Student ID: _____ Name: _____

Instructions

This is where you can give directions, if you want.

1. Something something NO_2^-.
   A. A
   B. B
   C. C
   D. D
   E. E

   Solution: Answer B is correct because I said so.

2. What should the answer be?
   A. Not A
   B. I wouldn't pick B
   C. Why would you pick this one?
   D. Please don't pick me
   E. None of these

   Solution: Probably a trick, but "None of these" is correct.

3. In question 2, which was the correct choice?
   A. No
   B. E
   C. No
   D. No
   E. No

4. Mark the correct formula for sugar.
   A. $C_4H_5O_3$
   B. $C_2H_5O_5$
   C. $C_4H_{10}O_2$
   D. $C_6H_{12}O_6$
   E. None of these

5. Remember to write a question here.
    A. One
    B. Two
    C. Fish
    D. Red
    E. Blue

6. Which is the smallest?
    A. 1 Å
    B. 0.1 Å
    C. 0.001 Å
    D. 2 Å
    E. 48 Å

7. Derive the following Maxwell relation: $\left.\frac{\partial P}{\partial T}\right|_V = \left.\frac{\partial S}{\partial V}\right|_T$

Solution:

$$dA = -SdT - PdV$$

$$\left(\frac{\partial A}{\partial T}\right)_V = -S \quad \text{and} \quad \left(\frac{\partial A}{\partial V}\right)_T = -P$$

Rewrite dA as:

$$-\left(\frac{\partial A}{\partial T}\right)_V = -\left(\frac{\partial A}{\partial V}\right)_T$$

$$-\left(\frac{\partial^2 A}{\partial V \partial T}\right) = -\left(\frac{\partial^2 A}{\partial T \partial V}\right)$$

$$-\left(\frac{\partial^2 A}{\partial V \partial T}\right) = -\frac{\partial}{\partial V}\left(\frac{\partial A}{\partial T}\right)_V = -\left(\frac{\partial S}{\partial V}\right)_T$$

$$-\left(\frac{\partial^2 A}{\partial T \partial V}\right) = -\frac{\partial}{\partial T}\left(\frac{\partial A}{\partial V}\right)_T = -\left(\frac{\partial P}{\partial T}\right)_V$$

$$-\left(\frac{\partial S}{\partial V}\right)_T = -\left(\frac{\partial P}{\partial T}\right)_V$$

$$\therefore \left.\frac{\partial P}{\partial T}\right|_V = \left.\frac{\partial S}{\partial V}\right|_T$$