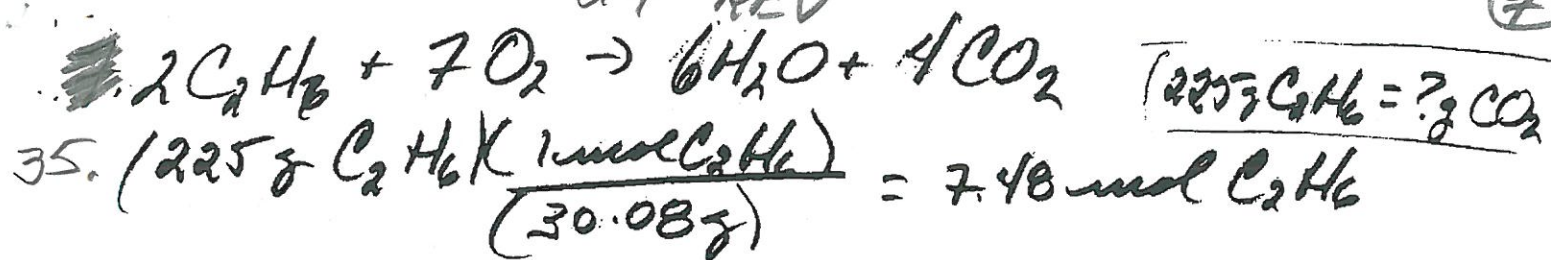
$$(.15600 \text{ mol CH}_3\text{OH}) \left(\frac{1 \text{ mol CO}}{1 \text{ mol CH}_3\text{OH}} \right) = .15600 \text{ mol CO}$$

$$(.15600 \text{ mol CO}) \left(\frac{28.01 \text{ g}}{\text{mol}} \right) = \boxed{4.37 \text{ g CO}}$$

$$\begin{array}{r} 12.01 \\ 16.00 \\ \hline 28.01 \end{array}$$

$$(.15600 \text{ mol CH}_3\text{OH}) \left(\frac{2 \text{ mol H}_2}{1 \text{ mol CH}_3\text{OH}} \right) = .3120 \dots \text{ mol H}_2$$

$$(.3120 \dots \text{ mol H}_2) \left(\frac{2.02 \text{ g}}{\text{mol H}_2} \right) = \boxed{.63 \text{ g H}_2}$$



$$35. (225g C_2H_6) \left(\frac{1 \text{ mol } C_2H_6}{30.08g} \right) = 7.48 \text{ mol } C_2H_6$$

$$(7.48 \text{ mol } C_2H_6) \left(\frac{4 \text{ mol } CO_2}{2 \text{ mol } C_2H_6} \right) = 14.96 \text{ mol } CO_2$$

$$(14.96 \text{ mol } CO_2) \left(\frac{44.01g}{1 \text{ mol } CO_2} \right) = \underline{\underline{658.39g CO_2}}$$



$$36. 50g O_2 \Rightarrow ?g SO_3$$

$$(50g O_2) \left(\frac{1 \text{ mol}}{32g} \right) = 1.56 \text{ mol } O_2$$

$$(1.56 \text{ mol } O_2) \left(\frac{2 \text{ mol } SO_3}{1 \text{ mol } O_2} \right) = 3.12 \text{ mol } SO_3$$

$$(3.12 \text{ mol } SO_3) \left(\frac{80.06g}{1 \text{ mol } SO_3} \right) = \underline{\underline{249.78g SO_3}}$$



37. 4.0 g $\text{KHCO}_3 \Rightarrow ? \text{ g } \text{K}_2\text{CO}_3$

$$(4.0 \text{ g } \text{KHCO}_3) \left(\frac{1 \text{ mol}}{100.12 \text{ g}} \right) = .04 \text{ mol } \text{KHCO}_3$$

$$(.04 \text{ mol } \text{KHCO}_3) \left(\frac{1 \text{ mol } \text{K}_2\text{CO}_3}{2 \text{ mol } \text{KHCO}_3} \right) = .02 \text{ mol } \text{K}_2\text{CO}_3$$

$$(.02 \text{ mol } \text{K}_2\text{CO}_3) \left(\frac{138.21 \text{ g}}{1 \text{ mol } \text{K}_2\text{CO}_3} \right) = 2.76 \text{ g } \text{K}_2\text{CO}_3$$



38. 2.8 g $\text{H}_2\text{O} \Rightarrow ? \text{ g } \text{H}_2$

$$(2.8 \text{ g } \text{H}_2\text{O}) \left(\frac{1 \text{ mol}}{18.02 \text{ g}} \right) = .16 \text{ mol } \text{H}_2\text{O}$$

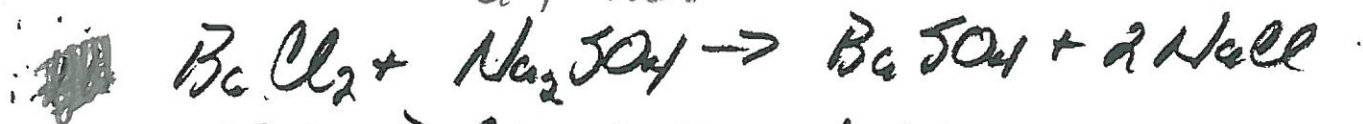
$$(.16 \text{ mol } \text{H}_2\text{O}) \left(\frac{1 \text{ mol } \text{H}_2}{2 \text{ mol } \text{H}_2\text{O}} \right) = .08 \text{ mol } \text{H}_2$$

$$(.08 \text{ mol } \text{H}_2) \left(\frac{2.02 \text{ g}}{1 \text{ mol } \text{H}_2} \right) = .16 \text{ g } \text{H}_2$$

(if you wondered about units)

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(9)

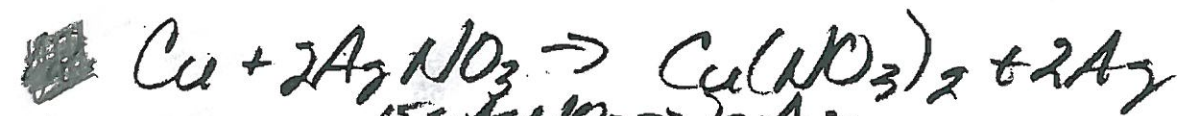


39. 18.9 g $\text{BaCl}_2 \Rightarrow ? \text{ g NaCl}$

$$(18.9 \text{ g BaCl}_2) \left(\frac{1 \text{ mol}}{208.23 \text{ g}} \right) = .09 \text{ mol BaCl}_2$$

$$(.09 \text{ mol BaCl}_2) \left(\frac{2 \text{ mol NaCl}}{1 \text{ mol BaCl}_2} \right) = .18 \text{ mol NaCl}$$

$$(.18 \text{ mol NaCl}) \left(\frac{58.44 \text{ g}}{1 \text{ mol NaCl}} \right) = \underline{\underline{10.5 \text{ g NaCl}}}$$



15 g $\text{AgNO}_3 \Rightarrow ? \text{ g Ag}$

40. (15.8 g AgNO_3) $\left(\frac{1 \text{ mol}}{169.87 \text{ g}} \right) = .09 \text{ mol AgNO}_3$

$$(.09 \text{ mol AgNO}_3) \left(\frac{2 \text{ mol Ag}}{2 \text{ mol AgNO}_3} \right) = .09 \text{ mol Ag}$$

$$(.09 \text{ mol Ag}) \left(\frac{107.87 \text{ g}}{1 \text{ mol Ag}} \right) = \underline{\underline{9.7 \text{ g Ag}}}$$

$$11. a) \frac{(3 \text{ mol HCl})(1 \text{ mol NaCl})}{(1 \text{ mol HCl})} = 3 \text{ mol NaCl possible}$$

$$\frac{(2.5 \text{ mol NaOH})(1 \text{ mol NaCl})}{(1 \text{ mol NaOH})} = 2.5 \text{ mol NaCl possible}$$

\therefore NaOH is limiting

$$b) \frac{(5.0 \text{ mol Zn})(1 \text{ mol ZnCl}_2)}{(1 \text{ mol Zn})} = 5 \text{ mol ZnCl}_2 \text{ possible}$$

$$\frac{(8.0 \text{ mol HCl})(1 \text{ mol ZnCl}_2)}{(2 \text{ mol HCl})} = 4 \text{ mol ZnCl}_2 \text{ possible}$$

\therefore HCl is limiting

$$c) \frac{(2 \text{ mol Fe(OH)}_3)(1 \text{ mol Fe}_2\text{(SO}_4)_3)}{(2 \text{ mol Fe(OH)}_3)} = 1 \text{ mol Fe}_2\text{(SO}_4)_3 \text{ possible}$$

$$\frac{(2.5 \text{ mol H}_2\text{SO}_4)(1 \text{ mol Fe}_2\text{(SO}_4)_3)}{(3 \text{ mol H}_2\text{SO}_4)} = .833 \text{ mol Fe}_2\text{(SO}_4)_3 \text{ possible}$$

\therefore H₂SO₄ is limiting

$$12. a) \frac{(2.5 \text{ mol NaOH})(1 \text{ mol HCl})}{(1 \text{ mol NaOH})} = 2.5 \text{ mol HCl REACTED}$$

HAVE

$$3.0 \text{ mol HCl} - 2.5 \text{ mol} = (.5 \text{ mol HCl IN EXCESS})$$

$$b) \frac{(8.0 \text{ mol HCl})(1 \text{ mol Zn})}{(2 \text{ mol HCl})} = 4.0 \text{ mol Zn REACTED}$$

HAVE

$$5.0 \text{ mol Zn} - 4.0 \text{ mol} = (1.0 \text{ mol Zn IN EXCESS})$$

$$c) \frac{(2.5 \text{ mol H}_2\text{SO}_4)(2 \text{ mol Fe(OH)}_3)}{(3 \text{ mol H}_2\text{SO}_4)} = 1.667 \text{ mol Fe(OH)}_3 \text{ REACTED}$$

HAVE

$$2.0 \text{ mol Fe(OH)}_3 - 1.667 \text{ mol} = (.33 \text{ mol Fe(OH)}_3 \text{ IN EXCESS})$$

43. a) $(2.5 \text{ mol NaOH}) \left(\frac{1 \text{ mol NaCl}}{1 \text{ mol NaOH}} \right) = 2.5 \text{ mol NaCl PRODUCED}$

$(2.5 \text{ mol NaOH}) \left(\frac{1 \text{ mol H}_2\text{O}}{1 \text{ mol NaOH}} \right) = 2.5 \text{ mol H}_2\text{O PRODUCED}$

b) $(8.0 \text{ mol HCl}) \left(\frac{1 \text{ mol ZnCl}_2}{2 \text{ mol HCl}} \right) = 4 \text{ mol ZnCl}_2 \text{ PRODUCED}$

$(8.0 \text{ mol HCl}) \left(\frac{1 \text{ mol H}_2}{2 \text{ mol HCl}} \right) = 4 \text{ mol H}_2 \text{ PRODUCED}$

c) $(2.5 \text{ mol H}_2\text{SO}_4) \left(\frac{1 \text{ mol Fe}_2(\text{SO}_4)_3}{3 \text{ mol H}_2\text{SO}_4} \right) = 0.83 \text{ mol Fe}_2(\text{SO}_4)_3 \text{ PRODUCED}$

$(2.5 \text{ mol Fe}_2(\text{SO}_4)_3) \left(\frac{6 \text{ mol H}_2\text{O}}{3 \text{ mol H}_2\text{SO}_4} \right) = 5 \text{ mol H}_2\text{O PRODUCED}$



b) $(9 \text{ mol N}_2) \left(\frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \right) = 18 \text{ mol NH}_3 \text{ POSSIBLE}$

$(11 \text{ mol H}_2) \left(\frac{2 \text{ mol NH}_3}{3 \text{ mol H}_2} \right) = 7.33 \text{ mol NH}_3 \text{ POSSIBLE}$

$\therefore \text{H}_2$ IS THE LIMITING REACTANT

c) N_2 IS IN EXCESS

b) $(11 \text{ mol H}_2) \left(\frac{1 \text{ mol N}_2}{3 \text{ mol H}_2} \right) = 3.667 \text{ mol N}_2 \text{ REACTED}$

HAVE 9 mol N_2 - 3.667 mol REACTED = 5.33 mol N_2 IN EXCESS

c) 7.33 mol NH_3 PRODUCED (FROM LIM. REACT. CALCULATION)



b) 70g CaCl_2 + 90g Na_3PO_4 = ? LIM REACT.

$$\frac{10.08}{70.90} (70\text{g } \text{CaCl}_2) \left(\frac{1 \text{ mol}}{110.98\text{g}} \right) = .6307 \dots \text{ mol } \text{CaCl}_2$$

$$\frac{3.2299}{30.92} (.6307 \text{ mol } \text{CaCl}_2) \left(\frac{1 \text{ mol } \text{Ca}_3(\text{PO}_4)_2}{3 \text{ mol } \text{CaCl}_2} \right) = .2102 \text{ mol } \text{Ca}_3(\text{PO}_4)_2$$

POSSIBLE

$$\frac{163.949}{163.949} (90\text{g } \text{Na}_3\text{PO}_4) \left(\frac{1 \text{ mol}}{163.949\text{g}} \right) = .5489 \dots \text{ mol } \text{Na}_3\text{PO}_4$$

$$\left(.5489 \text{ mol } \text{Na}_3\text{PO}_4 \right) \left(\frac{1 \text{ mol } \text{Ca}_3(\text{PO}_4)_2}{2 \text{ mol } \text{Na}_3\text{PO}_4} \right) = .2744 \dots \text{ mol } \text{Ca}_3(\text{PO}_4)_2$$

POSSIBLE

$\therefore \text{CaCl}_2$ is limiting

c) Na_3PO_4 is in excess

$$d) \left(.6307 \text{ mol } \text{CaCl}_2 \right) \left(\frac{2 \text{ mol } \text{Na}_3\text{PO}_4}{3 \text{ mol } \text{CaCl}_2} \right) = .4204 \text{ mol } \text{Na}_3\text{PO}_4$$

REACTED

HAVE

$$.5489 \text{ mol } \text{Na}_3\text{PO}_4 - .4204 \text{ mol} = .1284 \text{ mol } \text{REMAIN}$$

=.17 mol REMAIN

$$e) .2102 \text{ mol } \text{Ca}_3(\text{PO}_4)_2 \text{ (FROM LIM. REACT. CASE)}$$

$$\left(.2102 \text{ mol } \text{Ca}_3(\text{PO}_4)_2 \right) \left(\frac{310.18\text{g}}{\text{mol}} \right) = 65.20\text{g } \text{Ca}_3(\text{PO}_4)_2$$

$$\left(.6307 \text{ mol } \text{CaCl}_2 \right) \left(\frac{6 \text{ mol } \text{H}_2\text{O}}{3 \text{ mol } \text{CaCl}_2} \right) = 1.2614 \text{ mol } \text{H}_2\text{O}$$

$$\left(1.2614 \text{ mol } \text{H}_2\text{O} \right) \left(\frac{18.02\text{g}}{\text{mol}} \right) = 22.73\text{g } \text{H}_2\text{O}$$