$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

1 molecule C_3H_8 reacts with 5 molecules O_2 to give 3 molecules of CO_2 and 4 molecules of H_2O

10 molecules C_3H_8 react with 50 molecules O_2 to give 30 molecules of CO_2 and 40 molecules of H_2O

1 mole C_3H_8 reacts with 5 moles O_2 to give 3 moles of CO_2 and 4 moles of H_2O

Conversion factors:

$$\frac{C_3H_8}{5O_2} \qquad \frac{C_3H_8}{3CO_2} \qquad \frac{C_3H_8}{4H_2O} \qquad \frac{4H_2O}{5O_2}$$

A chemical equation links reactants and products with the relative numbers of moles of each component indicated by numerical prefixes. A mole of a substance is equal to 6.02×10^{23} molecules or atoms of that substance. 6.02×10^{23} is a magic number – if we weigh out a number of grams of a substance equal to its atomic or molecular weight, that number of grams will always contain 6.02×10^{23} atoms or molecules of the substance

$$C_3H_8 + 5\,O_2 \longrightarrow 3\,CO_2 + 4\,H_2O$$

1 mole 5 moles 3 moles 4 moles

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

1 mole C_3H_8 reacts with 5 moles O_2 to give 3 moles of CO_2 and 4 moles of H_2O

How many grams of O_2 are needed to burn 100 g of propane?

$$\frac{100 \text{ g } C_3H_8}{44 \text{ g/mol}} = 2.27 \text{ mol } C_3H_8$$

$$2.27 \text{ mol } C_3H_8 \times \frac{5 \text{ mol } O_2}{\text{mol } C_3H_8} = 11.36 \text{ mol } O_2$$

$$11.36 \text{ mol } O_2 \times 32 \text{ g/mol } O_2 = 363.6 \text{ g } O_2$$

How many grams of CO_2 are produced when we burn 500 g octane?

$$C_8H_{18} + O_2 \longrightarrow CO_2 + H_2O$$

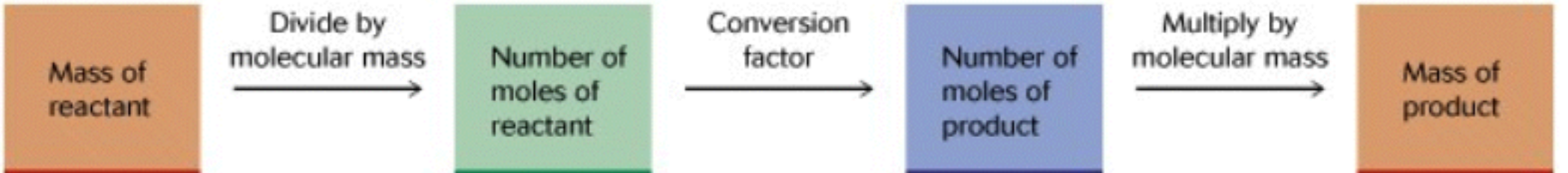
$$C_8H_{18} + 25/2O_2 \longrightarrow 8CO_2 + 9H_2O \quad \text{or}$$

$$2C_8H_{18} + 25O_2 \longrightarrow 16CO_2 + 18H_2O$$

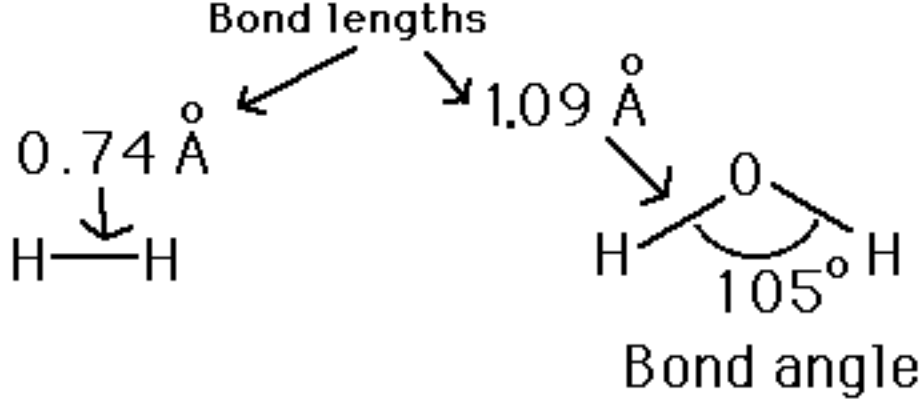
$$\frac{500 \text{ g } C_8H_{18}}{114 \text{ g/mol}} = 4.39 \text{ mol } C_8H_{18}$$

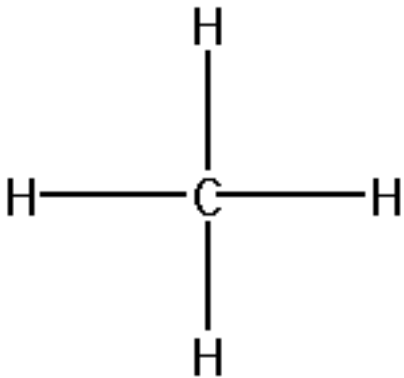
$$4.39 \text{ mol } C_8H_{18} \times \frac{8 \text{ mol } CO_2}{\text{mol } C_8H_{18}} = 35.12 \text{ mol } CO_2$$

$$35.12 \text{ mol } CO_2 \times 44 \text{ g/mol } CO_2 = 1545 \text{ g } CO_2$$

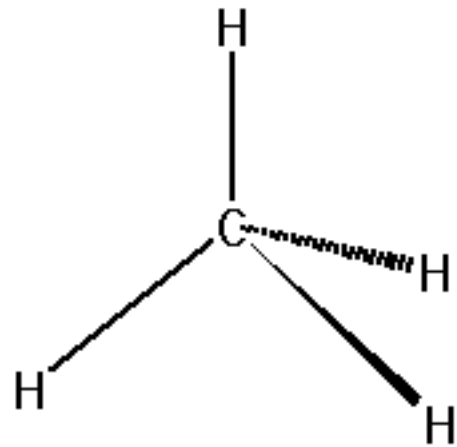

Mass of reactant
Divide by molecular mass
Number of moles of reactant
Conversion factor
Number of moles of product
Multiply by molecular mass
Mass of product

All covalently bound molecules have definite bond lengths giving them specific geometries. In a diatomic molecule such as H_2, the shape can be completely defined by specifying the bond distance. With more than two atoms in a molecule, we need more geometric parameters to define the molecular shape. The water molecule has two O–H bonds of equal length (1.09 Å) and an H–O–H bond angle of 105°.



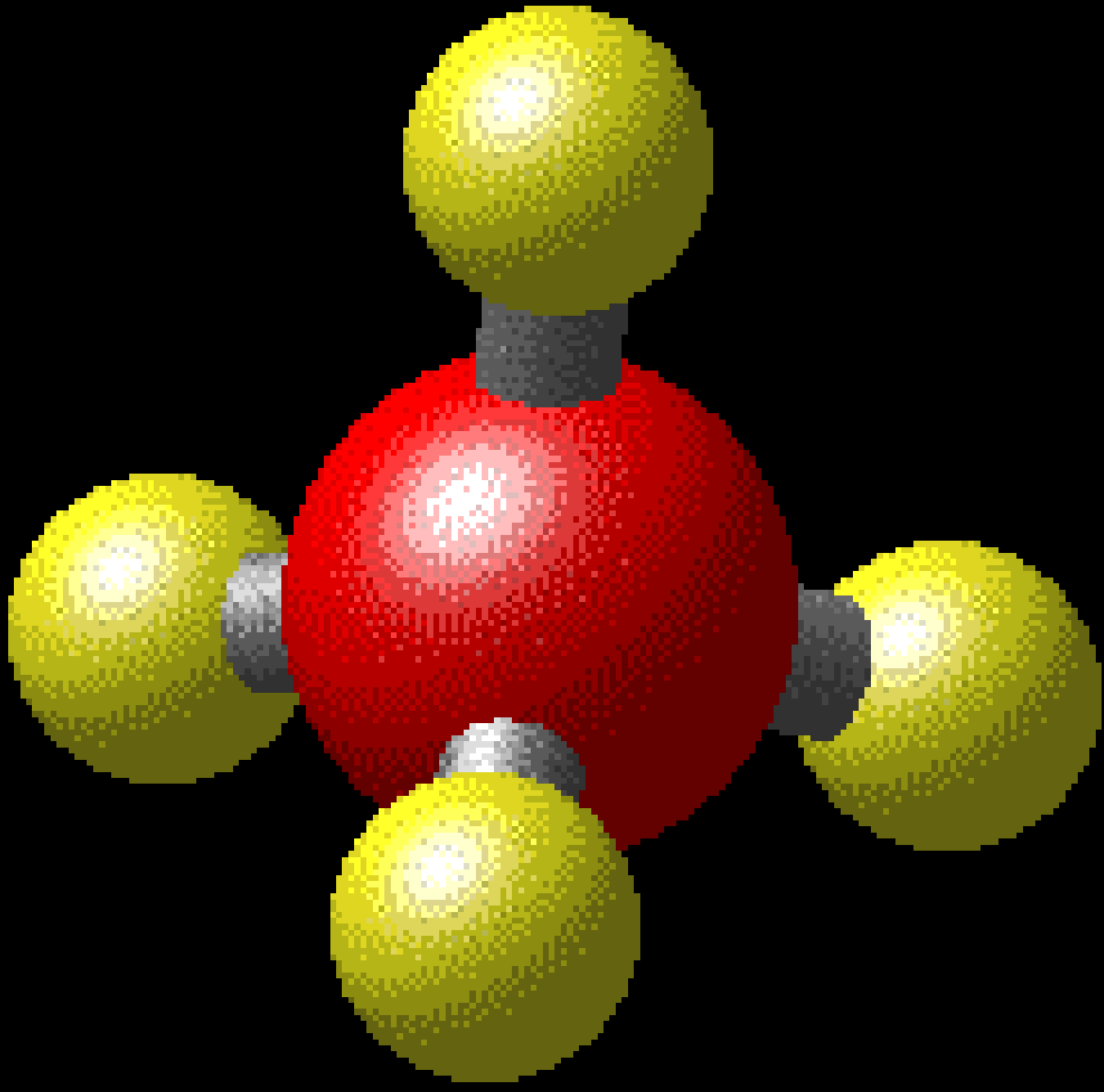


Planar Methane

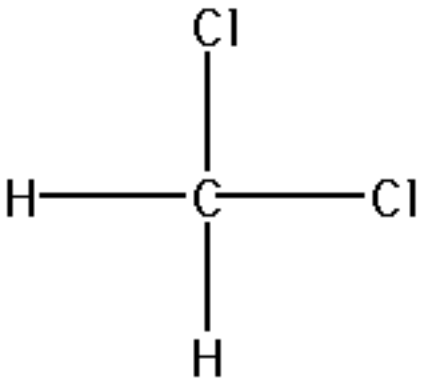


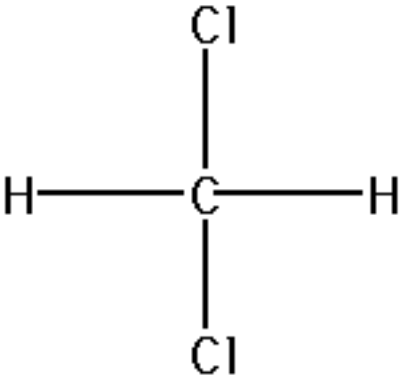
Tetrahedral Methane

Methane

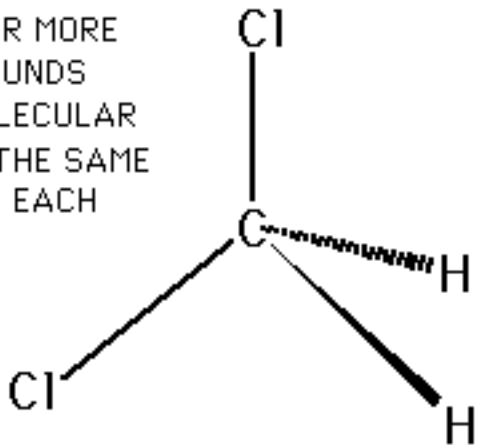


A planar CH_2Cl_2 could have 2 isomers:



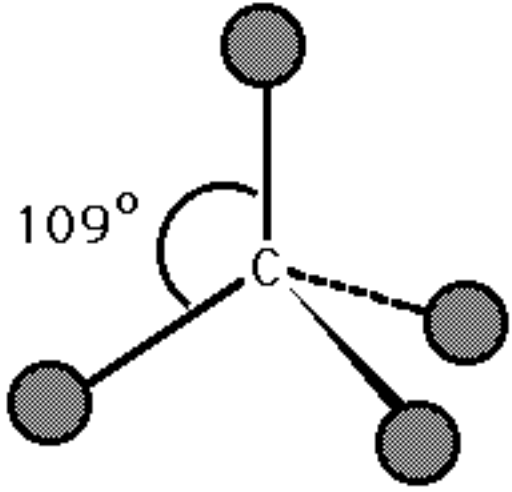


ISOMERS: TWO OR MORE DISTINCT COMPOUNDS OF THE SAME MOLECULAR FORMULA, WITH THE SAME NO. OF ATOMS OF EACH ELEMENT, BUT IN DIFFERENT ARRANGEMENT

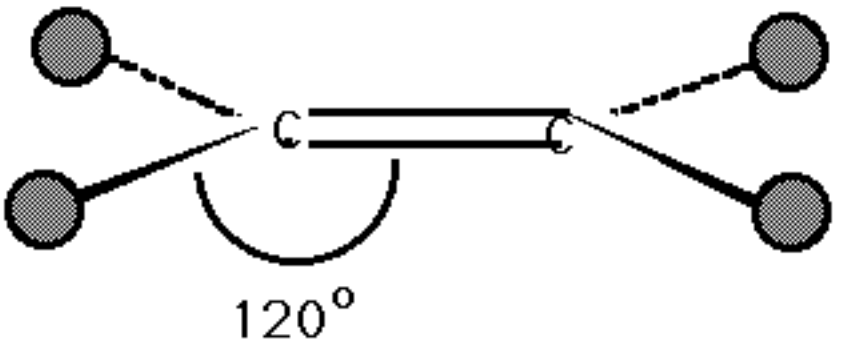


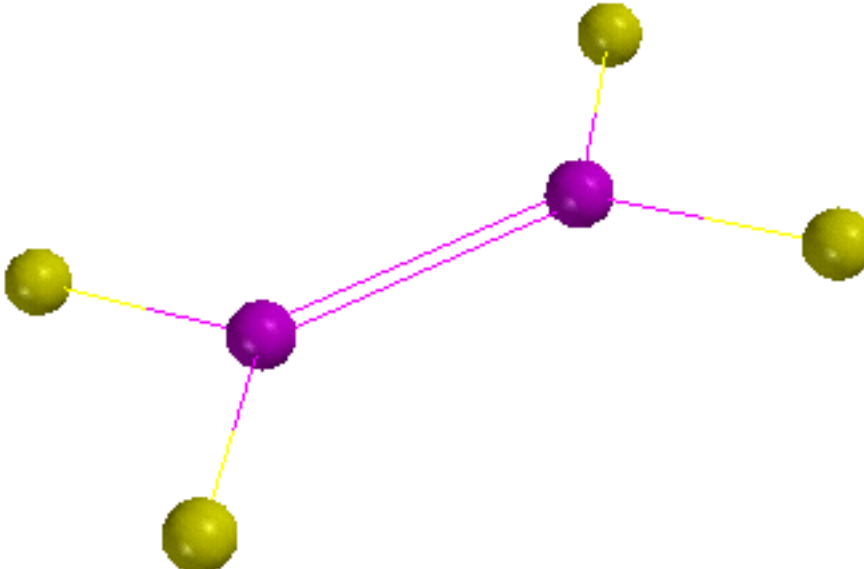
Only 1 isomer

Carbon with 4 single bonds is Tetrahedral

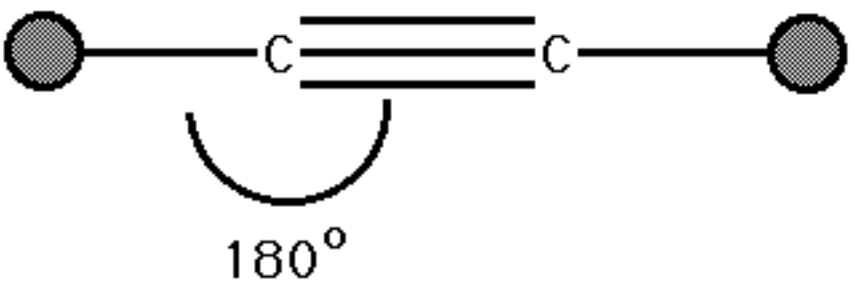


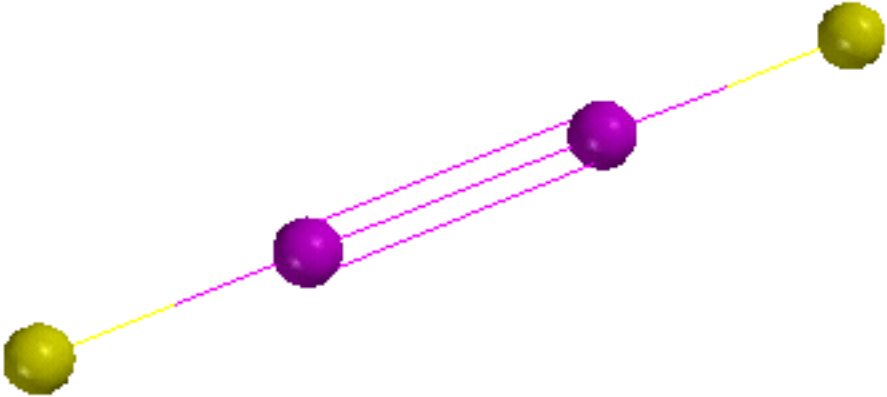
Carbon with 1 double bond is planar

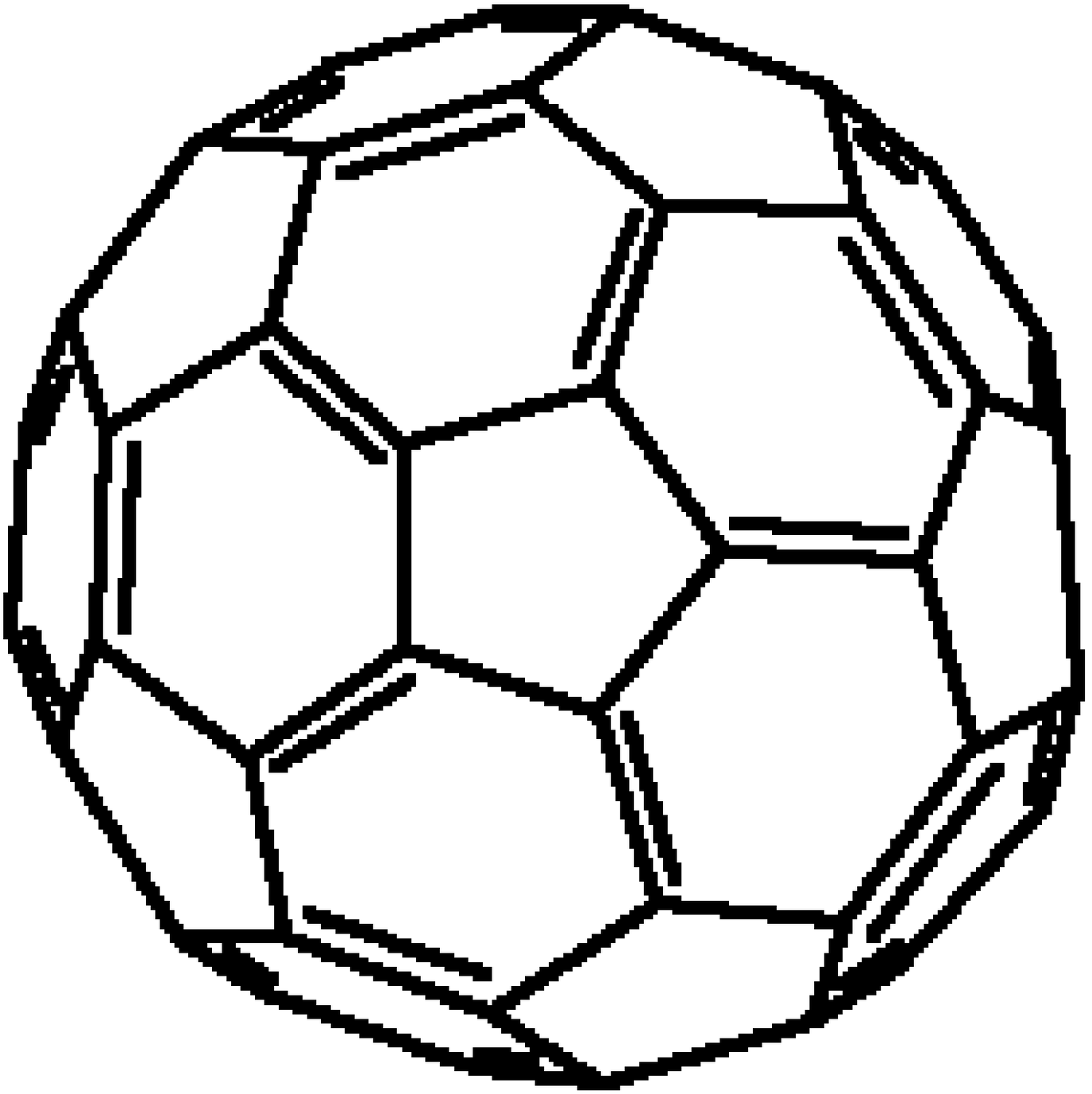




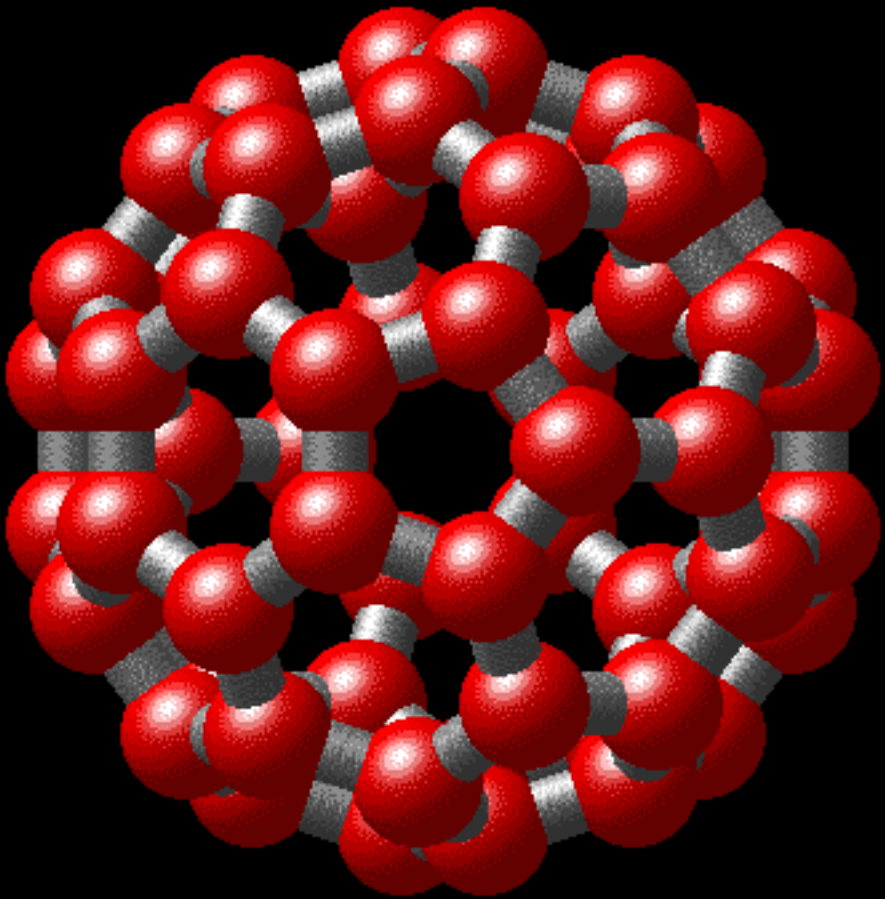
Carbon with 1 triple bond is linear



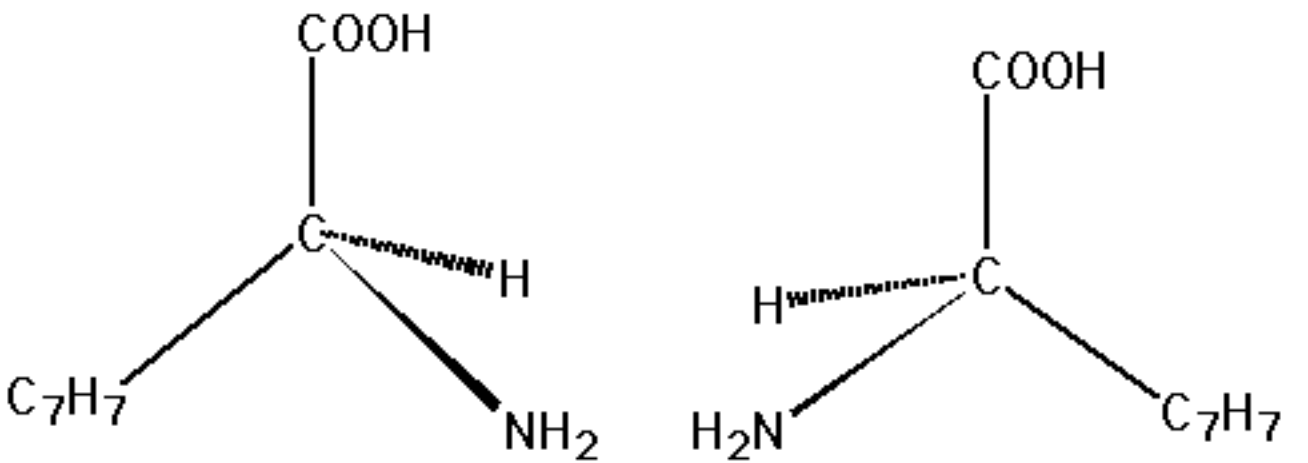




Bucky Ball

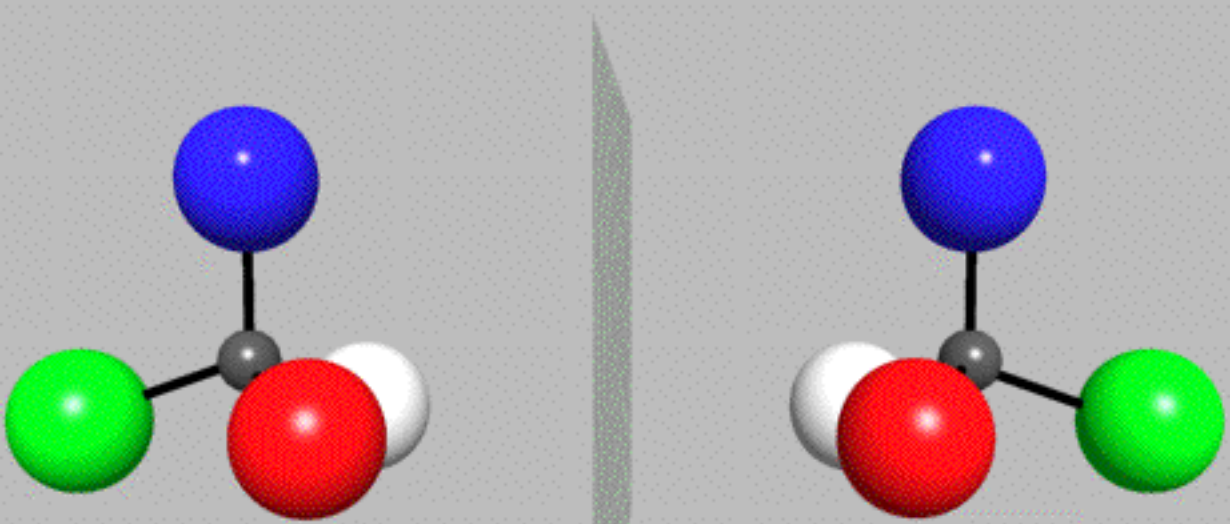


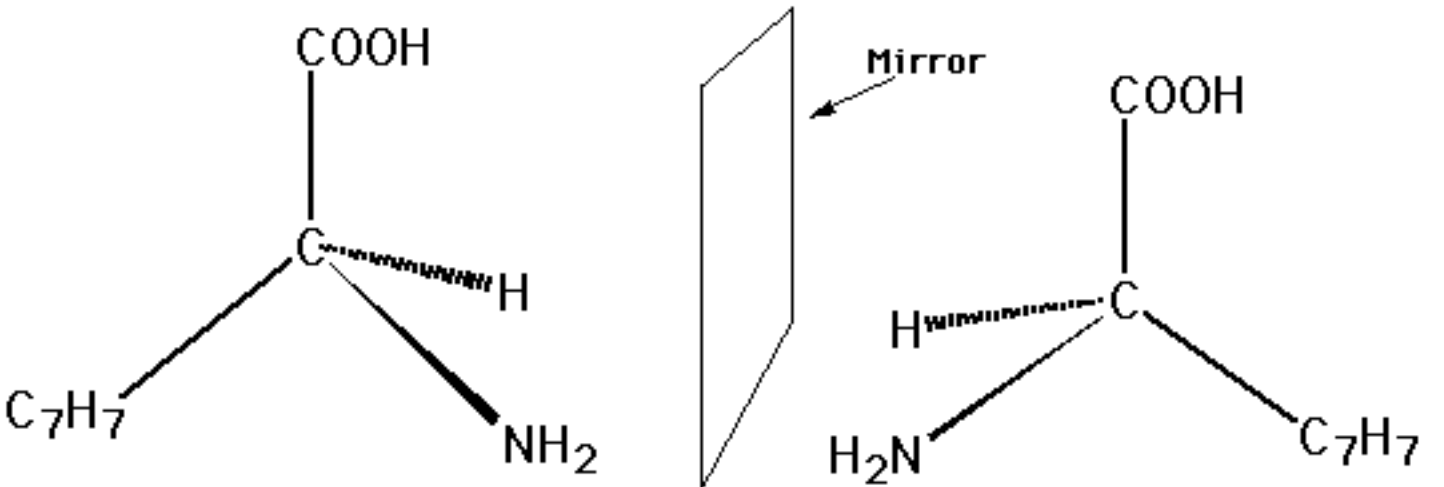
Isomers which are nonsuperimposable mirror images are enantiomers



2 Enantiomers of an Amino Acid : Phenyl-alanine

The Same-or Different?





TWO FORMS OF THE AMINO ACID PHENYLALANINE