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.

2. On the Periodic Table carbon sits mid way between helium and neon. These Two elements are very stable and unreactive because their outer electron shells are complete. Helium has no electrons in the second shell (and its first shell is complete). Neon has 8 in its second shell (complete). Carbon sits mid way between them with 4 electrons in its second shell.
3. Glucose.
4. Glucose has two optical isomers, one known as alpha glucose, the other as beta glucose. A polymer of alpha glucoses is starch, a polymer of beta glucoses is cellulose. Humans lack the enzymes needed to break down beta linked glucose chains.
5. Obviously just soaking up some nitric acid off the floor didn't replace all the OH groups in the cotton. The flammability was limited. But Schonbein was an experienced chemist-he knew he was onto something.
6. Celluboid.
7. Modern film is no longer made of dangerously flammable celluloid. It's made of cellulose acetate, which won't burn, and it thus called 'safety film'.
8. Bakelite.
9. True. Otherwise it wouldn't be glassy. It would be soft.
10. These days the raw material for most plastics comes from the petrochemical industry. In other words it comes in the first place from oil.

Carbon's structure allows it to be the backbone for macromolecules. The extreme (non organic) case of diamond. Story of the glucose polymers cellulose and starch. Why starch is digestible by humans but cellulose is no. The discovery of nitrocellulose and its importance. Celluloid. Bakelite. Nylon. Definition of thermo plastics, thermosets, and glass transition temperature.

PART VI

This Petrochemical World

Refining processes, distillation, cracking and reforming; the huge reliance on petrochemicals not only for fuels but also for a multitude of compounds from plastics to insecticides; an introduction to oil, its origins and products and octane numbers; the problems of the scale of use, "Silent Spring" and plastic pollution; and chemistry as it faces environmental and ethical considerations.

Question sheet:

1. Plant and animal fats and oils have the same chemical formula as petroleum oils. True or false?
2. Name four hydrocarbons which occur in crude oil.
3. Which hydrocarbons come off at the bottom of the fractional distillation tower? Which come off at the top?
4. In the oil refinery, what does the catalytic cracker do?
5. Knock in an engine can mean that the fuel chosen burns at the wrong speed for the engine. Is that speed too fast or too slow?
6. What percentage of the world's energy comes from burning oil?
7. Other than fuels, name three products which require raw materials from the petrochemical industry.
8. What was the name of the biologist whose book 'Silent Spring' sparked a major debate about pesticides?
9. What is the single biggest problem in the disposal of plastics?