13) $2\ C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

* all combustion reactions are exothermic

$\Delta S = -$ x

25 mole of gas reactant $\rightarrow$ 34 mole of gas product

$\uparrow n \quad \uparrow V$

system does work on surrounding

$W = -$ x

14) a) heat flows into solute - endothermic

b) heat is released - exothermic

c) heat flows out of solute - exothermic

d) heat must be added - endothermic

4a) Specific heat capacity -
amount of heat required
to raise the temp of 1g
of a substance 1°C

- H_2O has the largest C_p so
it requires the most energy
for this process

$$q = m \Delta T C_p$$
$$= (25.0\,g)(37.0 - 15.0^\circ C)\left(4.184 \frac{J}{g^\circ C}\right)$$
$$= 2.30 \times 10^3\ J$$

5) $q = m \Delta T C_p$

$$133\ J = (5.00\,g)(55.1 - 25.2^\circ C) x$$

$$x = 0.890 \frac{J}{g^\circ C}$$ aluminum

53) $m \Delta T c_p = m \Delta T c_p$

$(50.0\text{g})(330\text{K} - T_F)\left(4.184 \frac{\text{J}}{\text{g°C}}\right) = (30.0\text{g})(T_F - 280\text{K})\left(4.184 \frac{\text{J}}{\text{g°C}}\right)$

$6.90 \times 10^4 - 209 T_F = 125 T_F - 3.50 \times 10^4$

$334 T_F = 1.04 \times 10^5$

$T_F = 311\text{K}$

54) heat lost by Al + Fe = heat gained by water

$(m \Delta T c_p)_{Al} + (m \Delta T c_p)_{Fe} = (m \Delta T c_p)_{H_2O}$

$\left[(5.0\text{g})(100.0°\text{C} - T_F)\left(0.89 \frac{\text{J}}{\text{g°C}}\right)\right] + \left[(10.0\text{g})(100.0°\text{C} - T_F)\left(0.45 \frac{\text{J}}{\text{g°C}}\right)\right]$

$= (97.3\text{g})(T_F - 22.0°\text{C})\left(4.184 \frac{\text{J}}{\text{g°C}}\right)$

$4.5(100.0 - T_F) + 4.5(100.0 - T_F) = 407(T_F - 22.0)$

$450 - (4.5)T_F + 450 - 4.5 T_F = 407 T_F - 8950$

$416 TF_F = 9850 \qquad T_F = 23.7°\text{C}$

5) $m \Delta T c_p = m \Delta T c_p$

$(150.0\,g)(75.0 - 18.3^\circ C)(x) = (150.0\,g)(18.3 - 15.0^\circ C)(4.184 \frac{J}{g^\circ C})$

$x = 0.25 \frac{J}{g^\circ C}$