

$$\bar{x} = 65\%$$

# CHEMISTRY 121 MIDTERM 2

Oct. 27, 2006

Unless otherwise stated, show all your reasoning/work for full marks

(3) 1) Answer the following statements as True (T) or False (F). No explanation required (NER).

- a) A sigma bond is <sup>x</sup>weaker than a pi bond.
- b) An atom with 19 electrons contains an occupied 3d orbital.
- c) Valence electrons share a common principal quantum number.

F (1)  
F (1)  
T (1)

All or nothing  
= AON

(2) 2) Consider any stable atomic ions (+ or - charged!) with a Z less than 35 and fill in the blanks. NER.

- a) has empty d orbitals and totally filled 4s orbitals.
- b) has the highest IE of  ~~$_{51}\text{Sb}^{3+}$~~ ,  ~~$_{37}\text{Rb}^{+}$~~  and  $_{20}\text{Ca}^{2+}$

$\text{Sc}^{+}$ ,  $\text{Ti}^{2+}$  etc (1) AON  
 $_{20}\text{Ca}^{2+}$  (1)

(2) 3) Circle the number of electrons which can be accommodated at  $n = 3, l = 0$  and  $1, m_s = 1/2$ .

(2) (4)

16

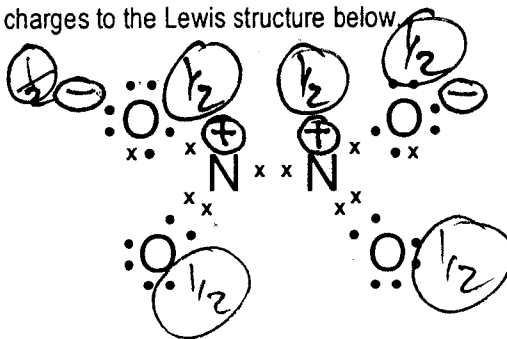
8

9

18

$3s$  &  $3p$   $\rightarrow$   $1/2$  filled  $\therefore 3s$  (1)  $3p$  (3)

3) 4) Assign any necessary formal charges to the Lewis structure below.



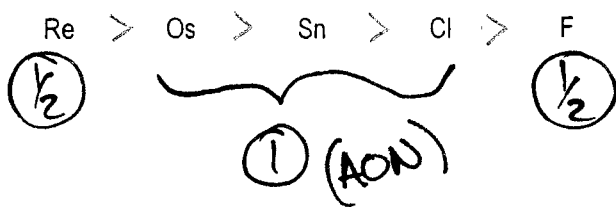
(2) 5) Circle the covalent bond. Pauling's electronegativity scale: H = 2.1, Li = 1.0, C = 2.5, O = 3.5, Se = 2.4.

$|\Delta EN| < 0.5$

Li-O 2.5	C-O 1	Se-Li 1.4	O-Se 1.1	C-H .4
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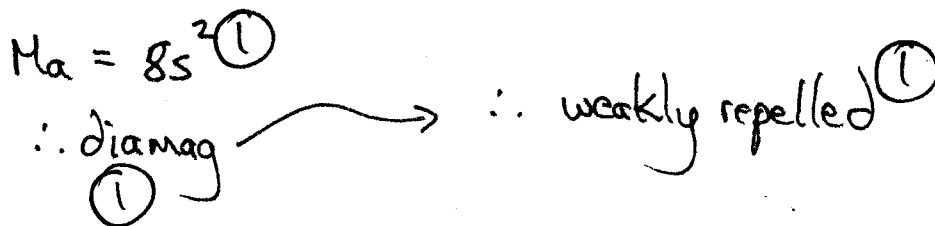
(2) AON

(2) 6) Arrange the following atoms in order of increasing electropositivities.



if right order but backwards = -1

(3) 7) A new element has been found on the planet Magrathea and is given the symbol Ma. It is placed under radium ( $_{88}\text{Ra}$ ) on the periodic table. Is Ma weakly repelled or attracted to a magnetic field? Explain.



(6) 8) Complete the following table. The Hybridization column refers to the central atom only.

Formula	Lewis Structure	Molecular Geometry Name	Hybridization	Polar molecule? (Y or N)
$\text{COBr}_2$		Trig. pl. (1)	(1/2) sp	(1/2) Y
$\text{Cl}_5\text{Ne}^+$		Sq. pyr. (1)	(1/2) sp <sup>3</sup> d	(1/2) Y

- (3) 9) An electron moves from  $n = 2$  to another energy level. The energy difference between the two levels is  $4.08 \times 10^{-19}$  J. Which energy level ( $n$ ) did it end up on?

$$\Delta E = -2.178 \times 10^{-18} \text{ J} \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

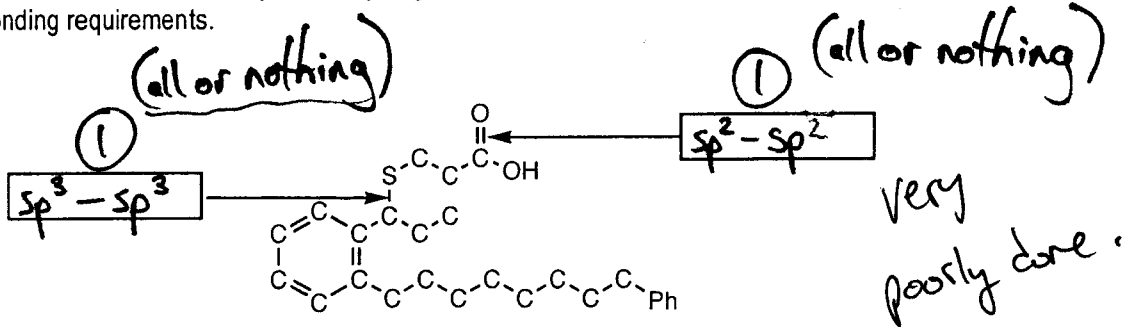
very well done.

$4.08 \times 10^{-19} \text{ J}$  (with arrow pointing to  $\Delta E$ )

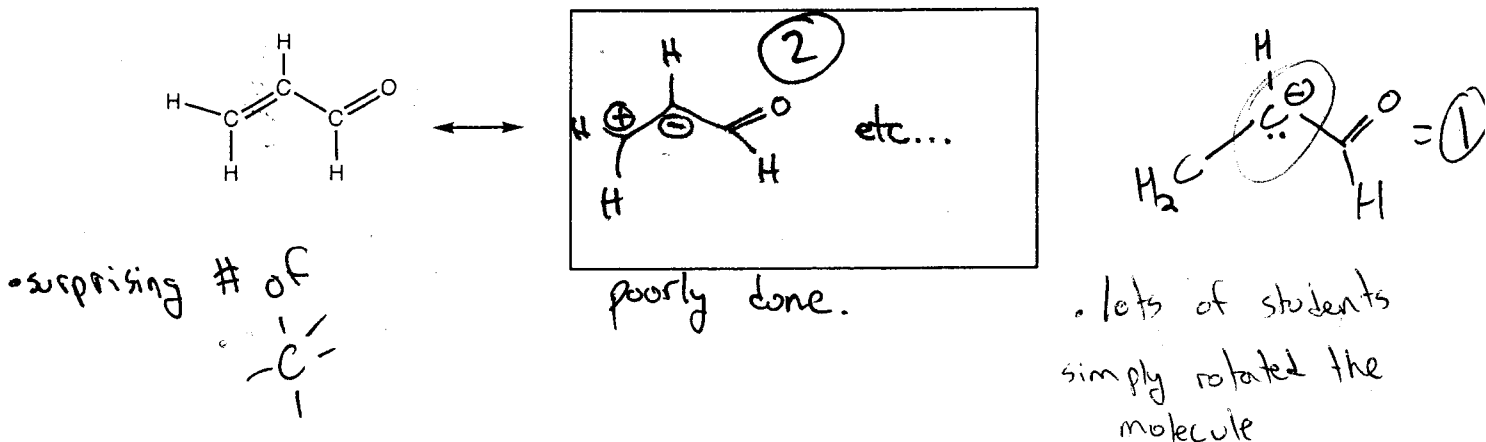
$n_i = 2$  (with arrow pointing to  $n_i^2$ )

$n_f = 4$  (circled)

- (2) 10) A newly discovered anti-asthma drug is shown below. Describe the arrowed sigma bonds in terms of atomic overlap in the valence bond theory. Most hydrogen atoms have been omitted for clarity but they're still there to satisfy bonding requirements.



- (2) 11) Complete the box below. Your choice of structures.



- (1) Bonus. You are writing this midterm in what room number? 366