CHEM 5, Spring 2016 NAME _____
EXAM 2 (Chp 3 & 4) 115 pt

Use the Scantron for Questions 1-25. Mark only one answer unless instructed otherwise.

CHP 3.1-3.4 (Atomic structure and isotopes)
ANSWERS FOR QUESTIONS 1 and 2:
A) protons B) neutrons C) *electrons* D) nucleus E) atomic number AB) mass

1. What does the nucleus of an atom contain? ***Mark more than one answer.***

2. Atoms are neutral because the number of _____ equal the number of_____? ***Mark two answers.***

(14 pt) Fill in this table with the missing values, isotope formulas or names.

Isotope name	Isotope symbol	Atomic number	Mass number	Protons	Neutrons	Electrons	Charge	(C)ation (A)nion (N)eutral
	$^{15}{}_{7}N^{-3}$							
			27	13			0	

CHP 3.5-3.10 (Periodic Table)
Mark the letters of the chemical symbol on your scantron that correspond to each of the following names. *There are more symbols than names.*

ELEMENT NAME
3. Manganese
4. Copper
5. Calcium
6. Nickel
7. Beryllium

ELEMENT SYMBOLS		
A. B	AC. Ca	CD. Nk
B. Ba	AD. Cd	CE. M
C. Be	AE. Co	ABC. Ma
D. Bm	BC. Cu	ABD. Me
E. Br	BD. N	ABE. Mg
AB. C	BE. Ni	ACD. Mn

(11 pt) Complete the following table.

Name	Symbol	Metal (M) Nonmetal (N) Metalloid (D)	Representative (R) or Transition (T) Element	Period Number	Group Number
Zinc					2B
	F			2	
		D		3	4A

8. Which elements have similar properties according to periodic law and the table? ***Mark more than one answer.***
A) Manganese B) Copper C) Calcium D) Nickel E) Beryllium

39 pt

9. The alkaline earth metals are in which group of the periodic table?

a) IA b) IIA c) VIA d) VIIA e) VIIIA

ANSWERS FOR QUESTIONS 11 and 12:

A) Hydrogen B) Helium C) Oxygen D) Nitrogen E) Carbon AB) Silicon AC) Aluminum

10. What is the most common element in the human body?

11. What is the most common element the air that we breathe?

BONUS (2 pt) Someone who likes to start fires is an _____***NAME THE ELEMENT***

CHP 3.11-3.17 (Electron configurations)

12. Which of the following statements is/are correct?

i. Principal energy levels are identified by the letters *s, p, d,*and *f*

ii. Principal energy levels appear in both the quantum mechanical model of the atom and the Bohr model of the atom

iii. In general, $n = 1$ is at lower energy than $n = 2$, and $n = 2$ is lower than $n = 3$, and so on

iv. The principal energy level is related to electron spin

A. i only B. iv only C. i and ii D. ii and iii E. iii and iv

13. What is the electron configuration for Br

A. [Ar] $4s^2\,4p^5$
B. [Ar] $4s^2\,4p^6$
C. [Ar] $3d^{10}\,4s^2\,4p^5$
D. [Ar] $3d^{10}\,4s^2\,4p^6$

14. Mark your scantron for the following elements or ions that have this electron configuration $1s^22s^22p^63s^23p^6$

A) Ne B) Na^+ C) K^+ D) S E) P^{3-}

15. How many total electrons can fit into principal energy level 3? A) 2 B) 8 C) 18 D) 32

16. In the third principal energy level, what is the order of energies of the sublevels, from lowest to highest?

A) $1s < 2s < 3s$ B) $3d < 3p < 3s$ C) $3p < 3s < 3d$ D) $3p < 3d < 3s$ E) $3s < 3p < 3d$

17. Which of the following pairs of atomic numbers belong to elements whose atoms have the highest occupied energy level electron configuration of the form ns^2, np^4 ?

A) 16 and 52 B) 40 and 72 C) 24 and 42 D) 9 and 17 E) 14 and 32

(9 pts) Draw the orbital energy diagram for the ground state electron configuration of <u>silicon</u>. The orbital energy diagram for the ground state electron configuration of lithium is given as an example.

<u>EXAMPLE:</u> Li (atomic number: 3 = 3 electrons) electron configuration: $1s^2\ 2s^1$ 1s ↑↓ 2s ↑

Increasing energy →

<u>27 pt</u>

CHP 4 (Chemical bonding, chemical naming and chemical formula calculations)

18. Which of the following is true regarding an ion? (circle all that are correct)

A) all ions have noble gas electron configuration

B) an ion is an atom that has gained or lost electrons

C) an ion is an atom that carries either a positive or negative charge

D) salts are made up of ions

(16 pt) Fill in the table with the missing names or symbols

Name of compound or ion	Formula
	HCl
	BrO_2
aluminum chloride	
magnesium hydride	
	Cu^{2+}
iron (III) oxide	
Dinitrogen tetroxide	
	S^{2-}

19. Which of the following is the best classification for a bond in which bonding electrons are shared equally?

A. Nonpolar
B. Polar covalent
C. Primarily ionic
D. Very strongly polar covalent
E. Slightly ionic

20. Which of the following chemical bonds is best described as nonpolar covalent?

A) H-H B) H-C C) H-N D) H-O E) H-F

21. The ratio of anions to cations in an ionic compound is always such that...

A. the compound is reduced in size when compared to the parent atoms
B. there are as many anions as there are cations
C. the anions outnumber the cations
D. the cations outnumber the anions
E. the compound is electrically neutral

24 pt

Draw the Lewis structure for SO_2 and fill in the blanks in the table (18 pt total)

Lewis structure (6 pt)		
	Valence Electrons (2 pt)	
	Electron group geometry (2 pt)	
	Bond Angle (2 pt)	
	Molecular geometry (2 pt)	
(2 pt) How many resonance structures are there?_____	Polar (P) or Non-polar (N) (2 pt)	

(12 pt) One of the pollutants from automobiles know as NOX was found to contain 17.3 g oxygen and 7.43 g nitrogen. What is the empirical formula for this compound. *Show all work for complete credit.*

	Oxygen	Nitrogen
Grams		
Molar mass		
Moles		
Mole ratio		
Whole number mole ratio		

THE EMPIRICAL FORMULA IS_____

30 pt

TOTAL ELECTRON GROUPS ***(Electron Group Geometry)***			
 2 linear Bond angle: 180°	 2 linear 180° CO_2		
 3 trigonal planar Bond angle: 120°	 2 bent 120° NO_2^-	 3 trigonal planar 120° BF_3	
 4 tetrahedral Bond angle: 109.5°	 2 bent 109.5° H_2O	 3 trigonal pyramid 109.5° NH_3	 4 tetrahedral 109.5° CH_4
	2 bonding groups	3 bonding groups	4 bonding groups

BONDING ELECTRON GROUPS
(Molecular Geometry)

PERIODIC CHART OF THE ELEMENTS

1 H 1.00797																1 H 1.00797	2 He 4.0026
3 Li 6.939	4 Be 9.0122											5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183
11 Na 22.9898	12 Mg 24.312											13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.909	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	*57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	‡89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)						

* Lanthanide Series

58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm (147)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.924	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97

‡ Actinide Series

90 Th 232.038	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (256)	103 Lr (257)

Electronegativity Chart of the Elements

H 2.1																H 2.1	He --
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne --
Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar --
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr --
Rb 0.8	Sr 1.0	Y 1.3	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe --
Cs 0.7	Ba 0.9	La* 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Ti 1.8	Pb 1.8	Bi 1.9	Po 2.0	At 2.2	Rn --
Fr 0.7	Ra 0.9	Ac† 1.1	Rf	Db	Sg	Bh	Hs	Mt	‡	‡	‡						

* Lanthanide Series
† Actinide Series