## ANALYSIS GUIDE D:
## SELECT CONTENT REPRESENTATIONS and MODELS MATCHED TO THE LEARNING GOAL

Record the main learning goal in the space below.

Describe the content representation or model in the space below.

| Is the content representation or model … | YES | NO |
|---|---|---|
| 1. Scientifically accurate? | | |
| 2. Closely matched to the main learning goal? | | |
| 3. Presenting science ideas in ways that are comprehensible to students? | | |
| 4. Reinforcing or introducing student misconceptions? | | |
| 5. Addressing common student misconceptions? | | |
| 6. Distracting students from the main learning goal with too many details or new terms? | | |

How can the content representation or model be improved to better match the learning goal?

How will you help students understand how the content representation or model relates to phenomena or ideas being studied? How will students make sense of the strengths and limitations of the content representation or model?

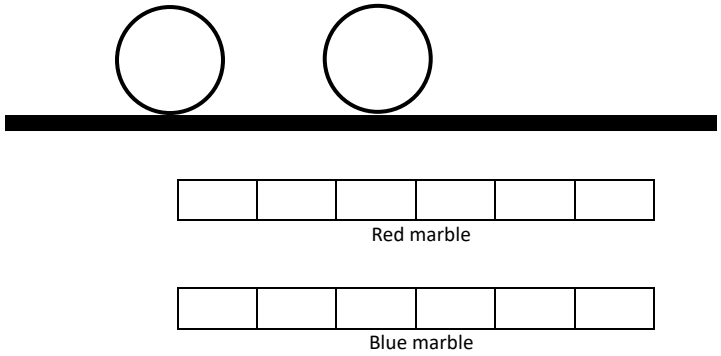
# Investigating Energy Changes in Collisions

**Trial 1: A Small Amount of Energy**

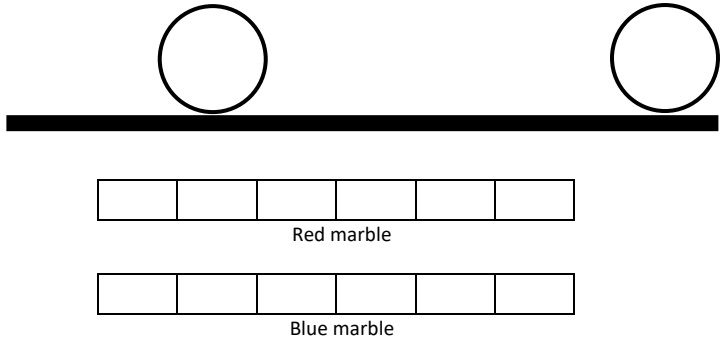
Energy bars

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

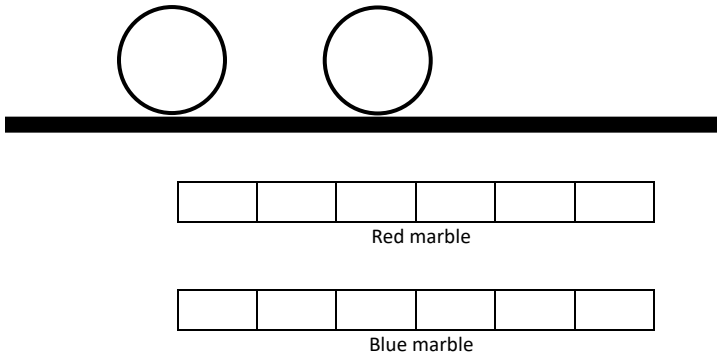



**Trial 2: A Medium Amount of Energy**

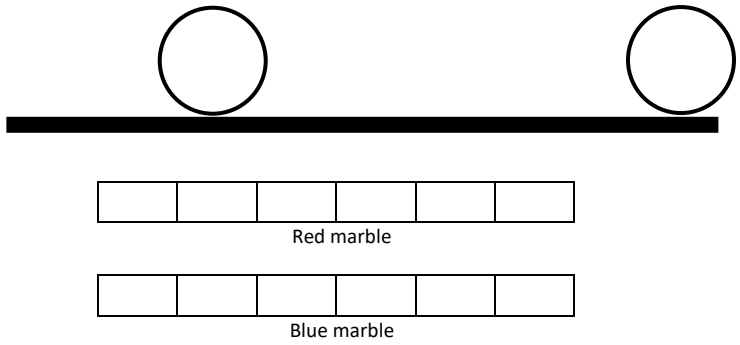
Energy bars

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

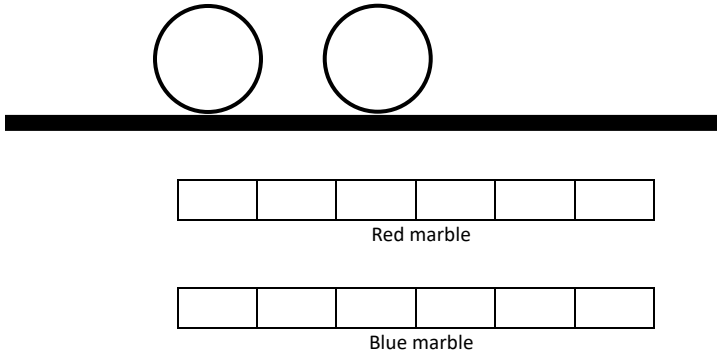


**Trial 3: A Large Amount of Energy**

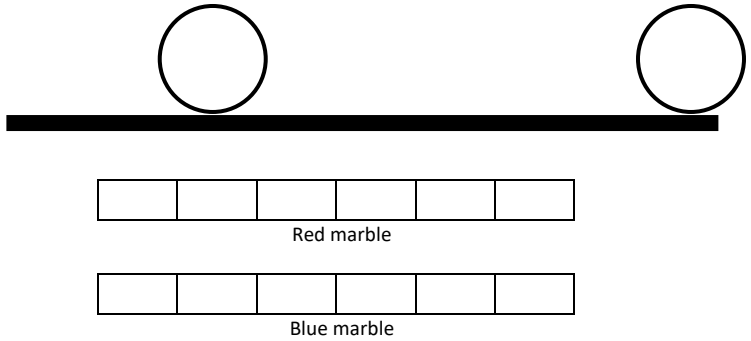
Energy bars

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

1. The red marble is rolling toward the blue marble

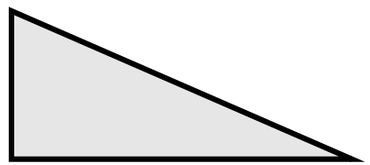



2. The red marble has just hit the blue marble



## 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 _____

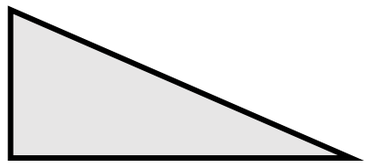
**The red marble has just hit the Styrofoam block:** Compare the distance the marble and Styrofoam block will move after the collision.

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

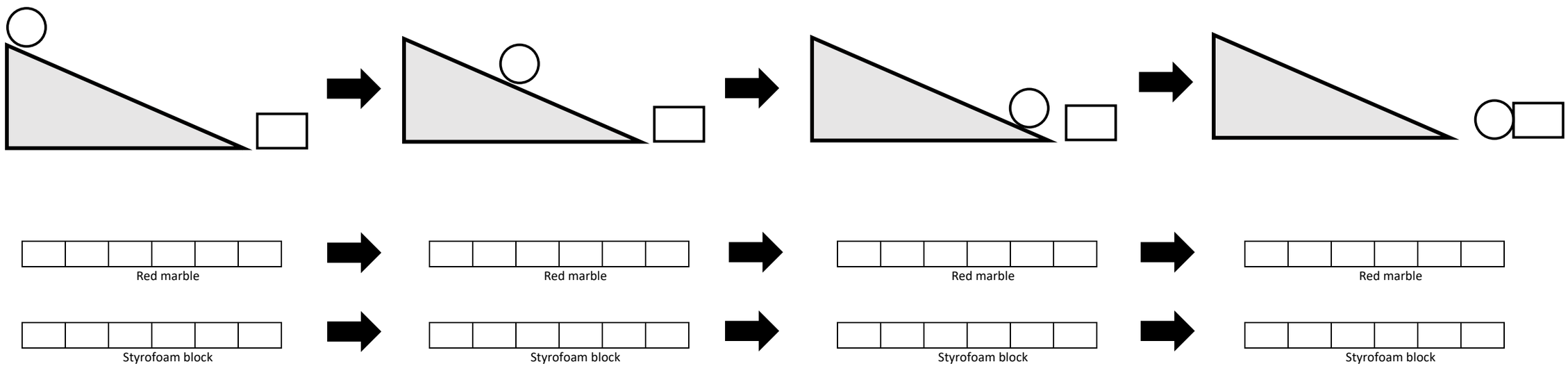
blue energy bars for the Styrofoam block

**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**



## System Diagram

## Hand-Crank Flashlight

cranking slowly

cranking fast

| | |
|---|---|
| **Teacher/Video** | SSUP_ET_L4_Parco_C1 |
| **Content Area** | Energy Transfer |
| **STeLLA Strategy** | Strategy 6: Engage students in developing and using content representations and models<br>Strategy D: Select content representations and models matched to the learning goal |
| **Context** | This is lesson 4 of 5 in the SSUP Energy Every Day, Everywhere series. In this lesson students use system diagrams to represent observable changes and evidence of changes in energy. In this series of clips, the class develops a common system diagram for the ramp/marble system used in Lesson 3. |

| Timecode | Speaker | Dialogue/Logging |
|---|---|---|
| 00:03 | T | So let's go ahead and do it again for Number 2 so we can indicate observable changes but not necessarily focus on labeling each independent part, all right? So how does that look? Mason, how does that look? |
| 00:26 | T | What does that look like? Someone help him out. Bryce? |
| 00:33 | SN | It was like a diagram without the labels. |
| 00:37 | T | Like this one without the labels? |
| 00:38 | S | Yes. |
| 00:39 | T | What do you think? Who gives- who says yes? Thumbs up. Any disagreement? Okay, let's go for it. |
| 00:48 | SN | Well, the marble will be on the- |
| 00:52 | T | Okay, we haven't gotten there yet. So I understand Cora's ready for the next step, but let's go ahead and maybe do the basic components. |
| 01:16 | T | How do we want to change it to indicate some observable change that we remember from that investigation? |
| 01:27 | T | Cora, you were going to say something. I'm going to reflect back to you. |
| 01:32 | SN | The marble has to be at- in the middle of the roll. |
| 01:36 | T | You want it in the middle? Does anyone have ideas on that? Are we good with middle? |
| 01:40 | SN/T | Middle / All right, let's do the middle. How do we want to indicate maybe that movement, Noah? |

| | | |
|---|---|---|
| 01:49 | SN | Like, five different lines. |
| 01:52 | T | Well- oh, so you're talking about the energy bars? Here we're just- |
| 01:57 | S | No, like I'm saying these things. |
| 02:01 | T | Oh, behind it? Like this, like we indicated yesterday? |
| 02:04 | S | Yeah. Yes. |
| 02:07 | T | Okay, does anyone else have a way that we want to represent that? Bryce? |
| 02:12 | SN | Parentheses, because it still has position energy because it's still- |
| 02:17 | T | Parentheses for the position energy? Do I have a thumbs-up? |
| 02:21 | SN/T | Yeah./Okay. Where do I put those position- the parentheses? |
| 02:25 | SN | Around the marble. |
| 02:27 | T | All right. |
| 02:28 | SN | Didn't we also do that for the other diagram? |
| 02:31 | T | Would you like to do it for the other diagram? |
| 02:33 | S | Yes. |
| 02:34 | T | Well- |
| 02:35 | S | It just has position energy. |
| 02:36 | T | Okay. Certainly. Yeah. Do we want to indicate the direction the marble is going for someone who may not know or understand that? What do you think? Do we need an arrow or anything like that? |
| 02:50 | SN/SN | No./I would say the- I would say the motion energy lines kind of indicate that. |
| 02:54 | T | You want to- you think the motion energy lines are good enough? Okay. |
| 02:57 | S | It also depends- |
| 02:58 | T | So what step is that, then? If we're- if this is marble at top of ramp, for Number 2, what would that look like? |
| 03:04 | S | Marble rolling downward. |

| | | |
|---|---|---|
| 03:06 | T | There you go, let's write that down. Does anyone heave a disagreement with that? Are we all onboard? |
| 03:11 | SN | Yeah. |
| 03:12 | T | Marble roll- okay. |
| 03:14 | SN | I was thinking of another way of putting it, but yeah. |
| 03:16 | T | All right, marble rolling down ramp. Okay. |
| 03:35 | T | What's next? Are we good here? Does this indicate an observable change from here to here? |
| 03:45 | T | What do we want our last one to look like? If we- if we do three and the third one, we still have some parts to our system that we haven't really talked about or shown change with yet, is there a way that we could demonstrate that through a diagram? |
| 04:01 | T | Payson, what do you think? |
| 04:03 | SN | We can, like, show the- the styrofoam block moves. |
| 04:08 | T | You want to show the styrofoam block moving? Do I see everybody on board with that? |
| 04:12 | SN | Sure, yeah. |
| 04:13 | T | Okay, so let's figure out how we're going to do that. Do we want to label that first this time? |
| 04:19 | SN | Yeah, probably. |
| 04:20 | T | So how do we want to label it? |
| 04:23 | S | Marble hits the styrofoam block. |
| 04:26 | T | Marble hits styrofoam block? Anybody else want to add to that? |
| 04:29 | SN | Marble- marble at the bottom of the ramp. |
| 04:33 | T | It's at the bottom but what is it doing at the bottom of the ramp? |
| 04:36 | S | The marble hits- it's about to hit the styrofoam block. |
| 04:39 | SN | Marble is hitting the styrofoam block. |
| 04:41 | T | Marble hits styrofoam block? Okay, let's- let's keep it- yes, Noah? |

| | | |
|---|---|---|
| 04:44 | SN | Can I say mine? |
| 04:45 | T | Yes. |
| 04:46 | S | Marble transferring energy to styrofoam block. |
| 04:49 | SN | I'd say that's a little too specific. |
| 04:52 | SN | (Inaudible). |
| 04:53 | T | Is it- is it occurring, though? |
| 04:54 | SS | Yeah. |
| 04:56 | T | Is there anything wrong with that? |
| 04:58 | SN | Uh-oh. |
| 04:59 | T | Who- who prefers that one? |
| 05:00 | SN | Me. |
| 05:01 | T | Who prefers to be more basic? |
| 05:04 | SN | Wow. Wow. |
| 05:05 | T | Okay. So I'm going to let you decide in yours and I'm going to write "Marble transfers energy…" |
| 05:18 | SN | Marble hitting the styrofoam block. |
| 05:19 | T | "…to styrofoam block." |
| 05:21 | S | And basically doing motion. |
| 05:24 | T | Isn't it nice that we can agree to represent things in different ways but the meaning is still there? Marble transfers energy to styrofoam block, right? Now we have to figure out a way to represent that. |
| 05:38 | T | Again, do we need to label all the parts or are we good here? |
| 05:41 | SS | We're good. |
| 05:42 | T | We're good here? Okay. Start with our base. Brianne, what are your ideas? |
| 05:49 | SN | When the marble's hitting the side of the block, because it has, like, marble and |

| | | |
|---|---|---|
| | | (inaudible) the styrofoam block, and the styrofoam block moves. |
| 06:00 | T | Okay, so we have to- we have to show that movement. How are we going to represent that? |
| 06:05 | S | We'll be drawing the styrofoam block with the marble right next to it because- |
| 06:11 | T | So, styrofoam block with the marble right here? |
| 06:14 | S | And also, can you- |
| 06:16 | SN | I was thinking that we could, like- |
| 06:18 | T | Like that? Can we indicate using other symbols, maybe? |
| 06:23 | SN | Yeah. |
| 06:24 | T | More in just a second? But can we agree on the basic structure of that representation? |
| 06:28 | SN | Yes. |
| 06:29 | T | Okay, Jack. |
| 06:30 | SN | Well, I was thinking it was like- like the marble- the marble's fine, but we could, like, for the styrofoam block, we could erase the styrofoam block, like draw it, very lightly and then, like, put arrows to, like, show that it moved. |
| 06:44 | T | Could we still leave it like that but still use your arrows? |
| 06:46 | S | Yeah. |
| 06:47 | T | Okay. How- who thinks the arrows are a good way to represent- |
| 06:50 | SN | Sure. |
| 06:51 | T | some kind of movement? Okay, I- I hear- or actually, I see thumbs up. |

## Lesson Analysis Protocol: SSUP_ET_L4_Parco_Clip 1 Example

### 1. Identify Lens and Strategy

- What instances of asking questions that probe and challenge do you observe?
- What instances of developing and using models do you observe?

### 2. Analyze the Video

- What do students understand (or not) about energy transfer and transformation in a system?
- How did students' and/or teacher's use of STL 2 and 3 (probe and challenge questions) and STL 6 (using content representations and models, reveal, support or challenge their thinking?

| Lesson Analysis Step | To Do | Your Analysis |
|---|---|---|
| **Claim** | Turn an observation, question or judgment into a specific claim that responds to the focus question. | Claim: Students are able to develop a system diagram to represent components of the system, observable changes, and changes in energy. While they are not clear about the differences between system components, observable changes and energy changes, they reveal understanding of motion and position energy as well as energy transfer. |
| **Evidence** | Point to a specific place in the video transcript, lesson plan, or student work that supports your claim. Be sure to use timestamps if your evidence comes from a transcript. | Evidence: 00:48 – 01:36 – The teacher is trying to discuss just the system components when a student wants to put the marble halfway down the ramp. Once the teacher has drawn the components, she returns to the student to share observable changes. From 01:40 – 02:54, students are describing how to represent motion and position energy and add symbols for position energy to part 1 of the diagram. From 04:20 – 05:24 students reveal different ideas about how to represent observable changes and energy changes when the marble hits the Styrofoam block. |
| **Reasoning** | Connect your claim and evidence with reasoning based on STeLLA Strategies, research on teaching and learning, your teaching experience, or scientific principles. | Reasoning: The Framework for K-12 Science Education says models are a thinking tool for making predictions and making sense of experiences (NRC, 2012). In this clip, they are also developing a systems model leveraging a crosscutting concept. They are working collaboratively to develop a model of the marble-ramp system in order to communicate their "mental model" with others (Strategy Book p. 27). Students accurately describe the components of the system, the observable changes happening in the system as the marble rolls down the ramp and collides with Styrofoam block. They also demonstrate understanding of energy transformation as they discuss how to represent motion energy with lines and position energy with parentheses. They are not making distinctions between observable changes and energy changes based on their discussion of how to label the collision between the marble and the Styrofoam block. |
| **Consider Alternatives** | Alternatives may include an alternative interpretation of evidence, new questions this clip, or analysis might raise, and/or alternative question(s), activity(s) or strategies that might have better supported student learning. | I wonder how important it is to make the distinction between the different parts of a system diagram (components of a system, observable changes, and evidence of energy changes)? It will be interesting to see if, when they create their own system diagrams with toys later in the lesson, they will be able to make complete system diagrams. It seems that it is more important to be able to represent the observable changes and evidence of energy changes in order to create an explanation of energy transfer and transformation in the system than to be able to identify the separate characteristics of a system diagram. |

### 3. Reflect and Apply

What ideas about engaging students in [insert STL strategy] do you want to keep in mind for your own teaching?

## Lesson Analysis Protocol: SSUP_ET_L4_Parco_Clip 1

### 1. Identify Lens and Strategy

- What instances of asking questions that probe and challenge do you observe?
- What instances of developing and using models do you observe?

### 2. Analyze the Video

- What do students understand (or not) about energy transfer and transformation in a system?
- How did students' and/or teacher's use of STL 2 and 3 (probe and challenge questions) and STL 6 (using content representations and models, reveal, support or challenge their thinking?

| Lesson Analysis Step | To Do | Your Analysis |
|---|---|---|
| **Claim** | Turn an observation, question or judgment into a specific claim that responds to the focus question. | |
| **Evidence** | Point to a specific place in the video transcript, lesson plan, or student work that supports your claim. Be sure to use timestamps if your evidence comes from a transcript. | |
| **Reasoning** | Connect your claim and evidence with reasoning based on STeLLA Strategies, research on teaching and learning, your teaching experience, or scientific principles. | |
| **Consider Alternatives** | Alternatives may include an alternative interpretation of evidence, new questions this clip or analysis might raise, and/or alternative question(s), activity(s) or strategies that might have better supported student learning. | |

### 3. Reflect and Apply

What ideas about engaging students in [insert STL strategy] do you want to keep in mind for your own teaching?

| | |
|---|---|
| **Teacher/Video** | SSUP_ET_TN GR4_L3_McDaniel_C1 |
| **Content Area** | Energy Transfer |
| **STeLLA Strategy** | Strategy 6: Engage students in developing and using content representations and models<br>Strategy D: Select content representations and models matched to the learning goal |
| **Context** | This is lesson 3 of 5 in the Energy, Every Day, Everywhere unit. In this lesson, students start to explore the marble/ramp system to provide evidence to answer the focus question "How can we change the amount of motion energy of an object?". In this clip, students are sharing their ideas about evidence for energy changes in the ramp/marble system using their diagrams of changes to the system. |

| | | |
|---|---|---|
| 00:00:04 | SN | So this one, it says just hit the Styrofoam. |
| 00:00:08 | T | Mm-hm. |
| 00:00:09 | S | So that- I mean, that it doesn't have any potential. |
| 00:00:13 | T | Oh, wait. Did you hear that? Do you agree? |
| 00:00:15 | SS | Yes. |
| 00:00:16 | T | That it doesn't have any potential. Okay, keep going, keep going, sorry. |
| 00:00:19 | SN | And the potential went away, even though in the beginning there was lots of potential, like with so many lines- |
| 00:00:26 | T | Did it go away or did it just change? |
| 00:00:29 | S | It changed because- 'cause it couldn't have just disappeared, it couldn't have just gone away. |
| 00:00:34 | T | It couldn't have just gone away. |
| 00:00:35 | S | It has to have- have done something. So the reason it hit that- there is no more, it's because- 'cause of that- |
| 00:00:47 | T | It changed over to what? |
| 00:00:49 | S | It changed over to motion energy. |
| 00:00:50 | T | It changed over to all motion, Jordan, it changed over to all motion energy. |

00:00:53 S Because it started going flat-

00:00:55 T/S Yeah./at the bottom, because let's say that there is, like, a table here (inaudible).

00:01:02 SN/T Yeah./But it's on the table, right? Mm-hm.

00:01:04 S So this would be far above the table. I'm guessing about, like, I don't know, seven centimeters.

00:01:12 T Like we did yesterday, yes.

00:01:14 S/T And after that-/And is the- is this red marble off of the table at all?

00:01:17 S It is not off the table at all.

00:01:18 T It is not.

00:01:19 S Even though it kind of looks it's floating 'cause my table's weird.

00:01:22 T Yeah, you're good. So tell me, why did you put three and three? Why did you put three M's and three M's for the Styrofoam?

00:01:29 S Because at first I had thought, oh, this, is going to have six and so is this, 'cause you had said it's always going to be the same. But then I realized wait, that would be too much, and- and Susanna had said that it would be three here and three here and she was correct.

00:01:45 T Why? Why?

00:01:46 S Because if- if there was six here and six here, it probably (inaudible) the other six 'cause there was no- there was no motion energy on the Styrofoam block at all, so where would it have gotten it?

00:01:59 T So yeah, we- no energy went- went into it. Yeah. So where did the Styrofoam block get its energy? Where did it get its motion energy?

00:02:06 S It got its motion energy from the marble. Because of how much- much it-

00:02:12 T Okay, so what- what happened? What- so what do you mean, it got it? So what happened when it hit?

00:02:19 S When it hit- hit the- when the red marble hit the Styrofoam wall, it was pushed forward, giving it motion energy.

00:02:28 T Okay, so what would happen then? When they hit each other, what was that- it's a collision. What happened in that collision?

00:02:33 S What happened in the collision is it transferred energy because half of its energy is in this

and half of its energy is in this.

| | | |
|---|---|---|
| 00:02:41 | T | Ah, did you hear that? So this is where the transfer of energy happened. I love it. Why do you have lines here and here? |
| 00:02:49 | S | Lines here and here make sense to me because- oh, I should probably not have put that one because I don't know. |
| 00:02:56 | T | No, you're fine. But these- these represent motion, correct? |
| 00:02:59 | S | Yes, because the red marble was going and it wouldn't just stop there because- 'cause of how tall it is. |
| 00:03:07 | T | It would slow down, right? But it wouldn't stop the whole way. I love it.. |
| 00:03:10 | S | And it also gives some- some to the Styrofoam block of the motion because it's pushing it. |
| 00:03:15 | T | I love it. Any questions? Anybody want to add on? Trayvon, you want to add on? |
| 00:03:20 | SN | I disagree with (inaudible) because when (inaudible) she only- she put three- three (inaudible). |
| 00:03:39 | T | Three motions? |
| 00:03:40 | S | Yeah, three motion lines. |
| 00:03:41 | T | Oh, oh, oh. Okay, so you're talking about the motion bars. Okay, so- |
| 00:03:45 | S | If it- three motion bars- |
| 00:03:47 | T | Okay. |
| 00:03:48 | S | And where she should've put four because it has more energy= |
| 00:03:51 | T | Okay. |
| 00:03:52 | S | 'cause it's going down the ramp. |
| 00:03:53 | T | So- oh, I love this. So she- he's saying right now- |
| 00:03:57 | SN | But I want to say something. |
| 00:03:58 | T | Where- where's the most energy happening? Or motion energy. Right here? Or at the end? When do you have the most motion energy? |
| 00:04:07 | SN | At number 3. |

| | | |
|---|---|---|
| 00:04:08 | T | 3. So how many do you have on number 3? Number 2? Look, number 2 has three lines for motion energy. Okay, look at number 3. She put four. And now she went back- move it to 4. Went back to three. Or kept it at four. |
| 00:04:24 | SN/T | And you-/So should she- what are you saying she should make here? |
| 00:04:27 | S | She should only put three here because she put four there and the- and the Styrofoam, and when it hits the Styrofoam block, it shouldn't have as much energy. |
| 00:04:38 | T | Oh, okay. Did you hear that? I love that. So maybe right here these lines that we used, maybe less lines for the red marble and less lines for this guy. But- |
| 00:04:49 | SN | Truly- |
| 00:04:50 | T | keep them the same. |
| 00:04:51 | S | It- actually, it would've gone further if I'd run it on the first ramp, but on the second ramp, which is- which- |
| 00:04:57 | T | But look what you said for the other one, though. You still said that ramp 3, which is all motion energy for the marble- whoa, nelly. All motion energy for the marble has four lines. Is it- look how they're all colored in. Okay, now go back to this guy. |
| 00:05:14 | SN | I don't understand what- |
| 00:05:15 | T | How many of these you have colored in for the red marble? |
| 00:05:17 | S | Three. |
| 00:05:18 | T | How many did you have on the last one? All of them, right? |
| 00:05:21 | S | Yeah. |
| 00:05:22 | T | So if you have all of them on the last one, you're going to have more motion lines than you will right here. That's what he's saying. I love these, I love these ideas. Thank you, guys, for sharing, that was awesome. Okay- |
| 00:05:32 | SN | I don't get this. |
| 00:05:34 | T | What? |
| 00:05:35 | SN | I disagree because on number 3, she did make her lines bolder. |
| 00:05:38 | T | Here. Uh-huh. |
| 00:05:40 | S | So it kind of represents more than the- |

| | | |
|---|---|---|
| 00:05:44 | T | Okay, so maybe she made them bolder and it does represent- okay. |
| 00:05:46 | S | Because- because on number 3, you can tell they're, like, thicker than number 4 over there- |
| 00:05:52 | T | Okay. So what do you think about that, Trayvon? |
| 00:05:56 | S | So these are really thin but then these are really bold. |
| 00:06:00 | T | Okay, so what do you think? |
| 00:06:02 | S | And I think that she is meaning to give this one more motion energy than this one. |
| 00:06:09 | SN | I was- |

## Lesson Analysis Protocol: McDaniel, Energy Transfer_Lesson 3, SSUP_ET_TN GR4_L3_McDaniel_C1

### 1. Identify Lens and Strategy

What instances of using content representations and models did you observe?

### 2. Analyze the Video

What do students understand (or not) about energy changes?

How did the teacher's use of the identified STeLLA strategies reveal, support, and challenge student thinking?

| Lesson Analysis Step | To Do | Your Analysis |
|---|---|---|
| **Claim** | Turn an observation, question or judgment into a specific claim that responds to the focus question. | |
| **Evidence** | Point to a specific place in the video transcript, lesson plan, or student work that supports your claim. Be sure to use timestamps if your evidence comes from a transcript. | |
| **Reasoning** | Connect your claim and evidence with reasoning based on STeLLA Strategies, research on teaching and learning, your teaching experience, or scientific principles. | |
| **Consider Alternatives** | Alternatives may include an alternative interpretation of evidence, new questions this clip, or analysis might raise, and/or alternative question(s), activity(s) or strategies that might have better supported student learning. | |

### 3. Reflect and Apply

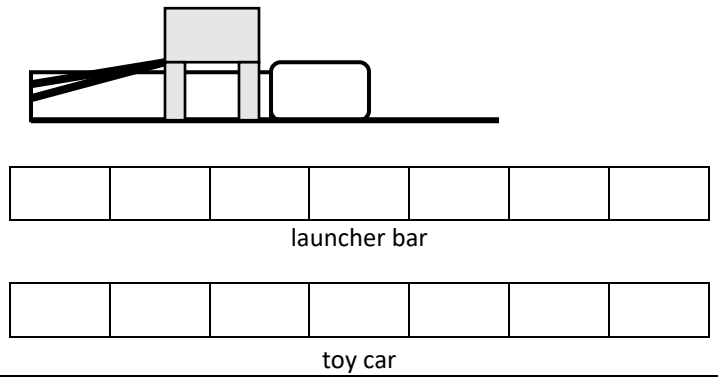
What did you learn through this analysis that you want to apply to your own practice?

## System Diagram
## Toy car launcher

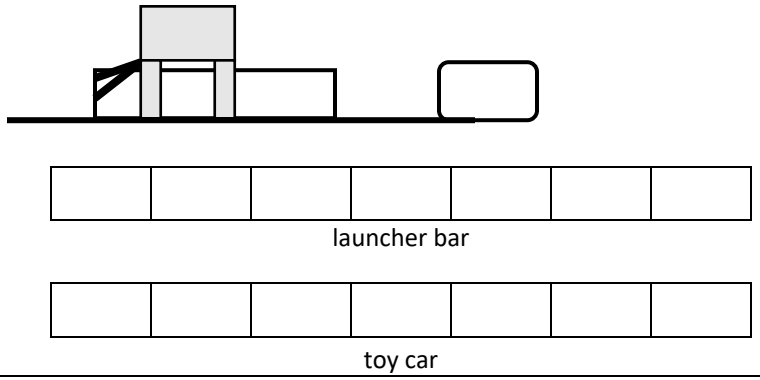
**1. Launcher bar pulled back; rubber band stretched**

**2. The launcher bar has just hit the toy car**

**1. Launcher bar pulled back; rubber band stretched**

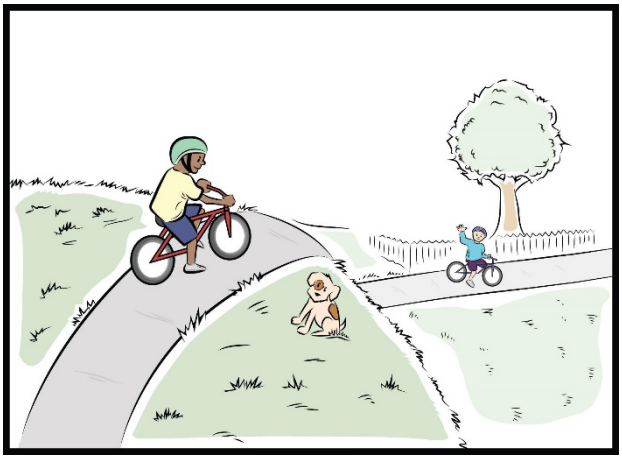



**2. The launcher bar has just hit the toy car**



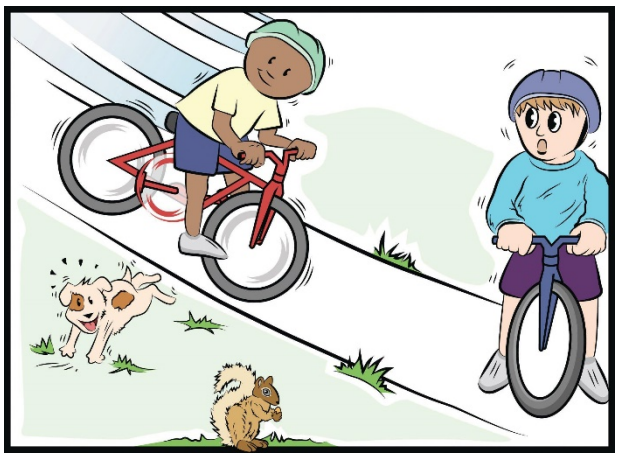
# Mumford and Leroy's Big Crash!

## Part 1



It was a bright, warm spring morning when Mumford hopped on his bicycle to meet up with his friend Leroy for a day of adventure. His dog, Spots, was coming along and ran beside Mumford. He rode up to the top of the big hill that was between his house and Leroy's.

Mumford stopped just before heading down the hill. This was his favorite part of riding to Leroy's house. With just a little push, his bicycle would pick up speed, faster and faster, as he coasted down the hill. Mumford could see Leroy waiting on his bicycle at the bottom of the hill. He decided he would let his bike coast right by Leroy. Mumford wanted all the speed he could get as he went down the hill. Leroy would have to catch up if he could!

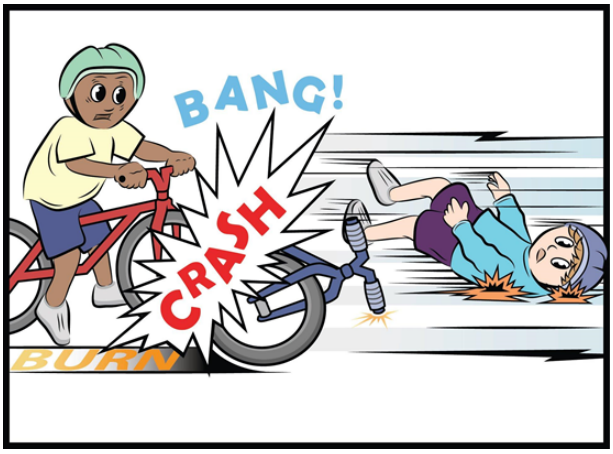


Just as Mumford took off, Spots started barking at a squirrel! Mumford took his eyes off the sidewalk to figure out why Spots was making so much noise. Mumford wasn't watching where he was going and didn't realize he was on a collision course headed straight for his friend, Leroy!


Have students make a prediction in their science notebook about what they think will happen next before reading Part 2 of the story.

## Part 2

Mumford looked up just before he hit Leroy and used his brakes as hard as he could. He left warm rubber skid marks on the sidewalk.



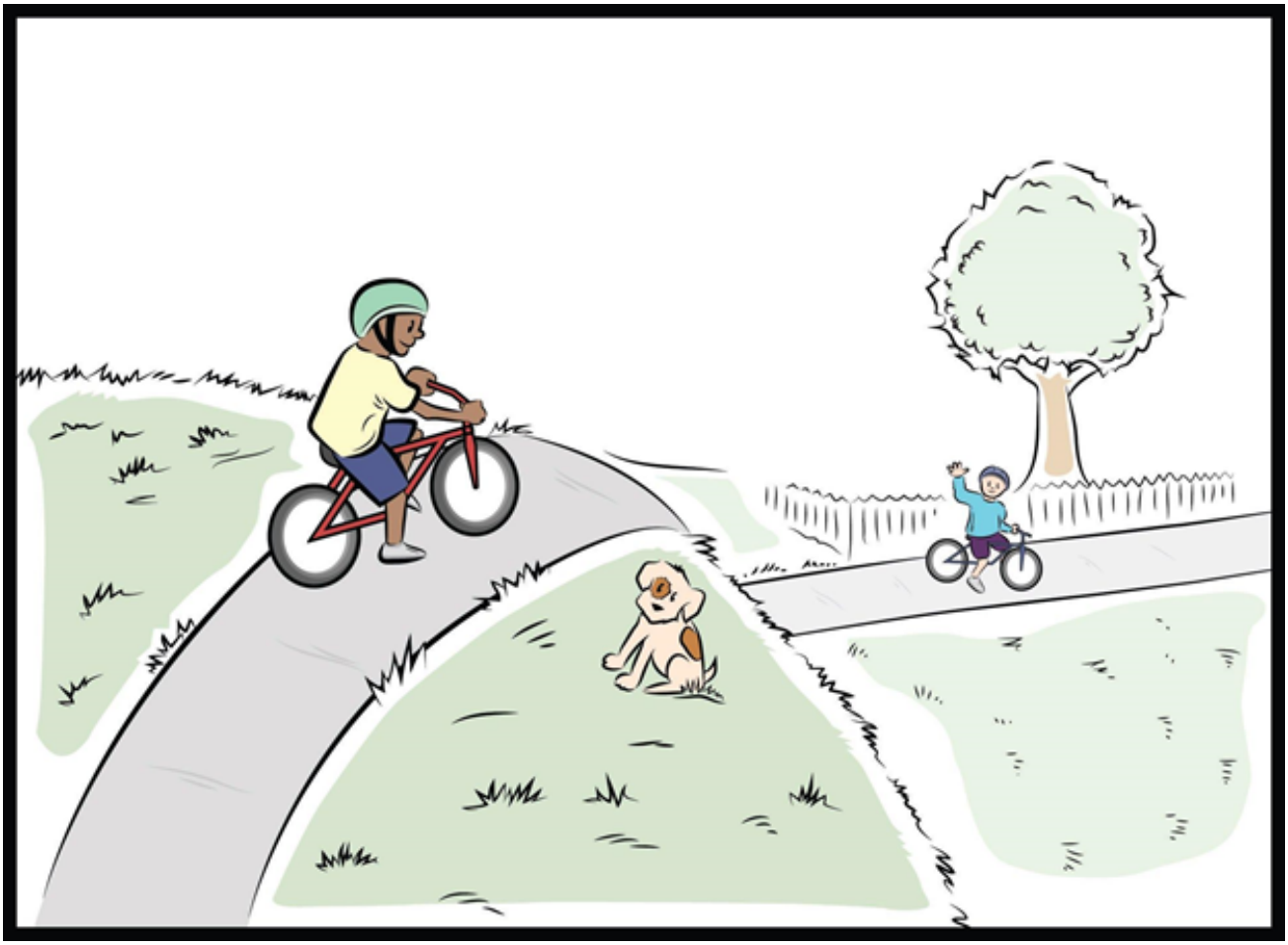

Even though he used his brakes, Mumford was still traveling pretty fast when his bike hit Leroy. When the two boys and their bikes collided, there was a loud crash as Mumford and his bike came to a sudden stop.

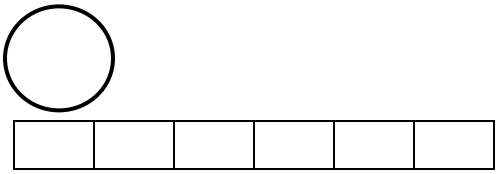
Leroy, who had been standing still when Mumford crashed into him, skidded across the sidewalk several feet. Leroy's shirt had a hole and his shoulder felt hot where he slid on it across the sidewalk. Sparks went flying where the metal from Leroy's bike hit the concrete sidewalk.

Leroy and Mumford were both wearing their bike helmets. They were very lucky that neither one of them were hurt when their bicycles collided. Mumford apologized to Leroy and promised to watch where he was going next time. Both boys laughed and rode off to continue their adventure.

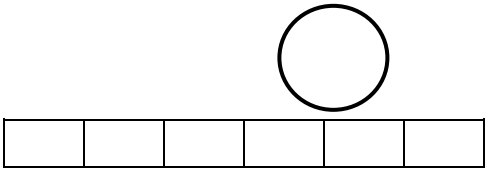

Have students make a list of all the observable changes that happened when Mumford started down the hill and then collided with Leroy.

1. Mumford is at the top of the hill. Leroy is at the bottom of the hill.



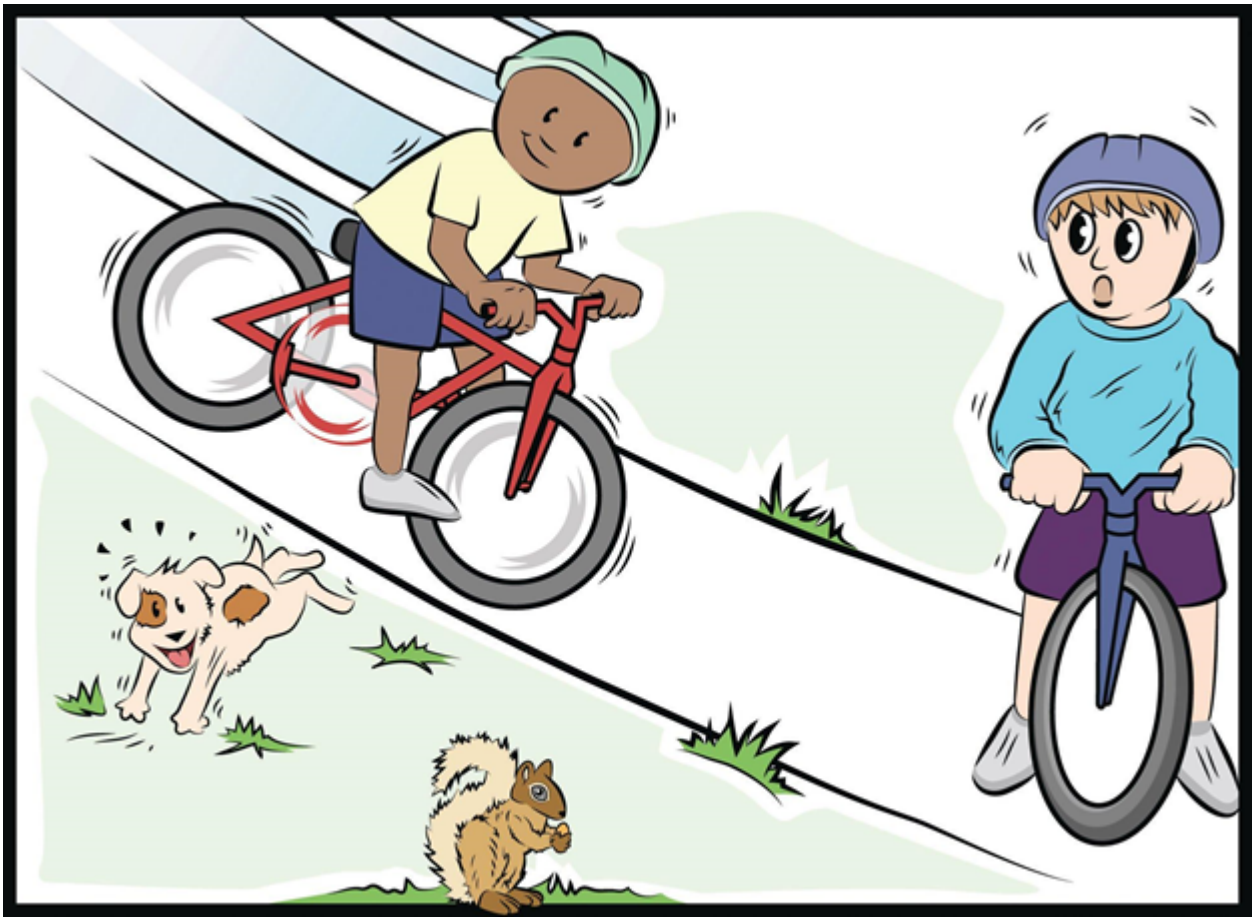


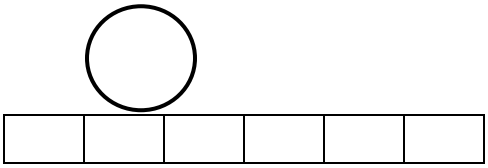
Mumford (red bicycle)



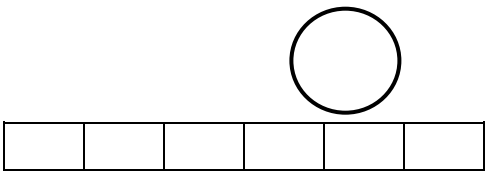
Leroy (blue bicycle)

2. Mumford is rolling down the hill. Leroy is at the bottom of the hill.



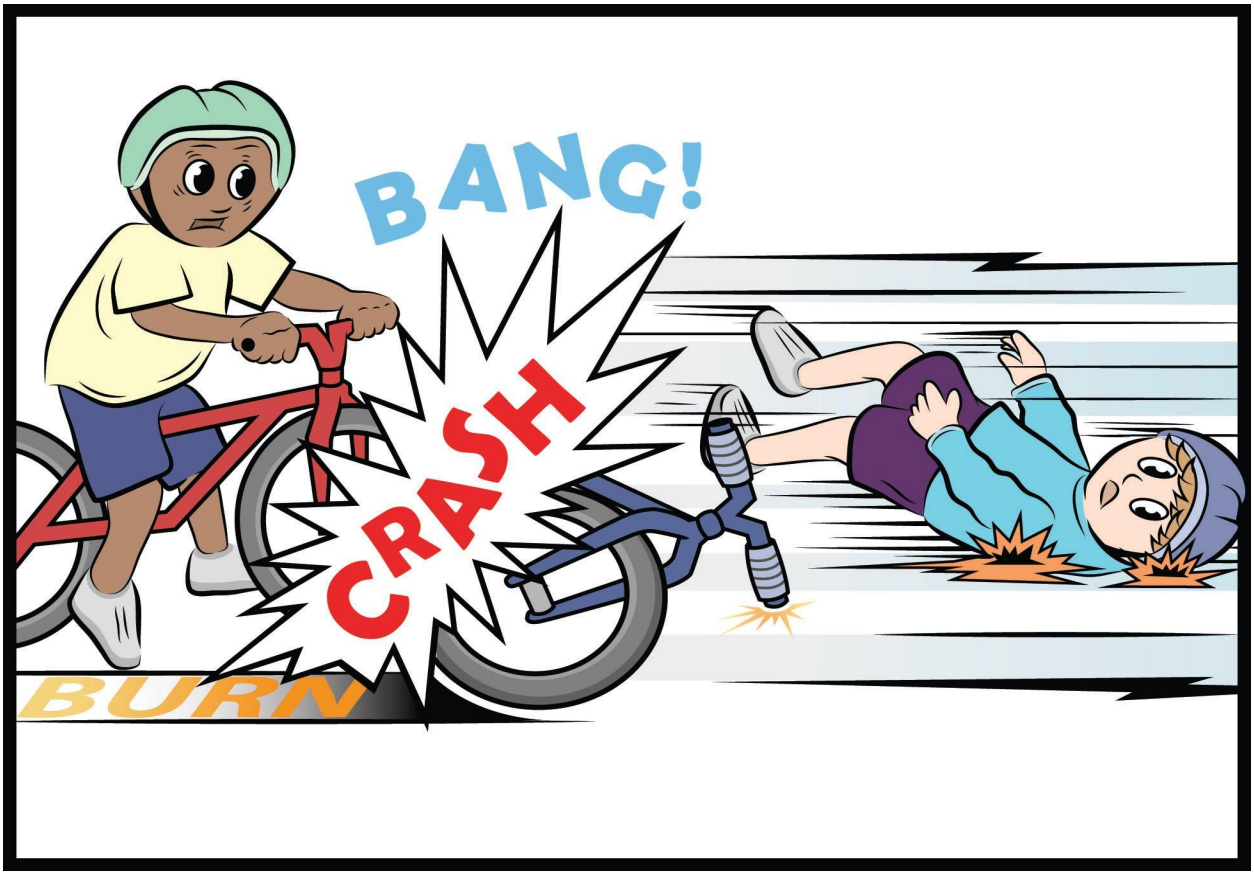


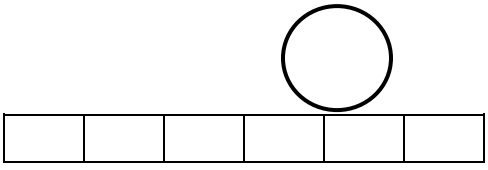
Mumford (red bicycle)



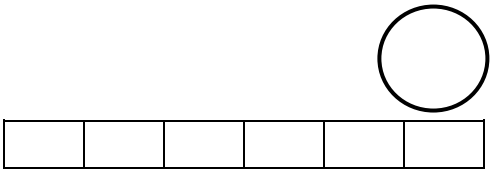
Leroy (blue bicycle)

3. Mumford collides with Leroy.



Mumford (red bicycle)



Leroy (blue bicycle)

## Reflection - Day 4

Name:_____

1. We have been discussing and using content representations and models. How has their use impacted your own learning about energy?

2. How do you see the use of content representations and models supporting students' understanding of a phenomenon or problem?