Use your books to look up information not given in the problem

1. Calculate the ΔH for the following reaction.

$$2N_2(g) + 5O_2(g) \rightarrow 2N_2O_5(g)$$

from the following information

$$H_2(g) + 1/2\ O_2(g) \rightarrow H_2O(l) \quad \Delta H = -285.5\ kJ$$

$$N_2O_5(g) + H_2O(l) \rightarrow 2\ HNO_3(l) \quad \Delta H = -76.6\ kJ$$

$$\tfrac{1}{2}\ N_2(g) + 3/2\ O_2(l) + \tfrac{1}{2}\ H_2 \rightarrow HNO_3(l) \quad \Delta H = -174.1\ kJ$$

2. A 30.0 g sample of water at 280 K is mixed with 50.0 g of water 330 K. Calculate the final temperature of water assuming no loss of heat.
3. How much energy is required for 500 g of water, starting at 25 °C, to boil and then heat the water vapor to 1000 °C?
   ($c_{H_2O(l)}$=4.184 J/g·K; $c_{H_2O(s)}$=2.06 J/g·K; $c_{H_2O(g)}$=2.03 J/g·K; heat of fusion (H_2O) = 300 J/g; heat of vaporization(H_2O) = 2256 J/g)
4. Calculate the $\Delta H°$ of the following reaction.

$$4\ N_2H_3CH_3(l) + 5\ N_2O_4(l) \rightarrow 12\ H_2O(g) + 9\ N_2(g) + 4\ CO_2(g)$$

$$\Delta H° = \sum[\Delta H°_f(\text{products})] - \sum[\Delta H°_f(\text{reactancts})]$$

see p. A21 for $\Delta H°_f$ values. (make sure everything is in the right state!)

5. Using the chemical reaction from problem 4, how much energy can be produced from 10 g of $N_2H_3CH_3(l)$ and excess $N_2O_4(l)$?
6. The specific heat capacity of silver is 0.24 J/g·K. What is the final temperature that silver can reach if 900 J of energy is used to heat a 150.0 g sample of silver at 25 °C?

1) $2N_2(g) + 5O_2(g) \rightarrow 2N_2O_5(g)$

$(\frac{1}{2}N_2 + \frac{3}{2}O_2 + \frac{1}{2}H_2 \rightarrow HNO_3) \times 4$

$2N_2 + 6O_2 + 2H_2 \rightarrow 4HNO_3 \quad \Delta H = -696.4\ kJ$

$4HNO_3 \rightarrow 2H_2O + 2N_2O_5 \quad \Delta H = 153.2\ kJ$

$2N_2 + \overset{5}{\cancel{6}}O_2 + \cancel{2H_2} \rightarrow \cancel{2H_2O} + 2N_2O_5 \quad \Delta H = -543.2\ kJ$

$\cancel{2H_2O} \rightarrow \cancel{1}O_2 + \cancel{2H_2} \quad \Delta H = 571\ kJ$

$2N_2 + 5O_2 \rightarrow 2N_2O_5 \quad \Delta H = 27.8\ kJ$

2)

$H_2O(l)$	$H_2O(s)$
30.0 g	50.0 g
$T_I = 280\ K$	$T_I = 330 K$
$C = 4.184$	$C = 4.184$

$$q = c \cdot m \cdot \Delta T$$

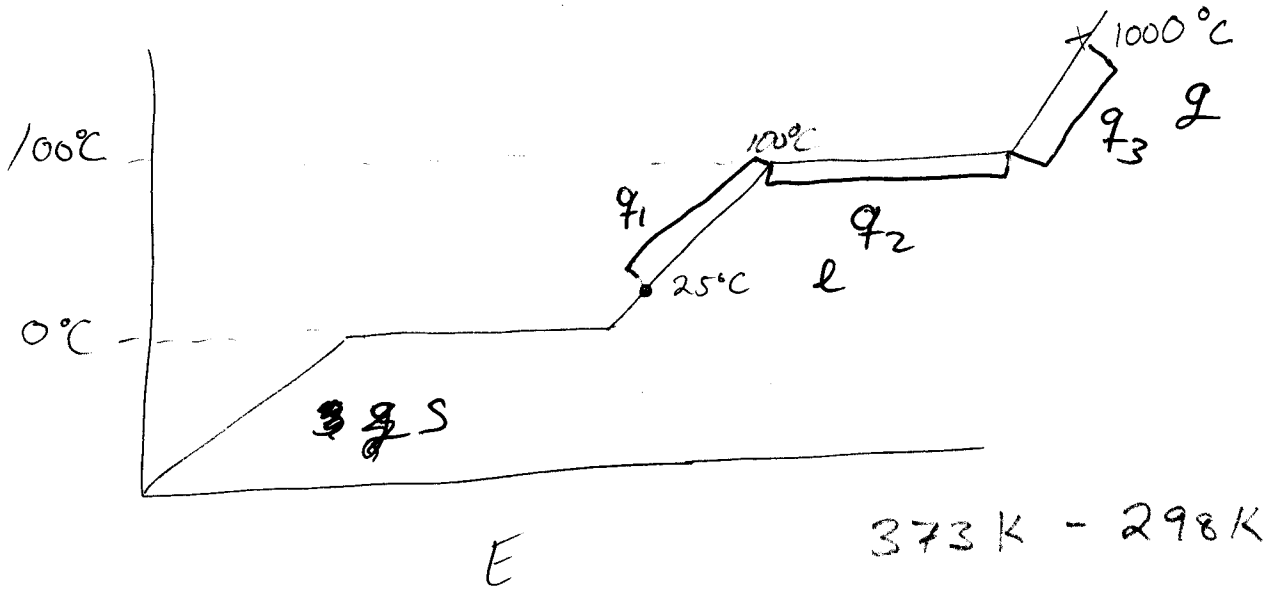
$$q = -q$$

$$4.184)(30.0)(T_f - 280) = -\left[(4.184)(50.0)(T_f - 330)\right]$$

$$125.52\,T_f - 35145.6 = -\left[209.2\,T_f - 69036\right]$$

$$334.72\,T_f = 104181.6$$

$$T_f = 311.25 K$$



500 g H_2O

$q_1 = c \cdot m \cdot \Delta T$

$= (4.184)(500)(75)$

$= 156900$ J

$q_2 = c \cdot m$

$= 2256(500)$

$= 1128000$ J

$q_3 = c \cdot m \cdot \Delta T$

$= (2.03\ J/g\ K)(500)(900)$

$= 913500$ J

$q_{Total} = 2198400$ J

1)

$$\underset{54\ kJ/mol}{4\,N_2H_3CH_3(l)} + \underset{-20\ kJ/mol}{5\,N_2O_4(l)} \rightarrow \underset{-242\ kJ/mol}{12\,H_2O(g)} + \underset{0}{9\,N_2(g)} + \underset{-393.5\ kJ/mol}{4CO_2(g)}$$

$\Delta H =$ products $-$ reactants.

$$\Delta H = \left[12(-242) + 4(-393.5)\right] - \left[4(54) + 5(-20)\right]$$

$$\Delta H = -4478\ kJ - 116\ kJ$$

$$\Delta H = -4594\ kJ$$

$$4\ N_2H_3CH_3(\ell) + 5\ N_2O_4(\ell) \rightarrow 12\ H_2O(g) + 9N_2(g) + 4(O_2(g)$$

$\Delta H = -4594\ kJ$

$10\ g \Rightarrow 0.2174\ mols\ N_2H_3CH_3 \times \frac{-4594\ kJ}{4\ mols\ N_2H_3CH_3} = -249.7\ kJ$

6) $q = c \cdot m \cdot \Delta T$

$900 = (0.24)(150)\,\Delta T$

$\Delta T = 25^\circ C = T_f - T_I$

$25^\circ C = T_f - 25^\circ C$

$T_f = 50^\circ C \rightarrow 323K$