GRADES 3-8

STRETCHING AND INJURY PREVENTION

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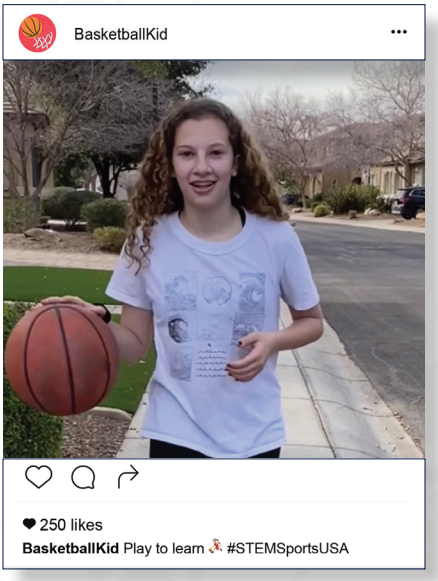

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Contents

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Stretching & Injury Prevention

Concept
Science: Forces and Motion
Mathematics: Angles

Objective
Students will identify warm-ups and stretches to prevent common injuries and why it occurs. Students will describe how forces and extreme angles play a role in injuries. Students will describe how unbalanced forces create motion and injury.

Standards

Next Generation Science Standards Connections

3-PS21.
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS21.
Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Common Core State Standards Connections

CCSS.MATH.CONTENT.4.G.A.1
Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

CCSS.MATH.CONTENT.7.G.B.5
Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

National Standards for K-12 Physical Education Connections

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

Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness.

Standard 5: The physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction.

Supplies Provided
Worksheets

Materials Needed
Pencils, Internet Access, and Space to Stretch and Warm-up

Sequence of Activities

Step 1: Create a list of the ways you prepare to play sports or get ready for a game. For example, do you stretch? What do you drink? What do you wear? If so, why?

Most of our pre-game involves preparing mentally and physically – both equally important. Yet when taking into consideration the six (6) most common injuries according to WebMD (below), physical preparation to mitigate injuries is crucial:

o Ankle sprain

o Groin pull

o Hamstring strain

o Shin splints

o Knee injury

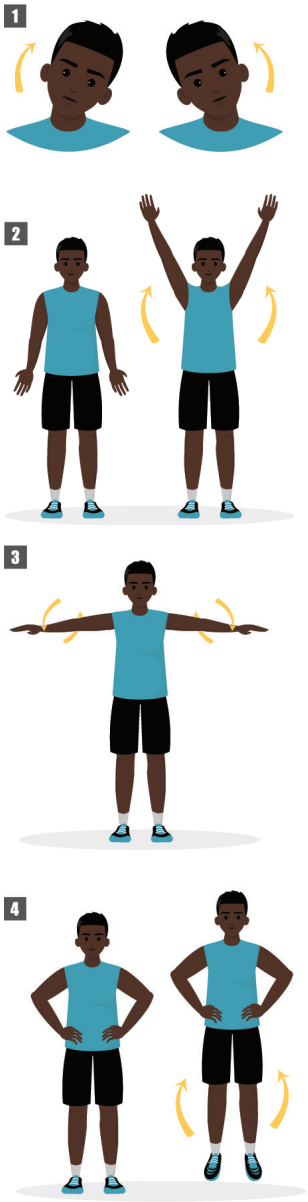
o Tennis elbow

What do each of these injuries have in common? Most of these injuries are due to a weakness in micro-muscles and poor flexibility, which can be avoided with proper stretching and warming up.

Step 2: Complete the stretches and warm-up activities to the right and on the next page. Then use the worksheet to match stretches and warm-up activities to prevent the corresponding injury.

Step 3: Locate and define key vocabulary terms: Force, Balanced,

Warm-up Exercises



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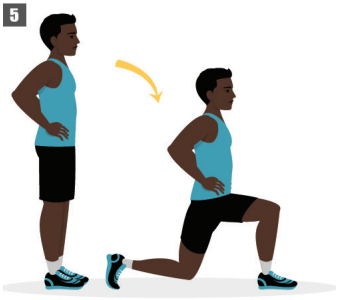

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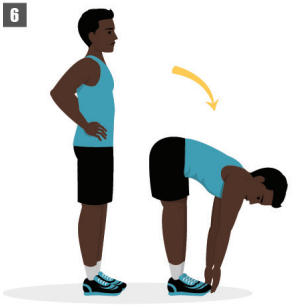

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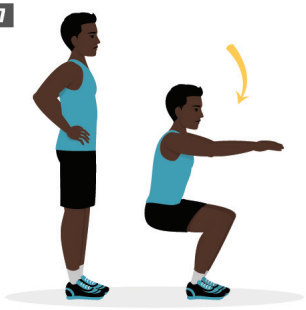

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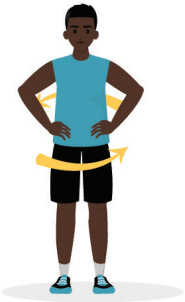


Unbalanced, Tendon, Ligament, and Joint. For more information, visit https://stemsports.com/resources/physical-activity-at-home-school/ or by visiting www.STEMSports.com under "Resources", then "Physical Activity at Home/School" and watch the video on What makes muscles grow?

A force is a push or pull. Your body regularly experiences forces. For example, when you are standing still, you have the force of gravity pulling you down and the force of the ground pushing you up. This situation is a balanced force, so no motion occurs (Newton's 1st Law). In sports and everyday activities, we need to move, and in turn, create unbalanced forces using our muscles. For example, when you walk you are pushing on the ground to create motion, or when you are opening the door you pull the handle with your arm. Likewise, when you are participating in sports or playing, your body is also experiencing force, such as kicking a ball requires your foot to push-off the ball.

There are times forces (push or pull) are too extreme for the bones, muscles, joints, tendons or ligaments in your body (tendons and ligaments are the tissues that connect our muscles and bones; joints are an important structural part of the body by which two parts of the skeleton are fitted together). The force can be impacted by the mass and the acceleration of the object (Newton's 2nd Law). In general, the faster you are going the more force will be applied. The same is true for mass. If you increase the mass, the force will be increased. For example, if you fall on your wrist with all your body weight, the pushing force from your

Newton's Laws

1st **Law of Inertia**

A body will remain at rest, or moving at constant velocity, unless it is acted on by an unbalanced force

2nd **Law of Force and acceleration**

The force experienced by an object is proportional to its mass times the acceleration it experiences

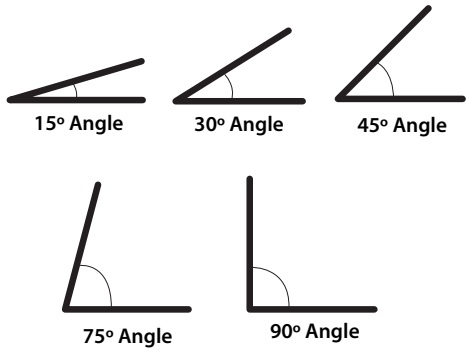
$\vec{F} = m\vec{a}$

3rd **Law of Action and Reaction**

If two bodies exert a force on one another, the forces are equal in magnitude, but opposite in direction

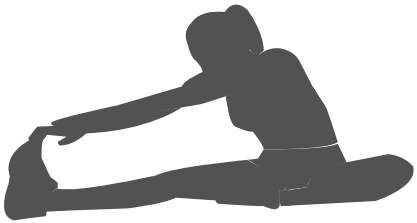
$\vec{F}_{12} = -\vec{F}_{21}$

body to the ground may cause your wrist to hurt, sprain or break. This is an example of Newton's 3rd Law: the equal reaction from you pushing on the ground from the fall is the ground pushing back – all that force of your body weight and acceleration is pushed back into your wrist, bone and tendons. Ouch!



Because most injuries are caused by motion, each of Newton's Laws can be applied. However, injuries are more than just the amount of force. The "angle" the force applies play a role in injuries as well. For example, rotate your wrist or your ankle and notice that you can make it move past a 45° angle.

When playing sports or engaging in physical activities, sometimes your body will move outside a normal or healthy angle. For example, if you are running in soccer and do not land your foot correctly, your ankle may roll over, creating an extreme angle. This paired with the force (push) off the ground can cause injury. Yet if we take time to warm up and stretch our body, joints and muscles can sometimes withstand more extreme angles and forces without injury. With that being said, we can never prevent all injuries through stretching and warming up. Sometimes injuries are not caused by extreme force and angles, but normal force and angles over time. This occurs when tendons, ligaments and joints get small tears or bruises over time, also known as a "microscopic" injury or an injury too small to be seen by the naked eye. Warming up and stretching is even more important to prevent these types of injuries because loose and



warm muscles protect the joints, tendons, and ligaments. So, having more force and angle exposure over time can still create those microscopic injuries.

For more information, visit https://stemsports.com/resources/physical-activity-at-home-school/ or by visiting www.STEMSports.com under "Resources", then "Physical Activity at Home/School" and read the below articles about injuries on the body during sports and physical:

- Practice Makes...Pain
- Overdoing It
- Rise in overuse injuries among kids and teens concerns doctors

- Consider what happens when an extreme unbalanced force is put on your elbow.

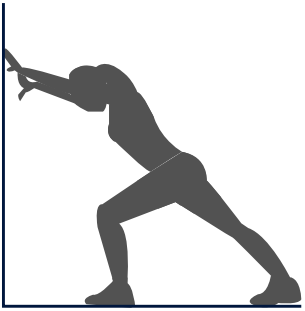
- Consider what happens when your knee is forced into an unnatural angle.

Step 4: For each injury, diagram and describe the angles and forces that would have caused the injury.

Step 5: Review the instructions you wrote for your pre-game routine in the Engage section and take time to add in stretches and warm-ups that could prevent injuries.

Step 6: Research pre-game nutrition and determine what you would add into your pre-game routine. Should you drink water, consume proteins (fish, chicken, beef, turkey, almonds, eggs), sugar (oranges, dates, cherries, apples) or carbohydrates (brown rice, whole grain bread, pasta)?

Step 7: Self reflection:
1) What part of the lesson did you enjoy the most?
2) What was the most difficult part of the lesson?
3) What question would you ask your teacher?
4) What question would you ask a coach?
5) What did you learn from the lesson?



STEM Jobs in Sports

- Physical Therapist
- Orthopedic Nurse
- Personal Trainer
- Nutritionist
- Team Doctor

Fun Facts

According to Active Health, preventative training programs are shown to reduce knee injuries such as ACL (anterior cruciate ligament; at the center and front of the knee) tears by as much as 50%.

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PART 1: Match the common injuries with the stretch/warm-up activity that you think would prevent that injury. Each stretch/warm-up may prevent more than one injury. (Middle School: please explain your reasoning for each selection).

A. Ankle sprain

B. Groin pull

C. Hamstring strain

D. Shin splint

E. Knee injury

F. Tennis elbow

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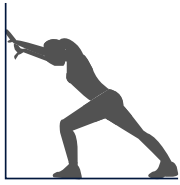

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Name: _____

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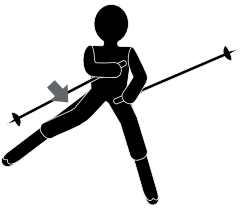
PART 2: For each injury diagram, describe the angle and force relationship that caused the injury.

1. What is the force acting on the ankle? Use one of Newton's 3rd Laws to describe the cause of the injury?

2. What is the impact of the angle on the ankle?

3. What is the force acting on the knee? Use one of Newton's 3rd Laws to describe the cause of the injury?

4. What is the impact of the angle on the knee?



5. What is the force acting on the groin (inner thigh)? Use one of Newton's 3rd Laws to describe the cause of the injury?

6. What is the impact of the angle on the groin (inner thigh)?

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7. What is the force acting on the elbow? Use one of Newton's 3rd Laws to describe the cause of the injury?

8. What is the impact of the angle on the elbow?

9. What is the force acting on the shin? Use one of Newton's 3rd Laws to describe the cause of the injury?

10. What is the impact of the angle on the shin?

11. What is the force acting on the hamstring? Use one of Newton's 3rd Laws to describe the cause of the injury?

12. What is the impact of the angle on the hamstring?

Notes

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