

The AMAZING CHEMICAL CIRCUS

by
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Chemistry and Performing Arts Faculty
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NOTE: This "loose script" was developed in the following manner:

1. Holly met with three chemistry faculty members who were willing to do demonstrations. Three themes were identified: colors of light from excited atoms, rates of reaction for combustion reactions, and production and types of polymers.

2. Holly came up with many ideas for possible theatrical "frames" for the demos. After a week of brainstorming and discussion with show participants (including actor from local community theater group), she settled on the idea of a "Chemical Circus."

3. Holly created characters of RINGMASTER and SQUIRT and wrote a few pages of the script.

4. Chemistry instructors met with Holly and Mike Lussenden (Technical Director) in the studio theater to work out order of demonstrations, possible dialogue, and blocking.

5. Holly wrote entire "loose" script, gave it to teenage actor playing Squirt (Holly's 14-year-old daughter Anne) and revised it based on Anne's comments and suggestions.

6. Chemistry instructors rehearse the night before the performance in the Studio Theater. Technical details are worked out and changes are noted in script.

7. Holly (Ringmaster) and Anne (Squirt) rehearse in the theater. They are coached re: physical comedy by actor from local community theater group. Script is modified accordingly.

8. Performance: instructors acted as the performers/educators they are.

Time elapsed from first group meeting to performance: 16 days.

AMAZING CHEMICAL CIRCUS, SEMI-FINAL DRAFT

Kazoo circus is heard. Lights up on SQUIRT and RINGMASTER playing the kazoo. They march around the stage doing silly synchronized hand motions until RINGMASTER signals the end and then both stop. SQUIRT stands U of RINGMASTER, and as RINGMASTER delivers speech in serious, radio announcer voice, SQUIRT acts out the emotions.

RINGMASTER

Ladies and gentlemen. Vertebrates and invertebrates. Plants and animals. Single-celled organisms. Welcome to the Amazing Chemical Circus. You are about to witness beautiful colors, high decibel explosions, flaming solvents, and ooey, gooey, foamy, gop made before your very eyes. Are you ready?

SQUIRT motions for audience to say, "Yes!"

RINGMASTER

OK, then. Our first experiment takes us to the world of the very, very, very, very, very small. To the smallest part of matter. Does anyone know what that is? [Get answer from audience] Yes. It's an atom. Does anyone know the three main subatomic particles in an atom? [Gets answers from the audience.]

SQUIRT mimes the nucleus of an atom and the electrons around it.

RINGMASTER

OK. Now it's time for me to introduce you to our first scientist who will show you--

RINGMASTER turns to introduce first guest, notices SQUIRT.

RINGMASTER

(Dismissing her.)

Oh. Squirt. You're still here. OK, thanks, see ya.

SQUIRT

(Not getting it.)

You're welcome.

RINGMASTER

No. You can go now. You're done.

SQUIRT

But. It's just getting exciting.

RINGMASTER

But I'm the ringmaster. I can take care of it by myself.
So. Bye.

SQUIRT

I'm an actor. I belong on the stage.

RINGMASTER

We don't need an actor.

SQUIRT

Yes, you do. I can act things out.

RINGMASTER

Act things out.

SQUIRT

Yeah.

RINGMASTER

We're talking about atoms and electrons.

SQUIRT

I can be an electron.

RINGMASTER

Electrons are so tiny, you can't even see them.

SQUIRT

That's why you need me to act them out. You said it was
Science Theater.

RINGMASTER

I'll tell you what. You go offstage. When I need you, I'll
let you know.

SQUIRT

OK. I'll be standing right there.

RINGMASTER

Great.

SQUIRT exits, but then comes back
and startles RINGMASTER again.

RINGMASTER

Now, where was--

SQUIRT

(Right in RINGMASTER's ear.)

RINGMASTER?!

RINGMASTER

(Startled.)

What??!

SQUIRT

How will I know when you need me?

RINGMASTER

I don't know! I'll think of something.

SQUIRT

How about you say a certain phrase like, "act it out." When you say, "Act it out." I'll come right out to help. That'll be our code.

RINGMASTER

Great. Now get off the stage.

SQUIRT

OK. Cool.

(To audience.)

We have a code!!

SQUIRT exits off to the side.

RINGMASTER

Sorry. Now. Without further ado, I'd like to introduce our first guest, a chemist who claims he can make colors appear out of atoms. Please welcome, the astonishing Mr. Green!

Applause. Mr. GREEN enters.

RINGMASTER

Welcome. Mr. Green.

MR. GREEN

It's Mr. Orange.

RINGMASTER

Oh, I'm sorry. Mr. Orange. Is it true that you're going to make colors out of atoms?

MR. GREEN

Yes, it is. In fact I was just doing an experiment about colors from white light.

Lights down. MR. GREEN shows the spectrum produced from white light through a wrap-around diffraction grating and RINGMASTER notices the red, green and blue lights produced from the white. Lights back up.

RINGMASTER

Is there anything different about red, green and blue light except for the color?

MR. GREEN

Yes. Blue has the most energy, etc.

RINGMASTER

How do atoms produce colors?

MR. GREEN

I'm glad you asked. I'd like to explain. But I'll need some help. I'm going to be talking about the electrons in atoms, and how they move, and I thought it would be a good idea to have someone "be" an electron. You know, act it out.

SQUIRT bounds on from off stage triumphantly.

RINGMASTER

I don't know if that's such a good idea.

SQUIRT

At your service!

MR. GREEN

Do you think you could act like an electron?

SQUIRT

Of course!

MR. GREEN

Wonderful. Here's what I want you to do.

RINGMASTER

I don't believe this.

SQUIRT beams, RINGMASTER scowls. BILL instructs SQUIRT to stand on various steps of the wooden steps and jump down to the ground, pressing the proper color LED penlight as she does.

RINGMASTER plays a little kazoo slur every time SQUIRT jumps, correlating the range of pitch to the energy of the color. MR. GREEN explains what this has to do with emission spectra. When this "act it out" demonstration is done--

MR. GREEN

Thanks very much. You did a wonderful job. Let's give her a hand.

SQUIRT exits triumphantly to audience applause.

MR. GREEN shows the audience the colors of light emitted electrical energy in the tubes of helium, neon, argon, krypton, and xenon. RINGMASTER notices the Ne lamp is the brightest. MR. GREEN asks audience, "Which element gives off the lowest energy light?"

RINGMASTER exits and MR. GREEN in presents and explains the following demos:

*Luminol-- chemical energy

*Spray solutions of metal salts-- heat energy

RINGMASTER enters at the end of this demonstration.

MR. GREEN

So that's how light is emitted from the atom (or some such thing to signal the end of his presentation.)

RINGMASTER

Wow. Thanks, Mr. Orange.

MR. GREEN

It's Mr. Brown.

RINGMASTER

Oh, sorry. Mr. Brown. Thanks for showing us the beautiful colors that are made by electrons in the atoms. Let's give a round of applause to Mr. Brown.

MR. GREEN

It's Mr. Blue.

RINGMASTER

Oh. The spectacular Mr. . . Rainbow!

BILL exits. RINGMASTER begins
the next introduction.

RINGMASTER

Our next set of experiments are about combustion. Combustion is a chemical term for something you see everyday. Burning. Burning a candle. Burning a piece of paper. Burning gasoline in our cars. Three things are needed for burning. Can anyone tell me what they are?

(She takes answers to the questions.)

As RINGMASTER talks SQUIRT enters
U and sneaks up behind her with
the drum.

RINGMASTER

Fuel. Spark. Oxygen. When the burning goes slowing, we'll just see flames and heat. But when burning happens quickly, we sometimes get a very loud explosion--

SQUIRT pounds the drum scaring
RINGMASTER.

RINGMASTER

What!!!! What are you doing?

SQUIRT

I'm acting it out.

RINGMASTER

Get off this stage!!!

RINGMASTER chases SQUIRT off the
stage.

RINGMASTER

My heart is pounding and your might be, too, when you see and hear the experiments performed by our next guest scientists. The one, the only, Mr. KaBOOM!

MR. KABOOM strides on stage to
applause.

RINGMASTER

What are you going to do for us today, Mr. KaBOOM?

MR. KABOOM cautions RINGMASTER to don goggles, gets her to shake 10 mL of ethanol (henceforth referred to as "fuel") in a milk jug and starts his first experiment which is

Ethyl alcohol combustion in

A) burn pool of EtOH, followed by

B) burn vaporized EtOH in jug

RINGMASTER

Mr. Kaboom, why did the fuel in the jug burn so quickly?

MR. KABOOM

Maybe this is something we should act out.

RINGMASTER

Shhh. Don't-

SQUIRT bounds on stage acting like an airplane. SQUIRT **should have goggles around her neck.**

SQUIRT

Here I am to help you act things out.

MR. KABOOM

Great. But I think we'll need some more people. Could we get some volunteers from the audience to help us act it out?

RINGMASTER picks 10-12 volunteers. She and SQUIRT group all but two of them together in a tight bunch. She takes the other two to the side, preferably one boy and one girl.

RINGMASTER

These people will be the fuel molecules that are in the dish, all bunched up like they would be in a liquid. Now we need two volunteers to be oxygen molecules. Thank you. What has to happen before the oxygen and the fuel can burn? (Answer: the oxygen has to touch the fuel.) That's right, the oxygen has to actually touch the fuel. OK, fuel molecules, put up your right hand like this. Oxygen molecules, it's up to you to go and slap every fuel's hand as fast as you can. Fuel, when your hand gets slapped, put it down. Hmmm, how are we going to know how long this takes? Hmmm. If we only had a stopwatch.

SQUIRT is pulling a stopwatch out of her pocket.

MR. KABOOM

Good job. You think of everything!

RINGMASTER

Grrr. OK. Does everyone know what they are going to do? (Review if necessary.) Go!

SQUIRT will time how long it takes for the two children to slap all the other folks hands. RINGMASTER plays incidental kazoo music.

SQUIRT

37 seconds!

MR. KABOOM

That's pretty fast. Now let's see how long it will take if the fuel molecules are mixed in with the oxygen like they would be if the fuel is a gas and the fuel and the oxygen are mixed together.

RINGMASTER and SQUIRT get all the people separated and position the two "oxygen" children in the midst of them.

RINGMASTER

Hands up, ethanol molecules. Are you ready, oxygen? Go.

SQUIRT times it. RINGMASTER plays zippy Kazoo music.

SQUIRT

6 seconds!

MR. KABOOM

Reminds audience that the time differences correspond with the different reaction rates of the previous experiment. Explains that the faster a combustion reaction, the louder the boom.

RINGMASTER

Let's thank our volunteers!

Volunteers go back to their seats. MR. KABOOM does the rest of his demonstrations in this order. (SQUIRT needs goggles if she didn't come on with them.)

MR. KABOOM performs these demos, explaining the set up and asking the audience for their predictions and suggestions:

*Effect of size on burning of iron

*Methane explosion (CH₄ cylinder, hose, modified paint can, rubber mallet)

RINGMASTER and SQUIRT do a little arguing routine while the audience waits for the methane can to blow. After the can blows. . .

RINGMASTER

See, I told you it would explode!

SQUIRT

I said it would blow all along!

RINGMASTER pushes SQUIRT off the stage.

For the burning of gases (see next experiment), MR. KABOOM will ask the audience which one they think will burn the fastest. RINGMASTER will help to tie strings on balloons and position them. MR. KABOOM will also don ear protection.

RINGMASTER

Mr. Kaboom, why do you have those things over your ears?

MR. KABOOM

What?

Repeat as necessary to get point across. Warn parents and children about ear protection.

Using "candle on a stick" light balloons on strings taped to a stool.

A) He balloon

B) H₂ balloon

C) H

2 & O2 balloon

MR. KABOOM

I hope you've enjoyed the demonstrations (or something else that will signal he is done.)

RINGMASTER

Let's give a big round of applause to Mr. KaBOOm.

MR. KABOOM exits to applause.

RINGMASTER

Our first experiment took us into the world of the atom. Our second experiments showed us what happens if atoms of fuel collide with atoms of oxygen--

SQUIRT enters with two foam noses and a box of polymers. Puts one of the nose on RINGMASTER.

RINGMASTER

(Talking in a nasal voice until she adjusts the nose.)

Our last scientist will show us the amazing world of great, big molecules, molecules made of many, many, many atoms. These huge molecules make up what we call polymers. Polymers like high density polyethylene found in milk jugs.

SQUIRT holds up an example of each of the polymers as the RINGMASTER talks about them.

RINGMASTER

Yogurt cups made of polypropylene. Etc. all the rest of the recyclables. And-- don't we have some foam? You know, the soft, squishy kind.

SQUIRT points at the RINGMASTER's nose.

RINGMASTER

OK, fine. I'll look myself.

Takes the box from SQUIRT.

RINGMASTER

Darn it I don't have any foam. I could have sworn I brought some. Where did it go?

In our pilot a child broke free of his parents and came right up to the RINGMASTER and told her, "It's on your nose, silly!"

RINGMASTER

OH! My nose. Of course.

(To SQUIRT.)

OK, thanks. You can leave now.

Motions to SQUIRT to remove her nose. SQUIRT pulls off the nose and exits.

RINGMASTER

Welcome to the scientist who will show us all about these big, huge molecules, the ELASTO-MAN.

ELASTO-MAN enters. RINGMASTER exits to sit in the audience.

ELASTO-MAN

Now we're going to make JUMBO molecules out of small ones.

RINGMASTER assembles large, toddler toy beads into a long chain while ELASTO-MAN starts the first demo. RINGMASTER assists ELASTO-MAN in manipulating models, etc. Demos include:

1. liquid latex (white) in a beaker, mix with water.
RINGMASTER bounces ball at end.?

2. Waterloc and instant snow.

3. Polyurethane--

So mix the 2 components of polyurethane (diol and diamine). RINGMASTER assembles a string of beads using alternating colors. When some are left over, she throws them over her shoulder and "showcases" the strand she made. While polyurethane is foaming up ELASTO-MAN moves D from the demo and apologizes for the fact that nothing is happening. RINGMASTER points it out and motions for kids to tell ELASTO-MAN.

ELASTO-MAN reminds audience that it's important to make observations!

ELASTO-MAN

Now I'm going to make one more kind of polymer. And I want everyone to listen very carefully to how I am making it. Because after our show, you will have a chance to go into the cafeteria and make some yourself.

ELASTO-MAN makes (5) slime.

Mix components - polyvinyl alcohol and borax. Use 20 mL of

polyvinyl alcohol and 2-3 mL of 4% borax.

RINGMASTER

Elasto-man. Why did it get all gloopy when you added the borax?

ELASTO-MAN

I think it would help if we "act it out."

RINGMASTER

Oh, no!

SQUIRT bounds on stage, RINGMASTER picks 10 volunteers and SQUIRT lines them up in two lines.

RINGMASTER

Now each one of these people are a small molecule. What will we do to try to get them to be a polymer?

People hold hands and form two lines. SQUIRT goes to head of one line, RINGMASTER to another. RINGMASTER talks while they lead the lines front to back, etc.

RINGMASTER

The chains are big and move slowly but they can move in opposite directions. But now another molecules, a cross-linker, jumps in and grabs both chains.

Person designated as cross-linker comes from audience and holds onto to arms of two members of different chains.

RINGMASTER

Now it's very hard to get the chains to move. That's what happened when the slime stiffened up. Please think of what is happening to the long strands of polymers when you make your own slime after the show.

(Concluding this section.)

Thanks to our volunteers and thanks to the Elasto-man.

ELASTO-MAN exits. SQUIRT exits.
RINGMASTER stands in spot.

RINGMASTER

We hope you've enjoyed our AMAZING CHEMICAL CIRCUS. Please fill out the cards in your program to tell us what you thought of it. You can put in the into the big beaker downstairs when you go to make your very own slime.

(Sees someone in the audience.)

Oh, there's a reporter here today. Would you like to say something?

PERSON DOING ASSESSMENTS

Explains that they will be filming the slime hands-on and which table to go to if you don't want to be filmed.

RINGMASTER

Let's get our amazing scientists out here for one more bow. Mr. Green. I mean Orange. No Brown. Mr. KaBOOM. And Dr. Shaw, Elasto-man. And of course, Squirt, my able assistant. All of these scientists will be down in the cafeteria so you can talk to them after the show. Thanks for coming!!

They all take a bow. Lights up.
SQUIRT tells the kids she'll lead them to the slime.