Acting Out CosmoSPHERES
Instructor's Guide

Game duration: Approximately one hour

1 Objectives

- To help students understand the CosmoSPHERES game better by acting it out in person
- To help students understand the choices they have in designing their game strategies
    - Strategy development for the "Acting out CosmoSPHERES" activity is intended to be student driven. Encourage students to try an idea and see what happens.
- To help students begin to develop a strategy for coding their players in the competition
    - Important: Modifications have been made to simplify the physical game. This activity is only meant to help students visualize their strategy choices and is not meant to reflect the actual scores that would result from using a similar strategy within the ZR programming environment.
- To further demonstrate to students the importance of accurate instructions in programming

2 Overview

Students will work in teams to create a strategy for the CosmoSPHERES game and then act it out. Two teams will compete to see which team's strategy redirects the path of an incoming comet furthest from the team's home base by the time the comet exits the arena.

Their mission:

- Navigate a debris field
    - Pick up 0-8 pieces of debris (to increase mass and gravitational attraction)
    - Use collision or lasso methods
- Dock with and pick up laser supply pack (optional)
- Get into position for comet entry
- Use gravitational attraction or laser pellet repulsion to move the comet away from their home base

The game area is laid out as a grid as shown below. Two Zone 1 areas are joined to the same Zone 2. This layout allows the students to compete in a similar fashion to the game simulation they see online but without running into each other.

Before beginning, each team will have 10 minutes to: a) plan an overall strategy, and b) decide the roles of each player.

Teams cannot change their strategy once the game has started.

This guide assumes familiarity with the CosmoSPHERES game. Details about the CosmoSPHERES game are available in the game overview powerpoint and the game manual.

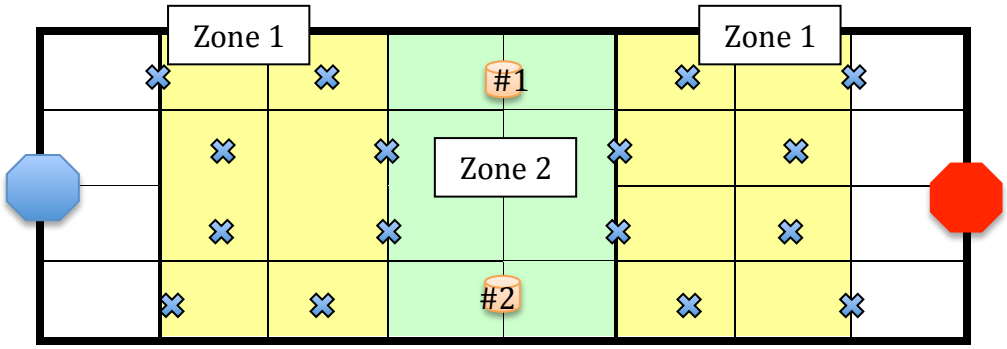


Figure 1: Game layout (4 x 8 yard grid) – Phase 1

Notes:

- Teammates on the sideline will give directions to their teammates on the grid based on their preplanned strategy.
- Team members will take roles, acting out the parts of debris, a SPHERES, and a comet. In addition, two team members will act as gravity and laser referees for the competing team.
- Game duration: Approximately one hour. This allows each team to test at least two strategies. Each test takes approximately, 25 minutes assuming the game area is already laid out (details below):

  Planning Phase: 10 minutes
  Phase 1: 5 minutes or until complete
  Phase 2: 5 minutes or until complete
  Scoring and discussion: 5 minutes

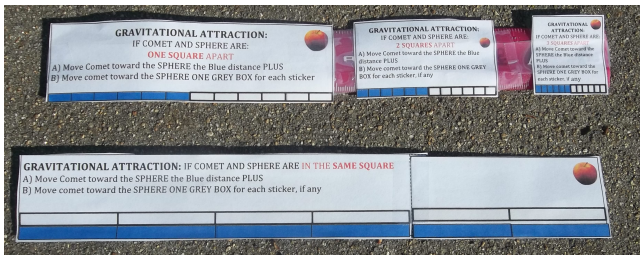
3 Materials (per grid)

The quantities given below are for one grid. Multiply the quantities given by the number of grids needed. We recommend 1 grid per every two teams involved in the activity at the

same time. This activity works well with 10-12 students on a team. Consider combining smaller teams or splitting larger teams.

- Blue tape (2 rolls per grid) or spray chalk
  - Used to create the game grid and mark debris locations
- 2 Yard sticks or measuring tape, to measure grid and comet deflection (2 per grid)
- Strategy sheets (6 copies per grid)
  - Print 6 copies of the strategy sheet provided on page 10 of this document for teams to use to document their strategy. This provides two per team plus two extras.
- Materials for "deflection measuring sticks"
  - Print copies of the "deflection measuring sticks" provided at the end of this activity
  - Six 12 inch rulers or pieces of cardboard (three per team)
  - Tape

  Cut out the deflection measurement sticks and tape them onto the rulers or pieces of cardboard. Gravitational Attraction examples are shown here. (The "Same Square" measuring stick fills one ruler. The measuring sticks labelled "One Square Apart'', "Two Squares Apart", and "Three Squares Apart" will fit on a second ruler.)



- 16 packs of fruit snacks (or small packs of skittles, or bean bags)
  - Representing laser pellet shots. These will be distributed equally between the two buckets representing laser supply packs.
- Roll of 100 stickers per grid
  - These will be used to keep track of the mass added to the SPHERES. (For example, these may be motivational stickers or colored dots.) This will be more than enough stickers for both teams to play the game twice with different strategies on their grid.
- 2 small buckets of equal size
  - 1 for each laser supply pack, to be placed on the grid and then carried by the "student SPHERES"
- 2 capes, or light-up headbands, flashlights, or other identifying costumes.
  - One for each "student Comet" to wear
- 2 hats of any kind
  - One for each "student SPHERES" to wear
- 4 bandanas (2 per team)
  - Bandanas will be tied around the arms of two students on each team to indicate their status as " student Referees"

- Pen/pencil

4 Preparation

- Review the Game Overview Power point and the "Acting out the Game Rules" with students in advance of Field Day.
- Set up the game area as follows:

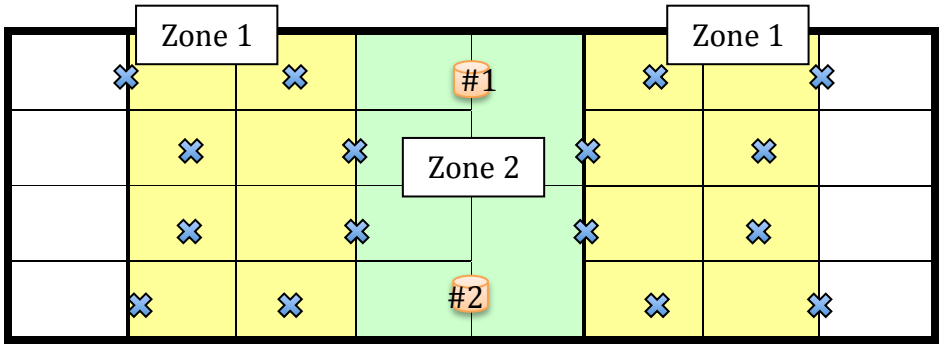


Figure 2: Game Set Up

  - Lay out the 4 x 8 yard grid with blue tape or spray chalk

  - Place the following items on the grid as shown above:

    - Add tape marks to indicate debris locations with an "x" as shown.
    - Set down two buckets representing laser supply packs (shown as #1 and #2), each containing 4 "laser pellet shots". (Laser pellet shots = fruit snack packs or equivalent.) Reserve the extras to one side.

- Print off Strategy Sheets (see page 10)
- Prepare the "deflection measuring sticks" (see *Materials* section).

5 Activity Description

This activity involves a strategy planning phase and two separate game phases, described below.

5.1 Planning Phase

Time: approximately 10 minutes

Part 1: Give each team two copies of the Strategy Sheet (see page 10) to a) plan an overall strategy, and b) decide the roles of each player. Encourage students to pick a strategy and see what results from that strategy.

Part 2: Set up

- Distribute costumes for the students acting as:
  - "SPHERES" (e.g. hats)
  - "Comets" (e.g. capes)
    - Note that this role is best assigned to a student who can stand still
  - "Referees" (e.g. bandanas)
- Distribute "deflection measuring sticks" to student referees (see description in M*aterials* section).
- Distribute two stickers to each student playing the role of "Debris"
  - Students will place:
    - one sticker on the back of the "SPHERES" for each collision
    - two stickers on the back of the "SPHERES" for each lasso
- Send students to their starting positions for Zone 1

5.2 Phase 1

Phase 1 Goal: Teams must guide the SPHERES through the debris field following their pre-planned strategy, and pick up debris or laser packs or both.

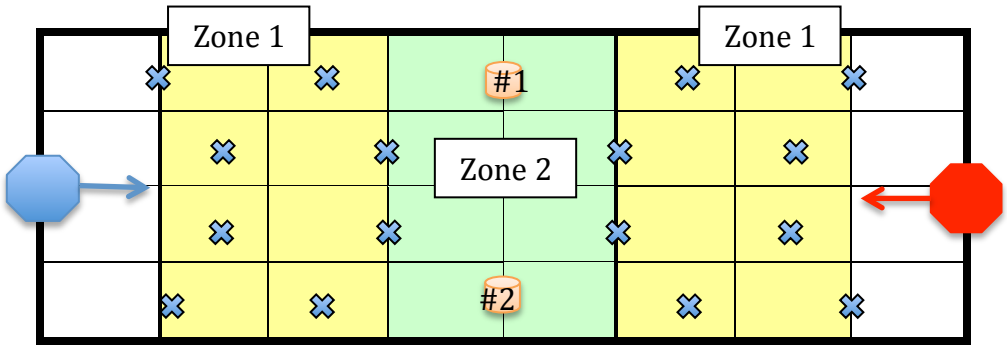


Figure 3: Phase 1 starting positions (showing SPHERES direction of travel)

Phase 1 Gameplay:

The players from each team acting as SPHERES will begin on opposite ends of the grid, as shown in the figure above. Each player will move through Zone 1 to Zone 2 to collect debris and/or laser packs, following the instructions given to them. The student SPHERES must move as described below.

A designated teammate will give directions. The teammate must tell their SPHERES how many steps to take, and in what direction to move, in order to get to the location the team members previously chose and marked on their strategy sheet. Teammates on the grid must not move without instructions.

The rest of the team and the team leaders from both teams will count from 1 to 10 in Phase 1, with a pause between each count to allow the SPHERES to act. After every "count" the SPHERES on each side of the grid may receive instructions:

- Move: SPHERES may take up to 3 normal-sized steps per count
    - For example: "Take two steps forward and then one step to the right"
- Collide: SPHERES may "collide" with debris in one count
    - The instruction would be: "Collide with Debris"
    - The student acting as a debris will place one sticker of their two stickers on the back of the SPHERES to indicate that the SPHERES collected half the mass of the debris
    - Once a debris is "picked up", the student acting as the debris leaves the grid
- Lasso: Lassoing debris takes 3 counts to complete
    - 2 counts to Do-Si-Do with partner (swing around twice, within the lines of the grid)
    - 1 count to "pick up" debris (exchange stickers)
        - The student acting as the debris will place both of their stickers on the back of the SPHERES to indicate that the SPHERES collected the full mass of the debris
        - Once the debris is "picked up", the student acting as the debris leaves the grid
- Laser Pack: Laser pack pick up takes 2 counts to complete
    - 1 count to rotate at least 90 degrees
    - 1 count to pick up the bucket
    - Each laser pack contains 4 laser shots (fruit snack or other small snack packs)
    - Teams arriving at a resupply pack at the same time may each take 4 pellets (Plan to have extra fruit snacks on hand for this purpose)
    - Teams must follow the pre-planned strategy, even it means sending their SPHERE to a laser pack that has already been picked up

Action	Number of counts
Move (up to 3 steps)	1
Collide with debris 1-exchange stickers	1
Pick up laser pack 1-rotate 2-pick up bucket	2
Lasso debris 1 & 2-do-si-do 3-exchange stickers	3

Once the count of 10 is reached:

- The SPHERES must stop where they are and wait for the start of Phase 2. This represents the end of the Phase 1 period. In the actual game, this occurs at 90 seconds. If the SPHERES did not reach the end of their planned path in Phase 1 by the "count" of 10, they will need to finish those instructions in Phase 2.
- All the students acting as "Debris" leave the grid.

Time: Approximately 5 minutes

5.3 Phase 2

Goal: Teams must guide the SPHERES through Zone 3, following their pre-planned strategy to deflect the comet using gravitational attraction or laser repulsion. "Referees" from the opposite team will measure the amount of deflection of the comet based on the position of the SPHERES during this phase.

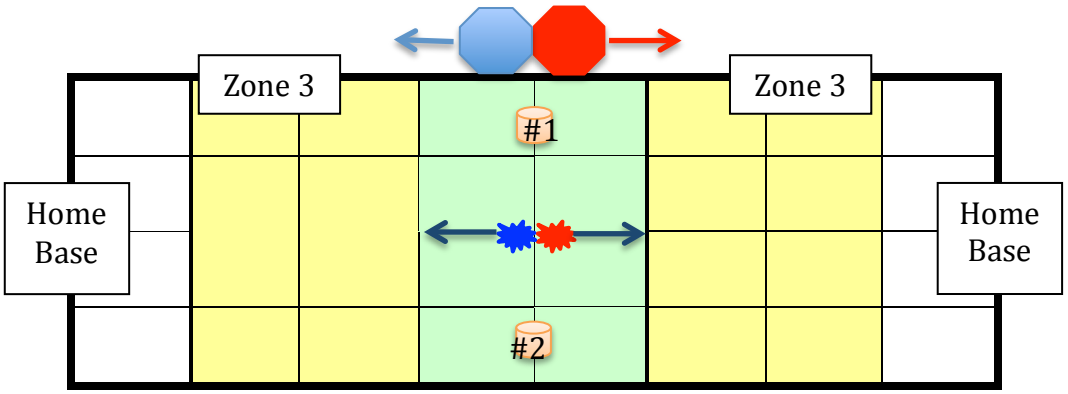


Figure 4: Phase 2 starting positions
Note: Comet initial positions are as shown. SPHERES positions and direction are determined by the student strategy.

Gameplay:

Send students acting as the comets to their initial positions on the grid, as shown in Figure 4.

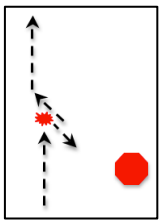
Selected teammates from the sidelines will give directions to the SPHERES as before. The rest of the team and the team leaders from both teams will count to 10, with a pause after each count to allow both the person acting as the SPHERES and the person acting as the Comet to move. After every "count", both the SPHERES and the Comet move and then comet deflection is determined.

Comet and SPHERES movement:

- Comet: The student acting as the Comet takes 3 heel-to-toe steps parallel to the grid line that connects with the "Home Base"
- SPHERES:
  - The SPHERES on each side of the grid may receive instructions and may take up to 3 steps at a time
  - If the instructions include firing a laser, the laser shot can occur during the same "count". The SPHERES tosses a "laser pellet" (fruit snack pack) underhand toward the Comet. Each time the SPHERES "fires" and "hits" the Comet, the "Laser Repulsion Referee" may move the comet as described below.
    - Note that only one laser shot can be fired per "count".

Comet Deflection:

- Once both the Comet and the SPHERES have moved, the "Referees" use their deflection measurement sticks to move the comet. Note that the people acting as the Comets should always face toward their own Home Bases.
- First, the Gravitational Attraction referee moves the comet directly toward the SPHERES by the amount of deflection indicated on the measurement stick.
    - The amount of comet deflection due to gravitational attraction is related to the mass of the SPHERES and to the distance of the comet from the SPHERES
    - Mass: The "Gravitational Attraction Referee" must check the number of stickers on the back of the SPHERES to determine how much mass the SPHERES has gained.
    - Distance: The "Gravitational Attraction Referee" has three "deflection measurement sticks" to use, based on how far the comet is from the SPHERES. (This distance is either "in the same square on the grid", "one square apart", "2 squares apart", or "3 squares apart".)
    - Each Gravitational Attraction measurement stick has a distance to move based on a) the SPHERES mass and b) the number of stickers collected (total debris mass). Each grey block represents one sticker, so if more stickers were collected than those shown on the measurement sticks, add distance equal to the number of extra blocks needed.
    - The "Gravitational Attraction Referee" measures from the heel of the Comet's shoe.
- Next, if a shot was fired and hit the comet, the Laser Repulsion Referee moves the comet directly away from the SPHERES:
    - The "Laser Repulsion Referee" will use the Laser Pellet Repulsion measurement stick to move the comet the correct distance away from the SPHERES.
    - The "Laser Repulsion Referee" measures from the toe of the Comet's shoe.
- If at any time the Comet and the SPHERES collide, the SPHERES must do nothing during the next count (skip a turn)
- The path of the Comet could look something like this, with the two opposing forces (gravitational attraction and laser repulsion) almost cancelling each other if students are using a laser pack



Phase 2 ends when both comets cross the outside of the grid. Make sure the Comet stays still at the end of the grid for final measurements.

Time: Approximately 5 minutes

5.4 End of Competition and Scoring

Once both Comets have left the grid, measure the distance from the home base location to the point where the Comet left the grid.

Have each team describe their strategy and compare the measurements. The team with

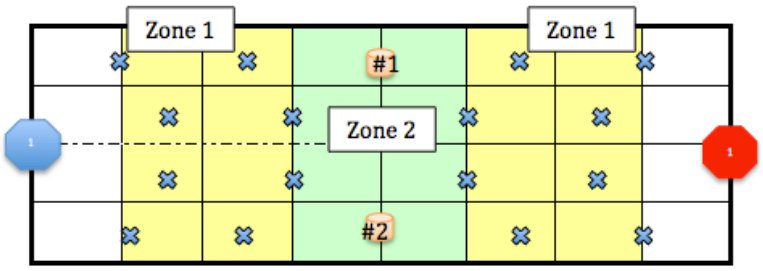
the greatest deflection wins that match.

5.5 Try Another Strategy

Mix up the roles played by the students and play again with another student strategy.

Strategy Sheet

Circle one:
Blue SPHERES
Red SPHERES



Assign roles:

SPHERES:_____ Comet:_____

Debris: 1) _____ 2) _____3) _____4) _____
5) _____6) _____7) _____8) _____

Referees: Laser Repulsion:_____ Gravitational Attraction_____

Person who give SPHERES directions:_____

Zone 1 Strategy:

Do you plan to pick up any debris? How many? Will you collide or lasso?

- Draw a circle around the debris you will collide with.
- Draw an L over the debris you plan to lasso.

Zone 2 Strategy:

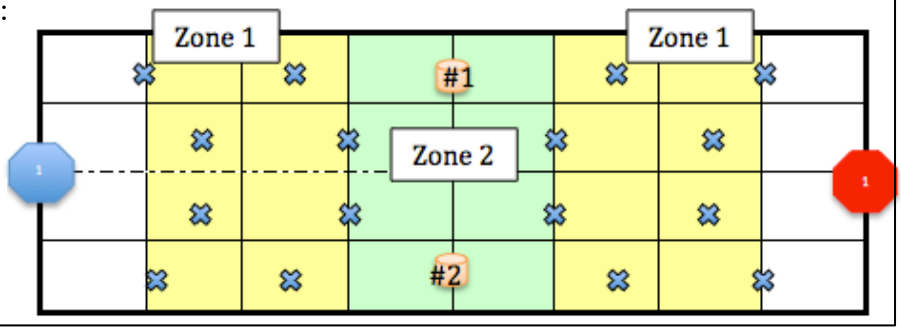
Will you pick up a laser pack?

- If so, how many? _____
- If more than one, which will you pick up first? _____

Phase 1 Path:

What path will you follow in Phase1?
Draw your path:

Action	Number of counts
Move (up to 3 steps)	1
Collide with debris 1-exchange stickers	1
Pick up laser pack 1-rotate 2-pick up bucket	2
Lasso debris 1 & 2-do-si-do 3-exchange stickers	3



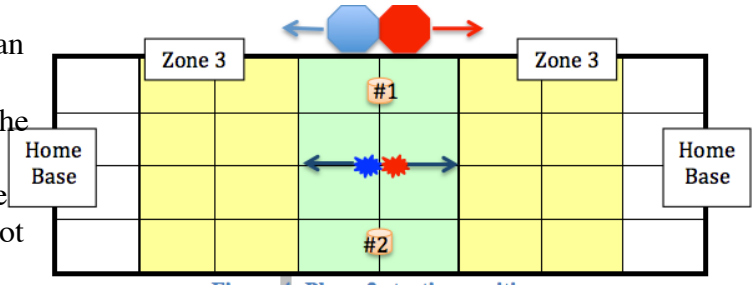
Phase 2 Path:

Will you tell your SPHERES to move in Phase 3?

- Draw your SPHERES path below.

If you picked up a laser pack:

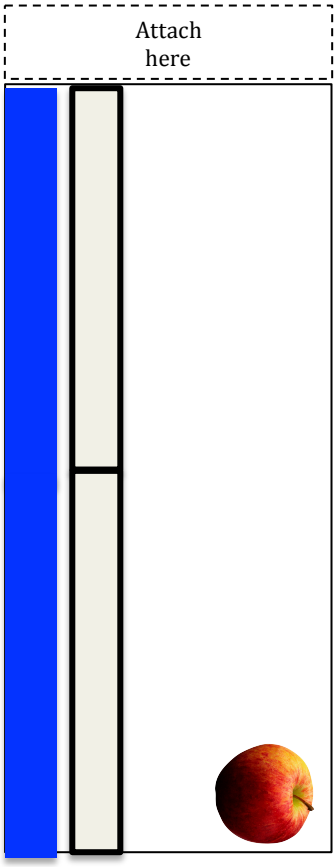
- Draw an "X" to show each spot where you plan to fire.
- Put an number next to the "X" for the number of times you plan to fire your laser from each spot (e.g. "X2").



Gravitational Attraction – Deflection Measurement Sticks

GRAVITATIONAL ATTRACTION:
IF COMET AND SPHERE ARE:
ONE SQUARE APART
A) Move Comet toward the SPHERE the Blue distance PLUS
B) Move comet toward the SPHERE ONE GREY BOX for each sticker

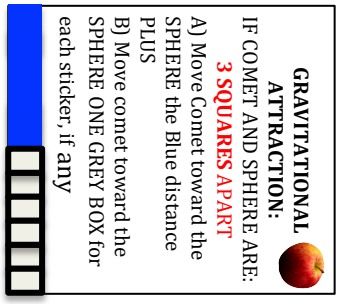
Attach here

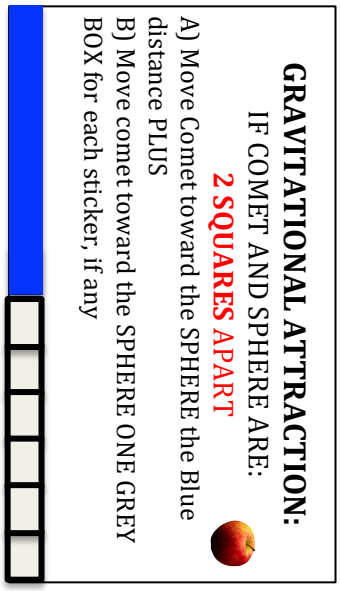


GRAVITATIONAL ATTRACTION: IF COMET AND SPHERE ARE IN THE **SAME SQUARE**
A) Move Comet toward the SPHERE the Blue distance PLUS
B) Move comet toward the SPHERE ONE GREY BOX for each sticker, if any

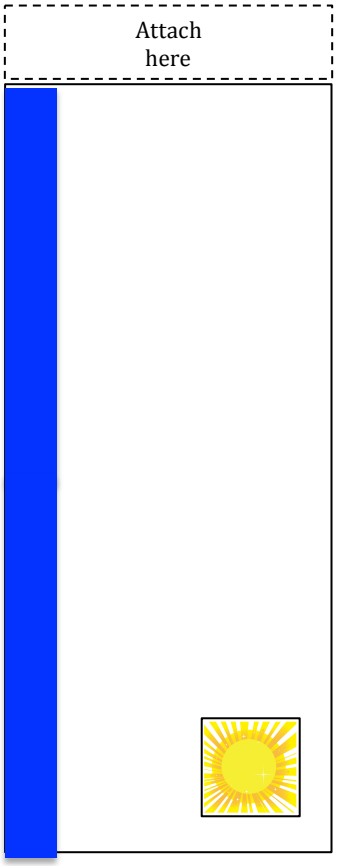
Attach here

Gravitational Attraction – Deflection Measurement Sticks, continued





Laser Repulsion – Deflection Measurement Sticks



Materials Check List

Item	**Qty per grid**	**# grids**	**Total Qty** (qty per grid) X (# grids)	**Assigned to:**
Rolls of Blue Tape	2			
Yard sticks or measuring tape	2			
Strategy sheets, printed (see page 10)	6			
Deflection Measuring Sticks must be assembled in advance- (see instructions on page 3 and templates on page 11 ad 12)	6 (4 for gravity, 2 for laser)			
Fruit snack packs, or equivalent	16		(Optional: purchase enough to hand out one to each student at the end of the game)	
Roll of 100 stickers	1			
Small bucket	2			
Costume for comets: (capes, light up headbands, or flashlights)	2			
Costume for SPHERES (hat)	2			
Costume for "Referees" (bandanas)	4			
Pen/pencil	4			

Set up Check List

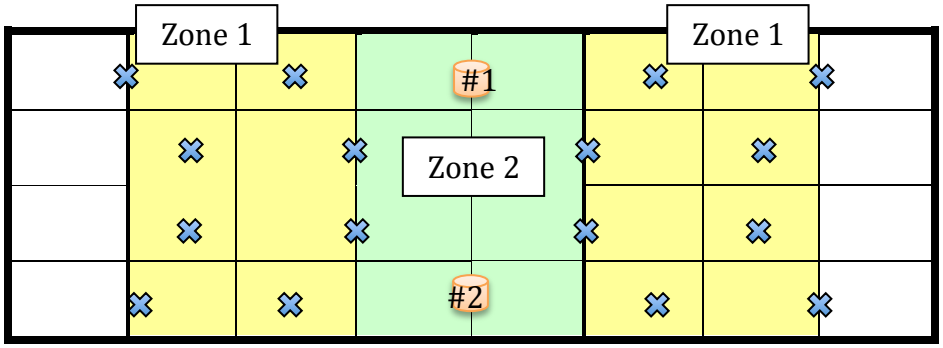


Figure 5: Game Set Up

- Lay out the 4 x 8 yard grid with blue tape or spray chalk
- Place the following items on the grid as shown above:
  - Add tape marks to indicate debris locations with an "x" as shown.
  - Set down two buckets representing laser supply packs (shown as #1 and #2), each containing 4 "laser pellet shots". (Laser pellet shots = fruit snack packs or equivalent.)