Periodic spasms of the larynx and incessant vomiting continued for the next eight days. The generalized fibrillations gradually diminished in intensity but the clonic jerkings of the temporal muscles persisted together with anorexia and a marked depression. The gastric juice which was vomited up contained appreciable free and total acidity. Throughout this period intravenous injection of Ringer's and enemata were freely given. On May 20 the animal seemed decidedly better. Thereafter the condition gradually improved. At the time of writing (May 30) the animal is again free from all symptoms of tetany. All treatment was discontinued 14 days after the reappearance of the tetany.

In many respects the tetany appearing during the œstrus cycle of this animal was more severe than the tetany seen the first month following the parathyroidectomy.

We are in no position to explain the reoccurrence of the tetany with all its severity during the œstrus cycle months after the absense of any sign suggestive of tetany. The facts however seem to show that the tetany appearing in partially strumectomized women during menstruation is due primarily to hypofunction or absence of the parathyroids. As in previous work we observed during the tetany seizures signs pointing to a paresis of the sympathetic nervous system (enophthalmos), pseudoptosis, paretic nictitating membrane, bradycardia, conjunctival injection, general vasodilation, and a sluggish *atonic gastero-intestinal tract*. The latter condition (paralytic ileus) would favor the production of toxic products by bacterial action; the splanchnic dilatation (paresis of vasoconstrictor control) would permit of so rapid an absorption of these poisonous products that the liver would be functionally inadequate to neutralize them because of the speed of their delivery (alimentary toxemia). As in Eck fistula animals parathyroidectomized animals suffer from an intestinal toxemia. On this hypothesis the reported Ca deficiency in parathyroidectomized animals might well be an *effect* of the tetany condition rather than its *cause*.

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THE ALGEBRAIC METHOD OF BALANCING A CHEMICAL EQUATION

A CHEMICAL equation is said to be "balanced" when, for each element involved, the number of gram atoms in the left member of the equation is equal to the number of gram atoms in the right member. Given, then, the initial and final substances concerned in a chemical reaction, say

$$\alpha Ag_2AsO_4 + \beta Zn + \lambda H_2SO_4 = \\ \delta AsH_3 + \varepsilon Ag + \zeta ZnSO_4 + \eta H_2O$$

"balancing" the equation consists in finding a set of values for α, β, λ, etc., such that the above named condition is fulfilled.

There are several methods of balancing a chemical equation. With simple equations the necessary coefficients are at once evident, or become so on brief application of the expedient of trial and error. In more complicated equations, however, the method of trial and error becomes tedious and other methods are convenient. In an oxidation-reduction reaction, consideration of the valence changes will usually give enough data to enable one to arrive at a solution of the problem, but this method is limited, even in application to such equations.

The algebraic method of balancing an equation is of general application and will be found time saving in dealing with complex equations. This method is outlined in a few of the textbooks, but is not in general use.

THE ALGEBRAIC METHOD

The ordinary method of balancing a chemical equation algebraically is a very simple procedure. In the following equation, let *a, b, c,* etc., represent the coefficients of the balanced equation:

$$aAg_2AsO_4 + bZn + cH_2SO_4 = \\ dAsH_3 + eAg + fZnSO_4 + gH_2O$$

It is obvious that one may write algebraic equations expressing the number of gram atoms of each element involved in the reaction. Thus:

For silver: $2a = e$
For arsenic: $a = d$
For oxygen: $4a + 4c = 4f + g$
For zinc: $b = f$
For hydrogen: $2c = 3d + 2g$
For sulphur: $c = f$

Since this results in six equations amongst seven unknowns, the value of each of the unknowns may readily be found in terms of any one of the unknowns, a numerical value being then assigned to the latter such that fractional coefficients will disappear. For example, from the six equations given above it follows that:

$$\begin{array}{ll} a = a & e = 2a \\ b = \dfrac{11a}{2} & f = \dfrac{11a}{2} \\ c = \dfrac{11a}{2} & g = 4a \\ d = a & \end{array}$$

and calling $a = 2$, the chemical equation is:

$$\begin{array}{c} 2Ag_2AsO_4 + 11Zn + 11H_2SO_4 = \\ 2AsH_3 + 4Ag + 11ZnSO_4 + 8H_2O. \end{array}$$

NUMBER OF EQUATIONS AND NUMBER OF UNKNOWNS

In applying the algebraic method there may be written as many equations as there are elements concerned, and obviously there will be as many coefficients as there are compounds. Since the relation between number of equations and number of unknowns determines the applicability of the algebraic method, one is led to inquire into this matter with respect to the chemical equations ordinarily encountered. A random selection of fifty equations from an inorganic chemistry text-book reveals the following:

If x = number of elements concerned
y = number of compounds concerned

Then:

For 4 of the equations: $x = y + 1$ (Case I)
For 17 of the equations: $x = y$ (Case II)
For 28 of the equations: $x = y - 1$ (Case III)
For 1 of the equations: $x = y - 2$ (Case IV)

Since x independent equations fix every possible ratio between $x + 1$ unknowns, it is evident that in Cases I, II and III above the number of *independent* equations written will be one less than the number of unknowns, although the procedure of the algebraic method yields actually two additional (dependent) equations in Case I and one additional equation in Case II.

Case IV offers a curious condition, for here it is evident that the ratios between all the unknowns can not be fixed, and there may be found an infinite number of sets of coefficients which will balance the equation. The following equation is an example:

$$\begin{array}{c} aKMnO_4 + bH_2SO_4 + cH_2O_2 = \\ dK_2SO_4 + eMnSO_4 + fH_2O + gO_2. \end{array}$$

The fact that this equation may be balanced in an infinite number of ways has no significance chemically, since the valence changes of manganese and oxygen settle the matter and there is only one set of coefficients which permit the equation to represent the chemical facts involved. In this case the valence changes involved require that $5a = 2c$ and this adds an additional equation to those required by stoichiometric considerations, and the problem of finding the coefficients falls then under Case III above. There are chemical equations, however, which can be balanced in an infinite number of ways having due regard for valence requirements. In the equation:

$$\begin{array}{l} aK_2Cr_2O_7 + bH_2SO_4 + cFeSO_4 + dH_2S = \\ eK_2SO_4 + fCr_2(SO_4)_3 + gFe_2(SO_4)_3 + hH_2O + iS \end{array}$$

there are nine unknown coefficient and seven equations. Valence changes of chromium, iron and sulphur require that $6a = c + 2d$, but this equation is included in those required by stoichiometric ratios and the problem remains indeterminate. There will be $3a - 1$ true solutions for every value given a.

NUMBER OF ELEMENTS AND NUMBER OF COMPOUNDS IN A CHEMICAL REACTION

From a chemical standpoint, the fact that, with but few exceptions, x elements enter into reactions involving either x or $x + 1$ compounds may strike one as curious. Closer examination of this point, however, does not appear to reveal anything in the way of a law of nature, but indicates that the rule arises from certain limited values in the equations ordinarily used in inorganic chemistry, as is shown below:

Let x = Number of elements
y = Number of compounds
c = Total number of elementary symbols appearing
r = Unnecessary repetition of symbols (*i. e.*, in excess of $2x$).
k = Average number of elements per compound (*i. e.*, $\frac{c}{y}$)

Then for any chemical equation:

$$c = 2x + r$$

$$\frac{c}{y} \text{ or } k = \frac{2x}{y} + \frac{r}{y}$$

$ky - 2x = r$, which is an expression in which the difference between x and y is fixed by k and r.

The preponderance of binary and ternary compounds in inorganic chemistry, with occasional appearance of single elements would readily lead one to give k an average value in the neighborhood of 2.25. The actual average for k in the fifty equations referred to above is 2.285, the extreme values being 1.5 and 3.1.

The repetition of acid radicals in many of the reagents of inorganic chemistry, coupled with the fact that it is seldom possible to determine the products of a reaction amongst more than three substances, results in an average value of r, not far from that for k. Actual average for fifty equations is 2.44.

These average values for k and r require that the average value for x and y should not differ widely.

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THE IOWA ACADEMY OF SCIENCE

The academy held its thirty-sixth annual session with Drake University, Des Moines, on Friday and Saturday, April 28 and 29. After a short business meeting President Morehouse gave his presidential address on "The cosmology of the universe." The academy then divided into sections for the reading of papers, and at six o'clock the sections met for dinners. In the evening President Edgar O. Lovett, of Rice Institute, Houston, Texas, gave the public address on "Some aspects of science." This address and the reception which followed were given at the splendid new municipal observatory, built by the city of Des Moines in one of its public parks and dedicated to Dr. Morehouse, the astronomer of Drake University. Opportunity was given the members for inspecting the equipment of the observatory and seeing the stars through the nine-inch telescope.

On Saturday morning the sections resumed their meetings, and at ten o'clock the academy convened to hear some papers of general interest. The following were elected as officers for the ensuing year:

President, R. B. Wylie, State University, Iowa City; *vice-president,* O. H. Smith, Cornell College, Mount Vernon; *secretary,* James H. Lees, Geological Survey, Des Moines; *treasurer,* A. O. Thomas, State University; *chairmen of sections: Botany,* H. S. Conard, Grinnell College, Grinnell; *chemistry,* Edward Bartow, State University; F. E. Brown, State College; *geology,* S. L. Galpin, State College, Ames; *mathematics,* C. W. Emmons, Simpson College, Indianola; *physics,* L. D. Weld, Coe College, Cedar Rapids; *zoology,* H. W. Norris, Grinnell College.

Resolutions were adopted favoring reforestation and conservation, and opposing the transfer of public forests to the Department of the Interior.

The following papers were presented:

ARCHEOLOGY

The new Albin inscribed tablet: Ellison Orr.

Decorative markings on some fragments of Indian pottery from Mills County, Iowa: Paul R. Rowe.

GEOLOGY

Recent studies of the Pleistocene in western Iowa: G. F. Kay.

Till-like deposits south of Kansas River in Douglas County, Kansas: Walter H. Schoewe.

Status of sedimentation in Iowa: A. C. Trowbridge.

Origin of limestone conglomerates: Miss Louise Fillman.

Classification of lenses: Miss Louise Fillman.

Notes on some mammalian remains reported in Iowa during the past year: A. O. Thomas.

Records of Paleozoic glass-sponges in Iowa: A. O. Thomas.

An Iowa Cambrian eurypterid: O. T. Walter.

The Laramie hiatus in the southern Rockies: Charles Keyes.

Horizontal oblique faulting in inclined strata: Charles Keyes.

Taxonomic rank of Pennsylvanian grouping: Charles Keyes.

A deposit of pyrites in coal: John M. Lindly.

The deep well at Winfield: John M. Lindly.

The structure of the Fort Dodge beds: James H. Lees.

The area near Stuart, Iowa: John L. Tilton.