Quiz I General Chemistry II Lecture I Spring 13 Dr. Hahn 20 pts 1/23 W 9:30 am quiz # _____

Name Key (print) Name _____ (sign)

Please show all work for full credit. This is the "confidence booster".

1. Given the following reaction, and the enthalpy associated with the reaction, if you rewrite the reaction as shown, what is the new enthalpy for the newly written reaction? (6 pts)

$N_2O\,(g) + NO_2\,(g) \rightarrow 3NO(g)\ \Delta H = 157.7$ kJ multiply Rxn by 2

$2\,N_2O\,(g) + 2\,NO_2\,(g) \rightarrow 6\,NO(g)\ \Delta H =$ 315.4 (fill in blank with #) kJ $2 \times 157.7$

2. For the reaction given, use the enthalpy of formation given to calculate the $\Delta H^\circ$ for the reaction. (7 pts)
Info: $\Delta H^\circ_f = [Cr_2O_3(s)] = -1139.7$ kJ/mol $\Delta H^\circ_f[CO(g)] = -110.5$ kJ/mol $\Delta H^\circ_f[CO_2(g)] = -393.5$ kJ/mol

$\Delta H^\circ = \Sigma n \Delta H_f^\circ(\text{product}) - \Sigma n \Delta H_f^\circ(\text{reactant})$

$Cr_2O_3\,(s) + 3\,CO(g) \rightarrow 2Cr(s) + 3\,CO_2(g)$

$\Delta H^\circ = \{2\,mol\,\Delta H_f^\circ[Cr(s)] + 3\,mol\,\Delta H_f^\circ[CO_2(g)]\} - \{1\,mol\,\Delta H_f^\circ[Cr_2O_3(s)] + 3\,mol\,\Delta H_f^\circ[CO(g)]\} = 2\,mol(0) + 3\,mol(-393.5\,kJ/mol) - (1\,mol)(-1139.7\,kJ/mol) - 3\,mol(-110.5\,kJ/mol) = -1180.5\,kJ + 1139.7\,kJ + 331.5\,kJ$

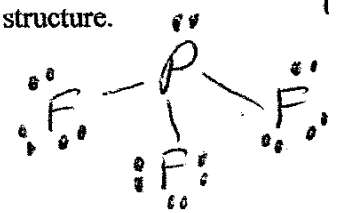
$\Delta H^\circ = 290.7\,kJ$

3. If a 4.5 gram block of Lead ($C_s = 0.128$ J / g °C), changes temperature from 25.2 °C to 30.5 °C, what is the heat released or absorbed by the lead block. (7 pts, $q = m\ C_s\ \Delta T$)

$q = (4.5\,g)\left(0.128\,\frac{J}{g\,^\circ C}\right)(30.5\,^\circ C - 25.2\,^\circ C) = 3.1\ J$

heat absorbed by lead block (lead checking account gets heat added)

Extra credit: (4 pts, ½ pt each) For the element F (florine), the group number is VII A the charge for an F ion is $7-8 = -1$ the # of valence electrons (for a neutral atom) is 7 and the electron configuration is $1s^2, 2s^2, 2p^5$ (use notation $1s^2$, etc) the valence electron configuration is $2s^2, 2p^5$ (use notation $1s^2$, etc) The number of valence electrons in the molecule $PF_3$ is 26. $5 + 3(7) =$ Draw the Lewis Dot structure. $13 \times 2 = 26\,\bar{e}$



# $\bar{e}$ pairs = 4

# lone pairs = 1

The VSEPRT shape of the molecule is (T-shaped) or (tetrahedral) or (trigonal pyrimadal) (circle one)

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1. Given the following reaction, and the enthalpy associated with the reaction, if you rewrite the reaction as shown, what is the new enthalpy for the newly written reaction? (6 pts)

$N_2O\,(g) + NO_2\,(g) \rightarrow 3NO(g)\ \Delta H = 157.7$ kJ reverse RXN - reverse sign $\Delta H$

$3NO(g) \rightarrow N_2O\,(g) + NO_2\,(g)\ \Delta H =$ -157.7 (fill in blank with #) kJ

2. For the reaction given, use the enthalpy of formation given to calculate the $\Delta H^\circ$ for the reaction.
$\Delta H^\circ_f[CaO\,(s)] = -634.9$ kJ/mol $\Delta H^\circ_f[HCl\,(g)] = -92.3$ kJ/mol $\Delta H^\circ_f[CaCl_2\,(s)] = -795.4$ kJ/mol
$\Delta H^\circ_f[H_2O\,(g)] = -241.8$ kJ/mol (7 pts) $\Delta H^\circ = \Sigma n \Delta H^\circ_f(\text{product}) - \Sigma n \Delta H^\circ_f(\text{reactant})$

$CaO\,(s) + 2\,HCl\,(g) \rightarrow CaCl_2\,(s) + H_2O\,(g)$

$\Delta H^\circ = \{1\text{mol}\,\Delta H^\circ_f[CaCl_2(s)] + 1\text{mol}\,\Delta H^\circ_f[H_2O(g)]\} - \{1\text{mol}\,\Delta H^\circ_f[CaO(s)] + 2\text{mol}\,\Delta H^\circ_f[HCl(g)]\} = \{-795.4\text{kJ} + (-241.8\text{kJ})\} - \{(-634.9\text{kJ}) + 2(-92.3\text{kJ})\} = -795.4\text{kJ} - 241.8\text{kJ} + 634.9\text{kJ} + 184.6$

$\Delta H^\circ = -217.7$ kJ

3. If a hot 0.352 gram block of Lead ($C_s = 0.128$ J / g °C), changes temperature from 45.1 °C to 20.5 °C, what is the heat released or absorbed by the lead block. (7 pts, $q = m\,C_s\,\Delta T$)

$q = (0.352\,g)\left(0.128\,\frac{J}{g\cdot{}^\circ C}\right)(20.5^\circ C - 45.1^\circ C)$

$q = -1.11$ J lead block is releasing heat

Extra credit: (4 pts, ½ pt each) For the element N (nitrogen), the group number is VA the charge for 5 − 8 = an N ion is −3 the # of valence electrons (for a neutral atom) is 5 and the electron configuration is $1s^2, 2s^2, 2p^3$ (use notation $1s^2$, etc) the valence electron configuration is $2s^2, 2p^3$ (use notation $1s^2$, etc) The number of valence electrons in the molecule $NH_3$ is 8. 5 + 3 = 8 Draw the Lewis Dot structure

# e⁻ pairs = 4
# lone pairs = 1
e⁻ geometry - tetrahedral

The VSEPRT shape of the molecule is (trigonal pyramidal) or (tetrahedral) or (trigonal planar) (circle one)

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1. Given the following reaction, and the enthalpy associated with the reaction, if you rewrite the reaction as shown, what is the new enthalpy for the newly written reaction? (6 pts)

$N_2O\,(g) + NO_2\,(g) \rightarrow 3NO(g)\ \Delta H = 157.7$ kJ  multiply by 3 → 157.7 x 3 = 473.1

$3\ N_2O\,(g) + 3\ NO_2\,(g) \rightarrow 9\ NO(g)\ \Delta H =$ 473.1 (fill in blank with #) kJ

2. Apply Hess's Law to the following to calculate Δ H for the reaction. (7 pts)

$Fe_2O_3\,(s) + 3CO\,(g) \rightarrow 2\ Fe\,(s) + 3\ CO_2\,(g)$ given the following reactions and enthalpies

$2\ Fe\,(s) + 3/2\ O_2\,(g) \rightarrow Fe_2O_3\,(s)$ $\Delta H = -824.2$ kJ

$CO\,(g) + ½\ O_2\,(g) \rightarrow CO_2\,(g)$ $\Delta H = -282.7$ kJ

reverse $Fe_2O_3 \rightarrow 2Fe + 3/2\,O_2$ +824.2

(x3) $3CO + 3/2\,O_2 \rightarrow 3CO_2$ 3(-282.7) = -848.1

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ $\Delta H = -23.9$ kJ

3. If a reaction shown below releases heat in a coffee cup calorimeter, assuming that the calorimeter has a negligible effect on the heat and that only the water in the reaction is effected by the heat of the reaction, how much heat does the reaction release or absorb ? Assume that the water in the coffee cup calorimeter weighs 43.3 grams, has a $C_s$ of 4.18 J/g °C and that the temperature goes from 25.5 °C to a final temperature of 67.2 °C. (7 pts, $q = m\,C_s\,\Delta T$) $T_f = 67.2$, $T_i = 25.5$°C

$\Delta T = 67.2 - 25.5 = 41.7$°C, $m = 43.3$ g, $C_s = 4.18$

$q(water) = (43.3\,g)\left(4.18\,\frac{J}{g\,°C}\right)(41.7\,°C) = 7547.4$ J

$q_{RXN} = -7547.4\ J \times \frac{kJ}{1000\ J} = 7.55$ kJ

Extra Credit: For the element O (oxygen), the group number is VI A the charge on an ion of O is

-2 the # of valence electrons (for a neutral atom) is 6 and the electron configuration is

$1s^2, 2s^2, 2p^4$ (use notation $1s^2$, etc) the valence electron configuration is

$2s^2, 2p^4$ (use notation $1s^2$ …) The # of valence electrons in the molecule $H_2O$ is 6+2=8.

Draw the Lewis Dot structure below. (4 pts each, ½ pt each)

4 x 2 = 8 e⁻

geometry of e⁻ = tetrahedral

# lone pairs = 2

The VSEPRT shape of the molecule is (linear) or (bent) or (tetrahedral) (circle one)

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1. Given the following reaction, and the enthalpy associated with the reaction, if you rewrite the reaction as shown, what is the new enthalpy for the newly written reaction? (6 pts)

$N_2O$ (g) + $NO_2$ (g) → 3NO(g) Δ H = 157.7 kJ

reversed RXN −157.7 + 3 × (−157.7)

6 NO(g) → 2 $N_2O$ (g) + 2 $NO_2$ (g) Δ H = −473.1 (fill in blank with #) kJ

2. Apply Hess's Law to the following to calculate Δ H for the reaction. (7 pts)

CaO (s) + $CO_2$ (g) → $CaCO_3$ (s) given the following reactions and enthalpies

−177.9 kJ

~~Ca(s) + $CO_2$ (g) + ½ $O_2$ (g) → $CaCO_3$ (s)~~ ΔH= - 812.8 kJ

2 Ca (s) + $O_2$ (g) → 2 CaO (s) ΔH= -1269.8 kJ

$2CaO \rightarrow 2Ca + O_2$ ÷ 2 → reverse & ÷ by 2 (1269.8/2) = 634.9

$CaO \rightarrow Ca + \frac{1}{2}O_2$

$CaO + CO_2 \rightarrow CaCO_3$ $\Delta H = -812.8 + 634.9 =$

3. If a reaction releases heat in a coffee cup calorimeter, assuming that the calorimeter has a negligible effect on the heat and that only the water in the reaction is effected by the heat of the reaction, how much heat does the reaction release or absorb ? Assume that the water in the coffee cup calorimeter weighs 20.3 grams, has a $C_s$ of 4.18 J/g °C and that the temperature goes from 25.5 °C to a final temperature of 10.7 °C. (7 pts, $q = m C_s \Delta T$) $T_f - T_i = 10.7°C - 25.5°C = -14.8°C$

$q(water) = (20.3\,g)(4.18\,\frac{J}{g\,°C})(-14.8\,°C) = -1255.8\,J$

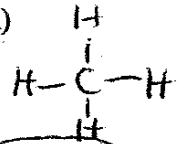
$q_{RXN} = +1255.8\,J = 1.26 \times 10^3\,J = 1.26\,kJ$

Extra Credit: For the element C (carbon), the group number is IV A the charge on an ionic form of C (if one exists) is +4 or −4 the # of valence electrons is 4 and the electron configuration is

$1s^2, 2s^2, 2p^2$ (use notation $1s^2$, etc) the valence electron configuration is

$2s^2, 2p^2$ (use notation $1s^2$ …) The # of valence electrons in the molecule $CH_4$ is 4 + 4 = 8

Draw the Lewis Dot structure below. (4 pts, ½ pt each)



4 ē pairs
no lone pairs

The VSEPRT shape of the molecule is (T-shaped) or (tetrahedral) or (trigonal planar) (circle one)

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1. Given the following reaction, and the enthalpy associated with the reaction, if you rewrite the reaction as shown, what is the new enthalpy for the newly written reaction? (6 pts)

$N_2O$ (g) + $NO_2$ (g) → 3NO(g) $\Delta H = 157.7$ kJ

2 $N_2O$ (g) + 2 $NO_2$ (g) → 6 NO(g) $\Delta H =$ _____ (fill in blank with #) kJ

2. For the reaction given, use the enthalpy of formation given to calculate the $\Delta H^\circ$ for the reaction. (7 pts)
Info: $\Delta H^\circ_f$=[$Cr_2O_3$(s)] = -1139.7 kJ /mol $\Delta H^\circ_f$[CO(g)] = -110.5 kJ/mol $\Delta H^\circ_f$[$CO_2$(g)]= -393.5 kJ/mol

$Cr_2O_3$ (s) + 3 CO(g) → 2Cr(s) + 3 $CO_2$(g)

3. If a 4.5 gram block of Lead ($C_s$ = 0.128 J / g °C), changes temperature from 25.2 °C to 30.5 °C, what is the heat released or absorbed by the lead block. (7 pts, $q = m\ C_s\ \Delta T$)

Extra credit: (4 pts, ½ pt each) For the element F (florine), the group number is _____the charge for an F ion is _____ the # of valence electrons (for a neutral atom) is _____ and the electron configuration is _____ (use notation $1s^2$, etc) the valence electron configuration is _____ (use notation $1s^2$, etc) The number of valence electrons in the molecule $PF_3$ is _____. Draw the Lewis Dot structure.

The VSEPRT shape of the molecule is (T-shaped) or (tetrahedral) or (trigonal pyrimadal) (circle one)

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$N_2O$ (g) + $NO_2$ (g) → 3NO(g) $\Delta H = 157.7$ kJ

3NO(g) → $N_2O$ (g) + $NO_2$ (g) $\Delta H =$ _____ (fill in blank with #) kJ

2. For the reaction given, use the enthalpy of formation given to calculate the $\Delta H^\circ$ for the reaction.
$\Delta H^\circ_f$[CaO (s)] = -634.9 kJ/mol $\Delta H^\circ_f$[HCl (g)] = -92.3 kJ/mol $\Delta H^\circ_f$[$CaCl_2$ (s)]= -795.4 kJ/mol
$\Delta H^\circ_f$[$H_2O$ (g)] = -241.8 kJ/mol (7 pts)

CaO (s) + 2 HCl (g) → $CaCl_2$ (s) + $H_2O$ (g)

3. If a hot 0.352 gram block of Lead ($C_s$ = 0.128 J / g °C), changes temperature from 45.1 °C to 20.5 °C, what is the heat released or absorbed by the lead block. (7 pts, $q = m C_s \Delta T$)

Extra credit: (4 pts, ½ pt each) For the element N (nitrogen), the group number is _____ the charge for an N ion is _____ the # of valence electrons (for a neutral atom) is _____ and the electron configuration is _____ (use notation $1s^2$, etc) the valence electron configuration is _____ (use notation $1s^2$, etc) The number of valence electrons in the molecule $NH_3$ is _____. Draw the Lewis Dot structure

The VSEPRT shape of the molecule is (trigonal pyramidal) or (tetrahedral) or (trigonal planar) (circle one)

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$N_2O$ (g) + $NO_2$ (g) → 3NO(g) $\Delta H = 157.7$ kJ

3 $N_2O$ (g) + 3 $NO_2$ (g) → 9 NO(g) $\Delta H =$ _____ (fill in blank with #) kJ

2. Apply Hess's Law to the following to calculate $\Delta H$ for the reaction. (7 pts)

$Fe_2O_3$ (s) + 3CO (g) → 2 Fe (s) + 3 $CO_2$ (g) given the following reactions and enthalpies

2 Fe (s) + 3/2 $O_2$ (g) → $Fe_2O_3$ (s) $\Delta H = -824.2$ kJ
CO (g) + ½ $O_2$ (g) → $CO_2$ (g) $\Delta H = -282.7$ kJ

3. If a reaction shown below releases heat in a coffee cup calorimeter, assuming that the calorimeter has a negligible effect on the heat and that only the water in the reaction is effected by the heat of the reaction, how much heat does the reaction release or absorb ? Assume that the water in the coffee cup calorimeter weighs 43.3 grams, has a $C_s$ of 4.18 J/g °C and that the temperature goes from 25.5 °C to a final temperature of 67.2 °C. (7 pts, $q = m C_s \Delta T$)

Extra Credit: For the element O (oxygen), the group number is _____ the charge on an ion of O is

_____ the # of valence electrons (for a neutral atom) is _____ and the electron configuration is

_____ (use notation $1s^2$, etc) the valence electron configuration is

_____ (use notation $1s^2$ …) The # of valence electrons in the molecule $H_2O$ is _____.
Draw the Lewis Dot structure below. (4 pts each, ½ pt each)

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$N_2O$ (g) + $NO_2$ (g) → 3NO(g) $\Delta H = 157.7$ kJ

6 NO(g) → 2 $N_2O$ (g) + 2 $NO_2$ (g) $\Delta H =$ _____ (fill in blank with #) kJ

2. Apply Hess's Law to the following to calculate $\Delta H$ for the reaction. (7 pts)

CaO (s) + $CO_2$ (g) → $CaCO_3$ (s) given the following reactions and enthalpies

Ca(s) + $CO_2$ (g) + ½ $O_2$ (g) → $CaCO_3$ (s) $\Delta H = -812.8$ kJ
2 Ca (s) + $O_2$ (g) → 2 CaO (s) $\Delta H = -1269.8$ kJ

3. If a reaction releases heat in a coffee cup calorimeter, assuming that the calorimeter has a negligible effect on the heat and that only the water in the reaction is effected by the heat of the reaction, how much heat does the reaction release or absorb ? Assume that the water in the coffee cup calorimeter weighs 20.3 grams, has a $C_s$ of 4.18 J/g °C and that the temperature goes from 25.5 °C to a final temperature of 10.7 °C. (7 pts, $q = m C_s \Delta T$)

Extra Credit: For the element C (carbon), the group number is _____ the charge on an ionic form of C (if one exists) is _____ the # of valence electrons is _____ and the electron configuration is _____ (use notation $1s^2$, etc) the valence electron configuration is _____ (use notation $1s^2$ …) The # of valence electrons in the molecule $CH_4$ is _____.
Draw the Lewis Dot structure below. (4 pts, ½ pt each)

The VSEPRT shape of the molecule is (T-shaped) or (tetrahedral) or (trigonal planar) (circle one)