Activity

Brackitz Ski Jump
Grades 6-8

Objective:

Build a ski jump that will launch a small ball to consistently hit a target the farthest distance possible from the jump ramp.

Vocabulary Used in This Activity:

height, length, distance, energy, potential energy, kinetic energy, angle, slope, mass, gravity, and inertia

NGSS Standards (Grades 6-8):

- **MS-PS2-2 Motion and Stability: Forces and Interactions**
  The change in an object's motion depends on the sum of the forces on the object and the mass of the object (i.e., balanced and unbalanced forces)
- **MS-PS2-4 Motion and Stability: Forces and Interaction**
  Gravitational interactions are attractive and depend on the masses of interacting objects. (i.e., gravity's effect on objects of different masses
- **MS-PS3-2 Energy**
  When the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system (i.e., relative amounts of potential energy by position)

Time Needed:

20 Minutes

Scoring:

Average distance of three successful launches.

Materials and Supplies:

- Brackitz Inventor Building Set
- Table
- Protractor
- Score Board/Paper
- Tape Measure (to measure launch distances)
- Container (to catch ball, i.e., box, basket, tub)
- Various small balls of different weight about 2-3" in diameter (ping pong, lacrosse, tennis, etc.). If time is limited, choose 1 ball (Lacrosse ball is best).

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Procedure:

- Ask students how many have seen the ski jump event in the Olympic Games: What is the object of the contest? (to have participants make the longest jump) What does the ski jump look like? (a long ramp with a starting and end point)
- Inform the group that they are to design a model that the Olympic committee will use to show how a ski jump works. The model is to allow an Olympic contestant (represented by a ball) to jump the farthest distance from the take off point of the ramp and consistently hit a target (in this case a container to catch the ball).
- Discuss what variables the ski ramp model would have. Include (and list on board):
  - Height of beginning of ramp
  - Total length of ramp
  - Steepness or angle of ramp
  - Angle of the end of the ramp
  - Weight of different balls
- Show the attached picture to discuss how the ramp might be assembled. Student designs can be of their own creation as long as they use the table as a building platform and only use Brackitz materials.
- Time should be given to teams to explore the Brackitz materials and to decide how to build the ramp. Drawing materials for sketches could be supplied if desired.
- Remind teams of the objectives of the model (farthest distance, consistency in distance).
- Also remind teams to change only one variable listed on the board at a time in their redesigns.
- Allow teams a limited amount of time to complete the project (a typical constraint given to real engineers), say 20 minutes.
- At the end of the 20-minute build period, have teams test and record their final models and compare/discuss results.

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Discussion:

- Height
  - How did the height of the ramp affect the distance the ball jumped?
  - Why do you think this happened? (discuss how gravity impacted the jump)
  - Discuss how the location and height of the ball at the beginning of the jump affected the amount of potential energy the ball had.
- Angle
  - How did the angle of the ramp affect the distance?
  - What happened when the angle was too flat or too steep?
  - Discuss the angle's impact on gravity, potential and kinetic energy.
- Takeoff
  - How did you design the take-off point of the ramp?
  - Why did you design it this way?
  - Was there an optimum angle for the end of the ramp?
  - What happened when the take off point was too flat or the angle was too steep? (Students should realize that by angling the end of the ramp up, the ball will go farther than off a ramp with no angled endpoint).
- Force/Gravity
  - What caused the ball to roll down the ramp?
  - How did the ramp cause an unbalanced force? (gravity overcame the inertia of the ball when it was sitting still)
- Object
  - Which ball(s) (If you multiple ball types were used) would work best to work best?
  - Why do you think that is true? (discuss different masses of the balls and the impact that had on the results)

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- Potential Energy
  - Where did the ball have the greatest amount of potential energy?
  - Why did you pick that location?
- Support Structure
  - How did you design the structure to hold up the ramp?
- Problem Solving
  - What problems did you encounter?
  - How did you overcome them?
  - What would you do next time?
- Lessons
  - What did you learn about the effect of gravity and the concept of potential energy from this activity?

Tip:

Example of making a ramp and rails with Brackitz components. Build a sample rail-ramp if time is limited.