

Name key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts this quiz, actually worth 10 pts each quiz for a total of 80 total quiz points with 20 pts HW points – quiz + HW points worth 10% of grade)

1. For the reaction $I_2(g) \rightarrow I_2(s)$ $\Delta H^\circ = -62.4$ kJ at 25°C . based on this data, at 25°C

(a) $\Delta H^\circ_{\text{vap}} = 62.4$ kJ/mol (b) $\Delta H^\circ_{\text{vap}} = -62.4$ kJ/mol (c) $\Delta H^\circ_{\text{sub}} = -62.4$ kJ/mol

(d) $\Delta H^\circ_{\text{sub}} = 62.4$ kJ/mol (4 pts) $I_2(s) \rightarrow I_2(g)$ is sublimation - change sign.

2. If you do a reaction in a calorimeter containing a 35.2 gram water solution which changes temperature from 20.5°C to 45.2°C , what is the heat (q)? Assume that the calorimeter has a negligible effect on the heat and the specific heat (c) of water is a good approximation for the specific heat of the reaction solution (4.18 J/g $^\circ\text{C}$). ($q = m C \Delta T$) (8 pts)

$m = 35.2$ g $\Delta T = 45.2^\circ\text{C} - 20.5^\circ\text{C} = 24.7^\circ\text{C}$ (2pt)

$q = (35.2 \text{ g}) (4.18 \text{ J/g}^\circ\text{C}) (24.7^\circ\text{C}) = 3634.3 \text{ J}$

(2pt) (2pt) (1pt) 3,634 J (1pt)

3 a. Using the given standard enthalpies of formation **show your set up for ΔH°** for the following reaction. (not enough time to actually do the calculation) (8 pts)

$\Delta H^\circ = \Delta H^\circ_f(\text{products}) - \Delta H^\circ_f(\text{reactants})$



Species ΔH°_f of (kJ/mol)

$\text{Fe}_2\text{O}_3(s)$	-824.2
$\text{Fe}_3\text{O}_4(s)$	-1118.4
$\text{CO}(g)$	-110.5
$\text{CO}_2(g)$	-393.5

backwards -1 (6pt)

$[2(-1118.4) + (-393.5)] - [3(-824.2) + (-110.5)]$

(1pt) (1pt) (1pt) (1pt)

$(-2630.3 + 2583.1) = -47.2 \text{ kJ}$

BA -2pt

b. What is the ΔH°_f [$\text{O}_2(g)$]? zero element most stable form (2pts)

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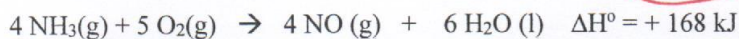
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1. Which of the following is a statement of the first law of thermodynamics (conservation of energy). (4 pts)

- (a) $W = -P\Delta V$ (b) $\Delta H = \Delta E + P\Delta V$ (c) $\Delta E_{\text{system}} = \Delta E_{\text{surroundings}}$ (d) $q = mc\Delta T$

2. (a) For the reaction shown below, is the reaction exothermic or endothermic? (8 pts)

(b) For the reaction shown below how much heat is absorbed / released if you start with 15.2 grams of the ammonia? (formula mass $\text{NH}_3 = 17.04 \text{ g/mol}$)



$$15.2 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.04 \text{ g NH}_3} \times \frac{+168 \text{ kJ}}{4 \text{ mol NH}_3} = 37.5 \text{ kJ}$$

 heat absorbed

3. a) Using the given standard enthalpies of formation show your set up for ΔH° for the following reaction. (not enough time to actually do the calculation) (8 pts)

$\Delta H^\circ = \Delta H^\circ_f(\text{products}) - \Delta H^\circ_f(\text{reactants})$



Species ΔH°_f of (kJ/mol)

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$$[2(-1118.4) + (-393.5)] - [3(-824.2) + (-110.5)] = -47.2 \text{ kJ}$$

b) What is the $\Delta H^\circ_f[\text{Fe}(\text{s})]$? zero element most stable form

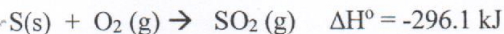
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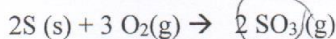
1. For a process at constant pressure, choose the best statement. (Constant pressure is the way most chemical reactions are conducted.) (4 pts) (pink)

- (a) $\Delta E = q$ and $w=0$ (b) $\Delta H = q$ (c) $\Delta E = \Delta H$ (d) $\Delta E = w$ and $q = 0$

2. Given the following reactions. (Hess Law) (8 pts)



Calculate the ΔH° for the reaction below. Show work.



$2SO_2 + O_2 \rightarrow 2SO_3 \quad \Delta H^\circ = -196.2 \text{ kJ}$ (1 pt)
 $2S + 2O_2 \rightarrow 2SO_2 \quad \Delta H^\circ = -2(296.1 \text{ kJ})$ (1 pt)

 $2S + 3O_2 \rightarrow 2SO_3 \quad \Delta H^\circ = -788.4 \text{ kJ}$ (1 pt)
 (2 pt) (1 pt) (1 pt)
 BA-6

3. If a car engine does expansion work inside a car piston with a volume of 2.5 Liters at 20.7 atm pressure, how much work is done? (work = - P ΔV , 1 Liter atm = 101.33 Joule). (8 pts)

$$W = -P\Delta V = -(20.7 \text{ atm})(2.5 \text{ l}) = 51.75 \text{ atm l}$$

$$51.75 \text{ l atm} \times \frac{101.33 \text{ J}}{1 \text{ l atm}} = 5243.8 \text{ J} = 5.24 \text{ kJ}$$

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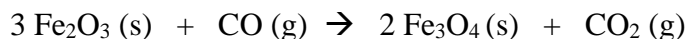
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(d) $\Delta H^\circ_{\text{sub}} = 62.4 \text{ kJ/mol}$ (4 pts)

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b. What is the $\Delta H^\circ_f[\text{O}_2(\text{g})]$? _____

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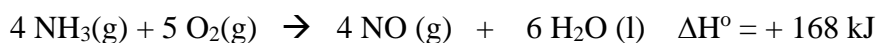
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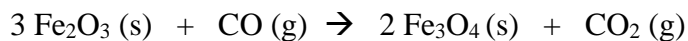
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b) What is the $\Delta H^\circ_f[\text{Fe}(\text{s})]$? _____

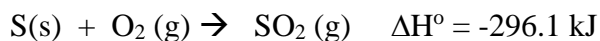
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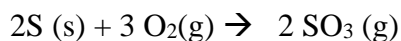
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