

Chem 1A Review: Exam I
Wednesday 7/6/11
Summer '11

1. Benzene (C_6H_6) reacts with oxygen gas to produce carbon dioxide and water.
 - a. Write a balanced equation for this combustion reaction.
 - b. If 100 grams of benzene react with excess oxygen, how many grams of carbon dioxide are produced? Grams of water?
 - c. Suppose that there is now a limited supply of 100 grams of oxygen. How many grams of each product are formed? How many molecules of each reagent are left (if there are any)?
2. Chlorophyll is a pigment that is responsible for giving plants their green color.
 - a. Draw an absorbance/transmission spectra for chlorophyll.
 - b. What color filter would have to be placed on chlorophyll to make it look black? Draw the absorbance/transmission spectra for this filter.
 - c. What filters would make the chlorophyll appear green? (Yes, there is more than one). Draw the absorbance/transmission spectra for these filters.
3. Suppose I have a metal that requires at least 500 kJ to eject a mole of electrons.
 - a. What's the kinetic energy (kJ/mol) of a mole of ejected electrons if I supply energy of 650 kJ/mol with a beam of photons?
 - b. Would a beam of light with a wavelength of 200 nm contain enough energy to eject a mole of electrons? If so, what's the kinetic energy of a mole of ejected electrons?
 - c. What's the maximum wavelength required to eject an electron?
4. Write the electron configurations of K, Ar, Sr, Mn, and As in their ground states.
 - a. Which of these atoms exhibit paramagnetism? Order these atoms from the smallest to the largest degree of exhibiting paramagnetism.
 - b. Which atom(s) has(have) the highest-energy occupied orbital with the largest number of radial nodes? Which atom(s) has(have) the highest-energy occupied orbital with the largest number of planar nodes?
 - c. Write the quantum numbers describing an electron in the highest-energy occupied orbital for each atom (Note: there's more than one possible set for each electron).
 - d. If the atoms were to obtain a complete octet, what neutral atom would their electron configuration be identical to?
5. For each of the following sets of atoms, arrange them from decreasing to increasing atomic radii, ionization energy, and electronegativity.
 - a. Ne, Ba, Al
 - b. Ca, Ge, Kr
 - c. Cs^+ , Xe, I^-

6. Draw the Lewis Dot Structure for the following molecules:

- a. CH_4
- b. HCN
- c. BrF_5
- d. SO_2
- e. $(\text{CH}_3)_2\text{NH}^*$ (dimethylamine)
- f. CH_3COOH^* (acetic acid)

For each molecule, give/describe the:

- a. steric number
- b. electronic arrangement
- c. molecular shape
- d. oxidation number for each atom
- e. formal charge on each atom
- f. molecular dipole moment (if there is one)

*For CH_3COOH & $(\text{CH}_3)_2\text{NH}$, think of the molecule as having three centers.