March 20, 2013

Print name _____

Sign name _____ circle registration section below _____

CIRCLE your recitation section in the list below.

Section	A	Fri 10 am, Aiqin Fang	B	Fri 11 am, Aiqin Fang
	C	Tue 3 pm, Rahul Jain	D	Tue 1 pm, Rahul Jain
	F	W 10 am, Neeraj Kumar	G	Wed 2 pm, Rahul Jain

Cell phones, PDAs, mp3 players, and other electronic devices must be turned off and stowed out of sight (your sight and mine). Calculator policy is in effect. Infractions will result in confiscation and point deductions.

Please clearly and legibly write your name, in ink, at the top of every page. Your score will not be recorded and your exam will not be returned if this is not done.

All answers should be rounded to the appropriate precision (correct significant figures.)

Atomic weights are provided in the Periodic Table. These values must be used.

You may not use any outside paper. If you reach a point where you need more scratch paper than the space available on this page and on the back of your exam, ask a proctor.

Be certain your answers are clear. If an answer is not clear, it will probably be considered wrong.

Problems marked with ** in the margin are directly from the assigned homework (either in the text or on worksheets in class).

Use your time effectively. **Time is up at 8:50!!**

name_____

1. [2 pts each] **Clearly** assign each statement as TRUE or FALSE. If we can't tell which you mean, it's wrong.

_____ **For a given sample of a gas at a fixed volume, pressure increases as temperature increases.

_____ "STP" specifies a one-mole sample of a gas at one atmosphere and 0 K.

_____** Both diffusion and effusion are faster at higher temperatures.

_____**If ΔH of a reaction is positive, then the system loses energy.

_____**The ΔH^0_f value for F_2 (g) is zero.

_____The longer the wavelength of a photon, the greater its energy.

_____**The melting of ice is exothermic.

_____The 4*d* subshell (sublevel) can hold 10 electrons.

_____A single 4*d* orbital can hold 10 electrons.

_____**A photon of red light has more energy than a photon of violet light.

_____When an electron in an atom relaxes from n=3 to n=1, a photon is absorbed by the atom.

_____**The *s* subshell occurs in every shell.

_____**The 2*d* subshell is not a possible subshell.

_____**The energy of the electron in the n=3 shell of a hydrogen atom is 7.27×10^{-19} J.

_____The reverse of an endothermic reaction is always exothermic.

2. [10 pts] Three 5-L flasks (labeled A, B and C) each contain a sample of gas (H_2, He or CH_4, respectively) at 273 K and 1 atm. For each of the following quantities or values, circle the best choice.

a. lowest density:	Flask A (H_2)	Flask B (He)	Flask C (CH_4)	all same
b. lowest average kinetic energy:	Flask A (H_2)	Flask B (He)	Flask C (CH_4)	all same
c. greatest mass:	Flask A (H_2)	Flask B (He)	Flask C (CH_4)	all same
d. greatest average molecular speed:	Flask A (H_2)	Flask B (He)	Flask C (CH_4)	all same
e. greatest pressure:	Flask A (H_2)	Flask B (He)	Flask C (CH_4)	all same

**3. [10 pts] Write the formation equation (the reaction corresponding to the ΔH^0_f) for $HClO_3$ (*l*). For full credit, include appropriate phase labels on all species.

reminder: phase labels?

name_____

4. **[6] A sample of methane gas is confined in a 1.1 L container at 432 torr and 87 °C. Calculate the number of moles of gas present. **Show your work** below, and write your final answer in the space provided. (No credit will be earned if the setup is not clearly shown.)

Answer: _____ moles

**5. [6 pts] Pb^{2+} (aq) + 2 Cl^- (aq) → $PbCl_2$ (s)

A 41.0-mL sample of a solution of 0.237 M $Pb(NO_3)_2$ is added to 60.0 mL of a solution of 0.250 M NH_4Cl. How many grams of precipitate can be produced, according to the balanced reaction equation above? **Show your work** below, and write your final answer in the space provided. (No credit will be earned if the setup is not clearly shown.)

Answer: _____ g

6. **(a) [6 pts] Balance the following equation by writing appropriate coefficients into the spaces provided. All reactants and products are shown. (You may use as much scratch space as you like, but please make sure you write your final answers clearly and legibly in the spaces provided.)

Final, graded answer:

_____ $S_2O_6^{2-}$ + _____H^+ + _____IO^- → _____SO_2 + _____ IO_3^- + _____ H_2O

Scratch space (will not be graded):

$S_2O_6^{2-}$ + H^+ + IO^- → SO_2 + IO_3^- + H_2O

(b) [2 pts each] For the reaction provided in part (a), identify:

element reduced _____ element oxidized _____ reductant (reducing agent) _____

(c) [2 pts] In the reaction provided in part (a), one species is a gas. Which one is it? _____

name_____

THE PERIODIC TABLE

	1 (1A)												13 (3A)	14 (4A)	15 (5A)	16 (6A)	17 (7A)	18 (8A)
1	1 H 1.008	2 (2A)																2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31	3 (3B)	4 (4B)	5 (5B)	6 (6B)	7 (7B)	8	9 (8B)	10	11 (1B)	12 (2B)	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.96	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (265)	105 Db (268)	106 Sg (271)	107 Bh (272)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Uut (284)	114 Uuq (289)	115 Uup (288)	116 Uuh (293)	117 Uus (294)	118 Uuo (294)

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Based on IUPAC 2007 (publ 2009).

Avogadro's number: 6.022×10^{23}

Gases: one atm = 760 mmHg = 760 torr PV = nRT R = 0.08206 (L atm)/(mol K)

$$D = \frac{PM}{RT} \qquad u_{rms} = \sqrt{\frac{3RT}{M}} \qquad T(K) = T(°C) + 273$$

Heat and heat capacity: $q = C \times \text{mass} \times \Delta T$

Electromagnetic Radiation: $E = h\nu = hc/\lambda$ $h = 6.626 \times 10^{-34}$ J·s $c = 3.00 \times 10^{8}$ m/s

Electron energy in single-electron species: $$E = -2.18 \times 10^{-18} J \left(\frac{Z^2}{n^2} \right)$$

Electron transitions in H atom: $$\Delta E = -2.18 \times 10^{-18} J \left(\frac{1}{n_{final}^2} - \frac{1}{n_{initial}^2} \right)$$