Textbook Page 324 #1, 2d, 4

#1. (a) $Hg(g)$ NOT standard state → $Hg(\ell)$

(b) $Mg(s)$ standard state

(c) $O_2(\ell)$ NOT standard state → $O_2(g)$

(d) $Br_2(\ell)$ standard state

#2.

(d) $C_2H_5OH(\ell) + 3\,O_2(g) \rightarrow 2\,CO_2(g) + 3\,H_2O(\ell)$ (ethanol)

ΔH_f $\quad -277.6\ \frac{kJ}{mol} \quad 0 \quad -393.5\ \frac{kJ}{mol} \quad -285.8\ \frac{kJ}{mol}$

$$\Delta H = \left[2\,\text{mol}\left(-393.5\ \tfrac{kJ}{\text{mol}}\right) + 3\,\text{mol}\left(-285.8\ \tfrac{kJ}{\text{mol}}\right)\right] - \left[1\,\text{mol}\left(-277.6\ \tfrac{kJ}{\text{mol}}\right)\right]$$

$$= -1366.8\ kJ$$

#4. $3\,Al(s) + 3\,NH_4ClO_4(s) \rightarrow Al_2O_3(s) + AlCl_3(s) + 3\,NO(g) + 6\,H_2O(g)$

ΔH_f $\quad 0\ kJ\ mol^{-1} \quad -295.8\ kJ\ mol^{-1} \quad -1675.7\ kJ\ mol^{-1} \quad -704.2\ kJ\ mol^{-1} \quad +90.2\ kJ\ mol^{-1} \quad -241.8\ kJ\ mol^{-1}$

$$\Delta H = \Sigma\, n{\cdot}\Delta H_{f\,(products)} - \Sigma\, n{\cdot}\Delta H_{f\,(reactants)}$$

$$= [1\ mol(-1675.7\ kJ\ mol^{-1}) + 1\ mol(-704.2\ kJ\ mol^{-1}) + 3\ mol(+90.2\ kJ\ mol^{-1}) + 6\ mol(-241.8\ kJ\ mol^{-1})]$$
$$- [3\ mol(0\ kJ\ mol^{-1}) + 3\ mol(-295.8\ kJ\ mol^{-1})]$$

$$= [-3560.1\ kJ] - [-887.4\ kJ]$$

$$= 2672.7\ kJ$$