

*Section 1.*—British and metric systems of measurement. Errors of observation and errors arising from too great reliance upon arithmetical calculations. Volumes of solids and liquids. Use of the balance. Flotation (iceberg, ship, Plimsoll line, submarine boat, dirigible). Principle of Archimedes. Density and specific gravity of solids and liquids. Common hydrometer and lactometer. Simple experiments dealing with solution of gases and solids in liquids. Evaporation, condensation, distillation, filtration, crystallization, emulsion.

*Section 2.*—Ideas of pressure and thrust in fluids (U tube, water-level, spirit-level, gauge-glass, town water-supply, artesian well). Transmission of fluid pressure (hydraulic press, jack, pressure-gauge). Pressure of gases (Boyle's law, syringe, siphon, cycle-pump, lift-pump). The barometer (mercurial and aneroid). Representation of forces. The spring balance. Experimental determination of the resultant of two concurrent forces and of parallel forces; graphical determination of the former. Moments and the couple. Tests of accuracy of a balance and methods of weighing. Centre of gravity and its bearing on equilibrium. Determination of position of centre of gravity in very simple cases. Simple and common contrivances based upon the lever and the inclined plane.

*Section 3.*—Simple experiments on the properties and composition of air. Combustion (fire, candle, Bunsen burner, gas-stoves, petrol). Ventilation and heating of rooms. Oxidation and the formation of oxides, particularly oxides of carbon. Respiration and the carbon cycle. Composition and properties of water. Simple experiments of oxygen, hydrogen, and carbon.

*And either—*

- (a) The difference between chemical and physical change and between mechanical mixtures and chemical compounds; indestructibility of matter; hard and soft waters; chief impurities of water; an elementary study of sulphuric acid, caustic soda, common salt, washing-soda, copper sulphate, and limestone as examples of acids, alkalies, and salts; *or—*
- (b) Simple study of the plant as an organic whole; an elementary knowledge of the chemical constituents of plants and the sources from which the plant derives them, treated as a cycle of transformations from living to non-living matter and back again; simple qualitative and quantitative experiments illustrating the nutrition of plants, the conduction of water and food substances in the plant, storage of reserve material, respiration, and transpiration; influences of temperature, moisture, and light on the growth of plants.

The candidate will be expected to show that he has acquired by actual experiment, observation, and measurement his knowledge of the matters set forth in the sections of the above syllabus selected by him; but he will not be expected to show that he is familiar with other than the simple apparatus and appliances commonly used in connection with elementary instruction in practical physics or chemistry in secondary schools. He will be required to forward, before the date of examination, a certificate in the prescribed form that he has carried out satisfactorily a course of practical work based on the syllabus.

#### (4) *Chemistry.*

Air; its weight; rusting of iron and the effect on the composition of air; effect of heating in air, lead, copper, sulphur, phosphorus, magnesium; volumetric analysis of air; detection of water and carbon dioxide in the air; constituents of air; respiration and the carbon cycle.

Air and combustion; the burning of a candle; structure of candle and gas flames; fuels (wood, coal, coke, charcoal, coal-gas, kerosene, petrol); products of combustion; danger of imperfect combustion.

Water; natural waters; common impurities and methods of removing them (*e.g.*, sedimentation, boiling, distillation, chlorination); hardness of water; composition of water; water of crystallization (easy experiments).

The determination and graphic representation of the solubility of solids in water at different temperatures (easy cases).

Preparation (laboratory and commercial) and properties of oxygen, nitrogen, and hydrogen.

Elements, mixtures, compounds; chemical and physical changes; indestructibility of matter; symbols, formulæ, equations; the determination in easy cases of the weight of the materials required to yield or to combine with a given weight of a given substance.

Experiments illustrating modes of chemical action. The nature and general properties of oxides, acids, bases and salts.