XIV. The prineiple of Archimedes. Weight of a body of known volume in air and water. *Experiments:* Weigh ebony cube in air and water. Show it is lifted up by the weight of water displaced; hence it affords a means of determining the volume of an irregular solid. Weigh the 100-gram weight in water, and then in methylated spirit. Show how we can thus get weight of known volume of methylated spirit.

XV. The principle of Archimedes. Weight of a body of unknown volume in air and water. *Experiments:* Weigh glass stopper in air and water, and determine volume and density. Weigh same stopper in methylated spirit, and thus find weight and volume of displaced spirit, and hence, density. Counterpoise beaker of water, hang in it stopper supported by thread from retort-stand; add weights to restore balance.

XVI. Expansion of liquids and gases. General effects of heat on matter. Apparent expansion. Temperature. *Experiments:* Fit up flask and tube as (1) a water and (2) an air thermometer. Melt ice and note temperature.

XVII. Thermometry. Changes in state. Ice, water, and steam. Hidden or latent heat. Conversion of scales. *Experiments:* Construct an alcohol thermometer; make scale for ordinary ranges of atmospheric temperatures. Determine melting-point and boiling-point.

XVIII. Distillation. Purification and separation of liquids. *Experiments:* Distil solution of ink, sugar, salt, &c. Distil beer or weak alcohol solution; find density of the distillate.

XIX. Revision.

XX. Revision.

Stage II.

Lesson 1. Evaporation. Condition of atmosphere as regards moisture. Systematic observations. Weather-charts. *Experiments:* Find loss of weight of dish of water day by day. Record graphically. Repeat experiment with larger and more shallow dish.

Lesson 2. Changes in weight of a bag of seaweed, compared with results of Lesson 1. Wet and dry bulb thermometers. *Experiments:* Weigh day by day bag of seaweed or roll of flannel. Take readings of hygrometer, barometer, thermometer, &c.

Lesson 3. Solution and solubility. Distinction between melting and dissolving. Determination of solubility of common substances. Saturation. *Experiments:* Ascertain, by experiments with small quantities on watch-glasses, what common substances are soluble in water; also show that some substances, such as iron, litharge, and sulphur, though not dissolved by water, are soluble in other liquids, such as acids, vinegar, nitric acid. Make saturated sclutions of salt, soda, borax, alum, chalk, lime, &c. Evaporate in weighed dish 10 c.c. of each, and find weight of residue. Depict graphically relative solubilities.

Lesson 4. Crystallization. Saturation alters with temperature. *Experiments:* Prepare crystals of alum, sugar, soda. Examine small crystals under lens. Determine solubility of alum at 20° C. and at 100° C.

Lesson 5. Measurement of heat depends on the quantity of matter and temperature for the standard substance water. The heat unit or calorie. Water equivalent of calorimeter. *Experiment:* Place a small copper vessel inside a beaker, but separated from it by loosely packed cotton wool. Mix known quantities of hot and cold water at known temperatures, and determine how many heat units have been absorbed by copper calorimeter. Hence, determine number of heat units absorbed when calorimeter is raised 1° C.

Lesson 6. Heat capacity or specific heat. *Experiment:* By method of mixtures determine number of heat units required to raise 1 gram of mercury 1° C. Repeat with lead shot, tin tacks, &c. (Allow for capacity of calorimeter.)

Lesson 7. Comparative study of the action of water and lime, chalk and marble. Heat a sign of chemical union. *Experiments:* Add water to lime, chalk, and marble, and note all changes. See how many heat units are given to water when 50 grams of lime are mixed with 100 grams of water. Add excess of water to weighed quantities of lime, marble, and chalk; dry on oven, and determine the water each has permanently taken up.

Lesson 8. The lime-kiln and the changes concerned in the manufacture of lime. *Experiments:* Heat $\frac{3}{4}$ gram of marble or chalk in furnace for half an hour. Determine loss of weight. Leave the lime to slake in air for a day, add excess of water, evaporate and weigh.

Lesson 9. Preparation of the gas which escapes from the lime-kiln. Chalk-gas and its properties. *Experiments:* Heat chalk or marble in iron tube fitted with asbestos plug and delivery-tube. Collect gas, and examine with lighted match, litmus, and lime-water; show it is heavier than air.

Lesson 10. Comparative study of the action of acids on chalk, lime, and marble. Preparation of the gas evolved from chalk. Its identity with chalk-gas. *Experiments:* Make experiments with small quantities on watch-glasses of the action of acids on above substances. Collect several jars of gas by displacement of air and of water.

Lesson 11. Weight of gas obtained from 1 gram of chalk by action of acids. *Experiments:* Weigh a flask containing acid and chalk, before and after the evolution of gas.

Lesson 12. Determination of volume of gas evolved from 1 gram of chalk. *Experiments:* Allow gas evolved to displace water from an aspirator; measure water displaced, and note temperature. Repeat experiment to obtain a mean of results.

Lesson 13. Synthesis of chalk from lime and chalk-gas. *Experiment:* Leave a dish of good lime under a jar of chalk-gas over water. After some hours note rise of water, and examine the dish for chalk. Pass chalk-gas into a large volume of lime-water, filter, and collect precipitate.

Lesson 14. To prove the white precipitate obtained above is chalk. *Experiment:* Carefully dry ·75 grams, and heat in furnace for twenty-five minutes. Show loss of weight is about 44 per cent.

Lesson 15. The action of chalk-gas on chalk in the presence of water. *Experiments:* Continue to pass chalk-gas into lime-water until the precipitate which first forms is redissolved. Boil some