

## Baseline Labs



### Flower: Basic Tutorials 1-3

- Determine how the **sugar in the water** affects the **petal loss**.
- Determine how the **salt in the water** affects the **petal loss**.
- Determine how the **red dye in the water** affects the **redness of the petals**.



### Ramp: Advanced Tutorials 1-3

- Determine how the **height of the tower** affects the **total distance traveled from the end of the ramp**.
- Determine how the **roughness of the ramp** affects the **time to end of the ramp**.
- Determine how the **size of the sled** affects the **total distance traveled from the end of the ramp**.

## Physical Science



### Phase Change

- Determine how the **amount of heat** affects the **boiling point of water**.
- Determine how the **size of the container** affects the **time the water takes to boil**.
- Determine how the **amount of ice** affects the **boiling point of water**.
- Determine how the **amount of ice** affects the **melting point of ice**.



### Chemical Reactions

- Determine how the **substance** added to vinegar impacts the **temperature change**.
- Determine how the **amount of substance** impacts the **temperature change**.
- Determine how the **amount of vinegar** impacts the **temperature change**.



### Collisions: Introduction

- Determine how the **mass of the green ball** affects the **final velocity of the green ball**.
- Determine how the **initial velocity of the red ball** affects the **total final momentum to the right**.
- Determine how the **mass of the red ball** affects the **total final momentum to the right**.



### Collisions: Elastic Billiards

- Determine how the **initial velocity of the green ball** affects the **total final momentum to the right**.
- Determine how the **mass of the red ball** affects the **final velocity of the red ball**.
- Determine how the **initial velocity of the green ball** affects the **final velocity of the green ball**.



### Collisions: Inelastic (Trains)

- Determine how the **initial velocity of the green train** affects the **total final momentum to the right**.
- Determine how the **initial velocity of the red train** affects the **total final momentum to the right**.
- Determine how the **mass of the red train** affects the **final velocity of the red train**.



### Momentum (1): Investigate

- Determine how the **mass of Car #1** affects the **momentum of Car #1 before collision**.
- Determine how the **velocity of Car #1 before collision** affects the **total velocity after collision**.
- Determine how the **velocity of Car #1 before collision** affects the **total momentum after collision**.



### Momentum (3): Predict (Coming Soon)

- Develop a mathematical model and make predictions about how the **mass of Car #1** affects the **momentum of Car #1 before collision**.
- Develop a mathematical model and make predictions about how the **velocity of Car #1 before collision** affects the **total velocity after collision**.
- Develop a mathematical model and make predictions about how the **velocity of Car #1 before collision** affects the **total momentum after collision**.



### Energy (1): Free Fall

- Determine how the **height of the drop** affects the **kinetic energy** as the ball hits the ground.
- Determine how the **height of the drop** affects the **potential energy** before the ball is dropped.
- Determine how the **mass of the ball** affects the **mechanical energy** as the ball hits the ground.



### Energy (2): Air Resistance

- Determine how the **volume of the ball** affects the **kinetic energy** as the ball hits the ground.
- Determine how the **mass of the ball** affects the **thermal energy** of the system.
- Determine how the **volume of the ball** affects the **thermal energy** of the system.



### Forces & Motion (1): Introduction

- Determine how the **roughness of the ramp** impacts the **time to end of the ramp**.
- Determine how the **height of the tower** impacts the **velocity of the sled**.
- Determine how the **mass of the sled** impacts the **force of the sled on the spring**.



### Forces & Motion (2): Gravity

- Determine how the **gravity of the planetary body** impacts the **force of the sled on the spring**.
- Determine how the **gravity of the planetary body** impacts the **time to end of the ramp**.
- Determine how the **gravity of the planetary body** impacts the **velocity of the sled**.



### Gravity and Mass: Introduction

- Determine how the **planetary body we are orbiting** affects the **mass of the gold**.
- Determine how the **planetary body we are orbiting** affects the **weight of the gold**.
- Determine how the **amount of gold** affects the **weight of the gold**.



### Gravity and Orbit Distance

- Determine how the **distance of orbit** affects the **gravity in orbit**.
- Determine how the **distance of orbit** affects the **mass of the gold**.
- Determine how the **distance of orbit** affects the **weight of the gold**.



### Gravitation (1): Investigate

- Determine how the **amount of gold** affects the **force of gravity**.
- Determine how the **distance in orbit** affects the **force of gravity**.
- Determine how the **planet mass** affects the **force of gravity**.



### Gravitation (2): Graph (Coming Soon)

- Develop a mathematical model about how **planet mass** affects **force of gravity**.
- Develop a mathematical model about how **amount of gold** affects **force of gravity**.
- Develop a mathematical model about how **orbit distance** affects **force of gravity**.

MATH



### Gravitation (3): Predict (Coming Soon)

- Develop a mathematical model and make predictions about how **planet mass** affects **force of gravity**.
- Develop a mathematical model and make predictions about how **amount of gold** affects **force of gravity**.
- Develop a mathematical model and make predictions about how **orbit distance** affects **force of gravity**.

MATH



### Liquid Density

- Determine how the **shape of the container** affects the **density of the liquid**.
- Determine how the **amount of liquid** affects the **density of the liquid**.
- Determine how the **type of liquid** affects the **density of the liquid**.



### Motion - Sleds (1): Investigate (Coming Soon)

- Determine how the **height of the tower** affects the **time to end of the ramp**.
- Determine how the **mass of the sled** affects the **momentum at the end of the ramp**.
- Determine how the **roughness of the ramp** affects the **acceleration at the end of the ramp**.



### Motion - Sleds (2): Graph (Coming Soon)

- Develop a mathematical model about how the **height of the tower** affects the **time to end of the ramp**.
- Develop a mathematical model about how the **mass of the sled** affects the **momentum at the end of the ramp**.
- Develop a mathematical model about how the **roughness of the ramp** affects the **acceleration at the end of the ramp**.

MATH



### Motion - Sleds (3): Predict (*Coming Soon*)

Develop a mathematical model and make predictions about how the height of the tower affects the time to end of the ramp.

MATH

Develop a mathematical model and make predictions about how the mass of the sled affects the momentum at the end of the ramp.

Develop a mathematical model and make predictions about how the roughness of the ramp affects the acceleration at the end of the ramp.



### Velocity (1): Free Fall

- Determine how the height of the drop affects the velocity as the ball hits the ground.
- Determine how the mass of the ball affects the time to drop.
- Determine how the height of the drop affects the time to drop.



### Velocity (2): Air Resistance

- Determine how the height of the drop affects the velocity as the ball hits the ground.
- Determine how the mass of the ball affects the acceleration as the ball hits the ground.
- Determine how the volume of the ball affects the force as the ball hits the ground.
- Determine how the volume of the ball affects the time to drop.



### Waves - Drum (1): Introduction

- Determine how the mallet position influences the loudness of the sound produced.
- Determine how the mallet speed influences the pitch of the sound produced.
- Determine how the substance in the drum (medium) influences the wave speed.



### Waves and Thermal Energy

- Determine how the temperature in the drum influences the loudness of the sound produced.
- Determine how the temperature in the drum influences the pitch of the sound produced.
- Determine how the temperature in the drum influences the wave speed.



### Waves - String (1): Introduction

- Determine how the length of the string impacts the wave speed.
- Determine how the strength of the string impacts the loudness of the sound.
- Determine how the tension of the string impacts the wave frequency.



### Waves - String (2): Advanced

- Determine how the loudness changes.
- Determine how the wave speed changes.
- Determine how the wave frequency changes.



### Newton's Truck (1): Investigate (*Coming Soon*)

- Determine how the mass of the truck affects the acceleration of the truck.
- Determine how the forward acceleration force affects the time to reach 1 kilometer.
- Determine how the roughness of the road affects the acceleration.
- Determine how the mass of the truck affects the velocity at 1 kilometer.



### Truck (3): Predict (*Coming Soon*)

- Develop a mathematical model and make predictions about how the mass of the truck affects acceleration.
- Develop a mathematical model and make predictions about how the roughness of the road affects acceleration.



### Electromagnet (1): Investigate (*Coming Soon*)

- Determine how the number of turns affects the strength of the magnetic field.
- Determine how the amount of current affects the strength of the magnetic field.
- Determine how the distance between the electromagnet and the piece of metal affects the lifting force between them.



### Electricity and Magnetism (3): Predict (*Coming Soon*)

- Develop a mathematical model and make predictions about how the number of turns affects the strength of the magnetic field.
- Develop a mathematical model and make predictions about how the amount of current affects the strength of the magnetic field.

- Develop a mathematical model and make predictions about how the **distance between the electromagnet and the piece of metal** affects the **lifting force between them**.

## Life Science



### Body Systems

- A hiker can't seem to catch their breath because their blood oxygen levels are low. Investigate how **air tank flow** influences **blood oxygen**.
- A hiker is experiencing dizziness and fatigue because their blood sugar levels are low. Investigate how **carbohydrates eaten** influences **blood sugar levels**.
- A hiker is shivering. Their body temperature is at 95 °F, but should be around 98.6 °F. Investigate how **layers of clothing** influence **body temperature**.



### Cells: Animal- Energy and Storage

- The cell cannot break down food. Determine how **lysosomes** impact the **ability to break down food**.
- The cell is low on energy. Determine how **mitochondria** impact the **cell's energy**.
- The cell is storing too many nutrients. Determine how **vacuoles** impact the **nutrient storage**.



### Cells: Animal - Function

- The Golgi body is not receiving enough protein. Determine how the **endoplasmic reticulum** impacts the **transportation of protein to the Golgi body**.
- The cell is producing too many ribosomes. Determine how **nucleoli** impact the **production of ribosomes**.
- The cell has too much protein. Determine how the **ribosomes** impact the **production of protein**.



### Cells: Plant - Function

- The Golgi body is not receiving enough protein. Determine how the **endoplasmic reticulum** impacts the **transportation of protein to the Golgi body**.
- The cell is producing too many ribosomes. Determine how the **nucleoli** impact the **production of ribosomes**.
- The cell has too much protein. Determine how the **ribosomes** impact the **production of protein**.



### Cells: Plant - Energy & Storage

- The cell is not capturing enough sunlight. Determine how **chloroplasts** impact the **ability to capture sunlight**.
- The cell is low on energy. Determine how the **mitochondria** impact the **production of energy**.
- The cell does not have enough storage space. Determine how the **size of the vacuole** impacts the **nutrient storage**.



### Diversity of Traits

- Investigate how **foliage** influences the **presence of red, short furred slinquettes** living in the environments.
- Investigate how a **fur color mutation** influences the **presence of green short furred slinquettes**.
- Investigate how a **fur length mutation** influences the **presence of red, long furred slinquettes**.
- Investigate how **temperature** influences the **presence of red, long furred slinquettes** living in the environments.



### Genetics

- Determine how the **Mother's F alleles** impact the **chance of producing the offspring with red fur**.
- Determine how the **Mother's H alleles** impact the **chance of producing the offspring with horns**.
- Determine how the **Mother's L alleles** impact the **chance of producing the offspring with short fur**.



### Natural Selection

- Investigate the **optimal amount of foliage** for the **green, long furred slinquettes' population**.
- Investigate the **optimal amount of foliage** for the **red, short furred slinquettes' population**.
- Investigate the **optimal temperature** for the **green short furred slinquettes' population**.
- Investigate the **optimal temperature** for the **red, long furred slinquettes' population**.



### Predation: Introduction

- Investigate how **seal birth rate** influences the **maximum shark population**.
- Investigate how **shark birth rate** influences the **maximum seal population**.
- Investigate how a **starting seal population** influences the **length of the predation cycle**.
- Investigate how a **starting shark population** influences the **length of the predation cycle**.



### Predation (2): Cycles

- Investigate how an **initial seal population** influences the **duration of predation cycles**.
- Investigate how **seal birth rate** influences the **final seal population**.

- Investigate how **shark birth rate** influences the **duration of predation cycles**.

## Earth Science



### Eclipses (1): Introduction

- Determine how the **phase of the Moon** affects the **possibility of viewing a lunar eclipse**.
- Determine how the **phase of the Moon** affects the **possibility of viewing a solar eclipse**.
- Determine if the **orbital tilt of the moon** impacts the **average number of lunar eclipses**.
- Determine how the **time of year** impacts the **average number of solar eclipses**.



### Eclipses (2): Advanced

- Determine how the **average number of lunar eclipses** changes.
- Determine how the **average number of solar eclipses** changes.
- Determine how the **possibility of viewing a lunar eclipse** changes.
- Determine how the **possibility of viewing a solar eclipse** changes.



### Lunar Phases (1): Introduction

- Determine how the **location of the observer** impacts the **percent of the Moon lit up**.
- Determine how the **orbital speed of the moon** impacts the **duration of lunar orbit**.
- Determine how the **position of the moon** impacts the **percent of the Moon facing the Sun**.



### Lunar Phases (2): Advanced

- Determine how the **duration of lunar orbit** changes.
- Determine how the **percent of the Moon facing the Sun** changes.
- Determine how the **percent of the Moon lit up** changes.



### Convergent (1): Introduction

- Investigate how the **duration of plate movement** impacts the **formation heights at the convergent boundary**.
- Investigate how **plate size** impacts the **number of earthquakes at the convergent boundary**.
- Determine how the **plate type** affects the **formation type**.



### Convergent (2): Advanced

- Determine the impact of the **duration of plate movement**.
- Investigate what affects the **formation type at the convergent boundary**.
- Investigate what affects the **number of earthquakes**.



### Divergent (1): Introduction

- Determine how the **convection current speed** affects the **spreading rate**.
- Today, your geologist team is taking measurements near a divergent boundary. Investigate how the **distance from the spreading center** is related to the **age of crust**.
- Determine how the **plate type** affects the **formation type**.



### Divergent (2): Advanced

- Investigate what affects the **age of crust**.
- Investigate what affects the **formation observed at the divergent boundary**.
- Investigate what affects the **spreading rate at the divergent boundary**.



### Seasons (1): Introduction

- Determine how the **location of the observer on Earth** affects the **angle of sunlight**.
- Determine how the **tilt of the Earth** affects the **average temperature**.
- Determine how the **location of Earth in orbit** affects the **distance of Earth from the Sun**.



### Seasons (2): Advanced

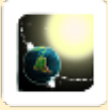
- Determine how the **angle of sunlight** changes.
- Determine how the **average temperature** changes.
- Determine how the **distance of Earth from the Sun** changes.



### Seasons - Earth has NO Tilt! Introduction

- If the Earth has no tilt, determine how the **location of Earth in orbit** affects the **average temperature**.
- If the Earth has no tilt, determine how the **location of Earth in orbit** affects the **distance of Earth from the Sun**.

- If the Earth has no tilt, determine how the **location of the observer** affects the **angle of sunlight**.



#### **Seasons- Earth has NO Tilt! Advanced**

- If the Earth has no tilt, determine how the **angle of sunlight** can change.
- If the Earth has no tilt, determine how the **average temperature** can change.
- If the Earth has no tilt, determine how the **distance of Earth from the Sun** can change.



#### **Weather (Coming Soon)**

- Determine how the **air temperature** affects the **severity of the storm**.
- Determine how the **atmospheric temperature** affects the **severity of the storm**.
- Determine how the **speed of the storm front** affects the **duration of the storm**.
- Determine how the **humidity** affects the **total precipitation**.