Physics of alpine skiing

Business

Alpine skiing is a single player sport that was introduced to the Winter Olympic Games in 1936 at the Garmisch-Partenkirchen Games. Alpine skiing changed from a main mean of transportation to recreational fun during the early 20th century. The wealthy Brits were some of the first people to take part in Alpine skiing while on vacation in the Alps during the summer months. The Roberts of Kandahar Cup in 1911 was the first official alpine skiing race which was held in Switzerland.

This race continues today on the World Cup circuit as “ The Kandahar.” The main goal of the sport is to ski down the mountain faster than your opponents. Starting order (1-7) is determined by a draw beginning with the seven top-ranked skiing competitors and the remaining players (8-15) are assigned using the same process. The official time clock begins when the competitor passes the knee high wand at the top of mountain. The skier must also maneuver around a certain number of gates depending on the event.

The shortest event in distance is the slalom and has a total of 50 gates. Giant slalom is a longer distance and has less gates and they are spread further apart. The super-G is a type of combination between the two with gates that are spaced out similarly to a giant slalom but with fewer turns and greater speed. Determining winners is simple. Whoever has the fastest average from their two runs is the winner, slowest being last.

In the event of a tie, the competitor with the highest total of FIS (the governing body for international skiing and snowboarding) points will win. FIS points are organized so that the best in the world in each has 0 points and

the 31st in the world has 6 points. Intense equipment and uniform is required for this sport due to the plunging temperatures, high altitude, and overall danger. The skin tight suit is worn to reduce air resistance. Padding can also be worn to protect the athlete from hurting themselves if they fall on the ice (Olympic Movement 24). Leather gloves, ski goggles, and helmet are all optional but are commonly worn because of extreme cold and harsh conditions.

Plastic boots are snapped in place to the bindings which attach competitor’s skis. Skis vary in materials but must be FIS certified before used in organized completion like The Olympics or The Kandahar. Curved poles are used in the giant slalom and super-G to decrease air resistance, but in the slalom straight poles with knuckle pads are used to help knock down the gates (Olympic Movement 31). Like any outdoor sport, alpine skiing is greatly affected by the weather conditions. The ideal conditions are below freezing, but the colder the better. Man-made snow becomes better quality in colder temperatures and this type of snow is commonly used in competition.

If at any time the snow gets to warm it will turn to slush, which is said by Olympic athletes to feel like skiing on water. It also becomes incredibly difficult to navigate turns and jumps, which causes a myriad of injuries. In the 2010 Vancouver Games and the 2014 Sochi Olympics, the conditions were unusually warm for the time of year so the snow was mainly slush where the alpine skiing was being hosted. Along with slush, icy conditions can very dangerous. Ice-snow is most common in the east where different temperatures and climates combine.

An avalanche occurrence can be fatal; however, an avalanche has never occurred during an Olympic alpine skiing race (Rodman p3). Newton's First Law of Motion states that an object at rest will remain at rest and an object in motion will remain in motion until an unbalanced force acts upon it. Friction is the most influential unbalanced force in alpine skiing. There is friction from the snow, friction from the air, friction from the surface of the ski or the suit the athlete wears (Howell, University of Utah). The skier must work to overcome these forces, in order to remain moving. Gravity is also a main force the skier must conquer.

If a skier points his skis straight down the hill gravity will make him go faster and faster until the force of friction equals the part of the gravitational force directed along the slope. At this point, the total force will equal zero and the skier will move at a constant speed. The Second Law of Motion states that Force= Mass x Acceleration. The force needed to move an object (the skier) is determined by his mass and his acceleration down the mountain. Using this equation, a competitor could determine if he could improve his race by building up force or mass to achieve the desired acceleration. Newton's third law states that for every action, there is an equal but opposite reaction.

This can be explained by the gates used in downhill slalom races. The athlete uses his straight poles to smack down the poles. The energy used to hit the gates is equal to the energy released when the gate comes back off from the snow. The racer has to make sure they are going fast enough to be out of the way by the time the gate reacts so they do not get hit. Sometimes in competition, racers are not fast enough and get injured from the gates reaction. A successful skier understands the physics used in the sport.

At the top of the mountain, when the racer is in starting position, he has the most potential energy. When the athlete begins the race down the mountain, his potential energy is converted into kinetic energy. The jumps in giant slalom and super-G require are projectile motion. The acceleration of the athlete is the horizontal motion when he jumps of the snow edge and gravity is the vertical motion. The skier then takes a curved path during his jump.

Once he lands safely back on course, the competitor’s energy is equal to what it was before the jump. In conclusion, alpine skiing is a physics centered sport. The success of the athlete is determined by the weather conditions and overall knowledge of the science that goes into it. If proper safety precautions are not taken by the athlete, injuries and even fatalities can occur. After many years of interpretation and advances, alpine skiing is now one of the fastest, safest, and historic games on Earth.