

Practice Exam

Printed Name: _____

Student Number: _____

Signature: _____

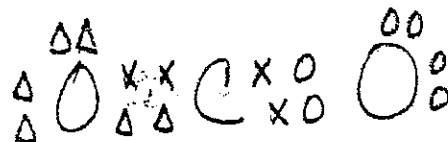
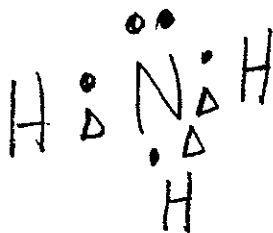
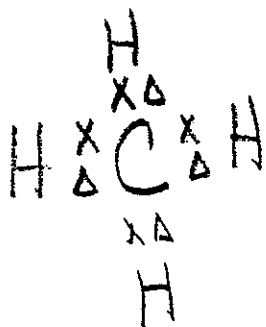
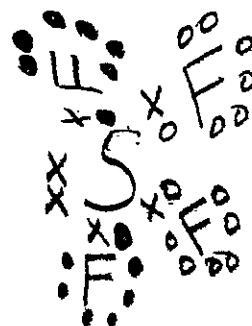
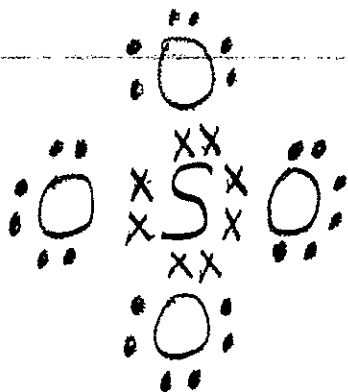
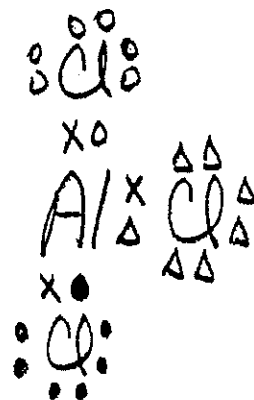
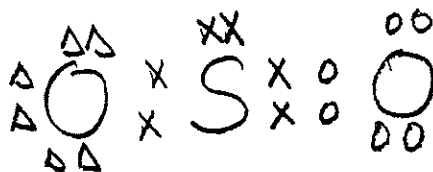
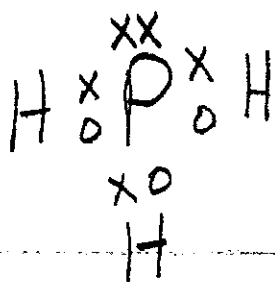
CHEMISTRY 1410

FOURTH EXAM

100 POINTS

Each multiple choice test question is worth 3 points. Read each question very carefully. There is no partial credit for the multiple choice test questions. The four numerical questions on the exam are worth 10 points each. On the four numerical questions (i.e., non-multiple choice questions) partial credit will be past upon the work shown. **NOTE: TO RECEIVE PARTIAL CREDIT FOR ANY NON-MULTIPLE CHOICE PROBLEM, THE WORK SHOWN MUST BE CONSISTENT WITH THE ANSWER GIVEN!!**

Use the Lewis dot structures drawn below to answer questions 1-12



Question 1: What is the molecular geometry of the PH_3 molecule

- (a) tetrahedron
- (b) triangular pyramid
- (c) planar triangle
- (d) T-shaped
- (e) see-saw

Question 2: What is the bond order of the P-H bond in the PH_3 molecule

- (a) 1
- (b) 2
- (c) 3
- (d) 1.5
- (e) Correct answer is not given

Question 3: The hybridization about the central atom in the PH_3 molecule is

- (a) sp
- (b) sp^2
- (c) sp^3
- (d) dsp^3
- (e) d^2sp^3

Question 4: What is the molecular geometry of the SO_2 molecule?

- (a) bent
- (b) planar triangle
- (c) tetrahedron
- (d) linear

(e) None of the above answers are correct

Question 5: What is the bond order of the sulfur oxygen bond in the SO_2 molecule?

(a) 1

(b) 2

(c) 3

(d) 1.5

(e) Correct answer is not given

Question 6: The hybridization about the central atom in the SO_2 molecule is

(a) sp

(b) sp^2

(c) sp^3

(d) dsp^3

(e) d^2sp^3

Question 7: What is the molecular geometry of the SO_4^{2-} ion

(a) trigonal bipyramid

(b) planar triangle

(c) tetrahedron

(d) T-shaped

(e) None of the above answers are correct

Question 8: What is the hybridization about the central atom in the SO_4^{2-} ion

(a) sp

(b) sp^2

(c) sp^3

(d) dsp^3

(e) d^2sp^3

Question 9: What is the molecular shape of the SF_4 molecule?

(a) T-shaped

(b) tetrahedron

(c) see-saw

(d) octahedron

(e) None of the above answers are correct

Question 10: What is the hybridization about the central atom in the SF_4 molecule?

(a) sp

(b) sp^2

(c) sp^3

(d) dsp^3

(e) d^2sp^3

Question 11: What is the molecular shape of the $AlCl_3$ molecule?

(a) planar triangle

(b) bent

(c) linear

(d) tetrahedron

(e) None of the above answers are correct

Question 12: What is the hybridization of the central atom in the $AlCl_3$ molecule?

(a) sp

(b) sp^2

- (c) sp^3
- (d) dsp^3
- (e) d^2sp^3

Question 13: Which of the following molecular shapes is not possible in the 10-electron system?

- (a) linear
- (b) T-shaped
- (c) octahedron
- (d) see-saw
- (e) trigonal bipyramid

Question 14: Which of the following statements pertaining to electronegativity is correct?

- (a) In general the electronegativity increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table
- (b) In general the electronegativity increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table
- (c) In general the electronegativity increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table
- (d) In general the electronegativity increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table
- (e) The electronegativity shows no periodic trends

Question 15: Using the electronegativity data given below

<u>Atom</u>	<u>Electronegativity</u>	<u>Atom</u>	<u>Electronegativity</u>
H	$\chi = 2.1$	C	$\chi = 2.5$
N	$\chi = 3.0$	O	$\chi = 3.5$

Na	$\chi = 1.1$	B	$\chi = 2.0$
S	$\chi = 2.5$	F	$\chi = 4.0$

Determine which of the following statements is true:

- (a) H_2O and CO_2 are both polar molecules, whereas BF_3 is a nonpolar
- (b) H_2O and CO_2 are both nonpolar molecules, whereas BF_3 is polar
- (c) H_2O and BF_3 are both polar molecules, whereas CO_2 is nonpolar
- (d) H_2O and BF_3 are both nonpolar molecules, whereas CO_2 is polar
- (e) BF_3 and CO_2 are both nonpolar molecules, whereas H_2O is polar

Question 16: Which of the following statements concerning chemical bonds and bond enthalpies is not true?

- (a) Bond breaking is always endothermic
- (b) The enthalpy change that occurs when two bonded atoms in a gas phase molecule are separated completely at constant pressure is called the bond enthalpy
- (c) Formation of chemical bonds is always exothermic
- (d) The enthalpy of the hydrogen and oxygen chemical bond in water can be experimentally determined by measuring the enthalpy required to vaporize one mole of liquid water to water vapor at the normal boiling point temperature of water.
- (e) None of the above answers are correct

Question 17: In comparing a C=C (double bond) to a C-C (single bond), one would expect:

- (a) the C=C bond to be stronger and the C=C bond distance to be longer
- (b) the C=C bond to be weaker and the C=C bond distance to be shorter
- (c) the C=C bond to be weaker and the C=C bond distance to be longer
- (d) the C=C bond to be stronger and the C=C bond distance to be shorter
- (e) the C=C and C-C bonds should have the same strength and the same bond distance

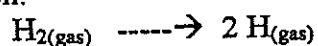
Question 18: Which of the following molecules is a free radical (a free radical has an odd number of valence electrons)?

- (a) NO_2
- (b) CH_4
- (c) CO
- (d) NH_3
- (e) N_2O

Question 19: A triple bond consists of .

- (a) one sigma bond and two pi bonds
- (b) three sigma bonds
- (c) three pi bonds
- (d) two sigma bonds and a pi bond
- (e) None of the above answers are correct

Question 20: The bond enthalpy of a hydrogen-hydrogen bond is 436 kJ/mole. For the reaction:



- (a) $\Delta H = + 436 \text{ kJ/mole}$ and the process is exothermic
- (b) $\Delta H = + 436 \text{ kJ/mole}$ and the process is endothermic
- (c) $\Delta H = - 436 \text{ kJ/mole}$ and the process is exothermic
- (d) $\Delta H = - 436 \text{ kJ/mole}$ and the process is endothermic
- (e) None of the above answers are correct

NUMERICAL (NON-MULTIPLE CHOICE) QUESTIONS: Each non-multiple choice question is worth 10 points. Remember partial credit is based on the work shown, and to receive partial credit the work must be consistent with the answer shown.

Question 21: Draw a Lewis dot structure, predict the molecular shape and give the hybridization involved and bond order for each of the following molecules or ions. In cases where resonance occurs, you must draw all resonance forms in order to receive full credit.



Question 22: Describe the bonding in the following molecules according to the valence bond approach. Illustrate the various orbitals involved in bonding, give their hybridization, and tell if the bonds are sigma or pi bonds.

(a) CO_2

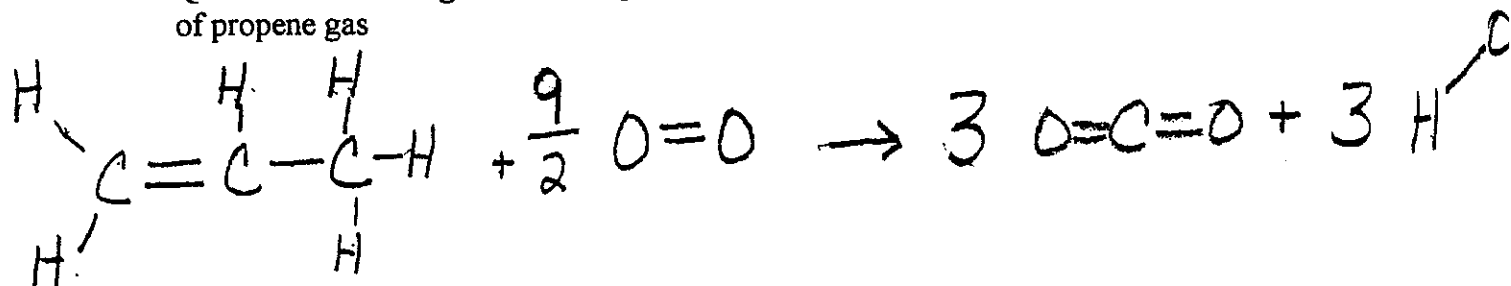
(b) C_2H_2

Question 23: For each of the following species or hypothetical species, draw the Molecular Orbital (MO) diagram. State whether or not the molecule forms. Give the bond order and the number of unpaired electrons in the species, if any.

(a) Be_2

(b) N_2^+

Question 24: Using bond enthalpies, calculate the ΔH for the combustion of one mole of propene gas



Information given:

O=O

C-H

C=O

O-H

C=C

C-C

Bond enthalpy = 498 kJ/mole

Bond enthalpy = 414 kJ/mole

Bond enthalpy = 715 kJ/mole

Bond enthalpy = 464 kJ/mole

Bond enthalpy = 614 kJ/mole

Bond enthalpy = 356 kJ/mole

VIIIA

2 He 4.00											10 Ne 20.18	18 Ar 39.95	36 Kr 83.80	54 Xe 131.29	86 Rn (222)		
												9 F 19.00	17 Cl 35.45	35 Br 79.90	53 I 126.90	85 At (210)	
												8 O 16.00	16 S 32.06	34 Se 78.96	52 Te 127.60	84 Po (209)	
												7 N 14.01	15 P 30.97	33 As 74.92	51 Sb 121.75	83 Bi 208.98	
												6 C 12.01	14 Si 28.09	32 Ge 72.59	50 Sn 118.69	82 Pb 207.20	
												5 B 10.81	13 Al 26.98	31 Ga 69.72	49 In 114.82	81 Tl 204.38	
												VIII B					
												IIB		IIIB		IIIB	
												29 Cu 63.55	30 Zn 65.38	47 Ag 107.87	48 Cd 112.41	80 Hg 200.59	
												28 Ni 58.69	46 Pd 106.42	78 Pt 195.08	77 Ir 192.22	79 Au 196.97	
												27 Co 58.93	45 Rh 102.91	76 Os 190.20	75 Re 186.21	76 Os 190.20	
												26 Fe 55.85	44 Ru 101.07	74 W 183.85	73 Ta 180.94	74 W 183.85	
												25 Mn 54.94	43 Tc (98)	72 Hf 178.49	71 Y 88.91	72 Hf 178.49	
												24 Cr 51.97	42 Mo 95.94	70 U 238.03	69 Zr 91.22	70 U 238.03	
												23 V 50.94	41 Nb 92.91	68 Er 167.26	39 Y 88.91	68 Er 167.26	
												22 Ti 47.88	40 Zr 91.22	67 Ho 164.93	38 Sr 87.62	67 Ho 164.93	
												21 Sc 44.96	39 Y 88.91	66 Dy 162.50	37 Rb 85.47	66 Dy 162.50	
												VIII B					
												20 Ca 40.08	38 Sr 87.62	64 Gd 157.25	56 Ba 137.33	64 Gd 157.25	
												19 K 39.10	37 Rb 85.47	63 Eu 151.96	55 Cs 132.91	63 Eu 151.96	
												12 Mg 24.31	36 Kr 83.80	62 Sm 150.36	54 Xe 131.29	62 Sm 150.36	
												11 Na 23.00	35 Br 79.90	61 Pm (145)	53 I 126.90	61 Pm (145)	
												10 Ne 20.18	34 Se 78.96	60 Nd 144.24	52 Te 127.60	60 Nd 144.24	
												9 F 19.00	33 As 74.92	59 Pr 140.91	51 Sb 121.75	59 Pr 140.91	
												8 O 16.00	32 Ge 72.59	58 Ce 140.12	50 Sn 118.69	58 Ce 140.12	
												7 N 14.01	31 Ga 69.72	57 La 138.91	49 In 114.82	57 La 138.91	
												6 C 12.01	30 Zn 65.38	56 Ba 137.33	48 Cd 112.41	56 Ba 137.33	
												5 B 10.81	29 Cu 63.55	55 Cs 132.91	47 Ag 107.87	55 Cs 132.91	
												4 Be 9.01	28 Ni 58.69	54 Xe 131.29	46 Pd 106.42	54 Xe 131.29	
												3 Li 6.94	27 Co 58.93	53 I 126.90	45 Rh 102.91	53 I 126.90	
												2 He 4.00	26 Fe 55.85	52 Te 127.60	44 Ru 101.07	52 Te 127.60	
												1 H 1.01	25 Mn 54.94	51 Sb 121.75	43 Tc (98)	51 Sb 121.75	
												VIII B					
												106 Uub [§] (263)	105 Uup [§] (262)	104 Uuq [§] (261)	89 Uu [§] 227.03	88 Ra 226.03	

• Lanthanides

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
--------------------	--------------------	--------------------	-------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------

† Actinides

90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	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 (260)
--------------------	--------------------	-------------------	--------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	--------------------	--------------------	--------------------	--------------------

