2. Chemical force (like cohesion) cannot act at a distance; it changes the properties of the substances on which it acts. Experiments to illustrate these facts.

3. Apparatus used in chemical experiments. Bunsen-burner and spirit-lamp; test-tubes and test-tube stand; test-glasses; Woulff's bottles; flasks; retort-stand; iron-wire gauze; beakers; evaporating-dishes; crucibles; tripods; crucible tongs: the uses of these pieces of apparatus.

4. Preparation of hydrochloric acid from common salt and sulphuric acid; the principal properties of this gas—it fumes in air; is heavier than air; has sour taste (is an acid); very soluble in water.

5. Illustrations of the difference between a mechanical mixture and a chemical compound. Forces which produce the chemical combination of hydrogen and chlorine—(*a*) light; (*b*) heat. Chemical union is termed combination or synthesis; and chemical separation is termed analysis. Heat always, light often, produced in chemical combination.

6. Meaning of decomposition or analysis. Examples: Decomposition of oxide of mercury by the aid of heat; chlorate of potash is also decomposed by heat. Decomposition of water by the aid of a current of electricity. Decomposition of hydrochloric acid by electricity.

7. Water: Exists in nature in three states; is a compound consisting of hydrogen and oxygen; synthesis of water—(*a*) burn hydrogen in oxygen; (*b*) explode a mixture of hydrogen and oxygen; (*c*) pass hydrogen over heated oxide of copper.

Decomposition of water—(*a*) obtain hydrogen from water by the action of sodium; (*b*) decompose water by a current of electricity.

8. Oxide of mercury: consists of mercury and oxygen. Mercury and its principal properties. Oxygen—recapitulation of properties. Synthesis of mercuric oxide by heating (to 600° F.) mercury to near its boiling-point, in air. Decomposition of mercuric oxide by heating to a still higher temperature.

9. Meaning of combustion or burning. Show that a burning candle is extinguished when placed in a vacuum. Take oxygen from a jar of air—no burning can occur in the nitrogen which is left behind. A body burning in air combines with the oxygen of the air and increases in weight. Experiments to illustrate this. Meaning of oxidation. Light generally, heat always, produced by burning, slow combustion—no light produced, and heat produced very slowly. Rusting of metals, particularly iron. Spontaneous combustion of finely divided iron and lead.

10. Iron-rust or oxide of iron: composed of iron and oxygen. Many iron-ores, as hæmatite and magnetic oxide, are iron-oxides. Synthesis of iron-rust. Burn iron wire (or steel spring) in oxygen—a black iron-oxide is formed, containing a little less oxygen than red rust. Show that a piece of iron increases in weight when it rusts. Rusting is slow oxidation. Iron does not rust when placed in an atmosphere free from oxygen. Pass steam over red-hot iron. Analysis of iron-rust. Pass dry hydrogen over heated iron-rust; water formed and metallic iron left behind. Meaning of the term reduction.

11. Meaning of word "binary." Other important binary compounds—carbon-dioxide or carbonic-acid gas—its synthesis and analysis. Production of carbon-dioxide from carbonate of lime. Properties of carbon-dioxide. Ventilation.

12. Sulphur-dioxide, its preparation and properties; common salt, its synthesis; sand as a binary compound; ammonia as a binary compound.

Recapitulatory lessons will be given as time permits.

*Second Stage.*—"Preparation and properties of the common gases, such as oxygen, hydrogen, nitrogen, and chlorine. The chemical character and constituents of pure air and pure water, and the nature of the impurities sometimes found in both. Effects of plants and animals on air."

*Second Year's Course.—Syllabus of Fortnightly Demonstrations.*

*Lesson I.*—Matter and its three states; the thermometer; changes of state; melting; evaporation; boiling; condensation; distillation and its uses; sublimation; volatility; filtration.

*Lesson II.*—General properties of gases; distinction between gases and vapours; gases have weight; gases have the power of expanding and producing pressure; pressure of the atmosphere; expansion of gases by heat; how pressure affects the volume of a gas; Boyle's Law; diffusion of gases.

*Lesson III.*—Oxygen, its occurrence in nature; preparation of oxygen (*a*) from mercuric oxide, (*b*) from a mixture of potassium-chlorate and black oxide of manganese, and (*c*) from the air. Properties of oxygen. Ozone, an allotropic form of oxygen. Its preparation and properties.

*Lesson IV.*—Combustion of substances in oxygen, as phosphorus, sulphur, sodium, carbon, and magnesium; products of combustion. Increase of weight after combustion. Chemical changes produced by heat.

*Lesson V.*—Hydrogen, its preparation from hydrochloric acid and zinc, and from water and sodium; properties of hydrogen.

*Lesson VI.*—Water as a binary compound; methods of proving the chemical composition of water (*a*) by analysis, and (*b*) by synthesis; properties of water; effect of pressure on the boiling-point of water. Papin's Digester.

*Lesson VII.*—The impurities usually present in water; solvent power of water; hard and soft water; matter in suspension in water; use of filters; matter in solution; inorganic impurities—carbonate of lime, sulphate of lime; common salt; mineral springs.

*Lesson VIII.*—Organic impurities in water, how to discover them; temporary and permanent hardness; methods of softening and purifying water.

*Lesson IX.*—Nitrogen. Methods of obtaining nitrogen from the air,—(*a*) Burn phosphorus in a bell-jar containing air, (*b*) pass air over heated copper; properties of nitrogen; its function in the air; nitrogen is contained both in ammonia (a strong base) and in nitric acid (a powerful acid).