[MUSIC PLAYING]

JESSICA HARROP: Hi, I'm Jessica and today I'm going to be talking about a chemical demonstration I like to call elements on fire. Let's watch as MIT's Dr. John Dolhun-- here he is-- creates a rainbow of colors at the Cambridge Science Festival.

JOHN DOLHUN: So what I'd like to do is do a grand finale by actually burning some elements since we're talking about elements. And we're going to have a little rondo music to go with this. So Clifton can go ahead and do that. I've got some lithium, some boron, strontium, sodium, and potassium.

[MUSIC PLAYING]

So there should be quite a broad spectrum of colors here. So the boron is a nice green color. The lithium is a beautiful red. The sodium back here is a yellow.

We've got a little bit of strontium which is kind of the bluish-red. I think the blue is probably the methanol. And the potassium is a little bit of a violet in with a yellow color. Can you see those?

JESSICA HARROP: So Dr. Dolhun puts salts of five different elements in watch glasses-- lithium, boron, strontium, sodium, and potassium. He also adds a little methanol to each watch glass. Then he lights them all on fire, and they produce flames of different colors.

Lithium is red. Boron is green. Strontium is a blue-red. Sodium is yellow. And potassium is violet with yellow streaks.

So what's happening? Well, the flame heats up the elements giving them more thermal energy. This excites the electrons from their ground or lower energy state to an excited or higher energy state. This is what that looks like.

Since energy cannot be created or destroyed, any energy that was absorbed by the atom must be emitted again as the electron returns to the ground state. This energy is emitted as light.

So why do different elements have different colored flames? Because the difference in energy between the ground state and the excited state is unique for each element. And what does energy have to do with it? Well the human eye perceives photons or light particles of different energies as different colors.

So red light is a lower energy than yellow, which is a lower energy than blue. Think about it like a rainbow spectrum. So energy increases along the spectrum. Red is low energy light. And violet is high energy light.

Going back to our atoms' energy levels, if the difference between the ground state and the excited state is smaller, the light particle is of lower energy. And we see that as redder light. Conversely, if the energy gap is larger, the light particle is of higher energy. And we see that as bluer light.

And this is a simplified picture of what's happening. Each element has a unique set of excited states, which each leads to a different pattern of light, which we see as red, green, yellow, et cetera.

[MUSIC PLAYING] Hope you enjoyed the video, and I'll see you next time.