Comparative Studies of Laws of Conservation of Mass, Energy, and Elecctric Charge, and Multiform Laws of Conservation of Energy and the like — No.2 of Comparative Chemistry Series Papers

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Abstract: As No.2 of comparative chemistry series papers, this paper discusses the same and different points of law of conservation of mass, law of conservation of energy, and law of conservation of elecctric charge. The same points: they belong to the three fundamental conservation laws in modern chemistry; and they are all widely used in chemistry. The different points: the law of conservation of energy and the law of conservation of elecctric charge are also correct in physics, while the law of conservation of mass is not correct in physics, because mass and energy can be converted mutually; and in the fields of natural sciences, the law of conservation of energy is the most important and the most widely used law, while the other two laws are not so important and far-reaching. By using the comparative method, and referring to the concept of Comparative Sciences Clusters, these three laws of conservation can be dealed with the unified method, and the concept of Multiform Laws of Conservation of Energy may be proposed, namely these three laws of conservation can be unified as sets of multiform laws of conservation of energy taking energy as the core. Finally, comparing with and referring to “partial and temporary unified theory of natural science” and “partial and temporary unified variational principle of natural science”, these three laws of conservation are dealed with the unified method of variational principle.

Key words: Comparative chemistry, comparative study, law of conservation of mass, law of conservation of energy, law of conservation of elecctric charge, science of conservation of energy, multiform laws of conservation of energy, partial and temporary unified theory of natural science, partial and temporary unified variational principle of natural science

Introduction

In reference [1], the concept of comparative chemistry is proposed. As No.2 of the series papers of comparative chemistry, this paper discusses the comparative studies of law of conservation of mass, law of conservation of energy, and law of conservation of elecctric charge; and the problem that these three laws of conservation are dealed with the unified method, as well as the multiform laws of conservation of energy, the related issues of variational principle, and the like.

1 The same points of three laws of conservation

The first same point: they belong to the three fundamental conservation laws in modern chrmistry.

However, this is the traditional viewpoint only. In this paper, we will discuss that these three fundamental conservation laws should be dealed with the unified method taking

energy as the core.

The second same point: they are all widely used in chemistry.

Moreover, in many cases they are used without contradiction. For example, as dealing with the same chemical formula, they can be used respectively for different problems.

2 The different points of three laws of conservation

The first different point: the law of conservation of energy and the law of conservation of elecctric charge are also correct in physics, while the law of conservation of mass is not correct in physics, because mass and energy can be converted mutually

The second different point: in the fields of natural sciences, the law of conservation of energy is the most important and the most widely used law, while the other two laws are not so important and far-reaching.

Law of conservation of energy has been the cornerstone of all natural sciences. It is widely used in physics, chemistry, biology and other fields.

However, for law of conservation of mass and law of conservation of elecctric charge, besides the field of chemistry, they cannot be or almost cannot be used in other fields.

3 By using the comparative method, and referring to the concept of Comparative Sciences Clusters, these three laws of conservation can be dealed with the unified method

One of the trends of science development is applying the least amount of laws and formulae to solve the problems as many as possible.

With the help of comparison we can find that, the importances of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge are not the same, the law of conservation of energy is the most important one, and its important role is still not appeared in many fields.

Since the law of conservation of energy is so important, as dealing with the problems related to movement and energy, the law of conservation of energy can be considered as the unique truth to establish the interdisciplinary science of conservation of energy, and deal with all the related problems in the areas of physics, chemistry, and the like with the unified method.

More information about science of conservation of energy can be found in reference [2].

For example, in reference [3, 4], for the problem of a small ball rolls along the inclined plane, the improved law of gravity and improved Newton’s second law are derived with principle of conservation of energy.

To compare with the idea of science of conservation of energy, and refer to the concept of Comparative Sciences Clusters proposed in reference [5], we can discuss the way to deal with these three laws of conservation by using the unified method.

Firstly, we discuss the way to deal with law of conservation of energy and law of conservation of mass by using the unified method.

The law of conservation of energy reads

$$E = cons \qquad (1)$$

where: E is the total energy of the closed system.

The law of conservation of mass reads

$$M = const \tag{2}$$

where: M is the total mass of the closed system.

To cpmpare with the concept of complex number, law of conservation of energy and law of conservation of mass can be unified as follows

$$E + Mi = const \tag{3}$$

To cpmpare with the concept of absolute value of complex number, after changing mass into energy, it gives

$$\sqrt{E^2 + M^2} = \sqrt{const^2} \tag{4}$$

In this way, the unification of law of conservation of energy and law of conservation of mass is realized.

Similarly, the unification of law of conservation of energy and law of conservation of elecctric charge, as well as the unification of law of conservation of mass and law of conservation of elecctric charge, can also be realized.

Secondly, we discuss the way to deal with law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge by using the unified method.

The law of conservation of elecctric charge reads

$$Q = const_j \tag{5}$$

where: Q is the total elecctric charge of the closed system.

To cpmpare with the concept of complex number, law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge can be unified as follows

$$E + Mi + Qj = const + const_i i + const_j j \tag{6}$$

To cpmpare with the concept of absolute value of complex number, after changing mass into energy, and treating the total elecctric charge as “equivalent energy”, it gives

$$\sqrt{E^2 + M^2 + Q^2} = \sqrt{const^2 + const_i^2 + const_j^2} \tag{7}$$

In this way, the unification of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge is realized.

In addition, in order to avoid the case of adding orders of magnitude with greatest difference, we can introduce the positive weighted constants, and it gives

$$E^2 \approx w_i M^2 \approx w_j Q^2 \tag{8}$$

where: w_i and w_j are suitable positive weighted constant.

Thus, Eq.(7) can be rewritten as follows

$$\sqrt{E^2 + w_i M^2 + w_j Q^2} = \sqrt{const^2 + w_i const_i^{\ 2} + w_j const_j^{\ 2}} \qquad (9)$$

Now, for law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge, we already present the unified processing ways to deal with any two laws of conservation, as well as several unified processing ways to deal with these three laws of conservation; if necessary, we can structure more of unified processing ways; and referring the concept of "Comparative Sciences Clusters", all of these unified of processing ways constitute the sets of multiform laws of conservation of energy taking energy as the core.

4 Three laws of conservation are dealed with the unified method of variational principle

In reference [6], for unified dealing with all of the problems of natural science, applying least square method, "partial and temporary unified theory of natural science so far" can be expressed in the following form of "partial and temporary unified variational principle of natural science so far"

$$\Pi_{\mathrm{NATURE}} = \sum_1^n W_i \int_{\Omega_i} F_i^{\ 2} d\Omega_i + \sum_1^m W_j' S_j^2 = \min_0 \qquad (10)$$

where: the subscript NATURE denotes that the suitable scope is all of the problems of natural science; all of the equations $F_i = 0$ denote so far discovered (derived) all of the equations related to natural science, and the suitable domains are Ω_i; all of the equations $S_i = 0$ denote so far discovered (derived) all of the solitary equations related to natural science; and W_i and W_i are the suitable positive weighted constants; $\min_0$ is introduced in reference [7], indicating the minimum and its value should be equal to zero.

In this way, the theory of everything to express all of natural laws, described by Hawking that a single equation could be written on a T-shirt, is partially and temporarily realized in the form of "partial and temporary unified variational principle of natural science so far".

To compare with and refer to "partial and temporary unified theory of natural science so far" and "partial and temporary unified variational principle of natural science so far", the three laws of conservation can be dealed with the unified method of variational principle.

Law of conservation of energy can be rewritten as the following form that the right end of expression is equal to zero

$$F_1 = 0 \qquad (11)$$

where: $F_1 = E - const$

If its suitable domain is Ω_1, then the law of conservation of energy can be rewritten

as the following integral form of variational principle.

$$\Pi_1 = \int_{\Omega_1} F_1^2 d\Omega_1 = \min \qquad (12)$$

Similarly, law of conservation of mass can be rewritten as the following form that the right end of expression is equal to zero

$$F_2 = 0 \qquad (13)$$

where: $F_2 = M - const_i$

If its suitable domain is Ω_2, then the law of conservation of mass can be rewritten as the following integral form of variational principle.

$$\Pi_2 = \int_{\Omega_2} F_2^2 d\Omega_2 = \min_0 \qquad (14)$$

And law of conservation of elecctric charge can be rewritten as the following form that the right end of expression is equal to zero

$$F_3 = 0 \qquad (15)$$

where: $F_3 = Q - const_j$

If its suitable domain is Ω_3, then the law of conservation of elecctric charge can be rewritten as the following integral form of variational principle.

$$\Pi_3 = \int_{\Omega_3} F_3^2 d\Omega_3 = \min_0 \qquad (16)$$

To compare with and refer to "partial and temporary unified variational principle of natural science so far", the three laws of conservation of mass, energy, and elecctric charge can be dealed with the unified method of variational principle as follows

$$\Pi_{1-3} = \sum_1^3 W_i \int_{\Omega_i} F_i^2 \, d\Omega_i = \min \qquad (17)$$

where: $\Pi_{1\text{-}3}$ denotes the functional to deal with these three laws of conservation with the unified way; $F_1 = 0$ （$F_1 = E - const$） denotes law of conservation of energy, and its suitable domain is Ω_1； $F_2 = 0$（$F_2 = M - const_i$） denotes law of conservation of mass, and its suitable domain is Ω_2； $F_3 = 0$（$F_3 = Q - const_j$） denotes law of conservation of elecctric charge, and its suitable domain is Ω_3； W_i is the suitable positive weighted constant, and $\min_0$ denotes the minimum and its value should be equal to zero.

To compared with the sets of multiform laws of conservation of energy taking energy

as the core; similarly other form variational principles for unified processing the three laws of conservation of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge, can also be constructed, and form the sets of variational principles taking energy as the core for unified processing the three laws of conservation of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge. For example, the variational principle for unified processing the three laws of conservation of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge can also be written as the following form

$$\Pi'_{1-3} = \sum_{1}^{3} W_i \int_{\Omega_i} F_i^4 d\Omega_i = \min_0 \qquad (18)$$

Or

$$\Pi''_{1-3} = \sum_{1}^{3} W_i \int_{\Omega_i} |F_i| \, d\Omega_i = \min_0 \qquad (19)$$

So on and so on.

5 Conclusions

In comparative chemistry, according to the methods of comparative study, the same and different points of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge can be discussed; and to construct the sets of Multiform Laws of Conservation of Energy taking energy as the core for unified processing the three laws of conservation of law of conservation of energy, law of conservation of mass, and law of conservation of elecctric charge, as well as the sets of variational principles of Multiform Laws of Conservation of Energy taking energy as the core.

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