

1. **electrolysis** The production of a chemical reaction by passing an electric current through an electrolyte. In electrolysis, positive ions migrate to the cathode and negative ions to the anode. The reactions occurring depend on electron transfer at the electrodes and are therefore redox reactions. At the anode, negative ions in solution may lose electrons to form neutral species. Alternatively, atoms of the electrode can lose electrons and go into solution as positive ions. In either case the reaction is an oxidation. At the cathode, positive ions in solution can gain electrons to form neutral species. Thus cathode reactions are reductions.
2. **Isomers** are chemicals which have the same number and type of atoms but have them arranged in a different way. Methane, ethane, and propane have no isomers because there is only one way the carbons can hook together. Butane has two isomers (n-butane and isobutane). Decane has seventy five isomers, and a molecule with 20 carbon atoms has over 100,000 isomers. Crude oil contains molecules having 1 to 100+ carbon atoms. Naming these compounds based upon normal chemical rhetoric would be hell on earth! The huge number of possible molecular arrangements is why people talk of fractions instead of using proper chemical nomenclature.
3. All engineers employ mathematics, physics, and the engineering art to overcome technical problems in a safe and economical fashion. Yet, it is the chemical engineer alone that draws upon the vast and powerful science of chemistry to solve a wide range of problems. The strong technical and social ties that bind chemistry and chemical engineering are unique in the fields of science and technology.
4. The heavy chemical industry, in its classical form, was based on inorganic chemistry, concerned with all the elements except carbon and their compounds, but including, as has been seen, the carbonates. Similarly the light chemical industry uses organic chemistry, concerned with certain compounds of carbon such as the hydrocarbons, combinations of hydrogen and carbon. In the late 1960s the phrase heavy organic chemicals came into use for such compounds as benzene, phenol, ethylene, and vinyl chloride. Benzene and phenol are related chemically, and they are also related to toluene and the xylenes, which can be considered together as part of the aromatic group of organic chemicals, the aromatic compounds being most easily defined as those with chemical properties like those of benzene.
5. The fertilizer industry is not only a matter of manufacturing the right chemical but also of distribution, getting the right material to the right place at the right time. Fertilizers are made centrally but must be distributed over a large agricultural area. A fertilizer factory is, typically, a large installation, characterized by enormous storage silos; the product is manufactured all the year round, but it requires considerable space to store it until the few weeks during which it is distributed on farmlands.
6. During the 19<sup>th</sup> century sulfuric acid was necessary in the production of alkali salts and dyestuffs, two giants of the day. Today the largest single use is in the manufacture of fertilizers. It is also necessary in petroleum purification, steel production, electroplating, and automobile batteries. The production of TNT (trinitrotoluene), nitroglycerin, picric acid, and all other mineral and inorganic acids require sulfuric acid. "Fuming" sulfuric acid contains excess amounts of sulfur trioxide and fume when exposed to air, hence it's name.
7. Coal is a mixture and has no single molecular structure. However, continuing research has deduced a general type of structure for coal. For example, molecular weights range between 300 and 1000, and the structure is characterized by a profusion of rings of carbon atoms, some rings bonded to each other (fused) and other rings bonded into long chains. The chains are bonded to each other at various points. By way of contrast with coal, the structure of petroleum has fewer rings of carbon atoms and less bonding of chains to chains.
8. Two of coal's major drawbacks are that it is a relatively dirty fuel and difficult to handle. Coupled with the atmospheric pollution caused by sulfur-containing coal, these drawbacks were prime reasons for a major shift from coal to petroleum in electrical generating plants, particularly in the industrialized nations, late in the 1960s. The dangerous and unhealthy character of deep coal mining and the environmental disruption caused by strip mining contributed to the shift.