VOLUME
1

STEM.ORG ACCREDITED EDUCATIONAL EXPERIENCE

STEM sports®



**INSIDE:**
Turn the page to learn more about our Digital Assets!

# STEM MULTI-SPORT

Net Edition

## SUPPLEMENTAL CURRICULUM

GRADES 3 - 5 AND GRADES 6 - 8

# Go Digital

In addition to the classroom, STEM Sports® K-8 Supplemental Curriculum is flexible and scalable to teach and implement at home and virtually on platforms such as Zoom, Google Classroom, Microsoft Teams, and other digital learning tools. For each and every module, we provide solutions for successful remote learning with PowerPoint presentation decks and digital worksheets with keys.

**To access these useful tools, visit STEMSports.com/digitaltools**

# Welcome

STEM Sports® provides turnkey K-8 supplemental curricula that use sports as the real-life application to drive STEM-based, hands-on learning in classrooms, after-school programs, and camps.

We are pleased to present Volume 1 of STEM Multi-Sport: Net edition, highlighted by the following:

- Content for a minimum of 16 hours of instruction that includes some healthy, physical activity.
- Turnkey kits equipped with all of the relevant sports equipment along with the necessary science supplies.
- Eight lessons aligned with Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K-12 Physical Education.
- STEM.org Accredited™ Educational Experience approved.
- 5E lesson plans so that students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.
- Differentiation: lessons for kindergarten to 2nd grade, 3rd to 5th grade, and 6th to 8th grade.
- "Capstone" Project (Grades 6th to 8th) to commensurate student's knowledge of each curriculum.
- Assessments in each lesson to evaluate students effectively.
- Ready-to-use worksheets that align with each lesson and standards.
- A list of STEM-based, sports-related jobs pertinent to the lesson concept in each module.
- Engineering Design Process (EDP) woven into each curriculum.
- STEM Sports® glossary to support instructors and students as they come across key vocabulary in each module.
- Mindfulness Matters: important messaging to assist with the uniqueness of blending STEM with sports.
- Well-designed and scalable lessons for teachers, administrators, or volunteers.
- Professional development or training are not required.

Please visit **STEMSports.com** for additional information and to learn about all of the curricula that we offer.

**We sincerely hope you and your students enjoy this STEM Sports® supplemental curriculum.**

Please complete our Teacher Survey at **STEMsports.com/teacher-survey**.
We appreciate your feedback.

Mindfulness may not be the first thing one thinks about STEM Sports®. However, mindfulness is essential to fully understanding the design and benefits of the STEM Sports® curricula by way of the following:

- Approximately 85% of STEM jobs anticipated for the year 2030 have yet to be invented.
- Moreover, within the next 10 years or so, 80% of all jobs will be STEM related.

The STEM Sports® curricula distinctly blends STEM content areas through hands-on/active play and sports. Active play provides a mechanism to teach STEM concepts; therefore, learning is integrated, engaging and meaningful as participants are exposed to STEM applications through real world experiences.

**Teachers** should be mindful of the fact STEM Sports® curricula are:

- Collaborative in nature, ensuring peer-to-peer learning opportunities
- Inquiry-based, allowing learners to discover information for themselves
- Designed for problem-solving: an essential lifelong skill
- Hands-on, engaging all types of learners
- Student-led, encouraging ownership of learning
- Active, promoting physical activity and wellbeing

**Participants** should be mindful of the fact STEM Sports® curricula are:

- Introduction to STEM concepts, facilitating comfort with STEM content areas
- Blending play and sport in an environment that is engaging, fun, and applicable to life outside the classroom
- Designed for all ensuring success for all participants – students do not have to be athletic or excel at science to accomplish curricula tasks
- Applicable to the real world where learning is meaningful for all participants

In sum, stakeholders should be mindful of all the STEM Sports® curricula have to offer. The unique design of the STEM Sports® curricula is essential to maximize learning and understanding of STEM concepts in sports and life applications.



For more information on mindfulness training for your school/organization, visit RayeEducationalServices.com or call 602-510-0298.

# Contents
## Grades 3-5

# Contents
## Grades 3-5

# Contents
## Grades 6-8

**STEM Multi-Sport Net Edition**

# Supplies Checklist

- ☐ **Six (6)** Digital Stopwatches
- ☐ **Six (6)** 25-Foot Tape Measures
- ☐ **One (1)** Digital Weight Scale
- ☐ **One (1)** Masking Tape Roll
- ☐ **One (1)** Radar Gun
- ☐ **Twenty-Four (24)** Disc Cones
- ☐ **Six (6)** Lacrosse Sticks
- ☐ **Six (6)** Lacrosse Balls
- ☐ **Six (6)** Tennis Rackets
- ☐ **Six (6)** Tennis Balls
- ☐ **Five (5)** Right Hand Hockey Sticks
- ☐ **One (1)** Left Hand Hockey Stick
- ☐ **Six (6)** Floor Hockey Pucks
- ☐ **One (1)** STEM Multi-Sport Net Edition Curriculum Manual

## Materials Needed

- ☐ Pencils
- ☐ Smartphone/Tablet
- ☐ Tennis Court (Module 7.0)
- ☐ Calculators
- ☐ Internet Access
- ☐ Softball or Baseball ***(Extend only)***
- ☐ Clipboard
- ☐ Outdoor Space
- ☐ Ice Rink/Platform (Optional yet recommended)



Net Edition

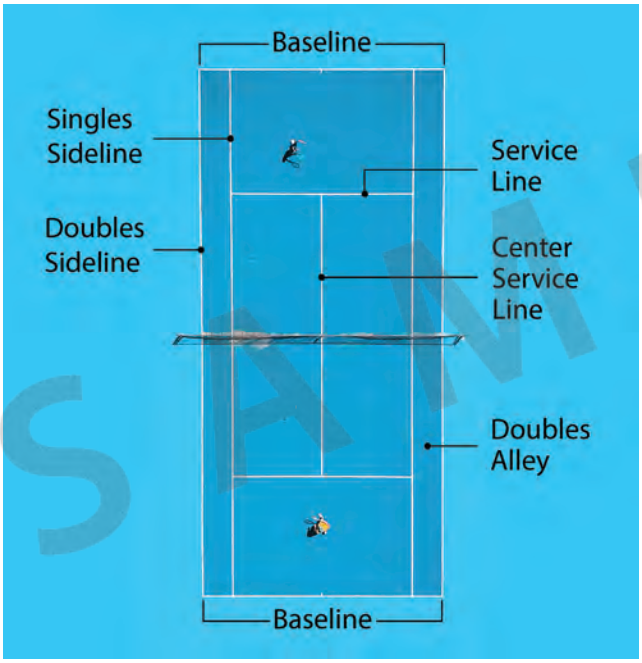
# STEM Sports® Glossary

**Area:** The amount of space a flat shape (2D) consumes.

**Balanced Force:** Two forces acting in opposite directions on an object, equal in size.

**Baseline – Tennis Court:** A 36 foot line that stretches along the short sides of a tennis court's rectangular shape. It is the area that forms the back boundaries of the court.

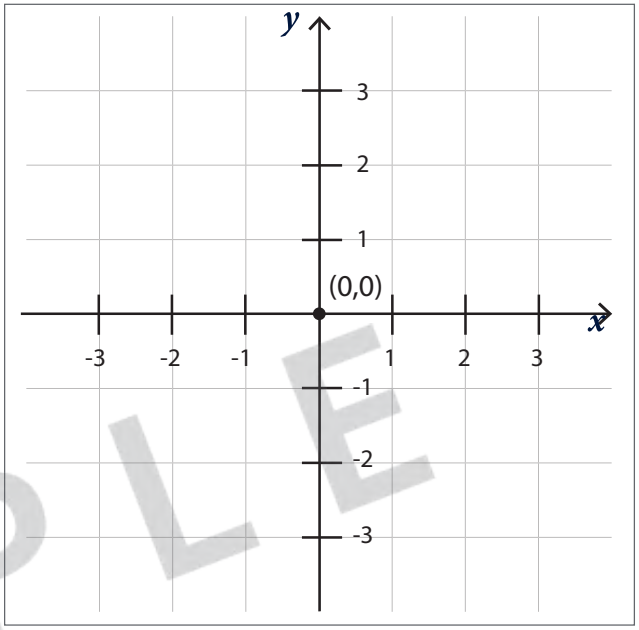
**Center Service Line:** A line on a tennis court that divides the two service boxes on each side.




**Claim, Evidence and Reasoning (CER):** A writing technique that supports scientific writing; a Claim answers the question or addresses the prompt; Evidence is used from student's experiments or research and explanations; Reasoning is a scientific principle, law or concept that connects the claim and evidence.

**Constraint:** A restriction that keeps something from being the best it can be.

**Coordinate Plane System:** A two-dimensional plane formed by the intersection of a vertical line called y-axis and a horizontal line called x-axis.




**Criteria:** A set of rules or directions that must be followed.

**Deuce:** In the game of tennis, it is a tied score at 40-all that requires one player to get two successive points to win the game.

**Doubles Alley:** This is the area between the singles and doubles sidelines on a tennis court.

**Double Fault:** Two faults in a row result in the receiving team earning a point, including the following actions and/or scenarios:

- "Let": The ball hits the net and lands in the opposite service box; it doesn't count as anything. The server serves again.
- The ball may bounce once on your side before returning it to the other side. However, the ball does not have to bounce; it can be volleyed/hit before it bounces.





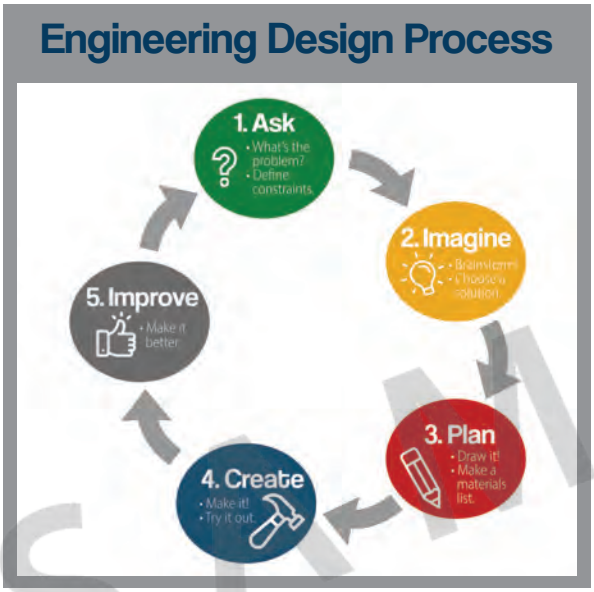
STEM sports

- Your racket or body may not touch the net.
- A ball hitting the net and going over during play is live and playable. When playing doubles, partners do not have to alternate shots.

**Doubles Sideline**: This is the outermost line that runs the length of the entire tennis court.

**Energy:** The motion of molecules or objects.

**Engineering Design Process (EDP):** An organized series of steps that engineers use to develop functional products or processes.



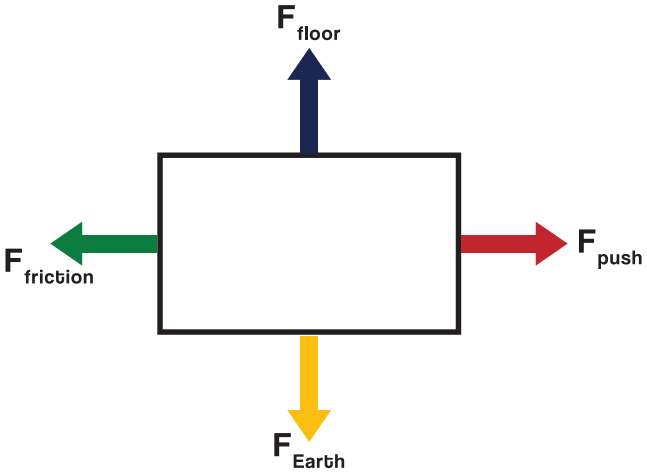

**Equal to:** A relationship between two quantities, or two mathematical expressions, stating that the amounts have the same value, or that the expressions represent the same mathematical object.

**Fault:** If the serve does not land in the correct service box, the serving player will get two chances to serve correctly into the service "opposite" box.

**Force:** Something that causes a change in the motion of an object.

| force | = | mass of object | x | acceleration |
|---|---|---|---|---|

**Force Diagram:** A diagram showing all the forces acting on an object, the force's direction and its magnitude.




**Greater than Symbol:** A symbol placed between two numbers where the first number is more than the second number.

**Joule:** A standard unit of energy or work in the International System of Units (SI).

**Kinetic Energy:** The energy an object possesses due to its motion.

**Less than Symbol:** A symbol placed between two numbers where the first number is less than the second number.

**Mass:** A fundamental property of matter that is a numerical measure of the inertia (inactive) of an object or the amount of matter an object contains.

**Molecular Motion:** An unsystematic movement of molecules inside a substance without any outside influence.

**Molecular Structure:** The manner of electrons and nuclei interacting to form a molecule.

**Molecules:** A group of two or more atoms connected by electrons in a chemical bond.

**Momentum:** The product of mass and velocity; a measure that describes an object's ability to continue in motion.

**Observation:** The process of carefully watching or examining a person or object.

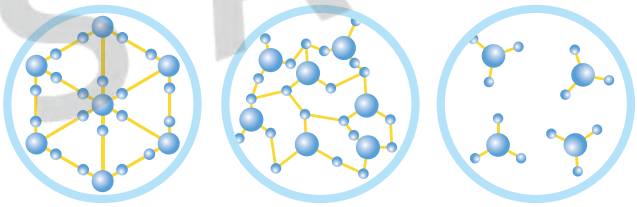
**Perimeter:** A continuous line forming the boundary of a closed geometric figure.

**Properties:** Any traits that can be measured, such as mass, color, density, length, odor, and temperature.

**Right Triangle:** A triangle with a 90° angle.

**Slap Shot:** The hardest shot in hockey that requires full and one fluid body motion to execute. Slap shot typically requires a player to raise the stick's blade above their shoulders or higher, whereas a "One-timer" is often lower or at shoulder height due to timing by way of receiving a teammate's pass.

**States of Matter:**




- A **Solid** is a set of atoms or molecules held together (within a constant state) so they maintain a distinct shape and size.
- A **Liquid** is a state of matter defined by its condensed make-up and ability to flow.
- **Gas** is a state of matter defined by its movable or non-condensed state and/or ability to flow.

**Stick-Handling:** A player's ability to effectively control the puck with their stick.

**Technology:** An object, idea or method used to solve problems or invent new objects, ideas, or methods.

**Tennis Racket:** Sports equipment consisting of a handle and oval frame with tight interlaced strings used to hit the ball.

**Unbalanced Force:** A force that changes the position, speed, or direction of the object to which it is applied.

**Velocity**: The rate of change of position with respect to time.

| velocity | = | s (displacement) | ÷ | t (time) |
|---|---|---|---|---|

**Wrister:** A wrist shot in which a player uses their arms (less body) to generate force on the shot.

Module 2.0

GRADES 3-5

# Playing on Ice

**Concept**
Physical Science

**Objective**
Students will learn about the physical properties of ice. Students will create a diagram that demonstrates the change from a liquid (water) to a solid (ice). Students will use this knowledge to determine the best playing surface in hockey.

**Time**
(2) 60-minute sessions

## Standards

### Next Generation Science Standards Connections

**5-PS1-1:** Develop a model to describe that matter is made of particles too small to be seen.

**5-PS1-2:** Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

**5-PS1-3:** Make observations and measurements to identify materials based on their properties.

### National Standards for K-12 Physical Education Connections

**Standard 2:** The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

**Standard 4:** The physically literate individual exhibits responsible personal and social behavior that respects self and others.

### Supplies Provided
Worksheets

***Visit STEMSports.com/digitaltools to access presentation decks, worksheets, and answer keys.***

### Materials Needed
Pencils
*Optional yet recommended: Ice Rink/Platform*

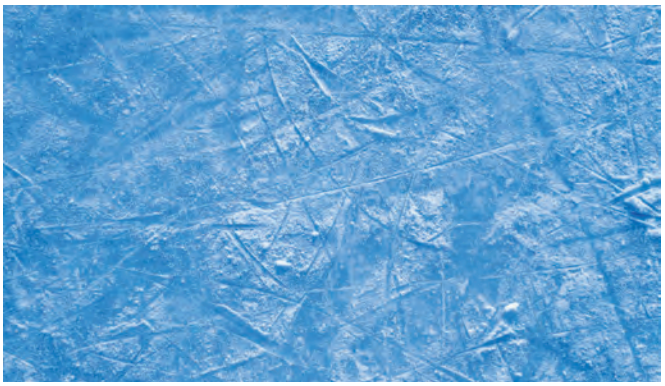
## Sequence of Lesson

**Have your students take this lesson's assessment prior to engaging by visiting: STEMSports.com/assessments**
***If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.***

**Engage:** Ask students the following: What do you think of when you see ice? Have you ever walked or skated on ice? If so, what makes it unique from walking on a basketball court or soccer field?

**Explore:** Have students reference the images of the hockey player and the physical results to the ice after skating/playing hockey. With a partner, ask students to brainstorm and share why they think this is a reaction with the ice and share out with the class.

*Teacher note: We strongly recommend the use of an ice rink/platform for students to skate on, and if possible, play a game of hockey to witness the physical results on the ice.*

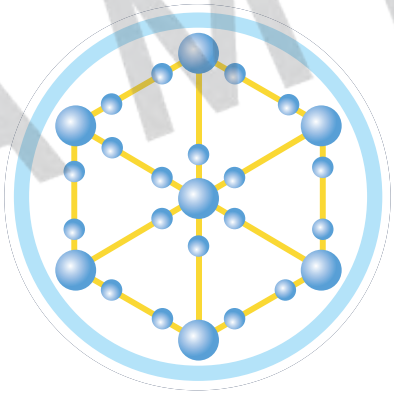


**Explain:** Define the terms Molecule and Molecular Structure for students, which can be found in the STEM Sports® Glossary in the front of this manual and at STEMSports.com under Resources. Tell students that all things, including ice/water, are made up of small particles we can not see called "molecules". Explain that while we can see the physical properties of water, we are unable to witness the change from a liquid (water) to a solid (ice) in real time. Using the molecular images as a guide, explain to students that when water reaches its freezing point of 0° Celsius or 32° Fahrenheit, molecules form a definitive structure known as a "molecular structure".

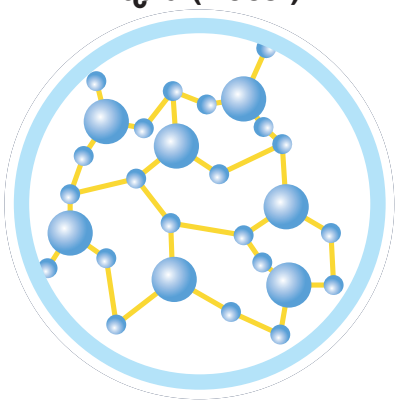
**Elaborate:** Use the diagram on page 21 and define the following key terms: Critical Point and Triple Point, which can be found in the STEM Sports® Glossary in the front of this manual and at STEMSports.com under Resources. Tell students the Toluene diagram depicts the states of matter – by phase – when transforming from a gas (vapor), liquid (water), and solid (ice).

Have students create a diagram that demonstrates the change from a liquid to a solid. Encourage students to use lines, arrows, boxes, and circles to clearly outline and describe this change. Use the worksheet as a guide.

**Solid (Ice)**



**Liquid (Water)**



**Evaluate:** Using the worksheet as a guide, have students fill in the blanks to determine the best playing surface for hockey.

**Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting: STEMSports.com/assessments**

***If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.***

**Extend:** Students could draw a scale model of a hockey rink and depict how the playing surface/ice transforms through heat/energy before, during, and after a hockey game by inserting the third state of matter: gas (vapor).

## STEM Jobs in Sports

- Ice Technician
- Zamboni Mechanic & Operator
- Ice Crew
- Hockey Skating Coach
- Operations Coordinator, Women's Ice Hockey

***For a growing list of occupations throughout the sports industry, click on the resource tab at STEMSports.com.***

## Fun Facts

The ice in a hockey rink is less than an inch thick.

Name: _____

# Playing on Ice

GRADES 3-5

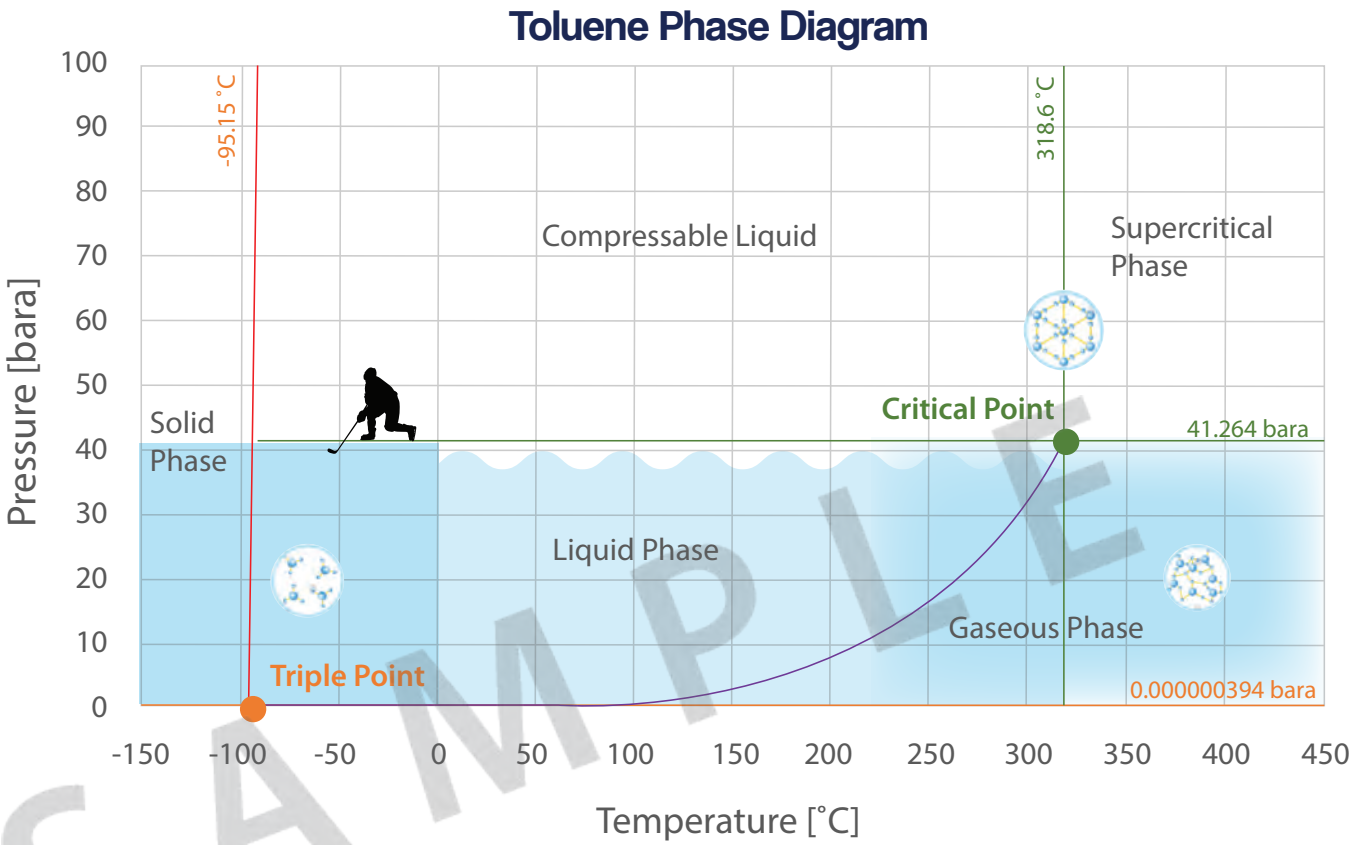
## Elaborate

Create a diagram that demonstrates the change from a liquid to a solid. Use lines, arrows, boxes, and circles to clearly describe this change.

Name: _____

# Playing on Ice

**GRADES 3-5**



Module 2.0

Name: _____

# Playing on Ice

**GRADES 3-5**

## Evaluate

Fill in the blanks to determine the best playing surface for ice hockey.

1. When water reaches its freezing point, molecules form a definitive structure known as a _____ structure. (Molecular or Proton)

2. The temperature to play ice hockey must be at least: _____°C / _____°F

3. Before changing to ice, it is this state of matter _____. (Solid or Liquid)

4. To play on the ice, it must be in this state of matter _____. (Liquid or Solid)

5. Based on the images from the *Explore* section, as well as your diagram that demonstrates the change from a liquid to a solid, why do you think this reaction occurs on ice? Please explain your answer.

_____

_____

_____

Module 2.0

GRADES 6-8

# Playing on Ice

**Concept**
Physical Science

**Objective**
Students will learn about the composition of ice. Students will create a diagram that identifies the physical properties of ice. Students will use this diagram to develop a model that demonstrates molecular transformation and structure to determine the best playing surface in hockey.

**Time**
(2-3) 50-minute blocks

## Standards

### Next Generation Science Standards Connections

**MS-PS1-1:** Develop models to describe the atomic composition of simple molecules and extended structures.

**MS-PS1-4:** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

### National Standards for K-12 Physical Education Connections

**Standard 2:** The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

**Standard 4:** The physically literate individual exhibits responsible personal and social behavior that respects self and others.

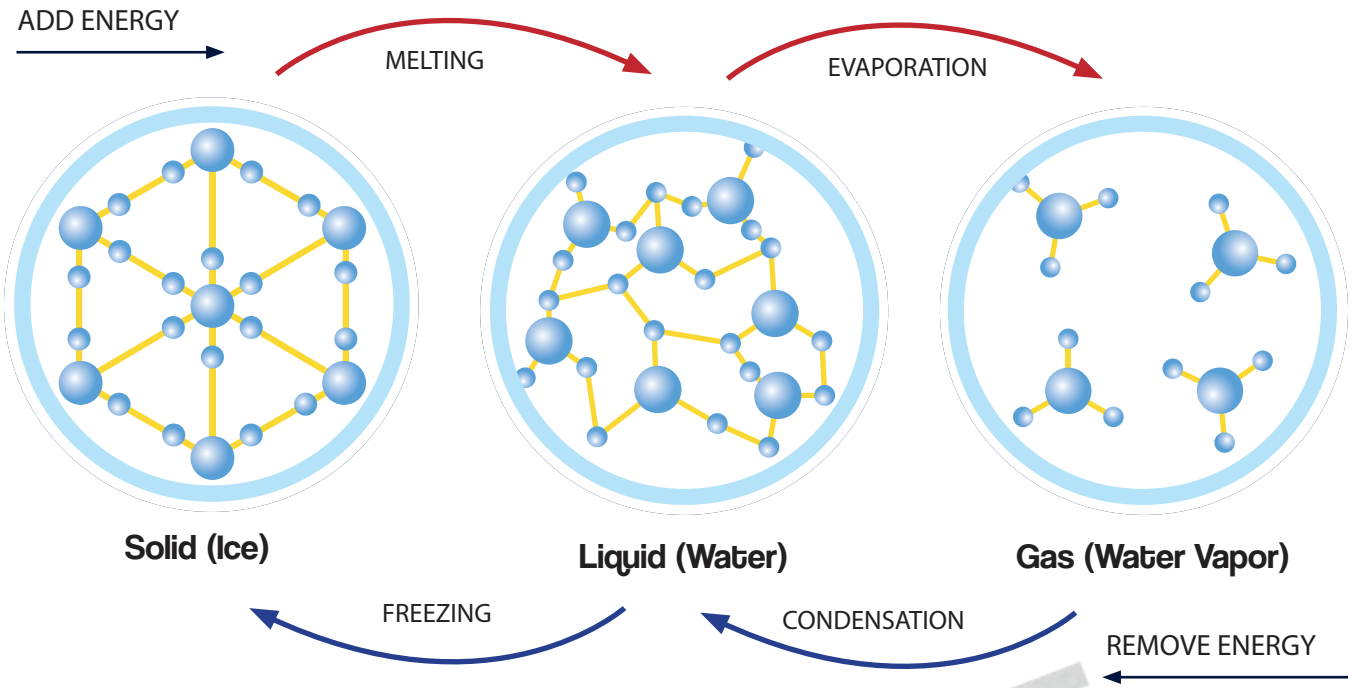
### Supplies Provided
Worksheets

***Visit STEMSports.com/digitaltools to access presentation decks, worksheets, and answer keys.***

### Materials Needed
Pencils
***Optional yet recommended:*** *Ice Rink/Platform*

## Sequence of Lesson

**Have your students take this lesson's assessment prior to engaging by visiting: STEMSports.com/assessments**
***If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.***




**Engage:** Ask students the following: What do you think of when you see ice? Have you ever walked or skated on ice? If so, what makes it unique from walking on a volleyball court or football field?

**Explore:** Have students reference the images of the hockey player and the physical results to the ice after skating/playing hockey to the right. With a partner, ask students to brainstorm and share why they think this is a reaction with the ice and share out with the class.

*Teacher note: We strongly recommend the use of an ice rink/platform for students to skate on, and if possible, play a game of hockey to witness the physical results on the ice.*

**Explain:** Define the terms Molecule and Molecular Structure for students, which can be found in the STEM Sports® Glossary in the front of this manual and at **STEMSports.com** under Resources. Tell students that all things, including ice/water, are made up of small particles we can not see called "molecules". Explain that while we can see the physical properties of water, we are unable to witness the change from a vapor (gas) to a liquid (water) to a solid (ice) in real time. Using the image as a guide, identify the three states of matter and following temperatures of each state:

- **Gas** - Water Vapor: Above 100°C / 212°F
- **Liquid** - Water: 0° - 100°C / 32° - 212°F
- **Solid** - Ice: O°C / 32°F or below

Explain to students that molecules form a definitive structure during the solid state known as "molecular structure" as energy/temperature decreases.

**Elaborate:** Define the following key terms: Critical Point and Triple Point, which can be found in the STEM Sports® Glossary in the front of this manual and at **STEMSports.com** under Resources. Tell students the Toluene diagram depicts the states of matter - by phase - when transforming from a gas (vapor), liquid (water), and solid (ice).

Have students create and label an outline that demonstrates the transformation from a gas to a liquid to a solid. Students should use lines, arrows, boxes and/or circles to concisely describe each composition's transformation from a few molecules to a defined structure.

**Evaluate:** Have students draw a scale model of a hockey rink and depict how the playing surface/ice is created and sustainable using information and data throughout the lesson, including molecular transformation by way of heat/energy before, during, and after a hockey game.

**Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting: STEMSports.com/assessments**

***If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.***

**Extend:** Students could research the properties and function of a Zamboni to understand its effectiveness to sustain and ensure the best playing surface.

## STEM Jobs in Sports

- Ice Technician
- Zamboni Mechanic & Operator
- Ice Crew
- Hockey Skating Coach
- Operations Coordinator, Women's Ice Hockey

***For a growing list of occupations throughout the sports industry, click on the resource tab at STEMSports.com.***

## Fun Facts

The layer of ice in an NHL rink is approximately three-quarters of an inch thick and is kept at a temperature of -9° Celsius or 16° Fahrenheit.

Name: _____ Class: _____

# Playing on Ice

**GRADES 6-8**

## Elaborate

Create and label an outline that demonstrates the transformation from a gas to a liquid to a solid. Use lines, arrows, boxes and/or circles to concisely describe each composition's transformation from a few molecules to a defined structure.

Module 2.0

Name: _____ Class: _____

# Playing on Ice

GRADES 6-8

## Evaluate

Draw a scale model of a hockey rink. Depict how the playing surface/ice is created and sustainable using information and data throughout the lesson, including molecular composition and transformation by way of heat/energy before, during, and after a hockey game.

# Notes

# Notes

# Notes

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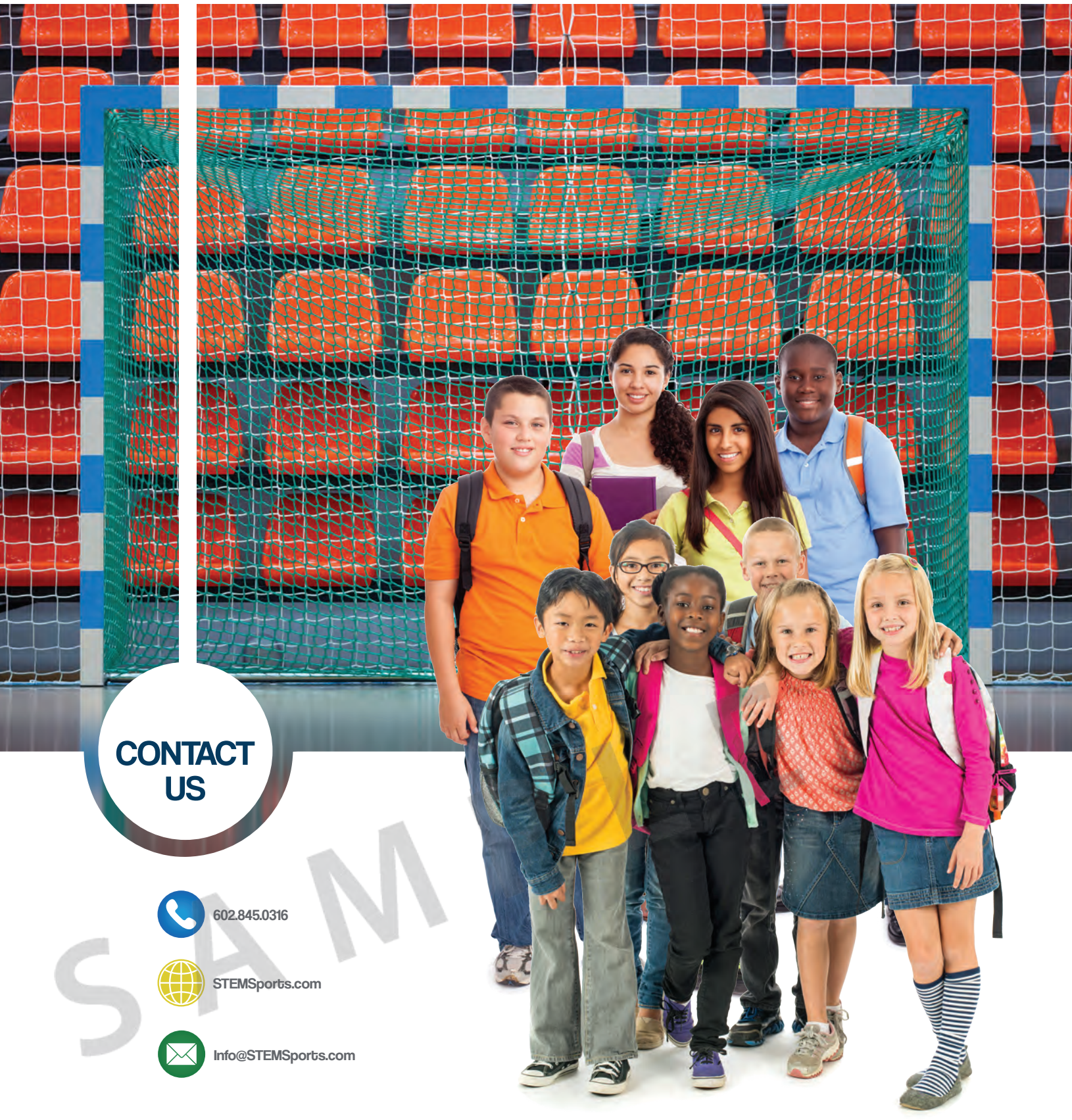

## CONTACT US

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