INTRODUCTION

USA Volleyball is the National Governing Body (NGB) for the sport of volleyball in the United States and is recognized as such by the Federation International de Volleyball and the United States Olympic Committee (USOC).

The vision of USA Volleyball is to be a world-class leading organization in all aspects of volleyball and to engage and inspire our nation through a cultivated passion for the game and continued success at winning Olympic and Paralympic medals.

The mission of USA Volleyball is to lead, serve and grow all areas of the sport of volleyball - including beach, indoor and sitting - achieving excellence while providing a lifetime of opportunities for all to participate in a safe and positive environment.

In order to accomplish this mission, USA Volleyball has established four strategic priorities:

★ Sustained competitive International, Olympic and Paralympic Success: As the USOC-recognized NGB, provide the opportunities and support necessary for our athletes at all levels of international competition, in beach, indoor and sitting, to reach the podium.

★ Participation, Program and Membership Growth: Provide the opportunities and resources through available programs which develop and retain a steadily growing participation base and a membership that is increasingly diversified.

★ Resource Optimization: Have a strategic and fiscally prudent financial plan that includes both resource cultivation and judicious allocation in support of our overall goals.

★ Marketing and Brand Affinity: Increase brand awareness while expanding affinity for USA Volleyball.

USA Volleyball is committed to and works toward opportunity for all to participate. It is an advocate for all Americans endeavoring to assure universal access to opportunities at all levels of the game.

Thus, USA Volleyball will diligently:

★ Work toward provision of ample opportunity, quality opportunity and equality of access for every resident of this diverse nation.

★ Act to expand opportunity for under-represented groups and aggressively recruit participation from those groups.

★ Make its daily decisions concerning resources, players, coaches, officials, administrators, and employees on the basis of individual merit and excellence of performance regardless of age, class, ancestry, color, national origin, race, religious creed, disability or handicap, gender, or sexual orientation.

★ Exercise its corporate will to encourage constituent organizations to act in accordance with the foregoing principles.

USA Volleyball believes that volleyball has so many positive things to offer those who participate. First, and most importantly, whether one is a gifted athlete or a recreational player, volleyball is FUN! It is a lifetime sport enjoyed by players from 8 to 80. Participation in volleyball is not only good exercise but also involves team cooperation and spirit. We are committed to introducing our sport to all of America.
STRUCTURE

This USA VOLLEYBALL STEM manual is designed to deliver content for 16+ hours of instruction for 12 students (6 pairs) as a project-based, student-centered, student-led program. The enclosed curriculum is your guide as a teacher/administrator/volunteer to implement the program. How you format that instruction is up to you.

In the back of this book are the worksheets for each lesson. The worksheets are to be copied for each student to use and keep as they work their way through each exercise.

DISCLAIMER

This curriculum, including any/all portions of this kit/equipment is intended for educational purposes only. The sport of volleyball involves risk of injury, loss and damage. By choosing to partake in this program, all teachers, students and participants assume full responsibility for such risks. This curriculum makes no representation or warranty, expressed or implied, including but not limited to any warranty of merchantability or fitness for a particular purpose. There are risks associated with participation in any athletic activity, and the student/teacher/participant is responsible for any potential risks associated with these activities. USA Volleyball shall not incur any liability for any damages, including but not limited to, direct, indirect, special or consequential damages arising out of, resulting from, or in any way connected to the use of this curriculum, whether or not based upon warranty, contract, or otherwise, whether or not injury was sustained by persons or property, and whether or not loss was sustained from, or rose out of, the implementation of this curriculum. The curriculum contained within this document is the property of USA Volleyball, and may not be reproduced or otherwise distributed for use without the written consent of USA Volleyball.
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WORKSHEETS

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CONCEPT: The Magnus Effect and Bernoulli’s Principle

OBJECTIVE: The student will discuss how these two laws apply to the game of volleyball

Many times these two laws are seen as similar, yet they are different. Magnus Effect, or Magnus Force is named after Gustav Magnus. He explained how projectiles can curve when moving through a fluid (like air). When a ball is spinning, the Magnus Force will push it in a direction perpendicular to the direction of movement. Bernoulli’s Principle, or Bernoulli’s Equation, named after Daniel Bernoulli, says a slow-moving fluid exerts more pressure than a fast-moving fluid. In the case of volleyball, the fluid is air. In simple terms, the Magnus Effect gives the ball the spin and Bernoulli’s Principle gives the lift or drop.

ACTIVITIES:

One of the key skills in volleyball is serving, and there are several types of serves. The key to a good serve is having an idea and a routine. What are you going to do and how are you going to do it? In other words, where are you serving the ball and what type of serve are you going to use?

Most beginners worry about getting the ball over the net and lose focus on the other details. For this exercise we remove the distraction of the net. Do not use a net for this exercise.

The three types of serves are torque serve, overhead, and underhand. For this exercise we are going to use the torque serve. See the link on the following page for a video demonstration.

Pair off in groups of two with a balloon and two volleyballs (see following page). Stand 30 feet (9 meters) from a wall, using the wall as a backdrop. One partner will record data while the other is serving. The partner that is recording data is also looking for movement in the ball. What is the balloon/ball doing?

Starting with the balloon, using a torque serve, strike it towards the wall. Repeat this five times then switch places with your partner.

Now switch to the recreation volleyball, still using a torque serve, and strike the ball towards the wall. Repeat five times then switch places with your partner. After each of you has done this five times, switch to the light touch volleyball and repeat the process five times each.

QUESTIONS:

1. Did you notice movement in each? If so, please describe it.
2. How can you tell if the sphere was moving?
3. When the sphere moved what did you do differently to cause the change in direction?
4. Did you notice any change in the movement between three spheres? If so, why?

Now, go back and repeat the activity again with the three different spheres, but try to make contact on the top part of the sphere rather than making direct contact with the center of the sphere.

5. Any change in movement from before?
6. Did it create more movement or less movement?
7. Why do you think that?
CONCEPT: The Magnus Effect and Bernoulli’s Principle

OBJECTIVE: The student will discuss how these two laws apply to the game of volleyball

MATERIALS:
- Recreation volleyball
- Light Touch volleyball
- Balloons
- Data Sheet
- Clip board
- Pencil

OUTCOMES:
Student should be able to describe and discuss the forces at play and how those forces affect the ball and balloon and ultimately, how those actions could affect match play.

RELATED SKILL SETS:
Torque serve

FUN FACTS:
A ball that does not move or spin is called a floater. Why is that?
Over half of the youth in the world use a torque serve.

RELATED VIDEO:
CONCEPT: Ideal serving speed

OBJECTIVE: The student will use a radar gun to determine the optimal speed of a serve

ACTIVITIES:

In lesson three, we covered “how to serve” while we learned about the Magnus Effect and Bernoulli’s Principle. In this lesson we will apply those techniques as we use a radar gun to determine optimal serving speed. In volleyball, serving is the only time you are in complete control of the outcome.

With your instructor, cut and measure enough ribbon to give you 32 feet (10 meters) of playing area on the court. If you are playing in a room that is 50 feet wide (16 meters), cut your ribbon 50 feet long (16 meters), but mark off the dimensions of the volleyball court using the blue painter’s tape. Dimensions can be found in lesson one. For this exercise, the ribbon height should be placed at 6 feet, 6 inches (2 meters).

For tips on using the radar gun see Optimal Speed Worksheet on page 25.

With your partner on the other side of the ribbon holding the radar gun, serve the ball keeping it inside the playing area. Using the data sheet, record your partner’s 10 serves, noting serve speed and if the serve was in or out. Switch sides with your partner so each of you has a chance to serve while the other records data.

Discuss your findings with your partner and make notes.

This time, practice serving cross-court with one partner on one corner and the other partner on the other corner as seen on the following page.

Using the data sheet, record your partner’s 10 serves, noting serve speed and if the serve was in or out. Switch sides with your partner so each of you has a chance to serve while the other records data.

QUESTIONS:

1. Of your first 10 serves, how many were in? What percentage is that?

2. What was the highest recorded speed for each partner? Was that serve in or out?

3. On the second set of serves, going cross-court, how many serves were in? What percentage is that?

4. What was the highest recorded speed for each partner cross-court? Was that serve in or out?

5. Of the two different serve locations, which produced the best “in” percentage? Why?

6. Which location produced the fastest speed? Why?
CONCEPT: Ideal serving speed

OBJECTIVE: The student will use a radar gun to determine the optimal speed of a serve

ACTIVITIES PART TWO:

Now that you have had a chance to review your findings, you and your partner head back out to the court keeping each of your five serves in the court. Be sure to record your speeds. Hint - you may have to adjust your serve to produce less power.

QUESTIONS:

1. What was the average of your five serves? What was your highest speed? Slowest speed?

2. Did you have to adjust your serve? If so, what did you do and why?

3. Based on your findings, what is the optimal serve speed for you? Why?

4. Illustrate the trajectory of your serve on paper. Trajectory is a major part of serving and changes dramatically depending on your type of serve (torque, overhead or underhand). Did your ceiling height come into play for this exercise, if at all? Did it impact your choice of serve?

MATERIALS:

- Recreation volleyball
- Radar gun
- 2-inch ribbon or rope
- Painter’s tape
- Data sheet
- Clipboard
- Pencil

OUTCOMES:

Students will learn to synthesize data and adjust their outcomes based on data.

RELATED SKILL SETS:

Serving, court awareness
CONCEPT: The Magnus Effect and Bernoulli’s Principle

OBJECTIVE: The student will discuss how these two laws apply to the game of volleyball

<table>
<thead>
<tr>
<th></th>
<th>STRIKING</th>
<th>STRIKING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Center of Sphere</td>
<td>Top of Sphere</td>
</tr>
<tr>
<td><strong>BALLOON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PARTNER ONE</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>PARTNER TWO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RECREATION BALL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PARTNER ONE</strong></td>
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<td></td>
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<tr>
<td><strong>PARTNER TWO</strong></td>
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</tr>
<tr>
<td><strong>LIGHT TOUCH BALL</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>PARTNER ONE</strong></td>
<td></td>
<td></td>
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<td><strong>PARTNER TWO</strong></td>
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</table>
CONCEPT: Ideal serving speed

OBJECTIVE: The student will use a radar gun to determine the optimal speed of a serve

<table>
<thead>
<tr>
<th>PART ONE</th>
<th>PARTNER ONE</th>
<th>PARTNER TWO</th>
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<tbody>
<tr>
<td>1. How many serves were in?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. What is the percentage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Highest recorded speed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Serve in or out?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cross-court - how many serves were in?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. What is the percentage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Highest recorded speed cross-court?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Serve in or out?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Best “in” percentage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Location that produced highest speed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Why?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART TWO</th>
<th>PARTNER ONE</th>
<th>PARTNER TWO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Average speed of your five serves?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Highest speed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Slowest speed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Did you make any adjustments?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. What did you do?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. What was your optimal serve speed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Why?</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRAJECTORY ILLUSTRATION</th>
<th>PARTNER ONE</th>
<th>PARTNER TWO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trajectory illustration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(separate piece of paper)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Was ceiling height a factor?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Did the ceiling impact your choice of serve?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### INCLUDED ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
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<tbody>
<tr>
<td>Molten First Touch volleyballs</td>
<td>6</td>
</tr>
<tr>
<td>Molten Light Touch volleyballs</td>
<td>6</td>
</tr>
<tr>
<td>Molten Camp volleyballs</td>
<td>6</td>
</tr>
<tr>
<td>P &amp; G inflatable GoPlay!VBall</td>
<td>1</td>
</tr>
<tr>
<td>Radar gun</td>
<td>1</td>
</tr>
<tr>
<td>Ribbon (spool)</td>
<td>6</td>
</tr>
<tr>
<td>Painter’s tape (roll)</td>
<td>6</td>
</tr>
<tr>
<td>Ball pump</td>
<td>1</td>
</tr>
<tr>
<td>Ball needles (package)</td>
<td>1</td>
</tr>
<tr>
<td>12-inch latex balloons (package)</td>
<td>1</td>
</tr>
<tr>
<td>Weight scale</td>
<td>1</td>
</tr>
<tr>
<td>100’ tape measures</td>
<td>6</td>
</tr>
<tr>
<td>500 toothpicks</td>
<td>1</td>
</tr>
<tr>
<td>100 straws</td>
<td>1</td>
</tr>
<tr>
<td>Fishing line (spool)</td>
<td>1</td>
</tr>
<tr>
<td>Molten SPB ball bags</td>
<td>2</td>
</tr>
<tr>
<td>STEM Manual</td>
<td>1</td>
</tr>
</tbody>
</table>

### INSTRUCTOR PROVIDED:

<table>
<thead>
<tr>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
</tr>
<tr>
<td>Ruler</td>
</tr>
<tr>
<td>Clip board</td>
</tr>
<tr>
<td>Pencil</td>
</tr>
<tr>
<td>Calculator</td>
</tr>
<tr>
<td>Damp cloth or paper towel</td>
</tr>
<tr>
<td>Smartphone, tablet or internet connected computer</td>
</tr>
<tr>
<td>Cardboard box (recycled materials)</td>
</tr>
<tr>
<td>Regular tape</td>
</tr>
</tbody>
</table>
Sitting volleyball is played from a sitting position on the floor. The sport is governed by the same set of rules as the able-bodied game, with a few minor rule modifications. Players are allowed to block serves, but one “cheek” must be in contact with the floor whenever they make contact with the ball.

The objective is for teams to send the ball over the net through the crossing area and to ground it on the court of the opposing team. Each team is allowed to have up to three contacts with the ball before returning it to the opposing team’s side of the court.

Each game consists of a maximum of five sets. Each of the first four sets is completed once one team has earned 25 points and has a minimum lead of at least two points. In the case of a tie at 24-24, the set continues until one of the teams secures a lead of two points and declared the winner of the set. In the case of a two-two set draw, a tiebreaking fifth set is played. In the fifth set, a team only needs to win 15 points, again with a difference of at least 2 over the opposing team. The winning team must win a total of three sets.

Each team has a maximum of 12 players. The initial positions of the players in the playing area are specific. These are determined and controlled during the game by the position of the buttock in relation to the ground.

In sitting volleyball, the net is about one meter high, and the court is 10 x 6 meters with a two-meter attack line. The court is divided into two sides of five meters deep by six meters wide. The net height, lower than that of able-bodied or standing volleyball, is set at a height of 1.15m for men, and 1.05m for women.

Players must remain in contact with the court at all times when handling the ball. Standing, rising, or taking steps is not permitted. A short loss of contact with the court is permitted in two scenarios: when making a defensive play in the back zone to save a ball and when making a defensive play in the front zone.

The World ParaVolley (formerly the World Organization Volleyball for Disabled) is the International Sport Federation.
**Sitting Volleyball Skills**

**Spiking**
Start with the body 4-5 feet away from the net
Move towards the ball by using your arms and pushing with your lower body
Pull back your hitting arm as if you were pulling to shoot a bow and arrow
Swing your arm forward fast, reaching as high as you can while rotating your shoulders
Direct the ball in part by turning your wrist in different directions as you follow through

**Forearm Passing / Dig**
Thumbs together and even in height
Point thumbs downwards
Keep arms fully extended to create a platform with your forearms
Direct the platform angle to rebound the ball towards your target

**Overhead Passing / Setting**
Open hands and spread fingers into a ball shaped “cup” above the forehead
Allow the wrists and hands to be loose
Make a triangle with the thumbs and pointer fingers
Flick the wrists and extend the arms to push the ball to the target

**Blocking**
Start with your hands down, ready to move side-to-side
Once in position, raise arms with hands open wide and fingers spread apart
Turn wrists outwards so the thumbs point upwards
Watch the hitter, not the ball
Extend your arms across the net without touching it
Flick your wrists toward the middle of the court

**Serving**
Breathe. Patience. Relax – Your OPPONENTS are the nervous ones.
Pull back on your hitting arm as if you were going to shoot a bow and arrow
In your non-hitting hand, raise the ball to shoulder height with your arm in front of you
Toss the ball gently 1-2 feet out of your hand
Swing through the ball to your target
Snap your wrist for top spin; keep wrist rigid and consistent for float

**Differences Between Olympic and Paralympic Volleyball**
Olympic
Net height: Men – 7’11”, Women – 7’4”
Court Size: 18m long x 9m wide, divided in half by the net
Illegal to block a serve
Feet must be behind the service line at contact:
Paralympic
Net height: Men – 3’9”, Women – 3’3”
Court Size: 10m long x 6m wide, divided in half by the net
Blocking a serve is legal
A players bottom must be behind the service line (feet can cross)
A players bottom must be touching the ground when the player contacts the ball

**Sitting Volleyball Court Diagram**

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sitting.volleyball@usav.org
**Volleyball Should Be a Game Before It Becomes a Sport.**

<table>
<thead>
<tr>
<th>STAGE</th>
<th>Beginner</th>
<th>Advanced Beginner</th>
<th>Intermediate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skill Level</strong></td>
<td>Experience: 0-1 year</td>
<td>Experience: 1-3 years</td>
<td>Experience: 3-5 years</td>
<td>Experience: 5+ years</td>
</tr>
<tr>
<td><strong>Ball</strong></td>
<td>Official size is not necessary; a ball could even be used. Weight: 7.5 oz or less</td>
<td>Circumference: 25.6”-26.4”; Weight: 9 oz or less</td>
<td>Circumference: 25.6”-26.4”; Weight: 9 - 10 oz</td>
<td>Circumference: 25.6”-26.4”; Weight: 9 - 10 oz</td>
</tr>
<tr>
<td><strong>Court Size</strong></td>
<td>4 courts 9.5’ x 29.5’ 1 vs 1 2 vs 2</td>
<td>3 courts 14.5’ x 39’ 2 vs 2 4 vs 4</td>
<td>2 courts 19.5’ x 46’ 2 vs 2 4 vs 4</td>
<td>1 court 29.5’ x 59’ 4 vs 4 6 vs 6</td>
</tr>
<tr>
<td><strong>Net Height</strong></td>
<td>Any net height ex: Tennis (3’) Great for beginners</td>
<td>Both: 6’ 6”</td>
<td>Both: 7’ 4 1/8”</td>
<td>Male: 7’ 11 5/8” Female: 7’ 4 1/8”</td>
</tr>
<tr>
<td><strong>ADM</strong></td>
<td><strong>STAGE 1</strong> Discover, Learn &amp; Play Age: 0 - 12</td>
<td><strong>STAGE 2</strong> Develop &amp; Challenge Age: 10 - 16</td>
<td><strong>STAGE 3</strong> Train &amp; Compete Age: 14 - 19</td>
<td><strong>STAGE 4 &amp; 5</strong> Participate &amp; Succeed Thrive &amp; Mentor Age: 15 +</td>
</tr>
<tr>
<td><strong>The American Development Model</strong></td>
<td>This first step gives new athletes a fun environment to learn core fundamentals, rules and the benefits of sport. Playing multiple sports will develop key motor skills needed for future growth.</td>
<td>After an athlete has engaged in a sport, the purpose of this stage is to refine skills, promote social growth and identify personal strengths. Athletes may also explore recreational competition.</td>
<td>Athletes at this stage are driven to participate in organized school and club sports. They begin to recognize the commitment needed to excel at a competitive level.</td>
<td>Athletes choose to continue up the competition ladder or stay in a sport for fun and social aspects. Athletes can choose to give back and become a coach or referee.</td>
</tr>
</tbody>
</table>

Smaller courts, less people and lower nets make learning the game easier and more fun by allowing players more opportunities to touch the ball, a key factor in developing their core skills, understanding how the game is played and promoting social growth through sport.
Program written, designed and managed by STEM Sports, LLC. A division of Huddle UP Group, LLC.

For general inquiries or questions regarding the program contact:

**Jordan Parry**
Jordan@STEMsports.com
(802) 279-1682

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(719) 228-6800
usavolleyball.org

Follow us @usavolleyball

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Tag us on social media using #USASTEM

For tips, drills and skills follow us on YouTube @usavolleyball

Resources for players, parents, teachers, coaches and officials, contact:

USA Volleyball
Director of Sport Development
John Kessel
STEM@usavolleyball.org

Additional educational volleyball resources can be found at:

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Molten USA is the Official Sponsor of USA Volleyball, its National Teams, High Performance Program, National Championships and Coaching Accreditation Program
www.moltenusa.com

To order additional STEM Sports balls or supplies from Molten and receive a discount, contact
Mike Du Varney (mike@huddieupgroup.com) or call (303) 520-7345.

**MOLTEN’S PASS IT FORWARD PROGRAM**

Molten’s Pass it Forward program is an interactive program designed to help spread the joy of sport and play while engaging youth in a conversation regarding giving, sportsmanship and accountability.

To tell your Molten’s Pass It Forward program story or to apply for Molten’s Pass It Forward program, please visit www.moltenusa.com/passitforward

#moltenpassitforward