PRACTICE TEST 2 SOLUTIONS

1) $7.1g\ N_2 \left(\frac{1mol\ N_2}{28g\ N_2}\right)\left(\frac{3H_2}{1N_2}\right)\left(\frac{2g\ H_2}{1mol\ H_2}\right) = \boxed{1.5g\ H_2}$

2) $3.82g\ Mg_3N_2 \left(\frac{1\ mol\ Mg_3N_2}{100.9g\ Mg_2N_3}\right)\left(\frac{3\ MgO}{1\ mol\ Mg_2N_3}\right) = \boxed{0.113\ mol - limiting}$

$7.73g\ H_2O \left(\frac{1\ mol\ H_2O}{18g\ H_2O}\right)\left(\frac{3\ MgO}{3\ mol\ H_2O}\right) = 0.429\ mol$

9) $C_iV_i = C_fV_f$

$C_f = \frac{C_iV_i}{V_f} = \frac{(5.005M)(43.72mL)}{500\ mL} = \boxed{0.438M}$

15) A) $\underset{-3}{N}\underset{+1}{H_4}\underset{-1}{Cl}$ B) $\underset{+1}{Na_3}\underset{-3}{N}$ C) $\underset{+2}{Mg}\underset{\boxed{+4}}{S}\underset{-2}{O_3}$ D) $\underset{+3}{Al}(\underset{+1}{N}\underset{-2}{O_2})_3$ E) $\underset{+2}{Ca}\underset{-2}{S}$

highest

18) $CH_3OH_{(l)} \rightarrow CO_{(g)} + 2H_{2(g)}$ $\Delta H = 128.1KJ$

$15.5g\ CH_3OH \left(\frac{1\ mol\ CH_3OH}{32g\ CH_3OH}\right)\left(\frac{+128.1KJ}{1\ CH_3OH}\right) = \boxed{62\ KJ}$

23) $H_{2(g)} + Br_{2(g)} \longrightarrow 2HBr_{(g)}$ $\Delta H = {}^-72KJ$

$1\ mol\ HBr \left(\frac{{}^-72KJ}{2HBr}\right) = \boxed{{}^-36\ KJ}$

26) $Li_3PO_4 \rightarrow 3Li^+ + PO_4^{-3}$, which make 4 ions in solution. The more ions, the more conductive the solution.

29) $Pb^{+2}_{(Aq)} + Mg_{(s)} \rightarrow Pb_{(s)} + Mg^{+2}_{(Aq)}$

from Table (will be provided)

$Pb_{(s)} \rightarrow Pb^{+2} + 2e^-$ hard ⇒ needs to be reversed to match rxn in question

rev

$Mg_{(s)} \rightarrow Mg^{+2} + 2e^-$ easy (higher than Pb on Table)

$+\quad Pb^{+2} + 2e^- \rightarrow Pb_s$ easy

$Pb^{+2}_{(Aq)} + Mg_{(s)} + \cancel{2e^-} \rightarrow Mg^{+2}_{(Aq)} + Pb_{(s)} + \cancel{2e^-}$ $\boxed{\text{EASY (easy + easy) ∴ IT happens ✓}}$

29) cont'd)

$Fe^{+2} + 2Na \rightarrow Fe_{(s)} + 2Na^{+}$

reverse ⇒ $Fe \rightarrow Fe^{+2} + 2e^{-}$ hard

$Na \rightarrow Na^{+} + e^{-}$ easy ⟸ x2 to match question (doesn't affect 'easy')

$2Na_{(s)} \rightarrow 2Na^{+}_{(Aq)} + 2e^{-}$ easy

$Fe^{+2}_{(Aq)} + 2e^{-} \rightarrow Fe_{(s)}$ easy

$Fe^{+2} + 2Na_{(s)} + \cancel{2e^{-}} \rightarrow Fe_{(s)} + 2Na^{+}_{(Aq)} + \cancel{2e^{-}}$ $\boxed{\text{EASY - It will occur}}$

$Ni_{(s)} + Ca^{+2}_{(Aq)} \longrightarrow Ni^{+2}_{(Aq)} + Ca_{(s)}$ ⟸

$Ni_{(s)} \rightarrow Ni^{+2} + 2e^{-}$ hard

$Ca_{(s)} \rightarrow Ca^{+2} + 2e^{-}$ easy ⟸ reverse

$Ni_{(s)} \rightarrow Ni^{+2} + 2e^{-}$ hard

$Ca^{+2} + 2e^{-} \rightarrow Ca_{(s)}$ hard

$Ni_{(s)} + Ca^{+2}_{(Aq)} + \cancel{2e} \rightarrow Ca_{(s)} + Ni^{+2} + \cancel{2e}$ $\boxed{\text{HARD - It does not happen}}$

30) $CaO_{(s)} + H_2O_{(\ell)} \longrightarrow Ca(OH)_{2\,(s)}$

$1.5g\ CaO \left(\frac{1\ mol\ CaO}{56.1g\ CaO}\right) = 0.0267\ mol\ CaO \left(\frac{1\ mol\ H_2O}{1\ mol\ CaO}\right) = .0267\ mol\ H_2O$

$1.45g\ H_2O \left(\frac{1\ mol\ H_2O}{18g\ H_2O}\right) = 0.0806\ mol\ H_2O$

if our 0.0267mol of CaO were to be used, it would require 0.0267 mol of H_2O. We have 0.0867mol H_2O, so There'll be plenty of H_2O, and CaO is limiting.

$.0806\ mol\ H_2O - .0267\ mol\ H_2O = .0539\ mol\ H_2O$ → Amount of H_2O not used.

$.0539\ mol \left(\frac{18g\ H_2O}{1\ mol\ H_2O}\right) = \boxed{0.970g\ H_2O}$

31) $C_sV_s = C_dV_d$

$\frac{C_sV_s}{V_d} = C_d = \frac{(13.5M\ HNO_3)(25.0\ \cancel{mL})\left(\frac{10^{-3}\cancel{L}}{1\ \cancel{mL}}\right)}{(.500\cancel{L})} = \boxed{0.675M\ HNO_3}$

32) $22.5g\ C_6H_{12}O_6 \left(\frac{1\ mol\ C_6H_{12}O_2}{180g\ C_6H_{12}O_2}\right)\left(\frac{1}{35.5\cancel{mL}}\right)\left(\frac{1\ \cancel{mL}}{10^{-3}L}\right) = 3.52M\ C_6H_{12}O_6$

33) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$ $\Delta H = -186\ kJ$

$\frac{1}{2}H_{2(g)} + \frac{1}{2}Cl_{2(g)} \rightarrow HCl_{(g)}$ $\Delta H = -186\ kJ \div 2 = \boxed{-93\ KJ/mol}$

34) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ $\Delta H = {}^{-}482\text{ kJ}$

$12\text{g CO}\left(\frac{1\text{ mol CO}}{28\text{g CO}}\right)\left(\frac{{}^{-}482\text{ kJ}}{2\text{ mol CO}}\right) = {}^{-}103\text{ kJ}$, The negative sign means the energy of the system is less or that it was released. Therefore, the amount of energy released = $\boxed{{}^{+}103\text{kJ}}$

35) $s = \frac{q}{m \cdot \Delta T}$

$$\frac{q}{s \cdot \Delta T} = m = \frac{(9.86\text{ J})}{\left(0.90\frac{\text{J}}{\text{g}\cdot\text{K}}\right)(30.5°\text{C} - 23.2°\text{C})} = \frac{9.86\cancel{\text{J}}}{\left(.90\frac{\cancel{\text{J}}}{\text{g}\cancel{\text{K}}}\right)(7.3\cancel{°\text{C}})} = \boxed{1.5\text{g Al}}$$

36) RXN interested in: $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$ $\Delta H = ?$

$2S_{(s)} + 3O_{2(g)} \rightarrow 2SO_{3(g)}$ $\Delta H = {}^{-}790\text{ kJ}$

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$ $\Delta H = {}^{-}297\text{ kJ}$

since no $S_{(s)}$ in final eqn. it must cancel, if we reverse this rxn the $S_{(s)}$ can cancel, but we should also x2 to completely cancel the $S_{(s)}$

$2S_{(s)} + 3O_{2(g)} \rightarrow 2SO_{3(g)}$ $\Delta H = {}^{-}790\text{ kJ}$

$2SO_{2(g)} \rightarrow 2S_{(s)} + 2O_{2(g)}$ $\Delta H = 594\text{ kJ}$

$\cancel{2S_{(s)}} + \cancel{3}O_{2(g)} + 2SO_{2(g)} \rightarrow 2SO_{3(g)} + \cancel{2S_{(s)}} + \cancel{2O_{2(g)}}$ $\Delta H = {}^{-}196\text{ kJ}$

$O_{2(g)} + 2SO_{2(g)} \rightarrow 2SO_3$ $\boxed{\Delta H = {}^{-}196\text{ kJ}}$