

Chemistry 181H

Fall, 2008

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Practice Problem Set

Do: before first exam

1. There are two stable isotopes of carbon (mass numbers 12,13) and hydrogen (mass numbers 1,2) while there are three stable isotopes of oxygen (mass numbers 16,17,18), and only one stable isotope of sodium. What are the mass numbers of the lightest and heaviest versions of sodium bicarbonate?
2. Covalent compounds exist as individual molecules, for example in the gas phase, whereas ionic materials generally do not form “molecules” and are not found in the gas phase. Explain.
3. Calculate the value of the Coulomb *potential energy* and also the *force* acting between a Ca^{2+} cation and an O^{2-} anion if they are separated by three times the sum of their ionic radii.
4. The Azide anion, N_3^- , contains some non-zero formal charges in all of the Lewis structures that contribute to its structure. Draw three Lewis structures and identify the formal charges in each.
5. Indicate the components necessary to calculate the lattice energy of CaBr_2 from measurable reactions.
6. Draw the Lewis and VSEPR structures for the following molecules or molecular ions: (a) ICl_3 (b) OTeF_2 (c) ClO_2^-
7. Draw the Lewis structure and identify the VSEPR structure at each atom in the organic molecules in the reaction: methanol, CH_3OH , plus acetic acid, $\text{CH}_3\text{CO}_2\text{H}$ producing methyl acetate ester, $\text{CH}_3\text{-CO}_2\text{-CH}_3$, and water.
8. Microwave ovens rely on radiation with a frequency of approximately 2450 MHz. Calculate the wavelength of this radiation. The water molecules strongly absorb this radiation and heat up the food at a microscopic level. Based on the wavelength, what property of the water molecules changes (increases) when they absorb this radiation?
9. Estimate the temperature of a glowing incandescent filament in a lightbulb.
10. Estimate the total power in watts radiated by a student in class.
11. What is the maximum energy of the series of lines in the helium ion that would be equivalent to the Balmer series in hydrogen? [This series terminates in the $n=2$ state.]