



Force & Motion

Name _____



MOTION STATIONS

Instructions: There are seven (7) stations in the classroom. Each station is an investigation on force and motion. There is a task card at each station with an explanation of the investigation. Read the task card carefully, and then do the activity.

Stay at the station until you are given the signal to move by your teacher.



STATION # 1 ~ VELOCITY

BACKGROUND INFORMATION. Speed is a way to describe motion. It describes how much time it takes to travel a distance.

Average Speed is calculated by dividing distance by time.

$$\text{Speed} = \text{distance} \div \text{time}$$

Distance can be calculated by multiplying speed and time

Velocity is speed AND direction. Velocity changes when speed changes, when direction changes, or both.

DATA:

Time to Walk 5 Meters (sec)					
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Time

My average speed is (show your calculations): _____

REMEMBER YOUR UNITS!



STATION # 2 ~ 1ST LAW OF MOTION – INERTIA

BACKGROUND INFORMATION: The **law of inertia** states that an object at rest tends to remain at rest and an object in motion tends to remain in motion (in a straight line) unless the object is acted upon by an unbalanced force.

For example - Inertia is experienced daily by passengers in cars. As the brakes are applied to the car, it slows down. However, by the law of inertia, the people continue to move forward in a straight line. Inertia is also experienced by an object that is NOT moving. The object will continue to remain stationary as long as there are no unbalanced forces acting upon it.

DATA:

Mass		Force needed to move the cart (N)
Cart		
Cart + 1 weight		
Cart + 2 weights		
Cart + 3 weights		

How does increasing mass affect the amount of force needed to put an object in motion?



STATION # 3 ~ 2ND LAW OF MOTION – MASS & ACCELERATION

BACKGROUND INFORMATION: The relationship of force and mass to acceleration is shown in Newton's second law, the **law of acceleration**. The law is shown as

$$\text{force} = \text{mass} \times \text{acceleration}$$

This means that *as the mass of an object increases, more force must be applied to the object to make the object move or to stop the object from moving.* It is the

reason why a car loaded with people accelerates more slowly than when it is nearly empty when the driver presses the gas pedal equally.

DATA:

# of Washers	Trial 1	Trial 2	Trial 3	Average Distance (cm)
0				
1				
2				
3				

How does increasing mass affect the motion of objects? Explain your answer **using data from your experiment.**



STATION # 4 ~ 3RD LAW OF MOTION – ACTION – REACTION

BACKGROUND INFORMATION: The **law of action and reaction** states that whenever an object exerts a force (action) on a second object, the second object exerts an *equal and opposite force* (reaction) on the first. For example, when a jet engine is started or when a rocket is fired, rapidly expanding gases exert a force on them while they exert equal but opposite forces on the gases. The gases move backward and the jet or rocket moves forward or upward.

DATA:

# of marbles pushed	#of marbles that move
1	
2	
3	
4	

What pattern do you see?



STATION # 5 ~ GRAVITY

BACKGROUND INFORMATION: One force that affects everything on Earth is **gravity**. Gravity is a force that acts at a distance and pulls objects toward each other. The amount of matter in an object is called its **mass**. The force of gravity depends on the amount of mass a body has. The **weight** of an object is the *measurement of the force of gravity on that object*. You weigh something on a scale, according to the force that the Earth pulls it down. So the weight is actually the force of gravity on that object.

If you drop an object, it will speed up because of acceleration due to gravity. Interestingly, mass does not have anything to do with acceleration due to gravity. *Heavy objects fall just as fast as lighter objects*. Air friction will slow some objects down, but if we didn't have any air, all objects would fall at the same speed.

DATA:

Time for Helicopter to Fall (sec)				
	Trial 1	Trial 2	Trial 3	Average
Helicopter				
Helicopter + 1 paper clip				
Helicopter + 2 paper clips				
Helicopter + 3 paper clips				

Did the mass of the paper helicopter make any significant difference in the time it took to fall? Why or why not?



STATION # 6 ~ MEASURING FORCE

BACKGROUND INFORMATION: Forces are pushes or pulls. If forces are **unbalanced**, they make objects move or stop moving.

Forces are measured in **Newtons (N)**.

A newton is the amount of force necessary to accelerate one kilogram of mass at a rate of one meter per second squared.

Weight is the downward force of gravity on an object. It is properly measured in newtons (N).

DATA:

WEIGHT (G)	FORCE NEEDED TO MOVE (N)

What relationship do you see between weight and force?



STATION # 7 ~ FRICTION

BACKGROUND INFORMATION: **Friction** is a force that resists the motion of an object. That means that friction slows objects down. Friction results from the close contact of two surfaces that are sliding across each other. When you slam on your brakes and your car skids to a stop with locked wheels, it is the force of friction that brings it to a stop. Friction resists the car's motion. Friction is caused by irregularities (bumps and holes) in the surface of objects that are touching.

DATA:

Force needed to lift block _____

Surface	Force needed to move block (N)

What is the relationship between the type of surface and the amount of force needed to move across the surface?

