Exploration and Practice of Physical Chemistry Teaching Reform in General Colleges

Zhao Jun, Yin Yuxin, Shao Guolin, Ma Yingchong, Yu Chunling, Dai Hongyi

School of Light Industry and Chemical Engineering, Dalian Polytechnic University, Dalian 116034, China

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Abstract: aiming at the characteristics of physical chemistry curriculum, the author analyzes the teaching practice and exploration over the years from four aspects. In the teaching process, we must pay attention to the physical chemistry analysis thinking methods and skills training; according to the characteristics of physical chemistry formulas, we propose methods that are favorable for recitation; we must use multiple teaching methods, and do not advocate a single teaching method; teachers are teaching in the process, it should be connected with reality, increase the interest of the classroom, and improve the students' interest in learning.

1. Introduction

Physical chemistry is an important theoretical discipline of the chemistry major, emphasizing the use of logical thinking. Physical chemistry can study some principles and methods in chemistry with the help of certain mathematical methods and theories. Through the phenomenon, you can see the essence of the chemical reaction process. Macro-to-micro, physical to superficial, static to dynamic, qualitative to quantitative, pure discipline to marginal discipline, equilibrium study to non-equilibrium study. These are the six trends of modern chemistry. Six major trends. Practice shows that as long as they are excellent students in physical chemistry, their learning ability is particularly strong, they can adapt to the change of research direction quickly, and have strong innovative thinking. They are the backbone of the country.

2. Exploration and Practice of Physical Chemistry Teaching Reform

2.1 Focus on Physical Chemistry Thinking Methods and Skills Training

At present, textbooks of physical chemistry are mainly divided into three major modules: chemical thermodynamics, statistical thermodynamics, and chemical kinetics. Among them, chemical thermodynamics has the largest proportion, and statistical thermodynamics and chemical kinetics have equal proportions. Statistical thermodynamics is a course taught by specialized professors, so chemical thermodynamics plays a major role in physical chemistry. The main content of chemical thermodynamics is to study the problems of energy conversion and change direction between chemical reactions. Thermodynamics is very important for chemistry learning. A gentleman once said: In chemistry, if thermodynamics is not learned, chemistry will not be learned well. It emphasizes not only keeping in mind the knowledge, but also the logical thinking and problem-solving skills for studying this subject.[1]

Chemical thermodynamics involves many complicated and difficult to understand formulas, and the derivation process of each formula has specific physical meanings. If students do not use the correct learning method in the learning process, but simply memorize it, they often only understand the superficial meaning when solving these problems, which will cause the concept to be ambiguous and the application conditions to be confused. For this type of problem No deep understanding. Therefore, teachers should pay attention to “methodology” in the course of teaching. Because there are many conceptual formulas of physical chemistry, it is sometimes difficult for students to understand. Teachers need to help students to integrate and maintain a clear head. The thermodynamic calculation needs to use the characteristics of the state function. The teacher should

tell the students the change value of the thermodynamic function under thermodynamic conditions and solve the problem with the student.

There are five state functions in thermodynamics, but we cannot know the absolute values of these state functions, because we cannot determine the absolute value of thermodynamic energy. Thermodynamic energy refers to the sum of all energy sources in a thermodynamic system, including the energy between molecules and the energy between molecules. In the middle we have a lot of unknown values, but in practical applications we don't need to know these values, we just need to know the change value of the state function. Of all the thermodynamic functions, five quantities can be determined experimentally. They are P, V, T, C_V, C_P, so people consider whether it is possible to express the functional relationship that is not easily determined by experiments with a functional relationship that can be easily determined by experiments. We call this method the variable substitution method. [2]The formulas commonly used for variable substitution are correspondence formulas and Maxwell formulas.

The linearization method is a method often used in the discipline of physical chemistry. It can convert high-order equations into linear equations, or transform complex equations into simple equations through reciprocal operations, approximations, and reciprocal operations. Therefore, the laws of thermodynamics can be obtained. For studying thermodynamics, chemical equilibrium and reaction speed, it is very convenient to apply the concept of reaction progress.

2.2 Associative Memory Method of Physical Chemical Formula

Physical chemistry involves many complex and difficult to understand formulas, and these formulas are similar in form, and students are often confused. Teachers can let students properly associate, deepen students 'understanding of these formulas, and improve students' memory. For example, it is possible to associate similar formulas and the methods of dealing with similar problems, and to gather scattered knowledge to make these knowledge organized, help students to understand, and help students learn.

The first and second formulas are the formulas for lowering the freezing point and increasing the boiling point of dilute solutions, and the third formula is the Arrhenius formula. These formulas are similar in appearance, so students can use associative memory when they are remembering, which is convenient for memorization.

The core of handling thermodynamic problems is the basic thermodynamic equations. Chemical thermodynamic functions are complex and difficult to understand, but the basic thermodynamic equations are the basis of difficult to understand functions. There are sixteen basic thermodynamic equations, and students are particularly prone to confuse these equations, so students must master the basic laws and understanding skills between these functions in the memory process. The thermodynamic function is based on four basic equations, of which the four basic thermodynamic expressions are dU = TdS-PdV, dH = TdS + VdP, dG = -SdT + VdP, dA = -SdT-PdV. According to these four A basic thermodynamic formula can write the corresponding characteristic function and the relationship between variables. These four are: U (S, V), H (S, P), G (T, P), A (T , V), the direction and limits of the judgment process are derived from these functional relationships.[3]

Students must learn to summarize and summarize regularly because physical and chemical formulas are complex and require students to understand them. For example, when the teacher talks about the expression formula of the chemical formula of ideal gas and actual gas, he only needs to convert the pressure in the ideal gas into the actual gas. The fugacity of the chemical formula in these two cases is exactly the same; in the formula formula of the ideal dilute solution and the actual dilute solution, the ideal concentration is converted into the activity in the actual state, then these two In this case, the formula of the chemical formula is exactly the same. Students can deepen their impressions according to the above methods.

2.3 Linking Theory with Practice and Deepening Memory

When teachers teach students the course of physical chemistry, they should combine the knowledge in the books with the actual production, which can not only deepen the students' impressions, help students understand the knowledge points learned more quickly, but also allow

students to experience physical chemistry. Charm. The theory of physical chemistry plays an important role in some aspects, for example, in guiding chemical production and design, physical chemistry provides theoretical guidance for the ammonia industry. According to the principles of thermodynamics, increasing the temperature is not conducive to the improvement of the equilibrium conversion rate, but through kinetic analysis, it is concluded that increasing the temperature is beneficial to the improvement of the equilibrium conversion rate. To some extent, contradictions have arisen between the two. From an economic perspective, it is hoped that the reaction rate will be faster, and the lower conversion rate can be made up by increasing the reaction rate, and the process can also be green and environmentally friendly, and the raw materials that have not been reacted can be recycled. Comprehensive consideration, the reaction temperature of ammonia synthesis industry is generally around 773K, which involves the course of “catalytic reaction kinetics”.

Physical chemistry is different from other courses in chemistry. This course mainly studies the source of the chemical reaction, the basic rules of the chemical reaction and some theoretical knowledge, rather than directly studying the chemical reaction. Therefore, students should enhance their sensory understanding. Some students think that physical chemistry is just formulas and exercises in books, which have nothing to do with our lives, but this idea is wrong. In fact, it is closely related to our lives.[4]

For example, in winter, the road is covered with snow, the road is very slippery, and traffic accidents are prone to occur. To prevent accidents, the relevant departments sprinkle salt on the road. This uses the colligative nature of the dilute solution, which is the principle of freezing point reduction. An egg cannot be cooked on the Qinghai-Tibet Plateau or a plateau at a higher altitude. The principle is the Clausius Kraberon equation. When the external atmospheric pressure decreases, the boiling point of water also decreases, so the eggs are not cooked; “colloids and surfaces” The knowledge in these two chapters is also closely related to daily life. For example, many river inlets will form deltas. This is because the composition of river water is different from that in seawater. River water contains many sediment particles and has a negative charge. When the salt content in the seawater, the negative charge will be neutralized by the cations in the seawater, causing the phenomenon of sedimentation, so a delta will be formed. Artificial rainfall, supersaturated solutions, and supercooled liquids all use the Kelvin formula of vapor pressure on curved surfaces. Washing, oil extraction in oil fields, and the use of pesticides all use the properties of surfactants. Such examples are countless in reality. These examples are very good proofs. While imparting the knowledge of physical chemistry to students, teachers can improve their interest in learning, enhance their understanding of the knowledge, and promote their knowledge while linking the knowledge with the reality in real life. Student memory.[5]

2.4 Flexible Use of Multiple Teaching Methods

Psychology has shown that too shallow knowledge will reduce students 'interest in learning, and difficult to understand and complex knowledge will also reduce students' interest in learning. In this subject, different knowledge points have different degrees of complexity and different thinking methods. Therefore, teachers should teach in different ways based on knowledge points of different levels of difficulty, so that students can improve physical chemistry. Interest from passive learning to active learning.

2.4.1 Historical Interest

Physical chemistry is boring for students. So how do teachers pass on this boring and incomprehensible knowledge to students? In addition to the associative memory method and the physical chemistry thinking method mentioned above, teachers can also appropriately introduce some historical stories about celebrities in chemistry to enhance students' interest in learning. Behind some great scientists are those qualities that are worth learning: courage to explore, innovation, fear of hardships, and active involvement in great causes. These qualities will motivate students. For example, the British chemist Boyle will be strict The experimental method was introduced into chemistry, and tried many times before it was successful. This is a place that is

worth learning for students.

2.4.2 Logic of Blackboard Exhibition, Vivid Multimedia Image

Teachers need to combine blackboard writing with multimedia, which can effectively improve students' learning interest. Blackboard is a traditional teaching method. Teachers use the form of blackboard writing to impart knowledge, so that students can have time to follow the teacher's thinking and continue to think, so that students' thinking will follow the teacher's narrative development. This teaching method has strong theoretical knowledge and is suitable for chapters with more formulas. This teaching method is helpful for clarifying the students' thinking and making them better understand the knowledge points. However, multimedia teaching is a more commonly used teaching method in university classrooms today. The knowledge presented by multimedia is vivid and vivid, and it will bring boring knowledge to life, which will help increase students' interest in learning and increase the interest of knowledge. Multi-media teaching saves teachers a lot of time writing blackboards and speeds up teachers' lecture speed. In the course of physical chemistry, these chapters of chemical kinetics, surface physics, etc. can use multimedia teaching methods.

2.4.3 Discussion and Integration

Discussion teaching method can be used in physics teaching. Discussion teaching method is used in the teaching process, which is of great help to students' judgment ability, and it also helps students to improve their language expression ability and autonomous learning ability. However, not all teaching content is suitable for discussion teaching methods. What students can't understand at present, such as classic and objective theoretical knowledge, is more suitable for specialized teachers. Teachers and students should work hard when using discussion-based teaching methods. Teachers should encourage students to prepare for the classroom so that students have a certain understanding of the content of the classroom in advance. [6]In the discussion class, the classroom is reversed so that students become the main body and teachers become auxiliary roles.

3. Conclusion

According to the four reform measures mentioned above, it shows that the measures have been applied well. The combination of physical chemistry theoretical knowledge and practice effectively stimulates students 'interest in learning, enhances students' learning initiative, and enables students to be more engaged in learning; the cultivation and training of this thinking method promotes students to develop good learning Habits, deepen students 'understanding of what they have learned; the diversity of teaching methods not only stimulates students' interest in learning, but also cultivates students 'various qualities, laying a foundation for students' future development.

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