

1a

1b

1c

Ms. Galusha begins the discussion by introducing the deep question. She invokes the Flash application, which presents the question: What is an electric circuit all about?

Ms. Galusha

Let's talk about this. What is an electric circuit all about?

After giving the class a moment to think about the question, she clicks on the screen, showing the illustration of a circuit shown in **Figure 1a**. After giving her students a moment to review the illustration, she asks...

Ms. Galusha

So what's going on here?

Vignesh

Those are the parts of a circuit.

Ms. Galusha

Tell me more about that.

Shumet

One of the wires isn't connected, to the motor.

Ms. Galusha

So?

Shumet

The wire needs to be connected.

Ms. Galusha

Ok, the wire isn't connected? What's going on there?

Rachel

The wire needs to be connected so the electricity can flow.

Amir

Yeah, all the wires must be connected from the D-cell to the motor so the electricity can get to the motor.

Ms. Galusha

Ok, so I think I heard you say that if we connect the wire to the motor, the electricity will get from the D-cell to the motor. Does anyone have anything to add?

Semira

The switch is open.

Mark

Yeah, the switch has to be closed too so there is a complete pathway back to the D cell.

Ms. Galusha

So you're saying the switch has to be closed and the wire connected to complete the circuit?

Several students nod their heads.

Ms. Galusha

Let's see if you're right. First I'll close the switch.

Ms. Galusha clicks on the switch, **Figure 1b**. The motor still does not run.

Ms. Galusha

What's going on?

Amir

Why can't the electricity jump from the wire to the motor? That's what lightning does.

Ms. Galusha

That's a really great question Amir. I think lightning has special properties. I'll look

that up and get back to you. But we can see that it didn't happen here. The electricity did not pass through the air, because air does not conduct electricity and the motor is not running. Let's see what happens now when we connect the wire. Will the motor start?

Figure 1c; Ms. Galusha connects the wire by clicking on it. The circuit is complete; the motor runs and the flag spins counterclockwise. Ms. Galusha then asks the class...

Ms. Galusha

So, what is an electric circuit all about?

Semira

It's a complete path that lets the electricity flow from the D-cell through the insulated wire to a motor.

Ms. Galusha

Sandy, what do you have to say about what Semira said?

Sandy

Yes, I think she's right about a circuit being a complete path.

Mark

It doesn't have to have a motor. It could have a light bulb. And the electricity can come from plugging a plug into the wall.

Ms. Galusha

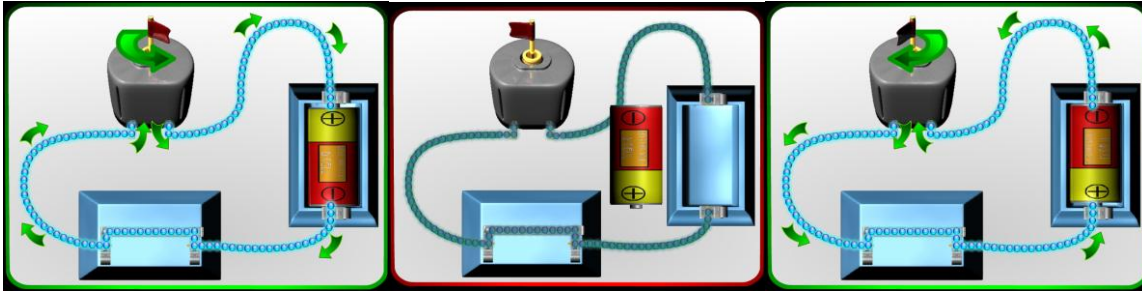
What do you think about that?

Minh

Yeah, electric circuits make lots of things happen. There just needs to be a complete pathway from the electricity source.

Ms. Galusha

OK, I think we have done a great job describing some important things about an electric circuit.



1d

1e

1f

Ms. Galusha

Let's explore another important concept about electricity.

Ms. G. clicks on the arrow in the illustration, which presents the question: What's going on with the flow of electricity in a circuit? She points to the circuit with the motor running and says...

Ms. Galusha

What's going on here?

Maria

The electricity comes out of the D-cell and goes through the wires.

Ms. Galusha

Great observation! Tell me more about that.

Jose

It comes out of both sides of the battery and goes to the motor.

Ms. Galusha

Hmm, is that what is going on here? Let's take another look. What's going on?

Kashina

I think electricity flows from the negative end of the D cell through the circuit and back to the positive end of the D cell.

Ms. Galusha

Good thinking. What makes you say that?

Vignesh

Well, the minus sign on the battery is the negative. The plus sign is the positive. The electricity must flow that way because the motor is spinning that way.

Ms. Galusha points to the circuit and moves her arm in a circle from negative to positive.

Ms. Galusha

So you think it flows this way?

Vignesh

Yes.

Ms. Galusha

I think you are on to something. What does everyone else think?

Tina

Yes, I think that's right because we know the electricity has to flow in one direction only.

Ms. Galusha

So I hear you saying that electricity flows from negative to positive through the pathway?

When no one disagrees, Ms. Galusha clicks on a wire, which shows an animation of the electricity as a series of little blue balls flowing through the circuit from the negative pole of the battery to the positive, **Figure 1d**.

Ms. Galusha

OK, I can see that you are all thinking like scientists; the current is flowing in one direction from positive to negative. So here's a question for you. What happens if I flip the D-cell over so it faces the other way?

Ms. Galusha clicks on the animation, and the D-cell flips over, but hovers over its cradle, **Figure 1e**. After a moment, Jose says...

Jose

Then the negative will be on the other side. The current goes from negative to positive so it will go the other way.

Ms. Galusha

George, what do you have to say about that?

George

Yeah.

Ms. Galusha

Tell me more about that.

George

Jose got it right. It will flow the opposite way since it goes from negative to positive.

Ms. Galusha

Anyone have anything else to add?

After a pause Ms. G clicks on the animation, which shows the current flowing from negative to positive, **Figure 1f**, with the flag turning in the opposite direction.

Ms. Galusha

Any questions?

Jose

Why isn't the current flowing through the battery?

Ms. Galusha

Great question Jose. Electricity is motivated through the D-cell by a chemical reaction that happens inside. It's a bit more complicated so we don't show it that way in the animation, but you can research that if you'd like. The key thing to remember here is that the D-cell acts as the source for the flow of electricity.

Ms Galusha then moves to sum up what has been learned so far...