

Name: _____

Quiz #8

CHEM 1411 — Spring 2019

Due Thursday, March 21 by 8:00 am

Late papers will not be accepted!

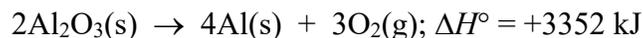
There is no clearer manifestation of pure evil than teachers giving assignments over holiday breaks. — James Halloran

Energy Changes

1. Change in energy: (10 pts)
- Calculate the energy change, ΔE , when $q = -47$ kJ and $w = +88$ kJ.
 - Calculate the energy change, ΔE , when the system releases 125 kJ of heat while 104 kJ of work is done on the system.

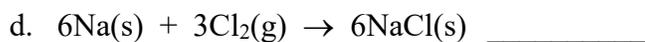
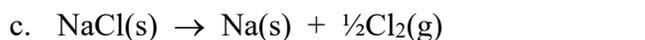
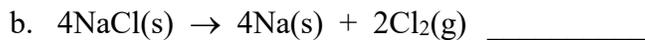
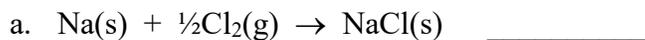
Thermochemical Equations

2. When aluminum oxide, Al_2O_3 , is heated to high temperatures, it decomposes to produce aluminum metal by the following thermochemical equation: (10 pts)



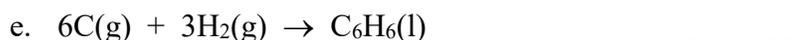
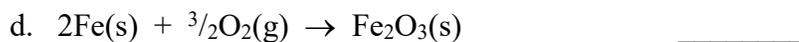
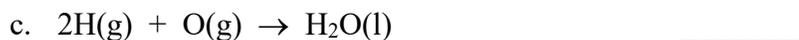
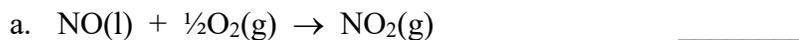
- If 100.0 g of Al_2O_3 is to be decomposed, how much heat energy will be required?
- How many grams of aluminum will be produced if 1680 kJ of heat energy is used?

3. The reaction $2\text{Na(s)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NaCl(s)}$ has $\Delta H^\circ = -821.8 \text{ kJ}$. What is the enthalpy change for the reactions shown below? (10 pts)



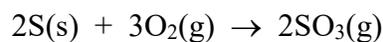
4. Write a **thermochemical equation** to represent the standard enthalpy of formation (ΔH_f°) for the formation of NO(g) from its elements under standard conditions; this reaction absorbs 90.29 kJ of energy per mole of NO formed. (10 pts.)

5. Identify which of the reactions below has a value of ΔH° that corresponds to the enthalpy of formation, ΔH_f° ? (State “yes” if it does correspond to ΔH_f° and “no” if it does not.) (10 pts.)

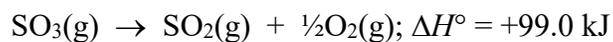


Hess's Law

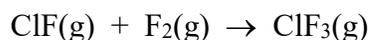
6. Use Hess's law to derive the enthalpy of the following reaction: (10 pts.)



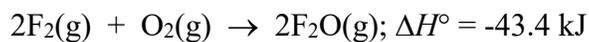
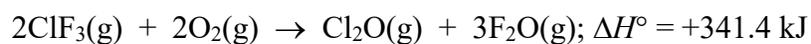
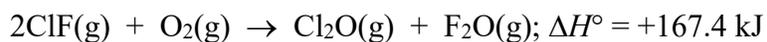
Use the following thermochemical equations:



7. Use Hess's law to derive the enthalpy of the following reaction:

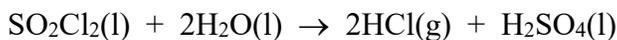


Use the following thermochemical equations: (10 pts)



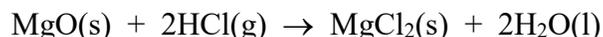
Heats of Reaction

8. Calculate the energy change for the following reaction, using the enthalpies of formation provided below the equation. (10 pts.)



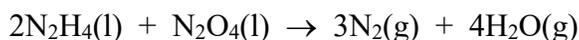
Substance	ΔH_f° (kJ/mol)
$\text{SO}_2\text{Cl}_2(\text{l})$	-394.1
$\text{H}_2\text{O}(\text{l})$	-285.8
$\text{HCl}(\text{g})$	-92.3
$\text{H}_2\text{SO}_4(\text{l})$	-814.0

9. Calculate the energy change for the following reaction, using the enthalpies of formation provided below the equation. (10 pts)



Substance	ΔH_f° (kJ/mol)
$\text{MgO}(\text{s})$	-601.7
$\text{HCl}(\text{g})$	-92.3
$\text{MgCl}_2(\text{s})$	-641.6
$\text{H}_2\text{O}(\text{l})$	-285.8

10. The lunar module (LM) which was used to land on the surface of the moon during the *Apollo* missions used a mixture of hydrazine, N_2H_4 , and nitrogen tetroxide, N_2O_4 , as a fuel source. Calculate the energy change for the reaction of hydrazine with nitrogen tetroxide, shown below, using the enthalpies of formation provided below each compound. (10 pts)



Substance	ΔH_f° (kJ/mol)
$\text{N}_2\text{H}_4(\text{l})$	+50.6
$\text{N}_2\text{O}_4(\text{l})$	-19.4
$\text{N}_2(\text{g})$	0
$\text{H}_2\text{O}(\text{g})$	-241.8