

7. A substitution reaction occurs when other atoms, or groups of atoms, are substituted for a hydrogen on a hydrocarbon chain.
8. The family formula for the alcohols is R-OH.
9. Nitrogen
10. Triglycerides are of the family of esters.

The modern version of the old cathode ray tube is of course a TV tube or a TV type computer monitor. In fact these are still often referred to as a CRT – for Cathode ray tube. They have built in magnets to control the electron beams. We said that an atom which had lost some electrons would bind to another atom which had an excess of electrons. That's right but it isn't the half of it. What we described is an ionic bond. Other types of bonds are covalent bonds, where atoms electrons (they may share equally or un equally; most organic compounds have bonds of this type.) There are metallic bonds, forming an electron sea. There are hydrogen bonds where (as in water) the hydrogen is bonded to an electronegative partner and is left with a lower electron density. The result of this is a polar molecule, which is attracted to other polar molecules (we will talk about this latter). And do not forget van de Waals forces between atoms.

## PART IV

### Improving on Nature

Organic chemistry goes industrial with William Perkin exploring carbon's tetrahedral bonds and the discovery of chirality. This video looks at the concept of atoms as 3D objects and 3D structural diagrams and models. There is also a brief look at various synthetic organic compounds developed from natural ones, both achievements and diffi.

Question sheet:

1. By the middle of the nineteenth century there were at least three important advances in chemistry. Name two of them.
2. What is the name given to substances which have two versions, each of which  
Changes light in a different way?
3. In three dimensional space carbon's bonds push as far apart as possible around its atom. Why?
4. For it to be possible for a molecule to have a mirror image version of itself the central atom must have at least four bonds and each one must have a different group attached. True or false?
5. Name three out of the four ways shown in the program of representing an Organic molecule.
6. Cocaine is a drug with good aspects and bad aspects. What are they, and What did organic chemists hope to do? Were they successful?
7. From what family of drugs do caffeine and nicotine come?
8. What is the common name for diacetylmorphine?
9. Name an organic compound that is beneficial in principle yet, when used on a large scale, has caused problems.
10. Why do you think the program showed a supermarket, when it talked about the benefits of organic chemistry?

Answers to above questions:

1. Valency. Structural diagrams. The periodic table. You could also say that the success of William Perkin drew public attention to the financial rewards of chemical synthesis.
2. Optical isomers.

3. Carbon's four bonds are based on its four outer electrons. Their similar electrical charge causes them to repel each other as far apart as possible.
4. True.
5. The four ways shown were a) basic formula b) flat structural diagrams c) 3D structural diagram d) molecular model.
6. Cocaine has the good aspect of being a powerful analgesic (pain killer). It has the bad aspect of being addictive. Chemists hoped to improve on its analgesic qualities while at the same time removing the addictive qualities. They were successful, by creating novocaine and xylocaine.
7. Alkaloids.
8. Heroin.
9. The program mentioned CFC gases and the insecticide DDT.
10. The supermarket contains numerous examples of products which are partly or wholly the result of modern organic chemistry.

Chemistry labs of today don't rely so much on the old methods of reacting chemicals together. Today mass spectra, NMR and IR combined make quick identification possible. What are these and how do they work? If you want to understand better about the positioning of covalent bonds around atoms, then find out about VSEPR (valence-shell electron-pair repulsion) theory and Lewis structures. The two versions of optical isomers are referred to as L or D (look carefully and you'll see this on the labels of the glyceraldehydes bottles in the program). What do L and D stand for? The standard approach, by the way, to marking bottles of separated isomers is with a (+) or a (-) before the compound's name.

## Part V

### Polymers And Plastics

Shows how carbon's structure allows it to be the backbone for macro molecules, and why starch and not cellulose is digestible by humans. Further sections show the extreme non-organic case of diamonds and the discovery of nitrocellulose and its importance; give the definitions of thermoplastics, thermosets, and glass transition temperature; and look at celluloid, bakelite, and nylon.

Question sheet:

1. The word 'polymer' comes from the Greek words 'poly' and 'meros'. What Do they mean?
2. On the Periodic Table carbon sits half way between what two elements? What is special about these two?
3. Starch and cellulose turned out to be polymers of what monomer?
4. Why can you digest starch, but not cellulose?
5. If cellulose becomes explosive when all its OH groups are replaced by nitrate groups, why didn't Schonbein's apron explode instead of just bursting into flame?
6. What was the first thermoplastic, which was made from cellulose?
7. Why is modern film called 'safety film'?
8. What was the first thermoset plastic called?
9. The glass transition temperature of hard plastic, as used for example in a CD case, is higher than room temperature. True or false?
10. Where does the raw material for most plastics come from these days?

Answers to questions above:

1. Poly means many. Meros means parts. Polymers are molecules with many repeating parts.