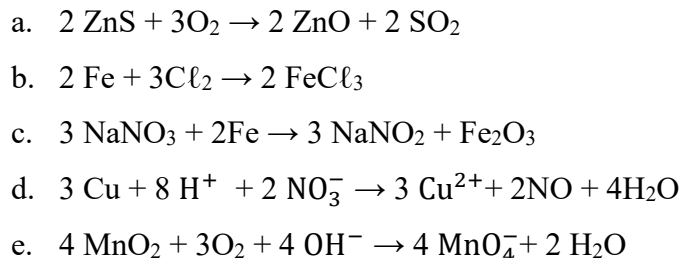
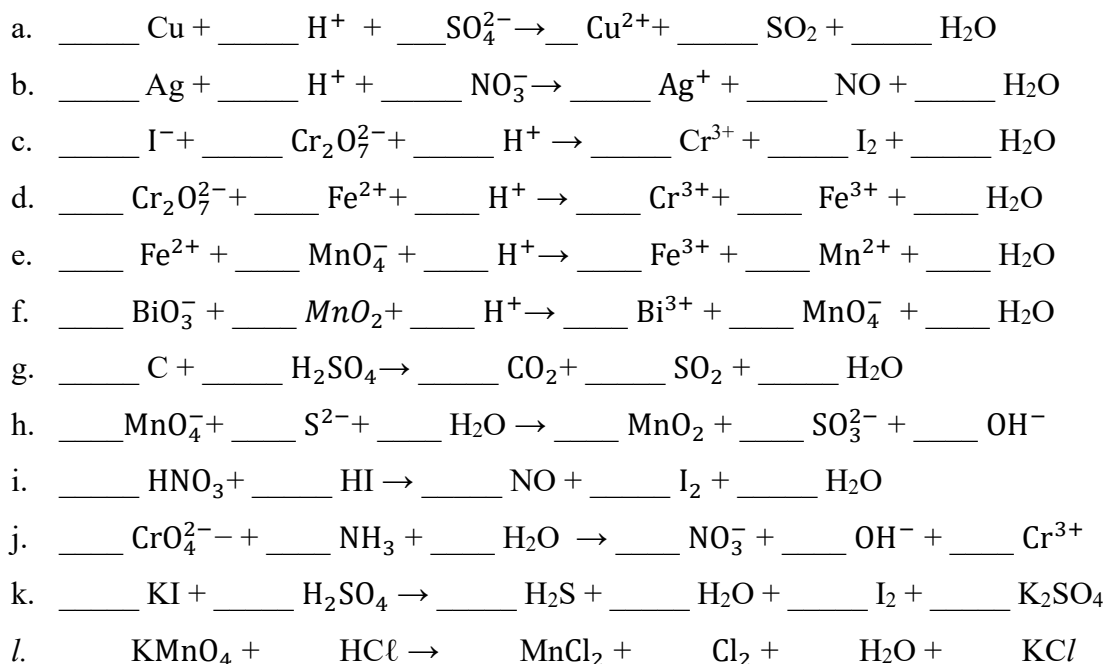


Balancing Equations

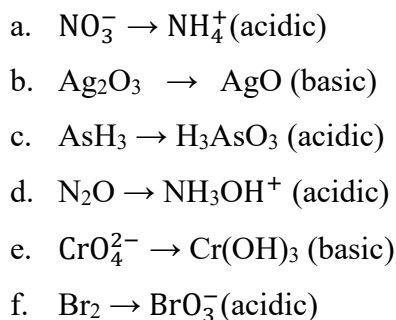
- 1) For each of the following equations, identify [a] the element which was oxidized, [b] the element which was reduced, [c] the oxidizing agent, and [d] the reducing agent.



- 2) Balance the following redox reaction equations using the oxidation number method.



- 3) Write a balanced equation for each of the following half-reactions, and state whether it represents oxidation or reduction.



4) Balance the following redox equations:

- $\text{ClO}_3^- + \text{N}_2\text{H}_4 \rightarrow \text{NO} + \text{Cl}^-$
- $\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} \rightarrow \text{MnO}_2 + \text{CO}_3^{2-}$ (basic)
- $\text{Sb} + \text{NO}_3^- \rightarrow \text{Sb}_2\text{O}_5 + \text{NO}$ (acidic)
- $\text{IPO}_4 \rightarrow \text{I}_2 + \text{IO}_3^- + \text{H}_2\text{PO}_4^-$ (basic)
- $\text{Cr}_2\text{O}_7^{2-} + \text{C}_2\text{O}_4^{2-} \rightarrow \text{Cr}^{3+} + \text{CO}_2$ (acidic)
- $\text{As} \rightarrow \text{AsH}_3 + \text{H}_2\text{AsO}_4^-$ (basic)

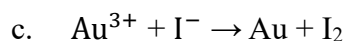
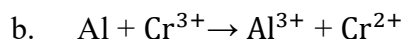
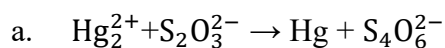
5) Balance the following redox reaction equations

- ___ H_3PO_4 + ___ $\text{KOH} \rightarrow$ ___ K_3PO_4 + ___ H_2O
- ___ $\text{K} +$ ___ $\text{B}_2\text{O}_3 \rightarrow$ ___ $\text{K}_2\text{O} +$ ___ B
- ___ $\text{HCl} +$ ___ $\text{NaOH} \rightarrow$ ___ $\text{NaCl} +$ ___ H_2O
- ___ $\text{Na} +$ ___ $\text{NaNO}_3 \rightarrow$ ___ $\text{Na}_2\text{O} +$ ___ N_2
- ___ $\text{C} +$ ___ $\text{S}_8 \rightarrow$ ___ CS_2
- ___ $\text{Na} +$ ___ $\text{O}_2 \rightarrow$ ___ Na_2O
- ___ $\text{N}_2 +$ ___ $\text{O}_2 \rightarrow$ ___ N_2O_5
- ___ $\text{H}_3\text{PO}_4 +$ ___ $\text{Mg}(\text{OH})_2 \rightarrow$ ___ $\text{Mg}_3(\text{PO}_4)_2 +$ ___ H_2O
- ___ $\text{NaOH} +$ ___ $\text{H}_2\text{CO}_3 \rightarrow$ ___ $\text{Na}_2\text{CO}_3 +$ ___ H_2O
- ___ $\text{KOH} +$ ___ $\text{HBr} \rightarrow$ ___ $\text{KBr} +$ ___ H_2O
- ___ $\text{Na} +$ ___ $\text{O}_2 \rightarrow$ ___ Na_2O
- ___ $\text{Al}(\text{OH})_3 +$ ___ $\text{H}_2\text{CO}_3 \rightarrow$ ___ $\text{Al}_2(\text{CO}_3)_3 +$ ___ H_2O
- ___ $\text{Al} +$ ___ $\text{S}_8 \rightarrow$ ___ Al_2S_3
- ___ $\text{Cs} +$ ___ $\text{N}_2 \rightarrow$ ___ Cs_3N
- ___ $\text{Mg} +$ ___ $\text{Cl}_2 \rightarrow$ ___ MgCl_2
- ___ $\text{Rb} +$ ___ $\text{RbNO}_3 \rightarrow$ ___ $\text{Rb}_2\text{O} +$ ___ N_2

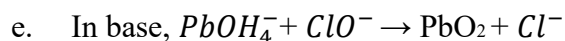
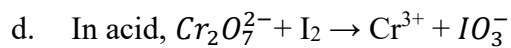
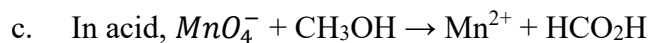
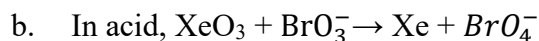
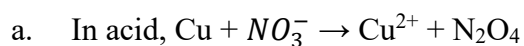
- 17) $\text{___ C}_6\text{H}_6 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 18) $\text{___ N}_2 + \text{___ H}_2 \rightarrow \text{___ NH}_3$
- 19) $\text{___ C}_{10}\text{H}_{22} + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 20) $\text{___ Al(OH)}_3 + \text{___ HBr} \rightarrow \text{___ AlBr}_3 + \text{___ H}_2\text{O}$
- 21) $\text{___ CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 22) $\text{___ C}_3\text{H}_8 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 23) $\text{___ Li} + \text{___ AlCl}_3 \rightarrow \text{___ LiCl} + \text{___ Al}$
- 24) $\text{___ C}_2\text{H}_6 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 25) $\text{___ NH}_4\text{OH} + \text{___ H}_3\text{PO}_4 \rightarrow \text{___ (NH}_4)_3\text{PO}_4 + \text{___ H}_2\text{O}$
- 26) $\text{___ Rb} + \text{___ P} \rightarrow \text{___ Rb}_3\text{P}$
- 27) $\text{___ CH}_4 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 28) $\text{___ Al(OH)}_3 + \text{___ H}_2\text{SO}_4 \rightarrow \text{___ Al}_2(\text{SO}_4)_3 + \text{___ H}_2\text{O}$
- 29) $\text{___ Na} + \text{___ Cl}_2 \rightarrow \text{___ NaCl}$
- 30) $\text{___ Rb} + \text{___ S}_8 \rightarrow \text{___ Rb}_2\text{S}$
- 31) $\text{___ H}_3\text{PO}_4 + \text{___ Ca(OH)}_2 \rightarrow \text{___ Ca}_3(\text{PO}_4)_2 + \text{___ H}_2\text{O}$
- 32) $\text{___ NH}_3 + \text{___ HCl} \rightarrow \text{___ NH}_4\text{Cl}$
- 33) $\text{___ Li} + \text{___ H}_2\text{O} \rightarrow \text{___ LiOH} + \text{___ H}_2$
- 34) $\text{___ Ca}_3(\text{PO}_4)_2 + \text{___ SiO}_2 + \text{___ C} \rightarrow \text{___ CaSiO}_3 + \text{___ CO} + \text{___ P}$
- 35) $\text{___ NH}_3 + \text{___ O}_2 \rightarrow \text{___ N}_2 + \text{___ H}_2\text{O}$
- 36) $\text{___ FeS}_2 + \text{___ O}_2 \rightarrow \text{___ Fe}_2\text{O}_3 + \text{___ SO}_2$
- 37) $\text{___ C} + \text{___ SO}_2 \rightarrow \text{___ CS}_2 + \text{___ CO}$

6) For each of the following, separate the skeletal (unbalanced) equation into two half reactions.

For each half reaction, balance the elements (mass balance), and then add electrons to the right or left side to make a net charge balance. Identify which half reaction is the oxidation and which is the reduction. Then, multiply each half reaction by an appropriate factor so that the two multiplied half reactions add together to make a balanced redox equation.



7) Use the ion-electron method to complete and balance the following skeletal redox equations, occurring in either acidic or basic aqueous solution, as indicated. Identify the oxidation and reduction half reactions in each case.



8) Balance the following redox reactions in an acidic solution.

