Chemistry 121
Exam 2

Fall 2005
November 17, 2005

Oregon State University
Dr. Richard Nafshun

Test Form 1

Instructions: You should have with you several number two pencils, an eraser, your 3" x 5" note card, a calculator, and your University ID Card. If you have notes with you, place them in a sealed backpack and place the backpack OUT OF SIGHT or place the notes directly on the table at the front of the room.

Fill in the front page of the Scantron answer sheet with your test form number (listed above), last name, first name, middle initial, and student identification number. **Leave the class section number and the test form number blank.**

This exam consists of 25 multiple-choice questions. Each question has four points associated with it. Select the best multiple-choice answer by filling in the corresponding circle on the rear page of the answer sheet. If you have any questions before the exam, please ask. If you have any questions during the exam, please ask the proctor. Open and start this exam when instructed. When finished, place your Scantron form and note card in the appropriate stacks. You may keep the exam packet, so please show your work and mark the answers you selected on it.

Abbreviated Solubility Rules:
Rule 1: All nitrates, group 1A metal salts and ammonium salts are soluble.
Rule 2: All carbonates, hydroxides, phosphates and sulfides are insoluble.
Rule 3: Rule 1 always takes precedent.

$R = 0.0821 \frac{L \bullet atm}{mol \bullet K}$	$R = 8.314 \frac{kg \bullet m^2}{s^2 \bullet mol \bullet K}$	$\mu_{rms} = \sqrt{\frac{3RT}{Molar\ Mass}}$
PV = nRT	760 Torr = 1 atm = 760 mm Hg	K = 273.15 + °C
1 mole = 6.02×10^{23}	$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$	milli (m) = 1/1000

Substance	**J/g·°C**
Water	4.184
Methyl Alcohol	2.549
Ice	2.093
Steam	2.009
Benzene	1.750
Wood (typical)	1.674

Substance	**J/g·°C**
Soil (typical)	1.046
Air	1.046
Aluminum	0.901
Mercury	0.138
Gold	0.130
Lead	0.128

Name	Charge	Formula
Hydroxide	1-	OH^-
Cyanide	1-	CN^-
Nitrate	1-	NO_3^-
Acetate	1-	CH_3COO^-
Carbonate	2-	CO_3^{2-}
Phosphate	3-	PO_4^{3-}
Hydronium	1+	H_3O^+
Ammonium	1+	NH_4^+
Sulfate	2-	SO_4^{2-}

Periods ↓	Group IA	IIA	IIIB	IVB	VB	VIB	VIIB	VII			1B	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 H Hydrogen 1.0079																	2 He Helium 4.0026
2	3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.179
3	11 Na Sodium 22.98977	12 Mg Magnesium 24.305											13 Al Aluminum 26.9815	14 Si Silicon 28.0855	15 P Phosphorus 30.97376	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
4	19 K Potassium 39.0983	20 Ca Calcium 40.08	21 Sc Scandium 44.9559	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.996	25 Mn Manganese 54.9380	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.70	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.59	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.9059	40 Zr Zirconium 91.22	41 Nb Niobium 92.9064	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.4	47 Ag Silver 107.868	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.69	51 Sb Antimony 121.75	52 Te Tellurium 127.60	53 I Iodine 126.9045	54 Xe Xenon 131.30
6	55 Cs Cesium 132.9054	56 Ba Barium 137.33	57–71 *Rare earths	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.37	82 Pb Lead 207.2	83 Bi Bismuth 208.9804	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium 226.0254	89–103 †Actinides	104 Rf Rutherfordium (261)	105 Ha Hahnium (262)	106 Sg Seaborgium (263)	107 Ns Neilsbohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 ‡ (269)	111 ‡			114				

→ Stable region?

6	57 La Lanthanium 138.9055	58 Ce Cerium 140.12	59 Pr Praseodymium 140.9077	60 Nd Neodymium 144.24	61 Pm Promethium 145	62 Sm Samarium 150.4	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.9254	66 Dy Dysprosium 162.50	67 Ho Holmium 164.9304	68 Er Erbium 167,26	69 Tm Thulium 168.9342	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
7	89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.0359	92 U Uranium 238.029	93 Np Neptunium 237.0482	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium 259	103 Lr Lawrencium 262

1. How many grams of H_2O (g) are theoretically produced from 1026.9 g of sucrose and an excess amount of oxygen?

$$C_{12}H_{22}O_{11}\,(g) \quad + \quad 12\,O_2\,(g) \quad \rightarrow \quad 12\,CO_2\,(g) \quad + \quad 11\,H_2O\,(g)$$

1026.9 g ↓ ① 3.000 mol —②→ 33.000 mol ↑③ 594.7 g

① 1026.9 g $C_{12}H_{22}O_{11}$ $\left(\frac{1 \text{ mol}}{342.3 \text{ g}}\right)$ = 3.000 mol $C_{12}H_{22}O_{11}$

↓

(12 × 12.01) + (22 × 1.0079) + (11 × 16.00) = 342.3 g/mol

② 3.000 mol $C_{12}H_{22}O_{11}$ $\left(\frac{11 \text{ mol } H_2O}{1 \text{ mol } C_{12}H_{22}O_{11}}\right)$ = 33.000 mol H_2O

③ 33.000 mol H_2O $\left(\frac{18.02 \text{ g}}{1 \text{ mol}}\right)$ = 594.7 g H_2O

(A) 11.00 g H_2O (g) are produced.
(B) 1484 g H_2O (g) are produced.
(C) 648.7 g H_2O (g) are produced.
(D) [✓ 594.7 g H_2O (g) are produced.]
(E) 198.2 g H_2O (g) are produced.

2. Which of the following ionic compounds is **insoluble** in water?

(A) [✓ $CaCO_3$]
(B) LiF
(C) Na_3PO_4
(D) NH_4NO_3
(E) $NaNO_3$

CO_3^{2-} (carbonates) are insoluble. CO_3^{2-} is NOT combined with an ion listed in Rule 1.

3. Which of the following ionic compounds is **soluble** in water?

(A) $MgCO_3$
(B) $AlPO_4$
(C) $Ca_3(PO_4)_2$
(D) $Al(OH)_3$
(E) [✓ LiOH] – Rule 2 : OH^- (hydroxide) are insoluble. However, this hydroxide is combined with a Group IA metal ion (soluble).

4. A student calculates that 220.4 grams of calcium carbonate should theoretically be produced during a process. She actually recovers 133.2 grams of calcium carbonate. What is the percent yield for this process?

$$\text{Percent Yield} = \frac{\text{actual}}{\text{theoretical}} \cdot 100\% = \frac{133.2\,g}{220.4\,g} \cdot 100\% = 60.44\%$$

(A) 1.655 %.
(B) 165.5 %.
(C) 87.2 %.
(D) 39.56 %.
(E) [✓ 60.44 %.]

5. A student dissolves three moles of $Mg(NO_3)_2$ into a beaker. How many magnesium ions are present in the solution?

(A) There are 6.02 x 10^{23} magnesium ions in the beaker.
(B) There are 1.20 x 10^{24} magnesium ions in the beaker.
(C) [✓ There are 1.81 x 10^{24} magnesium ions in the beaker.]
(D) There are 3.61 x 10^{24} magnesium ions in the beaker.
(E) There are 219 magnesium ions in the beaker.

$$3 \text{ mol } Mg(NO_3)_2 \left(\frac{6.02\times10^{23}\ Mg(NO_3)_2}{1 \text{ mol } Mg(NO_3)_2}\right)\left(\frac{1\ Mg^{2+}\text{ ion}}{1\ Mg(NO_3)_2}\right) = 1.81\times10^{24}\ Mg^{2+}\text{ ions}$$

6. Consider the mixture of two aqueous solutions: one of sodium phosphate and one of calcium nitrate. The net ionic equation for the process that occurs is:

(A) Ca^{2+} (aq) + 2 NO_3^- (aq) → $Ca(NO_3)_2$ (s)
(B) ~~Na^+ (aq) + NO_3^- (aq) → $NaNO_3$ (s)~~
[✓ (C) 3 Ca^{2+} (aq) + 2 PO_4^{3-} (aq) → $Ca_3(PO_4)_2$ (s)]
(D) ~~6 Na^+ (aq) + 6 NO_3^+ (aq) → 6 $NaNO_3$ (s)~~
(E) 2 Na_3PO_4 (aq) + 3 $Ca(NO_3)_2$ (aq) → $Ca_3(PO_4)_2$ (s) + 6 $NaNO_3$ (aq)

$2\ \cancel{Na_3}PO_4(aq) + 3\ Ca(\cancel{NO_3})_2\ (aq) \rightarrow 6\cancel{Na^+}\ (aq) + 6\ \cancel{NO_3^-}\ (aq) + \ Ca_3(PO_4)_2($

Spectator Ions are not included in the net ionic equation

7. A student obtains a Thermos® bottle at 24.1 °C and 0.989 atm. The student closes the bottle containing air [78% N_2 (g); 21% O_2 (g); 1% other gases]. The student places the bottle over a Bunsen burner so the bottle and the air heat up to 30.5 °C. Which of the following is true?

(A) The gases inside the bottle are traveling faster (Yes) at the higher temperature than at the lower temperature; the pressure inside the bottle is higher (Yes) at the higher temperature than at the lower temperature; the number of moles of gas present inside the bottle is higher at the higher temperature than at the lower temperature. ↑ No

(B) The gases inside the bottle are traveling the same (No) at the higher temperature than at the lower temperature; the pressure inside the bottle is higher at the higher temperature than at the lower temperature; the number of moles of gas present inside the bottle is higher at the higher temperature than at the lower temperature. No

(C) The gases inside the bottle are traveling the same (No) at the higher (No) temperature than at the lower temperature; the pressure inside the bottle is the same at the higher temperature than at the lower temperature; the number of moles of gas present inside the bottle is the same at the higher temperature than at the lower temperature.

[✓ (D) The gases inside the bottle are traveling faster (Yes) at the higher temperature than at the lower temperature; the pressure inside the bottle is higher at the higher temperature than at the lower temperature; the number of moles of gas present inside the bottle is the same at the higher temperature than at the lower temperature.] All true

(E) The gases inside the bottle are traveling the same (No) at the higher temperature than at the lower temperature; the pressure inside the bottle is lower (No) at the higher temperature than at the lower temperature; the number of moles of gas present inside the bottle is the same at the higher temperature than at the lower temperature. yes

8. A student obtains 15.00 mL of NaOH (aq) of unknown concentration. Upon titration, 28.33 mL of 0.1540 M HCl (aq) are required for neutralization. Determine the concentration of the NaOH (aq).

(A) 2.759 M
(B) 3.438 M
(C) [✓ 0.2909 M]
(D) 0.08154 M
(E) 65.44 M

$$\underset{\text{NaOH}}{M_1V_1} = \underset{\text{HCl}}{M_2V_2}$$

$$(M_1)(15.00\text{ mL}) = (0.1540\text{ M})(28.33\text{ mL})$$

$$M_1 = 0.2909\text{ M}$$

9. A student dilutes 125.00 mL of 5.000 M NaOH to a new volume of 500.00 mL. The concentration of the new solution is:

(A) 0.0320 M
(B) [✓ 1.250 M]
(C) 5.000 M
(D) 0.5000 M
(E) 3.125 M

$$\underset{\text{before}}{M_1V_1} = \underset{\text{after}}{M_2V_2}$$

$$(125.00\text{ mL})(5.000\text{ M}) = (M_2)(500.00\text{M})$$

$$M_2 = 1.250\text{ M}$$

10. A student obtains a 1.75 liter balloon at 22.0 °C. He cools the balloon to –35.0 °C. The volume of the balloon at –35.0 °C is:

↓ $22+273.15 = 295.15\text{ K}$

↓ $-35.0°\text{C}+273.15 = 238.15\text{ K}$

(A) 2.78 L
(B) [✓ 1.41 L]
(C) 2.17 L
(D) 0.461 L
(E) 0.708 L

$$\frac{\cancel{P_1}V_1}{\cancel{n_1}T_1} = \frac{\cancel{P_2}V_2}{\cancel{n_2}T_2} \qquad \frac{1.75\text{ L}}{295.15\text{ K}} = \frac{V_2}{238.15\text{ K}}$$

$$V_2 = 1.41\text{ L}$$

11. A student places 9.36 g of a diatomic (a molecule having two atoms; such as O_2) gas into a 3.00-L container at 310 K and measures the pressure to be 1.12 atm. This noble gas is:

(A) H_2
(B) F_2
(C) [✓ Cl_2]
(D) N_2
(E) O_2

$PV = nRT$

$$n = \frac{PV}{RT} = \frac{(1.12\ \cancel{atm})(3.00\ \cancel{L})}{(0.0821\ \frac{\cancel{L}\cdot\cancel{atm}}{mol\cdot\cancel{K}})(310\ \cancel{K})} = \underline{0.1320}\ mol$$

$$\text{Molar Mass} = \frac{g}{mol} = \frac{9.36\,g}{0.1320\ mol} = 70.91\ g/mol$$

12. A student places 761.427 grams of iodine gas (I_2) into a 200.0-L flask at 305.0 K. The pressure inside the flask is:

(A) [✓ 0.3756 atm.]
(B) 95.36 atm.
(C) 0.01049 atm.
(D) 2.662 atm.
(E) 1.000 atm.

$PV = nRT$

$$P = \frac{nRT}{V} = \frac{(3.00\ mol)(0.0821\ \frac{L\cdot atm}{mol\cdot K})(305.0\ K)}{200.0\ L} = 0.3756\ atm$$

$$\boxed{761.427\,g\left(\frac{1\ mol}{253.81\,g}\right) = 3.00\ mol}$$

13. A student places 4.00 moles of Xe (g) and 12.00 moles of CO_2 (g) into a flask at 298 K and measures the pressure to be 4.00 atm. The pressure due to CO_2 (g) is:

(A) 1/4 atm.
(B) 3/4 atm.
(C) 1.00 atm.
(D) [✓ ~~2~~3.00 atm.]
(E) 4.00 atm.

$$P_{CO_2} = \left(\underset{\overset{\uparrow}{\frac{3}{4}}}{\frac{12\ mol}{16\ mol}}\right)(4.00\ atm) =$$

14. The root-mean-square speed of Ar (g) at 1.07 atm and 301.4 K is:

(A) [✓ ~~3.14~~ 434 m/s.]
(B) 741 m/s.
(C) 514 m/s.
(D) 7.296 x 10^{-6} m/s.
(E) 1220 m/s.

$$u_{rms} = \sqrt{\frac{3RT}{\text{Molar Mass}}} = \sqrt{\frac{(3)(8.314\ \text{J/mol·K})(301.4\ \text{K})}{39.948 \times 10^{-3}\ \frac{\text{kg}}{\text{mol}}}}$$

$$= 434\ \text{m/s}$$

units → 8.314 J/mol·K

15. Consider the following five gases: F_2 (g) I_2 (g) He (g) C_2H_4 (g) N_2 (g)

Of these, the gas with the **greatest** velocity at room temperature is:

↑ smallest mass

(A) F_2 (g)
(B) I_2 (g)
(C) [✓ He (g)] 4 g/mol
(D) C_2H_4 (g)
(E) N_2 (g).

16. The reaction below takes place in a classroom (a constant pressure of 1.00 atm and a constant temperature of 293 K for both reactants and products).

$$C_7H_{16}\,(g) \quad + \quad 11\ O_2\,(g) \quad \rightarrow \quad 7\ CO_2\,(g) \quad + \quad 8\ H_2O\,(g)$$

$$4.50\ \text{L} \xrightarrow[\times 8]{} \underline{36.0}\ \text{L}$$

$$4.50\ \text{L}\ C_7H_{16}(g) \left(\frac{8\ \text{mol}\ H_2O(g)}{1\ \text{mol}\ C_7H_{16}(g)} \right) = 36.0\ \text{mol}\ H_2O$$

When 4.50 L of C_7H_{16} (g) react,

(A) 4.50 L of H_2O are formed.
(B) 9.00 L of H_2O are formed.
(C) 12.05 L of H_2O are formed.
(D) 24.1 L of H_2O are formed.
(E) [✓ 36.0 L of H_2O are formed.]

17. Shown below is the balanced equation for the combustion of butane. What is the volume (liters) of CO_2 (g) produced at 1.500 atm and 298.0 K from the combustion of 100.0 g of butane in excess O_2 (g)?

$$2\ C_4H_{10}\ (g) \quad + \quad 13\ O_2\ (g) \rightarrow \quad 8\ CO_2\ (g) + \quad 10\ H_2O\ (g)$$

100.0g　　　　　　　　　　　　　　　　　　　　___ L

↓ ①　　　　　　　　　　　　　　　　　　　　　↑ ③

$\underline{1.721}$ mol $\xrightarrow{②}$ $\underline{6.882}$ mol

① 100.0g C_4H_{10} $\left(\frac{1\ mol}{58.12\ g}\right)$ = 1.721 mol C_4H_{10}

↓

(4*12.01)+(10*1.0079) = 58.12 g/mol

② 1.721 mol C_4H_{10} $\left(\frac{8\ mol\ CO_2}{2\ mol\ C_4H_{10}}\right)$ = 6.882 mol CO_2

↓

③ PV = nRT　$V = \frac{nRT}{P} = \frac{(6.882\ mol)(0.0821\ \frac{L \cdot atm}{mol \cdot K})(298.0\ K)}{1.500\ atm}$

$\boxed{V = 112.3\ L}$

(A) 125.5 L
(B) 28.08 L
[✓ (C) 112.3 L]
(D) 224.0 L
(E) 149.3 L

18. Which of the following processes is exothermic?

[✓ (A) $2\ C_8H_{18}\ (l) + 25\ O_2\ (g) \rightarrow 16\ CO_2\ (g) + 18\ H_2O\ (g)$.] Combustion
(B) $H_2O\ (s) \rightarrow H_2O\ (l)$.
(C) $H_2O\ (l) \rightarrow H_2O\ (g)$.
(D) $NH_4NO_3\ (s) \rightarrow NH_4NO_3\ (aq)$.

19. How much heat is required to raise the temperature of 150.0 grams of water from 20.6°C to 90.0°C?

(A) [✓ 43.6 kJ]
(B) 12.9 kJ
(C) 10.4 kJ
(D) 2.16 kJ
(E) 0.0794 kJ

$$q = mc\Delta T = (150.0\,g)(4.184\,J/g\cdot°C)(90.0°C - 20.6°C)$$
$$= 43{,}555\ J = 43.6\ kJ$$

20. A system gives off 1345 kJ of heat and does 3305 kJ of work. The change in internal energy is:

(A) + 4650 kJ.
(B) [✓ - 4650 kJ.]
(C) + 1960 kJ.
(D) - 1960 kJ.
(E) + 4.445 x 10^6 kJ.

$$E = q + w$$
$$= (-1345\ kJ) + (-3305\ kJ) = -4650\ kJ$$

21. Use the data in the table below to answer the following question:

$\Delta H°_f$	(kJ/mol)
CO_2 (g)	−393.5
C_6H_6 (g)	+ 49.0
H_2O (l)	−285.9

What is $\Delta H°_{reaction}$ for the following reaction?

$$C_6H_6\ (l) + 15/2\ O_2\ (g) \rightarrow 6\ CO_2\ (g) + 3\ H_2O\ (l)$$

$$\Delta H°_{reaction} = \underbrace{\left[(1)\left(+49.0\ \tfrac{kJ}{mol}\right) \quad \left(0\ \tfrac{kJ}{mol}\right)\right]}_{\substack{\text{reactants} \\ +49.0\ kJ}} \quad \underbrace{\left[6\left(-393.5\ \tfrac{kJ}{mol}\right) \quad 3\left(-285.9\ \tfrac{kJ}{mol}\right)\right]}_{\substack{\text{products} \\ -3218.7\ kJ}}$$

$$\Delta H°_{reaction} = \text{products} - \text{reactants}$$
$$= (-3218.7\ kJ) - (+49.0\ kJ) = -3268\ kJ$$

(A) +335 kJ.
(B) -335 kJ.
(C) [✓ -3268 kJ.]
(D) -6535 kJ.
(E) -8368 kJ.

22. Determine ΔH° for this reaction:

$$2\ N_2(g) + 5\ O_2(g) \rightarrow 2\ N_2O_5(g)$$

using the following three equations:

(1) $H_2(g) + (1/2)\ O_2(g) \rightarrow H_2O(l)$ $\Delta H_1° = -285.8$ kJ Flip and Multiply by 2

(2) $N_2O_5(g) + H_2O(l) \rightarrow 2HNO_3(l)$ $\Delta H_2° = -76.6$ kJ Flip and Multiply by 2

(3) $2\ N_2(g) + 6\ O_2(g) + 2\ H_2(g) \rightarrow 4\ HNO_3(l)$ $\Delta H_3° = -696.4$ kJ Keep

(1) Flipped and x 2 $2\ \cancel{H_2O}(l) \rightarrow 2\ \cancel{H_2}(g) + \cancel{O_2}(g)$ $\Delta H_1°$ (changed) = $+ 285.8\ kJ * 2$

(2) Flipped and x 2 $4\ \cancel{HNO_3}(l) \rightarrow \boxed{2\ N_2O_5(g)} + \cancel{2H_2O}(l)$ $\Delta H_2°$ (changed) = $+ 76.6\ kJ * 2$

(3) Keep $\boxed{2\ N_2(g)} + \overset{5}{\cancel{6}}\ O_2(g) + \cancel{2H_2}(g) \rightarrow 4\ \cancel{HNO_3}(l)$ $\Delta H_3°$ = -696.4 kJ

$2\ N_2(g) + 5O_2(g) \rightarrow 2\ N_2O_5(g)$ + 28.4 kJ

(A) -95.8 kJ.
(B) + 371 kJ.
(C) [✓ +28.4 kJ.]
(D) -1059 kJ.
(E) +1345 kJ.

23. The heat of formation ($\Delta H°_f$) of NH_4Cl (s) is –315.4 kJ/mol. The chemical equation associated with this reaction is:

(A) ~~$½\ N_2\ (g) + 4\ HCl\ (aq) \rightarrow NH_4Cl\ (s) + 3/2\ Cl_2\ (g)$~~
(B) [✓ $½\ N_2\ (g) + 2\ H_2\ (g) + ½\ Cl_2\ (g) \rightarrow NH_4Cl\ (s)$]
(C) $NH_4^+\ (aq) + Cl^-\ (aq) \rightarrow NH_4Cl\ (s)$
(D) $NH_4^+\ (s) + Cl^-\ (s) \rightarrow NH_4Cl\ (s)$
(E) $NH_4\ (s) + Cl\ (g) \rightarrow NH_4Cl\ (s)$

24. Consider:

$$2\ C_8H_{18}\ (l) + 25\ O_2\ (g) \rightarrow 16\ CO_2\ (g) + 18\ H_2O\ (l)\ \Delta H^\circ_{\text{reaction}} = -10900\text{ kJ}$$

How much energy is released when 4.0000 moles of octane, C_8H_{18}, is combusted?

(A) 10900 kJ.
(B) [✓ 21800 kJ.]
(C) 32700 kJ.
(D) 43600 kJ.
(E) 87200 kJ.

$$4.0000\text{ mol } C_8H_{18}(l)\ \left(\frac{-10{,}900\text{ kJ}}{2\text{ mol } C_8H_{18}(l)}\right) = 21{,}800\text{ kJ is released}$$

25. Which one of the following statements is **TRUE**? ANY

(A) [✓ The CH 121 Final Exam is scheduled for 7:30-9:20am on Tuesday, December 6, 2005.]
(B) The CH 121 Final Exam is scheduled for 7:30-9:20am on Tuesday, December 6, 2005.
(C) The CH 121 Final Exam is scheduled for 7:30-9:20am on Tuesday, December 6, 2005.
(D) The CH 121 Final Exam is scheduled for 7:30-9:20am on Tuesday, December 6, 2005.
(E) The CH 121 Final Exam is scheduled for 7:30-9:20am on Tuesday, December 6, 2005.