Development Process: Notion of Motion 2.0	
Exhibit Component	**Magnetic Wall**
Exhibit Learning Goal	**Youth will investigate how the angles of inclined planes impact the movement of balls as they work to solve specific challenges to increase their understandings of forces, inclined planes, motion, and potential and kinetic energy.**
Exhibit Environment Description	Magnetic panels (14' wide x 3.6' tall) are mounted to the wall with a low storage trough at the bottom to hold wooden balls (10) and magnetic panel pieces(30). This exhibit encourages youth to investigate the effects of gravity on the motion of balls rolling through a system of inclined planes that they build themselves. Using manipulatives, learners are able to create a ramp system, test their design by rolling balls through it, evaluate performance of the system, and then modify their design. The exhibit interactions can be a collaborative experience where adult and youth work together to build a ramp system manipulating the degree of ramp angles, make observations about the force of gravity, momentum, acceleration, and potential and kinetic energy.
TARGETED SCIENCE CONCEPTS	Forces: Gravity and Friction Energy: Potential and Kinetic Energy Motion: Momentum and Acceleration Magnetism
TARGETED MATH CONCEPTS	Angles Measurement
APPLIED TECHNOLOGY CONCEPTS	Inclined Planes Balls
APPLIED ENGINEERING CONCEPTS	Design, Build, and Modify a System of Inclined Planes

How does the exhibit meet Next Gen Science Standards?	K-PS-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. K-PS2-2: Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. 3-PS2-2: Make observations and/or measurements of an objects motion to provide evidence that a pattern can be used to predict future motion.
How does the exhibit meet National Math Standards?	CCSS.MATH.CONTENT.K.MD.A.1: Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. CCSS.MATH.CONTENT.1.MD.A.1: Order three objects by length; compare the lengths of two objects indirectly by using a third object.
How does the exhibit meet National Engineering & Technology Standards?	**Engineering Design** **Standard One: Students will apply the engineering design process, troubleshooting, research and development, invention and innovation, and experimentation in problem solving and engineering design.** 1P2: Ask questions and make observations to help figure out how things work. 1P4: Troubleshoot as a way of finding out why something does not work so that it can be fixed. 1P5: Use the process of experimentation, which is common in science, to solve engineering problems. 1P6: Apply the engineering design process using a variety of strategies, such as problem-solving, creative thinking, visual imagery, critical thinking, reasoning. 1P8: Apply innovation to modify an existing product or system to improve it. **Connecting Engineering to Science, Technology, and Mathematics** **Standard Two: Students will be able to apply concepts of science, technology, and mathematics in an engineering design process.** 2P1: Apply their knowledge of science, technology, engineering, and mathematics when solving practical problems. **Nature of Engineering** **Standard Three: Students will be able to be creative and innovative in their thought process and actions.** 3P1: Use engineering as a vehicle for creative and critical thinking and inquiry. 3P3: Show how to integrate the knowledge from diverse sources and experiences into practice in order to consider how to solve practical problems.

Dimensions of Success: **Features of Learning Environment**	**Scale of 1 to 4** **1=Evidence Absent** **2=Inconsistent Evidence** **3=Reasonable Evidence** **4=Compelling Evidence**	**Notes Refer to "Anticipated Exhibit Environment" in support of Rating**
Organization *Are there enough materials for the activity to be successful for more than one child at a time?* *Are they organized in a way that makes sense to the exhibit user?*	4	Ample materials and space for 8-10 users of differing ages provide opportunities to experiment with ramps at the same time giving users opportunities to share and negotiate for space. Materials are stored in a low storage trough easily accessible to users.
Materials *Can exhibit props be used comfortably and safely?* *Will the exhibit materials help the child reach the STEM learning goal?* *Will the materials hold the user's attention for 10 minutes or more?* *Are materials developmentally appropriate?*	*4*	Materials are designed to use safely and have no sharp edges or small pieces that would be choking hazards. Pieces including ramps, target cups, tunnels, etc. can be combined to create ramp systems to solve specific challenges that aid exhibit users in increasing their understandings of forces, motion, inclined planes, and potential & kinetic energy. Exhibit manipulatives provide limitless opportunities to explore, create, observe, evaluate, and modify systems. Challenge cards are provided to extend the experience. Age appropriate for ages 3 and up.
Space Utilization *Is the amount of space appropriate for the activity?* *Is the space utilized in a way that is conducive to informal STEM learning?* *Do set-up and resources allow for exploration and active learning?*	*4*	Sixteen linear feet of wall space is devoted to the exhibit. Exhibit users have multiple entry points to begin exploring the materials and building ramp systems. Activities are student driven. The exhibit's large size is easily visible when families enter the space inviting users to explore the materials and interact with other children in the space.

Dimensions of Success: **Activity Engagement**	**Scale of 1 to 4** **1=Evidence Absent** **2=Inconsistent Evidence** **3=Reasonable Evidence** **4=Compelling Evidence**	**Notes Refer to "Anticipated Exhibit Environment" in support of Rating**
Participation *Do multiple youth have access to the exhibit activity at any given time?* *How does the exhibit invite kids to participate?* *How are kids engaging in the exhibit?*	4	Multiple users have enough of each type of material to have access at the same time. Exhibit has moving parts and is open-ended encouraging kids to self-direct and make choices. Exhibit pieces are easy for kids to manipulate. Exhibit users select unique building materials to construct a ramp system and test it by rolling balls through the system.
Purposeful Activities *Does the learning goal lead to kids thinking/reasoning about a STEM idea?* *Does each part of the activity help youth move towards understanding the learning goal?*	4	Kids will be designing, building, and testing ramp systems. Problem-solving Challenge Cards will engage kids in hands-on, minds-on experiences aligned with the learning goal; i.e. "*Can you build a ramp system that starts at 4' tall and allows a ball to travel 4 feet*?" Or "*Can you build a system that starts at 3' tall and makes the ball hit the Target Cup?"* Rulers will be placed around the edges of the magnetic wall, both vertically and horizontally, as well as tape measures provided. Challenge Cards include reflection questions and activity ideas to try at home to assist parents in scaffolding their child's learning. Designing, building, testing and redesigning, to meet exhibit challenges will lead youth to a better understanding about how the degree of a ramp's angle impacts distance and speed that an object will travel.
Engagement with STEM *Do kids have an opportunity to manipulate materials physically or virtually?* *Are there opportunities for kids to do the cognitive work of exploring STEM content?*	4	Exhibit users will be able to manipulate materials physically to build ramp systems on the magnetic wall. Exhibit users are cognitively exploring STEM concepts by asking questions, making predictions, and exploring cause and effect to try to figure out how force and energy influence the motion of balls.

Dimensions of Success: STEM Knowledge and Practices	Scale of 1 to 4 1=Evidence Absent 2=Inconsistent Evidence 3=Reasonable Evidence 4=Compelling Evidence	Notes Refer to "Anticipated Exhibit Environment" in support of Rating
STEM Content Learning *Are STEM ideas presented accurately?* *Does exhibit help kids make connections between STEM ideas?* *Does exhibit avoid having kids simply parrot back definitions or memorize facts?*	4	All STEM concept messaging is reviewed by the project science consultants and advisors for accuracy. The exhibit integrates STEM concepts by prompting kids to understand science and math concepts by applying engineering and technology solutions to specific challenges presented in the exhibit. Exhibit users are constructing their own knowledge by experimenting with real objects in an open-ended, child-directed active learning environment.
Inquiry *Does exhibit provide kids with opportunities to do authentic practices that STEM professionals do (ask questions, experiment, predict, etc.)*	4	Exhibit users are investigating how forces and energy influence the motion of balls in the context of an engineering design problem. Engineering graphic will be included in exhibit to prompt inquiry. 
Reflection *Does exhibit ask open-ended questions to help students make sense of what they're learning?* *Are kids provided opportunities to process throughout the activity instead of just at the end?*	4	Exhibit includes open-ended questions on Challenge Cards, i.e. *"What changes can you make to your track that helps the ball hit the Target Cup?" "What happened to the ball when you made that change?"* Challenges invite users to process their experience throughout the activity by working to solve problems and responding to "what if" reflection questions.

Dimensions of Success: **Youth Development in STEM**	**Scale of 1 to 4** **1=Evidence Absent** **2=Inconsistent Evidence** **3=Reasonable Evidence** **4=Compelling Evidence**	**Notes Refer to "Anticipated Exhibit Environment" in support of Rating**
Relationships *Does the exhibit encourage and help develop positive relationships between:* *Kids & Kids,* *Kids & Parents/Caregivers,* *Kids & Staff,* *Staff & Parents/Caregivers* *Does the exhibit encourage Family Learning Together?*	4	The exhibit allows for diverse collaborations of activity engagement encouraging positive relationship building. Challenges are designed to encourage working together with a partner or family member. The exhibit has enough unique materials to lessen user frustration with competition for supplies. Challenge cards encourage families to learn and explore together providing *Challenges, Reflection Questions, and Try It At Home* activities encouraging parental involvement.
Relevance *Does the exhibit prompt youth to discuss why the STEM content is important to their personal lives, future careers, communities, or greater society?* *What are exhibit's real-world connections?*	4	Children have a multitude of experiences walking, running, sliding, sledding, and biking up and down hills. They intuitively understand the forces involved with these types of play. These real-world connections will be captured with photographs of real kids involved with these hill play activities to prompt exhibit users to relate the exhibit experiences to their personal lives. Exhibit will include parent tips for extension experiences to help kids relate the exhibit to their lives and photographs that help users associate other play activities with inclined planes (riding a bike downhill).
Youth Voice *Does the exhibit allow kids to guide the learning activity?* *Is there a pathway within the exhibit for kids to share their ideas with the greater community?*	*4*	All exhibit activities are child directed. The large magnetic wall allows multiple kids to share their ramp engineering activities naturally with other people playing in the exhibit. In addition, exhibit users will be encouraged through signage to "*Work with a partner" "Tell a friend about your design."*

What are Measurable Outcomes of Exhibit Goals?	Measurable Goals: 1) Youth ages 5-8 successfully meeting the exhibit challenges tracked by staff observations. 2) An increase in the amount of time spent interacting with the exhibit pieces compared to time spent playing with the magnetic wall exhibit in the previous Notion of Motion exhibit.
Exhibit Inclusiveness:	Gender Equity: Yes ADA: The exhibit is accessible and usable by children in wheel chairs. Varied Developmental Levels: Wide age and developmental range. Exhibit text will be presented in both English and Spanish.
How are 21st Century Skills nurtured?	**Creativity**: Designing your own ramp system. **Critical Thinking**: Testing and redesigning **Collaboration**: Large space and # of supplies invites kids to play together. **Communication**: Posted challenges prompt adults to ask the right questions so that users will share their design story, shared space and supplies. By leaving their work on the magnetic board, youth are allowed to communicate their designs to the rest of the museum. **Problem Solving**: Testing and redesigning their constructed track system.
How is the exhibit content layered for different developmental levels of visitor experiences?	Different developmental levels are accommodated by the open ended approach to the exhibit. Depending on the developmental level of the child, different strategies can be used to solve the challenges since each challenge has multiple solutions of differing complexity. Challenges pose varied difficulty to accommodate varied developmental levels. Additionally, parents and facilitators are present within the museum, so scaffolding can be provided from these individuals.
How does the exhibit encourage return visits?	The magnetic wall is different every time you play with it and it offers immediate results from your exploration.
Is the Exhibit FUN?	**YES!**