salt, are like, and that is perhaps the reason that so little attention has been paid to the definition of solutions; what every one has a clear idea of, hardly needs defining. But when we come to speak of solutions of colloids, difficulties arise. It is not hard to distinguish true solutions of crystalloids, for they are characterized by the circumstance that for every temperature there is a fixed and constant ratio between the quantities of substance dissolved and solvent. But when we come to apply this criterion of solubility to colloid solutions, we find it insufficient. Some maintain that such solutions are in reality nothing but suspensions or emulsions[1]; and indeed this may be true in certain cases, for there exist as wide differences between colloids and colloids as between crystalloids and colloids. But the question at issue is, Can a suspension or emulsion remain perfectly homogenous for an indefinitely long time? The question can be answered in the affirmative in the case of suspensions or emulsions in which the suspended or emulsified particles have the same density as the suspending or emulsifying liquid. This is an extreme case, it is true. Still it proves that there may be entirely homogeneous mixtures which are certainly not solutions.

Again, it may be said that the surface tension between the extremely small emulsified or suspended particles and the liquid may be so great that, in comparison with it, gravity vanishes. According to this, even if there existed a difference of density between the particles and the liquid the emulsion or suspension would remain as such indefinitely. Their exist then homogeneous mixtures that may not be true solutions.

Further, under certain conditions, a true solution may become heterogeneous. If one part of a solution be at a different temperature or pressure from another, diffusion will take place and the solution will cease to be homogeneous.

With reference to the third question, probably all will agree in understanding by mechanical means, in this connection, filtration, subsidation, etc. In regard to subsidation, it has been shown above, that many emulsions and suspensions do not subside even after the lapse of a long time, so that this criterion fails in this respect. But let us see if we cannot separate a solution into its constituents by means of filtration. Take a solution of casein in dilute sodium carbonate, for instance. This passes quite freely through ordinary filter-paper; but if the paper be converted into parchment paper, although the sodium carbonate still passes quite freely through its pores, the casein is retained. If now an amorphous precipitate of ferrocyanide of copper be deposited in the parchment paper, even the salt is kept back, only the water being able to pass through the interstices of the precipitate. Thus by mechanical means a solution has been resolved into its component parts.

We conclude, then, that the existing definitions of solutions are inadequate; it remains to propose another more in accordance with fact.

Scientific definitions generally consist in the statement of certain attributes that separate as by a boundary the thing to be defined from all other things. If, then, there exists some attribute of solutions which is ever present, and indeed characterizes them as such; if other attributes are but different modes of expressing this essential attribute, such an attribute can well serve to define solutions. An attribute that fulfils the above conditions is the osmotic pressure. A solution is accordingly a *homogeneous mixture exerting an osmotic pressure.*

It is, of course, assumed that temperature and pressure are constant, else a solution might cease to be homogeneous. As osmotic pressure is a term applied only to mixtures in the liquid or solid state, it follows that "gaseous solutions" do not exist. For a "solution" of a gas in a gas, mixture is much the better term, and is indeed in common use; for a solution of a liquid in a gas, the proper word is still mixture, as well as for the rare case of the "solution" of a solid in a gas.

That osmotic pressure is the true criterion of solutions has strict scientific warrant. As soon as the conception of a pressure in solutions analogous to that in gases was gained, a great stride in advance was made. The most striking properties of solutions, diffusion, lowering of the freezing point, raising of the boiling point, are directly due to osmotic pressure; hence if osmotic pressure be predicated of solutions, it is implicitly stated that they diffuse, boil at a higher and freeze at a lower temperature than the solvent. All other properties of solutions are also more or less directly referable to osmotic pressure. The definition proposed is, therefore, entirely adequate, sharply separating solutions from all other mixtures.

[1] See my paper "On the Nature of Colloid Solutions" in American Journal of Science for March, 1892.

TEXAS GYPSUM FORMATION.

BY DUNCAN H. CUMMINS, AUSTIN, TEXAS.

PROMINENT among the strata composing the Permian formation in Texas, are the Gypsum Beds, which, taken with those of the north-west, are the most extensive of any such formations in the world. The Texas beds extend over an area of upwards of six million acres. Extending from the north line of the State, south, to the line of the Texas and Pacific Railroad, the beds vary in thickness from that of a sheet of paper up to seventy-five feet. The east line of the deposit passes Sweetwater, on the line of the Texas and Pacific Railroad, in Nolan County. The west line passes about twenty miles east of the Staked Plains. The greatest thickness of these beds is about nineteen hundred feet.

There are six forms of gypsum to be found in these beds, all contain the same chemical ingredients, but differ in their manner of crystallization: selenite, rose, massive, radiated, and fibrous gypsum, and alabaster.

The selenite is a clear, transparent variety, and may be split into very thin slices. Excellent cabinet specimens of this variety may be found in the red clays near Guthrie, in King County.

Rose gypsum is a foliated selenite, found only in one place in this belt, so far as has been reported, and that near Sweetwater, in Nolan County. The plates are fixed in the form of a rose and are so called by the people of that vicinity.

Massive gypsum is the principle form of which these beds are composed, this form occurs in beds of varying thickness at different horizons, ranging in thickness from one inch to seventy-five feet throughout this belt. It is generally white in color, but often it possesses a blue or reddish cast.

The radiated variety is usually round in figure, the lines of crystallization diverging from a common centre. This form possesses high specific gravity.

Fibrous gypsum, or satin spar as it is sometimes called, occurs in white or slightly colored deposits throughout this belt. Very few of these seams exceed two inches in thickness, although there may be seen in the museum of the Texas Geological Survey blocks of this form, from Kent County, exceeding twelve inches in thickness.

Alabaster occurs in many localities throughout the gypsum belt. Its beauty as a cabinet specimen is due to its color and translucent structure. It may be carved into many ornaments, and is capable of receiving a high polish.

Besides these six distinctive forms, the gypseous marls and the heavy beds of gypsiferous sandstones occur in great abundance throughout this area. Many of the above-mentioned forms have beautiful combinations and weatherings. Noticeable among these are a puddingstone gypsum, a combination of blue and white massive gypsum, a striated form composed of alternating layers of red and white massive gypsum, and a form of alabaster exhibiting very peculiar weatherings, grooves being washed in many directions on its surface, also a beautiful cabinet specimen from King County, it being round nodules of alabaster or selenite with a heavy incrustation of carbonate of copper.

On account of the scarcity of transportation, no uses are being made of these vast beds, which are unexcelled for use as fertilizers, or the manufacture of plaster of Paris.

In conclusion, to the scientist, Texas presents opportunities for study excelled by no place. Her geological and mineralogical products are subjects for discussion the world over, and no prettier field is open for investigation than the Texas gypsum formation.