

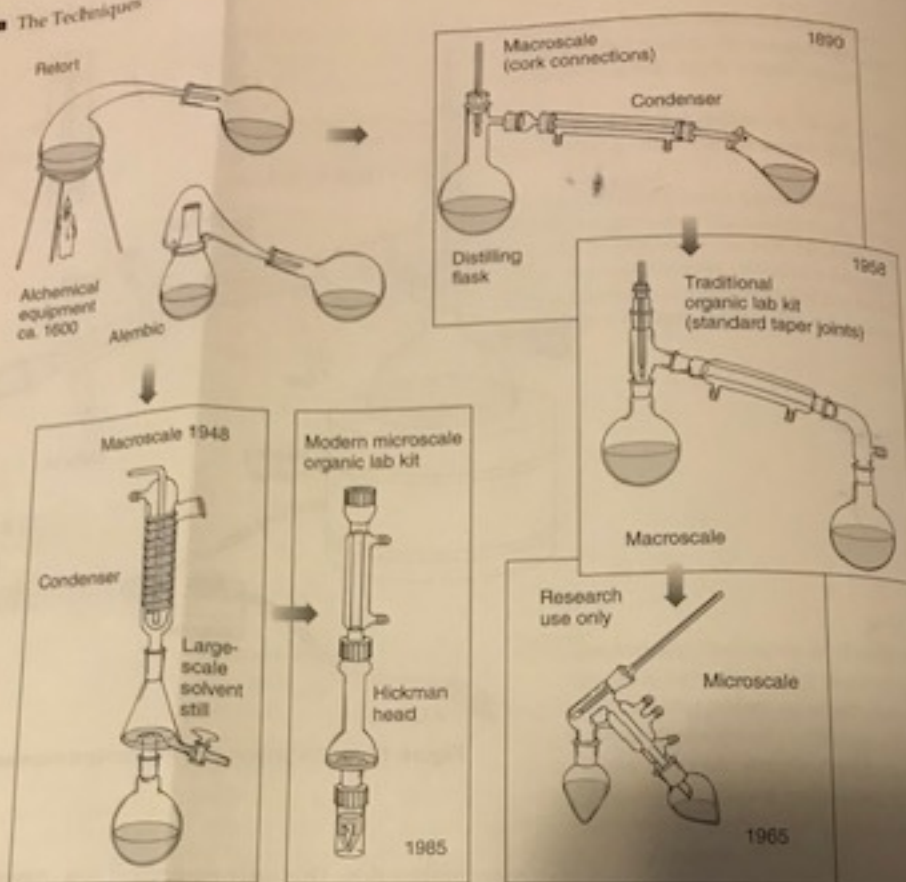


Figure 14.2 Some stages in the evolution of distillation equipment from alchemical equipment (dates represent approximate time of use).

14.2 Distillation Theory

In the traditional distillation of a pure substance, vapor rises from the distillation flask and comes into contact with a thermometer that records its temperature. The vapor then passes through a condenser, which reliquefies the vapor and passes it into the receiving flask. The temperature observed during the distillation of a pure substance remains constant throughout the distillation so long as both vapor and liquid are present in the system (see Figure 14.3A). When a liquid mixture is distilled, often the temperature does not remain constant but increases throughout the distillation. The reason for this is that the composition of the vapor that is distilling varies continuously during the distillation (see Figure 14.3B).

For a liquid mixture, the composition of the vapor in equilibrium with the heated solution is different from the composition of the solution itself. This is shown in Figure 14.4, which is a phase diagram of the typical vapor-liquid relation for a two-component system (A + B).

In Figure 14.4, horizontal lines represent constant temperatures. The upper curve represents vapor composition, and the lower curve represents liquid composition.