

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. Celluloid.
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?

10. The last sentence in the program is "Since public safety only follows public concern, understanding these issues will be crucial to our future". What does this mean?

Answers to above questions:

1. False. Petroleum oils are hydrocarbons. Fat and animal oils are triglycerides.
2. Mentioned in the program are: natural gas, methane, butane, petrol, kerosene (jet fuel), diesel, lubrication oil, bitumen, petroleum, wax, alicyclics and aromatics. Of course there are lots more.
3. Waxes, bitumen and lubrication oils come off at the bottom of the tower. At the very top methane, ethane, propane and butane are drawn off as gases.
4. The catalytic cracker takes molecules of heavier oil and breaks (or 'cracks') them down into the smaller molecules that make petrol.
5. Too fast.
6. 40% of the world's energy comes from oil.
7. We mentioned solvents, paints, glues, dyes, plastics, perfumes, fibres and cloth, fertilizers, pesticides, drugs and explosives. The list is really very long.
8. Rachel Carson.
9. The overwhelming majority of plastics are not biodegradable. So disposal becomes a big problem.
10. Put another way-if people don't understand the issues they won't care about them. And if they don't care about them then they are risking their future safety.

We wanted to talk about burning plastics as a way of disposing of them. But there's a problem here too. What is it? We didn't mention tetraethyl lead, the longest-lived method of increasing the octane number of petrol (since the 1930's). We didn't mention it because it's not used now. Why isn't it used now? Why was it used for so long? We had to cut out the full story of thalidomide (lack of time again). Thalidomide was given to women in the nineteen sixties as a drug to prevent nausea during pregnancy. But there was inadequate research before its release. It turned out that thalidomide had an optical isomer which was a dangerous mutagen. Tests had been done on the safe isomer, but the manufactured drug was a racemic mixture, meaning that it contained both isomers. Many babies were born horribly malformed. We now know that even the safe isomer can be changed by the body to create some of the dangerous form, so it's totally banned for pregnant women. But it has minimal effects on adults themselves, and recently thalidomide has shown itself to be useful anti-cancer drug.

PART VII

Proteins

Describes how protein is intimately involved in life processes, and how proteins function as hormones; looks at the discovery of amino acids, their family formula, and polymerization of them; takes a look at peptides, denaturing albumin, and the levels of protein structure; and shows the lock and key model of enzyme action with an introduction to enzymes themselves.

Question sheet:

1. What chemical element distinguishes the amine group of compounds and is a signature of protein?
2. What is the simplest amino acid?
3. How many amino acids are present in human biology?
4. A molecule of what substance is dropped off when two amino acid units bond?