



*Acting Out SpySPHERES
Instructor's Guide*

Version 1.1 print DRAFT

Game duration: Approximately one hour

1 Objectives

- To help students understand the SpySPHERES 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 SpySPHERES” 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 SpySPHERES game and then act it out. Two teams will compete to see which team’s strategy captures the most points in the time allowed.

Student’s Mission:

Collect most points while managing energy in Low Earth Orbit where satellites are half of the time virtually illuminated by the sun and the other half in the Earth’s shadow.

Game Format:

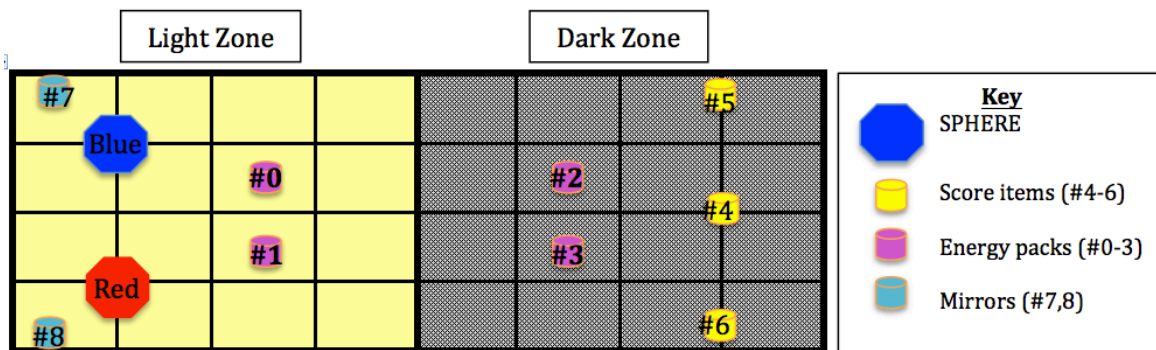


Figure 1: Game layout at start of game (4 x 8 yard grid)

The game area is laid out as a grid as shown in **Figure 1** above. This layout allows the students to compete in a similar fashion to the game simulation.



The game is split into 2 phases. Both phases will be played in succession. SPHERES start in the Light Zone as shown in **Figure 1**. Light and Dark zones switch between Phase I and Phase 2 as shown in Figure 2

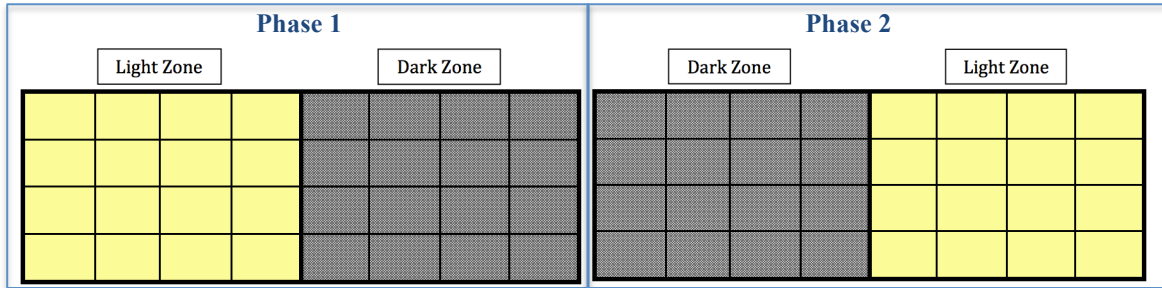


Figure 2: Light and Dark Zones switch between Phase 1 and Phase 2

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 instructor's guide assumes some familiarity with the SpySPHERES game. Details about the SpySPHERES game are available in the [game overview powerpoint](#) and the [game manual](#).

Notes:

- This activity works well with 10-12 students on a team. Consider combining smaller teams or splitting a larger team.
- Team members will take roles, acting out the parts of: SPHERES, Score Keepers, Dark Side Guides, Energy Rechargers, Picture Referees, Increment Counter.
- Teammates on the sideline will help give directions to their teammates on the grid based on their preplanned strategy.
- Teammates on the sideline are also encouraged to stand around the outside edges of the Dark Zone to mark which side is in the dark and then switch to the other end of the board at the light switch time.
- Game duration: Approximately one hour. Each test takes approximately 35 minutes assuming the game area is already laid out (details below):

Phase 1 Planning Period: 10 minutes

Phase 1 (initial Light/Dark Zones): 10 minutes or until complete

Phase 2 (switched Light/Dark Zones): 10 minutes or until complete

Scoring and discussion: 5 minutes

Repeat with game with new strategy and with students in new roles.

3 Preparation

In advance

- Review the SpySPHERES Game Overview Power point, part 1, with students prior to introducing this activity
- Read through this guide
- Gather Materials. See Materials Check List. (see page 11)
- Print off Strategy Sheets (see page 8)
- Print off Score Keeper's Sheet and Information Sheet (see pages 9-10)

Day of Activity

- Set up the Game Grid. See “Grid Set-up Checklist” on the last page of this document. (See page 12).

4 Activity Description and Guidelines

This activity involves a strategy planning phase and two game phases which are played in succession. The game phases are similar to the ZR game but do not exactly mirror the game play in the ZR IDE. Phase 1 represents the first 60 seconds of game play and Phase 2 represents the second 60 seconds of game play after the first light zone switch occurs.

Since time is important in the game, the pace of the SPHERES movement on both teams must be coordinated. To do this, each phase of the game is broken into 5 increments with 3 steps allowed in each increment. An example for Phase 1 is shown in Figure 3. The possible actions descriptions that the SPHERES can make are described in Table 1 below.

PHASE 1				
Increment 1 (3 steps)	Increment 2 (3 steps)	Increment 3 (3 steps)	Increment 4 (3 steps)	Increment 5 (3 steps)

Figure 3: Five increments in each phase

Teams must wait for both SPHERES to complete their 3 steps before moving to the next increment. Note that students can choose to remain in place as one of their “steps”. It does not cost energy to stand in place.

Assign someone (Eg. a student) to help keep track of the increments by either calling out the increment number or writing the increment number on a white board or flip chart.

IMPORTANT: To simplify acting out the game we have made the following additional modifications:

1. Taking Pictures: Pictures can only be taken at the end of each increment (every third step) This reflects the idea that in SpySPHERES the camera is turned off for 3 seconds after each picture is taken. Students are not required to take pictures at the end of each increment but if they choose to take a picture they should plan to take it at the end of an increment.
2. Energy Use: Since the SPHERES recharge their energy in the light, we will assume for the acting out the game that when the SPHERES are in the light zone their energy use is balanced by their energy recharge. Therefore this game only requires players to monitor energy while in the dark zone.

Table 1: SPHERES Actions/ Descriptions

SPHERES Actions/Description	Energy Cost	Score
Move forward or backward <ul style="list-style-type: none"> • A designated teammate will give directions. The teammate must tell their SPHERES what direction to step in order to move along the path that was marked on their strategy sheet. For example: “Take two steps forward and then one step 45 degrees to the right • Students should take normal sized steps 	Energy cost <u>in dark zone only</u> : 1 energy for each step	n/a
Take Picture <ul style="list-style-type: none"> • When a SPHERE takes a picture Picture Referee and the Score Keeper from the opponents team work together to determine the score. • First the Referee: 	Energy cost <u>in dark zone only</u> : 1 energy per picture	Scores range from: 2.75 to 2.25 points as



<ul style="list-style-type: none"> ○ Checks that the SPHERE has 1 energy ○ Checks that SPHERE is facing the opponent ○ Checks that the opponent is in the light zone ○ Checks that neither the SPHERE nor the opponent is wearing the mirror cloak ○ Checks if SPHERES have more than 1 grid lines between them (If less than 1 grid line between them then they are too close) • If all of the above are true the Referee holds up a Green Card. Otherwise the Referee holds up a Black Card. • Then the Scorekeeper: <ul style="list-style-type: none"> ○ Writes down the value of the picture taken as described below • Black Card Pictures (bad pictures) <ul style="list-style-type: none"> ○ 0.01 points. • Green Card Pictures (good pictures) are scored based on the following criteria: <ul style="list-style-type: none"> ○ If SPHERES have 2 grid lines between them: 2.75 points ○ If SPHERES have 3 grid lines between them: 2.5 points ○ If SPHERES have 4 or more grid lines between them: 2.25 points 		<p>described to the left</p>
<p>Item pick up:</p> <ul style="list-style-type: none"> • Items can be picked up by moving to their location. • All items are available for pickup by either SPHERES and once picked up are no longer available for pick up. • If both SPHERES arrive in the same square on the grid at the same time to pick up an item: Neither team can collect the item. This is to mimic the effect of collision avoidance. 	<p>n/a</p>	<p>n/a</p>
<p>Score Item pick up:</p> <ul style="list-style-type: none"> • Score items are worth 1.5 points each and points are earned when picked up. 	<p>n/a</p>	<p>1.5 points each</p>
<p>Mirror Item pick up:</p> <ul style="list-style-type: none"> • Mirror items can be held until ready for use. • Once activated the mirror is active for 2 increments (6 steps). • When the mirror is active neither SPHERES can get points for taking pictures of the opponent SPHERES. Attempted pictures still cost 1 energy. 	<p>n/a</p>	<p>n/a</p>
<p>Energy Pack pick up:</p> <ul style="list-style-type: none"> • Energy packs recharge SPHERES energy to max value of 5.0 • Energy packs are used immediately at the time of pick up. • What if: <ul style="list-style-type: none"> ○ If you pick up an energy pack when your energy is already fully charged? <ul style="list-style-type: none"> ▪ The energy pack is still used up but your total energy does not change. ○ If you run out of energy in the dark zone: <ul style="list-style-type: none"> ▪ Your SPHERE “drifts”. You can no longer follow your strategy but must continue to take steps in the same direction as the <u>previous step</u> until you get to the game boundary or enter the light zone. (Or if you had been stationary you must remain stationary until the light switches) ▪ SPHERES stuck in out-of-bounds in the dark zone can resume their strategy once the light switches. ▪ If you re-enter the light zone or the light zone switches your energy is immediately recharged to 5.0 energy 	<p>Energy packs recharge SPHERES energy to max value of 5.0.</p>	<p>n/a</p>



Light/Dark Zone Switch <ul style="list-style-type: none"> Switch of Light and Dark Zones is announced at the end of the first 5 increments (15 steps). SPHERES must continue to follow their strategy as planned even if it does not turn out as they hoped. 	n/a	n/a
Dark Side Guide <ul style="list-style-type: none"> Stays in the Dark Zone Takes energy away from the SPHERE for every step taken and every picture taken (good or bad) only when the SPHERE is in the Dark Zone until energy reaches 0. 	n/a	n/a
Energy Recharger <ul style="list-style-type: none"> Recharges the SPHERES energy to bring total energy of 5 (marbles or florist glass) when: <ul style="list-style-type: none"> SPHERES picks up an energy pack SPHERES enters the Light Zone (by moving from light to dark or because the dark/light zones switch. If the SPHERES already has 5 energy (maximum amount) they don't get any more. 	n/a	n/a

4.1 Phase 1 Planning Period

Time: approximately 10 minutes

Part 1: Strategy Sheets

Give each team two copies of the Strategy Sheet (see page 8) to:

- Tell each team which color SPHERE (red or blue) they will be.
- Decide the roles of each student
- Plan an overall strategy for both Phase 1 and Phase 2

Have students fill in the Strategy Sheet by drawing their planned path on the game grid with letters written on the path to indicate the location of specific actions. Show where they expect to stop in phase 1 and then start from that location on the grid in Phase 2. (Each phase they can take a total of 15 steps.)

- P = take picture
- UM= use mirror

Part 2: Set up

- Distribute optional signs or costumes to the designated students:
 - Ex: SPHERES- Spy Sunglasses; Lanyard with pretend camera (one red, one blue)
 - Dark Side Guide: black cape or black hat
 - Energy Recharger: fluorescent yellow shirt/hat
 - Picture Referee: arm band
- Hand the following items to the designated Students (See materials list for details.)
 - Dark Side Guides: 2 Buckets (empty except for Information sheet)
 - Energy Rechargers: 2 Buckets (each with 15 pieces of marbles/florist glass and Information sheet)
 - Picture Referees: 2 sets of Picture Cards
 - Score Keepers: 2 clipboards with score sheets and pen/pencil
- Send students to their starting positions for Phase 1
 - SPHERES will pick up buckets with 5 energy and stand on x's
 - Dark Side guide stands in the Dark Zone.
 - All other students stand around the edges of the Dark Zone.



4.2 Phase 1 Gameplay:

Phase 1 Game play:

The players from each team acting as SPHERES will begin on the grid as shown in

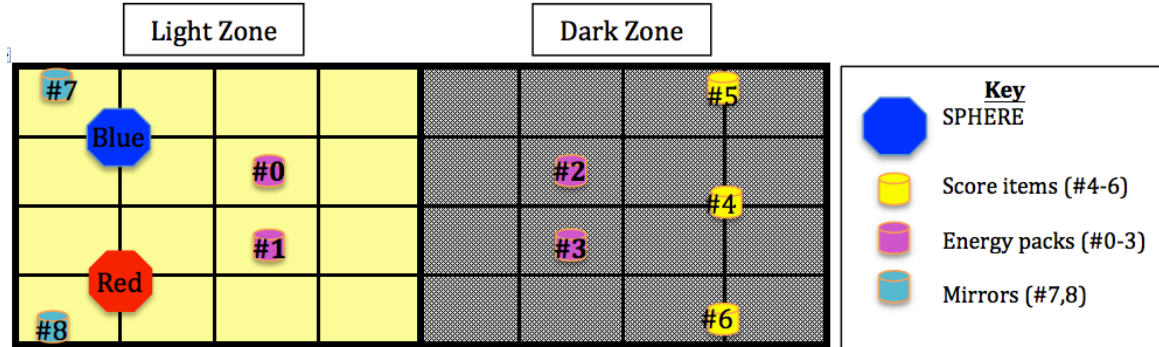


Figure 1 above.

The rest of the team and the team leaders from both teams will call off the increments from 1 to 5 in Phase 1, with a pause between to allow the SPHERES to take 3 steps during each increment. (See Action/Descriptions **Table 1** above.

SPHERES follow the plan as written on the strategy sheet with selected teammates from the sidelines giving directions to the SPHERES.

After each step

- Dark Side guide takes energy from SPHERES for steps taken in the Dark Zone only.
- Energy Recharge follows directions for recharging energy if energy packs are picked up or SPHERES moves from dark zone into light zone.

After completing each increment:

- Score Keeper and Picture Referee: Record picture score and Data score, if any (using score keepers sheet as a guide)
- Dark Side guide: Takes energy from SPHERES for pictures (and any additional steps) taken in the Dark Zone only
- Increment counter: Keeps track of the increment number

After completing the first 5 increments:

- The SPHERES must stop where they are.
- Dark Side guide moves to the other side of the game grid.
- All other students standing around the edges of the Dark Zone switch to the other side of the game grid.

Time: Approximately 10 minutes

4.3 Phase 2 Gameplay

Time: approximately 10 minutes

Continue game play with selected teammates from the sidelines giving directions to the SPHERES as before.

Dark Side Guide, Energy Recharge, Picture Referee and Score Keeper continue as before.

The rest of the team and the team leaders from both teams will count from increment 5 to increment 10, with a pause after each count to take 3 separate steps during each increment.

SPHERES must continue to follow their strategy plan. They should follow the steps exactly as planned even if it does not turn out the way they had hoped!

4.4 End of Competition and Scoring

After completing all 10 increments at the end of Phase 2:

- The SPHERES must stop where they are. This represents the end of the game.
- The Score keeper will tally up all points to calculate the total score.

Have each team describe their strategy and compare their scores. The team with the highest score wins that match.

Time: Approximately 5 minutes

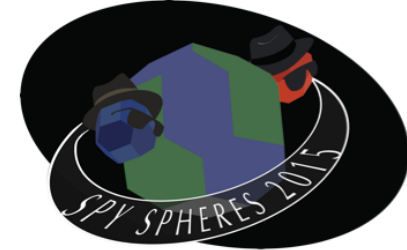


Strategy Sheet

Circle one: Red SPHERES / Blue SPHERES

Assign roles for your team:

- * SPHERES (spy): _____
- * Dark Side Guide: _____
- * Energy Recharger: _____
- * Score Keeper: _____
- * Picture Referee: _____
- * Person who gives the SPHERES directions: _____
- * Increment Counter: _____



Phase 1: Increments 1-5 (number of possible steps =15)

(fill in grids below and add any additional instructions on the back of this sheet)

- 1) Draw your planned path.
- 2) Mark "P"= everywhere you plan to take a picture. (Pictures can only be taken at the end of every increment.) -OR- list here which increments you plan to take a picture:

- 3) Mark "UM"= where you plan to start to "use mirror" if you choose to use one.

Light Zone				Dark Zone			
#7							#5
Blue			#0		#2		#4
			#1		#3		#6
#8	Red						

Key

- SPHERE
- Score items (#4-6)
- Energy packs (#0-3)
- Mirrors (#7,8)

Phase 2: Increments 6-10 (number of possible steps=15)

- 4) Mark a star where your path starts (the same place your path ends on the grid above.)
- 5) Draw the rest of your planned path using the same markings as above.

Note: You must finish the path you drew for Phase 1 before you start the path marked in phase 2 no matter where you are when the light switches.

Light Zone				Dark Zone			
#7							#5
			#0		#2		#4
			#1		#3		#6
#8							



Score Keeper's Score Sheet

	<u>Calculations</u>	<u>Points</u>
<p>Bad Pictures taken (Black Cards) <u>Keep tally here:</u> (Do calculation at game end)</p>	$\underline{\hspace{2cm}} \times 0.01 =$	
<p>Good pictures taken (Green Cards)</p> <p>Write picture value in rows to the right. (not all rows will be used)</p> <p><u>Good Picture Score Criteria</u> If SPHERES have: 1. 2 grid lines between: 2.75 points 2. 3 grid lines between: 2.5 points 3. 4 or more grid lines between: 2.25 points</p>	Good Picture 1	
	Good Picture 2	
	Good Picture 3	
	Good Picture 4	
	Good Picture 5	
	Good Picture 6	
	Good Picture 7	
	Good Picture 8	
	Good Picture 9	
	Good Picture 10	
<p>Score Items collected <u>Keep tally here:</u> (Do calculation at game end)</p>	$\underline{\hspace{2cm}} \times 1.5 =$	
	total	

Picture Referee's Guide

- Check that the SPHERE has 1 energy
- Check that SPHERE is facing the opponent
- Check that the opponent is in the light zone
- Check that neither the SPHERE nor the opponent is wearing the mirror cloak
- Check if SPHERES have more than 1 grid lines between them (If less than 1 grid line between them then they are too close)

If all of the above are true the Referee holds up a **green card**.
 Otherwise the Referee holds up a **black card**.



Information Sheet **Dark Side Guide/ Energy Recharger**

Dark Side Guide

When your team's SPHERES is in the Dark Zone:

Take away 1 energy (marble or florist glass) for every step they take
Take away 1 energy for every picture they take (good or bad)

Note: If they run out of energy they can still take bad pictures but can no longer take good pictures.

Energy Recharger

When your SPHERE does the following:

- A) Picks up an **energy pack**
- B) **Enters the Light Zone** by either of these ways:
 - Moves from the Dark Zone to the Light Zone
 - Because the Dark/Light Zones Switch

You will recharge your SPHERES energy by giving them enough energy (marbles or florist glass) to bring their total energy to 5 (marbles or florist glass) in their bucket.

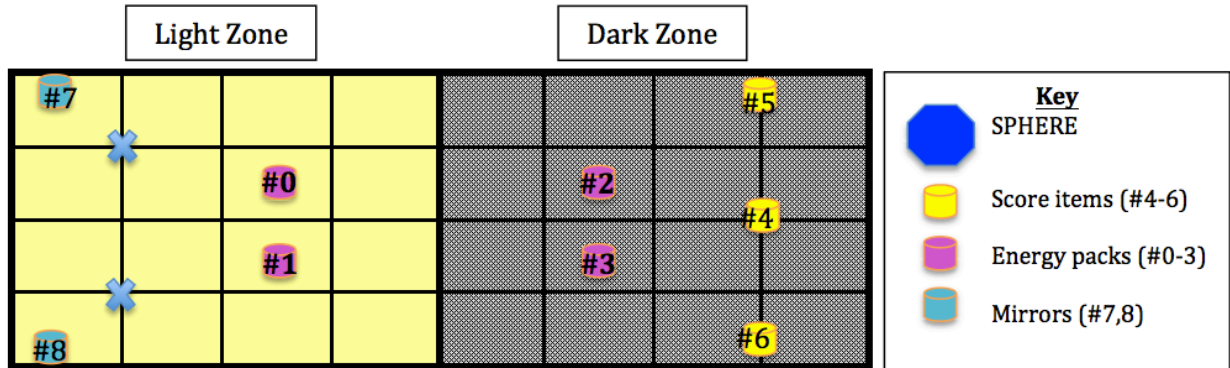
Note: If they already have 5 energy they don't get any more.



Materials Check List

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.

Item /function	Qty per grid	# grids	Total Qty (qty per grid) X (# grids)	Assigned to:
Rolls of Blue Tape (60 yds rolls) or Spray Chalk ○ To create game grid	2			
Yard sticks or measuring tape ○ To help layout game grid	1			
Picture cards carried by the Picture Referee ○ One Green Card (for good pictures) ○ One Black Card (bad pictures)	2 sets			
Strategy sheets, printed (see page 8) ○ Used to document strategy- 2 per team plus 2 extras	6			
Bag of marbles or florist glass ○ These represent energy ○ Place 5 pieces in each SPHERES bucket at start of game (10 total) ○ Give 15 pieces to each of the students acting as Energy Rechargers (30 total).	40			
Small bucket • Carried by each student “SPHERES” (for florist glass/energy and picture cards) • Carried by each Energy Recharger (for florist glass/energy) • Carried by each Dark Side Guide (for florist glass/energy)	6			
Small containers/boxes/baskets/blocks • 4 Pink containers to represent energy • 3 Yellow containers to represent data	7			
Print Score Sheets and Information Sheets (see pages 9-10)	2 each			
Clip board for Score Keeper’s score sheet	2			
Mirror item • Something for the SPHERES to wear to indicate their mirror has been activated like a cloaking device. Example: silver emergency blanket or tinfoil wrapped hat.	2			
Optional: Costume for SPHERES- Sunglasses; Lanyard with pretend camera (one red, one blue)	2			
Optional: Identifying signs or costumes for other student roles. Examples: Dark Side Guide: black cape or black hat; Energy Recharger: fluorescent yellow shirt/hat; Picture Referee: arm band	As needed			
Optional: Bell or other “alarm” • Used by students acting as to announce Dark/Light Zone Switch	1			
Optional: Flip chart or White Board to keep track of increments within each phase.	1			
Pen/pencil	4			

Grid Set-up Check List**Figure 4: Game Set Up**

- Lay out the 4 x 8 yard grid with blue tape or spray chalk
 - Highlight the line separating the light and dark zone (double wide tape or different color tape)
- Place the following items on the grid in their locations as shown above:
 - SPHERES starting location: Add tape marks to indicate with an “x” as shown.
 - SPHERES bucket: Set down two buckets at SPHERES locations.
 - Count out 5 marbles or florist glass in each bucket
 - Mirrors (shown as #7 and #8): Something the SPHERES can wear to indicate when the mirror is activated as a cloaking device. Example: silver emergency blanket or tinfoil wrapped hat.
 - Data Items: 3 small yellow containers/boxes/baskets/blocks
 - Energy Items: 4 small pink containers/boxes/baskets/blocks
- Have the following items ready to hand to the team/designated students at the start of the activity:
 - Team: Strategy sheets and pen/pencils
 - Dark Side Guides: 2 Buckets (empty except for information sheet); Optional sign/costume
 - Energy Rechargers: 2 Buckets (each with 15 pieces of marbles/florist glass and information sheet); Optional sign/costume
 - Picture Referees: 2 sets of Picture Cards; Optional sign/costume
 - Score Keepers: 2 clipboards with score sheets and pen/pencil