QUANTITATIVE ANALYSIS.

(PART 2.)

(1) See Art. **2.**

(2) CaO = 56 per cent. CO_2 = 44 per cent. See also Art. **21.**

(3) (*a*) The precipitate of antimony sulphide always contains more or less free sulphur and water. These must be expelled from a part of the precipitate after it is weighed, and from the amount of pure antimony compound obtained from the portion of precipitate taken, the amount of antimony sulphide or antimony in the precipitate is calculated. The sulphur and water may be driven off by heating a portion of the precipitate in an atmosphere of carbon dioxide, or a portion of the precipitate may be treated with fuming nitric acid, and the antimony weighed as oxide, after driving off the acid mixture by heat.

(*b*) If a correction were not made by one of the methods given, the water and free sulphur would be weighed as antimony sulphide, and an erroneous result would thus be obtained.

(4) See Art. **121.**

(5) See Art. **3.**

(6) See Art. **22.**

(7) See Arts. **64, 65,** and **66.**

(8) See Art. **132.**

(9) See Art. **4.**

(10) See Art. **30.**

(11) (*a*) See Art. **49.**

(*b*) See Art. **51.**

(12) Fe_2O_3 contains 90 per cent. of FeO; hence, $.225 \times .90 = .2025$ gram of FeO, and as the weight of a constituent divided by the weight of the original substance, and this number multiplied by 100, gives the percentage of that constituent in the substance, $.2025 \div 1 = .2025$. $.2025 \times 100 = 20.25$ per cent. of FeO. Ans.

(13) (*a*) and (*b*) See Art. **5.**

(14) (*a*) and (*b*) See Art. **31.**

(15) No method has been given in the Instruction Paper for the analysis of an alloy containing only these two metals, but methods of separating and determining them are given in the analysis of nickel coins (Art. **59,** *et seq.*) and in the analysis of chalcopyrite, and one of these methods may be employed, omitting, of course, the portions referring to other elements. See Arts. **115** and **116.**

(16) As the stone contains 90 per cent. of calcium carbonate, it contains $2{,}000 \times .90 = 1{,}800$ pounds of calcium carbonate; and as calcium carbonate contains 56 per cent. of calcium oxide, $1{,}800 \times .56 = 1{,}008$ pounds of lime. Ans.

(17) (*a*) and (*b*) See Art. **6.**

(18) See Arts. **32** to **37,** inclusive.

(19) See Art. **87.**

(20) As ZnO contains 80.26 per cent. of zinc,

$.1505 \times .8026 = .1207913$ gram of zinc.

$.1207913 \div .625 = .1933.$

$.1933 \times 100 = 19.33$ per cent. of zinc. Ans.

(21) A porcelain crucible with a perforated bottom similar to a Gooch crucible. This is frequently called a porcelain Gooch crucible. See also Art. **6.**

(22) See Art. **39**, *et seq.*

(23) See Art. **88**, *et seq.*

(24) Feldspar is essentially a silicate of aluminum and potassium with a smaller quantity of sodium, or of aluminum and sodium with a smaller quantity of potassium, and in addition to these constituents, it nearly always contains smaller amounts of iron, calcium, and magnesium. See also Art. **139**.

(25) (*a*) and (*b*) See Arts. **6** and **11**.

(26) See Arts. **40** and **42**.

(27) See Art. **92**.

(28) See Art. **7**.

(29) (*a*) See Art. **43**.

(*b*) See Art. **44**, *et seq.*

(30) They may be separated by fusing the precipitate of iron and alumina with acid potassium sulphate and proceeding as directed in Art. **141**, but it is better to take a fresh sample and proceed as directed in Art. **95**.

(31) See Art. **12**.

(32) See Art. **58**, *et seq.*

(33) See Art. **20**.

(34) See Art. **48**.

(35) (*a*) and (*b*) See Art. **96**.

(36) See Art. **144**.

(37) See Arts. **11** and **12**.

(38) (*a*) It is an alloy of lead and antimony, containing the metals in varying proportions, the percentage of each metal depending upon the kind of type for which it is intended.

(*b*) It is dissolved for analysis by treating a sample of the finely divided alloy with a mixture of equal volumes of concentrate nitric and tartaric acids. See also Art. **54**.

(39) See Art. **11.**

(40) (*a*) and (*b*) See Art. **58.**

(41) See Art. **12.**

(42) (*a*) The iron is weighed in the form of ferric oxide Fe_2O_3.

(*b*) As the iron in the original substance is in the ferrous state, it is reported as ferrous oxide *FeO*. See also Arts. **17** and **19.**

(43) See Art. **55.**

(44) (*a*) and (*b*) See Art. **109.**

(45) As the limestone contains 40 per cent. of carbon dioxide, 1 gram of it would contain 40 per cent. of 1 gram, or .4 gram of carbon dioxide. 1,000 cubic centimeters (1 liter) of carbon dioxide weighs 1.97 grams; hence,

$1.97 : .4 = 1{,}000 : x$. $x = 203.05$ cubic centimeters. Ans.

(46) As Fe_2O_3 contains 90 per cent. of *FeO*, the weight of *FeO* may be obtained by multiplying the weight of Fe_2O_3 by .90; or it may be calculated by a proportion. As 1 molecule of Fe_2O_3 contains 2 molecules of *FeO*, the proportion would be

$$Fe_2O_3 : 2FeO = \text{wt. of } Fe_2O_3 : x.$$

(47) It is composed of tin, lead, bismuth, and cadmium.

(48) See Arts. **104** to **107,** inclusive.

(49) See Art. **19.**

(50) No scheme is given for the analysis of an alloy containing only these two metals, but a method of separating and determining them is given in the analysis of Wood's metal (Art. **73,** *et seq.*), and the method here given may be employed by omitting the portions referring to other metals.

(51) See Art. **114.**

(52) (*a*) Zinc is present in the solution in the form of chloride, and as it is precipitated as sulphide, the chlorine set free unites with the hydrogen of the hydrogen sulphide.

forming hydrochloric acid. Zinc sulphide is soluble in a solution containing any considerable amount of free hydrochloric acid, and enough acid may be formed during the reaction to prevent the complete precipitation of the zinc. If sodium acetate is now added, the hydrochloric acid unites with the sodium, forming sodium chloride, and setting free acetic acid, in which zinc sulphide is insoluble, and consequently the zinc will be completely precipitated.

(*b*) If enough sodium acetate is added to unite with all the hydrochloric acid, the nickel and cobalt will also be precipitated; hence, care must be taken to leave enough free hydrochloric acid in the solution to prevent the precipitation of these metals. Enough hydrochloric acid to accomplish this may be left in the solution without interfering with the precipitation of zinc.

(53) See Art. **16.**

(54) As the alloy contains 17 per cent. of antimony, the weight of antimony required will be 17 per cent. of the weight of the alloy, or $125 \times .17 = 21.25$ pounds. Ans.

(55) See Art. **19.**

(56) See Art. **78.**

(57) See Art. **10.**

(58) See Art. **109,** *et seq.*

(59) As the sample contains 90 per cent. of silver, and .8 gram of it are taken for analysis, we have $.8 \times .90 = .72$ gram of silver in the sample. As this is all converted into chloride, taking the atomic weights of silver and chlorine as 107.66 and 35.37, respectively, we have

$$107.66 : 143.03 = .72 : x. \quad x = .9565 \text{ gram.}$$ Ans.

(60) See Art. **21.**

(61) (*a*) Bismuth oxychloride, basic bismuth nitrate, and basic bismuth carbonate.

(*b*) Bismuth oxychloride $BiOCl$, bismuth oxide Bi_2O_3, and metallic bismuth.

(62) As Cu_2S contains 79.82 per cent. of copper, we have $.952 \times .7982 = .759886$ gram of copper in the sample; and as the bronze contains 92 per cent. of copper, this is 92 per cent. of the weight of the sample. Hence,

$.759886 \div .92 = .8295$ gram of sample taken. Ans.

(63), (64), (65), (66), (67), (68), (69), (70) The percentage of the elements to be determined in the compounds sent for analysis cannot be given, as it will vary somewhat from time to time. A careful record of the composition of each sample is kept, however, and the student will be graded upon his results.