Ch 60 Ex #3 125 pts Name: _____

Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____

N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8

Part 1. Multiple choice: select the best answer and write the letter in the space provided. 3 pts each

___ 1. Light energy of specific wavelength is emitted from the atom : a) when an electron leaves the atom b) an electron is added to the atom c) the electron undergoes a transition from a higher to a lower energy level d) the electron undergoes a transition from a lower to a higher energy level e) ionization occurs f) during positron emission

___ 2. λ represents : a) frequency b) wavelength c) velocity of light d) coulombs e) μS

___ 3. According to the quantum mechanical model, the number and distribution s,p,d,f orbitals in the atom is due to: a) the electric charge b) the mass of the nucleus c) the electron's wave characteristics d) the electron's spin e) the electron's mass

___ 4. Which is strongly attracted to a magnet ? a) Co b) C c) Cs d) Cl e) Zn f) O

___ 5. A +3 charge is impossible for which atom ? a) Ca b) Ni c) Co d) Ga e) Sc f) Fe

___ 6. Which atom can exist as either a cation or as an anion ? a) C b) Sc c) H d) Ag e) Hg

___ 7. Which atom in question 6 exists as an ation which is isoelectronic with a noble gas ?

___ 8. The valence electrons of antimony are in which subshell(s) ? a) 5s only b) 4d only b) 4s and 4p d) 5p only e) 5s and 5 p f) 6s and 6 p

___ 9. $[Kr]4d^{10}$ is the electron configuration of: a) Ag b) Cd c) In^{3+} d) In^{+} e) Sn^{2+} f) Cd^{2+}

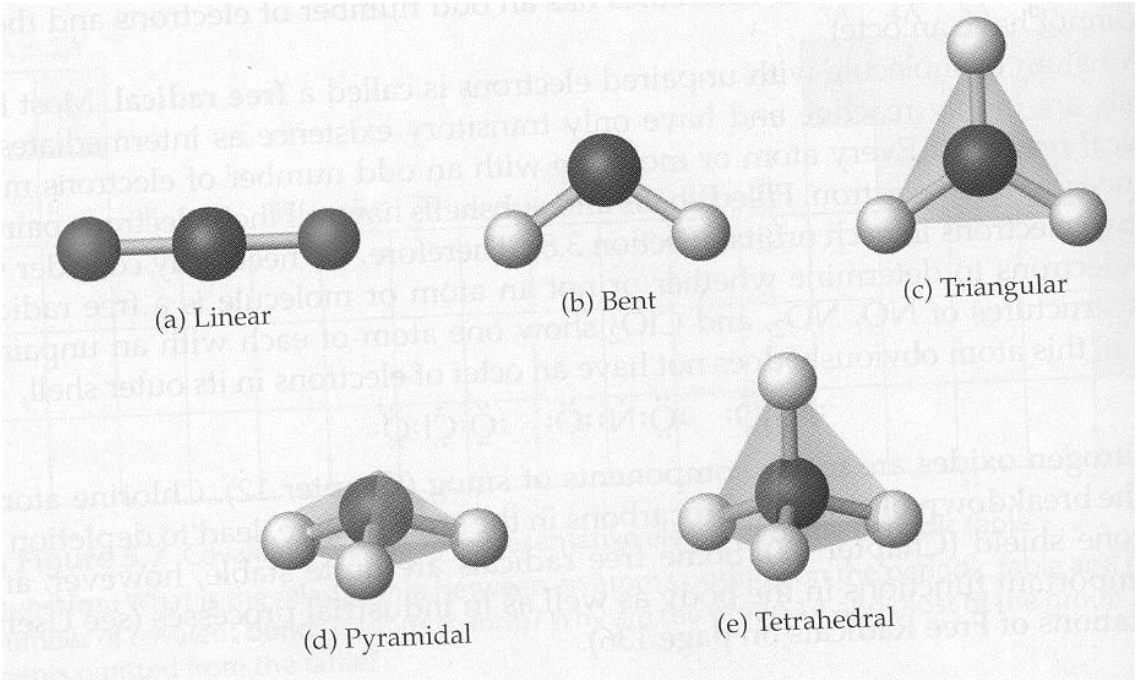
___ 10. A half-filled f subshell has electrons in its orbitals arranged in which way ?
a) one pair + 5 unpaired b) two pairs + 3 unpaired c) 3 pairs + 1 unpaired
d) 7 unpaired e) 6 paired and 1 unpaired e) 7 pairs

___ 11. Compare the electronegativities of Br and I (see @ top of exam). Which is true ?
a) Br > I because I has more electrons
b) Br > I because Br is above I on the chart
c) Br>I because I has more protons
d) Br> I because electron is attracted to a lower energy level in Br
e) Br>I because e^- in Br experiences a greater amount of shielding than in I
f) Br>I because Br is more polar

___ 11. Compare the ionization energies of Br and Se . Which is true ?
a) IE of Br > Se because e^- in Se is at a higher E level than in Br .
b) IE of Se > Br because e^- in Br is at a higher E level than in Se.
c) IE of Br > Se because Br has more electrons (increased repulsions)
d) IE of Se > Br because Se has more unpaired electrons
e) IE of Br > Se because Br has more protons attracting the electrons at same energy level

___ 11. Which of these molecules is most polar ? a) CO b) O_2 c) F_2 d) CO_2 e) I_2 f) NO_3^-

___ 12. Which of these molecules is not polar ? a) H_2O b) HF c) HCN d) CO e) CS_2

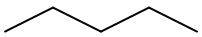


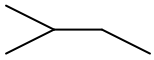
Questions 13 – 18 . Refer to the above chart and write the letter of the molecular shape which best describes the molecule in the question .

___13. CO_2^{2-}, ___14. NO_2^{+} , ____15. IO_4^{-1} , ____16. SO_3^{2-} , ___17. SO_3 , ____18. BrO_2^{-1}

___ 19. Which of these molecules above, with a <u>bent</u> shape has a bond angle of 109^o

___ 20. Which of these molecules can exhibit resonance ? a) CO_2^{2-} only b) CO_2^{2-} & NO_2^{+} c) CO_2^{2-} , NO_2^{+} , SO_3 d) CO_2^{2-} & BrO_2^{2-} e) SO_3 & SO_3^{2-}

___ 21. The line formula  represents a) ethane b) pentane c) butane d) propane e) hexane

___ 22. The line formula  represents an isomer of which compound in #21 ?

23. Draw a Lewis formula for the molecule dinitrogen tetroxide (N_2O_4) The two N atoms are in the middle. Describe the VSEPR electron geometry and bond angles around each nitrogen atom. Is the molecule polar ?
This question is a bit hard – leave it till last.

12 pts

Ch 60 Ex #3 125 pts . Name: _____

Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____

N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8

Part 1. Multiple choice: select the best answer and write the letter in the space provided. 3 pts each

___ 1. Light energy of specific wavelength is emitted from the atom : a) during positron emission b) when an electron leaves the atom c) an electron is added to the atom d) the electron undergoes a transition from a lower to a higher energy level e) the electron undergoes a transition from a higher to a lower energy level f) ionization occurs

___ 2. λ represents : a) frequency b) wavelength c) velocity of light d) coulombs e) μS

___ 3. According to the quantum mechanical model, the number and distribution s,p,d,f orbitals in the atom is due to: a) the electric charge b) the mass of the nucleus c) the electron's spin d) the electron's mass e) the electron's wave characteristics

___ 4. Which is strongly attracted to a magnet ? a) C b) O c) Cs d) Cl e) Zn f) Ni

___ 5. A +3 charge is impossible for which atom ? a) Co b) Ni c) Sr d) Ga e) Sc

___ 6. Which atom can exist as either a cation or as an anion ? a) Sc b) Ag c) C d) H e) Hg

___ 7. Which atom in question 6 exists as an cation which is isoelectronic with a noble gas ?

___ 8. The valence electrons of antimony are in which subshell(s) ? a) 5s only b) 4d only b) 5s and 5p d) 5p only e) 4s and 4 p f) 6s and 6p

___ 9. [Kr] $5s^2$ $4d^{10}$ is the electron configuration of: a) Ag b) Cd c) Sn^{2+} d) In^{+} e) In^{3+} f) Sn

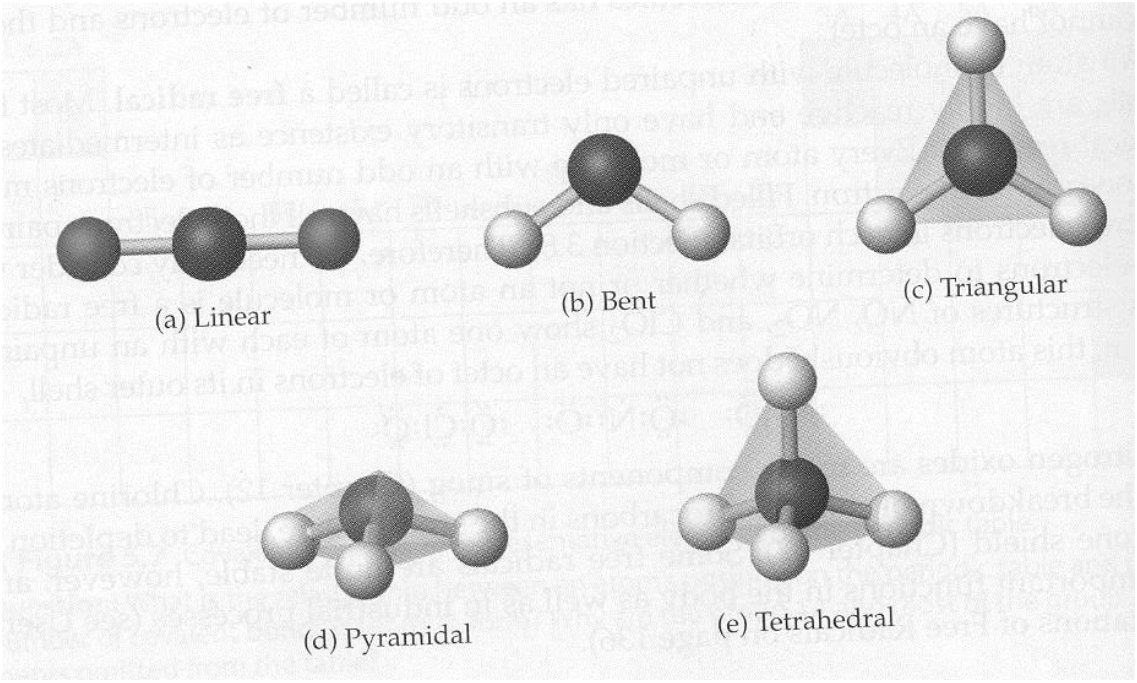
___ 10. A half-filled f subshell has electrons in its orbitals arranged in which way ?
a) one pair + 5 unpaired b) two pairs + 3 unpaired c) 3 pairs + 1 unpaired
d) 7 pairs e) 7 unpaired f) 6 paired + 1 unpaired

___ 11. Compare the electronegativities of Br and I (see @ top of exam). Which is true ?
a) Br > I because I has more electrons
b) Br>I because I has more protons
c) Br> I because electron is attracted to a lower energy level in Br
d) Br>I because e^- in Br experiences greater amount of shielding than in I
e) Br>I because Br is more polar

___ 11. Compare the ionization energies of Br and Se . Which is true ?
a) IE of Br > Se because e^- in Se is at a higher E level than in Br .
b) IE of Se > Br because e^- in Br is at a higher E level than in Se
c) IE of Br > Se because Br has more protons attracting the electrons at the same energy level
d) IE of Se > Br because Se has more unpaired electrons
e) IE of Br > Se because Br has more electrons (more repulsions)

___ 11. Which of these molecules is most polar ? a) CO_2 b) O_2 c) F_2 d) NO e) NO_3^- f) I_2

___ 12. Which of these molecules is not polar ? a) H_2O b) HF c) HCN d) CF_4 e) CO

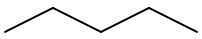


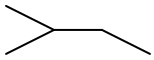
Questions 13 – 18 . Refer to the above chart and write the letter of the molecular shape which best describes the molecule in the question .

___13. NO_2^+ , ___14. CO_2^{2-} , ____15. SO_3^{2-} , ____16. IO_4^{-1} ,
___17. BrO_2^{-1} , ___18. SO_3

___ 19. Which of these molecules above, with a <u>bent</u> shape has a bond angle of 109^o

___ 20. Which of these molecules can exhibit resonance ? a) CO_2^{2-} only b) CO_2^{2-} & NO_2^+
c) CO_2^{2-} , NO_2^+ , SO_3 d) CO_2^{2-} & BrO_2^{2-} e) SO_3 & SO_3^{2-}

___ 21. The line formula  represents a) ethane b) hexane c) butane
d) propane e) pentane

___ 22. The line formula  represents an isomer of which compound in #21 ?

23. Draw a Lewis formula for the molecule dinitrogen tetroxide (N_2O_4) The two N atoms are in the middle. Describe the VSEPR electron geometry and bond angles around each nitrogen atom. Is the molecule polar ?
This question is a bit hard – leave it till last.

12 pts

Ch 60 Ex #4 110 pts . Name: _____

Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____

N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8

Part 1. Multiple choice: select the best answer and write the letter in the space provided

___ 1. Blue Light energy of specific wavelength is emitted from the atom . That light energy λ = appx : a) 450 nm b) 500 nm c) 400 nm d) 600 nm e) 650 nm

___ 2. Which λ in question 1 has the greatest energy ?

___ 3. The term used to describe a light "particle" is : a) orbital b) sublevel c) alpha d) photon e) beta f) gamma

___ 4. A p^5 electron configuration has how many unpaired electrons ? a) 1 b) 2 c) 3 d) 4 e) 5

___ 5. A +4 charge is possible for which atom ? a) Sn b) N c) Ca d) Ga e) Sc

___ 6. Which atom can exist as either a cation or as an anion ? a) Cl b) Sb c) K d) Li e) Hg

___ 7. Which atom in question 6 exists as an anion which is isoelectronic with a noble gas ?

___ 8. Valence e- s of tin are a) 5s only b) 4d only b) 5s and 4d d) 5p only e) 5s and 5 p

___ 9. $[Kr]4d^{10}$ is the electron configuration of: a) Ag b) Cd c) Sn^{4+} d) In^{+} e) Sn^{2+} f) Sb^{3+}

___ 10. An element with a subshell of electrons as shown  is:
a) Cu b) Ru c) Cr d) Os e) Mn f) Sm

___ 11. Which of the elements in #10 is not attracted to a magnetic field ?

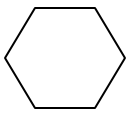
___ 12. Most of the elements listed in #10 are "paramagnetic" because: a) they are polar b) They are very electronegative c) the unpaired electrons spin d) their outer electrons are not valence electrons e) the electrons disobey the octet rule

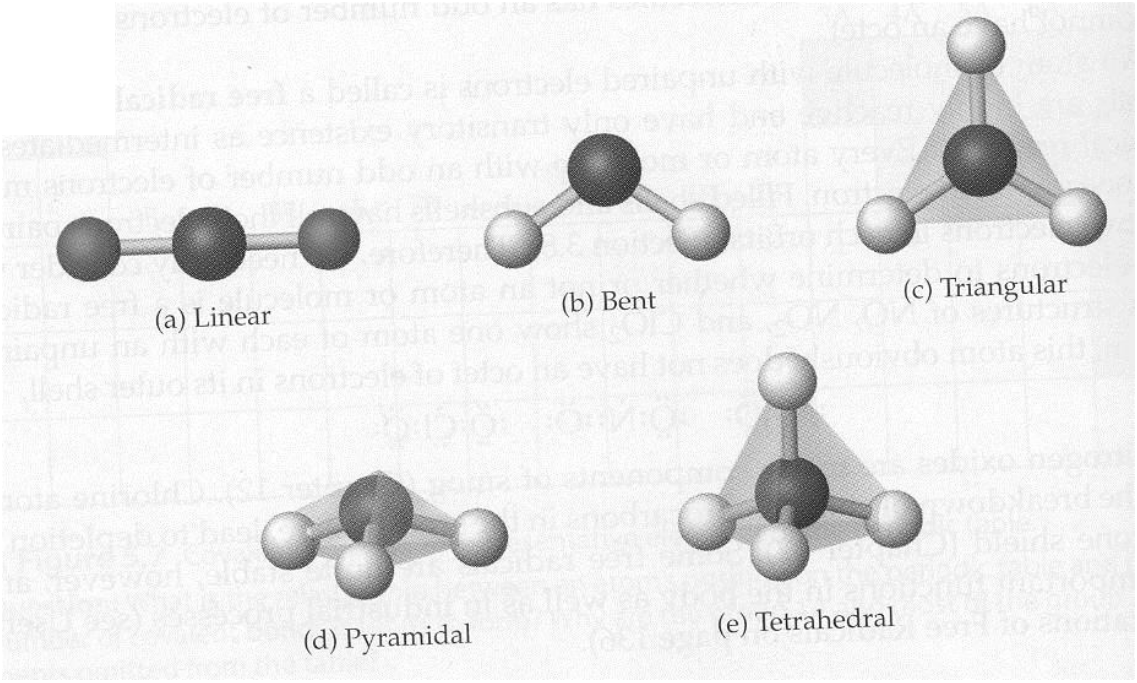
___ 13. Compare the ionization energies of S and Cl . Which is true ?
a) IE of Cl > S because e^- in Cl is at a higher E level than in S .
b) IE of S > Cl because e^- in S is at a higher E level than in Cl.
c) IE of Cl > S because Cl has more electrons (increased repulsions)
d) IE of S > Cl because S has more unpaired electrons
e) IE of Cl > S because Cl has more protons attracting the electrons at same energy level

___ 14. Which of these molecules is <u>most</u> polar ? a) CO_2 b) CO_2^{2-} c) F_2 d) BH_3 e) I_2

___ 15. Which of these molecules is not polar ? a) H_2O b) CS_2 c) HCN d) HBr e) CO

___ 16. The line formula on the right represents a hydrocarbon With a formula C_xH_y . Which of these is correct ?
a) CH_6 b) C_6H_6 c) CH_{12} d) C_6H_{14} e) C_6H_{12}





Questions 17 – 22 . Refer to the above chart and write the letter of the molecular shape which best describes the molecule in the question .

___17. NO_2^- , ___18. IO_2^- ____ 19. IO_3^- , ____ 20. AsO_4^{-3} ,
___ 21. SCN^- , ___22. BH_3

___ 23. Which of these molecules above, with a <u>bent</u> shape has a bond angle of 109^o

___ 24. Which of these exhibits resonance ? a) CF_4 b) C_2H_4 c) CH_2O d) SI_6 e) O_3

___ 25. Which of the molecules in #24 can have an isomer ?

Part 2. Bonding

13. Draw a Lewis formula for the molecule N_2O_2 The two N atoms are in the middle. Count the valence electrons. Describe the VSEPR electron geometry at each N atom.

6

Sketch and describe molecular shape and bond angles around <u>each</u> nitrogen atom.

6

Is the molecule polar the way you have sketched it ? Show with arrows.

3

14. Draw all possible isomers of each of these compounds

a) C_2H_6O

4

b) $C_2H_2F_2$

4

15. Draw all possible resonance forms for these molecules

a) CNO^{-1}

4

b) $C_2O_4^{2-}$

4

Part 2. Bonding

13. Draw a Lewis formula for the molecule N_2O_4 The two N atoms are in the middle. Count the valence electrons. Describe the VSEPR electron geometry at each N atom.

6

Sketch and describe molecular shape and bond angles around <u>each</u> nitrogen atom.

6

Is the molecule polar the way you have sketched it ? Show with arrows.

3

14. Draw all possible isomers of each of these compounds

a) C_2H_6O

4

b) $C_2H_2Br_2$

4

15. Draw all possible resonance forms for these molecules

a) OCN^{-1}

4

b) HCO_2^{-1} (C in in center, attached to H and two O)

4

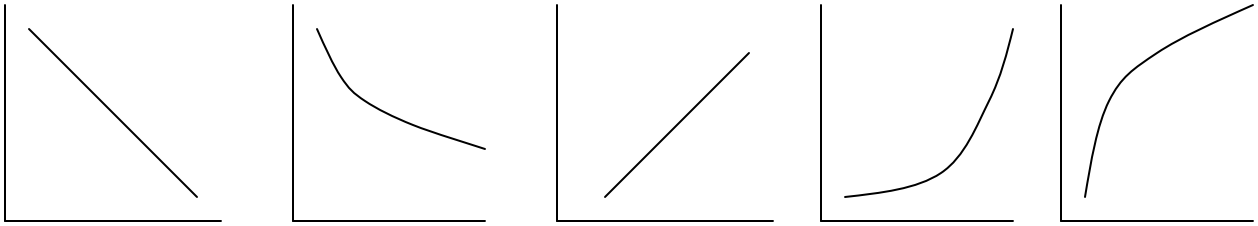
/ 31

Part 3. Gas laws. 1 atm = 760 torr. R = 0.0821 L atm $mole^{-1}K^{-1}$ or 760 L torr $mole^{-1}$ K^{-1}

PV = nRT STP = 273 K = 0^oC . one mole of gas at STP = 22.4 L

16. Which of these graphs tells us that pressure and volume are inversely proportional at constant T. (P = y axis, V = x axis) (circle the letter.)

2 pts



a) b) c) d) e)

17. 0.250 moles of butane and 37.0 L oxygen are mixed at STP and combusted and after the reaction, the temperature is brought back to 0^oC. How many liters of the gaseous product are produced at STP ?

15

18. What is the density of a sample of ammonia gas measured at a temperature of 27^oC and a pressure of 300 mmHg ?

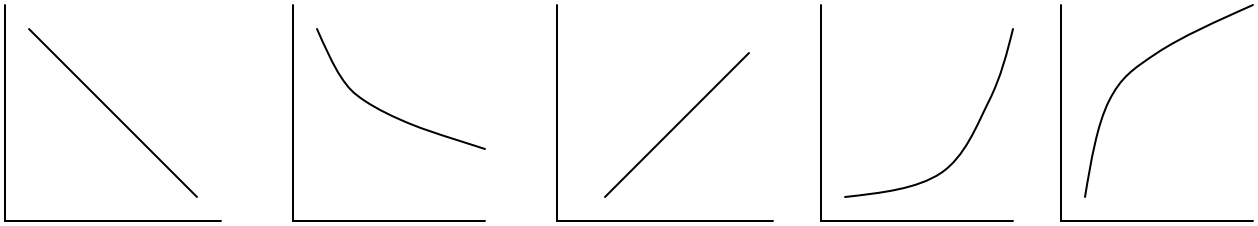
15

Part 3. Gas laws. 1 atm = 760 torr. R = 0.0821 L atm $mole^{-1}K^{-1}$ or 760 L torr $mole^{-1}$ K^{-1}

PV = nRT STP = 273 K = 0^oC . one mole of gas at STP = 22.4 L

16. Which of these graphs tells us that pressure and volume are inversely proportional at constant T. (P = y axis, V = x axis) (circle the letter.)

2 pts



a) b) c) d) e)

17. 0.250 moles of butane and 16.8 L oxygen are mixed at STP and combusted and after the reaction, the temperature is brought back to 0^oC. How many liters of the gaseous product are produced at STP ?

15

18. What is the density of a sample of ammonia gas measured at a temperature of 27^oC and a pressure of 300 mmHg ?

Ch 60 Ex #3 100 pts Name: _____

Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____

N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8

Part 1. Multiple choice: select the best answer and write the letter in the space provided

____ 1. Which of the following colors of light has the highest λ ?
a) blue **b**) violet **c**) red **d**) yellow **e**) green **f**) orange

____2. Suppose that an electron in lithium undergoes a transition from the 3s to the 2s orbital and emits blue light. If an electron undergoes a transition in that same atom from the 4s to the 2s orbital, what color of light might you expect to see ?
a) violet **b**) green **c**) yellow **d**) orange **e**) red

____ 3. Which of the following elements or ions has a half-filled **d** sublevel of orbitals ?
a) Fe **b**) Ni^{2+} **c**) Cr **d**) Zn **e**) N **f**) V^{5+}

____ 4. Which of these elements has the greatest amount of paramagnetic character ?
a) Ti **b**) P **c**) Eu **d**) Co **e**) As **f**) Ar

____ 5. Which of these ions has a noble gas configuration of electrons ?
a) Ga^{3+} **b**) As^{3-} **c**) V^{3+} **d**) Sn^{2+} **e**) Fe^{3+} **f**) Zn^{2+}

____ 6. Which of these elements can form either a cation or an anion ?
a) H **b**) He **c**) P **d**) Cl **e**) Na **f**) Ca

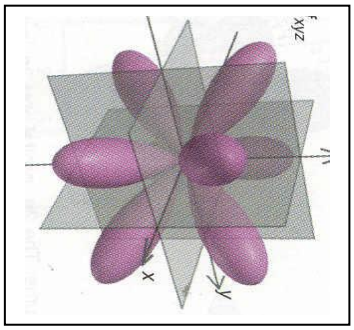
____ 7. The electron configuration [Kr] $5s^2$ $4d^{10}$ is found in which element or ion ?
a) Mn^{2+} **b**) Sn^{2+} **c**) Ag **d**) Cd^{2+} **e**) Zn **f**) Hg

____ 8. Which of the following molecules can exhibit resonance ?
a) CF_4 **b**) H_2O **c**) IO_2^{-1} **d**) SO_3 **e**) SO_3^{2-} **f**) SO_4^{2-}

____ 9. If we compare the electronegativities of phosphorus and arsenic, which of these statements is true ?

a) EN of phosphorus is less because it has fewer protons
b) EN of arsenic is greater because it has more protons
c) EN of phosphorus is greater since the electron is attracted to a lower E level
d) EN of arsenic is greater since the electron is attracted to a higher E level
e) EN of phosphorus is greater because it has more unpaired electrons

____ 10. How many electrons can fill a subshell of orbitals of the type shown here ?
(This picture shows one orbital only.)
a) 1 **b)** 3 **c**) 6 **d)** 5 **e)** 14 **f)** 7 **g**) 10



____ 11. Which of the following molecules violates the octet rule in its Lewis formula ?
a) BrO_2^- **b**) NO_2^- **c**) NO_2 **d**) NO_2^+ **e**) CO

/ 66

Ch 60 Ex #3 100 pts .. Name: _____
Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____
N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8
Part 1. Multiple choice: select the best answer and write the letter in the space provided

____ 1. Which of the following colors of light has the highest λ ?
a) red **b**) violet **c**) blue **d**) yellow **e**) green **f**) orange

____2. Suppose that an electron in lithium undergoes a transition from the 3s to the 2s orbital and emits blue light. If an electron undergoes a transition in that same atom from the 4s to the 2s orbital, what color of light might you expect to see ?
a) green **b**) violet **c**) yellow **d**) orange **e**) red

____ 3. Which of the following elements or ions has a half-filled **d** sublevel of orbitals ?
a) Fe **b**) Ni^{2+} **c**) Zn **d**) Cr **e**) N **f**) V^{5+}

____ 4. Which of these elements has the greatest amount of paramagnetic character ?
a) Ti **b**) P **c**) As **d**) Co **e**) Eu **f**) Ar

____ 5. Which of these ions has a noble gas configuration of electrons ?
a) Ga^{3+} **b**) Zn^{2+} **c**) V^{3+} **d**) Sn^{2+} **e**) Fe^{3+} **f**) As^{3-}

____ 6. Which of these elements can form either a cation or an anion ?
a) P **b**) He **c**) H **d**) Cl **e**) Na **f**) Ca

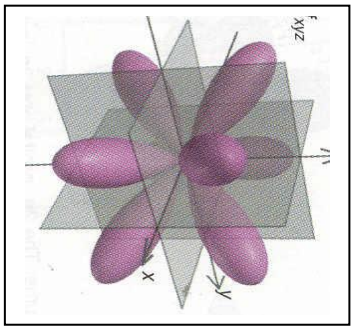
____ 7. The electron configuration [Kr] $5s^2$ $4d^{10}$ is found in which element or ion ?
a) Sn^{2+} **b**) Mn^{2+} **c**) Ag **d**) Cd^{2+} **e**) Zn **f**) Hg

____ 8. Which of the following molecules can exhibit resonance ?
a) CF_4 **b**) H_2O **c**) IO_2^{-1} **d**) SO_3^{2-} **e**) SO_3 **f**) SO_4^{2-}

____ 9. If we compare the electronegativities of phosphorus and arsenic, which of these statements is true ?

a) EN of phosphorus is less because it has fewer protons
b) EN of arsenic is greater because it has more protons
c) EN of phosphorus is less since the electron is attracted to a lower E level
d) EN of arsenic is less since the electron is attracted to a higher E level
e) EN of phosphorus is greater because it has more unpaired electrons

____ 10. How many electrons can fill a subshell of orbitals of the type shown here ?
(This picture shows one orbital only.)
a) 1 **b)** 3 **c**) 6 **d)** 5 **e)** 7 **f)** 14 **g**) 10



____ 11. Which of the following molecules violates the octet rule in its Lewis formula ?
a) BrO_2^- **b**) NO_2 **c**) NO_2^- **d**) NO_2^+ **e**) CO

/ 66

Ch 60 Ex #3 100 pts … Name: _____
Electronegativities H : 2.1 , B: 2.0 , C : 2.5 section _____
N: 3.0 , O : 3.5 , F : 4.0 , Cl : 3.0 , S: 2.5 , I : 2.5 , Br : 2.8
Part 1. Multiple choice: select the best answer and write the letter in the space provided

____ 1. Which of the following colors of light has the highest λ ?
a) green **b**) orange **c**) blue **d**) yellow **e**) red **f**) violet

____2. Suppose that an electron in lithium undergoes a transition from the 3s to the 2s orbital and emits blue light. If an electron undergoes a transition in that same atom from the 4s to the 2s orbital, what color of light might you expect to see ?
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____ 3. Which of the following elements or ions has a half-filled **d** sublevel of orbitals ?
a) Fe **b**) Ni^{2+} **c**) Zn **d**) N **e**) Cr **f**) V^{5+}

____ 4. Which of these elements has the greatest amount of paramagnetic character ?
a) Ti **b**) Eu **c**) As **d**) Co **e**) P **f**) Ar

____ 5. Which of these ions has a noble gas configuration of electrons ?
a) As^{3-} **b**) Zn^{2+} **c**) V^{3+} **d**) Sn^{2+} **e**) Fe^{3+} **f**) Ga^{3+}

____ 6. Which of these elements can form either a cation or an anion ?
a) P **b**) He **c**) Ca **d**) Cl **e**) Na **f**) H

____ 7. The electron configuration [Kr] $5s^2$ $4d^{10}$ is found in which element or ion ?
a) Zn **b**) Mn^{2+} **c**) Ag **d**) Cd^{2+} **e**) Sn^{2+} **f**) Hg

____ 8. Which of the following molecules can exhibit resonance ?
a) CF_4 **b**) H_2O **c**) SO_2^{2-} **d**) SO_3^{2-} **e**) ClO_2^- **f**) SO_4^{2-}

____ 9. If we compare the electronegativities of phosphorus and arsenic, which of these statements is true ?

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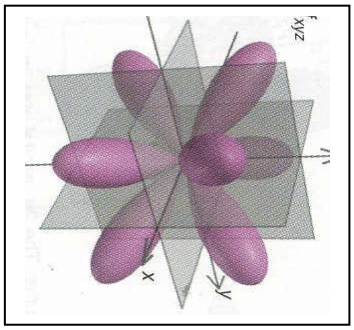
____ 10. How many electrons can fill a subshell of orbitals of the type shown here ?
(This picture shows one orbital only.)
a) 7 **b)** 14 **c**) 6 **d)** 5 **e)** 1 **f)** 3 **g**) 10



____ 11. Which of the following molecules violates the octet rule in its Lewis formula ?
a) BrO_2^- **b**) NO_2^+ **c**) NO_2^- **d**) NO_2 **e**) CO

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In the next three questions (12 pts each) draw the Lewis formula, the VSEPR electron geometry (either linear, tetrahedral or trigonal planar), give the bond angles, sketch the molecule in 3-D and indicate its molecular shape and polarity (just indicate yes or no).

Lewis Formula	VSEPR & Bond angles	Sketch & shape	Polarity ?
BrO_2^{-1}			
CO_3^{2-}			

IO_3^{-1}

Bonus. Draw 2 isomers of
Dichloroethane: $C_2H_4Cl_2$

4 pts
In the next three questions (12 pts each) draw the Lewis formula, the VSEPR electron geometry (either linear, tetrahedral or trigonal planar), give the bond angles, sketch the molecule in 3-D and indicate its molecular shape and polarity (just indicate yes or no).

Lewis Formula	VSEPR & Bond angles	Sketch & shape	Polarity ?
CO_2^{2-}			
BrO_3^{-1}			

BO_2^{-1}

Bonus. Draw 2 isomers of
Difluorohydrazine $N_2H_2F_2$

4 pts
In the next three questions (12 pts each) draw the Lewis formula, the VSEPR electron geometry (either linear, tetrahedral or trigonal planar), give the bond angles, sketch the molecule in 3-D and indicate its molecular shape and polarity (just indicate yes or no).

Lewis Formula	VSEPR & Bond angles	Sketch & shape	Polarity ?
BCl_4^{-1}			
NO_3^{-1}			

IO_2^{-1}

Bonus. Draw 2 isomers of Trichloroethane: $C_2H_3Cl_3$

4 pts