Lesson 1

Content standards that are the target of student learning: (TPE 1)	**English Language** Development (ELD) standards (if applicable): (TPE 1)	**Learning Objectives** (both content and language): (TPE 1)
MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. MS-PS3-2. Interpret graphical displays of data to describe how a system of objects may also contain stored (potential) energy, depending on their relative positions	*Gravitational Potential Energy* is energy that depends on the height above the ground the object. *Kinetic Energy* is the energy that depends on the movement of the object.	Students will observe through a Phet simulation called Energy Skate Park that kinetic energy increases when mass and speed increase. They will also observe that potential energy increases with mass and height from ground. From watching patterns of skater, students will define energies based on their dependencies.

AGENDA:

Time	**Activity** Formal and Informal Assessments: (TPE 2) Resources and Materials: (TPEs 4,9)	**Strategy & Assessments** Instructional Strategies and Learning Tasks to Support Student Learning (what you and the students will be doing) (TPEs 1,4,5,6,9,10)
Day 1 9:00 (start) 9:10 *(25min)* 9:35 *(15 min)* 9:50 *(8min)* 9:58	**Breakfast and Check In** *(5 min)* **Do Now:** *(5 min)* Rolling Marbles (Attachment 1) **Guided Inquiry Lab** Phet Energy Skate Park **Lecture:** go over Q's from Inquiry Lab **Models:** symbolically represent energy types with bar graphs and pie charts **Pass out Reading HW:** Reading and Q's (Could be started in class) **End**	**Do Now: Pre-Assessment** priming previous knowledge of forces and reveal common misconception that steeper means faster. To be disproved through lab ***Models:*** *I know students understand bar graphs if they can apply them to other situations such as height of skater v. age* ***Hw: "Read it"****--confirmatory reading to scaffold language demands of vocabulary. I know students will understand if they can use vocabulary in class.*

Lesson 2

Content standards that are the target of student learning: (TPE 1)	English Language Development (ELD) standards: (TPE 1)	Learning Objectives (both content and language): (TPE 1)
MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. MS-PS3-5. When the motion of an object changes, there is inevitably some other change in energy at the same time.	*Conservation of energy* is a rule of physics that shows how one energy type like potential energy is *Transferred* to another like kinetic energy. This law of conservation is similar to the Law of Conservation of momentum we learned last week.	**For DCI B & SEP A.** Students will come to understand by inquiry that total energy is conserved in a skate park when a skater goes down a ramp potential energy decreases as kinetic energy increases. They will prove understanding by creating pie charts and bar graphs of new situations.

AGENDA:

Time	Activity Formal and Informal Assessments: (TPE 2) Resources and Materials: (TPEs 4,9)	Strategy & Assessments Instructional Strategies and Learning Tasks to Support Student Learning (what you and the students will be doing) (TPEs 1,4,5,6,9,10)
Day 1 9:00 9:10 (20 min) 9:35 (15min) 9:50 (8min) 10:00	**DO NOW:** *Bungee Story* (check with table) **Guided Inquiry Lab** Phet Energy Skate Park Part II (Conservation of Energy) **Lecture:** go over Q's from Inquiry Lab **Modelling:** *Picture This* symbolically represent energy types with bar and pie charts **Demo:** Newton's Cradle **Assign HW Exit Ticket** **End**	**Do Now:** (students use each other as formative assessors of work) **Inquiry Lab:** Students will come to understand that total energy is conserved in a skate park when a skater returns to original height he started at. E is also transferred as skater starts on a ramp with potential energy and skates to the bottom gaining kinetic energy. Students will come to understanding by inquiry of simulation. In addition, they will make pie charts and find that total circle = total energy, while slices make up energy types. **Hw:** Explain how the newton's cradle works through 2 of 3: Drawings, Energy Bar Charts, captions/procedure

Energy Skate Park Part 1: Kinetic & Potential Energy

To access PHet simulation type "phet energy skate HTML" into your browser. Click Phet link and find picture similar to this.

Directions:

Observe: Play around and write down an observation.

Press the yellow button to reset. Make sure you're on INTRO, with all boxes checked (ALSO CHOOSE SLOW MO)

Types of energy: Kinetic and Potential

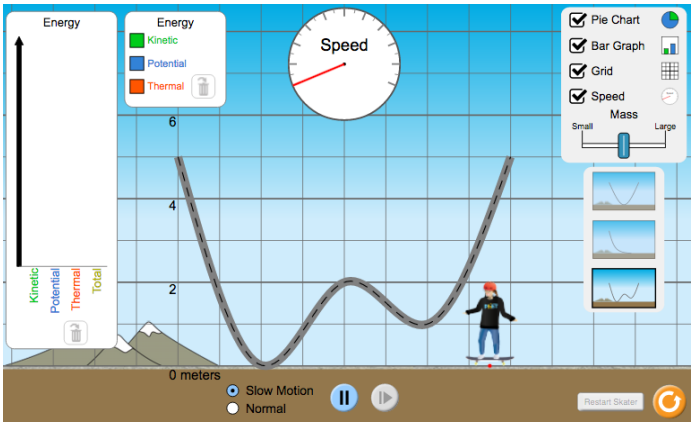
1a. What happens as you lift the skater?
1b. When happens as you lower her?
1c. What do you think potential energy is dependent on? Explain with a because sentence.

2a. When does kinetic energy increase (go up)?
2b. When does kinetic energy decrease (go down)?
2c. What do you think kinetic energy is? Explain with evidence ("because sentence")

Check point! Is speed in your answer? If not, see how are speed and KE.

Now place the skater back at on ramp. PLAY & PAUSE.
3. What happens *if you increase mass*?
3b. What do you think that means?

Final Check!! *Hopefully you found that there is a energy based on speed called "_____ energy" and a energy based on how high or far you are from the ground called _____ energy.*



Observations:

_____

_____

1a._____

_____

1b._____

_____

1c._____

_____

_____

_____

2a._____

_____

2b._____

_____

2c._____

_____

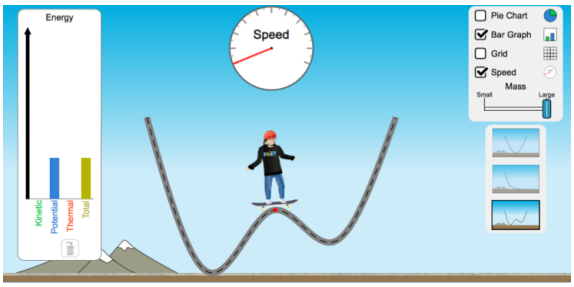
3. _____

3b._____

_____

When would KE (kinetic energy) be 0?

When would PE (potential energy) be 0?



Energy Skate Park Part 2: Thermal Energy; Conservation of Energy

To access PHet simulation type "phet energy skate HTML" into your browser. Click Phet link and find picture similar to this.

Directions: Click W ramp. Make sure grid (graph) and bar chart is showing. Add SLOW MO

Place skater on the ramp and press play. Observe 3 bars and describe what happens.

Observation: _____
_____
_____

Conservation Part I:

4a. What happens to potential energy (PE) as kinetic energy (KE) goes up?

4a._____

4b. What happens to total energy (yellow)?

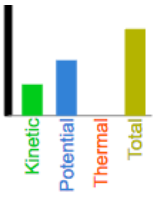
4b._____

4c. What do you think happens?

4c. _____
_____

Check point! Just like momentum was transferred from marble to the other, energy transfers from one type to another.

But notice the total energy stays "the same" --the total energy is *conserved too.*



If KE= 4 and Total= 10, then PE= ____

5a. Set the skater at 4m. How high do you think she will get on the other side?

5a. Prediction:_____

5b.Press play and see how high she gets

5b. Observation:_____

5c. Why do you think that is? (Hint: Look at bars)

5c. _____
_____

*Now change to "**Friction**" scene. (at bottom of screen) Check SLOW MO and GRID only*

6a. Set the skater at 4m. How high do you think she will get on the other side?

6a. Prediction:_____

6b.Press play and see how high she gets

6b. Observation:_____

6c. What happened?

6c. _____
_____

Reset and play again.

7a. What happens to other energies as thermal goes up?

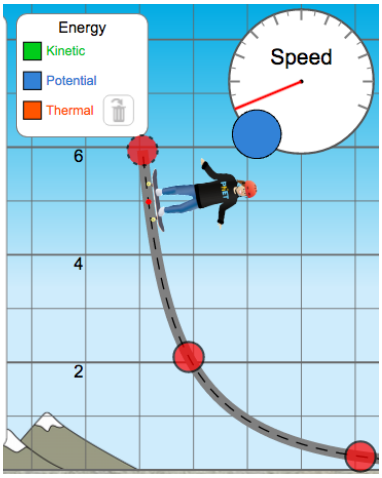
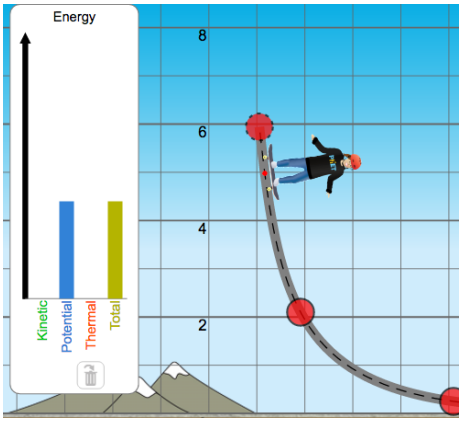
7a._____

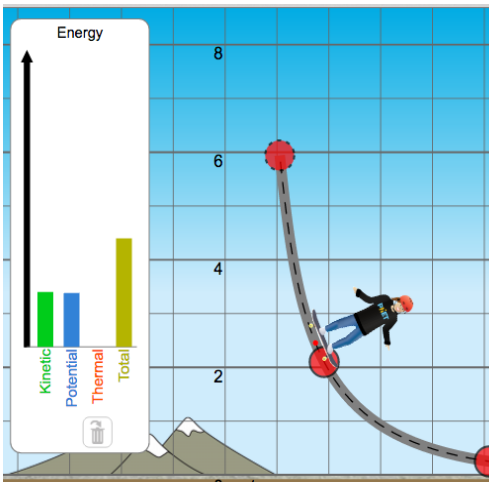
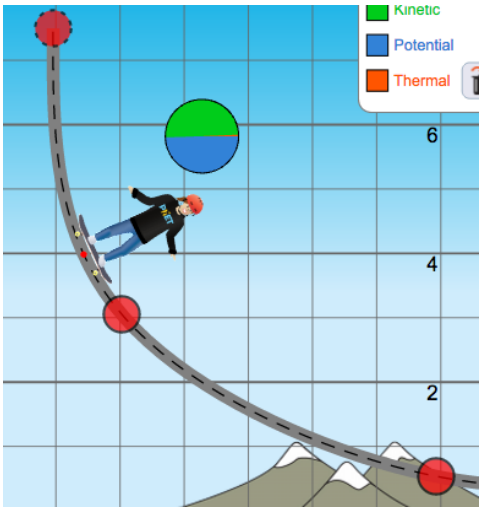
7b.What do you think is happening? (Hint: try to use *transfer* and/or *conserve* in your answer)

7b._____
_____

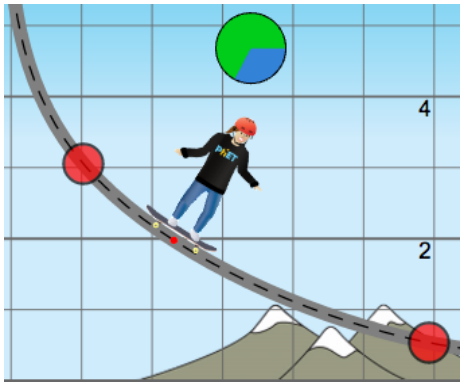
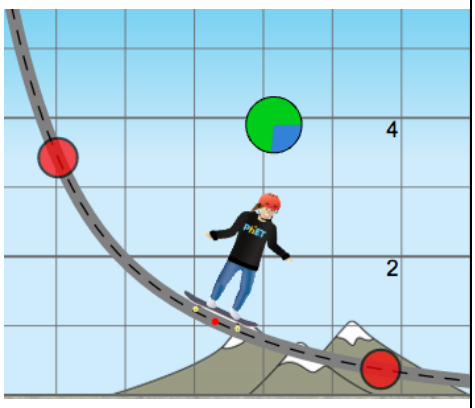
Picture This:

Energy Modelled through Bar Graphs and Pie Charts

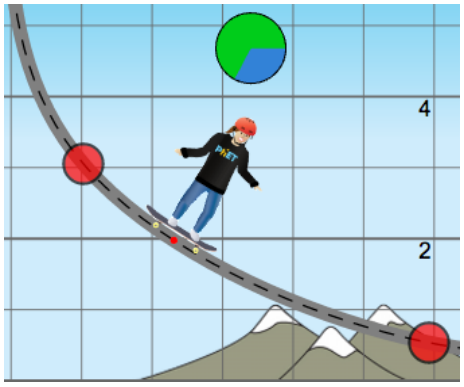
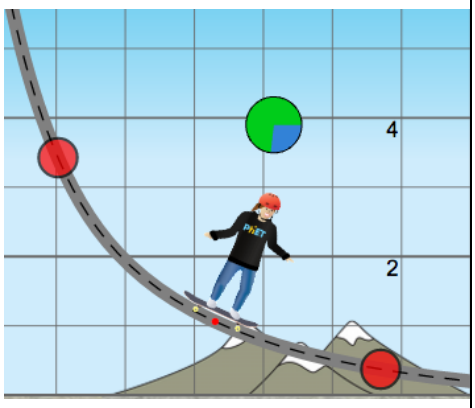
A. For each picture:	1. Draw the picture of each skater if there is half potential energy (half blue). 2. Mark the how high up the skater is from the ground.	3. Draw the missing bar or pie chart
 (Hint:Skater is at a height of 5m here) 		

B. For each picture:	1. Draw the picture of each skater if there is no kinetic energy (no green) 2. Mark the how high up the the skater is from the ground.	3. Draw a matching bar or pie chart for your picture.
 (Hint: Skater is at a height of 2.5m here) 		

Exit Ticket 1:

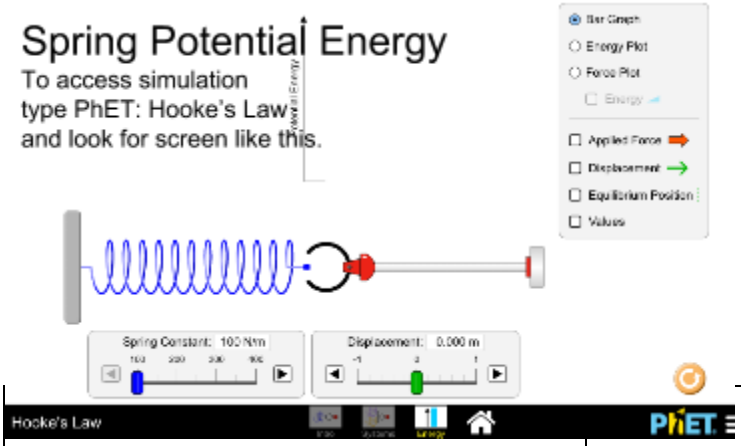
B. For each picture:	1. Draw the picture of each skater there is HALF GREEN. (you will have to 1st calculate 2. Mark the how high up the the skater is from the ground.	3. Draw the missing bar or pie chart
 (The skater has a 1/3 PE (blue) & height of 2 meters) (Skater has 1/4 PE (blue) at height of 1 meter.)  		

Exit Ticket 2:

C. For each picture:	1. Draw the picture of each skater there is No GREEN. (you will have to 1st calculate 2. Mark the how high up the the skater is from the ground.	3. Draw the missing bar or pie chart
 (The skater has a 1/3 PE (blue) & height of 2 meters) (Skater has 1/4 PE (blue) here at height of 1 meter)  		

Spring Potential Energy

To access simulation type PhET: Hooke's Law and look for screen like this.



As usual, take 2 minutes to play and make an observation or two.

Directions:

Now, Choose "Energy" Scene (at bottom of screen). Check bar graph and equilibrium position only.

Check point!
A Force is a _____ or _____

1. Apply a force to the spring. What happens?
2. Maximize spring constant. (spring strength/tightness). What happens to potential energy.
3. What do you think this potential energy is based on?

Check Point! Spring Potential Energy is another type of potential energy. It is based on how far

4. How is this potential different and like gravitational potential energy (the kind from skate park)

Observation:

1. _____
_____
_____

2._____
_____

3._____
_____

4. Different:
_____
_____
_____

Same:
_____
_____
_____