Chem1A-WeeklyDrop-inProblemSets

Week of 8/3 - 8/6

Reaction Equilibrium, ICE Table

1. Consider the reaction for the decomposition of HI at 440 ºC

$$2\ HI\ (g) \rightleftharpoons H_2\ (g) + I_2\ (g)$$

Initially there was only HI in the container, and its concentration was HI of 1.0 mmol/L. Once equilibrium was established, the concentration of HI was measured to be 0.078 mmol/L. Calculate the equilibrium constant (Kc).

2. Consider the following equilibrium reaction at 25°C:

$$N_2\ (g) + 3\ H_2\ (g) \rightleftharpoons 2\ NH_3\ (g)$$

Initially, a 2.00 L reaction vessel contains 1.00 mol of N_2, 2.00 mol of H_2, and no NH_3.

At equilibrium, it is found that the concentration of NH_3 is 0.40 M.

a. Set up an ICE table for the reaction.

b. Calculate the equilibrium concentrations of all species.

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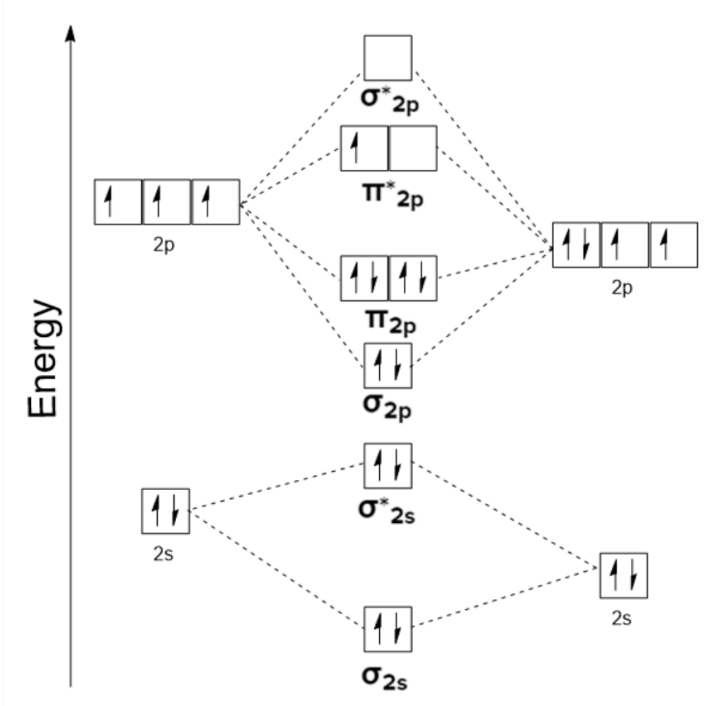
c. Determine the value of the equilibrium constant Kc for the reaction

Week 6 7/27/26-7/31/26

Molecular Orbitals, Intermolecular Forces, Gas Laws, Thermodynamics

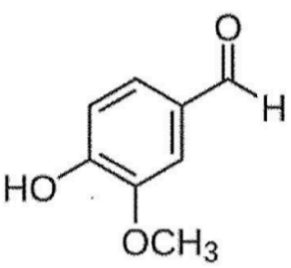
1. Consider the following Molecular Orbital Diagram:



a. Identify the molecule that is represented by the diagram.

b. Calculate the bond order.

2. Consider the following compounds:



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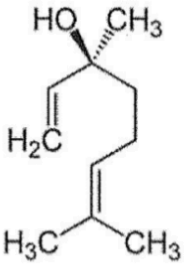

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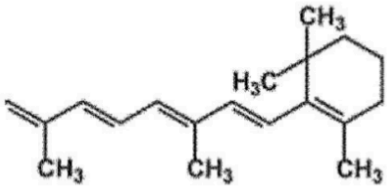

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a. Determine the IMFs present for each compound.

b. Order the compounds above from lowest to highest boiling point and explain your reasoning.

c. Determine the molecule that is least soluble in water. Justify your answer using IMFs.

3. Determine the following for your assigned pair of ideal gas variables:
    a. An equation relating the two variables. Specify any necessary conditions.
    b. Explain the relationship between the variables (on the molecular level) in your own words.
    c. Are the variables inversely or directly proportional? Show this on a graph.

    i. Pressure (x-axis) and volume (y-axis)

    ii. Temperature (x-axis) and volume (y-axis)

    iii. Temperature (x-axis) and pressure (y-axis)

    iv. Moles (x-axis) and volume (y-axis)

4. You blast a 6 kg rock with 50 kJ of energy. The rock is originally at room temperature (25°C) and has a specific heat of 0.853 g/(J·°C).

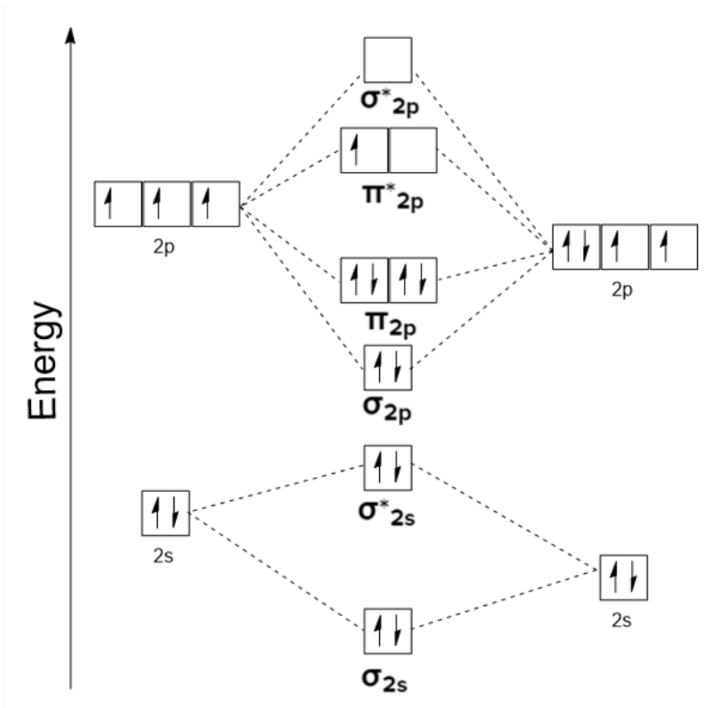
    a. What is the final temperature of the rock after you've blasted it with energy?

    b. If the specific heat of the rock was actually 1.243 g/(J·°C), would the final temperature be higher or lower than predicted in part a? Explain your reasoning.

Week 3 7/13/26-7/16/26

MO Orbitals, Ideal vs. Real Gases, Solubility

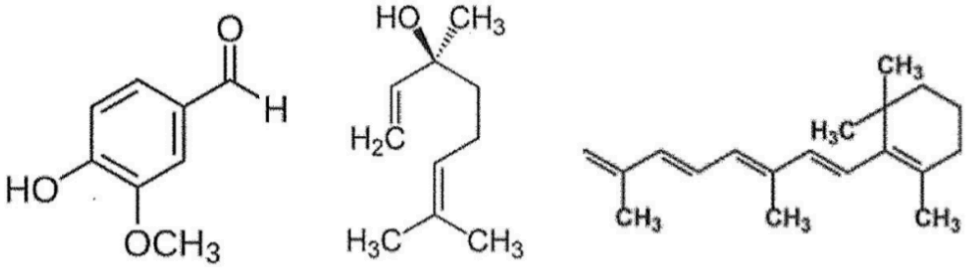
5. Consider the following Molecular Orbital Diagram:



a. Identify the molecule that is represented by the diagram.

b. Calculate the bond order.

6. Consider the following compounds:



1 2 3

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a. Determine the IMFs present for each compound.

b. Order the compounds above from lowest to highest boiling point and explain your reasoning.

c. Determine the molecule that is least soluble in water. Justify your answer using IMFs.

7. Determine the following for your assigned pair of ideal gas variables:
    a. An equation relating the two variables. Specify any necessary conditions.
    b. Explain the relationship between the variables (on the molecular level) in your own words.
    c. Are the variables inversely or directly proportional? Show this on a graph.

    v. Pressure (x-axis) and volume (y-axis)

    vi. Temperature (x-axis) and volume (y-axis)

    vii. Temperature (x-axis) and pressure (y-axis)

    viii. Moles (x-axis) and volume (y-axis)

8. You blast a 6 kg rock with 50 kJ of energy. The rock is originally at room temperature (25°C) and has a specific heat of 0.853 g/(J·°C).

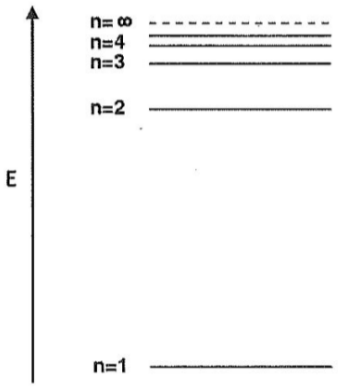
    a. What is the final temperature of the rock after you've blasted it with energy?

    b. If the specific heat of the rock was actually 1.243 g/(J·°C), would the final temperature be higher or lower than predicted in part a? Explain your reasoning.

Week 2 6/29/26-7/3/26

Light and Color, Photoelectron Spectroscopy and Periodic Trends, Atomic Emission Spectroscopy

1. Below is the electron energy level diagram for a hydrogen atom.



   a. If green light is emitted when an electron goes from $n = 3$ to $n = 2$, what color of light do you expect to be emitted for an electron going from $n = 4$ to $n = 3$?

   b. Compared to hydrogen, would you expect the $n = 1$ energy level for lithium to be lower or higher? Explain your reasoning.

   c. Consider an electron at $n = 1$ in ground state hydrogen. The energy required to excite an electron from $n = 1 \rightarrow 2$ is 1.63×10^{-18} J and $n = 1 \rightarrow 3$ is 1.93×10^{-18} J. If a light with wavelength 110 nm hits the atom, what will be the energy level of this electron?

   d. Assume the same starting conditions as in part c. What will be the final energy level of the atom if a light with wavelength 122 nm is added?

2. A laser emits a beam of light with a wavelength 480 nm Calculate the frequency of this light in Hz. If the amplitude is doubled, what happens to the brightness of the light? the frequency and wavelength?

3. Consider the element Calcium (Ca).
   a. Write out the electron configuration and the noble gas configuration.

b. Draw the orbitals (ignore orientation) where valence electrons can be found.

c. How many nodes exist? Identify how many of each type of node exist.

4. Consider the following list of elements: Pb, Bi, Po, At

   a. Rank them from highest to lowest in metallic character.

   b. Rank them from highest to lowest in electronegativity.

   c. Rank them from highest to lowest in atomic radius.

26SU Chem 1A Weekly Problem Sets