

PART I

The Organic Mystery

Talks about the origins of organic chemistry, the theory of Vitalism and its collapse; the complexity of organic compounds and basic carbon chains; and the concept of valency and Kekule's structural diagrams.

You may wish to hand out the work sheet before the first viewing and help the students at various times by stopping the tape so they can find the correct answers or you may wish to view the tape twice with the students and hand out the question sheet for second viewing. This is up to the individual teacher and it does apply to all seven parts.

Question sheet:

1. The great chemist Jons Berzelius divided all substances into two great categories. What did he call them?
2. What was the Vitalist rule? How was it proven true?
3. Ordinary alcohol and dimethyl ether have the same basic formula C_2H_6O . What is the term used to describe different substances, like this, which have the same formula?
4. "Valency" is the term used to describe the combining powers of the elements. What is the valency of carbon? (How many hooks?)
5. What is the valency of Hydrogen?
6. Why is the ability of carbon atoms to link together into chains so important?
7. What advantage does a structural formula have over a basic (simple or empirical) formula?
8. In the program common salt was compared with table sugar. Although they look a like they are chemically very different. List two ways that they differ.
9. a) A carbon atom combined (hooked) with four hydrogen atoms makes a molecule of what substance? Is this a gas, liquid, or solid?
9. b) ... a carbon combined with two hydrogen and one oxygen is ...?
9. c) ... a carbon combined with two oxygens is ...?
10. The program stops at 1865. List three milestones in organic chemistry up to this date.

Answers to above questions sheet:

1. Berzelius divided all substances into the categories of organic and inorganic.
2. The Vitalist Rule said that organic substances could only be made by living things. This was disproved first by Friedrich Wohler in 1828 when he made urea from ammonium cyanate, an inorganic compound.
3. "Isomers" meaning equal parts.
4. The Valency of carbon is "4".
5. The Valency of hydrogen is (1).
6. Carbon's ability to join into chains makes it possible to form very large and complicated molecules.
7. A structural formula can show different arrangements of the same atoms. It can show isomers. Basic formulas cannot.
8. Ways that common salt and table sugar differ... They taste different (salty & sweet). Sugar has much more complicated formula than salt. Salt is a sodium chloride $-NaCl$. Sugar has a much more complicated formula than salt. Salt is inorganic. Sugar is organic.
9. CH_4 is the gas methane. CH_2O is the gas formaldehyde. CO_2 is the gas carbon dioxide.

10. Milestones given in the program to 1865 are.. Democritus and the idea of atoms. Jons Berzellius proclaims the Vitalist Divide. Berzelius also introduces modern chemical symbols. Wohler disapproves Vitalism. Frankland proposes valency. Kekule publishes his structural formulas, showing the versatility of carbon compounds and isomers.

We said Kekule's structural diagrams showed how carbon could support a huge number of variations. So far there are 16 million organic compounds known. The alchemists made many discoveries, but they confused them with religion and magic. Their "Holy Grail" was to turn lead into gold. Often they would write in secret code; as a result when an alchemist died, his knowledge usually died with him. Much had to be rediscovered again and again. How does modern science try to avoid this problem?

Unfortunately, valency is a concept that only works in a general way. There are exceptions. Find out about some of these and gain a more sophisticated understanding of how elements combine. Our program says that the periodic table started out as a list of elements in order of atomic weight. What is atomic weight and what is atomic number? Why was the change made and did it change the order at all? Where double and triple bonds are concerned we see types of isomerism called "cis" and "trans". What are these and why can they not occur with single bonds?

PART II

A Taste of Hydrocarbons

Tells of carbon's place in the periodic table of elements; reveals the logic of the alkane family and alkane isomers; looks at the IUPAC name system and the consolidation of valency; and the consolidation of valency; and presents the unique case of benzene.

Question work sheet. Again use your good judgment with this sheet.

1. Mendeleev's periodic table of the elements started out as a list of the elements in the order of their weight. But it was more than just a list. In what order did he list them?
2. What is the commonest atom with which carbon combines?
3. In the case of alkane hydrocarbons, what determines their density?
4. How many carbon atoms are there in a molecule of a. propane. B. methane. C. octane?
5. The alkane family of hydrocarbons is said to be 'saturated'. What does this mean?
6. Write the family formula of the alkanes.
7. Name two families of hydrocarbons other than alkanes. In each case state the main distinguishing feature.
8. Why do many organic substances have more than one name?
9. Write the basic formula for benzene.

Answers to above question sheet:

1. Mendeleev arranged the elements in rows so that similar elements went under each other in columns. In other words he grouped them according to their behavior.
2. Hydrogen
3. The density of alkanes is determined by the length of their carbon chain.
4. Propane 3, Methane 1, Octane 8.
5. "Saturated" means that the carbon atoms are attached to the maximum number of hydrogens possible. In other words all the bonds are single.
6. Alkane family formula $-C_nH_{2n+2}$