Gen Chem II Lecture Spring 20 Dr. Hahn A section Quiz 1 1/15 Wednesday Exam # _____

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

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

Sublime backward

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 °C). ($q = m\,C\,\Delta T$) (8 pts)

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

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

2pt 2pt 1pt $3.63\,kJ$ 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)

$\Delta H^\circ = \Delta H^\circ_f$ (products) - ΔH°_f (reactants)

$3\,Fe_2O_3\,(s) + CO\,(g) \rightarrow 2\,Fe_3O_4\,(s) + CO_2\,(g)$

Species	ΔH°_f of (kJ/mol)
Fe_2O_3 (s)	-824.2
Fe_3O_4 (s)	-1118.4
CO (g)	-110.5
CO_2 (g)	-393.5

backwards, -1

6pt

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

Fe_3O_4 1pt, CO_2 1pt, Fe_2O_3 1pt, CO 1pt

$(-2630.3 + 2583.1) = -47.2\,kJ$

BA -2pt

b. What is the $\Delta H^\circ_f[\,O_2\,(g)\,]$? zero (2pts) element most stable form

Gen Chem II Lecture Spring 20 Dr. Hahn C section form A Quiz 1 1/15 Wednesday Exam # _____

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. 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) ΔE system = ΔE surroundings (d) $q=mc\Delta T$ 2pt

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

system - gains heat +ΔH

(b) For the reaction shown below how much heat is absorbed / released if you start with 15.2 grams of the ammonia ? (formula mass NH3 = 17.04 g/mol) 6pt

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (l)\quad \Delta H^o = +168\ kJ$ BA -2pt

$$15.2\ g\ NH_3 \times \frac{1\ mol\ NH_3}{17.04\ g\ NH_3} \times \frac{+168\ kJ}{4\ mol\ NH_3} = 37.5\ kJ$$

2pt 1pt 2pt

heat absorbed 1pt

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

$\Delta H^o = \Delta H^o_f$ (products) - ΔH^o_f (reactants) backwards -1pt

$3\ Fe_2O_3\ (s) + CO\ (g) \rightarrow 2\ Fe_3O_4\ (s) + CO_2\ (g)$ 6pt

Species	ΔH^o_f of (kJ/mol)
Fe_2O_3 (s)	-824.2
Fe_3O_4 (s)	-1118.4
CO (g)	-110.5
CO_2 (g)	-393.5

BA -2

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

1pt 1pt 1pt 1pt

b) What is the ΔH^o_f[Fe (s)] ? 2pt Zero element most stable form

Gen Chem II Lecture Spring 20 Dr. Hahn C section form B Quiz 1 1/15 Wednesday Exam # _____

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

work = zero (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)

$S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H^\circ = -296.1$ kJ

$2\,SO_3(g) \rightarrow 2\,SO_2(g) + O_2(g)$ $\Delta H^\circ = 196.2$ kJ reverse RXN

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

$2S(s) + 3\,O_2(g) \rightarrow 2\,SO_3(g)$

2pt

$2SO_2 + O_2 \rightarrow 2SO_3$ 1pt $\Delta H^\circ = -196.2$ kJ 1pt

X2

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

$2S + 3O_2 \rightarrow 2SO_3$ $\Delta H^\circ = -788.4$ kJ

1pt 1pt

2pt

BA – b

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)

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

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

Gen Chem II Lecture Spring 20 Dr. Hahn A section Quiz 1 1/15 Wednesday Exam # _____

Name _____ 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 $I_2(g) \rightarrow I_2(s)$ $\Delta H^o = -62.4$ kJ at 25°C.based on this data, at 25°C

(a) $\Delta H^o_{vap} = 62.4$kJ/mol (b) $\Delta H^o_{vap} = -62.4$kJ/mol (c) $\Delta H^o_{sub} = -62.4$ kJ/mol
(d) $\Delta H^o_{sub} = 62.4$ kJ/mol (4 pts)

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 °C). ($q = m\ C\ \Delta T$) (8 pts)

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

$\Delta H^o = \Delta H^o_f$ (products) - ΔH^o_f (reactants)

$3\ Fe_2O_3\ (s) + CO\ (g) \rightarrow 2\ Fe_3O_4\ (s) + CO_2\ (g)$

Species	ΔH^o_f of (kJ/mol)
Fe_2O_3 (s)	-824.2
Fe_3O_4 (s)	-1118.4
CO (g)	-110.5
CO_2 (g)	-393.5

b. What is the $\Delta H^o_f [\ O_2\ (g)\ ]$? _____

Gen Chem II Lecture Spring 20 Dr. Hahn C section form A Quiz 1 1/15 Wednesday Exam # _____

Name _____ 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)

3. 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) ΔE system = ΔE surroundings (d) $q=mc\Delta T$

4. (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 NH3 = 17.04 g/mol)

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (l) \quad \Delta H^o = +\ 168\ kJ$

5. a) Using the given standard enthalpies of formation **<u>show your set up for ΔH^o</u>** for the following reaction. (not enough time to actually do the calculation) (8 pts)

$\Delta H^o = \Delta H^o_f$ (products) - ΔH^o_f (reactants)

$3\ Fe_2O_3\ (s) + CO\ (g) \rightarrow 2\ Fe_3O_4\ (s) + CO_2\ (g)$

Species	ΔH^o_f of (kJ/mol)
Fe_2O_3 (s)	-824.2
Fe_3O_4 (s)	-1118.4
CO (g)	-110.5
CO_2 (g)	-393.5

b) What is the ΔH^o_f [Fe (s)] ? _____

Gen Chem II Lecture Spring 20 Dr. Hahn C section form B Quiz 1 1/15 Wednesday Exam # _____

Name _____ 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)

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

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

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

$S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H^o = -296.1$ kJ

$2\ SO_3(g) \rightarrow 2\ SO_2(g) + O_2(g)$ $\Delta H^o = 196.2$ kJ

Calculate the ΔH^o for the reaction below. Show work.

$2S(s) + 3\ O_2(g) \rightarrow 2\ SO_3(g)$

8. 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)