tion that each substance is an aggregate of particles, with intermolecular spaces (See Section 1), for this is not a case of chemical union and condensation.

4. Take four ounces of the best white castile-soap, or better palm-oil soap. Put the soap in a quart-bottle after cutting it into thin shavings. Fill up the bottle with pure rain water. Shake well till all the soap is dissolved, or as much as will dissolve. *If it does not* settle clear on standing, pour off some of the liquid and add more water, till finally a clear solution is obtained. Then add to some of this clear solution half its own volume of pure concentrated glycerine. This will produce magnificent bubbles. With a common clay pipe it is easy to blow them three or four inches in diameter. Pour a *little* of the mixture into a shallow dish and dip into it the open mouth of a common tumbler or a wide mouthed jar. The mouth will be covered with a thin film. Observe the play of colors, The theory of light enables us to measure the thickness of this film. A gary band always appears before the bubble bursts. In the soap films made by Plateau the thickness scarcely reached the millionth of a millimeter (·0394 inch). Sir. Wm. Thompson has shown that it is impossible for such a film to contain more than one layer of molecules. As a parallel case: Rosaniline dye gives a distinct color to 100-million times its weight of alcohol.

5. Faraday prepared goldleaf the thickness of which he estimated at the hundreth part of a wave-length of light or not more than the 5-millionths of a millimeter. A grain of common goldleaf covers 49 sq. inches. A square inch of this may be cut into 100 strips, and each strip into 100 peices all visible to the naked eye. One of these peices weighing one 490-thousandth of a grain, may be attached to glass and have parallel lines ruled across it at the rate of 10,000 or even 224,000 *to the inch: So that a grain of gold can by mechanical* means alone be divided into 4,900,000,000 or more fragments each of which is still visible by means of the microscope. But when goldleaf is dissolved in nitro-hydrochloric acid the subdivision is carried much farther, and the particles are no longer visible even with the most powerful magnifiers.

6. *Three millionths of a millionth of a gramme, or less of sodium* may be detected by the appearance of the peculiar yellow line in the spectrum of a substance. If a clear platinum wire which of itself gives no color to the flame, be passed between the fingers, the yellow sodium flame will be seen when the wire is again put into the flame. For sodium exists in the dust suspended in air, and in fact is almost universally present.

7. Make colorless solutions of potassic iodide (KI) and mercuric chloride ($HgCl_2$) commonly called corrosive sublimate. Pour them separately into a small jar of water. They produce bright scarlet mercuric iodide. ($2KI+H_2Cl_2=2KCl+H_2I_2$.)

8. Use plumbic nitrate (nitrate of lead) and KI—bright yellow.

9. Argentic nitrate (nitrate of silver) and KI—pale yellow.

10. To a weak solution of starch add a few drops of chlorine water. Drop into this some solution of KI and a deep blue appears. The Cl unites with the K to produce KCl (potassic chloride), and the I with the starch forms a deep-blue compound.

11. *Dissolve by heating a little gallic acid in some strong sulphuric* acid. A rich crimson is produced.

12. Add a dilute solution of ferrocyanide of potassium to a very dilute solution of copper nitrate. Red color produced.

13. Add a dilute solution of copper nitrate to a solution of common salt, and heat the mixture. Bright green cupric chloride is formed.

14. Heat together a small quantity of mercury and plenty of flour of sulphur. Bright red vermillion is produced.

15. Take two warm glass jars with the necks ground so as to fit each other closely. Moisten the interior of one jar with a little hydrochloric acid (HCl) and cover the mouth with a piece of glass. Moisten the interior of the other jar with a little ammonia (NH_3) and immediately place it mouth downwards on the glass plate and exactly over the mouth of the lower jar. So long as the glass plate remains the jars will appear empty. Withdraw the glass and the two gases will combine to form solid ammonic chloride (NH_4Cl), or *sal ammoniac, which will be seen at first as a white cloud* and afterwards as a fine dust in the jars.

16. Grind together equal parts by weight of ammonic chloride and sodic sulphate. Two dry solids form a semi-liquid mass, dissolved in their own water of crystallization.

17. Make a warm and thick solution of white sugar and add slowly *in a wide mouthed jar less than half full, some strong sulphuric acid* (H_2SO_4). Stir gently, and the clear syrup will be blackened and a semi-solid, porous mass of carbon left in the mortar or jar. The acid withdraws the elements of water from the sugar and leaves the carbon.

18. Grind together two dry solids, acetate of lead, and sulphate of zinc. They form a liquid. (See Exp. 16.)

19. Boil some distilled water in a large test tube about half full. Keep dropping in lumps of calcic chloride until the boiling water will dissolve no more. Have ready a little dilute sulphuric acid in wide mouthed tumbler, wine-glass, or egg-cup. Pour into this the solution of calcic chloride. Two liquids produce a milk white solid, which may be turned out on a piece of dark colored blotting paper. This solid is gypsum, calcic sulphate, or plaster of paris.

20. Powder separately some lime and some sal ammoniac. Stir the dry powders together and a pungent gas (NH_3) is evolved when the mixture is slightly warmed.

21. Mix four parts of dilute sulphuric acid with five parts of the powdered crystals of sodic sulphate. Great cold is produced. The thermometer will fall from 50° Fah. to 3°.

22. Strong hydrochloric acid poured on powdered ice lowers the temperature about 15° Fah.

23. Finely powered fresh crystals of sodic sulphate drenched with *strong hydrochloric acid—temperature sinks from* 50° F. *to* 0°.

24. Place a thin slice of yellow phosphorus, which must be cut under water and handled cautiously, upon a bit of sheet iron. When it has become quite dry, sprinkle upon it a few grains of iodine. The vapors of iodine and phosphorus combine and evolve sufficient heat to set fire to the phosphorus.

25. *Dissolve a small quantity of red phosphorus in carbon disulphide.* Pour out the solution on a filter paper laid over a retort ring. The liquid evaporates in a few minutes leaving the P. in a very minute state of division. The oxygen of the air combines with it and spontaneous combustion takes place.

26. Fill a plain retort entirely full, tube and bulb, with milk of lime. Drop in a dozen slices of yellow phosphorus cut as thin as possible (under water). Put the thumb over the end of the retort and place the end under the surface of lime water in a shallow dish. The retort will remain entirely full. Place the spirit lamp under retort. Some of the lime-water will boil out into the dish, but no air must be allowed to enter the retort, else there is danger of an explosion. After the retort has been heated for some time, a gas, phosphoretted hydrogen (PH_3) will be given off and rise through the water of the dish. *As each bubble of gas comes in contact* with the air a flash of light is seen, especially in a dark room, the spontaneous combustion of the gas forming beautiful rings of smoke which are luminous in the dark, and revolve vertically round a circular axis and at the same time the whole ring increases in diameter horizontally.

27. Take a shallow glass dish full of water. Throw in a number *of small fragments of phosphorus. Surround and cover these with* powdered potassic chlorate. Put the end of the funnel down through the water and pour strong sulphuric acid directly on the chlorate and the phosphorus. The chlorate is decomposed; its oxygen seizes the phosphorus, which burns with a distinct flame under water.

To be continued.