ANSWER KEY.

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Balancing Redox Reactions

Chemistry | ANSWER KEY

Balance each reaction with half-reactions. Balance atoms other than O and H first. In acidic solution, add H_2O to balance O, then H^+ to balance H, then e^- to the more positive side. Make electrons lost equal electrons gained, then check atoms and charge.

1. $Ag^+ + Cu \rightarrow Ag + Cu^{2+}$

Oxidation: $Cu \rightarrow Cu^{2+} + 2e^-$
Reduction: $Ag^+ + e^- \rightarrow Ag$ (multiply by 2)
$2Ag^+ + Cu \rightarrow 2Ag + Cu^{2+}$
Charge: +2 = +2

2. $Al + Cu^{2+} \rightarrow Al^{3+} + Cu$

Oxidation: $Al \rightarrow Al^{3+} + 3e^-$ (multiply by 2)
Reduction: $Cu^{2+} + 2e^- \rightarrow Cu$ (multiply by 3)
$2Al + 3Cu^{2+} \rightarrow 2Al^{3+} + 3Cu$
Charge: +6 = +6

3. In acidic solution: $MnO_4^- + Fe^{2+} \rightarrow Mn^{2+} + Fe^{3+}$

Reduction (Mn: +7 to +2): $MnO_4^- \rightarrow Mn^{2+} + 4H_2O$, then $8H^+ + MnO_4^- \rightarrow Mn^{2+} + 4H_2O$.
Charge is +7 on the left and +2 on the right, so add $5e^-$ to the left.
Oxidation: $Fe^{2+} \rightarrow Fe^{3+} + e^-$ (multiply by 5)
$MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$
Charge: −1 + 8 + 10 = +17 on the left, 2 + 15 = +17 on the right

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4. In acidic solution: $Ag + NO_3^- \rightarrow Ag^+ + NO$

Reduction (N: +5 to +2): $NO_3^- \rightarrow NO + 2H_2O$, then $4H^+ + NO_3^- \rightarrow NO + 2H_2O$. Charge is +3 on the left and 0 on the right, so add $3e^-$ to the left.
Oxidation: $Ag \rightarrow Ag^+ + e^-$ (multiply by 3)
$3Ag + 4H^+ + NO_3^- \rightarrow 3Ag^+ + NO + 2H_2O$
Charge: +3 = +3

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5. In acidic solution: $Cu + SO_4^{2-} \rightarrow Cu^{2+} + SO_2$

Reduction (S: +6 to +4): $SO_4^{2-} \rightarrow SO_2 + 2H_2O$, then $4H^+ + SO_4^{2-} \rightarrow SO_2 + 2H_2O$. Charge is +2 on the left and 0 on the right, so add $2e^-$ to the left.
Oxidation: $Cu \rightarrow Cu^{2+} + 2e^-$ (electrons already match)
$Cu + 4H^+ + SO_4^{2-} \rightarrow Cu^{2+} + SO_2 + 2H_2O$
Charge: +2 = +2

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