Chem1B, General Chemistry II

1.) Predict which nuclides should be stable and which should be radioactive. For those that are radioactive, predict which type of nuclear decay they are most likely to undergo.

a.) $^{7}_{3}\text{Li}$

b.) $^{134}_{53}\text{I}$

c.) $^{28}_{15}\text{P}$

2.) Predict the products, including their **structure**, from the following reactions. **Balance** the equations where appropriate.

a.) Combustion of heptane $\rightarrow$?

b.) Hydrogenation of 2-pentene $\rightarrow$?

c.) Hydration of cyclohexene $\rightarrow$?

3.) Calculate the nuclear binding energy for antimony-127 that has an **atomic** mass of 126.906924 amu in (1) **J/mole**, (2) **J/atom**, and (3) **J/nucleon**.

4.) Consider a molecule of tris(ethylenediamine)copper(II) nitrate ion.

a.) Give the appropriate chemical formula for the complex. _____

b.) What is the **coordination number**, if en is bidentate? _____

c.) What is the **oxidation state** of the metal? _____

d.) What is the **overall charge** on the complex? _____

e.) What **geometry** will the above complex adopt? _____

f.) Depict the crystal-field splitting pattern for the above complex, showing explicitly which d-orbitals move where, and fill it appropriately to show whether it is **paramagnetic** or **diamagnetic** (en is a **strong field** ligand).

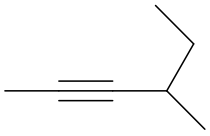
g.) The above compound absorbs strongly at 595 nm. Calculate the **splitting energy** between the d-orbitals in J/mole.

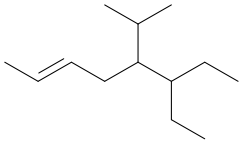
h.) What **color** will the compound appear to be?

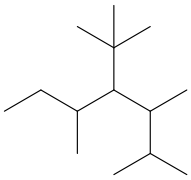
5.) Consider 2-butene. Draw its structure and the structures of all **five** of its isomers with the formula C_4H_8. Indicate whether each isomer is **constitutional** or **cis-trans** in comparison to 2-butene. Also indicate the **hybridization** at each individual carbon atom.

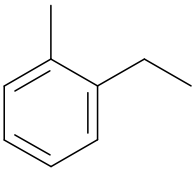
6.) Explain **why** alkanes exhibit conformational but not cis-trans isomerization but not cis-trans whereas alkenes exhibit cis-trans but not conformational.

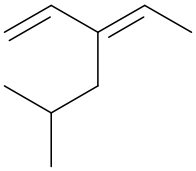
7.) Derive the correct IUPAC names for the following compounds. (21 pts)

(A) 

(B) 

(C) 

(D) 

(E) 

(A) _____

(B) _____

(C) _____

(D) _____

(E) _____

8.) The percent natural abundance of potassium-40 is 0.0117%. The radioactive decay of these atoms occurs 89% by β-emission and the rest by other decay modes. The half-life of potassium-40 is 1.25×10^9 years. Calculate the number of electrons produced per second by the potassium-40 present in a 1.00 g sample of the mineral microcline, $KAlSi_3O_8$. Assume that there are 365 days in a year.