8th grade Science STAAR Review

Objective 2: Force, Motion, & Energy

8.6.A demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion

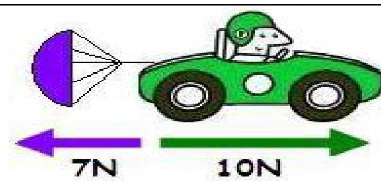
Force

A **Force** is a Push or a Pull that can change motion.

How Force is Measured

Newton - The SI unit used to measure force. The symbol for **Newton** is **N**.

Formula chart!

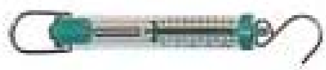


Net force= 3N to the right

Net Force= mass x acceleration

F = m x a

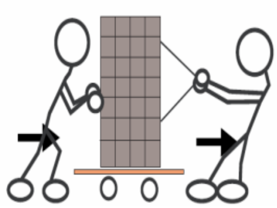
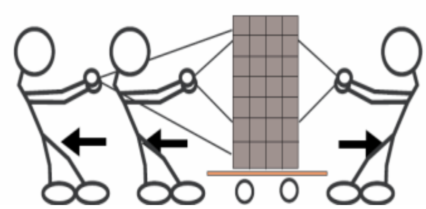
I am a roller skater with a mass of 72kg. If I am accelerating toward a wall at 3.7m/s^2, what will be the amount of force at which I hit the wall?



Spring Scale – Measures Force in Newtons (N).

Net Force

When more than one force acts on an object, the forces combine to form a **Net Force**. The combination of all the forces acting on an object is the **Net Force**.

Push 1 + Pull 1 = Net Force 2 to the right	Push 2 - Pull 1 = Net Force 1 to the left
 **Net Force** = 2 →	 **Net Force** = 1 ←
ADD forces in the same direction	**SUBTRACT forces in opposite directions.**

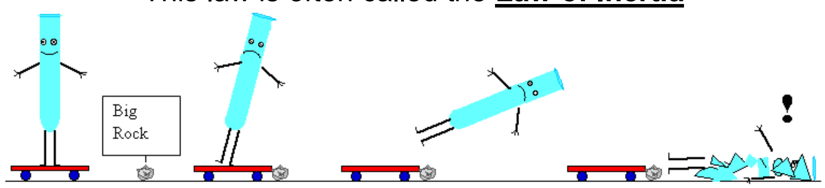
Magnitude is the size of a force.

8.6.C investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches

Newton's 1st Law

Newton's First Law: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

This law is often called the **Law of Inertia**



Examples of Newton's 1st Law:

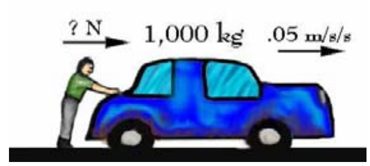
- Car suddenly stops and you strain against the seat belt (vehicle restraints) because our bodies want to keep moving
- When riding a horse, the horse suddenly stops and you fly over its head
- Ketchup stays in the bottom (at rest) until you bang (outside force) on the end of the bottom
- Can you think of another example?____

Newton's 2nd Law

Newton's Second Law: Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object). It can be measured by

F = M x A

This law is often called the **Law of Acceleration**



Calculate

____F____ = 1000 kg x 0.5 m/s/s

____F____ = ___500 N___

Examples of Newton's 2nd Law:

- Hitting a baseball- the harder the hit, the faster the ball goes accelerating
- A grocery cart filled with lots of food vs. an empty grocery cart
- The positioning of football players – massive players on the line with lighter (faster to accelerate) players in the backfield
- Can you think of another example? ____

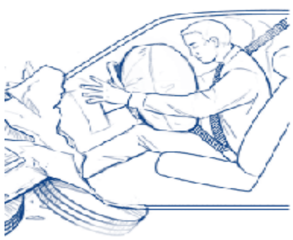
Newton's 3rd Law

Newton's Third Law: For every action there is an equal and opposite re-action. For every force there is a reaction force that is equal in size, but opposite in direction. This law is often called the **Law of Action-Reaction.**

Examples of Newton's 3rd Law:

- Momentum of the car moving forward and the car comes to a sudden stop, our body pushes against the seat (action) belt and the seat belt pushes back (reaction).
- When you lean on the wall to rest, the weight on the wall provides the reaction force and the wall pushes back on you (reaction force) with the same force.
- As the gases move downward, the rocket moves in the opposite direction.
- Can you think of another example?____

Use the Arrows to show Action and Reaction in the pictures below.

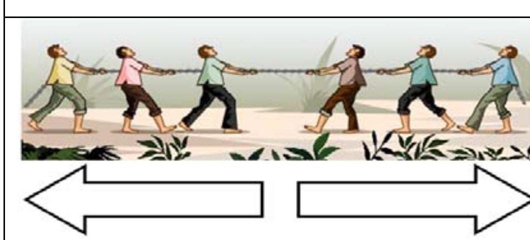

Sudden stop


Leaning on wall


Rocket lifting off

Forces may move an object	**Forces** may **transfer** between objects.
	

Types of Forces

Balanced – Forces that are equal in magnitude but opposite in direction. <u>Balanced forces do not cause a change in the motion of objects.</u>	**Unbalanced** - Force that cause a change in the motion of an object. One force must be larger than the other.
	

8.6.B differentiate between speed, velocity, and acceleration

Speed, Velocity & Acceleration

Speed is the rate used to measure the distance traveled over a period of time. 	**Velocity** is a measure of the speed in a <u>given direction.</u>  **Question: A green helicopter is moving up at 30 kilometers per hour. A blue helicopter is moving down at 30 kilometers per hour.** A. Are the helicopters' speeds the same? Explain. B. Are the velocities the same? Explain.

- **Acceleration** is the change of velocity over a period of time.
- If speed or direction changes, then you have acceleration.

In your own words, explain the differences between speed, velocity, and acceleration.

____

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7.7.A contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still

Work

Work is the amount of force applied times the distance over which it is applied. In order for work to occur or happen… THE OBJECT MUST MOVE IN THE DIRECTION OF THE FORCE APPLIED.

Work = Force x distance **W=f x d**

Formula chart!

Solve:

1. A force of 825 N is needed to push a car across a lot. Two student push the car 35 m . How much work is done?
2. You push against the wall for 3min with a force of 10 N. How much work is done? Explain.

Work or No Work?

 Leaning	 Pushing
Leaning on wall: Work or No Work? **Lifting barbell over your head: Work or No Work?**	**Pushing skateboard forward: Work or No Work?** **Standing in the rain: Work or No Work?**
 Lifting	 Standing

6.8.A compare and contrast potential and kinetic energy

Potential Energy

Forms of Energy	*Description of Energy*
Potential	Energy that is stored in an object.

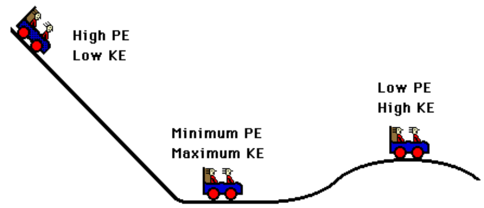
Example: The rubber band chicken. As the rubber band is stretched and placed in the hold position, the rubber band will store energy.

Kinetic Energy

Forms of Energy	*Description of Energy*
Kinetic	Energy of motion; Based on the mass and speed of the moving object.

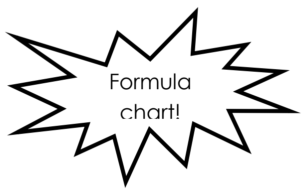
Example: The flying rubber band chicken. As the rubber band is released it becomes energy in motion.

Potential to Kinetic Energy



When the coaster is at its highest point on the track, it has it the greatest potential energy. As the coaster loses height it gains speed: PE is transformed into KE. As the coaster gains height it loses speed: KE is transformed into PE.

6.8.C calculate average speed using distance and time measurements



Average speed = $\frac{\text{distance}}{\text{time}}$

s = d/t

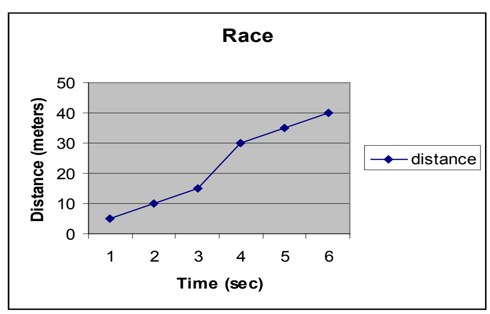
Solve:

1. You arrive in my class 45 seconds after leaving math which is 90 meters away. How fast did you travel?
2. You need to get to class, 200 meters away, and you can only walk in the hallways at about 1.5 m/s. (if you run any faster, you'll be caught for running). How much time will it take to get to your class?

6.8.D measure and graph changes in motion

Graphing Motion

Time (sec)	Distance (m)
1	5
2	10
3	15
4	30
5	35
6	40



Speed = $\frac{\text{distance}}{\text{time}}$ S = $\frac{d}{t}$

6.9.C demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy

Energy

Energy is the ability to do work.
Forms of Energy:

1. **Electrical**
2. **Chemical**
3. **Radiant/Solar**
4. **Nuclear**
5. **Mechanical**

Categories of Energy

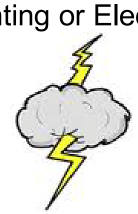
Potential	*Kinetic*
1. Chemical 2. Mechanical 3. Nuclear	1. Radiant / Sunlight 2. Thermal / Heat 3. Electrical 4. Sound 5. Mechanical

*** Mechanical Energy can be both potential and kinetic.**

Electrical Energy

Forms of Energy	*Description of Energy*
Electrical	Delivered by tiny charged particles called electrons, this form of energy is typically moved through a wire.

Example: Lighting or Electricity



Radiant Energy

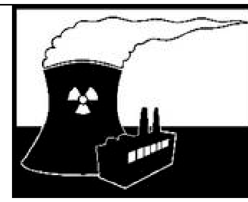
Forms of Energy	*Description of Energy*
Radiant / Solar	Energy that travels as light

Example: Sunshine 	<u>Solar Energy</u> – energy from the Sun only <u>Radiant Energy</u> – energy from all other light sources

Nuclear Energy

Forms of Energy	*Description of Energy*
Nuclear	Energy stored in the nucleus of an atom — the energy that holds the nucleus together.

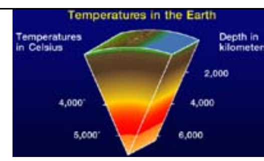
Example: Nuclear power plants split the nuclei of uranium atoms.



Thermal Energy

Forms of Energy	*Description of Energy*
Thermal / Heat	The vibration and movement of the atoms and molecules within substances. As an object is heated up, its atoms and molecules move and collide faster.

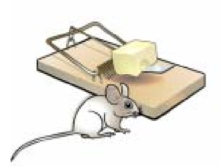
Example: Geothermal - heat from the earth.



Mechanical Energy

Forms of Energy	*Description of Energy*
Mechanical	Potential energy stored in objects by tension. Kinetic energy when machine parts are moving.

Example: Gears or compressed spring; moving parts



Sound Energy

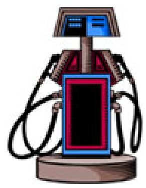
Forms of Energy	*Description of Energy*
Sound	The movement of energy through substances. Sound is produced when a force causes an object or substance to vibrate.

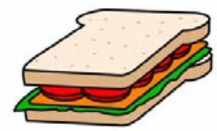
Example: Moving guitar strings

Chemical Energy

Forms of Energy	*Description of Energy*
Chemical	Energy stored within the bonds of atoms and molecules.

Example: Gasoline, Batteries, or Food





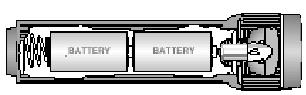
Energy Transformations

<u>Energy can change from one form to another.</u>

Example: Kinetic Energy can turn into potential energy and back again.

Chemical Energy can be used to create Electrical Energy and Electrical Energy can be used to create Heat Energy

Law of Conservation – Energy cannot be created or destroyed but can only change from one form to another.

<table>
<tr><th>Chemical - Electrical</th><th>Radiant - Chemical</th></tr>
<tr><td>


Batteries made of chemicals – Creates electricity to turn on the light bulb.
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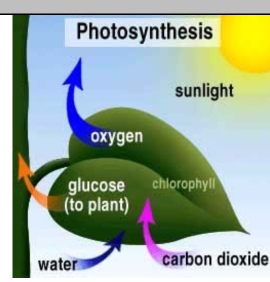

Sunlight – Photosynthesis produces glucose
</td></tr>
<tr><th>Nuclear – Electrical</th><th>Mechanical - Sound</th></tr>
<tr><td>

Nuclear Energy - Power Plant changes energy into electricity for homes
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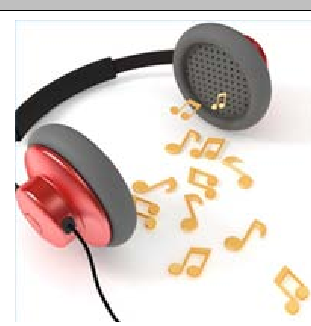
Speaker movement –Vibrations create sound
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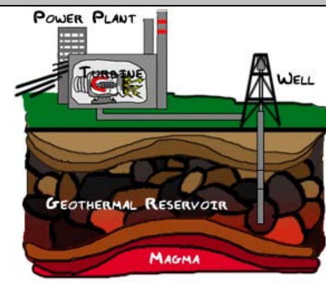
Energy Transformations

Chemical - Mechanical	Thermal – Electrical
 Gas – Engine turns blade to cut grass	 Heat from the Earth – Power Plant changes it to electricity for homes