

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.* A + B + D
2. Atoms are neutral because the number of A equal the number of C? *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
nitrogen - 15	$^{15}_{7}\text{N}^{-3}$	7	15	7	8	10	-3	anion
aluminum - 27	$^{27}_{13}\text{Al}$	13	27	13	14	13	0	N

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	Mn
4. Copper	Cu
5. Calcium	Ca
6. Nickel	Ni
7. Beryllium	Be

ACD  
BC  
AC  
BE  
C

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	Zn	M	T	4	2B
Fluorine	F	N	R	2	7A
Silicon	Si	D	R	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  
41 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 10 and 11:

- 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? **C**

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

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

CHP 3.11-3.17 (Electron configurations)

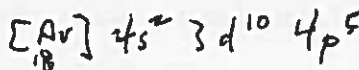
12. Which of the following statements is/are correct?

- NO** i. Principal energy levels are identified by the letters *s, p, d,* and *f*  
**YES** ii. Principal energy levels appear in both the quantum mechanical model of the atom and the Bohr model of the atom  
**YES** iii. In general,  $n = 1$  is at lower energy than  $n = 2$ , and  $n = 2$  is lower than  $n = 3$ , and so on  
**NO** 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  $_{35}\text{Br}$

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



14. Mark your scantron for the following elements or ions that have this electron configuration  $1s^2 2s^2 2p^6 3s^2 3p^6$  **18 e**

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

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?

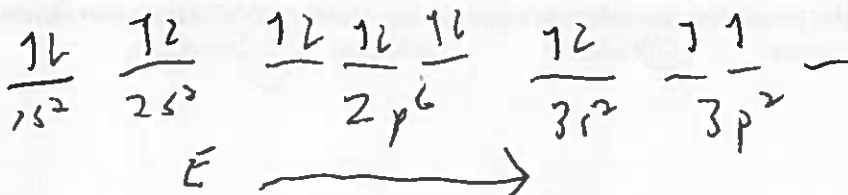
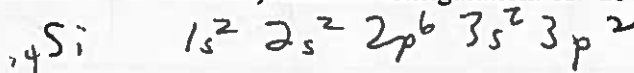
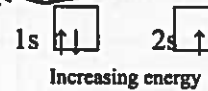
- A)  $1s < 2s < 3s$     B)  $3d < 3p < 3s$     C)  $3p < 3s < 3d$     D)  $3p < 3d < 3s$     **E)  $3s < 3p < 3d$**

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  $ns^2, np^1$ ? **8, 16, 34, 52, 84**

- 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 **silicon**. The orbital energy diagram for the ground state electron configuration of lithium is given as an example.

EXAMPLE: Li (atomic number: 3 = 3 electrons) electron configuration:  $1s^2 2s^1$



**27 pt**

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 *not all Fe<sup>2+</sup> Fe<sup>3+</sup>*
- 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
hydrogen chloride	HCl
bromine dioxide	BrO <sub>2</sub>
aluminum chloride <i>Al<sup>3+</sup> Cl<sup>-</sup></i>	AlCl <sub>3</sub>
magnesium hydride <i>Mg<sup>2+</sup> H<sup>-</sup></i>	MgH <sub>2</sub>
copper (II) ion	Cu <sup>2+</sup>
iron (III) oxide <i>Fe<sup>3+</sup> O<sup>2-</sup></i>	Fe <sub>2</sub> O <sub>3</sub>
Dinitrogen tetroxide	N <sub>2</sub> O <sub>4</sub>
sulfide ion	S <sup>2-</sup>

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?

- ΔEN = 0   ΔEN = 0.4   ΔEN ≥ 1.5   ΔEN ≥ 1.5   ΔEN ≥ 1.5*
- 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

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Draw the Lewis structure for SO<sub>2</sub> and fill in the blanks in the table (18 pt total)

$\text{:}\ddot{\text{O}}\text{--}\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{S}}}\text{=}\ddot{\text{O}}\text{:}$	Valence Electrons (2 pt)	6 + 2(6) = 18
	Electron group geometry (2 pt)	trig. planar
	Bond Angle (2 pt)	120°
	Molecular geometry (2 pt)	bent
	Polar (P) or Non-polar (N) (2 pt)	polar

(2 pt) How many resonance structures are there? 2

(12 pt) One of the pollutants from automobiles known as NO<sub>x</sub> 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	17.3g	7.43g
Molar mass	15.9994 g/mol	14.0067 g/mol
Moles	1.08129	0.530464
Mole ratio	1.08129 / 0.530 = 2.04	0.530 / 0.530 = 1
Whole number mole ratio	2	1

THE EMPIRICAL FORMULA IS NO<sub>2</sub>

21 multi choice =  $\frac{2}{42}$        $\frac{1}{41}$

p4 30  $\begin{bmatrix} 12 \\ 18 \\ 16 \end{bmatrix}$       27

p1  $\begin{bmatrix} 14 \\ 11 \end{bmatrix}$       24

p2  $\begin{bmatrix} 9 \\ 12 \end{bmatrix}$       30

122

30 pt  
30 pt