"The Elusive Phlogiston"

A skit about the discovery of oxygen

NOTE: You can pronounce phlogiston as "FLODGE-i-stohn" or "flah-GIST-on." People who speak American English tend to use the first one, and people who speak British English tend to use the second one. You can use whichever you prefer.

Props you will need: candle, matches, clear jar, piece of wood, small notebook and pencil (for Lavoisier), optional test tube or small jar or red powder for Priestly, scales for Lavoisier if you have some, plus anything you want to add to give a hint of the historical period in which each scent is set. (Small table and chairs for Priestly and Lavoisier to sit at, with perhaps a fancy teapot and cups, etc.)
NOTE: You might want to use large "cue cards" with the dates and places written on them so you can show the audience. Or, you can have the narrator come on and say the place and time.

Cast:
-Narrator (can also hold up the cue cards between scenes if you are using them)
-Johann Becher, *(Yo-han Beck-er),* an alchemist
-Georg Stahl *(Gay-org Stall)*, a student of Becher
- J. H. Pott, a student of Stahl (It was not possible to find out what J. H. stands for.)
-Johann Juncker *(Yo-han Yung-ker),* a student of Pott
-Joseph Priestly
-Antoine Lavoisier *(An-twon La-vwah-zee-ay)*
-Audience member 1
-Audience member 2

SCENE 1: Germany, 1669 **(Hold up a cue card with this printed on it, if you are using cue cards)**

Becher: Stahl, I think I have finally solved the mystery of fire!

Stahl: That's wonderful, Master Becher. I am so fortunate to be your student!

Becher: Yes, you are. You and I will go down in history as the people who discovered fire.

Stahl: I think fire has already been discovered.

Becher: You know what I mean. We are the ones who will unravel the deep mysteries about fire! You see, Stahl, the ancients thought that everything was made of four elements: water, earth, air and fire. But they had it all wrong. Everything is made of earth, but there are three kinds of earth. One of them, which I call "terra pinguis" is oily and catches fire easily. Substances that burn have a lot of terra pinguis in them.

Stahl: Yes, that makes sense. Things that burn contain a lot of the element that burns. So plants contain a lot of this element. But what about metals? I've seen you melt metals in your crucible.

Becher: Metals contain a very small amount of terra pinguis. Just enough to let them melt.

Stahl: So what does terra pinguis look like? Can we collect a bottle of it?

Becher: No, I don't think so. Terra pinguis is an element you never actually see.

Stahl: So how do you know it is there?

Becher: Well, it must be there. It must! How else could things burn?

Stahl: Yes, I see your point. I'll have to begin studying these three new elements.

Becher: I expect great things from you, Stahl. Some day, you'll be teaching your own students about terra pinguis and how it creates fire.

SCENE 2: Germany, 1703 (Stahl is now a teacher. Mr. Pott is his student.)

Stahl: So you see, students, every substance that burns contains an element than burns. My teacher called it "terra pinguis" but I prefer to call it... "phlogiston."

Pott: Floggee what?

Stahl: Phlogiston. It's from a Greek word meaning "flames," because phlogiston is very combustible. Fire is the visible evidence that phlogiston is leaving a substance. When all the phlogiston is gone, the fire stops and you are left with nothing but ashes. So, young Mr. Pott, if phlogiston left the wood and you ended up ashes, then what is wood made of?

Pott: Um...ashes and phlogiston?

Stahl: Correct! What a brilliant pupil you are! Yes, as long as the phlogiston remains in the wood you can't see the ash. When the phlogiston leaves, then you can see the ash that was there all along. Wood is made of phlogiston and ash.

Pott: Where does the phlogiston go?

Stahl: Into the air all around us.

Pott: But we breathe air.

Stahl: Yes, we do, but we breathe it back out again.

Pott: Yes, of course. So we shouldn't hold our breath or we'll catch on fire, right?

Stahl: Fortunately, you can't hold your breath long enough to let the phlogiston settle in.

Pott: Then...is that how dragons breathed fire? By holding their breath?

Stahl: Mr. Pott, you're brilliant! You shall follow in my footsteps as the next great alchemist. It won't be long until you are a teacher with your own students.

SCENE 3: Germany, 1740 (J. H. Pott is now a professor and is an expert on phlogiston.)

Pott: Today, students, I shall demonstrate to you the element phlogiston.
(Pott has a candle in a candle holder, set on a plate, and a clear glass jar taller than the candle.)

This candle contains both phlogiston and wax. By lighting the candle, I can drive the phlogiston out of the candle. *(He lights the candle.)* By putting the candle under a jar I can contain the phlogiston. *(He puts the jar over the candle.)* The air can only hold a certain amount of phlogiston. When the air becomes saturated with phlogiston, the candle will stop burning because the phlogiston can no longer leave the candle. *(He watches and waits until the candle goes out.)* There—the air is now is what I call "phlogisticated," meaning it is full of phlogiston and cannot hold any more. However, if I lift the jar and let the phlogiston out, then the candle can burn again in the fresh, "de-phlogisticated" air.

Juncker: Does phlogiston itself ever burn?

Pott: No, it cannot be consumed by fire.

Juncker: What does phlogiston look like?

Pott: We don't know exactly, but I can tell you that it definitely consists of a circular movement about its axis.

Juncker: *(perhaps looking a bit confused)* Hmm. Do we know anything else about phlogiston?

Pott: It is responsible for producing colors. And also, it starts fermentation, the process by which sauerkraut and wine are made.

Juncker: I've heard some scientists say that when they burn metals they get heavier, not lighter. Shouldn't something become lighter after the phlogiston goes out of it? How do you account for things weighing less after they burn?

Pott: That's simple enough. You see, in some metals, once phlogiston leaves, the remaining particles get more compact, so the metal weighs less.

Juncker: But I've heard reports that sometimes the burned metal actually gets a little larger. And it weighs more, too.

Pott: Well, in these cases, the phlogiston can weigh less than nothing. When negative-weight phlogiston is in a substance it will actually weigh less than it normally would. Once the phlogiston is gone, the substance will return to its normal weight, making it look like an increase in weight.

Juncker: Negative weight...I see. Only sometimes phlogiston has positive weight, too.

Pott: Much research remains to be done! Perhaps you will take up the challenge.

Juncker: And so I shall!

Narrator: Johann Juncker did indeed become a teacher of phlogiston. And he totally believed that phlogiston could have negative weight. He called it "levity."

By this time, the theory of phlogiston was spreading all over Europe. In England, a scientist named Henry Cavendish managed to isolate what we now call the element hydrogen. But, alas— he thought it was the elusive phlogiston, so he never received credit for discovering hydrogen.

In Germany, an apothecary named Carl Scheele found a way to make pure oxygen gas. But, believing in the phlogiston theory, he thought he had isolated “de-phlogisticated air” and never received credit for discovering oxygen.

Then, in England, a minister and amateur chemist named Joseph Priestly figured out a way to collect pure oxygen. And, believing in phlogiston, he also thought he had isolated de-phlogisticated air. Now, Priestly happened to work as a tutor for a wealthy English family who often traveled to Europe. On once occasion, they took Priestly along with them. One evening, they went to a social gathering of French intellectuals, and Priestly just happened to be seated next to one of France’s most brilliant chemists, Antoine Lavoisier.

SCENE 4: Paris, France, 1774

Priestly and Lavoisier are sitting together at a table.

Lavoisier: Now, tell me again how you were able to gather this de-phlogisticated air.

Priestly: I started with a red powder called mercuric calx. *Lavoisier pulls out a notebook and pencil and begins taking notes. (Optional: Have Priestly pull out a test tube of red powder (turmeric or paprika?) and say, “Here, I’ve brought some along with me.”)* After pouring liquid mercury into the top of the tube, I then turned it upside down and submerged it into a bath of liquid mercury. This would allow me to catch any gases that resulted from heating the red powder.

Lavoisier: *(scribbling notes)* Yes, go on. Then what happened?

Priestly: So there I am, holding an upside down tube filled with my red calx. *(If you are using a test tube, he can show this with the tube.)*

Lavoisier: With liquid mercury at the bottom.

Priestly: Yes. Then I heat the red powder to a very high temperature. After several minutes, I begin noticing that the mercury level in the tube is going down. A gas is appearing in the tube. After about an hour I carefully remove the tube so that the gas does not escape.

Lavoisier: What is the gas like?

Priestly: If I blow out a candle, then put it into the tube, the candle suddenly relights again! Just like that, the flame comes back! There must have been de-phlogisticated and the candle introduced new phlogiston into the test tube.

Lavoisier: Anything else? *(still taking notes)*

Priestly: Yes, if I put a mouse into a jar with this gas, it can survive for a very long time.

Lavoisier: Did you ever breathe it yourself?

Priestly: Yes, I did sneak a few breaths myself. It made me feel all light and airy, very full of life.

Lavoisier: Thank you, Mr. Priestly, for sharing this outstanding discovery with me. I am working with gases right now, myself, and I shall try this experiment in my own lab. Only, I think I'll try your experiment in reverse.

SCENE 5: Paris, France, 1777, at a gathering of scientists

(All other actors can be other members of Lavoisier's audience.)

Lavoisier: I am here to announce the discovery of a new element! It is a gaseous element, and I have named it "oxygen" using the Greek word "oxy" meaning "acid." This new element, I believe, is required to form acids, so I've called it the "acid-maker."

Audience member 1: Where did you find this element?

Lavoisier: It's everywhere, all around us! It's part of the air. Mind you, it's only part of the air. I believe that air is not one element but a mixture of elements.

Audience member 2: How much of the air is this new element, oxygen?

Lavoisier: I estimate that one fifth of the air is oxygen. I know this because my experiments use very precise measurements. I've seen one exactly one fifth of the air disappear and then reappear in the metal I am burning.

Audience member 1: How can air go into metal?

Lavoisier: It sounds strange, but it's true. Particles leave the air and are joined to metal. This is why metal can weigh more after burning than before.

Audience member 2: But I thought that was due to the negative weight of phlogiston.

Lavoisier: Phlogiston? My scales know nothing of phlogiston! My scales tell me that the air got lighter by precisely the same amount that the metal got heavier. There is no such thing as phlogiston!

Audience member 1: But phlogiston is a well-established theory. It's been around for hundreds of years! It must be true!

Lavoisier: For thousands of years, people believed in the four elements: fire, water, air and earth. And that turned out not to be true. I think scientists in the future should base their theories not on what people in the past have believed, but on what their measurements tell them.

Narrator: And that was the end of phlogiston. What became of Lavoisier? He went on to make many more contributions to the science of chemistry. Then... the French Revolution began and he became a victim in that horrific reign of terror. The revolutionaries executed Lavoisier because he had too many rich friends. Today, France holds dear the memory of Lavoisier. They establised the Lavoisier Medal in his honor. They are proud of all his many inventions and discoveries, including his discovery of the element oxygen.