

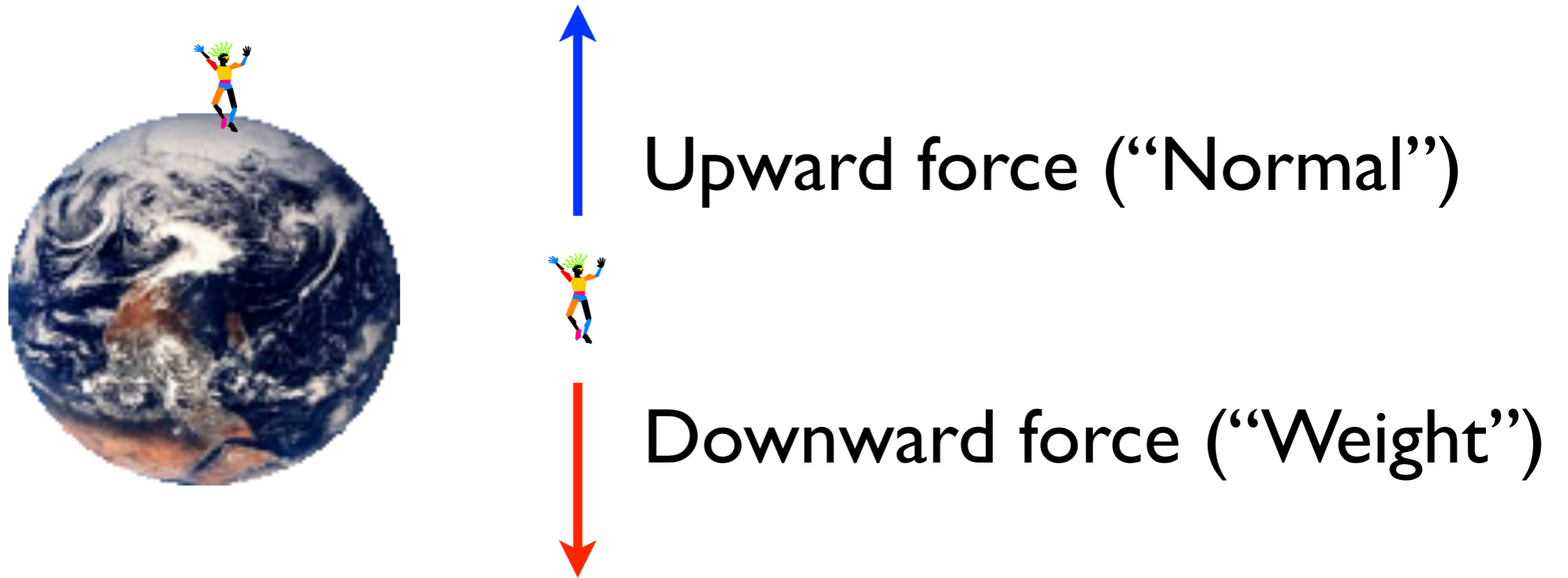
Achieving “Weightlessness”

*Edward Thomas, Jr.
Professor, Physics Department
Auburn University*

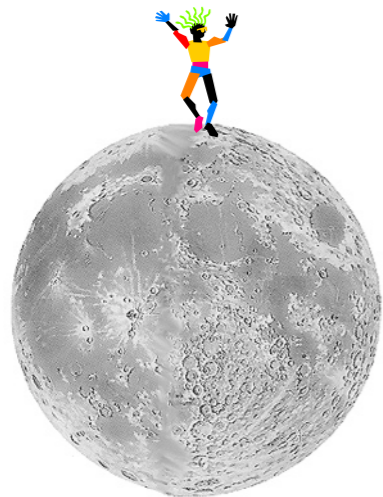
Weight vs. Mass

- **Mass** is the quantity of matter.
- **Forces** are the pushes and pulls on an object.
- Weight is a **force**
 - Weight is the gravitational force on an object.
 - Weight is NOT mass.

Weight vs. Mass



Weight vs. Mass



- ➔ Earth and moon exert different gravitational pulls on objects (gravitational acceleration)
- ➔ Mass of object remains the same
- ➔ Weight on the Moon is different (lower) than Weight on Earth

Weight vs. Mass

- Weight = (mass) x (acceleration due to gravity)
- $W = m \times g$

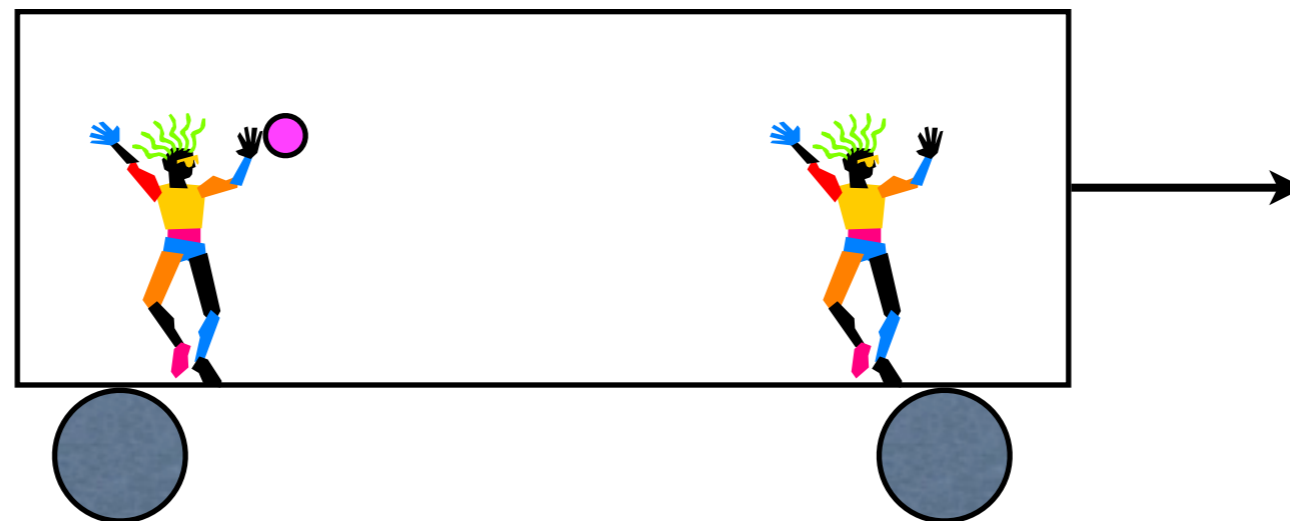
	Metric	English
Mass	kilogram (kg)	slug
Weight	Newton (N)	pound (lb)
Acceleration due to gravity (Earth)	9.8 m/s ²	32 ft/s ²
Acceleration due to gravity (Moon)	1.6 m/s ²	5.3 ft/s ²

Relative motion

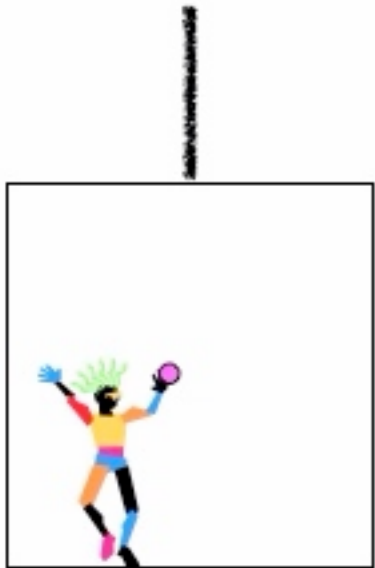
- Relative motion - the motion of one object with respect to another.
- What are some examples of this?

Relative motion

- Imagine two people traveling in a closed railroad car that is moving at a constant speed.
- They are bored, so they begin a game by throwing a ball back and forth.
- The speed of the ball depends upon where the measurement is performed.

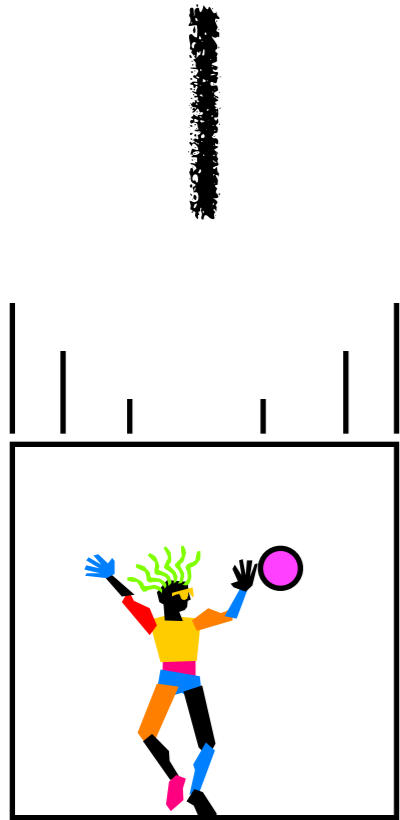


Relative motion and Weightlessness



- Imagine a person in an elevator moving at a constant speed.
- Now, drop a ball.
- The ball drops to the floor of the elevator due to gravity.

Relative motion and Weightlessness

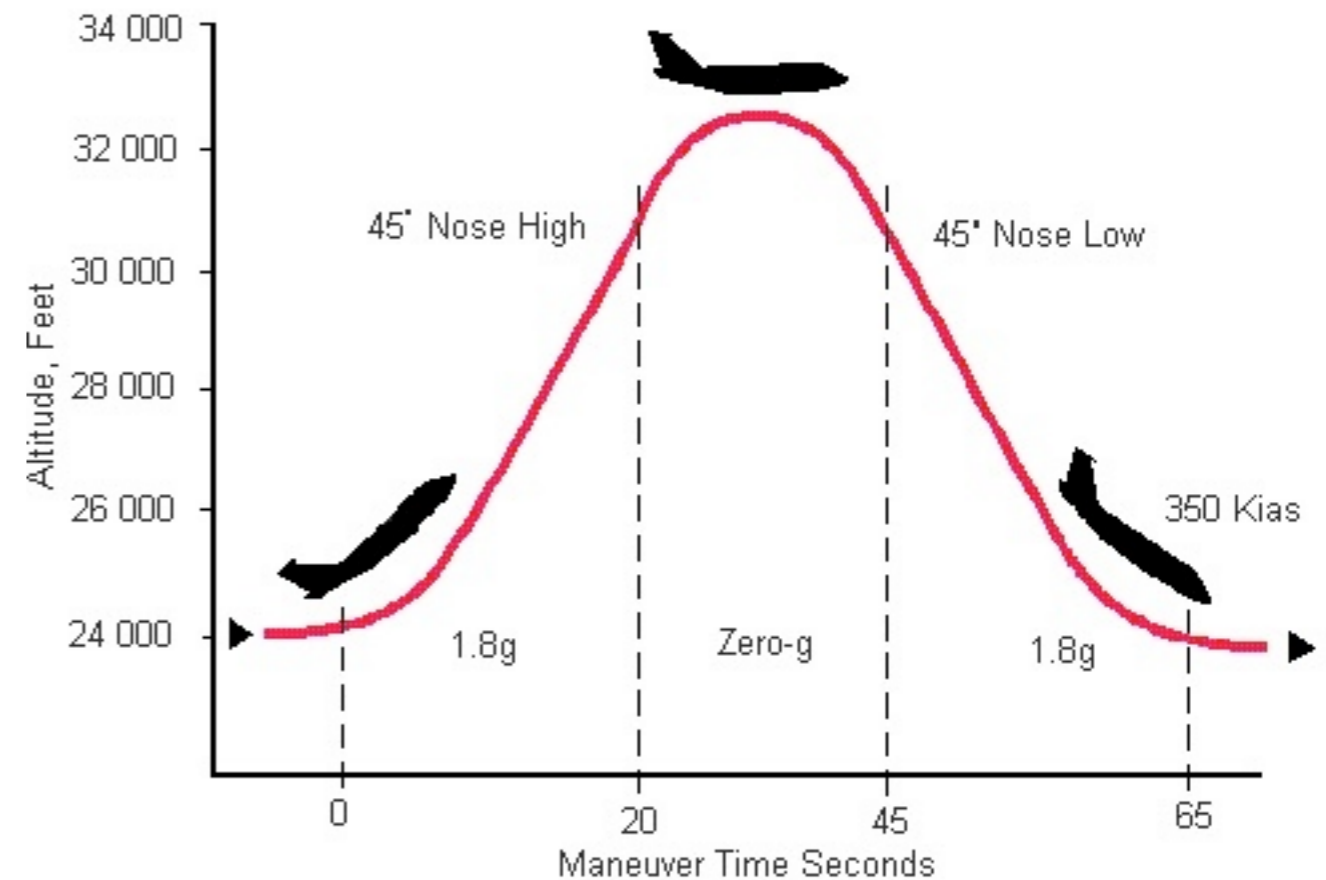


- Imagine a person in an elevator that is falling with the gravitational acceleration, “g” (cut the rope).
- Now, “drop” a ball.
- The ball is also falling with a gravitational acceleration, “g”.
- Inside the elevator, both the person and the ball are falling with the SAME acceleration - so the ball will not fall to the ground when released.

Weightless

Parabolic flight trajectory

- Plane follows a "parabolic" trajectory.
- Trajectory allows flight to have a 30-second period with an acceleration of "g".
- Inside the plane, effectively "zero-g"!



Gravity really works!



Commander David Scott - Apollo 15
<http://er.jsc.nasa.gov/seh/>

Questions???