CIRCUS OF FORCES

A Grade 6 Energy Board Game

Materials

- Game board *(printed off on 11x18 paper)*
- Player tokens *(1 per player/team)*
- 1 die
- 5 card decks:
  - Internal Forces
  - External Forces
  - Material Properties (Plasticity/Elasticity)
  - Action-Reaction Forces
  - Wildcards
- Optional: mini whiteboard for drawing/explaining

Goal: Be the first person to go through the circus and reach the Finish Bubble on the game board

How To Play:

1. Place all player tokens on START
2. Shuffle each deck of cards and place face down on the 'Card Mat'
   a. Pick up a *Internal Force Card* when you land on **red**
   b. Pick up an *External Force Card* when you land on **orange**
   c. Pick up a *Material Properties Card* when you land on **green**
   d. Pick up an *Action Reaction Force Card* when you land on **teal**
   e. Pick up a *Wildcard* when you land on **blue**
3. Roll the dice and move your marker/token the same number of spaces
4. Draw the correct card (see step 2). Read the card aloud and answer its question. Another player can check answers by looking on the page entitled "KEY".
   a. *If answered correctly, move ahead 2 spaces. If wrong, move back one spot.*
   b. If you get a wildcard, do what it says to do.
5. Each player plays 1 card per turn.

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TEACHER NOTES:

This Board game is designed as a culminating, review activity to be played after concepts have been taught. This activity is designed to align with the Grade 6 Energy Organizing Idea.

Energy Organizing Idea: Understandings of the physical world are deepened by investigating matter and energy.

Guiding Question: In what ways can interactions lead to physical change?

Learning Outcome: Students analyze forces and relate them to interactions between objects.

Suggestion: Teacher could use the following lessons from the APLC website first, before playing this game (click on links):

1. **Introduction to Forces Lesson**
2. **Plasticity vs Elasticity Lesson**
3. **Action and Reaction Forces Lesson**

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Name: _____ Class: _____

Part 1: Internal and External Forces

1. Identify one example of an internal force you encountered during the game.
   - What was happening in the circus act? _____
   - Which internal force was it? (tension, compression, shear, torsion) _____
   - Explain why it is an internal force: _____

2. Identify one example of an external force from the game.
   - What was happening in the circus act? _____
   - Which external force was it? (applied, friction, elastic/spring) _____
   - Explain why it is an external force: _____

Part 2: Material Properties

3. Give one example of a material that showed elasticity during the game.
   - Describe the circus act: _____
   - How did the material behave like an elastic material? _____

4. Give one example of a material that showed plasticity during the game.
   - Describe the circus act: _____
   - How did the material behave like a plastic material? _____

Part 3: Action-Reaction Forces

5. Give one example of an action-reaction force pair from the game.
   - What was the circus act? _____
   - What was the action force? _____
   - What was the reaction force? _____

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Part 4: Reflection and Connections

6. Which circus act in the game helped you understand forces the most? Explain why.

7. What is one thing you learned about forces or materials today that you didn't know before?

8.Pick a circus act that went "wrong" in the game (like slipping, dropping a prop, or a misfire). Which force(s) caused this to happen, and what was the effect?

9.Imagine you change one material in a circus act (like using a more rigid rope for the trapeze). How would the forces in the act change?

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CIRCUS OF FORCES BOARD GAME

Start

Finish

- Internal Force
- External Force
- Material Properties
- Action Reaction Forces
- Wildcard!

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CIRCUS OF FORCES

A Grade 6 Energy Board Game

Internal Force Card

Material Property Card

External Force Card

Action Reaction Force Card

WILD CARD!

Card Mat

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Internal Force Card

Internal Force Card

Internal Force Card

Internal Force Card

Internal Force Card

Internal Force Card

Internal Force Card

Internal Force Card

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Internal Force Card

Internal Force Card

Internal Force Card

I.1

A trapeze rope stretches as an acrobat swings back and forth.

I.2

The base of a human pyramid supports the weight of the performers above.

I.3

A clown twists a long balloon to make a balloon animal.

I.4

Scissors slice through a ribbon during the circus opening ceremony.

I.5

A tightrope bends slightly when the performer steps onto it.

I.6

Two acrobats pull on opposite ends of a rope during a tug-of-war act.

I.7

A wooden beam under a balancing platform is squeezed by the weight of performers.

I.8

A performer twists a metal ring during a strength demonstration.

I.9

The fabric of an aerial silk stretches as the performer hangs.

I.10

A knife slices through a stack of playing cards in a throwing act.

I.11

The bottom of a clown car's step lowers as many clowns climb inside.

I.12

An acrobat wrings out a wet towel during a slapstick act.

I.13

A rope ladder stretches as performers climb upward.

I.14

A performer snaps a board in half during a strength stunt.

I.15

A springboard bends as a performer prepares to jump.

External Force Card

External Force Card

External Force Card

External Force Card

External Force Card

External Force Card

External Force Card

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External Force Card

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External Force Card

External Force Card

External Force Card

E.1

A strong performer pushes a circus wagon across the floor.

E.2

A clown slides across the stage and slowly comes to a stop.

E.3

A springboard pushes an acrobat upward into the air.

E.4

A performer pulls on a rope to raise a curtain.

E.5

The tightrope walker's shoes grip the rope to keep them from slipping.

E.6

A trampoline stretches when an acrobat lands on it.

E.7

A juggler throws a ball upward into the air.

E.8

A clown drags a large shoe across the stage and feels it resist movement.

E.9

A spring-loaded clown cannon launches a performer into a net.

E.10

A performer pushes a balance pole forward while walking on a tightrope.

E.11

The wheels of a circus cart slow down as it rolls across the ground.

E.12

A stretched elastic band pulls a prop back to its original position.

E.13

A performer pulls open the heavy doors of the big top.

E.14

An acrobat's hands grip the trapeze bar to stop sliding.

E.15

A bungee cord stretches and then pulls a performer upward during a stunt.

Material Property Card

Material Property Card

Material Property Card

Material Property Card

Material Property Card

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Material Property Card

Material Property Card

Material Property Card

M.1

A trampoline stretches when an acrobat lands on it and then returns to its original shape.

M.2

A clown bends modeling clay to make a funny nose, and it keeps its new shape.

M.3

A rubber juggling ball squashes slightly when it hits the ground and then bounces back.

M.4

A metal wire is bent into a circus ring shape and stays bent.

M.5

An elastic band stretches to hold together juggling pins and returns to its original length.

M.6

Clay used to make a clown mask is shaped and does not return to its original form.

M.7

A springboard bends when a performer steps on it and then springs back up.

M.8

A foam nose is squeezed and then slowly returns to its original shape.

M.9

Soft wax used to secure candles for a fire act stays pressed into place.

M.10

A rubber circus mat compresses under a performer and then returns to normal.

M.11

A balloon animal twisted by a clown keeps its new shape.

M.12

A bungee cord stretches during a stunt and pulls back to its original length.

M.13

Thick rope is bent into a loop for storage and stays in that shape.

M.14

A soft spring toy stretches when pulled and snaps back when released.

M.15

Putty used to stick posters inside the big top can be reshaped and stays reshaped.

Action
Reaction
Force Card

Action
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A.1

An acrobat jumps off a trampoline.

A.2

A clown is launched from a spring-loaded cannon.

A.3

A tightrope walker steps onto the rope.

A.4

A juggler throws a ball into the air.

A.5

An acrobat swings on a trapeze.

A.6

A clown pushes a circus wagon forward.

A.7

A performer jumps from a platform into a safety net.

A.8

A tightrope walker uses a pole to balance.

A.9

An acrobat climbs a rope.

A.10

A juggler catches a falling ball.

A.11

A clown kicks a large circus ball.

A.12

A performer walks across a springy circus mat.

A.13

An acrobat pushes off the ground to start a flip.

A.14

A trapeze artist releases the bar and flies forward.

A.15

A clown leans against a wall during a skit.

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

WILD CARD!

The crowd goes wild!

Move ahead 2 spaces.

Oops! You slip during a clown act.

Move back 1 space.

You help catch an acrobat.

Move ahead 1 space.

A sudden breeze makes balancing tricky.

Move back 2 spaces.

You give the circus wagon an extra push.

Move ahead 3 spaces.

You get a super bounce on the trampoline.

Move ahead 2 spaces.

The clown car rolls backward unexpectedly.

Move back 2 spaces.

The crowd loves your act.

Move ahead 1 space.

A juggling ball knocks over a prop.

Move back 1 space.

A cannon launches late—oops!

Move back 2 spaces.

You catch a perfect flip in mid-air.

Move ahead 3 spaces.

A rope swings too far and slows you down.

Move back 1 space.

You master the tightrope with your pole.

Move ahead 2 spaces.

Clown Pie Fight and you get splatted in the face!

Move back 1 space.

You impress the audience and get an encore!

Move ahead 3 spaces.

Cards Key

Internal Forces

I1 - Tension
I2 - Compression
I3 - Torsion
I4 - Shear
I5 - Compression
I6 - Tension
I7 - Compression
I8 - Torsion
I9 - Tension
I10 - Shear
I11 - Compression
I12 - Torsion
I13 - Tension
I14 - Shear
I15 - Compression

External Forces

E1 - Applied Force
E2 - Friction
E3 - Elastic Force
E4 - Applied Force
E5 - Friction
E6 - Elastic Force
E7 - Applied Force
E8 - Friction
E9 - Elastic Force
E10 - Applied Force
E11 - Friction
E12 - Elastic Force
E13 - Applied Force
E14 - Friction
E15 - Elastic Force

Material Properties

M1 - Elasticity
M2 - Plasticity
M3 - Elasticity
M4 - Plasticity
M5 - Elasticity
M6 - Plasticity
M7 - Elasticity
M8 - Elasticity
M9 - Plasticity
M10 - Elasticity
M11 - Plasticity
M12 - Elasticity
M13 - Plasticity
M14 - Elasticity
M15 - Plasticity

Action Reaction Forces

See next page

Action Reaction Forces KEY

	Action:	Reaction:
A1	The acrobat pushes down on the trampoline	The trampoline pushes the acrobat up
A2	The cannon pushes the clown forward	The clown pushes back on the cannon
A3	The performer pushes down on the rope	The rope pushes up on the performer
A4	The juggler pushes the ball upward	The ball pushes downward on the juggler's hand
A5	The acrobat pulls down on the trapeze bar	The trapeze pulls up on the acrobat
A6	The clown pushes the wagon	The wagon pushes back on the clown
A7	The performer pushes down on the net	The net pushes up on the performer
A8	The walker pushes the pole to one side	The pole pushes back on the walker
A9	The acrobat pulls down on the rope	The rope pulls up on the acrobat
A10	The juggler pushes up on the ball	The ball pushes down on the juggler's hands
A11	The clown's foot pushes the ball	The ball pushes back on the foot
A12	The performer pushes down on the mat	The mat pushes up on the performer
A13	The acrobat pushes on the ground	The ground pushes back on the acrobat
A14	The artist pushes backward on the bar	The bar pushes the artist forward
A15	The clown pushes on the wall	The wall pushes back on the clown