Transcript for *Bill Nye the Science Guy* | Changing Phases of Matter

- Ooh! That's a solid! ♪ Solid ♪

- Here's a really neat experiment. You'll need a jar that can take boiling water to do this phase change. Like maybe an old jelly jar. In here I have a cup of boiling water and two cups of sugar. Now I'm gonna pour the sugar water into this jar.

- Whenever you're using a stove, be sure to have an adult around.

- [Cameraman] Careful. Eeh, ahh, ooh! Watch it! Ooh, ahh! Ooh, ooh, ooh, ahh! Ooh, ah! Ah! Ooh! Watch it. Ah.

- [Kid] Now I've tied a piece of string to a pencil and I'm gonna set the pencil in the jar like this. And that's it. I leave everything sitting here until it cools down, then later I cover the top with plastic wrap and put it where it won't be disturbed. Rock candy! It used to be a liquid and now it's a solid. You can even add food coloring to make them any color you'd like. Sometimes science is very sweet!

- This is solid carbon dioxide. We can change it into a gas immediately by putting it in warm water. Watch. Solid, changing phase from a solid to a gas. Which is pouring out of the spout of the hot bottle of science! And we apply the balloon and it inflates rapidly. That's carbon dioxide gas. Not bad, huh?

- It's a gas!

- I'm Maggie Stead and I'm a quality control scientist for Coca-Cola. And it's my job to make sure there's just a right amount of fizz in the can. We make 1450 cans a minute on this line. This is where we keep the CO2 in the silos, it's a liquid form here, it's kept under high pressure so it stays a liquid. It goes through the heaters, it becomes a gas where then it goes into the filling system and it gets in our cans of pop! We shake the bottles and we test the pressure and the temperature and with the temperature and pressure we can look on a CO2 little computer that we have and it tells you the actual volume of the CO2 in there. If there's no carbonation in there, it's really flat. It's lost all its pizazz, there's no point of drinking it, really. I mean I think people drink it because it's carbonated. So I've been here 16 years and it's still fascinating!

- [Bill Nye] Solid, liquid, gas! Three phases of matter. Solid, molecules are moving slowly, packed close together. ♪ Solid ♪ Liquid, molecules are moving a little faster, they're able to flow. ♪ It's liquid ♪ Gas, molecules are moving very fast! They're just, wild!

- It's a gas!

- Three phases of matter!

- When matter is a gas, a lot of the time you can't see it. It's invisible. But here's a way to prove to yourself and any of our fellow scientists that invisible gas is matter, we'll weigh it! First take a look at this broomstick balance of science! It's a broomstick with a hole in it. There's a lunch bag tacked to each end. Now we need to make some invisible gas. This is an old trick but it's a good one. Pour some vinegar into a pitcher. Then add a little bit of baking soda. That fizzing is carbon dioxide gas coming off. It's the same gas that bubbles out of our soft drinks. Even though it's invisible, you can still pour it just like you pour water or milk. Pour the invisible gas into one of the bags. It pours even though you can't see it. The gas is heavier than the air and the bag on this end goes down. It's invisible, but it's matter. It's in the phase of matter that we scientists call gas.

- It's a gas!

- And it's total science.

- [Teacher] Okay, today we're gonna be working with mold wax.

- [Student] Looks just like chocolate.

- And I'll have one of you pour that in for us. Aha!

- [Student] Phase one, the wax goes into the mold.

- [Teacher] Okay, now we're gonna let that cool. Okay now that the wax is gone to a solid, we can lift it out of the pattern.

- [Student] Cool!

- [Teacher] And there we are!

- [Student] Oh wow!

- [Teacher] We've got our pattern.

- [Student] That's neat.

- [Student] What do you need the water for?

- [Teacher] We're gonna mix that with plaster and sand.

- [Student] Oh.

- [Teacher] This is gonna get rock hard in about 15 to 20 minutes.

- [Student] Is this like cement?

- Like cement, yes. It'll be all right. Stick it down in there.

- [Student] Phase two, the mold goes into the plaster. I think there's gonna be like fire or something that he's burning the stuff from, and we don't wanna get burned from it, so we're wearing this stuff.

- What we're doing is we're taking some silicon bronze and we're melting it down and in about, oh, 2100 degrees fahrenheit. And the first pour!

- [Student] Phase three, the molten metal goes into the mold.

- Solid liquid, solid liquid!

- [Teacher] Okay! Look what we've got.

- A solid sits on a stand. The liquid flows and runs out of my hand. There's a gas in this balloon. Now it's in the room. Science.

- When matter's in the gas phase, it takes the shape of its container. When matter's in the liquid phase, it takes the shape of its container. When matter's in the solid phase, it holds its shape. Many solids hold their shape even when you hit them with a water balloon. Well, you know what I mean. Gases, liquids, solids, science! ♪ All matter forms ♪ ♪ Gas liquid and solid ♪ ♪ We gotta a clue from some famous scientists ♪ ♪ They took a look ♪ ♪ When the water turned to gases ♪ ♪ Then they conclude everything is made of matter ♪ ♪ Small particles just take a look around ♪ ♪ Change temperature ♪ ♪ Then the elements transform ♪ ♪ It warms my brain to think of all of that change ♪ ♪ Just take a look ♪ ♪ Form a shape get rearranged ♪ ♪ This was so cool ♪ ♪ That they finally formed a theory ♪ ♪ The elements form the solids liquids and gases ♪ ♪ Some elements will combine with other matter ♪ ♪ Makes such a change that they stay that way forever ♪ ♪ Some other things change from one thing to another ♪ ♪ When temperature is made hotter or cooler ♪ ♪ All molecules moving slower or faster ♪ ♪ Cause elements to change their form of matter ♪ ♪ The ocean and the air are made of molecules ♪ ♪ Together all the time often changing rules ♪ ♪ From solids liquids gases ♪ ♪ We have it all that ♪ ♪ The matter is to life ♪ ♪ What beat is to rap ♪ ♪ Cause it's cool right now ♪ ♪ It's hot right now ♪ ♪ It's gas right now ♪ ♪ It's liquid right now ♪ ♪ It's solid right now ♪ ♪ Changing phases like now ♪ ♪ When I tell you now ♪ ♪ Science is cool right now ♪ ♪ It's cool ♪

- [Director] And action! Bill! Bill!

- Oh excuse me! Just doing some cooking, you know, changing some phases of matter. Right here I've got a solid boiling in a liquid and I'm getting a gas! Well thanks for hanging out with me today, but right now I've got some serious phases of matter to change. See you around the universe!yself to the railing. Those were the days!