Date: Kuz

Worksheet #3: Balancing Redox Equations

Use the oxidation number method to balance the following redox equations.

Reactions in Acidic Solutions

	L	R
ox	15	8 (+7)
H.	0 (+14)	14
chg	+13	+13

$$\underline{2}\ Mn^{2+} + \underline{5}BiO_3^- \ ===> \underline{2}MnO_4^- + \underline{5}Bi^{3+}$$

$5e^-/Mn^{2+}$ ×2 = 10 $\quad 2e^-/BiO_3^-$ ×5 = 10

$$(14H^+) + 2Mn^{2+} + 5BiO_3^- \rightarrow 2MnO_4^- + 5Bi^{3+} + (7H_2O)$$

$$14H^+ + 2Mn^{2+} + 5BiO_3^- \rightarrow 2MnO_4^- + 5Bi^{3+} + 7H_2O$$

$$ClO_3^- + Cl^- \ ===> \ Cl_2 + ClO_2$$

(SKIP)

	L	R
ox.	0 (+8)	8
H.	16	4 (+12)
chg.	+10	+10

$$2P^0 + 5Cu^{2+} \ ===> \ 5Cu^0 + 2H_2PO_4^-$$

$5e^-/P$ ×2 = 10 $\quad 2e^-/Cu^{2+}$ ×5 = 10

$$(8H_2O) + 2P + 5Cu^{2+} \rightarrow 5Cu + 2H_2PO_4^- + 12H^+$$

$$8H_2O + 2P + 5Cu^{2+} \rightarrow 5Cu + 2H_2PO_4^- + 12H^+$$

	L	R
ox.	0 (+4)	4
H.	14	6 (+8)
chg.	0	0

$$2PH_3 + 3I_2 \ ===> 2H_3PO_2^- + 6I^-$$

$3e^-/PH_3$ ×2 = 6 $\quad 2e^-/I_2$ ×3 = 6

$$(4H_2O) + 2PH_3 + 3I_2 \rightarrow 2H_3PO_2^- + 6I^- + (8H^+)$$

$$4H_2O + 2PH_3 + 3I_2 \rightarrow 2H_3PO_2^- + 6I^- + 8H^+$$

$$NO_2 \ ===> \ NO_3^- + NO$$

(SKIP)

Reactions in Basic Solutions

$$2\,MnO_4^- + 3C_2O_4^{2-} \longrightarrow 2MnO_2 + 6CO_2$$

	L	R
ox.	20	16 (+4)
H	0 (+8)	8
chg.	−8	−8

$3e^-/MnO_4^-$ ×2 = 6

$2e^-/C_2O_4$ ×3 = 6

$(8H^+) + 2MnO_4^- + 3C_2O_4^{2-} \rightarrow 2MnO_2 + 6CO_2 + 4H_2O$

$(8OH^-) + 8H^+ + 2MnO_4^- + 3C_2O_4^{2-} \rightarrow 2MnO_2 + 6CO_2 + 4H_2O + (8OH^-)$

$4H_2O$

$4H_2O + 2MnO_4^- + 3C_2O_4 \rightarrow 2MnO_2 + 6CO_2 + 8OH^-$

$$ClO_2 \longrightarrow ClO_2^- + ClO_3^-$$

(SKIP)

	L	R
ox.	4 (+2)	6
H	16	12 (+4)
chg.	−4	−4

$$Cu(NH_3)_4^{2+} + S_2O_4^{2-} \longrightarrow 2SO_3^{2-} + Cu + 4NH_3$$

$2e^-/Cu(NH_3)_4^{2+}$ $2e^-/S_2O_4$

$(2H_2O) + Cu(NH_3)_4^{2+} + S_2O_4^{2-} \rightarrow 2SO_3^{2-} + Cu + 4NH_3$ $(+4H^+)$

$(4OH^-) + 2H_2O + Cu(NH_3)_4^{2+} + S_2O_4^{2-} \rightarrow 2SO_3^{2-} + Cu + 4NH_3 + 4H^+ + (4OH^-)$

$4H_2O$

$4OH^- + Cu(NH_3)_4^{2+} + S_2O_4^{2-} \rightarrow 2SO_3^{2-} + Cu + 4NH_3 + 2H_2O$

	L	R
ox.	3 (+13)	16
H	26	19 (+7)
chg.	−8	−8

$$4Zn + NO_3^- \longrightarrow 4Zn(OH)_4^{2-} + NH_3$$

$2e^-/Zn$ ×4 = 8

$8e^-/NO_3^-$ = 8

$(7OH^-) + (6H_2O) + 4Zn + NO_3^- \rightarrow 4Zn(OH)_4^{2-} + NH_3$ $(+7H^+)$

$7H_2O$ $(+7OH^-)$

$7OH^- + 6H_2O + 4Zn + NO_3^- \rightarrow 4Zn(OH)_4^{2-} + NH_3$

$$Al + OH^- \longrightarrow AlO_2^- + H_2$$

(SKIP)

	L	R
ox.	0 (+4)	4
H	8	6 (+2)
chg.	−2 / −2	

$$Zn \longrightarrow Zn(OH)_4^{2-} + H_2$$

$(4H_2O) + Zn \rightarrow Zn(OH)_4^{2-} + H_2 + 2H^+$

$(2OH^-) + 4H_2O + Zn \rightarrow Zn(OH)_4^{2-} + H_2 + 2H^+ + (2OH^-)$

$2H_2O$

$2OH^- + 2H_2O + Zn \rightarrow Zn(OH)_4^{2-} + H_2$