

Chemistry 105 A

First Letter of  
Last Name

PLEASE PRINT YOUR NAME IN BLOCK LETTERS

Last 4 Digits of USC ID: \_\_\_\_\_

Lab TA's Name: \_\_\_\_\_

Lab: Tu 9 / Tu 1 / Tu 4 / W 1 / W 4 / F 1

Please circle lab section above.

Question	Points	Score	Grader
1	12		
2	12		
3	12		
4	21		
5	12		
6	10		
7	10		
8	18		
9			
10			
<b>Total</b>	<b>100</b>		

**Please Sign Below:**

I certify that I have observed all the rules of Academic Integrity while taking this examination.

Signature: \_\_\_\_\_

**Instructions:**

1. You must show work to receive credit.
2. If necessary, please continue your solutions on the back of the preceding page (facing you).
3. YOU MUST use black or blue ink. (No pencil, no whiteout, no erasable ink.)
4. There are 10 problems on 9 pages. Please count them before you begin. A periodic table and some useful equations can be found on the last page.
5. You MUST submit all pages to the proctors, including the periodic table page. Put your name onto the periodic table page in the space provided.
6. Only a Casio FX-260 calculator may be used on Chem 105a/b exams.
7. Turn off cell phones and other electronic devices and put them away, out of sight. They may not be taken out of your bag during the exam.
8. When time is called, stop working on your exam immediately, turn the exam over and pass it to the aisle.
9. Your exam will be returned to you in your next lab period.
10. Good luck!! =)

1. (12 pt) Answer the following multiple choice questions:

i. Which has the longer N-O bond length,  $\text{NO}_2^-$  or  $\text{NO}_3^-$ ?

a.  $\text{NO}_2^-$

b.  $\text{NO}_3^-$

c. the bond lengths are the same

d. more information is needed

ii. Consider the reaction:  $\text{A}_2 + \text{B}_2 \rightarrow 2 \text{AB}$   $\Delta H = -285 \text{ kJ}$ . The bond energy for  $\text{A}_2$  is half the amount for  $\text{AB}$ . The bond energy of  $\text{B}_2 = 432 \text{ kJ/mol}$ . What is the bond energy of  $\text{A}_2$ ?

a. 717 kJ/mol

b. 478 kJ/mol

c. 239 kJ/mol

d. -143 kJ/mol

e. 98 kJ/mol

f. none of these

iii. If four atomic orbitals on one atom overlap with four orbitals on a second atom, how many molecular orbitals will form?

a. 1

b. 4

c. 8

d. 16

e. none of these

iv. Consider the molecular orbital description of  $\text{NO}^-$  anion (see question 5 for diagram). Which of the following statements is false?

a.  $\text{NO}^-$  is paramagnetic.

b.  $\text{NO}^-$  is isoelectronic with CO

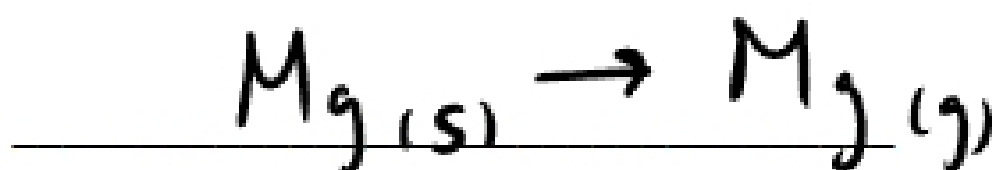
c. The bond energy of  $\text{NO}^+$  is greater than the bond energy of  $\text{NO}^-$ .

d. The bond order of  $\text{NO}^-$  is 2.

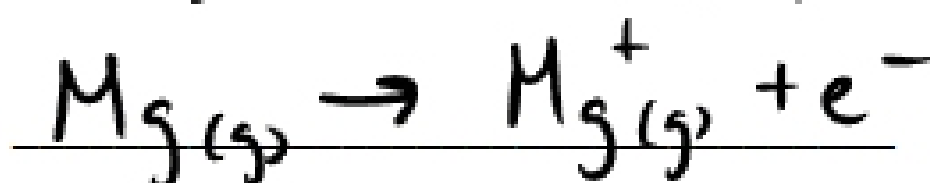
e. None of these statements is false.

2. (12 pt) Give the equations for each of the steps involved in the formation of the ionic solid  $\text{MgCl}_2$ :

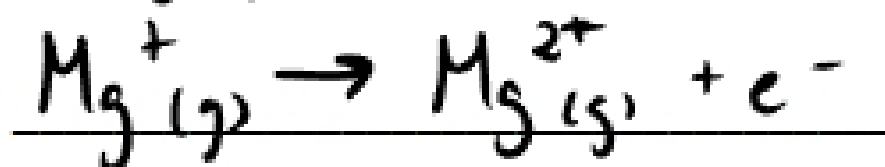
a. Sublimation of Mg



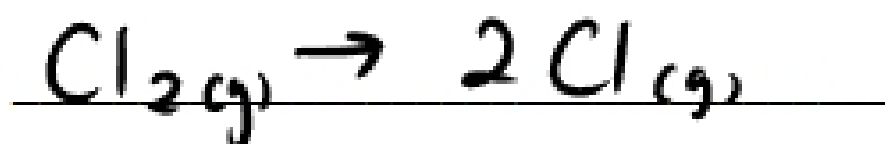
b. 1<sup>st</sup> ionization energy of Mg



c. 2<sup>nd</sup> ionization energy of Mg



d. Formation of Cl atom



e. Electron affinity of Cl



d. Lattice energy of  $\text{MgCl}_2$

