Key Physics Concepts

Section Summaries	Physics Principles
Section 1 Identifying and Classifying: What Is a Sport? Students apply their knowledge of sports to identify attributes that define an activity as a sport. From this, they begin to consider how differences between Earth and the Moon can affect sports.	**Pattern identification**
Section 2 Acceleration Due to Gravity: Free Fall on the Moon Students compare the free fall of different objects. They then calculate acceleration with respect to gravity on the Moon using measurements obtained from a slow-motion video of an astronaut in space dropping objects.	**Gravity** **Acceleration** **Distance covered by accelerating objects**
Section 3 Mass, Weight, and Gravity Using a simulation that allows for the comparison of mass and weight between Earth and the Moon, students investigate the ratio of gravity on Earth to that on the Moon. After determining that an object's inertia does not change, the forces needed to overcome weight and inertia on the Moon are discussed.	**Inertia** **Weight** **Universal law of gravitation** **Newton's second law**
Section 4 Projectile Motion on the Moon Beginning with scale drawings, students calculate the distances that projected objects will travel on the Moon. These distances are then compared to projectiles launched on Earth with the same velocity to determine how sports that use projectiles would be changed on the Moon.	**Projectile motion** **Gravity**
Section 5 Gravity, Work, and Energy: Jumping on the Moon Students measure vertical distances when jumping and then analyze their motion in terms of work and conservation of energy. Applying what they know about gravity on the Moon, they predict vertical distances they could jump on the Moon.	**Work** **Gravitational potential energy** **Kinetic energy** **Conservation of energy**
Section 6 Momentum and Gravity: Golf on the Moon Using a variety of balls, students measure the height each bounces when dropped and when projected by a collision. They use this data to infer a golf ball's speed when hit on Earth and on the Moon. The interaction of different golf clubs and golf balls with varying degrees of mass is also investigated.	**Gravitational potential energy** **Kinetic energy**
Section 7 Friction: Sliding on the Moon Students investigate the force necessary to overcome the friction between objects and the surfaces on which they move. They then relate this to gravity and predict the force needed to overcome the friction against a sliding motion made on the Moon.	**Weight** **Friction** **Coefficient of friction** **Normal force** **Newton's second law**

Key Physics Concepts

Section Summaries	Physics Principles
Section 8 Modeling Human Motion: Bounding on the Moon Using cylinders of different lengths and weights, students explore pendulum motion. They then compare the motion of the pendulums to the swinging motion of human legs when walking, finally predicting how walking on the Moon and on Earth is different.	**Gravitational field strength** **Simple harmonic motion** **Period of a pendulum**
Section 9 Air Resistance and Terminal Velocity: "Airy" Indoor Sports on the Moon Students start by investigating how mass and terminal velocity are related. They then use badminton shuttlecocks to investigate how air resistance affects motion. They then apply what they know about the ratio of gravity on Earth to that of the Moon to predict the air resistance to motion on the Moon.	**Air resistance** **Terminal velocity**

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