Teacher/Video	STCO2_SI_Int_EP_HSEnergy
Content Area	Energy Transfer
STeLLA Strategy	Strategy 1: Ask questions to elicit student ideas and predictions Strategy 2: Ask questions to probe student ideas and predictions
Context	This is an interview with a high school student who has previously taken a high school chemistry course but had no previous courses in physics. The interviewer is trying to find out what this student thinks about energy and how it changes using as an example a hand crank flashlight.

00:12 **Int** So, um, I have here what manufacturers call a hand crank flashlight. Have you ever seen or used one before?

00:23 **S** No, I don't believe so.

00:33 **Int** Okay. So I'm just gonna give you a little bit of time to play with it a little bit, to kind of get a sense for what it is and … um, what do you notice about it?

00:40 **S** Uh, it doesn't turn on when I … Oh, yeah, it does. Um …

00:42 **Int** Okay, so it has an on/off switch.

00:48 **S** Yeah, it has an on/off switch. I don't know what this is. Oh. That's probably the crank.

00:59 **Int** So what role do you think the crank plays in the flashlight?

01:08 **S** I'm guessing that this stores battery. So that there's not a battery in here. So that when you press power, it turns on.

01:14 **Int** Okay. And if you wanted to make that light, um … be brighter, what do you think you might need to do?

01:20 **S** Crank it. Maybe faster.

01:22 **Int** Okay. What if I …

01:28 **S** The light's changing.

01:30 **Int** Changing how?

01:32 **S** I think it might be getting brighter … or dimmer. I don't know if it depends on the direction I'm turning it or not.

01:38 **Int** That's a good question.

01:40 **Int** So one of the things that you said was maybe there's a motor in there.

01:44 **S** Yeah.

01:45 **Int** What's a motor?

01:46 **S** Uh, it's maybe something that can collect energy.

01:52 **Int** Collect energy.

01:53 **S** And, the way it moves, or the way it's … The way something is put on it. Like, energy put into it and how it collects … I don't know. Because it's not gonna make that noise

unless I put … something -- a force on it.

02:09 **Int** Okay.

02:10 **S** And then, I'm thinking it's taking this … my energy of doing this … and converting it to energy to light the … light.

02:19 **Int** To light the light. Okay. So you said, um, energy when you turn it, is … taken to light the light?

02:29 **S** Um hmm.

02:30 **Int** Is that … is that right? And you said that a motor might be in there to help store the energy.

02:34 **S** Um hmm. Or convert it. And/or convert it.

02:37 **Int** Okay. So, talk a little bit about energy conversion.

02:42 **S** Uh…

02:42 **Int** What do you know about that?

02:44 **S** I don't know a lot about it. But, I know … like it has to do with electrons. And there's no … there's no loss of energy. So, the same amount of energy that I'm putting into it is gonna be used to light the light. Um, but it has to do with electrons.

03:05 **Int** So, you said it had to do with electrons. What are … what are electrons?

03:10 **S** Um, they're negatively charged atoms.

03:12 **Int** Negative charged atoms. Could you draw a picture of an electron? What you think it might look like?

03:20 **S** It's mostly empty space. And it has a nucleus, which is really dense.

03:25 **Int** Okay.

03:25 **S** And then the nucleus is positively charged. And … electrons make up the … outer space of the … atom. And they're negatively charged. And they're on different layers. So, depending on what atom it is. Um, helium has less … outer layers than carbon would. Because it has less mass. Um …

03:49 **Int** And what is this whole thing that you drew?

03:52 **S** This is an atom.

03:52 **Int** Okay. So this is an atom---

03:53 **S** Um hmm. And these are the electrons.

03:55 **Int** Okay. Now you said that electrons maybe played a role in what's going on in here. Can you talk a little bit about … a little bit more about what role you think the electrons might play?

04:07 **S** Um … well, I know, uh, the movement of electrons is what…uh, is what we see as light. So, the jump from different … uh, orbitals, or outside layers, um, on an atom, either from one atom to another is … is what we see as light. So, them moving.

04:27 **Int** So, electrons moving. Jumping from one orbital to another.

04:32 **S** Um hmm.

04:32 **Int** Or from an atom to another.

04:33 **S** Um hmm.

04:34 **Int** Results in light being produced?

04:36 **S** Um hmm. Yeah.

04:37 **Int** And you said that what might be in there is a motor. Can you describe more about what the motor is, or what pieces and parts you might … what other pieces and parts you might see if you were to look inside the …

04:48 **S** Um … I … uh, I don't know if it's like maybe an electrical thing, where it's mo … that's able to move electrons. Like, when I do this … there's some circuit in there that will move the electron and that's … how come light produces, maybe.

05:04 **Int** So, you said the circuit might move the electron.

05:09 **S** Um hmm. Like maybe there's some … difference in, uh, like positive and negative charges. And that will move electrons around because they're negatively charged.

05:20 **Int** And so, since electrons are negatively charged, is … and you said it might be positive and negative, does that have anything to do with how the electrons might move?

05:32 **S** It probably has a lot to do, yeah. Because, electrons … um, are attracted by this opposites. So, they're gonna come together. And if there's more electrons in there, they're gonna go apart and … depending on the movement.

Teacher/Video	SSUP_ET_KY GR4_SG1_L1_Osborne_C1
Content Area	Energy Transfer
STeLLA Strategy	Strategy 1: Ask questions to elicit student ideas and predictions Strategy 2: Ask questions to probe student ideas and predictions
Context	This is lesson 1 of 5 in the Energy, Every Day, Everywhere unit. In this lesson, students explore a toy car launcher and wonder how do we know if something has energy? In this clip, students begin the unit by sharing what they already know about energy and what they wonder about energy.

00:00:03	T	Let's start with some things that you think you know about energy. Things that you might know about energy. Evan.
00:00:14	SN	It's the movement of something.
00:00:16	T	It's the movement of something. Okay.
00:00:22	SN	Do we write this too?
00:00:24	T	You can, you- well, let's not. Don't write it, 'cause this is a- a combination of all of us, okay? It's the movement of something.
00:00:44	T	Okay. Different ideas. Jameson?
00:00:47	SN	It turns stuff on.
00:00:50	T	It turns stuff on, okay.
00:00:55	S	Like computers and the electricity, like how it turns the lights on, makes it turn the lights on, the switch and it goes on.
00:01:06	T	So you're talking about computers and lights and electricity?
00:01:10	S	Mm-hm.
00:01:11	T	Okay. Oops.
00:01:26	T	I'm going to run out of space. Hunter?
00:01:28	SN	It's strong, very strong.
00:01:31	T	Energy is strong? Okay. What do you mean by strong?

00:01:41	S	Like, it can power really anything if you try.
00:01:49	T	Okay, so it can power things.
00:02:00	T	What else? Evangeline.
00:02:03	SN	It's stored in solar panels.
00:02:07	T	What do you mean?
00:02:08	S	Because, like, solar panels store e- e- energy. So basically, ener- solar panels store energy inside of them.
00:02:24	T	So you think maybe solar panels have something to do with energy?
00:02:27	S/T	Mm-hm./Okay.
00:02:43	T	Kyland.
00:02:44	SN	Energy changes-
00:02:45	T	Energy what?
00:02:46	S	Energy changes a sound like a guitar.
00:02:50	T	Ooh. Energy changes a sound like a guitar. What do you mean?
00:02:58	S	Like if you tune it, the energy changes and makes it either louder or…
00:03:05	T	Hm. Okay. So we could say e- energy- what if we say energy is related to a guitar? Or a guitar is related to energy? Is that what you mean?
00:03:22	S	Kind of.
00:03:23	T	Okay, what else- what do you mean? Tell me more.
00:03:29	S	The energy goes in the string of a guitar and makes it change the sound.
00:03:35	T	Okay, so energy goes through the guitar strings and changes it. Okay.
00:03:59	T	Apparently I should've written smaller. All right, I don't have any more space. Let's talk about some wonders. What are some things that you wonder about, some questions that you have about energy?
00:04:10	SN	How do we get energy?

00:04:12	T	How do we get energy? Okay.
00:04:29	T	Waylon.
00:04:30	SN	Where does energy come from?
00:04:32	T	Good one. Where does energy come from?
00:04:46	T	Chrislyn.
00:04:50	SN	What is energy?
00:04:52	T	Say it-
00:04:52	S	What is energy.
00:04:55	T	What is energy? Okay.
00:05:06	T	Blakely.
00:05:08	SN	How does energy help us?
00:05:10	T	How does energy help us?
00:05:25	T	Evan.
00:05:27	SN	If two things hit each other, will it move- will they- will they lose all energy? Or will the thing that hit another thing give all its energy to the thing it hit?
00:05:40	T	That's a long one. Hm. Say it again.
00:05:46	S	If two things move and hit each other, then will the- will it lose all energy? Or will-
00:05:53	T	Okay, so if two things- what do you mean, hit each other?
00:06:00	S	Like if something- if there was just something that was there not moving at all and something came moving and hit it-
00:06:10	T/S	Okay./would it lose all energy and that one move, or would it stop the thing and stay still?
00:06:16	T	Okay. So I'm trying to think of how I can write that. Hm.
00:06:30	T	There's a word that you can use if something's sitting still and it's called stationary. So I'm going to say that one. If something is stationary…

00:06:48	T	And something else…
00:06:54	S	Collides with it.
00:06:55	T	Ooh, collides, I like that word. If- and something else collides with it…what's your question part of it?
00:07:13	T	How- you're talking about how the energy moved from one to the other, is that what you were saying? Okay. So if something is stationary and something else collides with it, what happens to the energy? How about that?
00:07:25	S	Yes. Lose all energy or gives the energy to the thing that was stationary.
00:07:36	T	Will it lose energy or will energy move? Did I write that right? Okay.

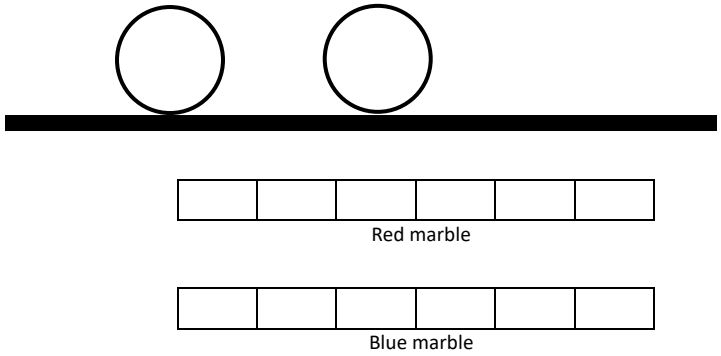
Investigating Energy Changes in Collisions

Trial 1: A Small Amount of Energy

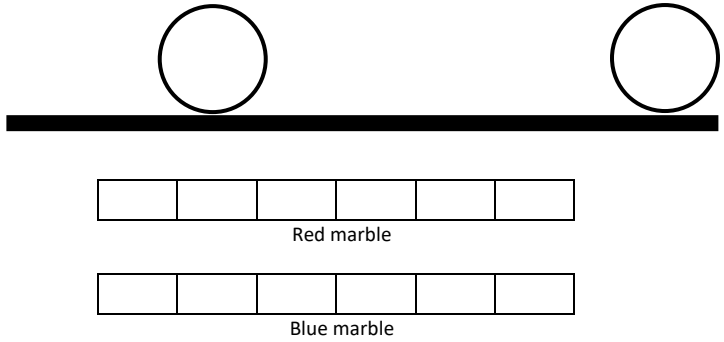
Energy bars

red energy bars for the red marble
blue energy bars for the blue marble

1. The red marble is rolling toward the blue marble



2. The red marble has just hit the blue marble

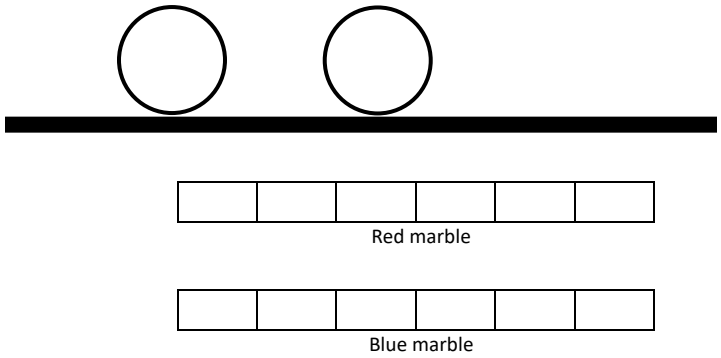


Trial 2: A Medium Amount of Energy

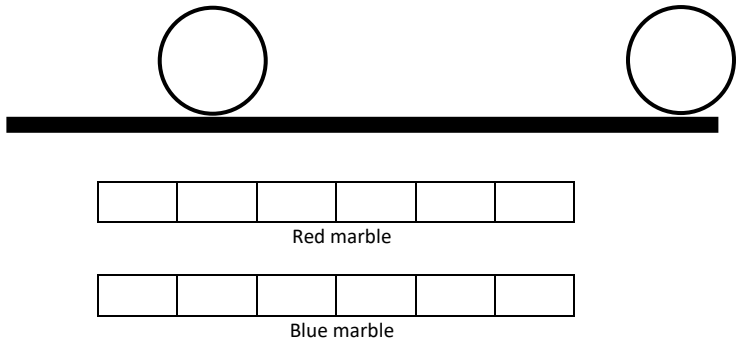
Energy bars

red energy bars for the red marble
blue energy bars for the blue marble

1. The red marble is rolling toward the blue marble



2. The red marble has just hit the blue marble

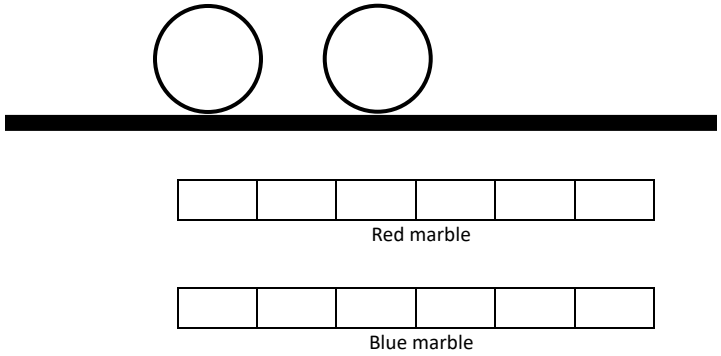


Trial 3: A Large Amount of Energy

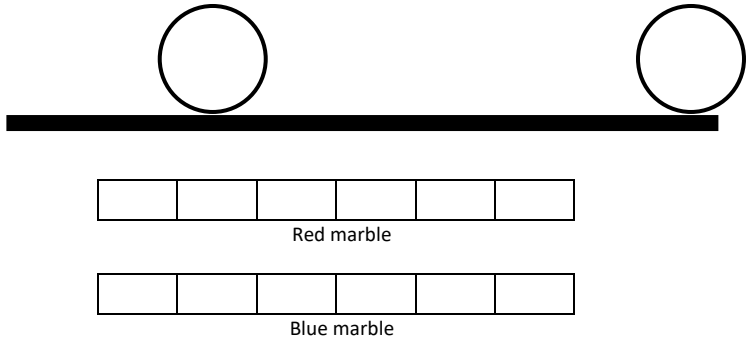
Energy bars

red energy bars for the red marble
blue energy bars for the blue marble

1. The red marble is rolling toward the blue marble



2. The red marble has just hit the blue marble

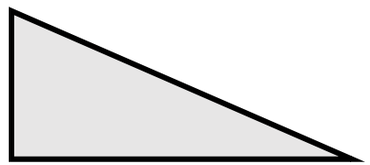


Investigating Energy Changes
Analogy Map

Part of Ruler/Marble System	Represents...	Part of Car Launcher System	They are alike because:
Red marble			
Blue marble			
		Track	

Predicting and Observing Changes in Energy

1. Compare the two ramp systems.
   Predict the observable changes and changes in energy in the marble and ramp system.

	 **Ramp 1**	 **Ramp 2**

Before the collision: Compare the speed of the marbles as they reach the end of each ramp.

I predict the marble on ramp 2 will roll _____ than the marble on ramp 1.

I think this because _____

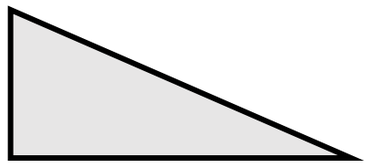
The red marble has just hit the Styrofoam block: Compare the distance the marble and Styrofoam block will move after the collision.

I predict the marble and Styrofoam block at the bottom of ramp 2 will move _____ than the marble and Styrofoam block on ramp 1.

I think this because _____

_____

2. Test your predictions and add your data to the table below.

		 Ramp 1	 Ramp 2
Height of ramp (cm)			
Distance the Styrofoam moved (cm)	**Trial 1**		
	Trial 2		
	Trial 3		

3. After you complete the trials, compare your data to your predictions. Then answer the following questions:
   What patterns do you observe in your data?

   Do the patterns you observe support your predictions?

   Explain your thinking:

4. Consider Ramp 2.
   - Draw a representation of the marble before it is released, halfway down the ramp, and when it collides with the Styrofoam block.
   - Color in the energy bars to represent the amount of energy.
   - Label the form of energy: P = position energy M = motion energy

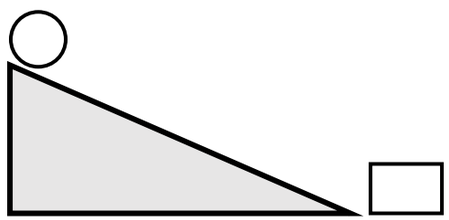
Ramp 2

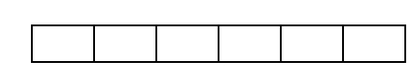
Energy bars

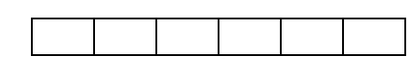
red energy bars for the red marble

blue energy bars for the Styrofoam block

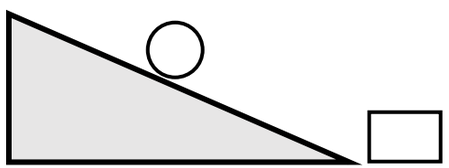
1. The red marble is at the top of the ramp

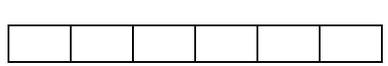


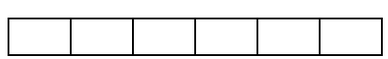




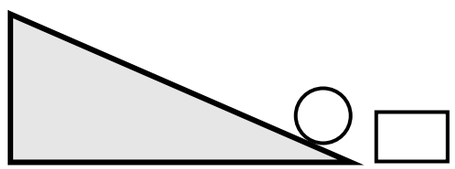
2. The red marble is hallway down the ramp

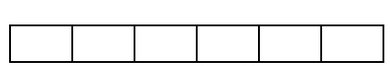


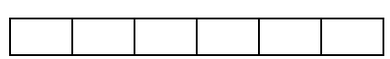




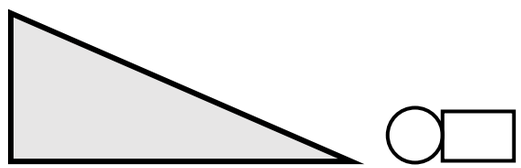
3. The red marble is at the bottom of the ramp

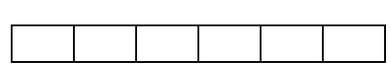


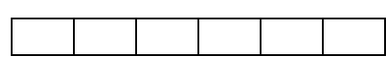




4. The red marble has just hit the Styrofoam block







Daily Reflections – Day 2 Name:_____

1. We are discussing elicit, probe and challenge questions to reveal student thinking. How do these types of questions resonate with your current questioning style? What role do you think the use of these questions play in revealing student thinking? Explain your thinking.

2. What challenges do you anticipate, or have you encountered when trying to develop a classroom culture that values student thinking? How do you see the STeLLA strategies contributing to a culture that values student thinking?

3. What was the evidence for energy transfers and energy transformations in the marble/ramp system we used today?