

Lesson Materials

Lesson 1 (NOTE: Alternative materials that you can push and/or pull could be used)

- Data recording sheet
- Yo-Yo
- Heavy box
- Container with a lid
- Toy car
- Spinning top
- Globe

Lesson 2 (NOTE: Alternative materials for the golf ball to collide into could be used)

- Data recording sheet
- Ruler
- Golf ball (1 for each group)
- Cardboard
- Sponge
- Wood Blocks
- Plastic
- Styrofoam

Lesson 3

- Engineering Problem and Design Process
- Simple Miniature Golf course designs
- Mini Golf Course

(Size before folding sides = 101 cm x 71 cm; Size after folding sides (5.5 cm) = 90 cm X 60 cm)

https://www.amazon.com/gp/product/B01D37J8HC/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1

- Paper
 - Cardboard
 - Sponge
 - Wood Blocks
 - Plastic
 - Styrofoam
 - Rulers
 - Masking tape
 - Scissors
-

Lesson 4

- Data recording sheet
 - Miniature Golf Course
(Size before folding sides = 101 cm x 71 cm; Size after folding sides (5.5 cm) = 90 cm X 60 cm)
https://www.amazon.com/gp/product/B01D37J8HC/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
 - Children's Miniature Golf Putters
 - Paper
 - Cardboard
 - Sponge
 - Wood Blocks
 - Plastic
 - Styrofoam
 - Rulers
 - Masking tape
 - Scissors
-

Data Recording Sheets
Lesson 1

Name: _____

Objects/Station **What did you do to make this object move?**

Yo-Yo	
Heavy Box	
Container with lid	
Toy Car	
Spinning Top	
Globe	

Lesson 2

Name: _____

Directions: Measure the distance that the golf ball travels after colliding with each material in cm.

Material	Trial 1	Trial 2	Trial 3	Average Distance (trial 1 + trial 2 + trial 3, then divide by 3)
Cardboard				
Sponge				
Wood Blocks				
Plastic				
Styrofoam				

Lesson 3

Engineering Problem: Your local Amusement Park needs some young engineering minds to help them build a new and improved miniature golf course. They have chosen your class to help with this big project. Can you help the owners of the Amusement Park design their new miniature golf course using your knowledge of energy and collisions?

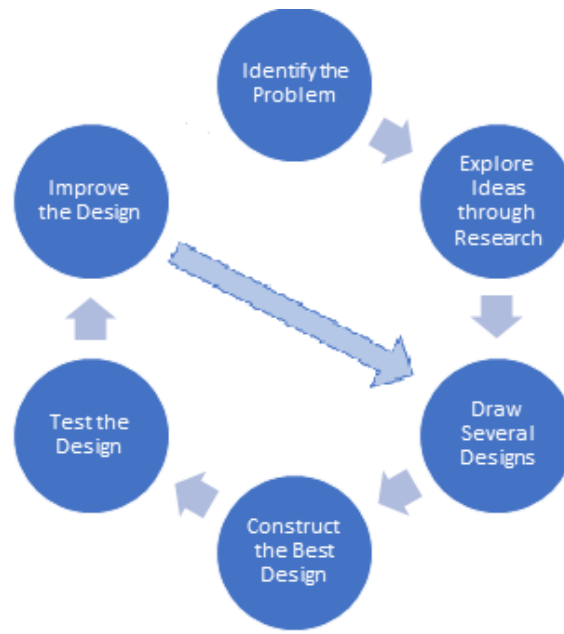
Criteria:

- 1) The golf ball must collide with at least two materials (changing its direction).
- 2) The golf ball must roll into the hole with one contact with the putter.
- 3) The course must be sturdy enough to withstand a golf ball colliding into it.

Constraints:

- 1) Two 45-minute class sessions
- 2) The materials from lesson two (e.g., cardboard, sponge, wood blocks, plastic, Styrofoam, tape, scissors)

Engineering Design Process:



Mini Golf Research:



Lesson 4

Names: _____

Directions: Answer *yes* or *no* to the following questions.

Tests	Group Member 1	Group Member 2	Group Member 3	Group Member 4
Did the golf ball collide with at least two surfaces?				
Was the course sturdy?				
Did you make a hole in one?				

Directions: Answer one of the following questions.

If you have “*no*” for most answers, how could you improve your design, so the golf ball collides with at least two surfaces, the course is sturdy, and people are able to make a hole-in-one?

If you have “*yes*” for most answers, is there a way you could make the course more challenging?

Summative Assessment Rubric

Criteria	Exemplary	Proficient	Developing	Novice
Force, Collisions, and Energy Transfer & Energy & Matter/Cause & Effect	Student could use their knowledge of force, collisions, and energy transfer to explain the reason they chose to use <i>all</i> the materials (i.e., matter) in their miniature golf course design to change the distance of a golf ball (i.e., cause and effect).	Students could use their knowledge of force, collisions, and energy transfer to explain the reason they chose to use <i>most</i> materials (i.e., matter) in their miniature golf course design to change the distance of a golf ball (i.e., cause and effect).	Students could use their knowledge of force, collisions, and energy transfer to explain the reason they chose to use <i>some</i> materials (i.e., matter) in their miniature golf course design to change the distance of a golf ball (i.e., cause and effect).	Students could not use their knowledge of force, collisions, and energy transfer to explain the reason they chose to use certain materials (i.e., matter) in their miniature golf course design to change the distance of a golf ball (i.e., cause and effect).
Analysis and Interpretation	Student was able to analyze and interpret the strengths and limitations of their miniature golf course design and consider ways to improve it.	Student was able to analyze and interpret the strengths and limitations of their miniature golf course design.	Student was able to analyze and interpret the strengths or limitations of their miniature golf course design.	Student could not analyze and interpret the strengths or limitations of their miniature golf course design.

