Exam 1 Review

Exam 1 Thursday
7:00-8:20pm

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Room Assignments
Past Exams
Cover Pages

If you haven't, please form a study group (Groups of three are very effective)

Dr. Richard Nafshun Office Hours: T 9:30am, W 9am, R 10am in 239 LPSC
Dr. Philip Watson Office Hours: M 3pm, W 3pm, F 3pm in 147 GILB
Dr. Morgan Ferguson Office Hours: M 2pm, W 2pm, W 4pm in 239 LPSC

Mole-Hole

Notecard (3"x5" handwritten notes on both sides)

Exam 1 and Exam 2 Room Assignments Thursday, February 2, 2012 7:00-8:20pm Thursday, March 1, 2012 7:00-8:20pm Click here to view a campus map	
Last name begins with A - B	...your room is CORD 1109
Last name begins with C	...your room is COVL 216
Last name begins with D - F	...your room is DEAR 118
Last name begins with G - Kh	...your room is GILB 124
Last name begins with Ki - Mo	...your room is GILB 224
Last name begins with Mu - Se	...your room is GLFN AUD (Listed as Burt Hall on Campus Map)
Last name begins with Sh - T	...your room is LPSC 125
Last name begins with U - Z	...your room is WNGR 151

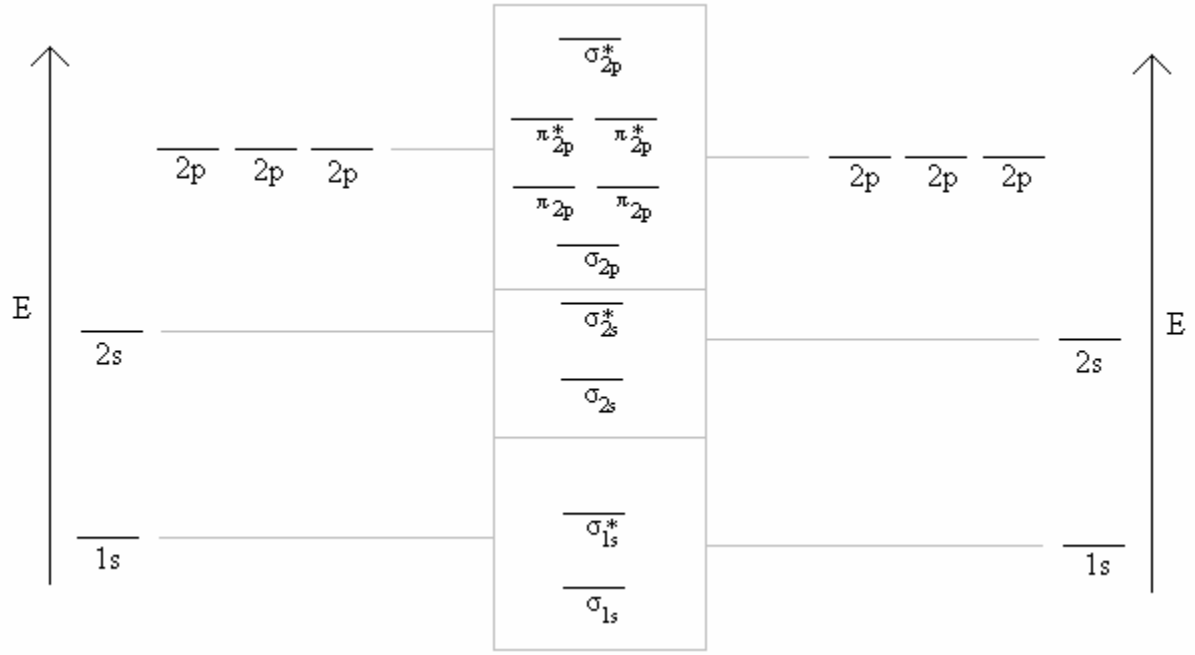
Chemistry 222 | Winter 2012 | Oregon State University
Exam 1 | February 2, 2012 | Drs. Nafshun, Ferguson, and Watson

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 class section number (see below), last name, first name, middle initial, and student identification number. Leave the test form number blank.

Section 001 (MWF 8am with Dr. Nafshun)
Section 002 (MWF 11am with Dr. Watson)
Section 003 (MWF 1pm with Dr. Ferguson)
Section 004 (MWF 3pm with Dr. Ferguson)
Section 006 (TR 8am with Dr. Nafshun)

This exam consists of 22 multiple-choice questions; each has 5 points attached. The last question (Question 23) has 2 points attached. When you finish this exam, proceed to the proctor. Submit your completed Scantron form. You may take your notecard and exam packet with you.



PV = nRT	$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$	$\mu_{rms} = \sqrt{\frac{3RT}{Molar\ Mass}}$
R = 0.08206 $\frac{L \bullet atm}{mol \bullet K}$	R = 8.314 $\frac{kg \bullet m^2}{s^2 \bullet mol \bullet K}$	760 Torr = 1 atm = 760 mm Hg
K = 273.15 + °C	1 mole = 6.02 x 10^{23}	STP = 273 K & 1 atm

The Periodic Table of the Elements

1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Electron Pair and Molecular Geometries

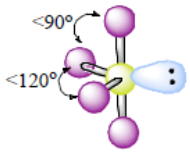
Number of Electron Groups	Number of Lone Pairs	Electron Pair Geometry	Molecular Geometry
2	0	Linear	Linear
3	0	Trigonal planar	Trigonal planar
	1	Trigonal planar	Bent
4	0	Tetrahedral (T_d)	Tetrahedral (T_d)
	1	Tetrahedral (T_d)	Trigonal pyramidal
	2	Tetrahedral (T_d)	Bent
5	0	Trigonal bipyramidal	Trigonal bipyramidal
	1	Trigonal bipyramidal	See-Saw
	2	Trigonal bipyramidal	T-Shaped
	3	Trigonal bipyramidal	Linear
6	0	Octahedral (O_h)	Octahedral (O_h)
	1	Octahedral (O_h)	Square pyramidal
	2	Octahedral (O_h)	Square planar

Add notes on notecard (figures, angles, examples...)

1. Determine the electron geometry and molecular geometry of BrF_4^+.

Br = 7
F = 4*7
e^-=1

36 electron system

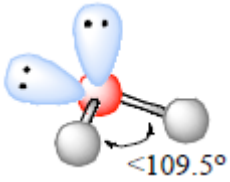


5:1

5 electron groups: 1 lone pair

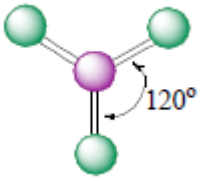
The electron geometry is trigonal bipyramidal
The molecular geometry is see-saw

2. The H-O-H bond angle in water is:



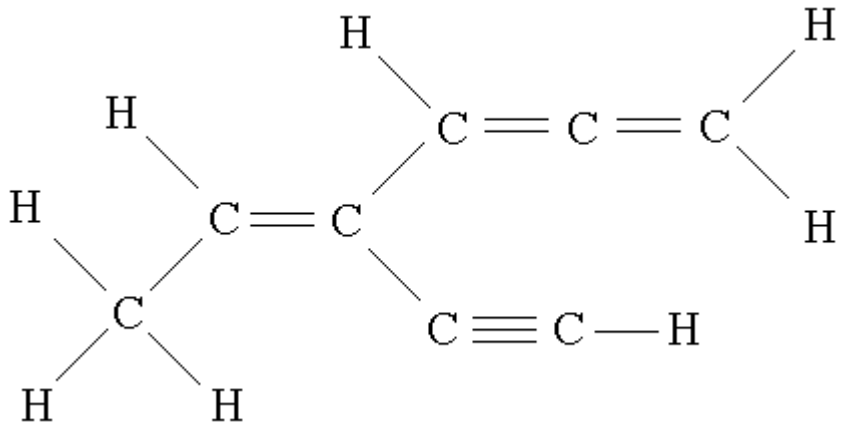
A little less than 109.5°

3. The O-N-O bond angle in the nitrate ion (NO_3^-) is:



4. Consider ethyne, C_2H_2. Ethyne contains _____σ-bonds and _____ π-bonds

5. Hybridization (sp, sp^2...), geometry (trigonal planar, tetrahedral...), bond angles of carbon



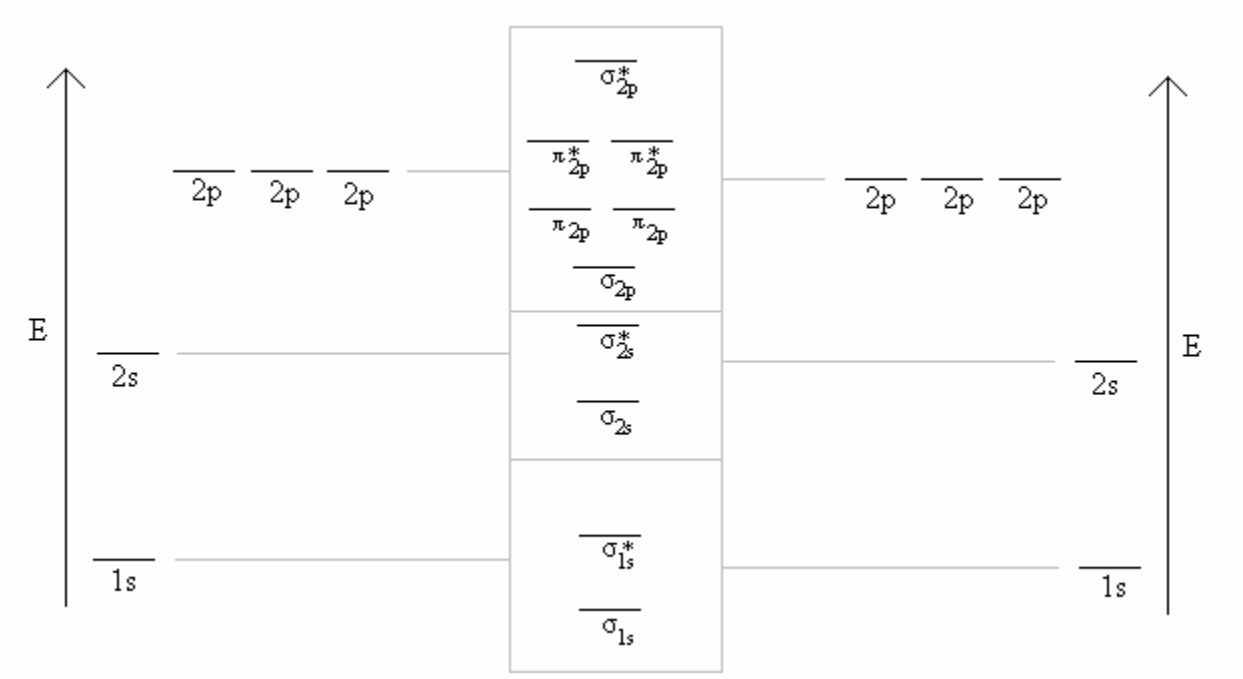
6. Polarity... C_2H_6, I_3^-, CH_3F, CO_2, PCl_5, O_2, NO_2^-, and SF_6.

7. Describe the sigma and pi bonds in C_2H_4.

H 1s orbital overlapping with C sp^2 hybridized orbitals

Side by side overlap of C p orbitals

8. Consider MO (Molecular Orbital Theory). Describe the bonding in O_2^{2-}.



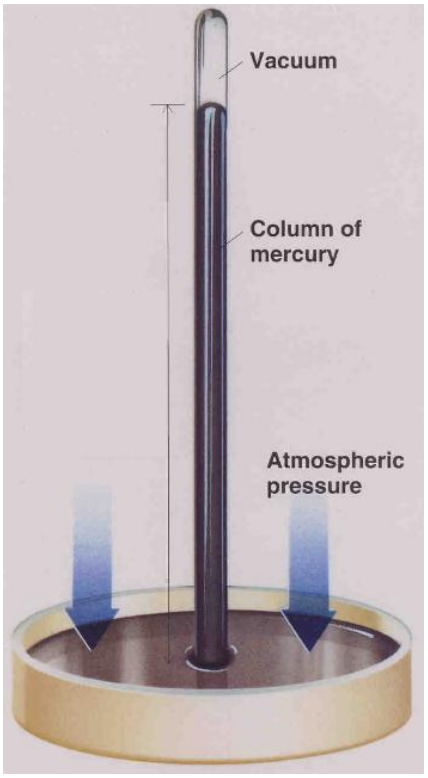
Magnetism:

diamagnetic	/	paramagnetic
all electrons are paired	/	at least one unpaired electron

Bond order:

Types of bonds:

9. A student measures the pressure inside their home to be 750 mm Hg. What does this mean? Atm?



10. A gas at 35.0°C occupies 4.50 L. What will be the volume at -45. 0°C?

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

P is a constant

V is NOT a constant

n is a constant

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

(Balloon or other flexible walled container)

$$\frac{4.50\ \text{L}}{308\ \text{K}} = \frac{V2}{228\text{K}}$$

$V_2 = 3.33$ L

We must use K

11. Flask (fixed volume container)

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

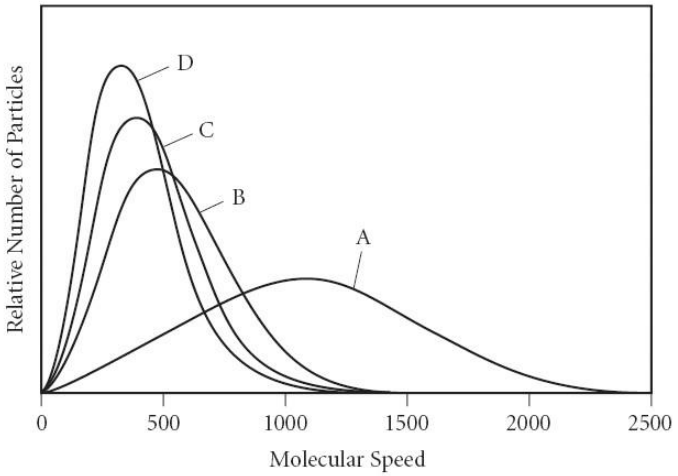
P is a NOT a constant

V is a constant

n is a constant

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

12. Discuss the data below.



Gas A has the highest velocity (μ_{rms}).
Gas A has the lowest molar mass.
Or, if the data is collected from the same gas at varying temperatures, A is the highest temperature.

$$\mu_{rms} = \sqrt{\frac{3RT}{Molar\ Mass}}$$

13. What happens when you cool gas? Heat a gas? Double the temperature? Squeeze a balloon to half the volume?

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

14. Calculate the density of gases.

g/L

PV=nRT

n is one step away from grams

What is the density (g/L) of F_2 under standard conditions, 1.00 atm and 273K?

Assume one liter of gas (so the mass can be determined for one liter).

PV = nRT

n = PV/RT = (1.00 atm)(1.00 L)/(0.0821 L•atm/mol•K)(273 K) = 0.0446 moles F_2

$$0.0446 \text{ moles } SF_6 \left(\frac{38g}{1mole}\right) = 1.7 \text{ grams } F_2$$

1.7 grams is the mass of one liter, so:

The density of F_2 is 1.7 g/L.

15. A student  places 1.854 g of a gas into a 1.12-L container at 273 K and measures the pressure to be 0.977 atm. This gas is:

PV=nRT

n=PV/RT

38 g/mol

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

16. A mixture of 0.200 moles of Ar, 0.400 moles of H_2, and unknown number of moles of He gases are placed into a 100.00-L flask. The temperature and pressure of the flask and gases are measured to be 300.3 K and 740 mm Hg. How many moles of helium gas are present?

17. (Review the gallon of gasoline problem in "Gases II" on Latest News)

A student combusts 865.8 grams of pentane, C_5H_{12}. How many liters of CO_2 (g) are produced at a pressure of 1.080 atm and a temperature of 306.0 K?

$$C_5H_{12}\ (g) \quad + \quad 8\ O_2\ (g) \quad \rightarrow \quad 5\ CO_2\ (g) \quad + \quad 6\ H_2O\ (g)$$

12.00 mol 60.00 mol

PV=nRT

V=nRT/P = 1395 L

18. The van der Waals equation for real gases recognizes that:

PV=nRT

The van der Waals equation for real gases:

$$\left(p + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

"a" accounts for the attractive forces between gas particles (a is low for small, non-polar, gases)
"b" accounts for the actual gas particle size (b is low for small gases)

van der Waals Coefficients		
Gas	a (Pa m^3)	b(L/mol)
Neon	0.0212	0.1710
Hydrogen	0.0245	2.661
Carbon dioxide	0.396	4.269
Water vapor	0.547	3.052

What does the vdW expression acknowledge?

The non-zero volumes of gas particles effectively decrease the amount of "empty space" between them
The molecular attractions between particles of gas decreases the pressure exerted by the gas
The molar volumes of gases are different
The gas particles have non-zero volumes and interact with each other