

of the solution, collect and examine the gas evolved, and identify the white substance precipitated with chalk.

Lesson 16. Hard water and its effect on soap. *Experiments:* Dry some fur taken from the inside of a kettle. Find the percentage loss of weight, when treated with acid, or by heating. Add soap solution to distilled rain, tap, and artificial hard waters.

Lesson 17. Formation of chalk-gas in the lungs. Why does it not accumulate in the atmosphere? *Experiments:* Inspire air through one vessel of lime-water, and expire it through another.

Lessons 18–20. Revision.

Stage III.

Lesson 1. The hardness of water. Action of hardness on soap. Measurement of hardness. *Experiment:* Make artificial hard water by passing chalk-gas into lime-water till clear. Boil this solution. Add soap solution to it. Make standard soap solution, and examine tap, rain, and distilled water with it.

Lesson 2. Burning of animal and vegetable substances in the air. *Experiments:* Heat weighed pieces of fat and lean meat in furnace; also bread, wood, paper; determine ash. Heat some wooden splinters in hard glass tube; burn the charred remains in air on platinum wire.

Lesson 3. Heating of mineral substances in air. *Experiments:* Heat weighed quantities of iron, copper, sulphur, and red-lead (in bone-earth crucible) in furnace.

Lesson 4. The rusting of iron. The nature of the change. Is the air concerned? Is water concerned? *Experiments:* Leave weighed quantity of iron borings or small French nails to rust in air: after two days, dry and weigh again. Leave iron nails under boiled distilled water for several days. Leave a muslin bag of iron borings suspended in jar of air over water for twenty-four hours.

Lesson 5. Examination of inactive part of air. Burning of a candle, of phosphorus, and of sulphur. *Experiments:* Test inactive part of air with litmus lighted taper, lime-water, &c. Burn candle, phosphorus, and sulphur in bell-jar of air. Test products of combustion and residual gas in each case as above.

Lesson 6. The rusting of phosphorus in air. Composition of air. Immaterial nature of heat. *Experiments:* Burn small piece of phosphorus in round-bottomed florence-flask, fitted with india-rubber stopper. Weigh before and after. Open under water; measure volume of water entering. Leave a stick of phosphorus to rust slowly in jar of air over water. Examine residual gas.

Lesson 7. The rusting of copper in air. Identity of residual air with the inactive part found in other experiments. *Experiments:* Pass air from aspirators over a weighed piece of copper gauze strongly heated in hard glass tube. Collect and examine issuing gas. Seal up bright copper gauze in hard glass tube; heat one end of gauze.

Lesson 8. The inactive part of air obtained from rusting-iron experiment (Lesson 4) will not rust copper. *Experiments:* Prepare aspirator of inactive air by rusting iron. Pass gas slowly over heated copper gauze. Put bag of filings to rust in air in which phosphorus has been burnt.

Lesson 9. Active part of air. Synthesis of air. *Experiments:* Heat red-lead in iron tube with asbestos stopper. Collect the active part, and examine its properties. Fill up a jar in which iron has rusted with this gas, and examine the mixture.

Lesson 10. Preparation and examination of active part of air. *Experiments:* Prepare several jars of oxygen by heating a mixture of potassic chlorate and manganese peroxide. Burn sulphur, phosphorus, iron wire in the case. Examine products of combustion. Show identity with those obtained in Lesson 5. The names oxygen and nitrogen.

Lesson 11. The burning of bread and of charcoal in air or oxygen. Signs of chemical union. *Experiments:* Pass current of air over bread heated in glass tube; examine the gases evolved. Pass oxygen from aspirator over charcoal heated in boat; examine gas evolved. Show identity of charcoal-rust with chalk-gas.

Lesson 12. Action of acids on metals. Examination of gases evolved. Burning of "inflammable air." *Experiments:* Try action of nitric, sulphuric, and hydrochloric acid on iron, copper, lead, zinc. Collect several jars of "inflammable air" and examine.

Lesson 13. Preparation and identification of the liquid formed in Lesson 12 with water. *Experiments:* Burn inflammable air against well-cooled surface. Collect liquid formed. Find boiling-point and freezing-point. Hydrogen.

Lesson 14. Is water hydrogen-rust, that is, oxide of hydrogen? The removal of oxygen from oxide of copper. *Experiments:* Pass well-dried hydrogen from aspirator over weighed oxide of copper in boat (heated). Collect water formed in calcium-chloride tube, weighed before and after experiment. Determine composition of water and percentage of copper in copper-oxide.

Lesson 15. Analysis of water by heated iron. *Experiments:* Pass gentle current of steam over iron contained in heated iron tube. Collect gas evolved and show its identity with hydrogen. Weigh the iron before and after experiment.

Lessons 16–20. Revision.

(3.) BIRMINGHAM SYLLABUS.

INSTRUCTION IN ELEMENTARY SCIENCE.

SYLLABUS FOR MECHANICS, OR ELEMENTARY NATURAL PHILOSOPHY, AS DEFINED IN THE FOURTH SCHEDULE OF THE CODE.

First Stage.—"Matter in three states: Solids, liquids, and gases. Mechanical properties peculiar to each state. Matter is porous, compressible, elastic. Measurement as practised by the mechanic. Measure of length, time, velocity, and space."

NOTE,—Instruction in this subject should be purely descriptive and experimental.