CHEM 1314
Exam III
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November 16, 1992

Name ____________________
TA Name ____________________
Lab Section ____________________

INSTRUCTIONS:

1. This examination consists of a total of 7 different pages. The last page includes a periodic table and some useful information. All work should be done in this booklet.

2. PRINT your name, teaching assistant's name and lab section now in the space at the top of this sheet. DO NOT SEPARATE THESE PAGES.

3. Answer all questions that you can and whenever called for show your work clearly. Your method of solving problems should pattern the approach used in lecture. You do not have to show your work for the multiple choice or short answer questions.

4. Point values are shown next to the problem number.

5. Budget your time for each of the questions. Some problems may have a low point value yet be very challenging. If you do not recognize the solution to a question quickly, skip it, and return to the question after completing the easier problems.

6. Look through the exam before beginning; plan your work; then begin.

7. Relax and do well.

	Page 2	Page 3	Page 4	Page 5	Page 6	TOTAL
SCORES	____ (25)	____ (26)	____ (22)	____ (15)	____ (12)	____ (100)

(9) 1. Write the chemical formula(s) of the product(s) and balance each of the following four reactions. Identify all product phases as either (g)as, (l)iquid, (s)olid or (aq)ueous.

a) HNO_3*(aq)* + $Ba(OH)_2$*(aq)* $\rightarrow$

b) $Al(NO_3)_3$*(aq)* + Na_2CO_3*(aq)* $\rightarrow$

c) Ba*(s)* + HCl*(aq)* $\rightarrow$

(4) 2. Write the ionic and the net ionic equation for any **one** of the equations in Problem #1.

(12) 3. Draw a Lewis electron-dot structure for each of the covalent molecules below. Include all resonance structures if they are needed to adequately represent the bonding in the molecule.

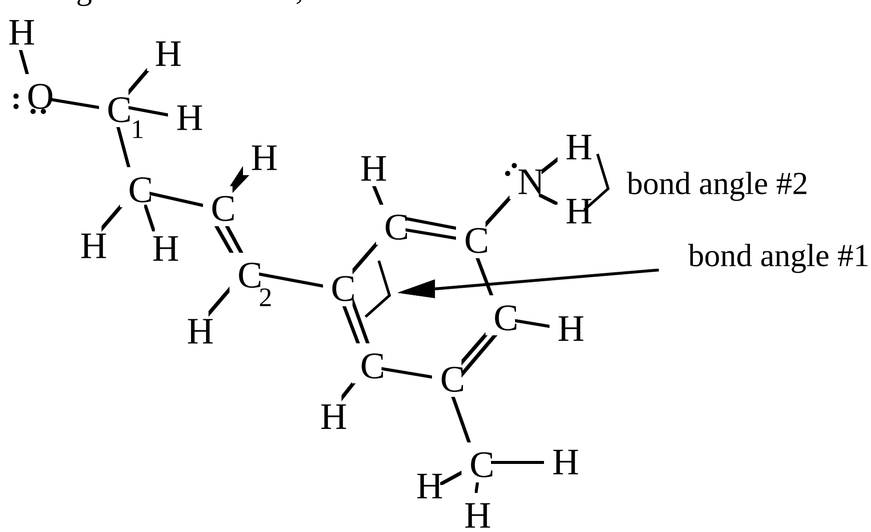
(a) BrO_3^- (b) H_2O_2

(c) $ClNO_2$

(18) 4. Complete the following table

Compound	Name of molecular geometry	Bond angle(s)	Hybridization on the central atom	Polar or nonpolar?
IF_3				
NH_2^-				
PO_4^{3-}				
N_2O				
O_3				

(8) 5. Given the following Lewis structure,



a) how many σ-bonds and how many π bonds. ____ σ-bonds ____ π-bonds

b) indicate the hybridization on each of the following atoms.
C_1 ______ C_2 ______ O ______ N ______

c) indicate the *ideal* bond angle for; bond angle #1 ______° bond angle #2 ______°

(14) 6. Answer each of the following statements.

a. Explain the term *effective nuclear charge* and use it to explain why the atomic radius of Cl is smaller than the atomic radius of Al.

b. Define the term *ionization energy* and indicate the overall trend in the first ionization energy for the elements in a period. Also, explain why the first ionization energy for boron is less than the first ionization energy for beryllium.

(8) 7. Indicate the atomic and/or hybrid orbitals on each atom in the following molecules which are involved in forming the covalent bond.

a. H_2O

b. N_2

(15) 8. Short answer.

a. Write the electron configuration for,

i. P^{3-}

ii. Fe^{3+}

iii. Po

b. Draw a Lewis structure for the ion SCN^{-} and determine the formal charge on each of the atoms.

c. Write the set of quantum numbers for the last electron added to complete the ground state electron configuration for a neutral Zr atom.

d. An unknown neutral element, X, has only 3 electrons in its *p* subshell. What is the formula of the compound formed between this unknown element and hydrogen?

Multiple Choice:

Print the letter (A, B, C, D) which corresponds to the answer selected.

9. _________ 10. _________ 11. _________ 12. _________

13. _________ 14. _________

ONLY THE ANSWERS IN THE AREA ABOVE WILL BE GRADED. Select the most correct answer for each question. Each question is worth 2 points.

9. Which of the following are reasonable values for the first four ionization energies for Mg?

	1st	2nd	3rd	4th
A)	496 kJ	4562 kJ	6912 kJ	9543 kJ
B)	578 kJ	1817 kJ	2744 kJ	11,577 kJ
C)	738 kJ	1451 kJ	7733 kJ	10,540 kJ
D)	657 kJ	1269 kJ	2136 kJ	2752 kJ

10. Which of the following species has the largest radius?

A) Ne
B) O^{2-}
C) Li^{+}
D) N

11. Which of the following atoms has a negative electron affinity?

A) He
B) Be
C) Ne
D) F

12. The shortest bond length in the following is

A) C–F
B) C–Cl
C) C–Br
D) C–I

13. The molecular geometry of a molecule is best described in terms of the location of the atomic nuclei. What geometries are possible for compounds with a central atom which can be described as using sp^2 hybrid orbitals?

A) trigonal planar or bent
B) tetrahedral, bent, or trigonal pyramidal
C) square planar, tetrahedral, or trigonal planar
D) trigonal bipyramidal or unsymmetrical tetrahedron

14. Which of the following species violates the octet rule?

A) NH_4^+
B) NO_2
C) $HClO_3$
D) N_2O_4

Useful Information

Periodic Table of the Elements

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.008																	2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											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** 24.30											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	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** 72.59	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** 95.94	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** 226.0	89 **Ac** 227.0	104 (261)	105 (262)	106 (263)												

Lanthanides	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** 157.2	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
Actinides	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** 237.0	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)

Solubility Table

Ion	Solubility	Exceptions
NO_3^-	soluble	none
ClO_4^-	soluble	none
Cl^-	soluble	except Ag^+, Hg_2^{2+}, *Pb^{2+}
I^-	soluble	except Ag^+, Hg_2^{2+}, Pb^{2+}
SO_4^{2-}	soluble	except Ca^{2+}, Ba^{2+}, Sr^{2+}, Hg^{2+}, Pb^{2+}, Ag^+
CO_3^{2-}	insoluble	except Group IA and NH_4^+
PO_4^{3-}	insoluble	except Group IA and NH_4^+
^-OH	insoluble	except Group IA, *Ca^{2+}, Ba^{2+}, Sr^{2+}
S^{2-}	insoluble	except Group IA, IIA and NH_4^+
Na^+	soluble	none
NH_4^+	soluble	none
K^+	soluble	none

*slightly soluble