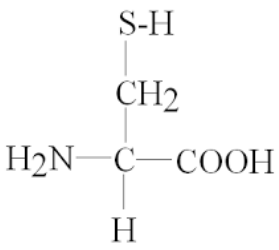
Carbon and the Molecular Diversity of Life Review

Chapter 4

1. Miller carried out a control experiment without discharging sparks and found no organic compounds. Provide an explanation for his observation.
2. Describe the importance of an atom's valence.
3. Explain why their hydrocarbon tails account for the hydrophobic nature of fats?
4. Draw a structural formula for C_2H_4. Draw the *trans* isomer of $C_2H_2Cl_2$.
5. Identify the characteristic that makes gasoline a useful fuel for cars and lipids a useful fuel for humans (and lots of other organisms). (Both consist largely of hydrocarbon chains, which provide fuel—gasoline for engines and fats for plant embryos and animals. Reactions of both types of molecules release energy.)
6. Predict whether you would expect to find isomers of propane (C3H8). Justify your prediction. (No. There is not enough diversity in propane's atoms. It can't form structural isomers because there is only one way for three carbons to attach to each other (in a line). There are no double bonds, so *cis-trans* isomers are not possible. Each carbon has at least two hydrogens attached to it, so the molecule is symmetrical and cannot have enantiomers.)
7. Draw the chemical formula for the hydroxyl, carboxyl, amino, and phosphate functional groups.
8. Identify what is indicated by the term *amino acid* about the structure of such a molecule.
9. Describe the chemical change that occurs to ATP when it reacts with water and releases energy.
10. Suppose you had an organic molecule such as cysteine (pictured below) and you chemically removed the $–NH_2$ group and replaced it with –COOH. Draw the new structure. Describe the change you would expect in the chemical properties of the molecule. State whether the central carbon is asymmetric before and after the change.



cysteine