Name: **Period:**   **Seat#:**

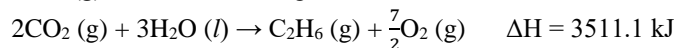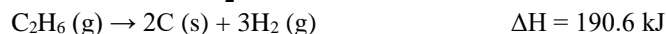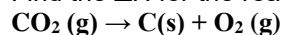**Directions**: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

1) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
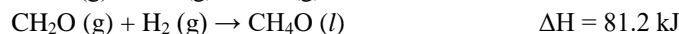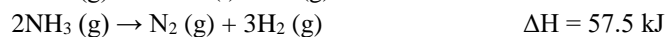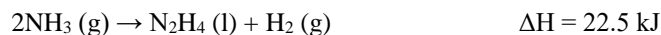N_2 (g) + $2O_2$ (g) → $2NO_2$ (g)

N_2 (g) + $3H_2$ (g) → $2NH_3$ (g)   ΔH = − 115 kJ
$2NH_3$ (g) + $4H_2O$ (l) → $2NO_2$ (g) + $7H_2$ (g)   ΔH = −142.5 kJ
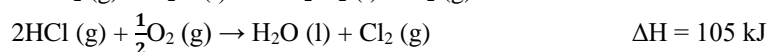H_2O(l) → H_2 (g) + O_2 (g)   ΔH = −43.7 kJ

−83 kJ

2) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
CO_2 (g) → C(s) + O_2 (g)

H_2O (l) → H_2 (g) + $\frac{1}{2}O_2$ (g)   ΔH = 643 kJ
C_2H_6 (g) → 2C (s) + $3H_2$ (g)   ΔH = 190.6 kJ
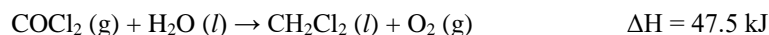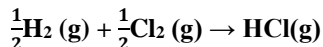$2CO_2$ (g) + $3H_2O$ (l) → C_2H_6 (g) + $\frac{7}{2}O_2$ (g)   ΔH = 3511.1 kJ

886 kJ

3) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
N_2H_4 (l) + CH_4O(l) → CH_2O(g) + N_2 (g) + $3H_2$ (g)

$2NH_3$ (g) → N_2H_4 (l) + H_2 (g)   ΔH = 22.5 kJ
$2NH_3$ (g) → N_2 (g) + $3H_2$ (g)   ΔH = 57.5 kJ
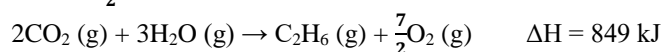CH_2O (g) + H_2 (g) → CH_4O (l)   ΔH = 81.2 kJ

− 46.2 kJ

4) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
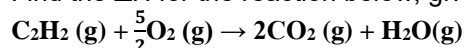$\frac{1}{2}H_2$ (g) + $\frac{1}{2}Cl_2$ (g) → HCl(g)

$COCl_2$ (g) + H_2O (l) → CH_2Cl_2 (l) + O_2 (g)   ΔH = 47.5 kJ
$2HCl$ (g) + $\frac{1}{2}O_2$ (g) → H_2O (l) + Cl_2 (g)   ΔH = 105 kJ
CH_2Cl_2 (l) + H_2 (g) + $\frac{3}{2}O_2$ (g) → $COCl_2$ (g) + $2H_2O$ (l)   ΔH = −402.5 kJ

− 230 kJ

5) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
C_2H_2 (g) + $\frac{5}{2}O_2$ (g) → $2CO_2$ (g) + H_2O(g)

C_2H_6 (g) → C_2H_2 (g) + $2H_2$ (g)   ΔH = 283.5 kJ
H_2 (g) + $\frac{1}{2}O_2$ (g) → H_2O (g)   ΔH = −213.7 kJ
$2CO_2$ (g) + $3H_2O$ (g) → C_2H_6 (g) + $\frac{7}{2}O_2$ (g)   ΔH = 849 kJ

−705 kJ

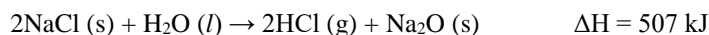**6)** Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
$HCl (g) + NaNO_2 (s) \rightarrow HNO_2 (l) + NaCl (s)$

$2NaCl (s) + H_2O (l) \rightarrow 2HCl (g) + Na_2O (s)$	ΔH = 507 kJ
$NO (g) + NO_2 (g) + Na_2O (s) \rightarrow 2NaNO_2 (s)$	ΔH = −427 kJ
$NO (g) + NO_2 (g) \rightarrow N_2O (g) + O_2 (g)$	ΔH = −43 kJ
$2HNO_2 (l) \rightarrow N_2O (g) + O_2 (g) + H_2O (l)$	ΔH = 34 kJ

−78 kJ

7) Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
$Zn(s) + \frac{1}{8}S_8 (s) + 2O_2 (g) \rightarrow ZnSO_4 (s)$
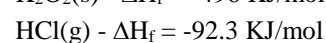
$Zn(s) + \frac{1}{8}S_8 (s) \rightarrow ZnS(s)$	ΔH = −183.92 kJ
$2ZnS(s) + 3O_2 (g) \rightarrow 2ZnO(s) + 2SO_2 (g)$	ΔH = −927.54 kJ
$2SO_2 (g) + O_2 (g) \rightarrow 2SO_3 (g)$	ΔH = −196.04 kJ
$ZnO(s) + SO_3 (g) \rightarrow ZnSO_4 (s)$	ΔH = −230.32 kJ

−976.03 kJ

To solve these problems, use the heat of formation values given below. Remember that the values can be a little different depending on which appendix or chart you are looking at!

8) What is the enthalpy of the following reactions?
Use equation from Equation Sheet – [Products minus reactants]
(a) $SiF_4 (g) \rightarrow Si (s) + 2F_2 (g)$
(b) $SiF_4 (g) \rightarrow Si (g) + 2F_2 (g)$
(c) $SO_3 (g) + H_2O (g) \rightarrow H_2SO_4 (aq)$
(d) $3K_2O_2 (s) + 3H_2O (l) \rightarrow 6KOH(aq) + O_3 (g)$
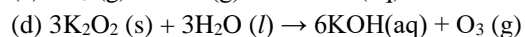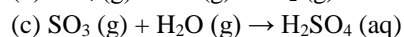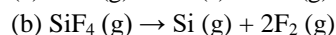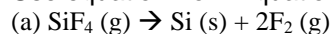(e) $Fe_3O_4 (s) + 8HCl (g) \rightarrow 2FeCl_3 (s) + FeCl_2 (s) + 4H_2O (g)$

$Fe_3O_4(s) - \Delta H_f = −1118.4$ KJ/mol
$FeCl_2(s) - \Delta H_f = −341.8$ KJ/mol
$FeCl_3(s) - \Delta H_f = −399.5$ KJ/mol
$H_2SO_4(aq) - \Delta H_f = -909.27$ KJ/mol
$H_2O(g) - \Delta H_f = -241.8$ KJ/mol
$KOH(aq) - \Delta H_f = -482.37$ KJ/mol
$O_3(g) - \Delta H_f = 143$ KJ/mol
$H_2O(l) - \Delta H_f = -285.8$ KJ/mol
$K_2O_2(s) - \Delta H_f = -496$ KJ/mol
$HCl(g) - \Delta H_f = -92.3$ KJ/mol
$Si(g) - \Delta H_f = 450$ KJ/mol
$SiF_4(g) - \Delta H_f = −1615.0$ KJ/mol
$SO_3(g) - \Delta H_f = −454.5$ KJ/mol
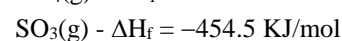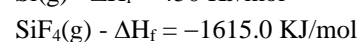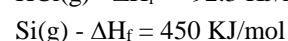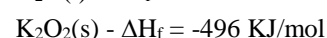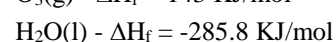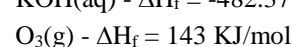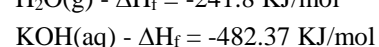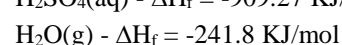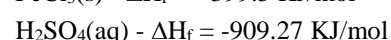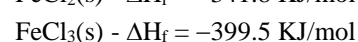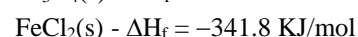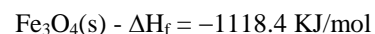
Answers
(a) *1615.0*
(b) *2065*
(c) *-212.97*
(d) *-405.82*
(e) *-251.2*