Refer to Balancing RedOx Reactions while working on these problems. You should also refer to your textbook chapter on oxidation-reduction reactions.

1. For the complete redox reactions below (i) break down the reaction into a set of halfreactions and (ii) identify the oxidizing and reducing agents.
$2 \mathrm{Cs}+\mathrm{Cl}_{2} \rightarrow 2 \mathrm{CsCl}$
$\mathrm{Cs} \rightarrow \mathrm{Cs}^{+}+\mathrm{e}^{-} \quad$ (Cs is the reducing agent)
$\mathrm{Cl}_{2}+2 \mathrm{e}^{-} \rightarrow 2 \mathrm{Cl}^{-} \quad\left(\mathrm{Cl}_{2}\right.$ is the oxidizing agent)
$\mathrm{Cl} 2+2 \mathrm{NaBr} \rightarrow 2 \mathrm{NaCl}+\mathrm{Br} 2$
$\mathrm{Cl}_{2}+2 \mathrm{e}^{-} \rightarrow 2 \mathrm{Cl}^{-} \quad\left(\mathrm{Cl}_{2}\right.$ is the oxidizing agent)
$2 \mathrm{Br}^{-} \rightarrow \mathrm{Br}_{2}+2 \mathrm{e}^{-} \quad\left(\mathrm{Br}^{-}\right.$is the reducing agent)
$\mathrm{Zn}+2 \mathrm{HCl} \rightarrow \mathrm{ZnCl} 2+\mathrm{H} 2$
$\begin{array}{ll}\mathrm{Zn} \rightarrow \mathrm{Zn}^{2+}+2 \mathrm{e}^{-} & \text {(Zn is the reducing agent) } \\ 2 \mathrm{H}^{+}+2 \mathrm{e}^{-} \rightarrow \mathrm{H}_{2} & \left(\mathrm{H}^{+} \text {is the oxidizing agent) }\right.\end{array}$
2. Balance the following redox reactions by the half-reaction (ion-electron) method. Work the problems on a separate sheet of paper.
$\mathrm{C}+2 \mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow \mathrm{CO}_{2}+2 \mathrm{SO}_{2}+2 \mathrm{H}_{2} \mathrm{O}$
$3 \mathrm{Cu}+\mathrm{HNO}_{3}+6 \mathrm{H}^{+} \rightarrow 3 \mathrm{Cu}^{2+}+2 \mathrm{NO}+4 \mathrm{H}_{2} \mathrm{O}$
$2 \mathrm{MnO}_{4}^{-}+5 \mathrm{SO}_{2}+\mathrm{H}^{+}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow 2 \mathrm{Mn}^{2+}+5 \mathrm{HSO}_{4}^{-}$
$8 \mathrm{Br}_{2}+12 \mathrm{OH}^{-} \rightarrow 2 \mathrm{BrO}_{3}^{-}+10 \mathrm{Br}^{-}+6 \mathrm{H}_{2} \mathrm{O}$
$2 \mathrm{Bi}(\mathrm{OH})_{3}+3 \mathrm{SnO}_{2}{ }^{2-} \rightarrow 3 \mathrm{SnO}_{3}{ }^{2-}+2 \mathrm{Bi}+3 \mathrm{H}_{2} \mathrm{O}$
$5 \mathrm{Fe}^{2+}+\mathrm{MnO}_{4}^{-}+8 \mathrm{H}^{+} \rightarrow 5 \mathrm{Fe}^{3+}+\mathrm{Mn}^{2+}+4 \mathrm{H}_{2} \mathrm{O}$
3. Balance the following redox reactions by the oxidation number method. Work the problems on a separate sheet of paper.

$$
\begin{aligned}
& \mathrm{I}_{2} \mathrm{O}_{5}+5 \mathrm{CO} \rightarrow \mathrm{I}_{2}+5 \mathrm{CO}_{2} \\
& 6 \mathrm{Sb}+10 \mathrm{HNO}_{3} \rightarrow 3 \mathrm{Sb}_{2} \mathrm{O}_{5}+10 \mathrm{NO}+5 \mathrm{H}_{2} \mathrm{O} \\
& 3 \mathrm{H}_{2} \mathrm{~S}+2 \mathrm{HNO}_{3} \rightarrow 3 \mathrm{~S}+2 \mathrm{NO}+4 \mathrm{H}_{2} \mathrm{O} \\
& 7 \mathrm{PbO}_{2}+7 \mathrm{H}_{2} \mathrm{SO}_{4}+2 \mathrm{Mn}\left(\mathrm{NO}_{3}\right)_{2} \rightarrow \mathrm{PbSO}_{4}+4 \mathrm{HNO}_{3}+2 \mathrm{HMnO}_{4}+4 \mathrm{H}_{2} \mathrm{O} \\
& \mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+6 \mathrm{Fe}^{2+} 14 \mathrm{H}^{+} \rightarrow 2 \mathrm{Cr}^{3+}+6 \mathrm{Fe}^{3+}+8 \mathrm{H}_{2} \mathrm{O} \\
& 8 \mathrm{Cr}^{3+}+3 \mathrm{ClO}_{4}^{-}+16 \mathrm{H}_{2} \mathrm{O} \rightarrow 3 \mathrm{Cl}^{-}+4 \mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+32 \mathrm{H}^{+} \\
& \mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}+3 \mathrm{SO}_{3}^{2-}+8 \mathrm{H}^{+} \rightarrow 2 \mathrm{Cr}^{3+}+3 \mathrm{SO}_{4}^{2-}+4 \mathrm{H}_{2} \mathrm{O}
\end{aligned}
$$

