

4B (Chemistry) - The Right Sword to Save the Princess

Narrator: After chemistry lesson, two students are talking about the structures of chemicals.

Student A: Do you understand the topic structure, bonding and properties taught in chemistry lesson today? I'm a little bit confused.

Student B: Hmm...yes! Maybe I should introduce my four friends who are the princes from different countries to you. You will understand the things taught in chemistry lesson today after listening to their story.

[Student A and B go away and Father goes up on stage]

Narrator: Once upon a time, there was a beautiful princess and her father wanted her to get married soon.

Father: A terrible witch has cast a spell (施咒) over my daughter and trapped her in a stone. To break the curse, the only way is to get married. So, I'm now going to invite princes from different countries to join a competition. If anyone of them can break the stone and save my daughter, I will let my daughter marry him!

[Father sits down and Prince A goes up on stage]

Prince A: I am Paco. I have found a well-known worker to make an iodine (碘) sword for me. I'm sure I can save the princess with this sword.

[hits the stone once and the sword breaks easily]

Prince A: [shouting] Why!!!!

[Prince B goes up on stage and laughs at Prince A and the soldiers force Prince A to leave]

Prince B: I'm Gemini from Country B. Let me explain why your sword broke easily. Iodine is a weak substance and has a simple molecular structure (簡單分子結構). The forces between the iodine molecules are weak intermolecular force (分子間引力). Even though it's a solid, it breaks easily. Maybe it's time for me to show off now!

[hits the stone with his sodium chloride sword but it also breaks immediately]

Prince B: Oh my God! Why!?

Master A & B: We're masters in chemistry. [Master A and B go up on stage]

Master A: Why did the sodium chloride (氯化鈉) sword break easily when Prince B

used it to hit the rock?

Master B: Sodium chloride has a giant ionic structure (巨型離子結構). The forces between the cations (正離子) and anions (負離子) are strong ionic forces.

Sodium chloride is brittle (易脆的) because the ion layers can slide. Once same ions meet, they repel (排斥) and break. The stone is made up of silicon dioxide (二氧化矽) which has a giant covalent structure (巨型共價結構) and so it cannot be broken by the sodium chloride sword easily.

Daddy: Let's invite Prince C to try this. [The soldiers force Prince B to leave]

[Prince C goes up on stage]

Prince C: I'm Hamish. I come from Country C. My sword is made of G..O...L...D...gold. It must be very hard and strong. Let me try now!
[tries three times but the sword still cannot break the stone]

[Master A and B go up on stage]

Master A: Although his sword is made of gold, it is still not hard enough to break this silicon dioxide stone. Gold has a giant metallic structure (巨型離子結構), which is not stronger than a giant covalent structure.

Master B: So his gold sword cannot break this stone.

Daddy: Oh no... This problem is really difficult to solve. Who can save my dear daughter? [shouting]

[The soldiers force Prince C to leave and Prince D goes up on stage]

Prince D: I'm Calvin. Can you guys see my shiny diamond sword? I'm confident that I can solve this problem and save the dear princess! [hit the stone once and the stone breaks]

Daddy: [shouting] Oh, finally you did it!

[Master A and B go up on stage]

Master A: Maybe I should explain why this happened. Even though a diamond looks brittle, it has a strong covalent bond. The carbon atoms in this structure are held by a strong covalent bond. The stone is made up of silicon dioxide. Although it is also a kind of covalent compound, it is weaker than a diamond. That's why the stone can be broken by this sword!

[The princess comes out from the stone]

Daddy: So here comes my gorgeous girl. She's all yours now!

Princess: Congratulations! I'll be your wife very soon! Can I kiss you, my dear handsome prince? No, it should be my dear handsome husband. [runs to Prince D and tries to kiss him]

Prince D:no no no!

[Princess and Prince D leave the stage and Student A and B go up on stage]

Student B: So do you understand now?

Student A: Yes! I finally got this! Thank you for telling me this entertaining story. Now, I know the hardness of substances is related to the strength of attraction between atoms or ions. Thank you so much!