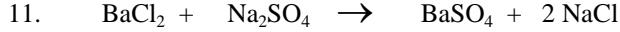
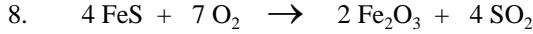
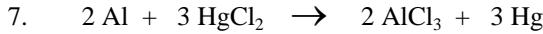
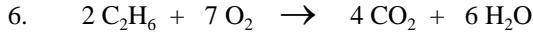


WRITING CHEMICAL EQUATIONS

ANSWERS TO PROBLEMS

BALANCING CHEMICAL EQUATIONS

Balance each of the following equations:

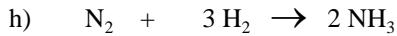


Balance the following oxidation-reduction equation:

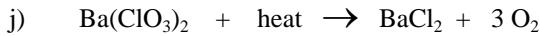
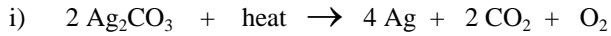
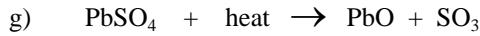
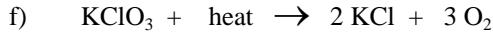
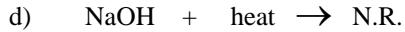
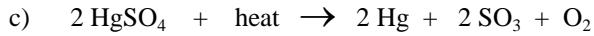
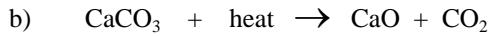


PROBLEMS: Writing chemical equations.

1. Complete and balance the following direct union equations.



2. Complete and balance the following decomposition equations. If no reaction takes place, indicate by writing N.R.



3. Complete and balance the following displacement equations. If no reaction takes place, indicate by writing N.R.

- a) Zn + H₂SO₄ → ZnSO₄ + H₂
- b) Cr + PbCl₂ → CrCl₂ + Pb
- c) Ag + HCl → N.R.
- d) 2 Al + 3 CuSO₄ → Al₂(SO₄)₃ + 3 Cu
- e) 2 Li + 2 H₂O → 2 LiOH + H₂
- f) Cl₂ + 2 KBr → 2 KCl + Br₂
- g) Ni + H₂O_(steam) → N.R.
- h) Cu + H₂SO₄ → N.R.
- i) Pb + FeCl₃ → N.R.
- j) Zn + SnBr₂ → ZnBr₂ + Sn

4. Complete and balance the following metathesis equations.

- a) Al₂O₃ + 6 HNO₃ → 2 Al(NO₃)₃ + 3 H₂O
- b) HgNO₃ + HCl → HgCl + HNO₃ (NOTE: HgCl actually exists as Hg₂Cl₂)
- c) NiSO₄ + Na₂CO₃ → NiCO₃ + Na₂SO₄
- d) Pb(NO₃)₂ + 2 HCl → PbCl₂ + 2 HNO₃
- e) Cr₂O₃ + 3 H₂SO₄ → Cr₂(SO₄)₃ + 3 H₂O
- f) 3 Ca(OH)₂ + 2 H₃PO₄ → Ca₃(PO₄)₂ + 6 H₂O
- g) CuSO₄ + H₂S → CuS + H₂SO₄
- h) 2 FeCl₃ + 3 Ca(OH)₂ → 2 Fe(OH)₃ + 3 CaCl₂
- i) 2 AgNO₃ + Na₂CrO₄ → Ag₂CrO₄ + 2 NaNO₃
- j) Al(OH)₃ + 3 HCl → AlCl₃ + 3 H₂O

5. Complete and balance the following combustion equations.

- a) $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$
- b) $\text{C}_5\text{H}_{12} + 8 \text{O}_2 \rightarrow 5 \text{CO}_2 + 6 \text{H}_2\text{O}$
- c) $2 \text{C}_8\text{H}_{18} + 25 \text{O}_2 \rightarrow 16 \text{CO}_2 + 18 \text{H}_2\text{O}$
- d) $2 \text{C}_3\text{H}_7\text{OH} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 8 \text{H}_2\text{O}$
- e) $2 \text{C}_2\text{H}_5\text{OC}_2\text{H}_5 + 17 \text{O}_2 \rightarrow 8 \text{CO}_2 + 20 \text{H}_2\text{O}$

6. Classify each of the following equations as direct union, decomposition, displacement, or metathesis reactions AND complete and balance each equation. If no reaction takes place, indicate by N.R.

- a) $\text{CuSO}_4 + \text{heat} \rightarrow \text{CuO} + \text{SO}_3$ type: decomposition
- b) $2 \text{CrCl}_3 + 3 \text{Na}_2\text{SiO}_3 \rightarrow \text{Cr}_2(\text{SiO}_3)_2 + 6 \text{NaCl}$ type: metathesis
- c) $\text{Fe}_2\text{O}_3 + 3 \text{H}_2 \rightarrow 2 \text{Fe} + 3 \text{H}_2\text{O}$ type: displacement
- d) $\text{MgO} + \text{CO}_2 \rightarrow \text{MgCO}_3$ type: direct union
- e) $\text{Ag} + \text{H}_2\text{SO}_4 \rightarrow \text{N.R.}$ type: displacement
- f) $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$ type: metathesis
- g) $\text{K}_2\text{SO}_4 + \text{heat} \rightarrow \text{N.R.}$ type: decomposition
- h) $2 \text{Ni} + \text{Pt}(\text{SO}_4)_2 \rightarrow 2 \text{NiSO}_4 + \text{Pt}$ type: displacement
- i) $\text{Fe} + 2 \text{H}_2\text{O}_{(\text{steam})} \rightarrow \text{Fe(OH)}_2 + \text{H}_2$ type: displacement
- j) $\text{Ba} + \text{F}_2 \rightarrow \text{BaF}_2$ type: direct union
- k) $\text{KOH} + \text{CO}_2 \rightarrow \text{KHCO}_3$ type: direct union
- l) $\text{Pt} + \text{O}_2 \rightarrow \text{N.R.}$ type: direct union
- m) $\text{Ba(OH)}_2 + \text{H}_2\text{CO}_3 \rightarrow \text{BaCO}_3 + 2 \text{H}_2\text{O}$ type: metathesis
- n) $2 \text{Ni}(\text{NO}_3)_2 + \text{heat} \rightarrow 2 \text{NiO} + 4 \text{NO}_2 + \text{O}_2$ type: decomposition
- o) $\text{Sr} + 2 \text{H}_2\text{O} \rightarrow \text{Sr(OH)}_2 + \text{H}_2$ type: displacement

- p) $2 \text{Ag}_2\text{CO}_3 + \text{heat} \rightarrow 4 \text{Ag} + 2 \text{CO}_2 + \text{O}_2$ type: decomposition
- q) $\text{MnCl}_2 + \text{H}_2\text{S} \rightarrow \text{MnS} + 2 \text{HCl}$ type: metathesis
- r) $\text{CaO} + \text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$ type: metathesis
- s) $\text{Cu} + \text{HCl} \rightarrow \text{N.R.}$ type: displacement
- t) $2 \text{Al} + 3 \text{Br}_2 \rightarrow 2 \text{AlBr}_3$ type: displacement
- u) $\text{Pb}(\text{NO}_3)_2 + \text{Na}_2\text{CrO}_4 \rightarrow \text{PbCrO}_4 + 2 \text{NaNO}_3$ type: metathesis
- v) $2 \text{Al}(\text{OH})_3 + \text{heat} \rightarrow \text{Al}_2\text{O}_3 + 3 \text{H}_2\text{O}$ type: decomposition
- w) $3 \text{Ca}(\text{OH})_2 + 2 \text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6 \text{H}_2\text{O}$ type: metathesis
- x) $2 \text{AsCl}_3 + 3 \text{H}_2\text{S} \rightarrow \text{As}_2\text{S}_3 + 6 \text{HCl}$ type: metathesis
- y) $\text{Cu} + \text{Hg}(\text{NO}_3)_2 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Hg}$ type: displacement
- z) $\text{Co}_2(\text{SO}_4)_3 + \text{heat} \rightarrow \text{Co}_2\text{O}_3 + 3 \text{SO}_3$ type: decomposition
- aa) $\text{Fe} + 4 \text{HNO}_3 \rightarrow \text{Fe}(\text{NO}_3)_2 + 2 \text{NO}_2 + 2 \text{H}_2\text{O}$ type: displacement
- bb) $\text{Ni}(\text{NO}_3)_2 + 2 \text{NaOH} \rightarrow \text{Ni}(\text{OH})_2 + 2 \text{NaNO}_3$ type: metathesis
- cc) $2 \text{Na} + 2 \text{H}_2\text{O} \rightarrow 2 \text{NaOH} + \text{H}_2$ type: displacement
- dd) $2 \text{KCl} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{HCl}$ type: metathesis
- ee) $\text{Mg} + 2 \text{H}_2\text{O}_{(\text{steam})} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$ type: displacement
- ff) $\text{Ag} + \text{HNO}_3 \rightarrow \text{AgNO}_3 + \text{NO}_2 + \text{H}_2\text{O}$ type: displacement
- gg) $\text{CaCO}_3 + 2 \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{CO}_3$ type: metathesis
 (NOTE: H_2CO_3 is unstable and breaks down to H_2O and CO_2)
- hh) $2 \text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{H}_2\text{O}$ type: metathesis
- ii) $\text{SrI}_2 + \text{Br}_2 \rightarrow \text{SrBr}_2 + \text{I}_2$ type: displacement
- jj) $\text{Ba}(\text{NO}_3)_2 + \text{heat} \rightarrow \text{BaO} + 2 \text{NO}_2 + \text{O}_2$ type: decomposition
- kk) $2 \text{Al} + 3 \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3 \text{H}_2$ type: displacement
- ll) $\text{PCl}_3 + \text{Cl}_2 \rightarrow \text{PCl}_5$ type: direct union

