We know that hexane is a large nonpolar molecule with a big surface area, giving it strong London dispersion forces. All the molecules that dissolved in hexane had very large surface areas, or in the case of dichloromethane, had small surface areas but were very massive, so the net adhesive forces of dichloromethane were similar to that of hexane.

The largest molecule that I could dissolve in water with a 10 drop:10 drop ratio was tetrahydrofuran, which has a molar mass of 72.68. Tetrahydrofuran’s shape is that of a ring, so while it has a much greater mass that water, it has an available surface area comparable to molecules such as 1-propanol or acetic acid, both of which are also polar and soluble in water. The molecules that did not dissolve in water had boiling points that were either much greater or much lesser than that of waters boiling point. The larger boiling points were molecules that had very large masses in combination with a large surface area (e.g. decane), or had a large enough dipole in combination with a large mass and surface area (e.g. pentyl acetate, pentanol), and thus their cohesive forces were much stronger than the cohesive forces of water. The small boiling points were molecules which were very massive, but did not have a large enough surface area, even if they had large dipoles (e.g. dichloromethane, very large dipole, large mass, but very small surface area), so their cohesive forces were much weaker than the cohesive forces of water. This explains why each “group” of molecules had boiling points higher or lower than water but with both not being soluble in it.

While the polarities of dichloromethane and water are similar, dichloromethane has a mass very close to that of hexane, which is much greater than the mass of water, so the adhesive forces of dichloromethane and hexane are very similar to each other and very different in value than the adhesive forces of water, meaning that both are not very soluble in water while they are soluble in each other.

Diethyl ether has a larger surface area than tetrahydrofuran, and tetrahydrofuran has a much larger dipole moment than diethyl ether. While they have similar masses, these differences are enough to make tetrahydrofuran soluble in water while diethyl ether is not very soluble in water.

When I mixed the oil and water, little oil “bubbles” formed and floated to the surface. A similar thing happened with hexane and water. When I added the SDS to the oil-water mixture, it appeared to homogenize and turned opaque. When I added the SDS to the hexane-water mixture, it also appeared to homogenize but was clear.

Canola oil contains many different types of molecules, most of which are much larger than hexane. Because of this, when the detergent forms micelles around the different molecules in the oil, they are different in size and very large, and thus more light is absorbed, making the mixture opaque. For the hexane, a relatively small molecule compared to the molecules in canola oil, the micelles formed were all more or less identical in size and much smaller than the micelles in the oil-water-SDS mixture, so more light is allowed to pass through, making the mixture clear.