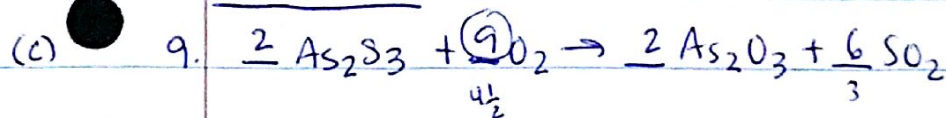


NCHO 1999



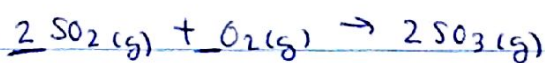
(A) 10. $24.0 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} \times \frac{1 \text{ mol MgCO}_3}{3 \text{ mol O}} \times \frac{84.3 \text{ g MgCO}_3}{1 \text{ mol MgCO}_3} = \boxed{42.2 \text{ g MgCO}_3}$

(D) 11. $9 \text{ mol H} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = \boxed{5.4 \times 10^{24} \text{ atoms}}$

(B) 12. $\frac{2.0 \text{ mol H}_2}{3 \text{ mol H}_2} \left| \frac{1 \text{ mol CH}_4}{1 \text{ mol CH}_4} \right. = \boxed{0.67 \text{ mol CH}_4}$ $\frac{2.0 \text{ mol CO}}{1 \text{ mol CO}} \left| \frac{1 \text{ mol CH}_4}{1 \text{ mol CO}} \right. = 2.0 \text{ mol CH}_4$

(D) 13. $\frac{1.90 \text{ g MgCl}_2}{95.2 \text{ g MgCl}_2} \left| \frac{1 \text{ mol MgCl}_2}{1 \text{ mol MgCl}_2} \right| \frac{2 \text{ mol Cl}^-}{1 \text{ mol MgCl}_2} = \frac{0.0399 \text{ mol Cl}^-}{.25 \text{ L}} = \boxed{0.16 \text{ M}}$

(A) 14. $3.0 \text{ L SO}_2 + 2.0 \text{ L O}_2 = 5.0 \text{ L gas initially}$



3.0 L SO_2 reacts w/ 1.5 L O_2 to form 3.0 L SO_3 and 0.5 L O_2 is leftover

Final gas volume = $3.0 \text{ L SO}_2 + 0.5 \text{ L O}_2 = 3.5 \text{ L gas final}$

$5.0 - 3.5 = \boxed{1.5 \text{ L decrease}}$

(A) 15. $\frac{0.164 \text{ mol NaOH}}{1000 \text{ mL}} \left| \frac{32.63 \text{ mL NaOH}}{32.63 \text{ mL NaOH}} \right. = 5.35 \times 10^{-3} \text{ mol NaOH} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} = \frac{2.68 \times 10^{-3} \text{ mol H}_2\text{SO}_4}{.02500 \text{ L H}_2\text{SO}_4} = \boxed{0.107 \text{ M H}_2\text{SO}_4}$

NCHO 1998

(B) 7. $\frac{1 \text{ mol Fe}}{1 \text{ mol FeX}} = \frac{55.85 \text{ g Fe}}{55.85 \text{ g Fe} + X \text{ g X}} = \frac{4.6 \text{ Fe}}{100 \text{ FeX}}$

$5585 = 4.6(55.85 + X)$

$5585 = 256.91 + 4.6X$

$4.6X = 5328.09$

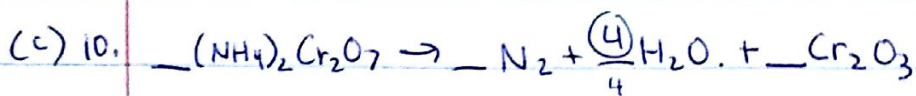
$X = 1158.2804 \text{ g}$

$\text{FeX} = 55.85 + 1158 = 1213.85 \text{ g FeX}$

$\approx \boxed{1200 \text{ g/mol FeX}}$

$$(D) 8. \quad 0.046 \text{ g C}_2\text{H}_5\text{OH} \times \frac{1 \text{ mol C}_2\text{H}_5\text{OH}}{46 \text{ g}} \times \frac{6 \text{ mol H}}{1 \text{ mol C}_2\text{H}_5\text{OH}} \times \frac{6.02 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} = \boxed{3.6 \times 10^{21} \text{ atoms H}}$$

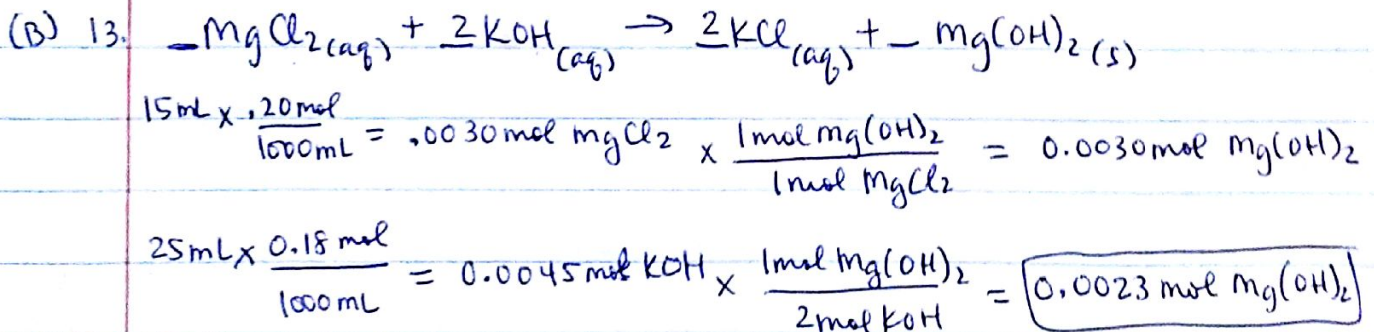
$$(C) 9. \quad \left. \begin{array}{l} \frac{2 \text{ H}_2\text{O}}{\text{BaCl}_2 \cdot 2 \text{ H}_2\text{O}} \times 100 = \frac{36}{244.23} \times 100 = 14.7\% \\ \frac{6 \text{ H}_2\text{O}}{\text{CaCl}_2 \cdot 6 \text{ H}_2\text{O}} \times 100 = \frac{108}{218.98} \times 100 = \boxed{49.3\%} \end{array} \right\} \begin{array}{l} \frac{5 \text{ H}_2\text{O}}{\text{CuSO}_4 \cdot 5 \text{ H}_2\text{O}} \times 100 = \frac{90}{249.61} \times 100 = 36.1\% \\ \frac{6 \text{ H}_2\text{O}}{\text{Ni}(\text{ClO}_4)_2 \cdot 6 \text{ H}_2\text{O}} \times 100 = \frac{108}{363.59} \times 100 = 29.5\% \end{array}$$



$$(B) 11. \quad (7.5 \text{ mL})(12 \text{ M HCl}) = (x)(0.15 \text{ M HCl})$$

$$x = 600 \text{ mL} = \boxed{0.6 \text{ L}}$$

$$(C) 12. \quad 355 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{2 \text{ mol Fe}} = \boxed{3.18 \text{ mol Fe}_2\text{O}_3}$$



(A) 14. 1.5 mL HCl(g) reacts with 1.5 mL NH₃(g) to form NH₄Cl(s)
 ∴ 0.5 mL of HCl(g) remains

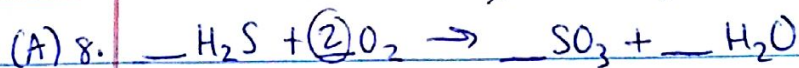
$$(D) 15. \quad 250. \text{ mL} \times \frac{0.10 \text{ mol NaCl}}{1000 \text{ mL}} \times \frac{58.44 \text{ g NaCl}}{1 \text{ mol NaCl}} = 1.46 \text{ g NaCl needed}$$

NCHO 1997

$$(D) 6. \quad \text{vol of coin} = 22.9 - 22.2 = 0.7 \text{ mL}$$

$$D = \frac{M}{V} = \frac{13.5243 \text{ g}}{0.7 \text{ mL}} = 19.3204 \text{ g/mL} = \boxed{20 \text{ g/mL}} \quad 1 \text{ s.f.}$$

$$(A) 7. \quad 2.3 \times 10^{-4} \text{ g Si} \times \frac{1 \text{ mol Si}}{28.09 \text{ g Si}} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol Si}} = \boxed{4.9 \times 10^{18} \text{ atoms Si}}$$



$$(B) 9. \quad 1 \text{ L NO} \times \frac{5 \text{ O}_2}{4 \text{ NO}} = \boxed{1.25 \text{ L O}_2}$$

$$(B) 10. \quad 1.73 \text{ g Sb} \times \frac{1 \text{ mol Sb}}{121.75 \text{ g Sb}} \times \frac{1 \text{ mol Sb}_2\text{S}_3}{2 \text{ mol Sb}} \times \frac{339.7 \text{ g Sb}_2\text{S}_3}{1 \text{ mol Sb}_2\text{S}_3} = 2.41 \text{ g Sb}_2\text{S}_3 \leftarrow \text{Theoret. yield}$$

$$\% \text{ yield} = \frac{1.40 \text{ g Sb}_2\text{S}_3}{2.41 \text{ g Sb}_2\text{S}_3} \times 100 = \boxed{58.1\%}$$

(D) 11. limiting reagent is used up first.

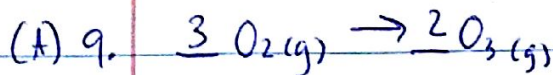
$$(D) 12. \quad 50.0 \text{ g CuSO}_4 \cdot 5\text{H}_2\text{O} \times \frac{1 \text{ mol CuSO}_4 \cdot 5\text{H}_2\text{O}}{249.68 \text{ g}} \times \frac{9 \text{ mol O}}{1 \text{ mol CuSO}_4 \cdot 5\text{H}_2\text{O}} \times \frac{16.00 \text{ g O}}{1 \text{ mol O}} = \boxed{28.8 \text{ g O}}$$

$$(B) 13. \quad 200 \text{ mL} \times \frac{0.50 \text{ mol Cl}^-}{1000 \text{ mL}} \times \frac{1 \text{ mol CaCl}_2 \cdot 6\text{H}_2\text{O}}{2 \text{ mol Cl}^-} \times \frac{219 \text{ g CaCl}_2 \cdot 6\text{H}_2\text{O}}{1 \text{ mol}} = 10.95 \text{ g} = \boxed{11 \text{ g}}$$

$$(C) 14. \quad \frac{5000}{10^6} = (5 \times 10^{-3}) \times (100) = \boxed{0.5\%}$$

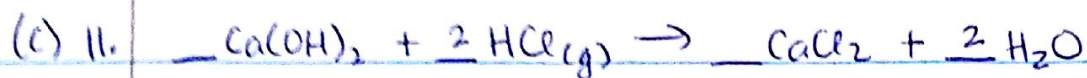
#

1996 NCHO



$$48.0 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \times \frac{2 \text{ mol O}_3}{3 \text{ mol O}_2} = \boxed{1.00 \text{ mol O}_3}$$

$$(B) 10. \quad 0.50 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11} \times \frac{12 \text{ mol C}}{1 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}} \times \frac{12.01 \text{ g C}}{1 \text{ mol C}} = \boxed{72.6 \text{ g C}}$$



$$0.160 \text{ mol HCl} \times \frac{1 \text{ mol CaCl}_2}{2 \text{ mol HCl}} \times \frac{111.0 \text{ g CaCl}_2}{1 \text{ mol CaCl}_2} = \boxed{8.88 \text{ g CaCl}_2}$$

(B) 12. $250 \text{ mL} \times \frac{0.100 \text{ mol Cl}^-}{1000 \text{ mL}} \times \frac{1 \text{ mol CaCl}_2}{2 \text{ mol Cl}^-} = 0.0125 \text{ mol CaCl}_2 \text{ needed}$

$$0.0125 \text{ mol CaCl}_2 \times \frac{1000 \text{ mL}}{0.500 \text{ mol CaCl}_2} = \boxed{25.0 \text{ mL}^{\text{of}} \text{ CaCl}_2 \text{ solution}}$$