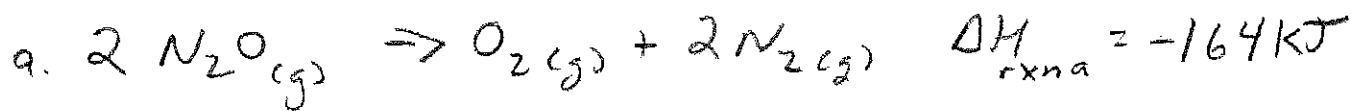


## Example of Hess' Law Calculations

### Problem

Given the following:



Calculate  $\Delta H_{rxn}$  for  $4 NH_3(g) + 3 O_2(g) \rightarrow 2 N_2(g) + 6 H_2O(l)$

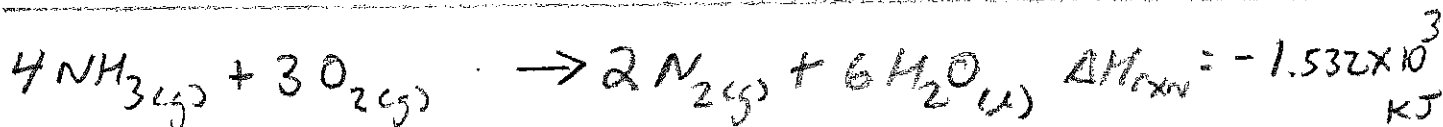
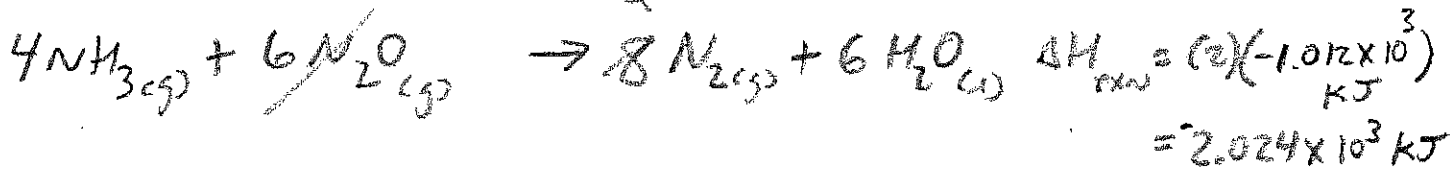
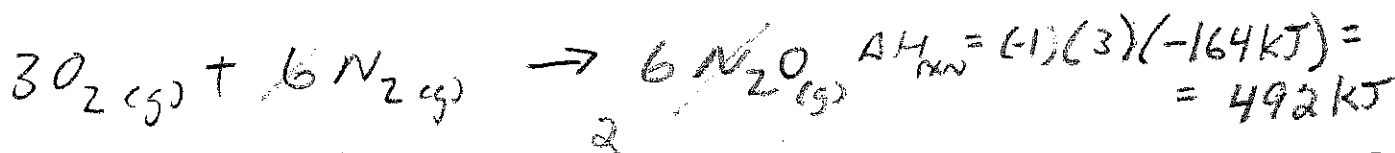
Note: a) Reversing chem. reaction, sign change with  $\Delta H_{rxn}$

b) Doubling each coefficient in chem rxn, doubles  $\Delta H_{rxn}$

Trick: Look at target reaction and find product species and see what you need to do to known reaction to make it a product. Same for reactants.

Solution:

1. Need to reverse Rxn a, since want  $O_2$  as reactant.
2. Need 3  $O_2$  so need to multiply 3 to all coefficient in rxn a.
3. Need to multiply 2 to all coefficient in rxn b, cause  $N_2O$  to cancel since it is not in target reaction.



$$\Delta H_{rxn} = -1.53 \times 10^3 \text{ kJ}$$