

XI. On January 1st, 1881, *A* gave *B* a note for \$85, bearing interest at 7 per cent. per annum. On this note the following amounts are endorsed: April 1st, 1881, \$15; July 15th, \$27; September 1st, \$26. What sum should *A* pay to *B* in order to cancel the debt on January 1st, 1882 (no days of grace)?

XII. *A* bought an article for \$40, and sold it to *B* at a certain gain per cent. *B* sold it to *C*, *C* to *D*, and *D* disposed of it for \$82.944. If each man gained the same percentage on what the article cost him, find what that percentage was? *Ans.* 20 %.

NOTE.—The answer to Question 4, Entrance Examination to High Schools, page 500, December MONTHLY, should have been printed 103 $\frac{1}{2}$ lbs., and not 30.4 lbs. The answer is obvious, as the space occupied by 56 lbs. of lead is to be filled with platinum, and then it is required to find the weight of this bulk of platinum.

SCIENCE.

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INTERMEDIATE CHEMISTRY.

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I.—(i.) Describe the chief properties of oxygen.

(ii.) You are given oxygen, nitrous oxide, and nitric oxide in separate bell-jars; how would you proceed to distinguish them?

(iii.) Describe the action of plant and animal life upon the oxygen of the air.

(i.) (1) *Physical Properties*.—A gas colourless, odourless, tasteless, invisible, heavier than air; slightly soluble in water, and non-condensable (except at very low temperature and high pressure).

(2) *Chemical Properties*.—Oxygen unites chemically with all the elements, fluorine excepted, to form compounds called oxides.

It is the union of the oxygen of the air with the constituents of the wood, the coal oil, or the coal gas (chiefly carbon and hydrogen), that produces the light and heat of ordinary combustion. The greater the attractive force between the oxygen and the substance uniting with it, the greater will be the amount of heat resulting from their combination.

It has been found by experiment that the burning of a pound of hydrogen in oxygen gives out more heat than does the burning of a pound of anything else in oxygen (a pound of hydrogen gives out 34.462 therms—a pound of carbon only 8.080 therms).

Oxygen has the strongest affinity for hydrogen. If a mixture of two volumes of hydrogen and one of oxygen be made in a soda water bottle (wrap bottle in a stout cloth), and a light applied to its mouth, the gases will unite with explosive force, forming water. Some metals unite slowly with the oxygen of the air at ordinary temperatures (rust), others upon the application of heat. In pure oxygen the oxydizing action is much more vigorous.

A glowing splint will instantly relight in pure oxygen; lighted sulphur will burn with an intense blue flame; phosphorus with dazzling brightness; resin, camphor, paraffin and wood charcoal with brilliant effects; iron wire tipped with burning sulphur, with great splendour.

(ii.) If a glowing splint be plunged into each of the three bell-jars it will relight in the one containing the oxygen, and in the one containing the nitrous oxide, but not in the one containing the nitric oxide. The oxygen and nitrous oxide are readily distinguished—(1) by nitric oxide, the oxygen forming with it red fumes ($2NO + O = N_2O_3$), and the nitrous oxide being in no manner affected by it; (2) by pyrogallate of potash, which is immediately blackened by the oxygen, and is not at all affected by the nitrous oxide. The pyrogallate of potash gradually and completely absorbs the oxygen. If oxygen be let into the jar containing the nitric oxide, red fumes will form. Nitric oxide blackens a solution of ferrous sulphate, $FeSO_4$.