



A Celebration of Diversity



VIRTUAL

STUDY GUIDE

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The thrill and excitement of the circus dates back hundreds of years. Today, we welcome a bold new circus to the scene, one which has re-imagined our need for community and unified our celebration of the vast potential of the human spirit. Audiences can behold amazing feats of human strength and daring, horses and humans, balancing and juggling, and joy and comedy. We celebrate our diversity and honor the incredible passion and dedication of our artists and team who have created the ground- breaking adventure redefining Circus for now and always. **Welcome to OMNIUM: A Bold New Circus!**



Max-i-Mime



The Poet and Ringmaster Johnathan Lee Iverson

How do seemingly ordinary people perform such extraordinary feats? The amazement of the circus provides a perfect platform for the study of STEAM (Science, Technology, Engineering, Arts and Mathematics), literature, history, social studies, arts and physical education, adaptable to all grades and ages. We also provide conversation starters about diversity, equity and inclusion. This study guide takes students on a delightful educational journey through Omnium. Each entry will highlight applicable core curriculum standards along with suggested activities, questions, and a bibliography. Please use this guide as a starting point for your own creative adventure into the world of circus education. The more you know, the more amazing the circus becomes!

Circus History



Circus performers have been entertaining audiences for thousands of years. There were jugglers in the courts of kings and acrobats in the Greek amphitheaters. The circus as we know it today started in England in 1768 with Philip Astley. Philip Astley was a horseman in the British cavalry and served in the French and Indian War. After his service, he wanted to share his knowledge and love of horses with others, so he opened a school. To promote his school, he put on “displays” in an indoor, circular space so that everyone could see. This led him to discover the wonder of centrifugal force. Astley “discovered that if he trained his horse to canter in a circle at a constant speed, while both he and his horse were leaning slightly inward, centrifugal force would help him keep his balance. He also discovered that a horse cantering in a circle of a certain size would provide just the right amount of force for achieving the most graceful balance” (John Culhane, *The American Circus*). He determined that the perfect diameter for the ring was 42 feet – the same size as the ring at Omnium!

The display was a hit, so Astley added more acts. The first was a trick rider who jumped on and off, changed his clothes, and flipped over and under the

horse all while it was cantering! As more acts were added, the display became known as a circus, based on the Latin word for ring. The circus became so popular that Astley soon opened another one in Paris. Other showmen, businessmen, theater producers, and former students took the idea of a circus, created their own version, and made it the most popular form of entertainment all over Europe and Russia.

The first American circus appeared in Philadelphia in 1785. President George Washington was in the audience to see it! Soon, circuses popped up all over the United States. Since the U.S. was a new country, there were very few large cities, so in order to reach a significant number of people, the circus had to travel. At first, circuses constructed a building to house the ring in every town they went to. This took a long time and was very expensive. In the mid-nineteenth century, circus owners replaced the buildings with tents, which they could pack up and travel with in trucks or trains. This made traveling much easier. The circus became so efficient that both the United States military and Kaiser Wilhelm’s German army studied their methods in an attempt to improve their own logistical operations. There were hundreds of different shows touring the country at the same time. There aren’t many authentic touring circuses like Omnium left today.

Discussion Questions:

How did the circus get its name?

Why does the circus perform in the ring?

When was the first circus created?

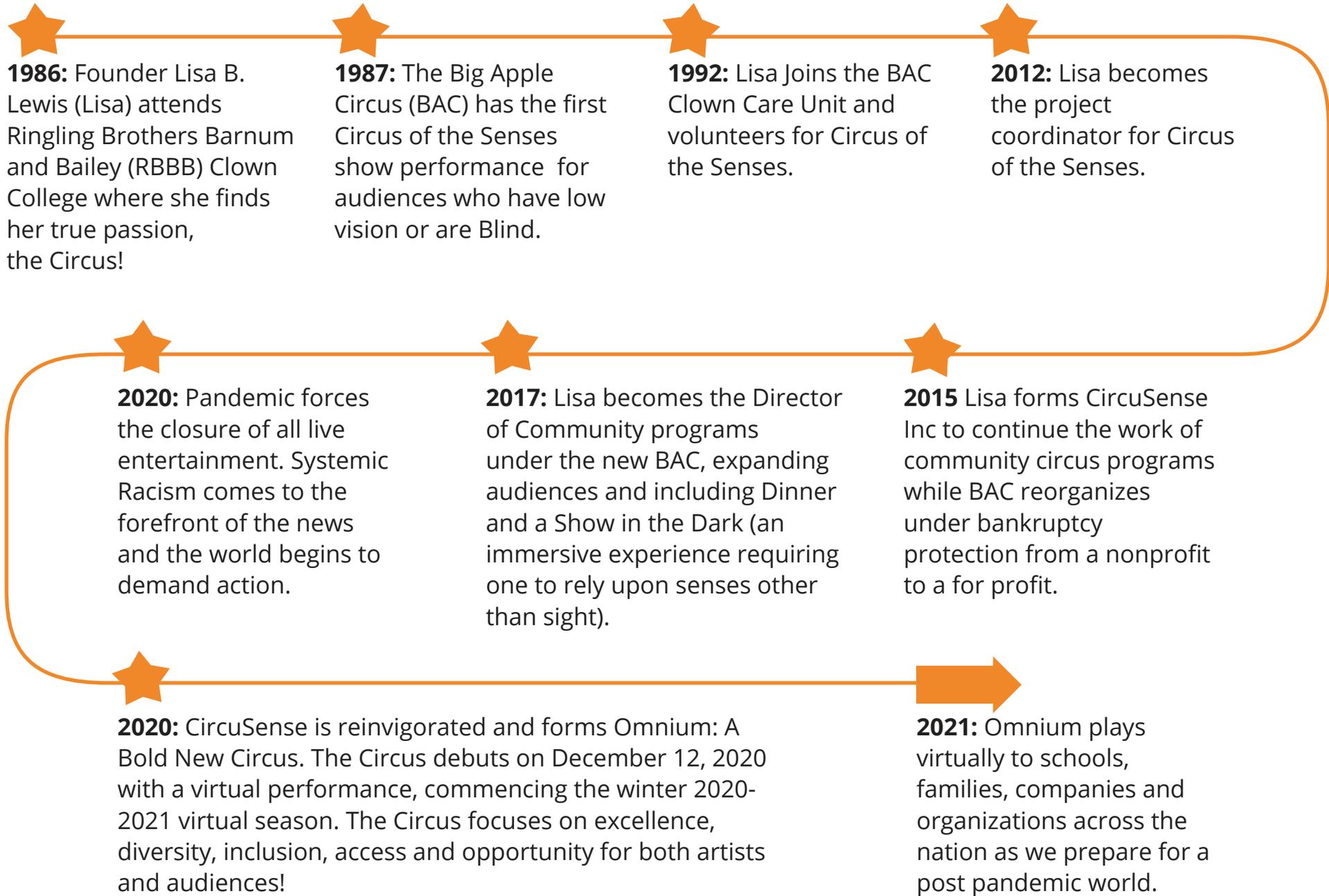
What else was happening in Europe at this time?

When was the first circus in America?

Which elements of our society at that time made it easier or more difficult for circuses?

Which part of the traveling circus inspired military minds around the world?

Omnium Circus Timeline



Omnium Circus Fun Facts



There are 10 countries represented among the cast of Omnium: Mexico, Brazil, Italy, Russia, France, Ethiopia, United States, Canada, Austria, China



Two performers use wheelchairs



There is a beautiful rainbow of melanin levels among the company with various races and complexions represented.

★ **One performer is Deaf, another has Deaf parents.**

★ **Two performers are 6th generation Circus performers.**

★ **One performer and her 18 horses are 3rd generation Circus family.**

Fun With Numbers



The tent we use for live performances belongs to the Espana family, 6th generation circus performing arts family.

The tent is 50 meters or 164 feet in diameter and seats 2000 people.

No seat is farther than 50 feet from the ring.

There are 120 side poles measuring 15 feet high that support the periphery (outside) of the tent.

The entrance tent is 20 meters or 66 feet in diameter.

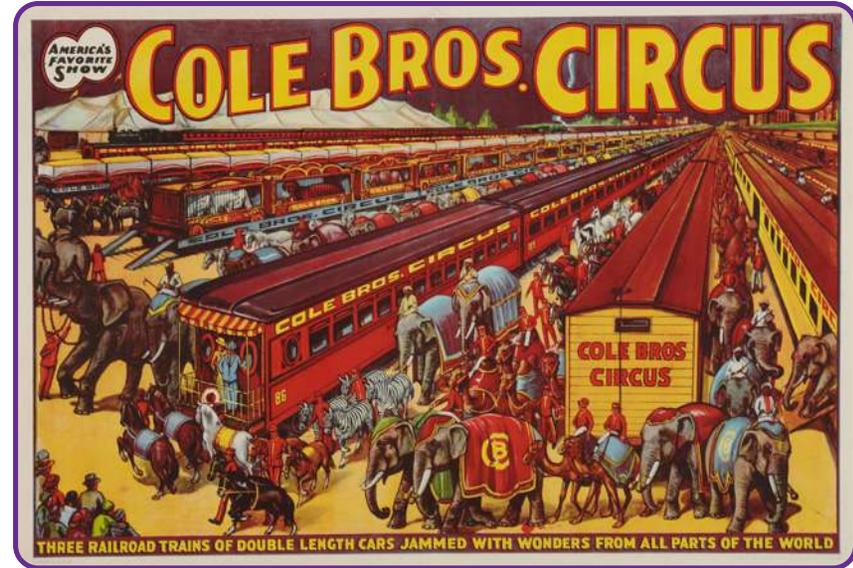
Setting up the tents and seats takes about 35 people and 40 hours.

Where the performers and staff live is called the "village."

Omnium will use over 2,000 feet of electrical cable to run power to every place that needs it.

Elements of the Circus

Circus gets its name from the ring, but it is also defined by the artistry within the ring. Circus is distinct (different) from theater, dance and other performing arts although it incorporates aspects of many of them. Circus presents a usually non-narrative sequence of variety acts showing the agility, grace, and strength of both human and animal performers. The types of acts fall into distinct categories, though individual acts often include more than one category.



Circus Vocabulary



Acrobat: Person who uses both gymnastics and dance in their act

Act: A display of skill and dexterity by a person or group of people

Aerial: An act performed in the air above the ring

Aerial Silks: A type of performance in which one or more artists perform aerial acrobatics while hanging from a fabric. The fabric may be hung as two pieces, or a single piece, folded to make a loop.

Applaud: When the audience claps to show appreciation

Audience: The people watching

Charivari: An opening act including many people, usually most of the company to perform a series of short acrobatic skills in rapid succession, “chari-vari” means noisy celebration

Company: All of the performers, crew and staff together

Costume: What the performer wears during the show

Contortion: The art of bending and twisting one’s body

Cyr Wheel: An acrobatic apparatus that consists of a single large ring made of aluminum or steel with a diameter slightly taller than the performer.

Diabolo: Is a juggling or circus prop consisting of an axle and two cups (hourglass/egg timer shaped) derived from the Chinese yo-yo. This object is spun using a string attached to two hand sticks.

Equestrian: One who works with horses.

Hand to Hand: An act of incredible strength and balance so named because the partners use their hands to balance each other, two or more people using each other to balance and perform feats of great strength and dexterity.

Hula Hoop: Circular plastic hoops approximately 80cm in diameter, used to twirl around different parts of the body

Juggling: Manipulation of objects

Pole: Pole dance has become one of the fastest growing trends in the world of fitness across the globe. Incorporating elements of dance, acrobatics and gymnastics – it’s a complete body workout and one of the best ways to develop flexibility, coordination, balance and muscle definition.

Ring Master: The person who guides us through the performance

Ring Curb: The small edge around the ring

Word Search



Search for all 19 Circus Vocabulary words here. Words can go any direction. Good luck and Have fun!

B P V
 C D P Y X M M M P
 M E V C N Q P D J G Y X L
 D R A Z R I S O C Y X U W W C A Z
 Z I C J V M W S A E N U U H G X U G H
 H K R W G N M K L O K D V D H G M E G Y K
 A O H V G D L Q M W J Y U S Z T T F C S C
 N B W C X G I G E Y G K C E A Y U D F Q Q O T
 A T G V U S P Q C K G O W C J L F A G I T S E
 T W T W O L I D Y L D V O I N D U P V N J N T J N
 L T D I A H N R Q J O P A N E H Y W P E F Q U E K
 H V V I H N W A U C T M R D I I U X W A P H M S L
 H T A R J G H O G G C F M C L D A A L G Q W S E E A B
 H C E N H E U F I X R H H J T U D Q V A D P A Q X I R
 D A R G E O Z Z D T T O A U H A N D T O H A N D R R Q
 Z D L G B Y Y U I R R V R X L U Y J S U O B U E E
 T F X A N A D I A B O L O I U W I M Z F A O T X A
 F V F D E I I M Y J J T T R V C B E X I J S P P C
 M W F C Q L N Y N M D N U G A J T J Z A C B N
 H Y D Q L U G B W A X R O E H R X M M K R L E
 P U L A F E G W N P Y V C S C I G Q U Y J
 K P Q L H T S U C K M T R Y F N G C W Z U
 N O H F I Y T J Y I O P I I V G G S M
 J L W G B L R U M Q C R Z N S R U
 E I L Q O I J Q Z N I Q U
 D W G L A G W R U
 A G N

- ACROBAT
- AERIALSILKS
- CHARIVARI
- COSTUME
- EQUESTRIAN
- JUGGLING
- RINGMASTER
- ACT
- APPLAUD
- COMPANY
- CYRWHEEL
- HANDTOHAND
- POLE
- AERIAL
- AUDIENCE
- CONTORTION
- DIABOLO
- HULAHOOP
- RINGCURB

Women in Circus

Circus women are a unique, strong, talented, and accomplished group of people. The same can be said for many circus people, but women often have to overcome greater societal barriers to be a part of the circus. Historically, performing has been a male-dominated industry. But the circus has no place for sexism or racism, Omnium promotes inclusivity and diversity. Omnium Circus is proud to celebrate the accomplishments of circus women past and present!

Annie Fratellini (1932-1997)

Like many circus children, Annie was trained in acrobatics and other circus skills, and since her mother was a good musician, she was also given a musical education. As for her clowning skills, she just had to watch her large family's comedy and clown acts to learn all the basics. She made her performing debut at Paris's Cirque Medrano at age thirteen, entering the ring in a big, rolling globe on which she later balanced while playing the saxophone. As a clown, Annie Fratellini had a childish and rebellious character that was neither female nor male in appearance. When asked if her character was male or female, she always answered, "Clowns have no gender!" In 1975, she and her husband, Pierre Etaix, opened the École Nationale du Cirque along with the Nouveau Cirque de Paris, its high-end, traveling branch that directly inspired the Circus you see today!



Women Performers in Omnium



Aerialist: Jen Bricker-Bauer: Born without legs, Jen was placed for adoption by her birth family. She was adopted by a loving family who supported her monumental efforts to become her best self.

Hula Hoop Artist: Noemi Espana: She is a 6th generation of an international circus family. Hard work, perseverance, dedication and the joy of sharing her incredible talents with audiences continue to drive her.

Contortionist: Sara Kebede: She was born in and lives in Ethiopia. Her most memorable challenge is traveling to new countries and learning new languages and experiencing new cultures. *“Now I know I can travel and work any work in the world. What is important in this world today is to support each other, to be kind to each other and peace”.*

Equestrian: Jenny Vidbel: A twin, 3rd generation of a Circus family, Jenny was strongly influenced by the dedication and joy of her grandparents. Today, she runs the Al and Joyce Foundation to honor their legacy.

Foot Juggler: Lina Liu: Born in China, her amazing talent as an acrobat opened the opportunity for her to move her family to the United States.

Black Circus Performers in the U.S.



Historically, circuses tended to feature nationality of the family at their helm. In the 19th century, companies grew larger and became more inclusive of international performers. Circus, however, was not immune to the systemic racism within its countries of origin. In 1994, a visionary Circus entrepreneur named Cedric Walker created UniverSoul, the first circus featuring an international company primarily featuring people of color. The incredible artistry of this circus highlighted the “black culture” so often overlooked by “white” society. He has provided opportunity for many performers to share their skills and talents with the world and provides the world the opportunity to enjoy these incredible performances.

He has opened the eyes of circus owners across the world to an incredible array of untapped talent. Omnimium is proud to support Cedric Walker and UniverSoul in a deliberate and conscientious expansion of opportunity for performers of color.

Realizing that the rich history of performers of color in the U.S. was quickly fading, a brilliant aerialist, Veronica Blair, began to record it and named it the Uncle Junior Project. Emanuel “Junior” Ruffin was the protégé of the world-famous wild animal trainer, Clyde Beatty. Starting out as a circus “cage boy” at the age of 13, Junior worked under Beatty “breaking” and training lions and tigers for the Clyde Beatty Wild Animal Circus. By the age of 20, Junior had worked his way up to performing center ring under the name of “Prince Bogino,” a name given to him by Beatty. Beatty believed that white audiences would accept Junior if he were a foreigner, not African American. Junior continued to break color barriers. In January 2010 Junior broke another barrier by becoming the first African American to be inducted into the Ring of Fame, the highest honor a circus performer can achieve. You can learn more about his history and the history of many other great performers at:

unclejproject.com

Black Performers in Omnium

Ringmaster: Johnathan Lee Iverson: Born in NYC, he began performing with the Harlem Boys Choir before becoming the most well know ringmaster in the history of RBBB Circus.

The Poet: Brandon Kazen-Maddox: Born in NY to Deaf parents, Brandon discovered early on a talent for gymnastics which led him to a discovery of his passions for Dance, Art, Theater and Circus.

Pole Act: Jason Span: Born in the U.S. to a military family, Jason served for 10 years in the U.S. Navy as a Navy Hospital Corpsman. It was after service, when he discovered his incredible talent for dance and circus.

Contortion: Sarah Kebede: Following years of international touring with great circuses, the pandemic finds her back home in Ethiopia in the middle of a war zone. She continues to practice her art and persevere!



Horses in the Circus

Equestrianism, from the Latin word Equus meaning horse, is the training, riding and presenting of horses. In addition to trick riding, early circuses presented entire dramas, battle reenactments and historical events on horseback. In the 19th century, horses were the primary means of transportation in cities, so the general public was far more familiar with them than most people are today. Circus audiences appreciated the subtle nuances of horse training and riding. With the rising popularity of automobiles in the 20th century, fewer Americans had that level of equestrian sophistication, so horse acts took up a smaller and smaller percentage of the circus performance. They are still and will always be an important feature of the Circus.



Today's horse acts can be generally divided into three categories: Trick Riding, Dressage and Liberty. Trick Riding features human acrobatics on galloping horses, Dressage features displays of slow controlled fancy horse footwork, and Liberty features untethered horses responding to spoken or gestured commands from a trainer who is not riding them.

Omnium features Jenny Vidbel. She uses a combination of Dressage and Liberty to create a horse ballet! Most of her horses and dogs are rescues. Jenny is a third-generation animal trainer. She learned the art of animal communication from her grandfather, one of the greatest animal communicators of his time. Jenny grew up amongst a wide variety of animals both domestic and exotic, but her true love and passion was found in the equine family. She trained her first pony when she was nine years old. His name was Frisky, and he was the first four-legged teacher she ever had: "He taught me patience, he taught me to open my mind to a horse's point of view, and he taught me humility." Frisky was the beginning of a wonderful adventure and career! Jenny has performed with her troupe of horses and ponies all over the country. She started adding dogs and farm animals to her animal family as she became involved in rescue. Jenny and her animal family spend their off time at her beloved farm in the Catskill Mountains. This is where her retired animals spend the rest of their lives enjoying 100 acres of green fields, forest and even an apple orchard.

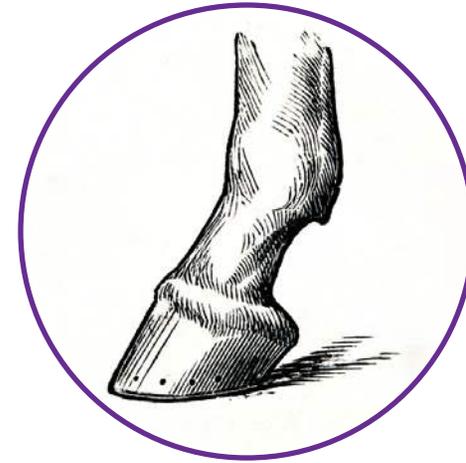
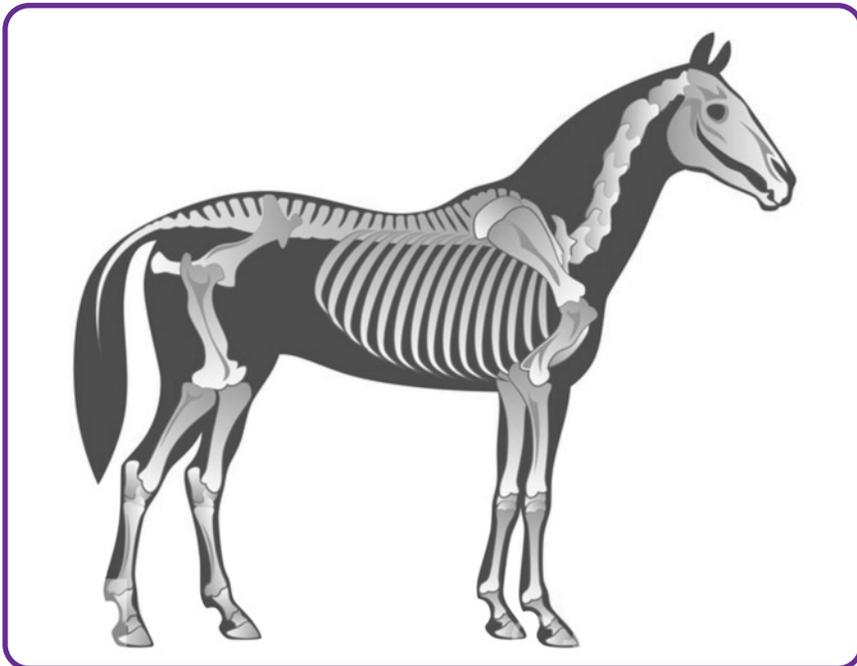
Fun Horses Facts

U Horses can sleep both lying down and standing up.

U Horses can run shortly after birth.

U Ponies are not baby horses. They are horses less than 14 hands (56 inches).

U Horses have around 205 bones in their skeleton.



U Horse hooves are made from the same protein that comprises human hair and fingernails.

U A horse's teeth take up a larger amount of space in their head than their brain.

U Because horses' eyes are on the side of their head, they are capable of seeing nearly 360 degrees at once.

U Horses are measured in "hands" a hand is about 4 inches. They are measured from the ground to the base of the neck.

Clowns in the Circus

Throughout history, there have been many different types of clowns in different cultures. The court jesters in Europe were some of the first clowns. Shakespeare's plays have lots of clowns. Jesters also entertained pharaohs in Egypt and emperors in China. Jesters were playful and could comment on policies made by the rulers without facing consequences. Their comments were taken as jokes. Hence, they were able to turn serious matters into funny situations. Many Native American cultures had clowns built into the fabric of their society, among them the Hopi, Iroquois, Winnebago, and Navajo. These clowns not only made situations funny, but they were also a big part of the religious ritual systems in their respective cultures. In the Circus, the role of the clown is to transition the energy of the audience from one amazing act to the next. They accomplish this by using their comedic skill to "refresh" our appetite for even more amazing feats.



Omnium features a very funny clown named Maxim Fomitchev. Maxim was born in Russia, trained in the physical arts of pantomime and comedy and has toured the world in many shows creating laughter wherever he goes! Maxim is Deaf.

There is much more to the art of clowning than makeup and costume. Especially in this show, they are comedic characters throughout the circus that help us follow the storyline. If you like making people laugh, there are several schools across the world. The two largest are the Clown Conservatory in San Francisco, CA (USA), LeCoq school in Paris (France), Ecole National du Cirque in Montreal (Canada), Circus Smirkus in Greensboro, VT (USA), Circadium in Philadelphia, PA (USA) and Clown Conservatory in San Francisco, CA (USA). There are also workshops and classes available which can give you a taste of what it takes to make thousands of people laugh together.

Why are people afraid of clowns?

Because clowns are an innocent and delightful part of the circus, they sparked the imagination of horror novelists like Steven King. People become afraid because they do not understand the difference between a made-up clown or story and a real clown. The fear of clowns is called **coulrophobia**, with the prefix "coulro" coming from the ancient Greek word for "one who goes on stilts".

Clowns in the Circus



Discussion Questions:

What is a real clown?

Can you name 10 things a person must do to practice the art of clowning?

How can he/she learn to do this?

Who are characters in film and television that have made you laugh?

Are they clowns?

Why or why not?

Our Senses

How do we perceive the circus? The circus uses all of our senses.



Sight: Light enters our eyes. Light travels in a straight line, bounces off objects and into our eyes through the pupil. Depending on the amount of light, the iris changes the size of the pupil to let more or less light in. In the circus tent, we have many lights. The different colored lights create different looks for each act.

Each act has different colors. Can you name them? Why do you think the designer chose those colors?



Sound: Sound waves travel through the ear canal to the eardrum. The eardrum passes the vibrations through the middle ear bones or ossicles into the inner ear. The inner ear is shaped like a snail and is called the cochlea. Inside the cochlea, there are thousands of tiny hair cells.

These structures facilitate hearing so that people can hear things like the circus's live band. Each instrument makes a different sound. How many different sounds do you hear?



Smell: Your sense of smell—like your sense of taste—is part of your chemosensory system, or the chemical senses. Your ability to smell comes from specialized sensory cells called olfactory sensory neurons, which are found in a small patch of tissue high inside the nose. Each olfactory neuron has one odor receptor.

How many different smells can you name?



Touch: Our sense of touch is controlled by a huge network of nerve endings and touch receptors in the skin known as the somatosensory system. This system is responsible for all the sensations we feel – cold, hot, smooth, rough, pressure, tickle, itch, pain, vibrations, and more.

How many different things can you name that you touched at the circus?



Taste: If you look at your tongue in the mirror, you can see that it is covered in little bumps. Inside of those bumps are taste buds. When you put something in your mouth, they send a message to your brain to give you information about whether the food is salty, sweet, sour, bitter or umami (a meaty, savory taste). What is your favorite circus food? Can you name a circus food that is sweet? Salty? Sour? Bitter? Umami?

Our Senses

What happens when we use different senses? Or if we don't like too much of any one sensation? Omnum welcomes all senses all the time.

Sometimes people don't see with their eyes. They are blind or have very low vision. We have two people describing the show so that those guests can "see" it with their ears. Once live, we will have a touch experience so they can "see" the show with their fingertips.

Sometimes, people do not hear with their ears. Sometimes, they "hear" with their eyes. Deaf people have a language called sign language which is a visual language which originated in France. "The poet" only uses sign language in Omnum. He also interprets the spoken words of others, who use sign language. Maxim, our clown, is Deaf. He communicates through American Sign Language. He is also fluent in French and Russian Sign Languages! The first American school for the Deaf was established in 1817 by Laurent Clerc and Thomas Hopkins Gallaudet. They are often credited as the inventors of American Sign Language.



The Poet Signing [what is he signing?] and plain Language interpreter.

Omnium Embraces Autism



We all process sensory information differently. People with Autism Spectrum Disorder often have very strong reactions to sensory input. Sometimes, too much sound or too many lights is frightening. Sometimes, they need less sensory stimulation. Omnium will have selected seating for those who need or prefer a modified sensory experience. This area reduces the light and sound. We also have a quiet area where you can go to relax if you feel overwhelmed. This can benefit those on the Autism spectrum and many others with sensory sensitivities.

In our virtual performance, there is a section for “Plain Language.” Omnium is proud to be the U.S. premiere of The Yalon Method of “Real-time Plain Language

Interpretation” developed by Prof. Shira Yalon-Chamovitz (the person you see on the video) as a means of increasing cognitive accessibility. The Yalon Method accomplishes for people with cognitive disabilities what audio description does for the blind - opens up a world of entertainment, experience and news which would otherwise be lost. It involves translating what is said in real time into plain language.

We are each unique and wonderful in our own way. We want to bring the magic of circus to every person; however you use your senses!



Inclusion: Circus Culture

We are born diverse, we chose inclusion.

The most vital element of all of the acts is the human element. The trust between partners is built over years of training, traveling, living and working together. Each performer trains to hone their physical ability, then they must let go of the fear of failure. The flyers know they will be caught. The catchers know the flyers will be in the right position at the right time so they can all succeed. Learning each skill takes hours and hours, days, months



Dupla Mao Na Roda performing their Hand Balancing act.

and years to learn and perfect. Circus performers do not give up! Because we all understand the dedication and trust necessary to make the circus work, we value, honor, and respect each other and our accomplishments. In the real world, this is a challenge for most of us at one time or another in our lives. The culture of circus shows us strength of character.

Science supports us with knowledge. Our values are essential to making effective and ethical decisions about the application of scientific knowledge. This is made clear in each new “trick” or skill presented to us, the audience. Partners, a troupe, family and a duo must gain such a symbiotic trust as to function as one protective organism. We are a circus family.

Learn more about our Omnium family at OmniumCircus.org/our-team/

Inclusion: Circus Culture



Diversity, Equity and Inclusion conversation starters for the classroom:

Teachers please note: These are only beginning questions based on the performance you have just seen. We hope to start a much broader conversation.

Take a moment to think about what diversity means to you. Do you think it means the same thing to other people? How would you describe the diversity in Omnium?

Have you ever made pre-judgments or assumptions about people because of the color of their skin, or any characteristic over which they had no choice before you met them? If so, what did you think? Did your opinion change after you got to know the person? Please share your experience(s).

Do you think that the colors of people's skins or the shape of their body says something about their character? Why or why not? After seeing Omnium, has your perspective changed? If so, how?

Has anyone ever made an assumption about you based on your race or physical attributes?

How has your experience in life been influenced by things over which you have no control?

How can you be more inclusive in your life? Name 3 ways.

The acts you see in the circus require a lot of skill. The performers have practiced for years. The performers must master the science of their skill in order to accomplish these feats.

Teachers, please note: The following descriptions include elements of the science curriculum for kindergarten through 12th grade. As many concepts overlap and are taught with different depth at various grade levels, this study guide is organized by circus acts and concepts most clearly demonstrated within each. Please cull appropriate information for your age group.

Contortion: Sara Kebede

Sara is able to move her body in seemingly impossible ways. We can use **biometrics**, the science of how the body moves, to understand how she does it. Sara has spent years stretching her muscles and tendons to make them more elastic and flexible. This gives her joints, tendons, ligaments and muscles a much wider **range of motion**. Hip and shoulder joints as well as our spines can become much more flexible over time by stretching them in a controlled and consistent manner. Knee and elbow joints cannot become more flexible through stretching. For her final trick Sara contorts her body so that her legs are over her head and she is balanced on the roof of her mouth. If you look at the picture you will see that she is **balanced** because she has found her **center of gravity**.



Pole: Jason Span

Poles are vertical poles on which circus performers climb, slide down and hold poses. The poles are generally between 10 and 30 ft in height and approximately 2 to 3 inches in diameter. The pole act uses the science of **friction** to help them overcome gravity. Friction is the resistance to motion between objects that are touching.



Jason uses every muscle in his body to go up, his skin sticks, or creates **friction** so he does not slide down. The resistance of motion between two objects the skin of the performer and the metal pole allows the person to stay in one place without sliding down. The most famous trick is “the flag”, where the artist hangs straight out from the pole with his or her hands. This requires an extraordinarily strong upper body. A few people are able to do push ups in this position, and even fewer can rotate the legs around in a circle—this requires enormous core strength. This requires a tremendous amount of strength, with so much strength, they are also able to achieve a static equilibrium. The person is not moving and can maintain a perfect balance—gravity pulls equally on all sides. In order to balance anything, we must find the **center of gravity** or the balance point. The balance point is the point where gravity pulls down equally on all sides of the object that we are trying to balance. The position called “the Flag” also demonstrates the **cantilever**. A cantilever is a ridged structure that extends horizontally and is supported at only one end. An airplane wing is a cantilever. Because of the position of his hands and his incredible strength, Jason is able to demonstrate the structure and strength of the cantilever.

Aerial Silks: Jen Bricker-Bauer and Dominik Bauer

In this daring and beautiful silk act, Jen and Dominik perform above the circus ring on two long pieces of fabric suspended from the top of the tent. Like a human spider Jen climbs and spins, twirls and twists as she ascends higher and higher. She wraps the shiny silks around her arms and torso and then suddenly falls as the silks unwind. She catches herself just before she hits the ground. As Aerial performers there are two scientific principles that Jen and Dominick know are important to their safety. The first is **friction**. Friction is the force that prevents things from moving smoothly over another surface. As the silks are very slippery, they do not provide much **friction** against the performers body. For that reason, silk performers must have tremendous upper body strength and a vice like grip to hold the fabric tightly and prevent slipping. The second scientific principle to be considered is the **plumb bob**. Plumb is the Latin word for the metal, lead. The **plumb bob** is an ancient tool that is nothing more than a string with some weight tied to one end of the string. When the other end of the string is tied to the ceiling the Plumb Bob will always hang straight down. When the two silks are

hung from the top of the tent they will also hang straight down. So for the Aerial Silk performer they must always be aware of the relationship of one silk to the other so that they can adjust accordingly to maintain their **center of gravity**.



Foot Juggler: Lina Liu

In the mind boggling and beautiful foot juggling act, the lithe and lovely Lina Liu balances and juggles as many as 5 umbrellas at the same time. The umbrellas spin and float in the air as she flips them up and then catches and balances them on her feet. She concludes this amazing act by simultaneously balancing and spinning five umbrellas at the same time on her hands and feet.



How does she do it? Practice, practice, practice and understanding and applying scientific principles. The scientific principles being applied in this act are: **balance, gravity, center of gravity, air resistance, centripetal** and **centrifugal force** and **angular momentum**. **Gravity** makes everything fall at an initial rate of 32 feet per second. The umbrellas do not fall that fast because of **air resistance**. The umbrellas act like a parachute and the air resistance makes them float, not fall. When Lina Liu catches them with her feet, she must immediately find their **center of gravity** so that she can balance them on her feet.

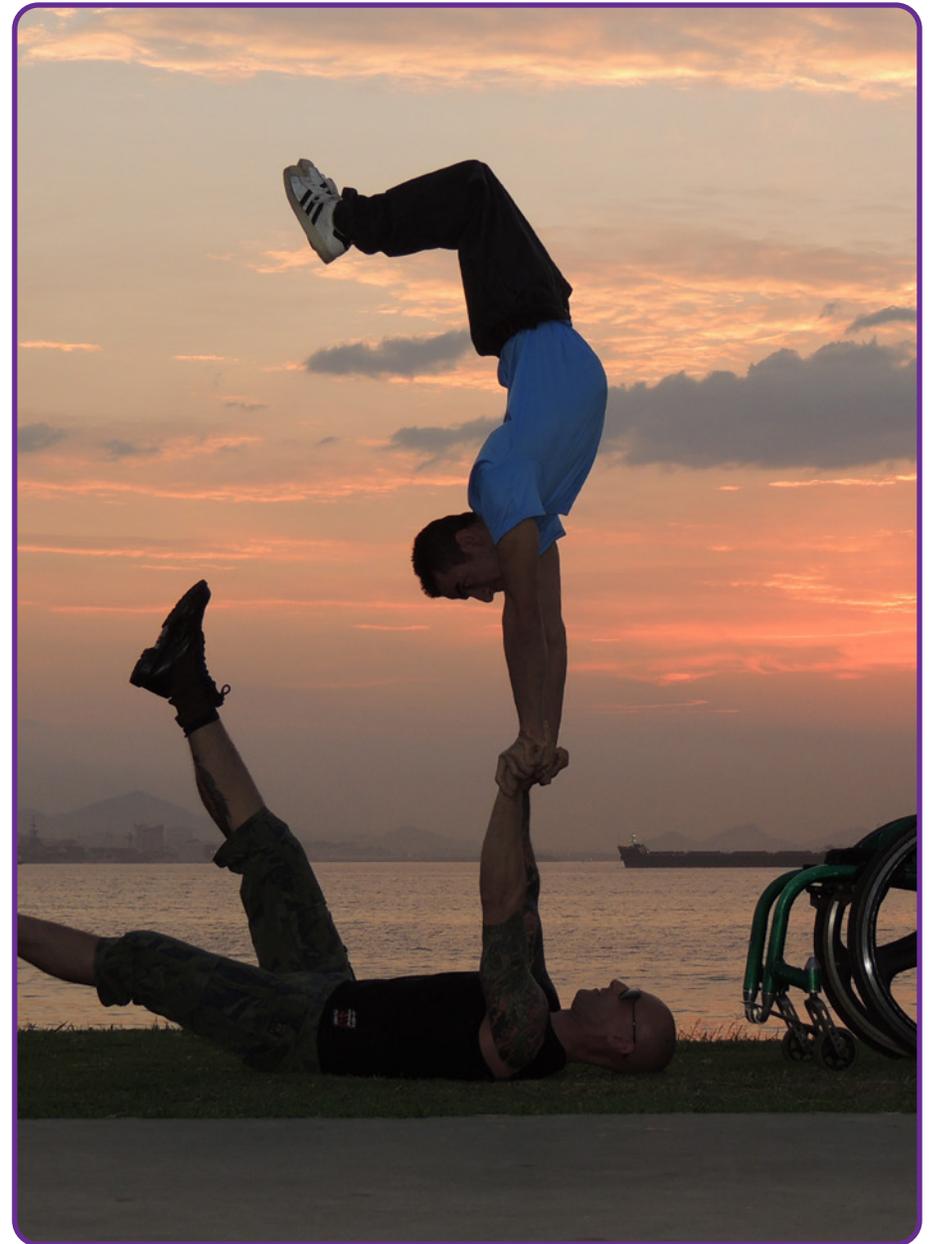
When Lina Liu finishes her act by balancing 5 umbrellas you may notice that all the umbrellas are spinning. The **centripetal force** and **angular momentum** affects the umbrellas and creates a much stronger center of gravity which allows the umbrellas to be balanced longer. At the end of her act Lina Liu is balancing umbrellas on both her feet and hands with equal precision. The word for somebody who can do things equally well with both their right and left hand is **ambidextrous**. There is no word to describe somebody who can do things equally with both their hands and feet.

Hand to Hand: Dupla Mão Na Roda

Dupla Mão Na Roda translates in English to Four Hands and Two Wheels/ Double Hands on Wheels.

In their hand to hand balancing act, Rafael and Alan use their amazing strength and flexibility to demonstrate seemingly impossible feats of balance. Both Rafael and Alan have extremely strong and well-developed internal balance. Rafael is able to hold his handstand and walk on his hands more fluidly than some people are able to walk on their feet. When Rafael balances Alan, he holds a perfect handstand. This allows Alan to focus on the balance point and trust that his partner can do the rest.

Not all of their tricks are vertical, some are beautifully off center. They are able to accomplish these feats because their weight is not balanced. It is counterbalanced. Using counterbalance, they accomplish what would be impossible if it were based on size and strength alone. **Counterbalance** occurs when two objects of unequal weight are balanced on a pivot point. Measuring scales have been used for thousands of years. They are a perfect example of counterbalance.





Hula Hoops: Noemi Espana

In her hula hoop act, the wonderfully graceful Noemi Espana spins hula hoops on her legs, arms, neck, waist, and above her head. Often times the hoops are spinning on her arms, legs, and waist all at the same time. The hoops seem to rise and fall effortlessly as they spin faster and slower. Her act ends as she is lifted to the top of the tents with hoops spinning around her body. The science behind anything that is spinning is **centripetal** and **centrifugal force** as well as **angular momentum**. Everything will fall at a rate of 32 feet per second. However if something is spinning faster than 32 feet per second it will not fall because of its **angular momentum**, which means that the spinning object will stay parallel to the ground. If the object starts spinning slower, it will tip and fall because it has lost **momentum**. Because Noemi's hoops are spinning so fast they do not fall. She can also make the hoops rise and fall around her body by changing the **speed** and **angle of rotation**. Because Noemi can spin hoops on both arms at the same time, she is obviously **ambidextrous**. She is able to do things equally well with either her right or left hand.

Cyr Wheel: Elan Espana

The Cyr Wheel is a large shiny hoop. The performer, Elan Espana, stands inside that hoop and begins to perform increasingly difficult and seemingly impossible spins, rolls, somersaults, inversions and pirouettes. His act is mesmerizing.

The science involved in the act is based on the **flywheel effect**. The flywheel is an off-center wheel that uses **momentum** to create **energy** and **motion**. To use the Cyr Wheel the performer must stand inside the wheel and hold the wheel with his hands above his head in the 2:00 and 10:00 positions. He will then tip the wheel slightly forward. His **center of gravity** will now be in the center of his chest, not in the center of the hoop. The **flywheel effect** occurs when the performer leans to his right or left, and the weight of his upper body creates **momentum** that carries the performer in a circle. The wheel begins to lose **energy** when the performer is upside down and continues to lose energy until he is right side up again. Once he is back to his original position the wheel will once again gain more **momentum** each time it turns. Because the wheel is off center it will “kick start” more energy every time it rotates.



The Cyr Wheel was first invented and developed by Daniel Cyr around 1993. Mr. Cyr was the co-founder of Circus Eloise and toured the world with his new Cyr Wheel act for many years. In 2003 he was awarded the silver medal at the Cirque du Demain in Paris for his revolutionary new act.

Science Vocabulary



Gravity: The invisible force that pulls everything on or near the surface of the Earth. Gravity pulls everything down at an initial rate of 32 feet per second. Gravity is much stronger on Earth than it is on the moon.

Balance: When the downward pull of gravity is equal on all sides of an object, so it does not fall.

Center of Gravity: The point of an object where gravity can pull equally on all sides. All of the weight is centered on that point.

Physics: The study of matter, energy, motion, and force.

Matter: Any object or anything that takes up space and has weight.

Force: A push or pull on an object.

Motion: A change of position wherein an object comes closer or moves further away from another object.

Inertia: The resistance to change in motion. An object at rest wants to stay at rest unless some force moves it. A moving object will continue to move unless some force stops it.

Momentum: The tendency of a body to maintain its inertial motion, or once something starts moving it will continue to move unless a brick wall stops it.

Friction: The resistance to motion between objects that touch. This is what causes a moving object to slow down or stop.

Centripetal Force: from the Latin “seeking the center,” any force which causes an object to move in a circular motion. That motion creates a pull toward the center of the spinning object.

Centrifugal Force: from the Latin “fleeing the center,” something that is not attached to the spinning object will fly off in a straight line. Something that is attached, will move in a circle around the center.

Velocity: The rate of speed with which something happens.

Terminal Velocity: the constant speed that a freely falling object eventually reaches when the resistance of the medium through which it is falling prevents further acceleration.

Acceleration: To increase speed or velocity.

Science Vocabulary



Speed: How fast something moves through space.

Potential Energy: Energy that is stored up.

Kinetic Energy: Energy in motion.

Pendulum: An object suspended from a fixed support so that it swings freely back and forth under the influence of gravity.

Apex: The top or highest part of something, especially one forming a point.

Pivot Point: The fixed point from which a suspended object hangs.

Plumb Line: An ancient tool that is a string with a weight on one end. When the string is attached to a fixed point above the ground it will indicate a perfectly vertical plane.

Flywheel: An off-center wheel that uses momentum to create energy and motion. First used in potter wheels and grinding wheels.

Cantilever: A long-ridged structure that extends sideways and is only supported at one end. An airplane wing is a cantilever.

Biometrics: The study of how the human body moves.

Equilibrium: A state in which opposing forces are balanced. The equilibrium position in a pendulum is the point where a suspended object hangs and does not move.

Angular Momentum: Is the rotational (spinning) equivalent of linear momentum.

Types of Motion: The quantity of motion of a moving body measured as a product of its mass and velocity.

Linear: Straight line

Curvilinear: A long a curved path

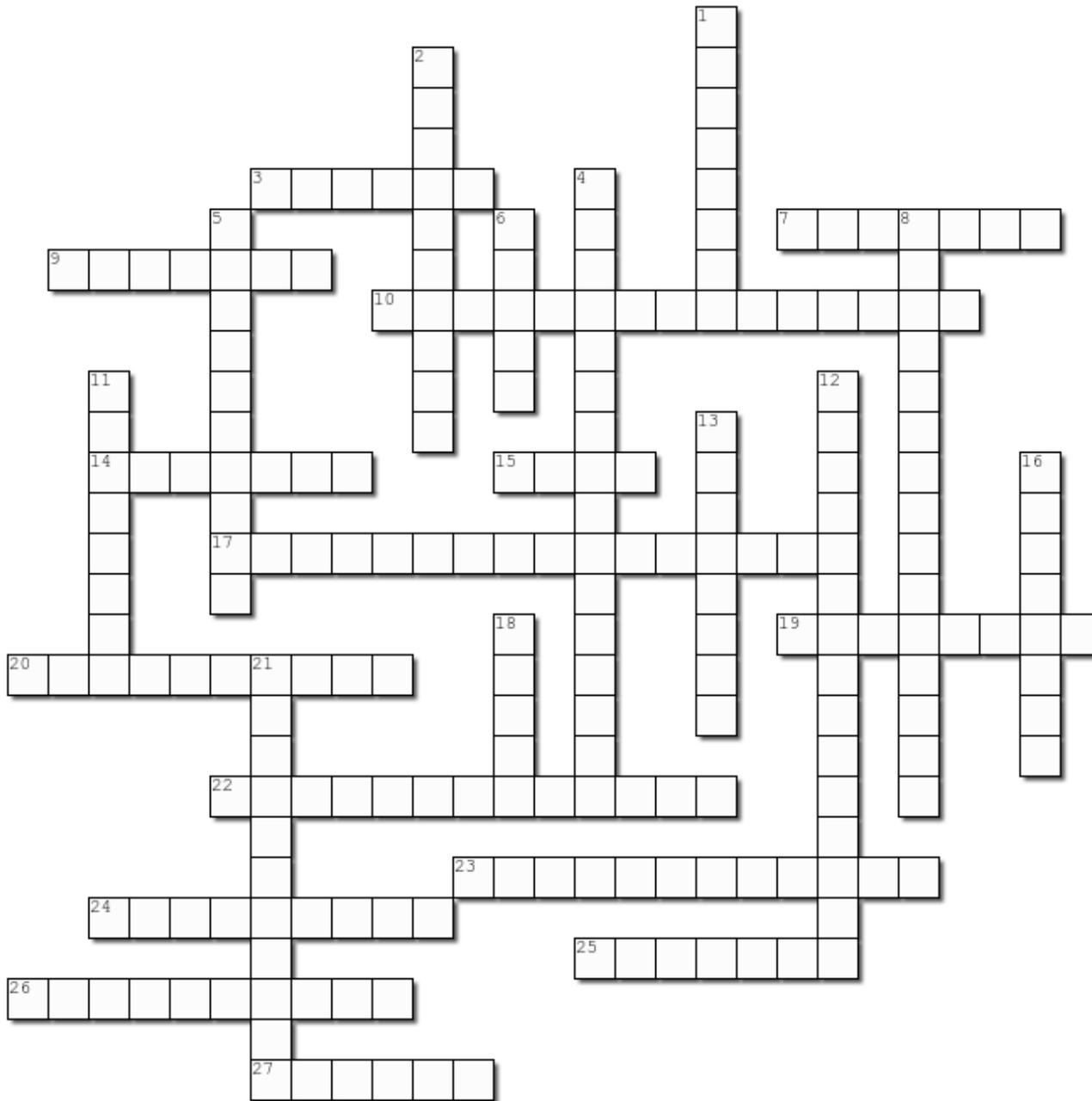
Rolling: Round, like a bicycle wheel

Oscillating: Side to side

Slow Motion: Moving very slowly

Circus Science

Complete the crossword puzzle below



Across

3. A change of position wherein an object comes closer or moves further away from another object.
7. When the downward pull of gravity is equal on all sides of an object
9. The study of matter, energy, motion, and force
10. Energy that is stored up
14. The resistance to change in motion
15. the top or highest part of something
17. from the Latin "fleeing the center"
19. The tendency of a body to maintain its inertial motion
20. A long ridged structure that extends sideways and is only supported at one end
22. Energy in motion
23. To increase speed or velocity
24. An ancient tool that is a string with a weight on one end
25. The invisible force that pulls everything on or near the surface of the Earth
26. A scientist who specialized in physics
27. y object or anything that takes up space and has weight

Down

1. An off center wheel that uses momentum to create energy and motion
2. The fixed point from which a suspended object hangs
4. from the Latin "seeking the center"
5. The study of how the human body moves
6. How fast something moves through space
8. is the rotational (spinning) equivalent of linear momentum.
11. The resistance to motion between objects that touch
12. The point of an object where gravity can pull equally on all sides
13. The rate of speed with which something happens
16. an object suspended from a fixed support so that it swings freely back and forth
18. A push or pull on an object
21. a state in which opposing forces are balanced

Recommended Circus Reading

[The Uncle Junior Project](http://www.unclejrproject.com), www.unclejrproject.com

[Big Apple Circus](#), Peter Angelo Simon

[American Circus: An Illustrated History](#), John Culhane

[Circus Techniques](#), Hovey Burgess

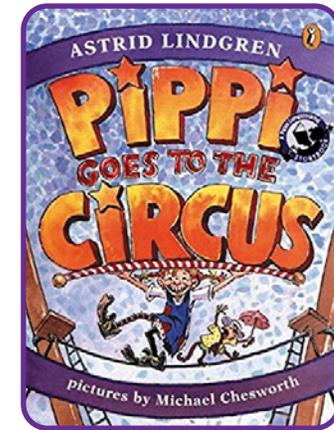
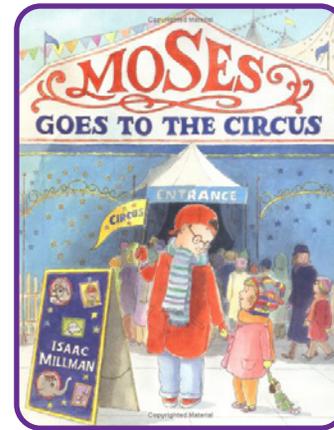
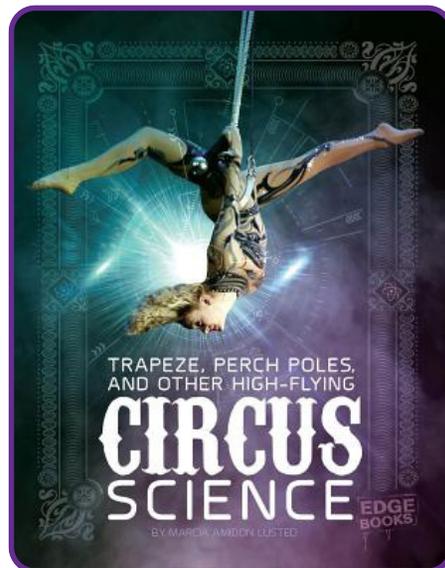
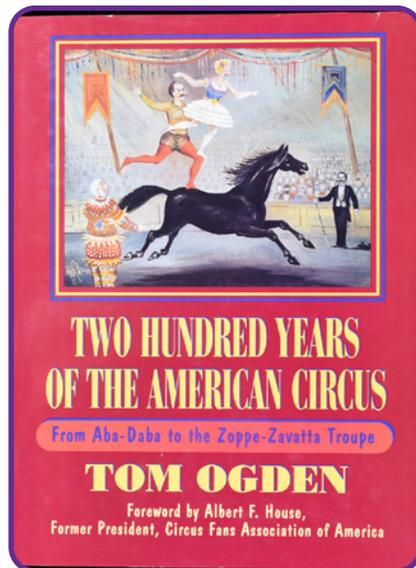
[Two Hundred Years of the American Circus](#), Tom Ogden

[The Fabulous Showman](#), Irving Wallace

[Be a Clown: Techniques from a Real Clown](#), Ron Burgess

[Roses Royal Midgets and other little people of Vaudeville](#), Trav SD and Jim Moore

[Circus Science Series](#), Marcia Amidon Lusted



For Younger Students:

[Moses Goes to the Circus](#), Isaac Millman

[If I Ran the Circus](#), Dr. Seuss

[Starring Mirette and Bellini](#), Emily Arnold McCull

[The Circus Alphabet](#), Linda Bronson

[Circus Family Dog](#), Andrew Clements, Sue Truesdell (Illustrator)

[Circus Fun](#), Margaret Hillert

[Circus Train](#), Joseph A. Smith

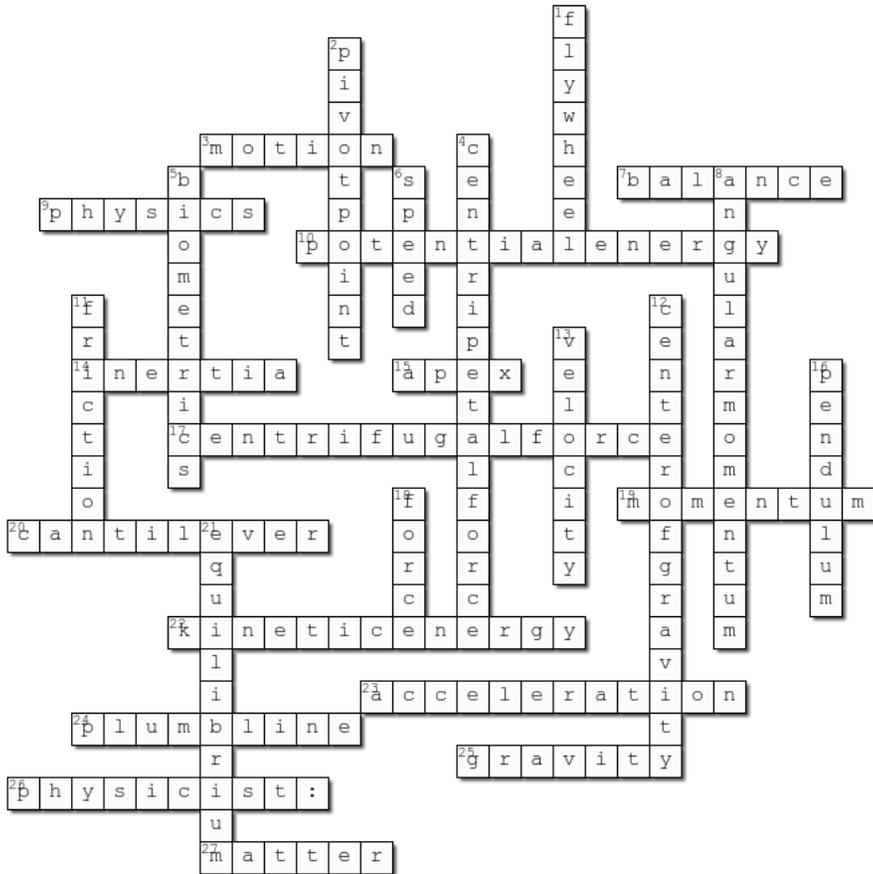
[Emeline at the Circus](#), Marjorie Priceman,

[Clifford at the Circus](#), Norman Bridwell

[Peter Spier's Circus!](#), Peter Spier Tengren (Illustrator),

[Pippi Goes to the Circus](#), Astrid Lindgren

Puzzle Answers



Created using the Crossword Maker on TheTeachersCorner.net

