CHEM 1211K Reading Day Study Session – Spring 2019

1. Write and balance a chemical equation to represent the reaction between aqueous solutions of a salt made from the most common monatomic ion of calcium and the nitrate ion and the salt that forms from the ammonium ion and the phosphate ion. Be sure to include phases for each reactant and product. Write the net ionic equation and identify the spectator ions in this reaction.

2. A 5.0g sample of an unknown hydrocarbon (contains only C and H) is composed of 4.13 g C and 0.870 g H. The 5.0 g sample contains 0.0860 moles of the compound. How many grams of O_2 are required to completely react with the hydrocarbon if the products are CO_2 and H_2O? You may assume 100% yield for the reaction.

3. What mass of Na_2CO_3 is required to produce 150. mL of a solution that is 0.500 M in sodium ions?

4. How many photons with wavelength equal to 465 nm are required to produce 15 J of energy?

5. Which statement is true regarding effective nuclear charge, Z_{eff}? Correct each false statement or explain why it is false.
   A) Z_{eff} is greater than the atomic number, Z, for any given atom with more than one electron.
   B) The value of Z_{eff} is closer to the value of the atomic number, Z, when the ratio of core electrons to valence electrons is greater.
   C) The number of protons, core electrons, and valence electrons in an atom all play a role in determining the magnitude of Z_{eff}.
   D) The value of Z_{eff} decreases progressing from left to right across a period because the number of valence electrons increases.
   E) The value of Z_{eff} for Br is closer to its atomic number, Z, than the value of Z_{eff} for Cl is to its atomic number.

6. The Lyman series refers to transitions of photons of light correlating to electrons in hydrogen atoms. All of the spectral lines in the Lyman series end at n = 1. The four lowest energy lines have wavelengths at 91.2nm, 97.2nm, 102.6nm, and 121.6nm. Draw and label these emission lines on the graph provided.
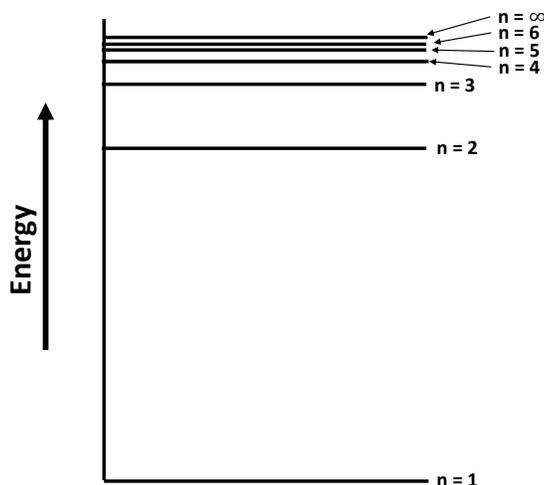
7. Which statement best describes the pi bonding in ethyne?

$$H - C \equiv C - H$$

A) There are two pi bonds created through the overlap of unhybridized 2p atomic orbitals on each C atom.

B) There are two pi bonds created through overlap of sp hybrid orbitals on each C atom.

C) There is one pi bond created through overlap of a 2p hybridized atomic orbital on each C atom.

D) There is one pi bond created through overlap of sp unhybridized atomic orbitals on each C atom.

E) There are two pi bonds created through overlap of an sp hybrid orbital on each C atom and a 1s unhybridized atomic orbital on each H atom.

8. The combustion of one gallon of gasoline produces 3.3×10^4 kJ of heat. Considering the thermochemical equation below, how many grams of ethanol, C_2H_5OH, are required to produce the same amount of heat as the combustion of one gallon of gasoline? Assume 100% yield and an excess of $O_2(g)$. Molar masses: ethanol = 48.08g/mol; O_2 = 32.00g/mol; CO_2 = 44.01g/mol; H_2O = 18.02g/mol

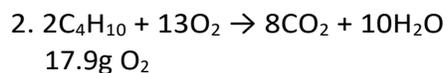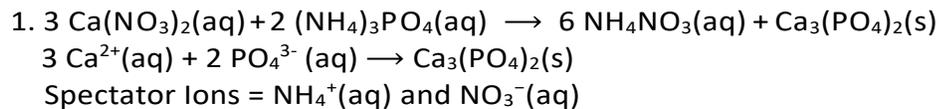$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l) + 1368kJ$$

9. Define vapor pressure in your own words. Draw an image to accompany your description.

10. Arrange the molecules in order of anticipated increasing vapor pressure: HF, GeH_4, SiH_4, PH_3, CCl_4.

11. The standard enthalpy of sublimation for a substance is 62.4 kJ/mol. If 153 kJ of energy are required to sublime 623 g of the substance, then what is the molar mass of the substance?

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1. $3\ Ca(NO_3)_2(aq) + 2\ (NH_4)_3PO_4(aq) \longrightarrow 6\ NH_4NO_3(aq) + Ca_3(PO_4)_2(s)$
   $3\ Ca^{2+}(aq) + 2\ PO_4^{3-}\ (aq) \longrightarrow Ca_3(PO_4)_2(s)$
   Spectator Ions = $NH_4^+(aq)$ and $NO_3^-(aq)$

2. $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$
   17.9g O_2

3. 3.97g

4. 3.5×10^{19} photons

5. A) **Corrected:** Z_{eff} is less than the atomic number, Z, for any given atom with more than one electron.
   B) **Corrected:** The value of Z_{eff} is closer to the value of the atomic number, Z, when the ratio of core electrons to valence electrons is smaller.
   C) **Correct**
   D) **Corrected:** The value of Z_{eff} increases progressing from left to right across a period because the number of valence electrons increases.
   E) **Corrected:** The value of Z_{eff} for Cl is closer to its atomic number, Z, than the value of Z_{eff} for Br is to its atomic number.
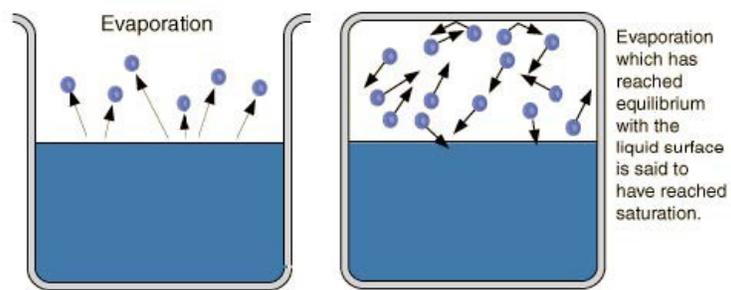
6.
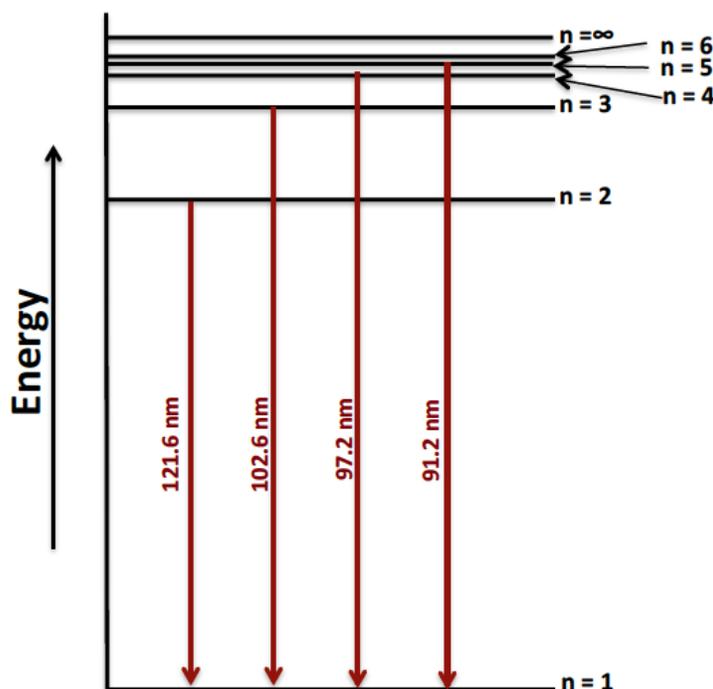
7. The answer is **A**. There are two pi bonds created through the overlap of unhybridized 2p atomic orbitals on each C atom.

8. 1200 g

9. Vapor pressure is the pressure a gas exerts on the surface of the liquid from which it evaporated.

10. $HF < PH_3 < CCl_4 < GeH_4 < SiH_4$

11. 254 g/mol