The High Jump

STEM CONNECTIONS
Science: Relationship Between Energy and Forces & Structure and Function
Math: Measurement and Data

DURATION
60 minutes

MATERIALS
• Cones (45)
• Beach balls (6)
• SloMo bump balls (6)
• Playground balls (6)
• Jump ropes (all; 1 per group marked to show feet)
• Masking tape
• Juggling scarves (1 per student)

SCHEDULE
• Intro: Cone Jump Circuits (15 min)
• High Jump (20 min)
• Leap Tag (20 min)
• Wrap Up (5 min)
OBJECTIVE
Students spring into action as they compare their vertical jumps to worldclass athletes and animal champions of the high jump.

ALIGNED STANDARDS
NGSS 1 LS11 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them grow, survive, and meet their needs.

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

CCSS.MATH.CONTENT.2.MD.A.3 Estimate lengths using units of inches, feet, centimeters, and meters.

21ST CENTURY SKILLS
• Communication and Collaboration
• Flexibility and Adaptability

HABITS OF MIND
• Gathering Data Through All the Senses
• Responding with Wonderment and Awe

BACKGROUND INFORMATION
Some of the best NBA players can jump about four feet high. Sure, this is a lot higher than most people, but they’ve got nothing on the high jump of a cat. A cat, though much smaller than a human, can jump over 8 feet high - that’s six times their length. Their back legs act kind of like a spring, and without even thinking about it, their tiny bodies can be launched all the way up to a window sill or even onto a high shelf! Most cats can pounce like miniature tigers on their prey, maybe a bug or a mouse, but a typical housecat might be too lazy to even try.

The kangaroo, as we know, are also pretty good jumpers and can be seen bouncing up to eight feet high around the plains of Australia. Just don’t get too close, because those muscular legs can also kick harder than a ninja! Even the most muscular athletes can’t compare to a kangaroo no matter how hard they try. Basketball players try to reach the rim, but sometimes only barely touch it. When they pull their legs up and extend their arms it almost looks like they are floating in air for a few seconds, when actually it’s just an optical illusion. It takes just as long to go up as it does to come down. You might try counting how long you can be in the air when you jump as high as you can.

Other athletes like volleyball players need to leap up to the net to hit the ball flying over, and football players need to dive over their fallen opponents without tripping over them. Jumping high takes a lot of work, but if you jump every day, your leg muscles will get strong and maybe you can try competing with your cat!

DAILY PREP
• Be ready to split students into groups of 3, either using the same groups as the day before or mixing things up.
• Set up for cone jump circuits. There should be 9 straight lines of 5 cones, with the cones placed about 1 foot apart. Adjust as needed based on the age, height, experience and number of your students. Be sure to leave enough space between lines for students to run back to the start of the next line. Set up each line as outlined below:
  • Line #1: Single cones
  • Line #2: Playground ball on top of each cone
• Line #3: Single cones
• Line #4: Beach ball on top of each cone
• Line #5: Single cones
• Line #6: Bump ball on top of each cone
• Line #7: Single cones
• Line #8: Mix of single cones and cones with large balls on top
• Line #9: Single cones
Whole Group

INTRO: CONE JUMP CIRCUITS

Get camper’s jumping legs ready for action with this warm-up circuit.

Explain how it works:

1. Each group of 3 starts behind a single line of cones.
2. Start with feet together and jump over the cones. Land with feet together. Feet should stay close together while jumping over the cones. Use arms to help lift your body over the cones. Try not to knock over the balls, but if you do, it’s okay. Just stop and put it back before you keep going.
3. When you get to the end, turn right and go to the start of the next line. If you finish the very last line, go back and then over to the start of the first line.
4. Listen to know what movement to do on the way back to the next line.

Before starting, demonstrate and have students practice these different movements. Skills include walking or running backwards, hopping on one foot, hopping only on right foot, hopping only on left foot, skipping, galloping, leaping, sliding side-to-side or grapevining.

Once students have reformed their lines at the beginning of the cones, call out a “Ready, set, go!” Every 15-20 seconds shout out a new skill for the students to perform.

Have students move through the circuit at least three times. The first time, have students go slowly. The second and third times, have students increase their speed. Remind students that the level of exertion should be at 2 or 3.

Small Groups

HIGH JUMP

Explain that many sports require athletes to jump high. This is also called a vertical leap or jump.

• How is a vertical jump different than a long jump? (In the long jump, you have to jump far. In the high jump, you have to jump high.)

Before beginning the activity, review with the students how to estimate a distance using the jump ropes marked for measuring. Have each group of 3 tape a measuring jump rope to a wall. The beginning of the rope needs to be at floor level. If a wall is not available, have one a student hold the jump rope so the handle just barely touches the ground.

Explain how it works:

1. One student jumps as high as possible.
2. After leaving the ground, the legs need to be straight.
3. Another student watches closely to estimate how high the jump is. The jump is measured from the ground to the bottom of the heels.
Have each student jump at least three times to get a feel for the motion.

Then gather together and ask students if there are some ways to be able to jump higher. Share some tips with the group:

- Lower your center of gravity by standing in an athletic stance. Bend knees and sit back.
- To defy gravity, use your legs and feet to push into the ground as hard as possible. The harder you push, the higher you will go.
- Use arms to help lift body into air. Arms should lift up in front of the body. Extend at least one arm as high as possible to give the wall a high five.
- Remember, gravity is going to bring you back down, so be ready to land. Bend your knees when you land.

Have students try again three to five times and ask students to remember their own best jump. You may also want to use a whiteboard or have scratch paper out for students to record their best numbers.

**Whole Group Discussion**

Gather together and have students share how high they were able to jump. How do they think they’d compare with the greatest human and animal high jumpers?

- **Kangaroos**: Kangaroos can jump 1.5 the length of their body, or 8 feet high. They’d hit their heads on the ceiling!
- **Cats**: Cats can jump about six times their length and over 8 feet high. If you could jump like a cat, you would be able to jump over a basketball hoop!
- **Jumping Spider**: Jumping spiders can jump 100 times their length. Yikes! If you could jump like a jumping spider, you would be able to jump over two jumbo jets balancing on top of each other tip to tip.
- **Fleas**: Fleas win the jumping contest once again. Fleas can jump as high as 8 inches, which is 150 times the length of their body. If you could jump like a flea, you would be able to jump 600 feet high. That’s like jumping over two jumbo jets with two blue whales balancing on top!
- **Athletes**: Basketball is one sport that requires a lot of jumping. To slam dunk a basketball, a player must be able to reach the rim of the basket, which is ten feet of the ground. Michael Jordan, who was already 6 feet and 6 inches tall, had a standing vertical jump of about 3 feet. With a running start, he could jump nearly 4 feet high. That means he could jump straight over your head!

**What other types of athletes need to have a big vertical leap or jump?**

- Football also requires good jumpers, especially when trying to jump over a pile of players into the end zone. The top standing vertical jump for professional football players is the same as basketball - about 46 inches. In volleyball, players must jump up to set the ball, spike it, and block it.
  - A volleyball net is between seven and eight feet high, but players must get their hands well above the net.
• In Cross-Fit, participants have to do a standing vertical jump up onto a platform on a box. Some of the best Cross-Fit athletes can jump 64 inches, which is almost five-and-a-half feet.

LEAP TAG

Celebrate everyone’s jumping skills with this crowd-pleaser.

Have students help set up for the game:

• Remove measuring jump ropes taped to the wall.
• Place all jump ropes on the ground in the shape of circles. Scatter the circles around the room. Jump ropes should be varying distances apart, but close enough for a student to jump from one to another.
• Place one jump rope circle in the very middle of the area.
• Set out cones between circles as obstacles to jump over.
• Place balls on top of some of the cones for an extra challenge.

Give each student a scarf. The scarf is loosely tucked into the back of the pants. Choose one student to be the tagger. For a large group, designate two taggers. Explain how to play:

1. Everyone starts inside a jump rope circle. There can only be two students in one circle at a time.
2. The tagger stands in the circle in the very middle.
3. When the game starts, hop, jump, or leap from circle to circle to keep the tagger from grabbing your scarf. Be careful not to land on the jump rope handles. And remember, there can only be two people in a circle at one time.
4. You’re out if your scarf is grabbed by the tagger, you knock a ball off a cone, or a full foot touches the ground outside a jump rope circle.
5. If you’re out, wait on the sidelines until the next game starts and you can come back in.

The game is over when only one student is left with a scarf, or you call time.

Variations:

• If there are two taggers, the tagger with the most number of scarves wins.
• As soon as a student is tagged, they become the new tagger.
• Don’t use scarves. The tagger must gently touch a student to get them out.
• Play freeze tag. Tagged students must freeze in the athletic stance position until another student unfreezes them.
• Everyone is it! If tagged, students must freeze in an athletic stance. The only way they can become unfrozen is if the person that tagged them becomes frozen.
• Students that are out must perform a skill to get back into the game. Examples include a certain
amount of pushups, sit ups or jumping jacks; walking/running backwards, doing the crab, or inchworm walking for a certain distance.

**WRAP UP**

Collect cones, balls and jump ropes. Gather together to debrief the day. Here are some possible discussion questions:

- If you could be any of the animal jumpers, which one would you be? Which sport would you play?
- Which do you like better, the long jump or the high jump? Why?
- What sports or games do you think you’d be better at after today?

**CHECK FOR UNDERSTANDING:**

- Which is easier: the standing vertical jump or the running vertical jump? (The running vertical jump)
- Why? (Running gives you energy to push off the ground with more force.)
- How are different animals able to jump so much farther than humans? (They can long, strong back legs with flexible tendons and light bodies that can fly through the air.)

**EXTENSION: RUNNING VERTICAL JUMP**

How high can you jump? Can you jump higher if you walk or run a few steps before jumping off of two feet? What about one foot?

Two foot jumpers are generally stronger in their lower bodies, especially their gluteus, hamstrings, quadriceps and lower back muscles. They rely on their absolute strength and power to exert force into the ground and explode up. Two-foot jumpers can reach the maximum height by taking one or zero steps before jumping.

One foot jumpers are generally lighter and have longer legs. In order to gain a maximum height, one foot jumpers must gain momentum by running at a moderate to high speed and take off of their strong leg.

Running vertical jumping ability is important in many sports. Jumping off of one and two feet is so important in the game of basketball that The National Basketball Association (NBA) draft combine tests players for both types of jumps. Other sports that require both one and foot jumping ability include gymnastics, diving, and martial arts.