In each of the following balanced oxidation-reduction equations, identify those elements that undergo changes in oxidation number and indicate the magnitude of the change.

1.
$$I_{2}Q_{5(s)} + 5CQ_{(g)}$$
 $I_{2(s)} + 5CQ_{2(g)}$ $I_{3(s)} + 2CQ_{3(g)} + 2$

Indicate whether the following balanced equations involve oxidation-reduction. If they do, identify the elements that undergo changes in oxidation number.

4.
$$2 OH_{(aq)}^{-} + Cr_{2}O_{7}^{2-}_{(aq)} \longrightarrow 2 CrO_{4}^{2-}_{(aq)} + H_{2}O_{(l)}$$
 $-2 +1 +6 -2 +6 -2 -1 -2$

5. $3 NO_{2(g)} + H_{2}O_{(l)} \longrightarrow 2 HNO_{3(aq)} + NO_{(g)}$
 $+4 -2 +1 -2 +1 +5 -2 +2 -2$

6. $PB_{(3(l))} + 3 H_{2}O_{(l)} \longrightarrow H_{3}PO_{4(aq)} + 3 HBr_{(aq)}$
 $+3 -1 +1 -2 +1 +5 -2 +1 -1$

not a REDOX

 $+1 +5 -2 +1 -1$

7.
$$2 H_2 SO_{4(aq)} + 2 NaBr_{(s)}$$
 \longrightarrow $Br_{2(s)} + SO_{2(g)} + Na_2 SO_{4(aq)} + 2 H_2O_{(l)}$
+1 +6 -2 +1 -1 0 +4 -2 +1 +6 -2 +1 -2
Br from -1 to 0
S from +6 to +4

- 8. Solid lead (II) sulfide reacts at high temperatures with oxygen in the air to form lead (II) oxide and sulfur dioxide.
 - (a) Write a balanced equation for this reaction.

$$2 \text{ PbS}_{(s)} + 3 \mathbf{0}_{2(q)} \longrightarrow 2 \text{ PbO}_{(s)} + 2 \text{ SO}_{2(q)}$$

(b) Which substances are reductants, and which are oxidants?

S goes from -2 to +4....it is oxidized PbS is the reducing agent $\mathbf{0}$ goes from 0 to -2...it is reduced $\mathbf{0}_2$ is the oxidizing agent

- 9. Hydrazine, N_2H_4 , and dinitrogen tetroxide, form a self-igniting mixture that has been used as a rocket propellant. The reaction products are N_2 and H_2O
 - (a) Write a balanced equation for this reaction.

$$2 N_2 \mathbf{H}_{4(q)} + N_2 \mathbf{O}_{4(q)} \longrightarrow 3 N_{2(q)} + 4 \mathbf{H}_2 \mathbf{O}_{(q)}$$

(b) Which substance serves as the reducing agent and which as the oxidizing agent?

N goes from -2 to 0....it is oxidized N_2H_4 is the reducing agent N_2O_4 is the oxidizing agent

10. Sulfuric acid functions as an oxidizing agent in (a) and as an acid in (b). How do you differentiate between these two functions?

(a)
$$4 H^{+}_{(aq)} + SO_{4}^{2-}_{(aq)} + 2 NaI_{(s)} \longrightarrow 2 Na^{1+}_{(aq)} + I_{2(s)} + SO_{2(g)} + 2 H_{2}O_{(l)} + 1 + 6 -2 + 1 -1 + 1 = 0 + 4 -2 + 1 = -2$$

(b)
$$BaF_{2(s)} + 2H^{+}_{(aq)} + SO_{4}^{2-}_{(aq)} \longrightarrow 2HF_{(aq)} + BaSO_{4(s)}$$

 $-2 -1 +1 +6 -2 +1 -1 +2 +6 -2$

No change in charge...NOT A REDOX RXN

Identify the oxidizing agent and the reducing agent in each of the following balanced net ionic equations.

11.
$$5 H_2^2 C_2 O_{4(aq)} + 2 Mn O_{4(aq)} + 6 H_{(aq)}^+ \longrightarrow 2 Mn^{2+}_{(aq)} + 10 CO_{2(g)} + 8 H_2 O_{(l)}$$

+1 +3 -2 +7 -8 +1 +2 +4 -2 +1 -2

12.
$$3 Cu_{(s)} + 8 H^{+}_{(aq)} + 2 NO_{3(aq)} \longrightarrow 3 Cu^{2+}_{(aq)} + 2 NO_{(g)} + 4 H_{2}O_{(l)} + 1 + 5 -2 + 2 + 2 -2 +1 -2$$

13.
$$Sn_{(s)} + 2H^{+}_{(aq)} \longrightarrow Sn^{2+}_{(aq)} + H_{2(g)}$$

$$0 + 1 + 2 0$$

14.
$$8 H^{+}_{(aq)} + 6 CI^{-}_{(aq)} + Sn_{(s)} + 4 NO_{3(aq)} \longrightarrow SnCI_{6^{2-}_{(aq)}} + 4 NO_{2(g)} + 4 H_{2}O_{(l)} + 1 -1 0 +5 -2 +4 -1 +4 -2 +1 -2$$

15.
$$2 \stackrel{QA}{MnQ_4}_{(aq)} + 10 \stackrel{RA}{Cl_{(aq)}} + 16 \stackrel{H^+_{(aq)}}{H^+_{(aq)}} \longrightarrow 5 \stackrel{Cl_{2(g)}}{Cl_{2(g)}} + 2 \stackrel{Mn^{2+}_{(aq)}}{Mn^{2+}_{(aq)}} + 8 \stackrel{H_2O_{(l)}}{H_2O_{(l)}} + 7 \stackrel{-2}{-2} \qquad -1 \qquad +1 \qquad 0 \qquad +2 \qquad +1 -2$$

16.
$$8 H^{+}_{(aq)} + Cr_{2}O_{7}^{2-}_{(aq)} + 3 SO_{3}^{2-}_{(aq)} \longrightarrow 2 Cr_{3}^{3+}_{(aq)} + 3 SO_{4}^{2-}_{(aq)} + 4 H_{2}O_{(1)}$$

+1 +6 -2 +4 -2 +3 +6 -2 +1 -2