

Mark the correct answer on your scantron. Most questions only have one answer, but if more than one answer is required it will be stated in the directions.

## CHP 3

1. Which of the following categories contains the most elements?

- a) metals      b) nonmetals      c) metalloids      d) noble gases      e) representative elements

2. Which of the following is NOT a metal?

- a) Al      b) Bi      c) Br      d) Mn      e) Pb

Complete the following table.

Name	Symbol	Group number	Metal, nonmetal, or metalloid?	Representative element, transition metal,	Number for period
aluminum	Al	3A	metal	Representative	3
silicon	Si	4A	metalloid	Representative	3
nickel	Ni	transition	metal	Transition	4
sulfur	S	6A	non-metal	Representative	3

(3.4) (10 pt) Fill in the following table for these elements.

ISOTOPE NAME	ISOTOPE SYMBOL	ATOMIC #	MASS #	# PROT	# ELEC	# NEUT	CHARGE #
Aluminum-27	$^{27}_{13}\text{Al}$	13	27	13	13	14	0
Chlorine-37	$^{37}_{17}\text{Cl}^{-1}$	17	37	17	18	20	-1

(2 pt bonus question) What do you do with a dead chemist? Barium NAME THE ELEMENT

3. Atomic emission spectra in the visible region produces discrete colored line spectra for every element. Which of the following are true regarding these line spectra

- a) The line spectra occur when electrons in the atoms undergo quantum jumps from higher energy to lower energy orbitals and emit light in the process.  
 b) Atomic emission spectra are used to identify elements.  
 c) All elements give the same atomic emission line spectra.  
d) a and b  
 e) none are true

4. Which of the following is a TRUE statement concerning the quantum model of the atom.
- a) atomic orbitals exist in discrete energy levels
  - b) the subenergy levels are designated as s, p, d, f
  - c) the ground state exists when the electrons occupy the lowest energy orbitals.
  - d) electrons in atoms exist at specific (discrete) energies.
  - c) ALL of the above are TRUE statements

5.

6. The maximum number of electrons that can occupy one p sublevel orbital
- a) 2
  - b) 4
  - c) 6
  - d) 8
  - e) 10

1L

7. What is the maximum number of electrons that can occupy the 3rd principal energy level?
- (a) 2
  - (b) 8
  - (c) 18
  - (d) 32
  - (e) 50

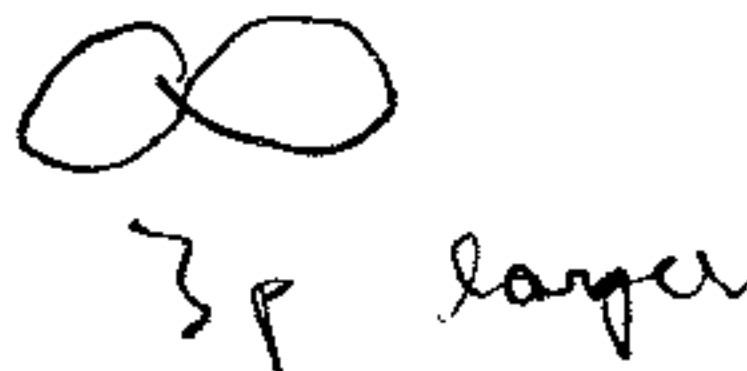
$$(2) + (6) + (10) = 18$$

8. What are all the sublevels that exist in principal energy level 2?
- a) s
  - (b) s, p
  - c) s, p, d
  - d) s, p, d, f
  - e) s, p, d, f, g

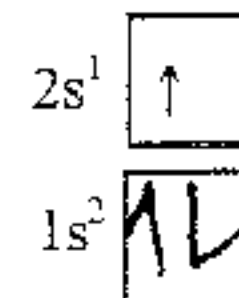
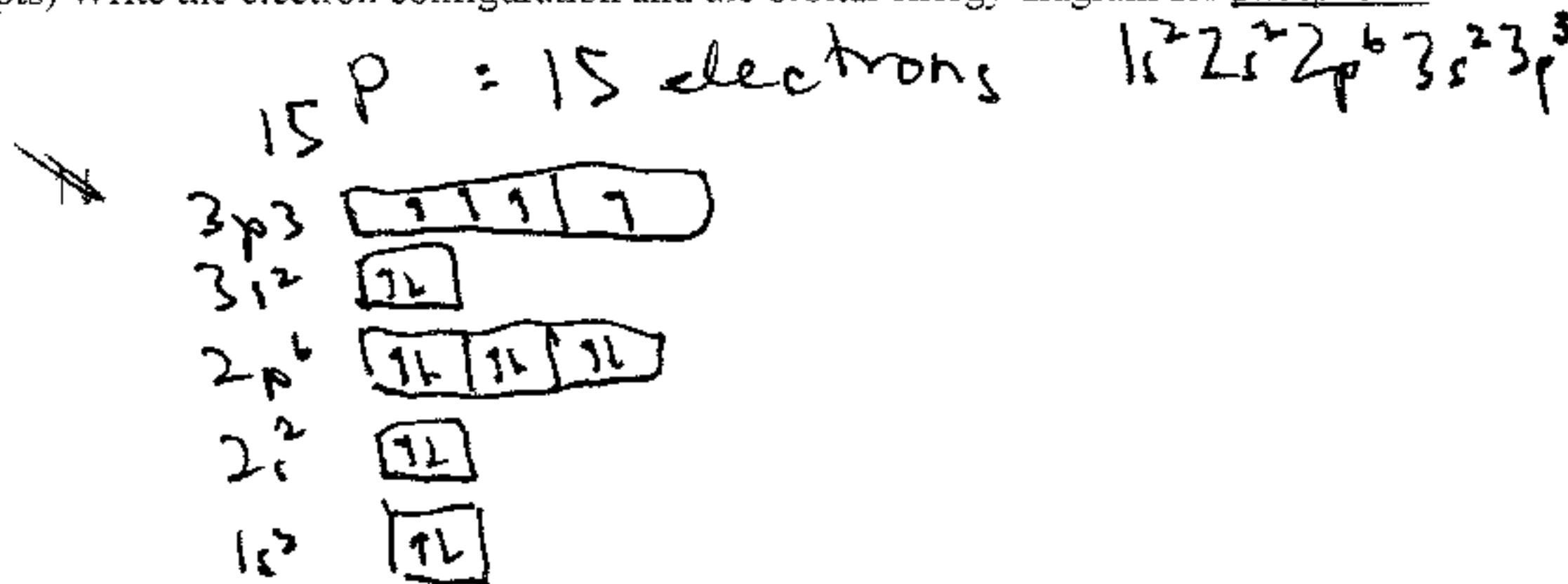
9. Which of the following sublevel (subshell) is filled first?
- A) 3s
  - B) 3p
  - C) 3d
  - D) 4s
  - E) 4p

10. Which element has 4 valence electrons in the 5<sup>th</sup> energy level?
- A) Zr
  - B) V
  - C) Sn
  - D) Mo
  - E) Sb

(4 pt) Draw a picture that depicts the shapes and relative sizes of a 2p and a 3p orbital. Be sure to label your pictures either 2p or 3p.



(12 pts) Write the electron configuration and the orbital energy diagram for phosphorus. For example, Li is



CHP 4 (Chemical Bonding and Molecular Shapes)

11. The electrons that occupy the highest energy orbitals in a ground state atom are called:

- a) a complete octet
- b) valence electrons
- c) the d orbital electrons
- d) the s electrons
- e) None of the above are correct

12. In the periodic table the number assigned to each period corresponds to the

- a) number of valence electrons
- b) the highest occupied principle energy level (shell)
- c) the total number of electrons in the s and p orbitals
- d) the atomic weights of the elements
- e) properties of the elements

13. Which of the following is a statement of the rule of eight (octet rule)?

- a) bond with eight other electrons.
- b) a stable configuration of eight valence electrons.
- c) form eight variations of molecules.
- d) follow the Eight Rules of Bonding.
- e) four bonding pair of electrons.

14. Which of the following is a covalent compound?

- A)  $\text{Cu}^{2+}$      B)  $\text{P}_2\text{O}_5$     C)  $\text{SnF}_2$     D)  $\text{SO}_3^{2-}$

15 Which of the following is not isoelectronic with Ar?

- A)  $\text{Cu}^+$     B)  $\text{S}^{2-}$     C)  $\text{Ca}^{2+}$     D)  $\text{Sc}^{3+}$     E) all are isoelectronic with Ar

16. Which of the following is common between metal and non-metal elements? Both

- a) form cations *false. only metals*
- b) form anions *false. only non-metals*
- c) are found in p block elements *YES*
- d) conduct electricity *metals*
- e) are gases at room temp. *non-metals*

(12 pt) Write the name, symbol or formula for each of the following:

Ge	Name: <i>Germanium</i>
calcium	Symbol: <i>Ca</i>
KCl	Name: <i>potassium chloride</i>
Magnesium fluoride	Formula: <i>magnesium fluoride</i>
$\text{NO}_3$	Name: <i>nitrogen trioxide</i>
Dihydrogen sulfide	Formula: <i>H<sub>2</sub>S</i>

Lewis structures and shapes:

17. A Lewis formula or Lewis diagram is used to show what?

- A. The physical properties of the compound  
 B. How Lewisite can be made in the laboratory  
 C. Whether a bond is polar or nonpolar  
 D. How metals form alloys  
 E. The arrangement of atoms and electrons in a molecule

18. Which of the following is another term for *unshared electron pairs*?

- A. Covalent pairs    B. Ionic pairs    C. Valence pairs    D. Lone pairs    E. Bonding electron pairs

Draw the Lewis structure for  $N_2O$  and fill in the blanks in the table (14 pt total)

<p style="text-align: center;"><u>Lewis structure (6 pt)</u></p> $\begin{array}{c} :\ddot{N} - N \equiv O: \\ \longleftrightarrow \\ :\ddot{N} = N = \ddot{O}: \\ \longleftrightarrow \\ :\ddot{N} \equiv N - \ddot{O}: \end{array}$ <p>How many resonance structures? 3</p>	Valence Electrons (2 pt)	$5 + 5 + 6 = 16$
	Electron group geometry (2 pt)	Linear
	Bond Angle (2 pt)	$180^\circ$
	Molecular geometry (2 pt)	Linear
	Polar or Non-polar (use the table at the end)	Polar

19. Which element will act as the positive pole in each of the following bonds  $O-F$  and  $O-Cl$ :

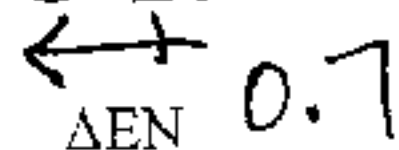
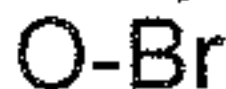
- a. F in  $O-F$  and O in  $O-Cl$   
 b. O in  $O-F$  and O in  $O-Cl$   
 c. F in  $O-F$  and Cl in  $O-Cl$   
 d. O in  $O-F$  and Cl in  $O-Cl$   
 e. O, F, and Cl are all highly electronegative so there can be no positive pole

20. Arrange the following bonds ( $H-N$ ,  $H-O$ ,  $H-S$ ,  $H-P$ ) in order of increasing polarity (lowest polarity < highest polarity).

- a.  $H-O < H-N < H-S < H-P$   
 b.  $H-P < H-S < H-N < H-O$   
 c.  $H-N < H-O < H-S < H-P$   
 d.  $H-S < H-P < H-O < H-N$

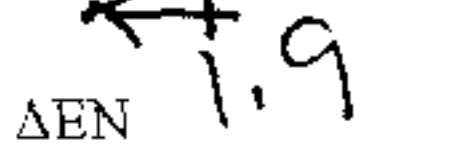
(6 pt) Calculate  $\Delta EN$  and classify each of the covalent bonds according to its polarity.Using a  $\longleftrightarrow$  show the dipole in those bonds that are polar.

$$3.5 - 2.8 = 0.7$$



Classification: Polar

$$4.0 - 2.1 = 1.9$$



Polar

21. Which of the following statements is *incorrect*?

- A. A molecule is polar if it contains polar bonds. *NOT necessarily*  
 B. A molecule is polar if there is an uneven distribution of charge. *TRUE*  
 C. A molecule is nonpolar if the central atom has no lone pairs and all the atoms bonded to it are identical. *TRUE*  
 D. A molecule is non-polar if it contains only non-polar bonds. *TRUE*

22. Which one of the following molecules is *polar*?

- a. CO<sub>2</sub>     b. CH<sub>2</sub>F<sub>2</sub>    c. CF<sub>4</sub>    d. C<sub>2</sub>H<sub>6</sub>    f. NCl<sub>3</sub>

23. What is the mass percent oxygen in the compound NO?

- A) .875%    B) 87.5%    C) 16.00%    D) 46.68%     E) 53.32%

$$14.01 + 16.00 = 30.01 \quad \%O = \frac{16.00}{30.01} \times 100$$

(5 pt) Calculate the mass of silver in a 1.50 g sample of silver sulfide (Ag<sub>2</sub>S, molar mass = 247.78 g)

$$\%Ag = \frac{215.74}{247.78} \times 100 = 87.10\%$$

$$2Ag = 2 \times 107.87 = 215.74$$

$$1.50g Ag_2S \times \frac{87.10 Ag}{100 Ag_2S} = 1.31g Ag$$

Fill in the blank.

The simplest or smallest whole number ratio of the atoms in a compound formula is known as the

Empirical Formula

An extremely explosive ionic compound is made from the reactions of silver compounds with ammonia. A sample of this compound is found to contain 17.261 g silver and 0.743 g nitrogen. What is the empirical formula for this compound. *Show all work for complete credit.*

	Silver	Nitrogen
Grams	17.261 g	0.743 g
Molar mass	107.87 g/mol	14.01 g/mol
Moles	0.16002 mol	0.0530
Mole ratio	$\frac{0.16002}{0.0530} = 3.02$	$\frac{0.0530}{0.0530} = 1$
Whole number mole ratio	3	1

Empirical Formula: Ag<sub>3</sub>N