INORGANIC CHEMISTRY.

(PART 1.)

(1) See Art. **125.**

(2) See Art. **4.**

(3) 1 kilogram = 1,000 grams; 50 kilograms = 50,000 grams. See Art. **5.** 1 gram of burning hydrogen raises 34,462 grams of water from 0° to 1°. Then, 50,000 ÷ 34,462 = 1.45 grams of hydrogen are needed to raise 50,000 grams from 0° to 1°, and 1.45 × 10, or 14.5, grams will be required to raise the same quantity of water to 10°. Ans.

(4) See Art. **11.** Oxygen is an extremely active supporter of combustion, while air, being composed of oxygen and nitrogen, the latter of which is not a supporter of combustion, is a less active supporter.

(5) See Art. **100.**

(6) See Art. **61.**

(7) $2NaBr + Cl_2 = 2NaCl + Br_2$.

(8) See Art. **36.**

(9) All acids, all hydrates, organic compounds, such as alcohol, petroleum, etc. See Art. **2.**

(10) Hydrochloric-acid gas is prepared according to the equation

$$\underset{98}{H_2SO_4} + \underset{117}{2NaCl} = \underset{73}{2HCl} + \underset{142}{Na_2SO_4}$$

Then,

(*a*) $73 : 98 = 36.5 : 49$ grams H_2SO_4;
$73 : 117 = 36.5 : 58.5$ grams $NaCl$.

(*b*) $73 : 98 = 1 : 1.3424$ kilograms H_2SO_4;
$73 : 117 = 1 : 1.6027$ kilograms $NaCl$. Ans.

(11) See Art. **71.**

(12) See Art. **44.**

(13) See Art. **115.**

(14) See Art. **99.**

(15) See Art. **85.**

(16) (*a*) See Art. **3** and Art. **31,** Experiment 22.

(*b*) A molecule of water contains 2 parts of hydrogen and 16 parts of oxygen, or 1 gram of water contains $\frac{2}{18}$ or $\frac{1}{9}$ part of its weight of hydrogen:

$250 \div 9 = 27.777+$ grams of H. Ans.

(17) See Arts. **30** and **31.**

(18) See Art. **98.**

(19) See Fig. 13 and Art. **22.**

(20) See Arts. **4** and **5.**

(21) See Art. **40.**

(22) (*a*) No.

(*b*) See Art. **75.**

(23) See Art. **28.**

(24) See Art. **10.** Oxygen is prepared according to the equation

$$\underset{261}{3MnO_2} = \underset{229}{Mn_3O_4} + \underset{32}{O_2}$$

Then,

$261 : 32 = 261 : 32$ grams. Ans.

(25) See Art. **55.**

(26) $H_2SO_4 + Zn = ZnSO_4 + H_2$. See Art. **3.**

(27) See Art. **10.**

(28) (*a*) See Art. **39.**

(*b*) See Art. **41.**

(29) (*a*) See Art. **45.**

(*b*) See Figs. 23 and 24.

$$4HCl + MnO_2 = MnCl_2 + 2H_2O + Cl_2$$

$$2NaCl + 2H_2SO_4 + MnO_2 = MnSO_4 + Na_2SO_4 + 2H_2O + Cl_2$$

(30) A desiccating agent is a compound that possesses a strong affinity for water or moisture; as, for instance, sulphuric acid, calcium chloride, etc. See also Art. **5.**

(31) (*a*) See Art. **116.**

(*b*) See Art. **117.**

(32) H_2SeO_4. See Art. **139.**

(33) See Art. **5.**

(34) Nascent hydrogen is distinguished by its increased chemical activity. See Art. **108,** *Theoretical Chemistry*.

(35) Silver has an atomic weight of 108; chlorine has an atomic weight of 35.5. Molecular weight of $AgCl$ = 143.5. Using formula **1,** *Theoretical Chemistry*,

$$x = \frac{100\,a\,n}{m},$$

and substituting the given values, we obtain

$$x = \frac{100 \times 108 \times 1}{143.5} = 75.261\% \text{ of silver,}$$

$$x = \frac{100 \times 35.5 \times 1}{143.5} = 24.739\% \text{ of chlorine.} \quad \text{Ans.}$$

(36) See Art. **10.** The production of oxygen from mercuric oxide is expressed by the equation

$$\underset{431.6}{2HgO} = \underset{399.6}{2Hg} + \underset{32}{O_2}$$

Then,

431.6 : 32 = 20 : 1.48 grams of oxygen. Ans.

(37) $2Na + 2H_2O = 2NaHO + H_2$. See Art. **3.**

(38) $5H_2 + 3O_2 = 5H_2O + O.$

(39) Two molecules of water and 1 molecule of potassium yield 2 molecules of potassium hydrate and 1 molecule of hydrogen.

(40) See Art. **61.**

(41) See Art. **76.**

(42) 114.7 grams.

(43) See Art. **5.**

(44) See Art. **97.**

(45) $H_2S_2O_7$.

(46) See Art. **56.**

(47) Hydrogen is obtained according to the equation

$$\underset{98}{H_2SO_4} + \underset{65}{Zn} = \underset{161}{ZnSO_4} + \underset{2}{H_2}$$

10 liters of hydrogen weigh .896 gram; then,

2 : 65 = .896 : 29.120 grams of zinc,

2 : 98 = .896 : 43.904 grams of sulphuric acid. Ans.

(48) Chlorine, bromine, iodine, and fluorine. See Art. **73.**

(49) (*a*) Water, sulphur dioxide, phosphorus pentoxide.

(*b*)
$$2H_2 + O_2 = 2H_2O$$
$$S + O_2 = SO_2$$
$$P_4 + 5O_2 = 2P_2O_5$$

(50) Bromine colors a solution of starch yellow, while iodine gives a blue color to the solution. See also Arts. **77** and **80.**

(51) Potassium chlorate has the formula $KClO_3$; its molecular weight is 122.5. Using formula **1,** *Theoretical Chemistry,*

$$x = \frac{100\,a\,n}{m},$$

and substituting the known values, we obtain

$$x = \frac{100 \times 39 \times 1}{122.5} = 31.84\% \ K,$$

$$x = \frac{100 \times 35.5 \times 1}{122.5} = 28.98\% \ Cl,$$

$$x = \frac{100 \times 16 \times 3}{122.5} = 39.18\% \ O. \quad \text{Ans.}$$

(52) 3.17 grams occupy the volume of 1 liter. 1 gram occupies, then, the volume of .31545 liter, and 32 grams will occupy 10.094 liters. Ans.

(53) One molecule of zinc and 1 molecule of sulphuric acid yield 1 molecule of zinc sulphate and 1 molecule of hydrogen.

(54)

Hyposulphurous oxide	$S''O$	Hyposulphurous acid	$H_2S''O_2$
Sulphurous oxide	$S^{iv}O_2$	Sulphurous acid	$H_2S^{iv}O_3$
Sulphuric oxide	$S^{vi}O_3$	Sulphuric acid	$H_2S^{vi}O_4$

(55) See Art. **10.**

(56) See Art. **88.**

(57) Hydrogen sulphide has the formula H_2S; its molecular weight is 34. Using formula **10,** *Theoretical Chemistry,*

$$w = \frac{Wm}{M},$$

and substituting the known values, we obtain

$$w = \frac{100 \times 32}{34} = 94.117 \text{ grams.} \quad \text{Ans.}$$

(58) 1 liter of H_2S weighs 1.52 grams, 100 liters weigh 152 grams.

(59) (*a*) and (*b*) See Art. **90.**

(60) 16 parts, by weight, of oxygen,
2 parts, by weight, of hydrogen.

For the determination of the composition of water by weight, see Art. **34.**

(61) See Art. **99.**

(62) See Art. **48.**

(63) See Art. **10,** Experiment 7, and Figs. 6 and 7.

(64) See Art. **108.**

(65) Hydrofluoric acid has the formula HF and a molecular weight of 20. Using formula **1,** *Theoretical Chemistry*,

$$x = \frac{100\,a\,n}{m},$$

and substituting the known values, we obtain:

$$x = \frac{100 \times 1 \times 1}{20} = 5\% \text{ of } H,$$

$$x = \frac{100 \times 19 \times 1}{20} = 95\% \text{ of } F. \quad \text{Ans.}$$

(66) See Art. **145.**

(67) See Art. **113.**

(68) (*a*) $2NaI + MnO_2 + 2H_2SO_4$
$= Na_2SO_4 + MnSO_4 + 2H_2O + I_2$.

Two molecules of sodium iodide and 1 molecule of manganese dioxide and 2 molecules of sulphuric acid yield 1 molecule of sodium sulphate, 1 molecule of manganese sulphate, 2 molecules of water, and 1 molecule of iodine. See Art. **79.**

(69) See Art. **134.**

(70) (*a*) A unit of heat is the amount of heat required to raise 1 gram of water from 0° to 1°.

(*b*) 34,462 units of heat. See Art. **5.**

(71) See Art. **99.**

(72) A reducing agent is a substance that removes oxygen, or elements similar to it, from its compounds, or decreases the valence of a substance, changing it from a higher to a lower state of oxidation.

(73) (*a*) See Art. **122.**

(*b*) SO_2.

(74) (*a*) and (*b*) See Art. **16.**

(75) The antiseptic or antizymotic property of a substance is that property which prevents or destroys putrefaction.

(76) (*a*) See Art. **54,** and Fig. 28.

(*b*) $NaCl + H_2SO_4 = HCl + NaHSO_4$

or with the application of heat,

$$2NaCl + H_2SO_4 = 2HCl + Na_2SO_4$$

(77) (*a*) See Art. **123.**

(*b*) See Art. **129.**

(78) See Art. **47.**

(79) See Art. **11.**

(80) A suitable freezing mixture is prepared by mixing 2 parts of ice with 1 part of ordinary salt.

(81) See Art. **105.**

(82) See Art. **14,** Experiment 17.

(83) (*a*) See Art. **77.**

(*b*) See Arts. **76** and **77.**

(84) See Art. **126.**

(85) See Art. **128.**

(86) See Art. **109.**

(87) See ozone, Arts. **13** and **16.**

(88) See Art. **127.**

(89) SO_2 is obtained according to the equation

$$\underset{64}{S_2} + \underset{64}{2O_2} = \underset{128}{2SO_2}$$

Using formula **10,** *Theoretical Chemistry,*

$$w = \frac{Wm}{M},$$

and substituting the known values, we obtain

$$w = \frac{10 \times 128}{64} = 20 \text{ grams of } SO_2. \quad \text{Ans.}$$