

# CONSTRUCTION AND APPLICATION OF SITUATIONAL MATERIAL DATABASE OF "IRON AND ITS COMPOUNDS" IN SENIOR HIGH SCHOOL CHEMISTRY

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## ABSTRACT

In order to solve the problems existing in the situational materials and application of "iron and its compounds" in senior high school chemistry, and achieve the goal of implementing the core literacy of chemistry. In this study, the collection, classification, evaluation and application of materials were carried out, the chemical situational material database was constructed, and the application strategy of materials was explored.

**Keywords:** Situational materials of high school chemical iron and its compounds.

## INTRODUCTION

High school chemistry curriculum attaches great importance to real situations from teaching content, teaching activities to teaching evaluation. The Chemistry Curriculum Standard for Senior High Schools (revised in 2020, 2017 edition) emphasizes the theme-oriented, contextualizing the course content and promoting the implementation of the core literacy of the subject. In the proposition suggestion of academic proficiency test, the real situation is used as the test carrier, and the chemical knowledge is used to solve the practical problems in the real situation. Senior high school chemistry teachers are constantly exploring the use of real situations to carry out teaching, but there is a lack of situational materials close to students' real life. Teachers are not clear about how to tap new materials, and sometimes the use is not appropriate enough, and the functional value of materials is not fully exerted. Therefore, it is of practical value to construct the real situation material database, explore how to use the materials effectively and create teaching situations.

### Classification and evaluation of materials

Hualin Bi<sup>[1]</sup> divides chemical situations into inquiry, experience, history and narrative situations. Tian Run<sup>[2]</sup> classifies chemical situations into practice, life, society, stories, natural phenomena, agro-industry and history of science based on the background of situation types. Hu Rong<sup>[3]</sup> divides real situations into application, life, experiment and chemical history situations according to the background of real events in situations. For the composition characteristics of the material function, we refer to Wang Zuhao's<sup>[4]</sup> evaluation standard of high-quality chemistry classroom teaching situation. The functional features F1-F6 are constructed to form features C1-C5.

Table 2 Composition characteristics of material function

dimension	code	index
Functional characteristics	F1	Students can transfer what they want to learn, and the chemical knowledge they have learned exists in a certain situation.
	F2	It can make students realize the significance of learning chemistry to social and personal development.
	F3	It can make students experience scientific methods and cultivate scientific inquiry spirit and problem consciousness.
	F4	It enables students to form a holistic and meaningful understanding of chemical concepts. It enables students to connect the newly learned chemical knowledge with the existing knowledge and form a meaningful connection.
	F5	With ideological and political elements, it can educate students ideologically and politically.
	F6	We can examine students' mastery of knowledge and evaluate teaching results.
Constitutive characteristics	C1	Specific events around the core concepts or scientific methods of chemistry.
	C2	Contains the core problems of chemistry to be solved.
	C3	Based on students' existing chemical knowledge, it conforms to students' cognitive characteristics.
	C4	Provide a framework for students to communicate and participate in the study of specific chemistry topics.
	C5	The material surrounding the core events comes from students' daily life or themes with contemporary social development significance.

Each material is classified, and its function and composition characteristics are analyzed. The more indicators in the functional dimension, the greater the influence of this situation on promoting students' learning chemistry, and the greater the help to deeply understand chemical knowledge; The more indicators in the composition dimension, the closer the relationship between teaching situation and teaching content, and the improvement of students' interest in learning, the achievement of learning goals and the level of students' thinking development.

Table 2 Classification, function and composition characteristics of materials

Situational material	classify	Chemical knowledge	Constitutive characteristics	Functional characteristics	F5 specific explanation
Space meteorite	Chemical History and Traditional Culture	The existing form of iron	C3	F1	
Iron in the crust (Danxia landform)	daily life	Color of iron hydroxide	C3	F1 F5	Protection of Danxia landform
Iron forged by the ancients (iron civilization)	Chemical History and Traditional Culture	Physical properties of iron	C3	F1 F5	national pride
The source of iron ore in China depends largely on imports.	Hot news at home and abroad	Regional distribution of high-quality iron ore	C5	F5	Lack of iron ore resources in the country
The dies forged in the steel works must be dry.	Chemical production	Chemical reaction between iron and water	C1 C2 C3 C4	F1 F2 F6	
Iron supplements and anemia	daily life	Life and health	C1 C3 C5	F1 F2 F4	

Most living things transport oxygen with iron ions.	daily life	Iron is one of the few valence-changing metal elements in which most salts are soluble.	C3	F2 F3 F4	
Reasons why vitamin C is often added to iron supplements	daily life	Redox of iron ions	C1 C2 C3 C4 C5	F1 F3 F4 F5 F6	
Green and yellow of glass and color correction	daily life	The color of iron Redox of iron	C1 C2 C3 C5	F1 F4 F6	
Preservation and use of ferrous sulfate in laboratory	Chemical production	Oxidation of iron	C1 C2 C3 C4 C5	F3 F4	
Manufacture of printed circuit board	Chemical production	Oxidation of trivalent iron ions	C1 C2 C4 C5	F1 F2 F3 F4 F6	
Toner in printer	daily life	Magnetism of ferroferric oxide	C5	F1	
Determination of Iron in Spinach	daily life	Examination of iron ions	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Mung bean soup is red when cooked.	daily life	Redox of iron ions	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Industrial blast furnace ironmaking	Chemical production	Reduction of iron oxide	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Chemistry interesting experiment: the change of tea color	daily life	Redox of iron ions	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Chemical principle of warm baby	daily life	Oxidation of iron	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Using reducing flame to produce ferrous oxide to obtain celadon.	Chemical History and Traditional Culture	Redox of iron ions	C1 C2 C3 C5	F1 F2 F3 F4 F5 F6	national pride
Traditional houses are made of red and blue bricks.	Chemical History and Traditional Culture	Redox of iron ions	C1 C2 C3 C5	F1 F2 F3 F4 F5 F6	Chinese traditional folk arts and crafts
Finishing and dyeing technology of Shunde Xiangyun yarn	Chemical History and Traditional Culture	Redox of iron ions	C1 C2 C3 C5	F1 F2 F3 F4 F5 F6	Chinese traditional folk arts and crafts
Insurance principle of double absorbent	daily life	Redox of iron	C1 C2 C5	F1 F2 F3 F4 F6	
Ink stains are difficult to clean after turning from blue to black; Pen tips with blue and black ink occasionally "jam" and "strike"	daily life	Redox of iron ions	C1 C2 C3 C4 C5	F1 F2 F3 F4 F6	
Bake the wok blue when it is boiling.	daily life	Oxidation of iron	C1 C3 C5	F1 F2 F3 F4 F6	
In 2020, a high-temperature molten steel in a factory exploded in contact with water, killing one person.	Chemical production	Reaction of iron with water	C1 C3 C5	F1 F2 F3 F4 F6f	

Rust as pigment	daily life	Physical properties of iron	C3	F1 F5	
Harm of Corrosion to Iron and Steel Industry	Chemical production	Oxidation of iron	C1 C3 C5	F1 F2 F3 F4 F6	

### Application cases of iron and its compounds.

Choose a material closely related to the life situation, which is rich in function and composition and can run through the classroom content. Therefore, three materials, metal parts, the composition of printer toner and the etching of circuit board, are selected. They have comprehensive knowledge and many functional dimensions, and can jointly use the printer as a whole.

Firstly, the presentation mode is determined, and the printer presents it in kind, and the items in the three materials are disassembled one by one according to the spatial order from the outside to the inside; The reaction between iron and water involved in the casting of metal parts can be analogized with boiling water in an iron pan in daily life, and the composition of toner is explored by a small experiment. The etching of the circuit board allows students to participate in the design themselves. The determination of ferric ion content in etching waste liquid can also be used as a problem situation to evaluate students' mastery.

Metal parts are related to the physical properties, ductility and silvery luster of iron, the manufacture of metal parts involves the reduction of iron oxide and the reaction of simple iron with water vapor, the etching of circuit board involves the conversion of valence of iron, and the determination of trivalent iron ions in etching waste liquid uses the precipitation reaction of iron ions.

### Material selection and application strategy

The real teaching situation of chemistry is generally manifested in words, pictures, videos, activities, etc. Different forms have different functions and are limited by objective conditions. Judging from the role in the classroom, inquiry activities can carry more teaching contents and concentrate students' attention. The teaching effect is much better than other forms, but it needs more time and complete experimental conditions. The material of words and pictures is simple and saves time, but it is not as impressive as videos and activities. Therefore, in the teaching process, we should choose according to the actual situation.

When looking for real situation materials, we can dig through curriculum standards and textbooks of different versions, and also through books, journal papers, demonstration courses, quality courses, the Internet, WeChat WeChat official account and other resources. Then, the collected real situation materials will be analyzed and classified according to the quality evaluation standard, and the real situation materials with more composition index and functional index will be selected. Some real situational materials only have C1, C3 and C5, and functional indicators only have F1 and F5. These materials are simple in composition and function, and most of them can only be used to guide classes and improve students' interest, so they need to be used in combination with other situational materials. Therefore, the more the number of the selected materials, the better, so that the situational materials can be better combined with the teaching content. The classroom designed for using situational materials is a mere formality and has no practical effect.

There are many and miscellaneous contents involved in chemistry class in senior high school, so it is difficult to support the teaching framework and content only by using a single situational

material. Therefore, when choosing real situational teaching, at least two or three materials, or even more, should be selected. At this time, the types of real situational materials should be considered, and the types of real situational materials should not be too single, for example, they should be combined with each other. Because many real situation materials are selected in actual teaching, it is necessary to pay attention to the logical development clues between the materials. When a large number of chemical history situations are used, they can be connected in series according to the logic of taking the classroom in chronological order, so that the situational materials contained in the classroom become rich.

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