Part 1 Laws of Motion

Name:

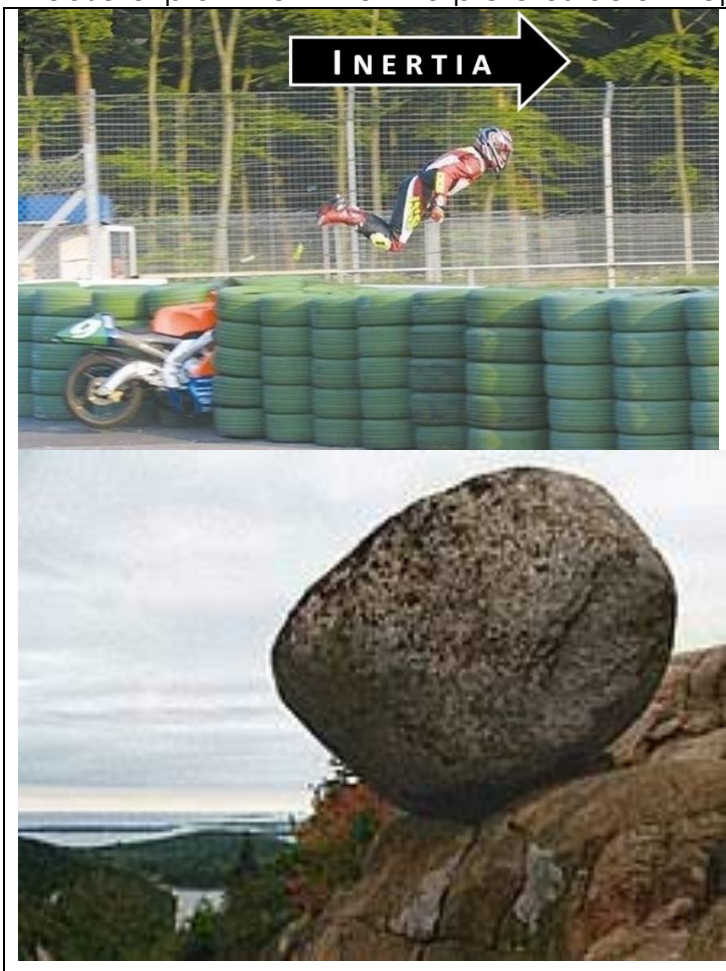
Part 1 Lesson 1, Newtons 1st Law

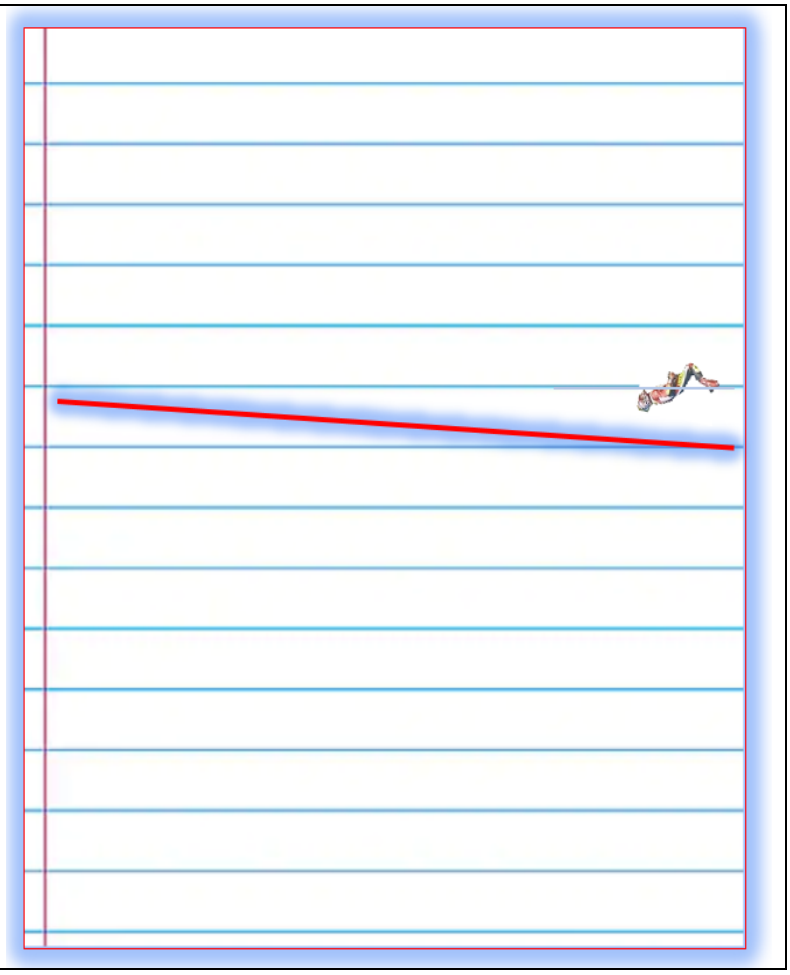
I am aware that I need to show all mathematical work in an organized manner to receive any credit for a question that involves calculations of any kind. Omitting / leaving out the units in the problem or at the end will also result in zero credit ◊ _____

Energy

Ability to do w_____
To cause something to move or c_____ directions
Energy cannot be c_____ or d_____ but transferred from one form to another.
Energy quality is _____ due to friction / force/ heat.
-From ____ quality energy to _____ quality energy.

Please explain how the two pictures below represents Newton's First Law of Motion.





Newton's 1st Law of Motion

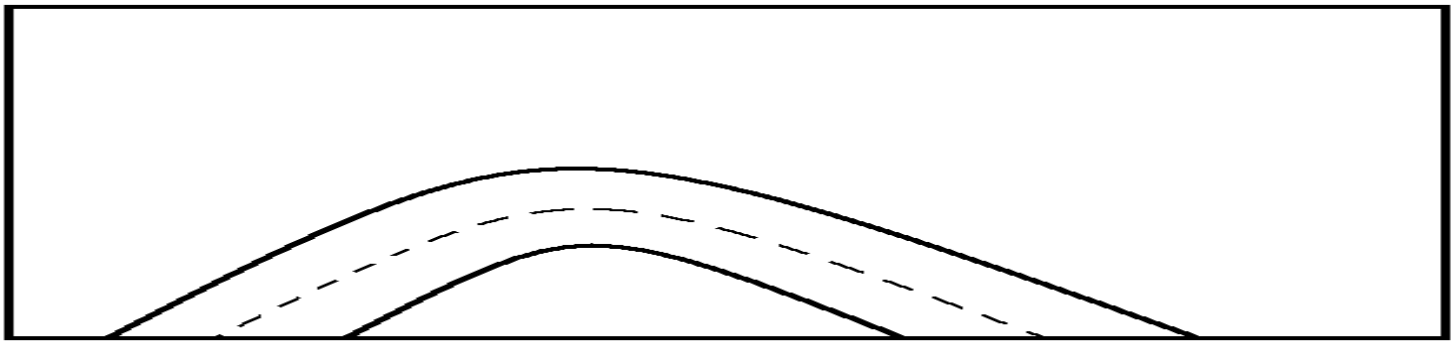
An object at _____ tends to stay at _____ and an object in _____ tends to stay in _____ with the same speed and in the same direction unless acted upon by an unbalanced _____.

Inertia: A property of matter by which it continues in its existing state of _____ or uniform _____ in a straight line.
Unless that state is changed by an external _____.

Part 1 Lesson 2 Newtons First Law cont.

Describe how the images below relate to Newton's First Law

Please draw what will happen to a car driving too fast on the sharp curve below. **Explain with some important vocabulary.**

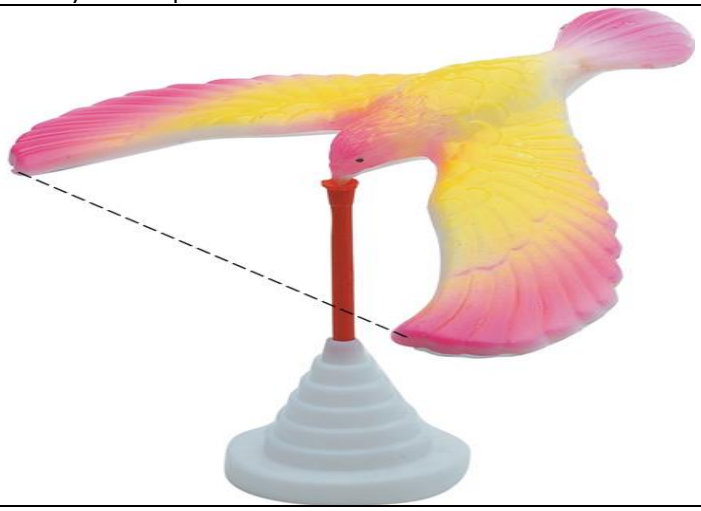


Part 1 Lesson 3 Center of Mass

Center of mass is the point at which the distribution of mass is_____ _____ , and does not depend on gravitational field.

- Center of gravity is the point at which the distribution of weight is equal in all directions, and _____depend on gravitational field.

Can you explain how this bird demonstration works?



Part 1 Lesson 4 Friction

Friction - The resistance encountered when one body is moved in c_____ with another.

The four types of friction

S_____ friction- friction between two surfaces that are not moving past each other.

S_____ friction- the force that opposes the motion of two surfaces sliding past each other.

Rolling friction- the friction between a rolling object and the surface it rolls on.

Fluid friction- when an object is moving in l_____ or g____.

Surface	Newtons	Newtons	Newtons
Wax Paper			
Construction Paper			
Sandpaper			
Rug			
Other?			

Which surface provided the least friction, <u>provide data</u> in your answer?

Which surface provided the greatest friction, <u>provide data</u> in your answer?

Quiz Wiz 1-10 Name that Friction

1)	2)	3)	4)	5)
6)	7)	8)	9)	10)

Bonus =

Please label the picture with correct type of friction below.

Part 1 Lesson 5 Friction cont.

Aerodynamic: Designed or arranged to offer the l_____ resistant to fluid flow.

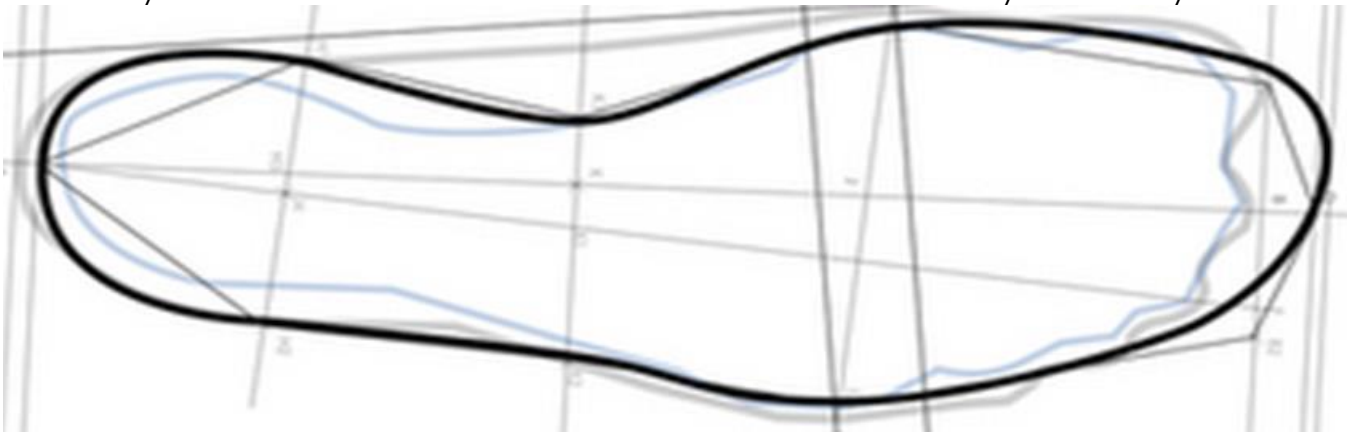
Please design an aerodynamic vehicle in the box below.

Hydrodynamic: A shape designed to move efficiently through the w_____.

Friction

- S_____ an object down until it stops
- Produces h____
- Wears objects d_____

Where is your footwear worn down the most? What does this tell you about your walk?



Describe the Positives and Negatives of Friction Below

Part 1 Lesson 6 Newton's 2nd Law

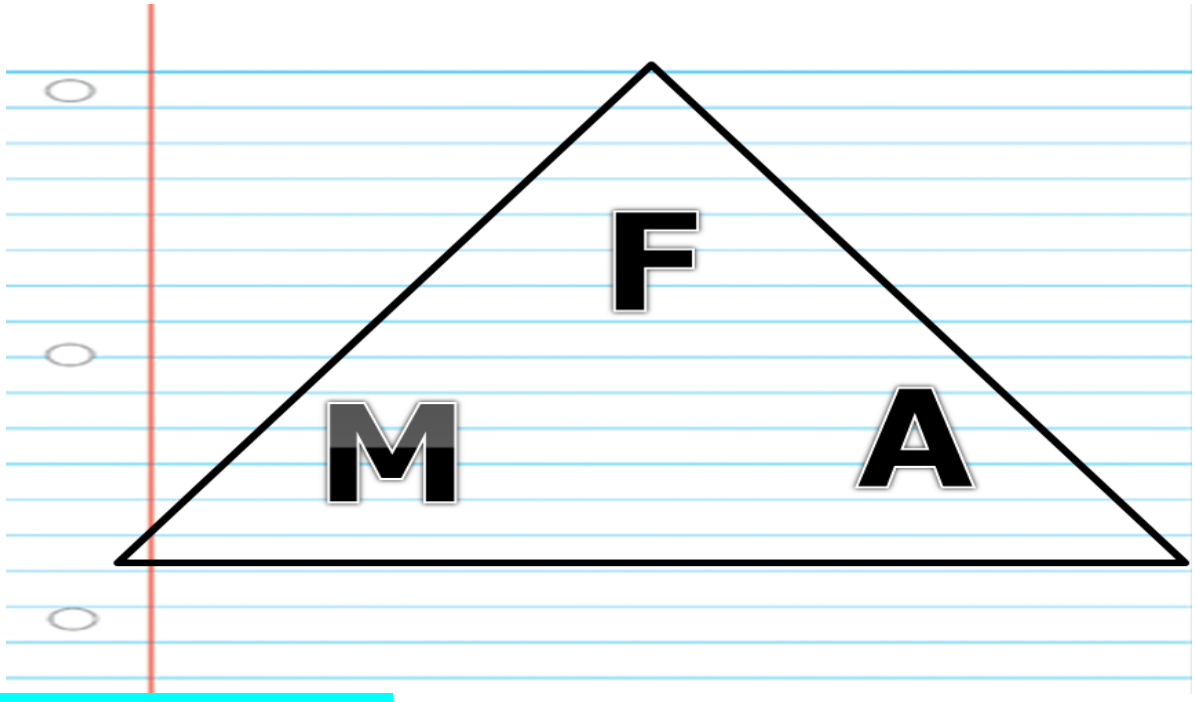
Please discuss how Newton's 2nd Law (F=ma) applies to the picture below. Both vehicles were traveling at the same speed.

Newton's 2nd Law

- The relationship between an object's m_____ = *m*, its a_____= a, and the applied f_____ *F* is *F* = *ma*.

The net force on an object is equal to the mass of the object m_____ by its acceleration.

Please fill some descriptions in the triangle below for F=ma



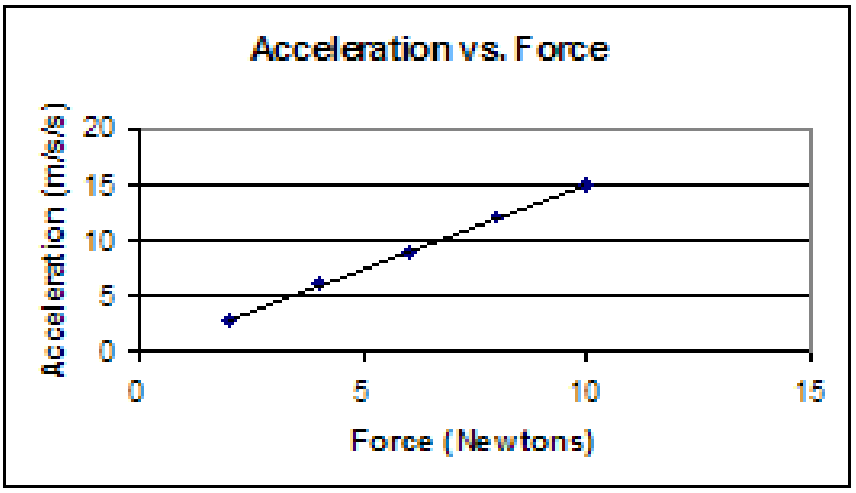
Part 1 Lesson 7 Newton's 2nd Law

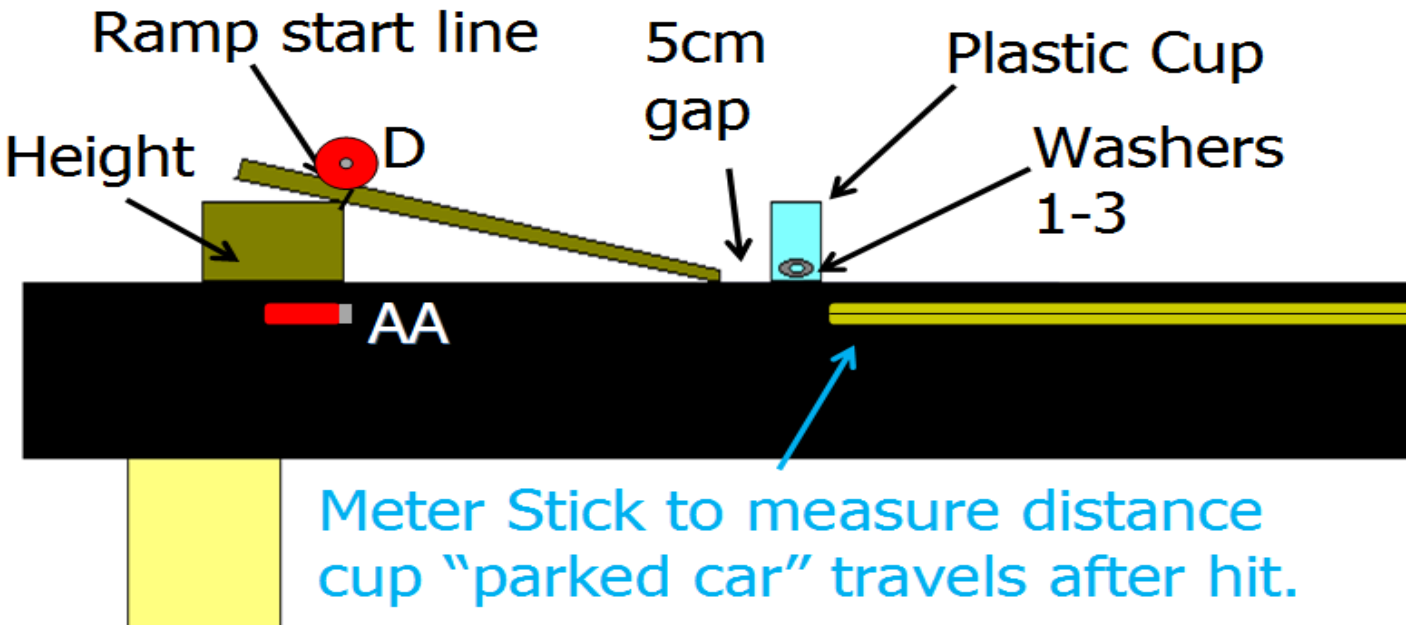
◊ **SHOW YOUR WORK IN AN ORGANIZED MANNER WITH UNITS!**

A go-cart with a mass of 500 kg including passengers accelerates from to a speed of 10 meters per second before crashing into a brick wall. F=ma -What was the force of this crash in newtons?	A leaf weighing **5 grams** falls from a tree at a rate of 2 meters every second (m/s^2). What is the force of the leaf hitting the ground in newtons? **Don't forget to convert?**
A car strikes a guardrail and the impact was 10,000 newtons. -The car weighed 800 kilograms, how fast was it moving in **meters per second (m/s^2)?**	A car strikes brick wall and the impact was 1,500 newtons. The car was traveling at 2 m/s^2. -How much did it weigh in **Kilograms**?

A bowling ball that weighs 5.4 kilograms is dropped from a building and travels 9.8 m/s². How much force is applied when it hits the ground?	A fruit bat weighing 2,200 grams hits a bystander and the impact was 16 newtons. How fast was the fruit bat flying?

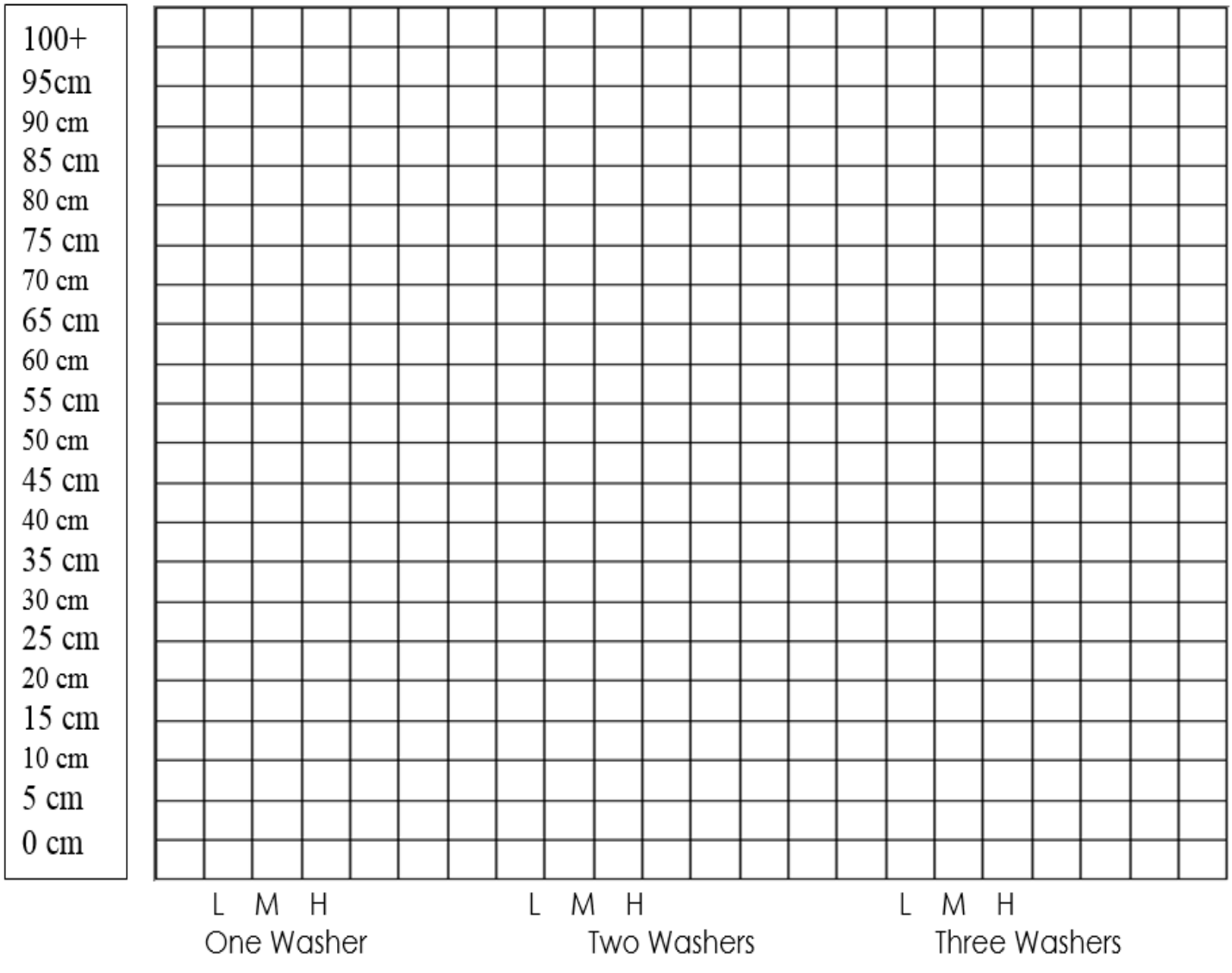
Use the chart on the right to explain how acceleration and force are connected. Please use some data in your response.





Ramp Height	Parked Car (1 washer)	Parked Car (2 washers) ?	Parked Car (3 washers)
Low	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____
Medium	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____
Highest	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____	D – Truck_____ AA –Car_____

Please graph your results in the space below (X Axis can be the mass of the parked car - # of washers), and Y axis can be distance traveled.



Which Battery caused the parked car to move further? **Use your data...** F=MA

- Mass = Weight of battery
- Acceleration = Acceleration of Parked Car

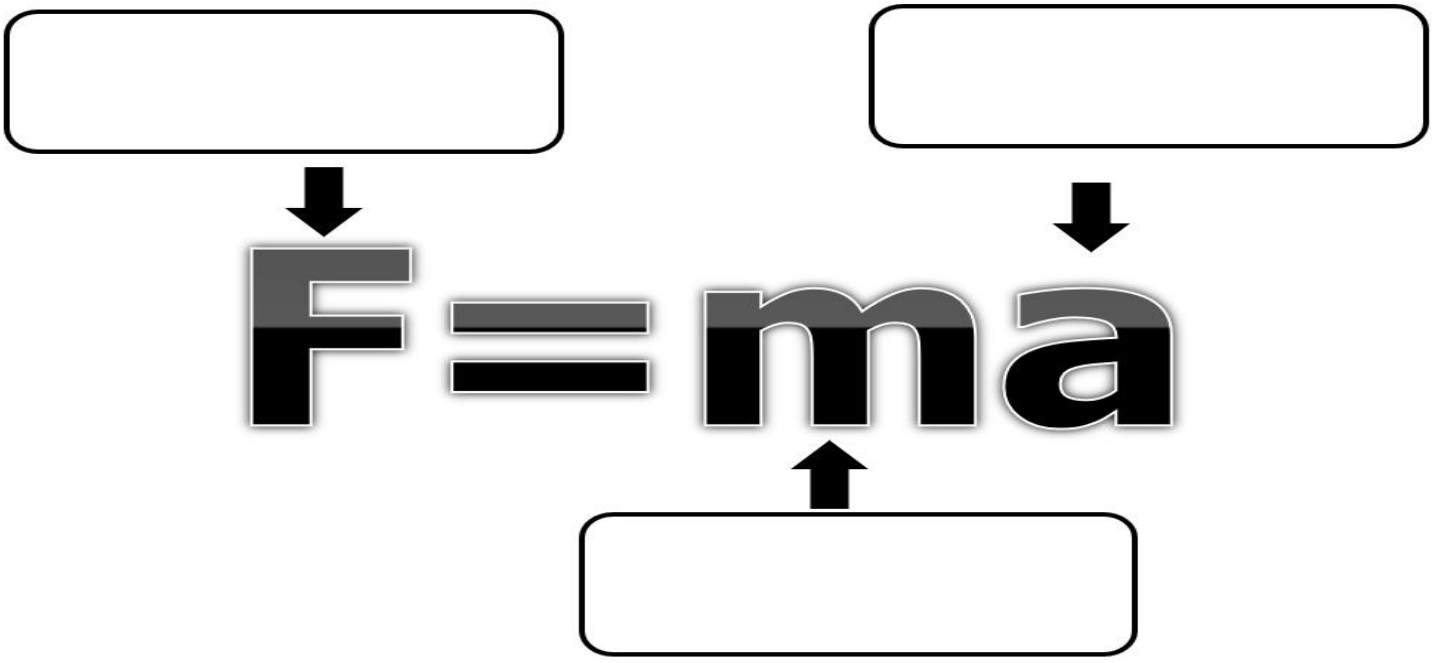
How did the height of the ramp affect the movement of the parked car?
Use Data in your response.

How did the resistance to force (washers) affect the movement of the parked car? **Use Data**

What should you be aware of when you become a licensed driver? Think F=ma

Name some quantities that are… Which one has magnitude and direction?

Scalar **Vector**

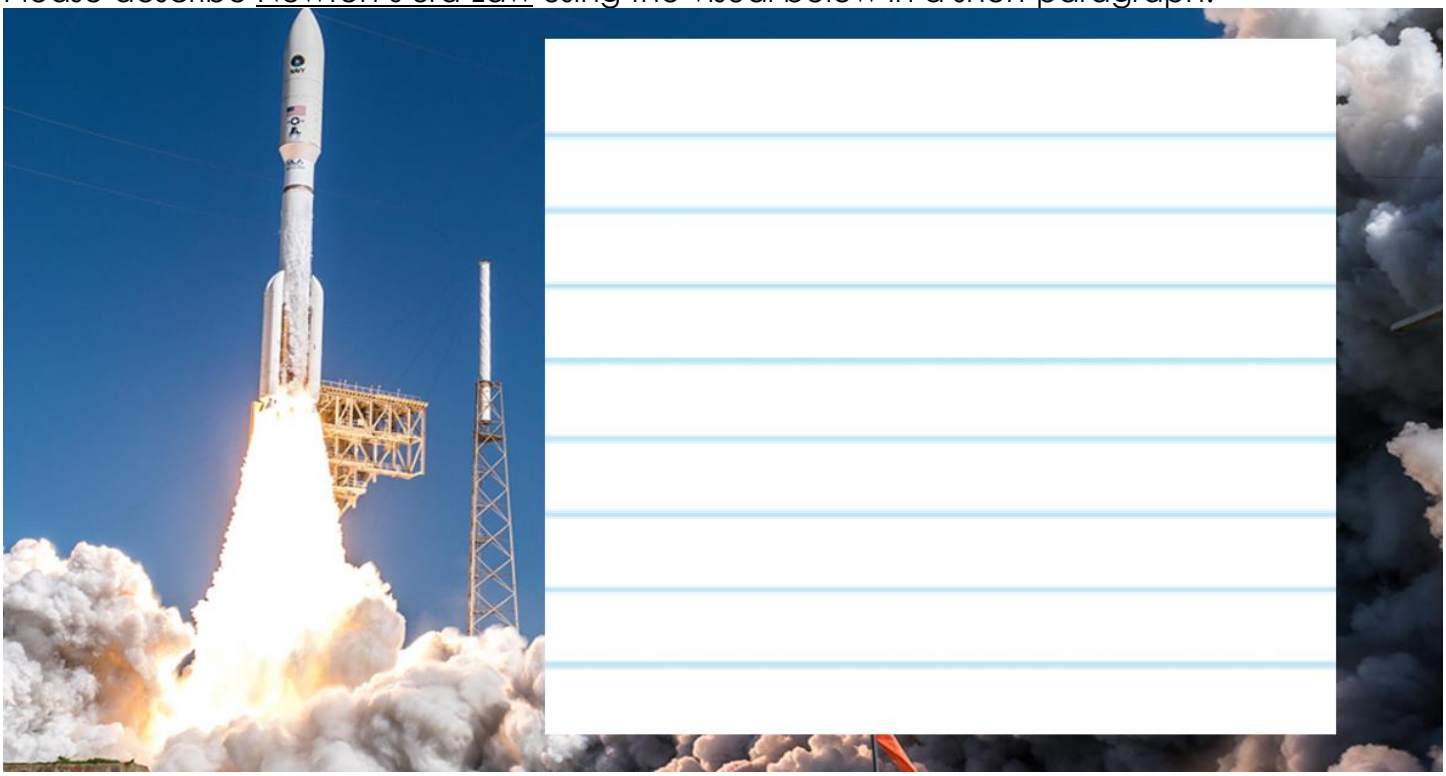


Part 1 Lesson 8 Newton's 3rd Law

3rd Law of Motion

For every action there is an e_____ and o_____ reaction.

Please describe Newton's 3rd Law using the visual below in a short paragraph.



Newtons 3rd Law of Motion Activity

Task #1. Roll one marble down the track so it collides with 5 marbles (together) that are standing still on the flat table. What happened?

-Repeat using rolling 2 marbles at a time, then 3 marbles at a time, then 4 marbles, and then five marbles. You may need to use your finger to hold the marbles together and then lift your finger to release the marbles so they roll together. What happened?

1 marble	2 marbles	3 marbles	4 marbles	5 marbles

Task #2. Remove the five marbles from track. Set-up another ruler ramp from the other side. Release one marble from each side at the same height and at the same time so the marbles will collide with the same force. What happened?

Repeat using the large marble on one side. What happened?

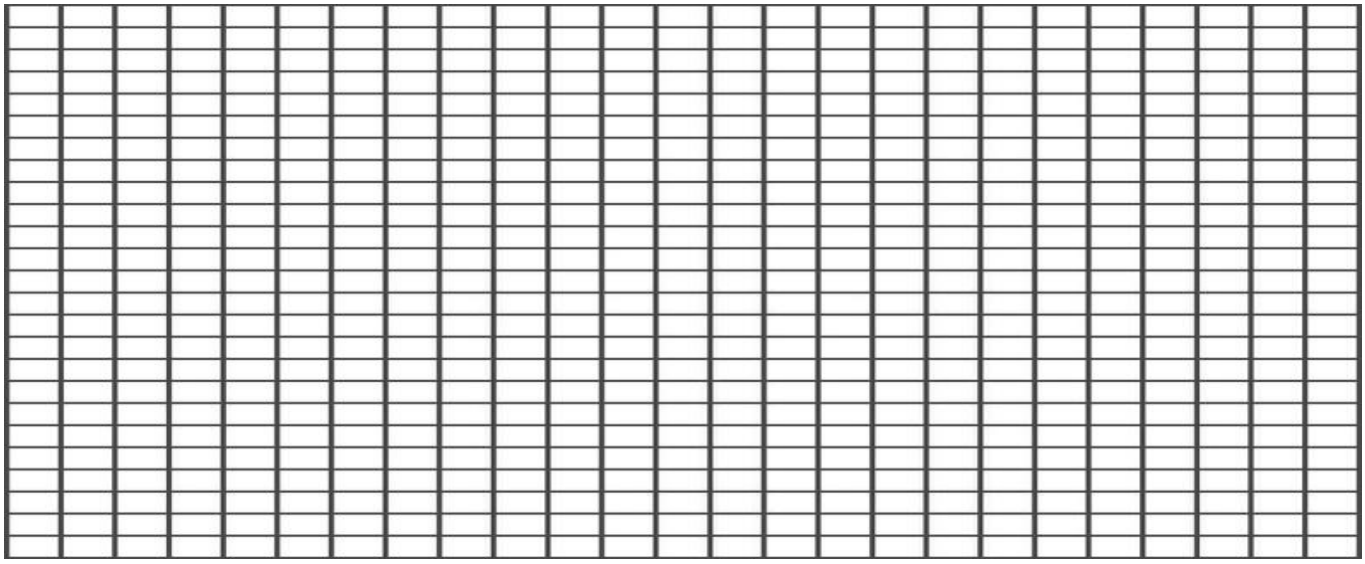
Task #3. Place a small marble at the bottom of the ramp and release the big marble down the track not too far from the bottom. Reverse the situation and have the small marble hit the big one from the same height. Describe the difference between the two trials.

Task #4 Quantify this activity. To quantify means that you that measure something. Perhaps use the measurements on the meter stick. Stop watch can also be provided. Describe what you did below and your results / measured distances or times.

What did you do?

What were your findings? Create an organized spread sheet?

Can you create a graph of your data? Or complete chart on computer.



How did the findings relate to any of Newton's Laws?

Across

3. The property of matter by which it retains its state of rest or its velocity along a straight line.
6. Newton's 2nd Law -The relationship between an object's mass m, its _____ a, and the applied force F is F = ma.
7. Newton's 2nd Law -The relationship between an object's _____ m, its acceleration a, and the applied force F is F = ma.
9. Energy can cause something to move or _____ directions
10. Friction •Slows an object down until it stops •Produces _____ •Wears objects down
14. Energy goes from high quality to ___ quality
15. 3rd Law of Motion, For every action there is an equal and _____ reaction
16. Energy is the ability to do _____?
17. Energy cannot be created or _____?
19. Every object in a state of uniform motion tends to remain in that state of _____ unless an external force is applied to it.
20. Energy cannot be _____ or destroyed?

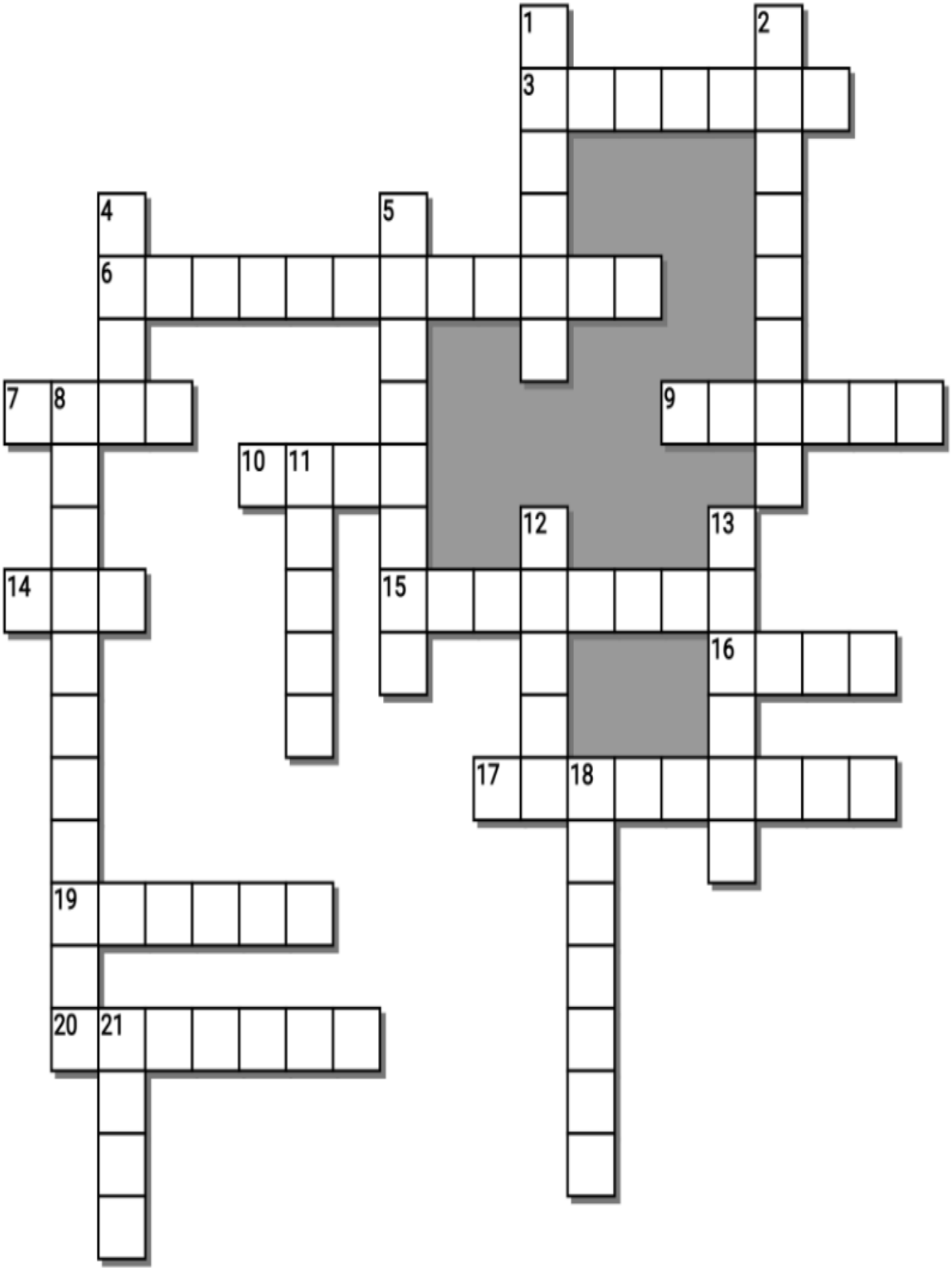
Down

1. Fluid friction- when an object is moving in _____ or gas.
2. Mass is measured in the _____
4. Center of _____: Point in a body at which the whole mass may be considered as concentrated.
5. The resistance encountered when one body is moved in contact with another.
8. Designed or arranged to offer the least resistant to fluid flow.
11. 3rd Law of Motion, For every action there is an _____ and opposite reaction
12. Newton's 2nd Law -The relationship between an object's mass m, its acceleration a, and the applied ____ F is F = ma.
13. One _____ is equal to 1 kilogram meter per second squared. In plain English, 1 newton of force is the force required to accelerate an object with a mass of 1 kilogram 1 meter per second per second.
18. _____ friction- the force that opposes the motion of two surfaces sliding past each other.
21. Every object in a state of uniform rest remain in that state of _____ unless an external force is applied to it.

----------Teacher can remove this word bank to make puzzle more challenging----------

Possible Answers

AERODYNAMIC, CHANGE, CREATED, DESTROYED, EQUAL, FORCE, FRICTION, INERTIA, LOW, MASS, MOTION, OPPOSITE, REST, SLIDING, WORK, ACCELERATION, HEAT, KILOGRAM, LIQUID, MASS, NEWTON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Laws of Motion

Lessons 11&12

Name:

1-20 = 5 pts
*20-*25 * = Bonus + 1 pt,
(Secretly write owl in correct space +1 pt)
Final Question = 5 pt wager

Score ____ / 100

LAZY BOY	RUB A DUB DUB	MAY THE FORCE BE WITH YOU	3rd TIMES THE CHARM	SPORT LILLY Bonus round 1 pt each
1)	6)	11)	16)	*21)
2)	7)	12)	17)	*22)
3)	8)	13)	18)	*23)
4)	9)	14)	19)	*24)
5)	10)	15)	20)	*25)

Final Question Wager ___ /5 Answer: _____

Part 1 Laws of Motion

Name:
Due:

I am aware that I need to show all mathematical work in an organized manner to receive any credit for a question that involves calculations of any kind. Omitting / leaving out the units in the problem or at the end will also result in zero credit ◊ _____

Energy

- Ability to do work
- To cause something to move or change directions
- Energy cannot be created or destroyed, but transferred from one form to another.
- Energy quality is lost due to friction / force/ heat.
  -From high quality energy to low quality energy.

Please explain how the picture below represents Newton's First Law of Motion. Why should you always wear a seatbelt in an automobile?

Newton's 1st Law

- Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.
- Inertia – Forces that resist to motion

A car in motion tends to remain in motion. The car hit a concrete barrier which was an external force. The objects in the car such as the passengers remained in a forward state of motion until they hit the ground. This is one reason to wear seatbelts, because you can be ejected from the vehicle.

Newton's 1st Law of Motion

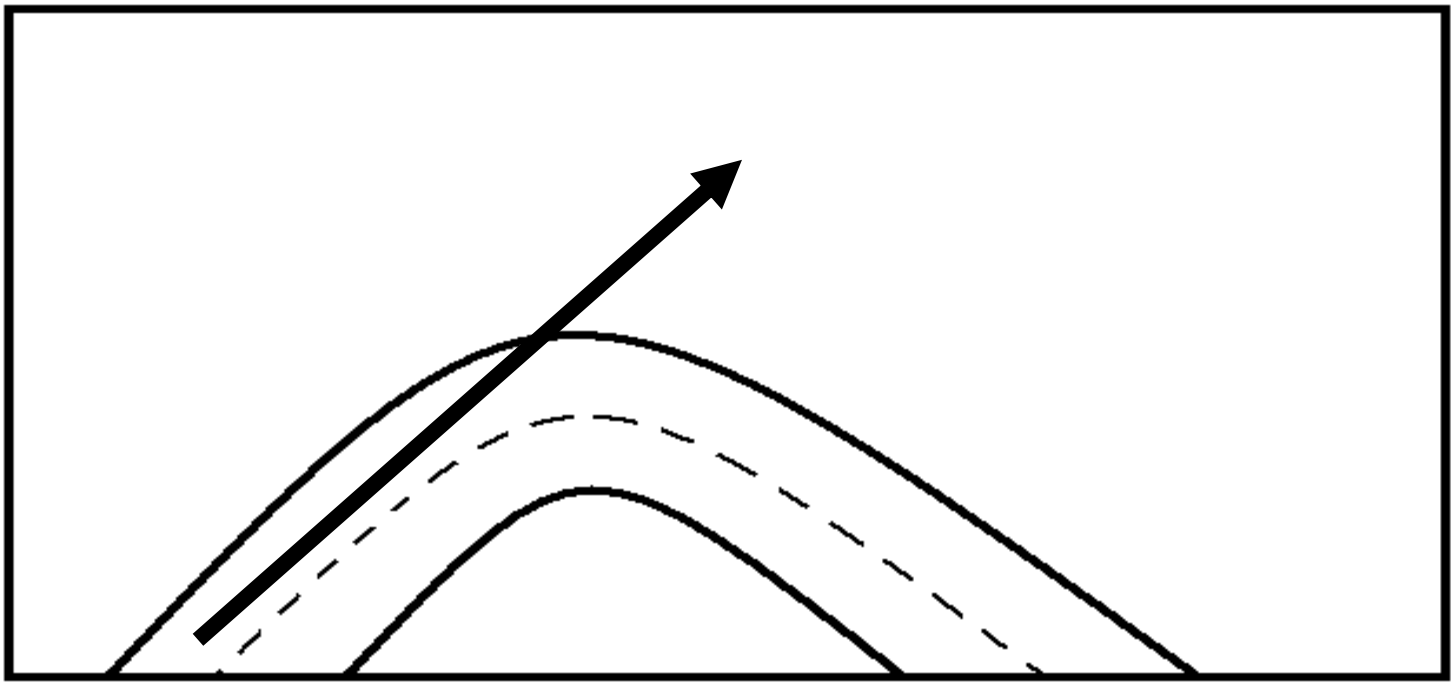
- Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.
- Inertia: The property of matter by which it retains its state of rest or its velocity along a straight line.

-So long as it is not acted upon by an external force.

Describe how the images below relate to Newton's First Law

 An object at rest tends to stay at rest unless acted on by a force.	 An object in motion tends to stay in motion unless acted on upon by a force.	 In a frictionless environment such as space, objects will travel until acted upon by a force.

Please draw what will happen to a car driving too fast on the sharp curve below. **Explain with some important vocabulary.**



Inertia – Forces that resist to motion. The car wants to travel in a straight line making high speed turns difficult. It is very important to control your speed in a vehicle making a sharp turn.

Can you explain how this bird demonstration works?

- Center of Mass: Point in a body at which the whole mass may be considered as concentrated.

The center of mass of the bird is at the beak. The reason for this is that the wings extend past the beak, out, and around the wooden stick. The bird is now balanced evenly.

Friction - The resistance encountered when one body is moved in contact with another.

The four types of friction

Static friction- friction between two surfaces that are not moving past each other.
Sliding friction- the force that opposes the motion of two surfaces sliding past each other.
Rolling friction- the friction between a rolling object and the surface it rolls on.
Fluid friction- when an object is moving in liquid or gas.

Surface	Newtons	Newtons	Newtons
Wax Paper			
Construction Paper			
Sandpaper			
Rug			
Other?			

Which surface provided the least friction, provide data in your answer?
Answers will vary depending on the surfaces used. Use data to support the correct surface. The wax paper required a force of only 1 newton to move.

Which surface provided the greatest friction, provide data in your answer?
Answers will vary depending on the surfaces used. Use data to support the correct surface. The sand paper required a force of 2 newtons to move the block

Quiz Wiz 1-10 Name that Friction

1)Rolling	2) Fluid	3) Sliding	4) Static	5) Rolling
6) Fluid	7) Fluid	8) Rolling	9) Sliding	10) Sliding

Bonus = Friction Fire from Cast Away with Tom Hanks

Please label the picture with correct type of friction below.

 Fluid Friction	 Sliding Friction	 Static Friction	 Rolling Friction

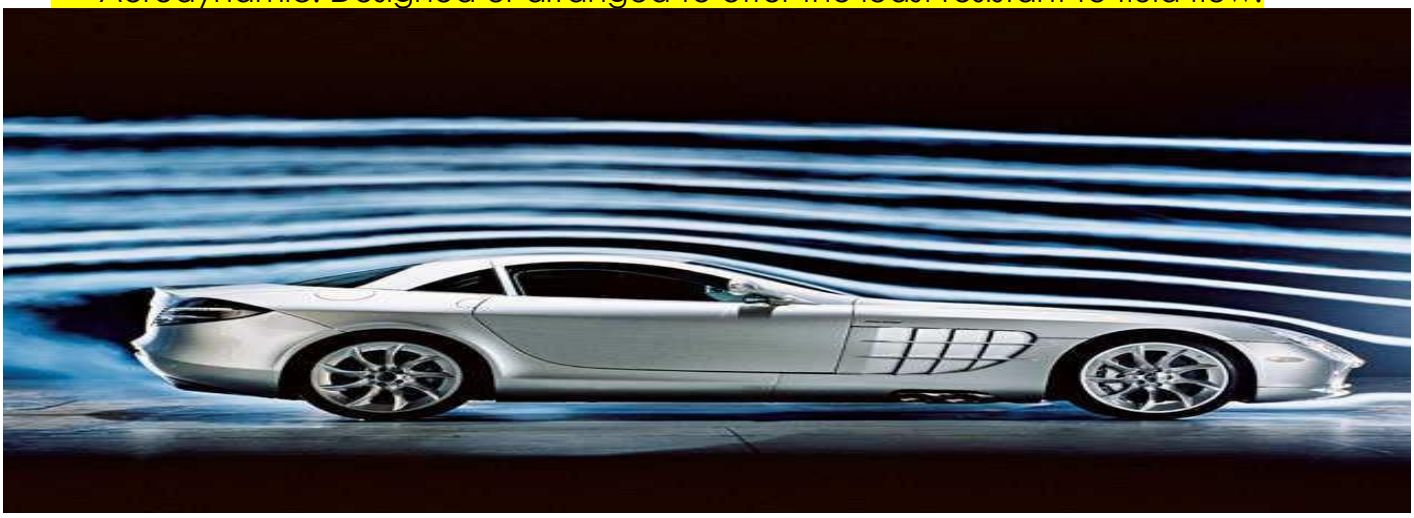
Friction cont.

Aerodynamic: Designed or arranged to offer the least resistant to fluid flow.

Please design an aerodynamic vehicle in the box below.

Answers will vary but it should look aerodynamic

- Aerodynamic: Designed or arranged to offer the least resistant to fluid flow.

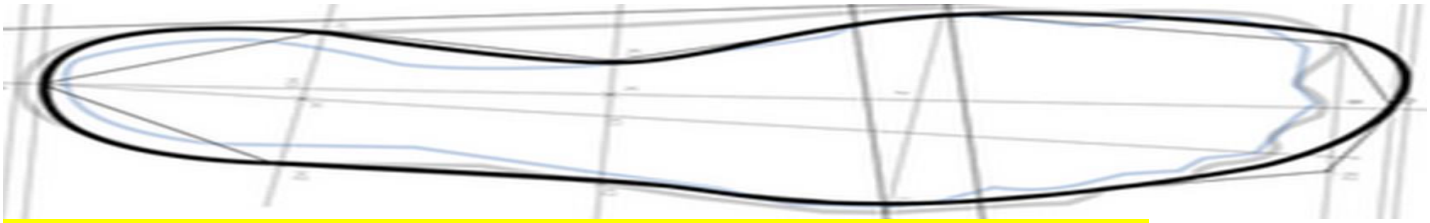


Hydrodynamic: A shape designed to move efficiently through the water.

Friction

- Slows an object down until it stops
- Produces heat
- Wears objects down

Where is your footwear worn down the most? What does this tell you about your walk?



Answers will vary but where it is worn out shows where more friction occurs

Describe the Positives and Negatives of Friction Below

Describe the Positives and Negatives of Friction Below

+	-
Without friction, we would not be able to walk, slowdown, or hold on to objects.	Friction •Produces heat which causes wear and requires lubrication. •Wears objects down and they need to be replaced (Example- tires)

Please discuss how Newton's 2nd Law (F=ma) applies to the picture below. Both vehicles were traveling at the same speed.

Newton's 2nd Law
-The relationship between an object's mass *m*, its acceleration a, and the applied force *F* is *F = ma*.

The net force on an object is equal to the mass of the object multiplied by its acceleration.

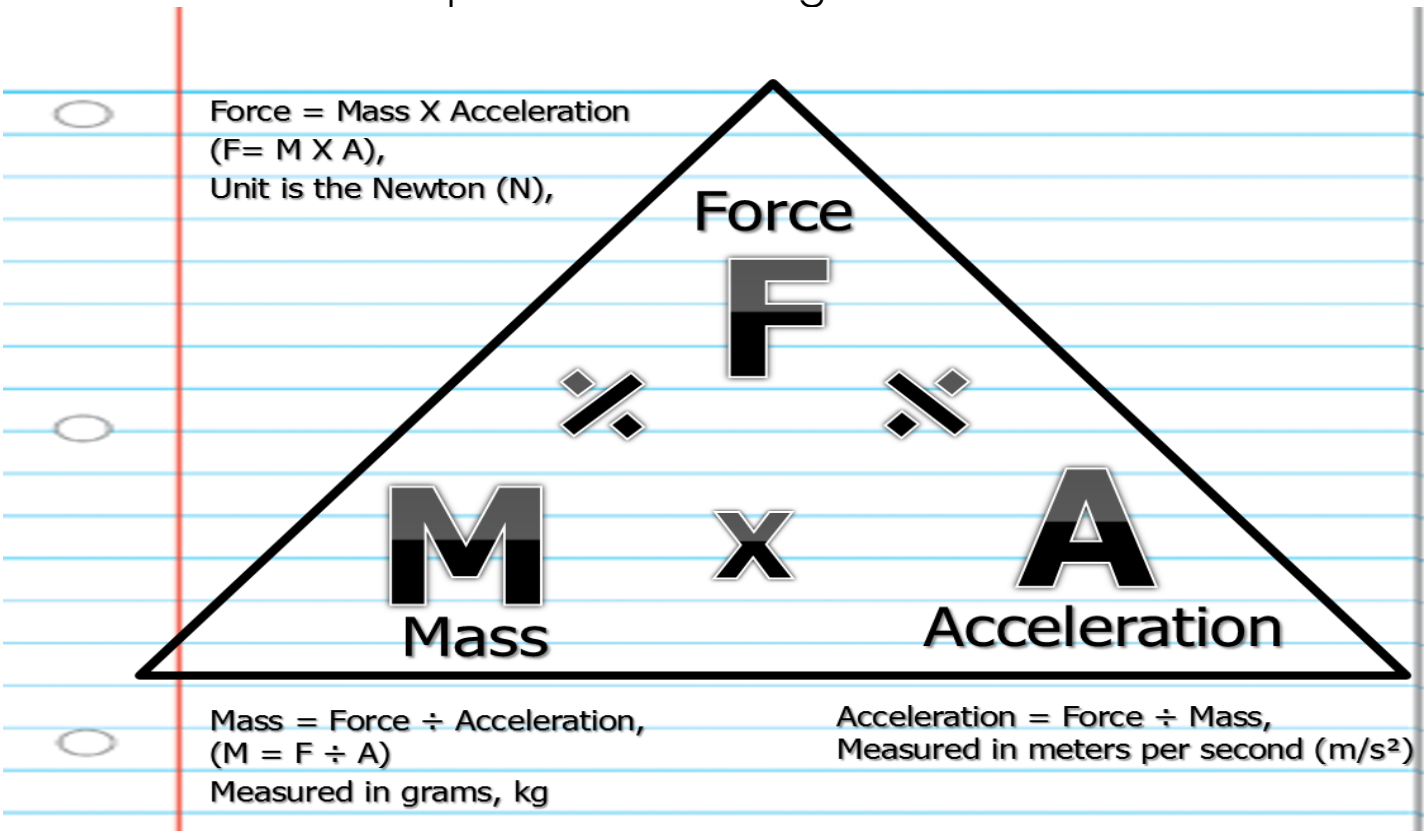
It is much easier to move the small rock because it has a small mass compared to the large rock.

Newton's 2nd Law

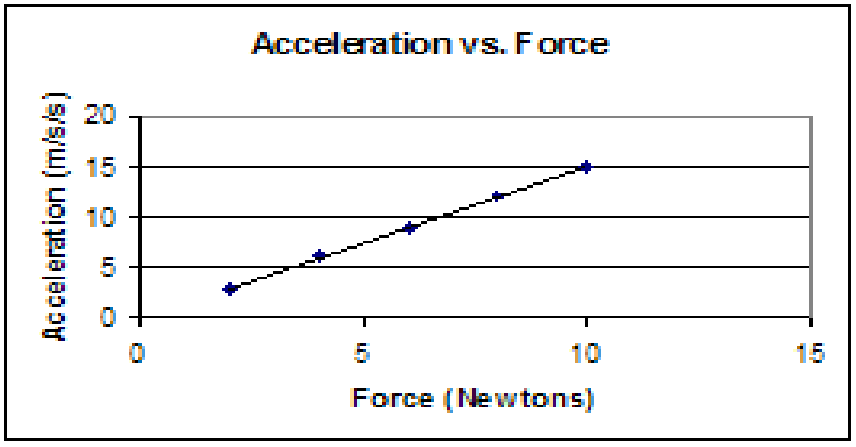
- The relationship between an object's mass = *m*, its acceleration= a, and the applied force *F* is *F = ma*.

The net force on an object is equal to the mass of the object multiplied by its acceleration.

Please fill some descriptions in the triangle below for F=ma



Use the chart on the right to explain how acceleration and force are connected. Please use some data in your response.

The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.	

◊ **SHOW YOUR WORK IN AN ORGANIZED MANNER WITH UNITS!**

A go-cart with a mass of 500 kg including passengers accelerates from to a speed of 10 meters per second before crashing into a brick wall. F=ma -What was the force of this crash in newtons? • F = ma • F = ?	A leaf weighing 5 **grams** falls from a tree at a rate of 2 meters every second (m/s²). What is the force of the leaf hitting the ground in newtons? **Don't forget to convert?** You need to convert to kilograms. • F = ma

• m = 500 kg • a = 10 m/s² • F ? = 500 kg times 10m/s² Answer = 5,000 newtons	• F = ? • m = .005 kilograms • a = 2 m/s² • F = .005kg times 2m/s² • Answer: .01 newtons.
A car strikes a guardrail and the impact was 10,000 newtons. -The car weighed 800 kilograms, how fast was it moving in **meters per second (m/s²)?** • F=ma Force 10,000 newtons m 800 kg a unknown 10,000 N = 1700 kg times X Opposite of multiplying is dividing. 10,000 N = X (m/s²) 800 kg X= 12.5 meters per second (m/s²)	A car strikes brick wall and the impact was 1,500 newtons. The car was traveling at 2 m/s². -How much did it weigh in **Kilograms**? • F=ma Force = 1,500 newtons m = unknown a = 2 m/s² 1,500 N = Unknown (kg) multiplied by 2 m/s². Opposite of multiplying is dividing. 1,500 N = X (kg) 2 m/s² X= 750 kg
A bowling ball that weighs 5.4 kilograms is dropped from a building and travels 9.8 m/s². How much force is applied when it hits the ground? • F = ma • F = ? • m = 5.4 kilograms • a = 9.8 m/s² • F ? = 5.4 kg times 9.8m/s² • F= 52.920 newtons	A fruit bat weighing 2,200 grams hits a bystander and the impact was 16 newtons. How fast was the fruit bat flying? Don't forget to convert • F=ma Force 16 newtons m 2.2 kg a unknown 16 N = 2.2 kg times X Opposite of multiplying is dividing. 16 N = X (m/s²) 2.2 kg X= 7.27 meters per second (m/s²)

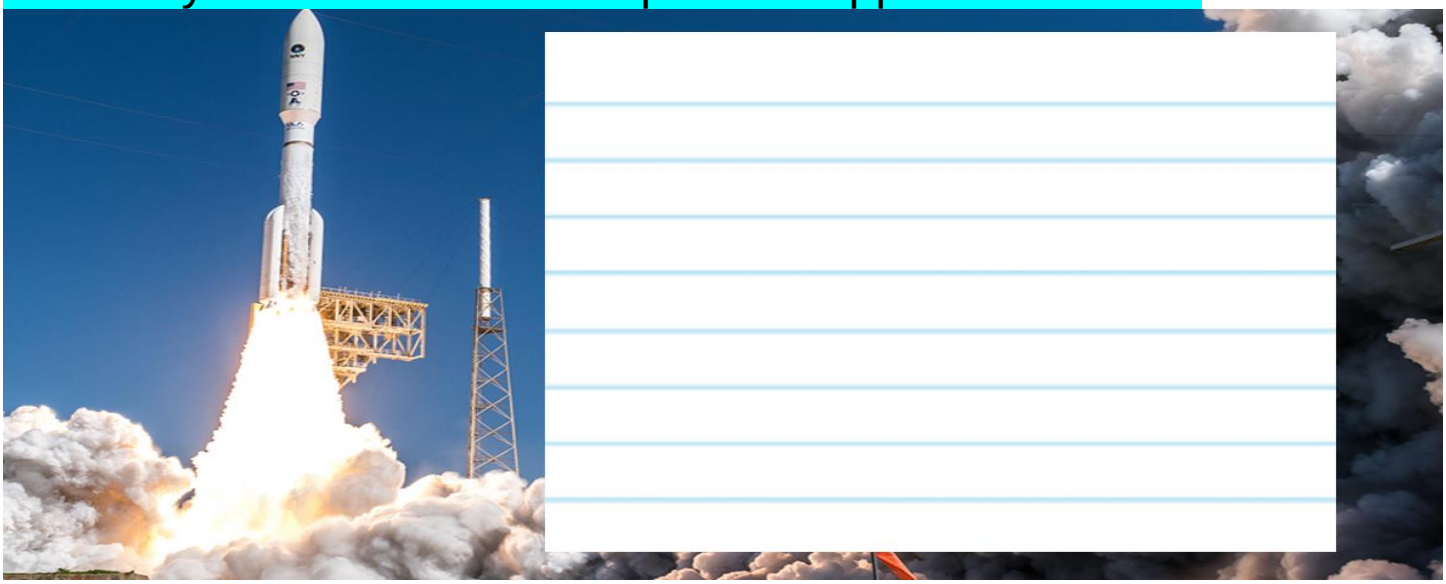
3rd Law of Motion

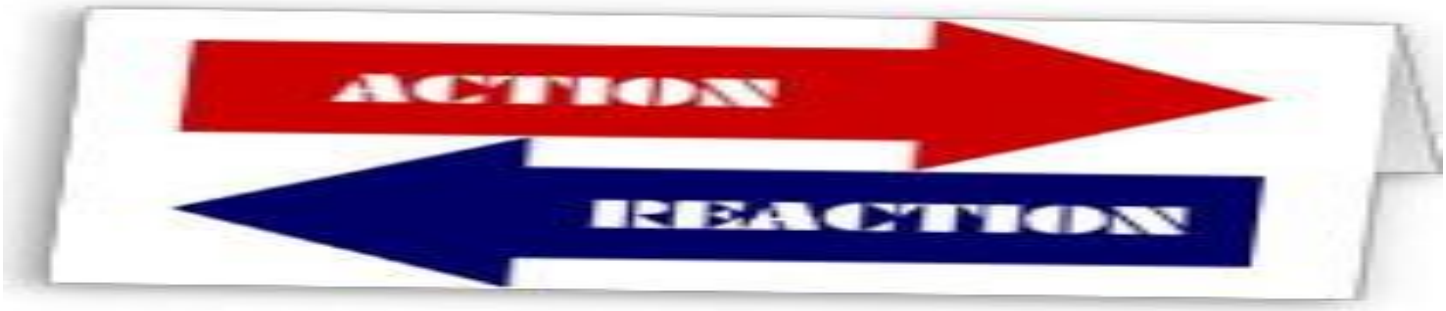
- For every action there is an equal and opposite reaction.

Please describe Newton's 3rd Law using the visual below in a short paragraph.

The rocket is able to lift off the ground because for every action there is an equal and opposite reaction. The force coming out of the rocket is equal to the speed of the space shuttles lift off.

3rd Law of Motion
For every action there is an equal and opposite reaction.





Which of Newton's Law's applies here? Explain using the space on the right.

Newton's 2nd Law
-The relationship between an object's mass *m*, its acceleration a, and the applied force *F* is *F* = *ma*.

The net force on an object is equal to the mass of the object multiplied by its acceleration.

It is much easier to move the small rock because it has a small mass compared to the large rock.

Please provide a visual that demonstrates each of Newton's three Laws

1st	2nd	3rd
Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.	The relationship between an object's mass *m*, its acceleration a, and the applied force *F* is *F* = *ma*.	For every action there is an equal and opposite reaction.

Across

3. The property of matter by which it retains its state of rest or its velocity along a straight line.
6. Newton's 2nd Law -The relationship between an object's mass m, its _____ a, and the applied force F is F = ma.
7. Newton's 2nd Law -The relationship between an object's _____ m, its acceleration a, and the applied force F is F = ma.
9. Energy can cause something to move or _____ directions
10. Friction •Slows an object down until it stops •Produces _____ •Wears objects down
14. Energy goes from high quality to ___ quality
15. 3rd Law of Motion, For every action there is an equal and _____ reaction
16. Energy is the ability to do _____?
17. Energy cannot be created or _____?
19. Every object in a state of uniform motion tends to remain in that state of _____ unless an external force is applied to it.
20. Energy cannot be _____ or destroyed?

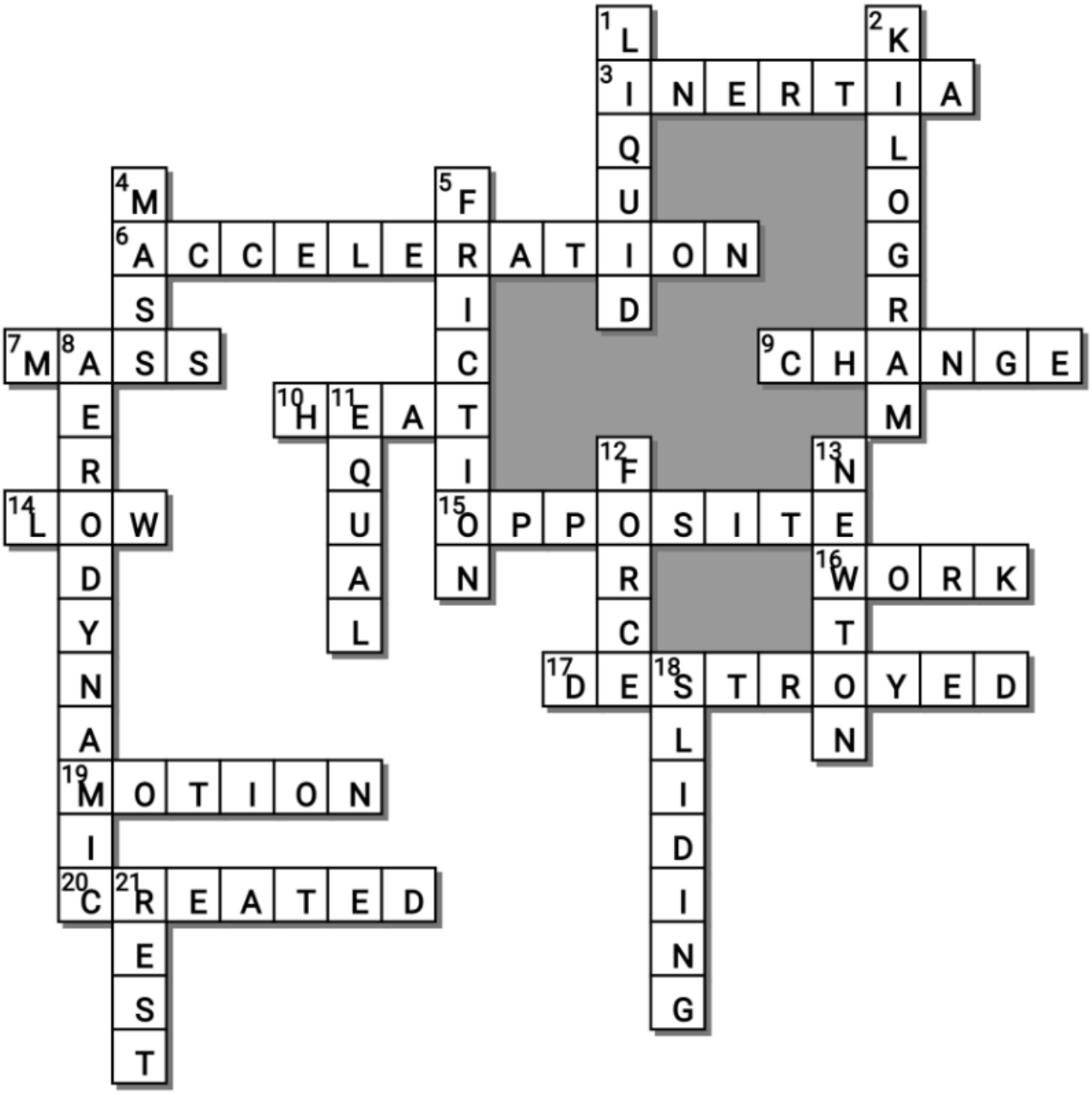
Down

1. Fluid friction- when an object is moving in _____ or gas.
2. Mass is measured in the _____
4. Center of _____: Point in a body at which the whole mass may be considered as concentrated.
5. The resistance encountered when one body is moved in contact with another.
8. Designed or arranged to offer the least resistant to fluid flow.
11. 3rd Law of Motion, For every action there is an _____ and opposite reaction
12. Newton's 2nd Law -The relationship between an object's mass m, its acceleration a, and the applied ____ F is F = ma.
13. One _____ is equal to 1 kilogram meter per second squared. In plain English, 1 newton of force is the force required to accelerate an object with a mass of 1 kilogram 1 meter per second per second.
18. _____ friction- the force that opposes the motion of two surfaces sliding past each other.
21. Every object in a state of uniform rest remain in that state of _____ unless an external force is applied to it.

----------Teacher can remove this word bank to make puzzle more challenging----------

Possible Answers

AERODYNAMIC, CHANGE, CREATED, DESTROYED, EQUAL, FORCE, FRICTION, INERTIA, LOW, MASS, MOTION, OPPOSITE, REST, SLIDING, WORK, ACCELERATION, HEAT, KILOGRAM, LIQUID, MASS, NEWTON


1 L
2 K
3 INERTIA
Q
L
4 M
5 F
U
O
6 ACCELERATION
G
S
I
D
R
7 MASS
C
9 CHANGE
E
10 HEAT
11 E
M
R
Q
I
12 F
13 N
14 LOW
U
15 OPPOSITE
D
A
N
R
16 WORK
Y
L
C
T
17 DESTROYED
N
A
S
L
19 MOTION
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D
20 C
21 REATED
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Law of Motion

Name:

1-20 = 5 pts
*20-*25 * = Bonus + 1 pt,
(Secretly write owl in correct space +1 pt)
Final Question = 5 pt wager

Score ____ / 100

LAZY BOY	RUB A DUB DUB	MAY THE FORCE BE WITH YOU	3rd TIMES THE CHARM	SPORT LILLY Bonus round 1 pt each
1) Letter D	6) FLUID FRICTION	11) Mass =m Acceleration=a Force=F	16) REACTION	*21) SERENA AND VENUS WILLIAMS
2) REST MOTION UNBALANCED	7) STATIC FRICTION	12) Kilograms=kg Acceleration newton	17) LETTER D D	*22) BODE MILLER
3) INERTIA	8) ROLLING FRICTION	13) F=ma Force 2,000 newtons m 200 kg a unknown 2,000 N = 200 kg times X Opposite of multiplying is dividing. 2,000 N / 200 kg = X (m/s²) X = 10 (m/s²)	18) HYDRODYNAMIC	*23) USAIN BOLT
4) CENTER OF MASS	9) AERODYNAMICS	14) F = ma F = ? m = 1.25 kg a = 3 m/s² F ? = 1.25 kg times 3 m/s² Force = 3.75 newtons	19) ELEPHANT	*24) JESSE OWENS
5) TRUE	10) DEFY INERTIA (is the bogus one)	15) F=ma Force = 4.9 newtons m = unknown a = 9.8 m/s² 4.9 N = Unknown (kg) multiplied by 9.8 m/s² Opposite of multiplying is dividing. 4.9 N / 9.8 m/s² = X (kg) X = .5 kg	20) LUBRICATED FRICTION	*25) Muhammad Ali (born Cassius Marcellus Clay Jr.)

Final Question Wager ___ /5 Answer:

F=ma
Force = 3 newtons
m = unknown
a = 1.5 m/s²
3 N = Unknown (kg) multiplied by 1.5 m/s²
Opposite of multiplying is dividing.
3 N = X (kg)
1.5 m/s² X = 2 kg