The complex molecule Propanal was discovered in a dense interstellar cloud called Sagittarius B2(North) located near the center of the Milky Way galaxy about 26,000 light years from Earth. Astronomers used the giant radio telescope in Greenbank, West Virginia to detect the faint signals from a massive cloud containing this molecule. It is one of the most complex molecules detected in the 35 years that astronomers have searched for molecules in space. Over 140 different chemicals are now known.

Problem 1 - How many atoms of hydrogen (H), carbon (C) and oxygen (O) are contained in this molecule?

Problem 2 - What percentage of all atoms are hydrogen? Carbon? Oxygen?

Problem 3 - What is the ratio of carbon atoms to hydrogen atoms in propanal?

Problem 4 - If the mass of a hydrogen atom is defined as 1 AMU, and carbon and oxygen have masses of 12.0 and 16.0 AMUs, what is the total mass of a propanal molecule in AMUs?

Problem 5 - What is the complete chemical formula for propanal?

$$C_3 \ H \ \underline{\ \ } \ O \underline{\ \ }$$

Problem 6 - If this molecule could be broken up, how many water molecules could it make if the formula for water is H_2O?

Problem 1 - How many atoms of hydrogen (H), carbon (C) and oxygen (O) are contained in this molecule?

Answer; There are 6 atoms of hydrogen, 3 atoms of carbon and 1 atom of oxygen.

Problem 2 - What percentage of all atoms are hydrogen? Carbon? Oxygen?

Answer: There are a total of 10 atoms in propanal so it contains 100% x (6 atoms /10 atoms) = 60% hydrogen; 100%x(3/10) = 30% carbon and 100% x (1/10) = 10 % oxygen.

Problem 3 - What is the ratio of carbon atoms to hydrogen atoms in propanal?

Answer: 3 carbon atoms / 6 hydrogen atoms = 1/2.

Problem 4 - If the mass of a hydrogen atom is defined as 1 AMU, and carbon and oxygen have masses of 12.0 and 16.0 AMUs, what is the total mass of a propanal molecule in AMUs?

Answer: 1 AMU x 6 hydrogen + 12 AMU x 3 carbon + 16 AMU x 1 oxygen = 6 AMU + 36 AMU + 16 AMU = 58 AMU for the full molecule mass.

Problem 5 - What is the complete chemical formula for propanal?

$$C_3 \ H_{\textcolor{red}{6}} \ O$$

Problem 6 - If this molecule could be broken up, how many water molecules could it make if the formula for water is H_2O?

Answer: A single water molecule requires exactly 1 oxygen atom ,and since propanal only has 1 atom of oxygen per molecule, you can only get 1 molecule of water by dissolving a single propanal molecule.