

Physics for Kids

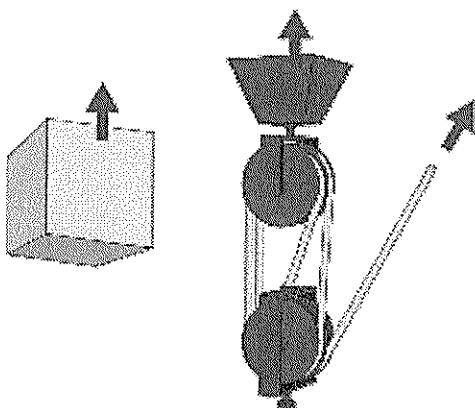
Force

What is force?

In physics, force is a push or pull on an object. A force can cause an object to accelerate, slow down, remain in place, or change shape.

How to Measure Force

The unit of measure for force is the newton which is abbreviated as "N". One newton is the force needed to accelerate one gram of mass by one centimeter per second squared. Other units of force include the dyne and the pound-force.



Examples of force

Force, Mass, and Acceleration

Force can be figured out if you know the mass and acceleration of an object. This equation comes from Newton's Second Law of Motion:

$$f = m * a$$

Where f = force, m = mass, and a = acceleration.

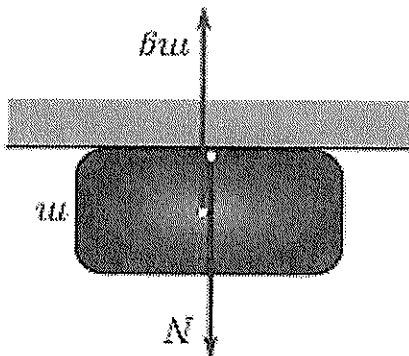
Forces and Vectors

Force not only has a magnitude (which is what we get in newtons when we use the equation above), but it also has a direction. This makes force a vector. Vectors are shown by an arrow that indicates the direction of the force and a number that indicates the magnitude. See the pictures to the right to see how the arrow is used to show the direction of the force.

Forces in Equilibrium

Sometimes there can be many forces acting on an object, but the object remains still. In this case the forces are in equilibrium. The sum of the forces, or the net force, is zero.

The picture below shows an object sitting on a table. The object isn't moving. This is because the force of gravity pulling the object down is equal and opposite to the force of the table pushing up. The net force is zero and the forces are in equilibrium.



Combined Forces

When multiple forces are acting on an object, the resultant force is the sum of the vectors of the individual forces. We won't get into complex vector math here, but take for example a tug of war. The two sides are each pulling. If one side is pulling with a force of 2 N in left direction and the other side is pulling with a force of 3 N in the right direction, then the resultant force is 1 N in the right direction.

Types of Forces

- Friction - Friction is a force caused when one object rubs against another. It works in the opposite direction of the main force.
- Gravity - Gravity is a force caused by a large body, such as the Earth. Gravity pulls objects toward the Earth with an acceleration of "g" which equals 9.8 m/s^2 .
- Electromagnetic - Electromagnetic force is a force associated with electric and magnetic fields.
- Nuclear - Nuclear forces are the forces that hold atoms and their particles together.
- Tension - A pulling force that is exerted by a string, cable, or chain on another object.
- Elastic - An elastic force is a force exerted by an object trying to return to its natural length. This is modeled by a spring that has been pulled by an external force, but is pulling back while trying to return to its original length.

Interesting Facts about Force

- An object that is accelerating in a circular motion experiences "centripetal" force.
- The four fundamental forces are gravity, electromagnetic force, the strong nuclear force, and the weak nuclear force.
- Torque is a type of force that measures changes in the rotational speed of an object. Torque is an important feature of automobiles, especially trucks.
- Drag is a force that decreases the velocity of an object. Thrust is a force that increases the velocity of an object.

Physics: Force

Test Quiz

Questions on this quiz are based on information from Physics: Force.

1) A force can cause an object to _____.

☐ Accelerate

☐ Slow down

☐ Remain in place

☐ Change shape

☐ All of the above

2) Which of the following is a unit of measurement for force?

☐ Liters

☐ Kilograms

☐ Newtons

☐ Kelvins

☐ Meters

3) Finish the formula: Force = Mass * _____

☐ Velocity

☐ Weight

☐ Acceleration

☐ Temperature

☐ Momentum

4) Because force is a vector measurement, it has both a magnitude and a _____.

☐ Direction

☐ Velocity

- ☐ Temperature
- ☐ Speed
- ☐ Volume

5) When the sum of the forces equals zero, the forces are said to be in _____.

- ☐ Tension
- ☐ Equilibrium
- ☐ Balance
- ☐ Combination
- ☐ Battle

6) What type of force is caused by a large body like the planet Earth?

- ☐ Friction
- ☐ Gravity
- ☐ Nuclear
- ☐ Tension
- ☐ Elastic

7) What type of forces hold atoms and their particles together?

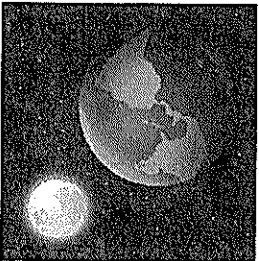
- ☐ Friction
- ☐ Gravity
- ☐ Nuclear
- ☐ Tension
- ☐ Elastic

8) What type of force is exerted by an object trying to return to its natural length?

- ☐ Friction
- ☐ Gravity
- ☐ Nuclear
- ☐ Tension
- ☐ Elastic

Physics for Kids

Gravity



What is gravity?

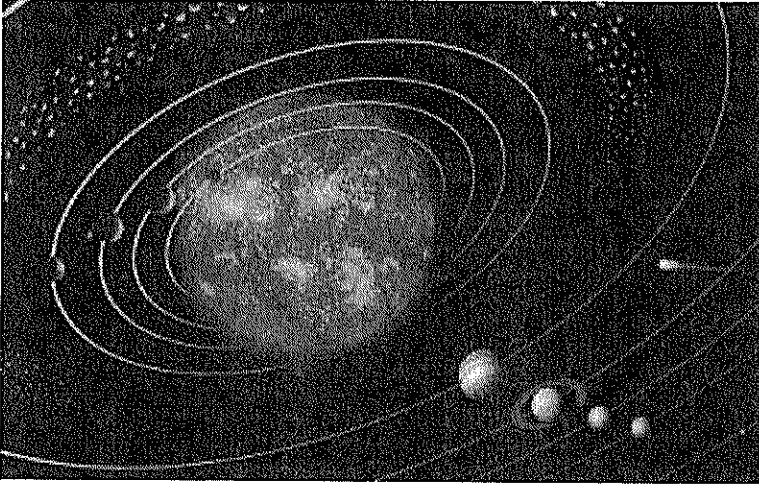
Gravity is the mysterious force that makes everything fall down towards the Earth. But what is it?

It turns out that all objects have gravity. It's just that some objects, like the Earth and the Sun, have a lot more gravity than others.

How much gravity an object has depends on how big it is. To be specific, how much mass it has. It also depends on how close you are to the object. The closer you are, the stronger the gravity.

Why is gravity important?

Gravity is very important to our everyday lives. Without Earth's gravity we would fly right off it. We'd all have to be strapped down. If you kicked a ball, it would fly off forever. While it might be fun to try for a few minutes, we certainly couldn't live without gravity.



Gravity also is important on a larger scale. It is the Sun's gravity that keeps the Earth in orbit around the Sun. Life on Earth needs the Sun's light and warmth to survive. Gravity helps the Earth to stay just the right distance from the Sun, so it's not too hot or too cold.

Who discovered gravity?

The first person who dropped something heavy on their toe knew something was going on, but gravity was first mathematically described by the scientist Isaac Newton. His theory is called *Newton's law of universal gravitation*. Later, Albert Einstein would make some improvements on this theory in his *theory of relativity*.

What is weight?

Weight is the force of gravity on an object. Our weight on Earth is how much force the Earth's gravity has on us and how hard it is pulling us toward the surface.

Do objects fall at the same speed?

Yes, this is called the equivalence principle. Objects of different masses will fall to the Earth at the same speed. If you take two balls of different masses to the top of a building and drop them, they will hit the ground at the same time. There is actually a specific acceleration that all objects fall at called a standard gravity, or "g". It equals 9.807 meters per second squared (m/s^2).

Fun facts about gravity

- Ocean tides are caused by the gravity of the moon.
- Mars is smaller and has less mass than Earth. As a result it has less gravity. If you weigh 100 pounds on Earth, you would weigh 38 pounds on Mars.
- The standard gravity from Earth is 1 g force. When riding a roller coaster you may feel a lot more g forces at times. Maybe as much as 4 or 5 g's. Fighter pilots or astronauts may feel even more.
- At some point when falling, the friction from the air will equal the force of gravity and the object will be at a constant speed. This is called the terminal velocity. For a sky diver this speed is around 122 miles per hour!

Physics: Gravity

Test Quiz

Questions on this quiz are based on information from Physics: Gravity.

- 1) How much gravity an object has depends on its _____.
- ☐ Weight
 - ☐ Speed
 - ☐ Momentum
 - ☐ Mass
 - ☐ Acceleration

- 2) Which of the following has the strongest gravitational pull?
- ☐ A bowling ball
 - ☐ A car
 - ☐ The Earth
 - ☐ The planet Mars
 - ☐ The Sun

- 3) When will gravity be the strongest?
- ☐ The further away you are from an object
 - ☐ The closer you are to an object
 - ☐ The faster your relative speed is to an object
 - ☐ All of the above
 - ☐ None of the Above

- 4) True or False: Gravity helps the Earth to stay in orbit around the Sun.
- ☐ TRUE
 - ☐ FALSE

5) What scientist is credited with first describing the mathematics of gravity?

- ☐ Thomas Edison
- ☐ Alexander Graham Bell
- ☐ Isaac Newton
- ☐ Bill Gates
- ☐ Leonardo da Vinci

6) What do we call the force of gravity on an object?

- ☐ Weight
- ☐ Mass
- ☐ Speed
- ☐ Acceleration
- ☐ Velocity

7) True or False: The more mass an object has, the faster it will fall.

- ☐ TRUE
- ☐ FALSE

8) What natural phenomena occurs on Earth due to the gravity of the Moon?

- ☐ Earthquakes
- ☐ Hurricanes
- ☐ Volcanic eruptions
- ☐ Thunder storms
- ☐ Ocean tides

9) Where would you weigh the most?

- ☐ Mars
- ☐ Pluto
- ☐ Earth
- ☐ The Sun
- ☐ The Moon

10) True or False: How much we weigh on Earth is a direct result of the force of the Earth's gravity.

- ☐ TRUE
- ☐ FALSE



Physics for Kids

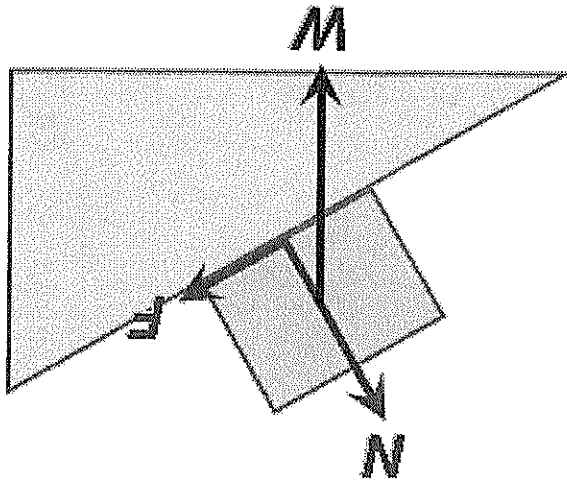
Friction

What is friction?

Friction is the resistance of motion when one object rubs against another. Anytime two objects rub against each other, they cause friction. Friction works against the motion and acts in the opposite direction.

Friction and Energy

When one object is sliding on another it starts to slow down due to friction. This means it loses energy. However, the energy doesn't disappear. It changes from moving energy (also call kinetic energy) to heat energy. This is why we rub our hands together when it's cold. By rubbing them together we generate friction and, therefore, heat.



The force F of friction pushes back on the block.

Preventing Friction

In some cases we want to prevent friction so it's easier to move. A good example of this is a ball or wheel. They roll to help reduce friction. Another way to reduce friction is with a lubricant like grease or oil. Machines and engines use grease and oil to reduce friction and wear so they can last longer.

Another way to reduce friction is to change the types of materials in contact with one another. For example, ice contacting with steel would produce less friction than rubber would on concrete. This is why ice skates slide so easily on the ice, but you don't slip when wearing rubber shoes on the sidewalk. These different materials are said to have different "coefficients of friction".

Using Friction

Friction is also a great help to us. After all, we would all just be sliding around everywhere if there wasn't friction to keep us steady. Friction is used in car brakes, when we walk or climb a hill, making a fire, skiing down a hill, and more.

Experiment with Friction

Different types of surfaces create different amounts of friction. Some materials are much smoother than others. Take three flat objects with different types of surfaces. Set them on one end of a tray and slowly lift it. The item with the least friction will start to slide first.

There are two main factors that will influence the total amount of friction: 1) the roughness of the surfaces (or the "coefficient of friction") and 2) the force between the two objects. In this example, the weight of the object combined with the angle of the tray will change the force between the two objects. Play around with different objects and see how these two factors change the friction.

Types of friction

- **Dry Friction** - This is what we've been mostly talking about here. Dry friction occurs when two solid objects touch each other. If they are not moving, it is called static friction. If they are moving, it is called kinetic or sliding friction.
- **Fluid Friction** - Fluid friction involves a fluid or air. The air resistance on an airplane or water resistance on a boat is fluid friction.
- **Rolling Friction** - Rolling friction occurs when a round surface rolls over a surface, like a ball or wheel.

Fun facts about Friction

- Although wheels are great for rolling and reducing friction, they couldn't work without friction.
- It would be really tough just to stand up without friction.
- Friction can generate static electricity.
- The harder two surfaces are pressed together, the more force it takes to overcome the friction and get them to slide.
- Fluid friction is used a lot in water parks so we can slide smoothly and fast down giant slides.

Physics: Friction

Test Quiz

Questions on this quiz are based on information from
Physics: Friction.

1) Friction is a force that acts in the _____ direction of the intended motion of an object.

☐ Same

☐ Parallel

☐ Opposite

☐ Northern

☐ None of the Above

2) Friction changes the energy of an object from kinetic energy to _____ energy.

☐ Electric

☐ Stored

☐ Solar

☐ Heat

☐ Wind

3) In what way can friction be reduced?

☐ Using grease

☐ Using a wheel

☐ Using oil

☐ Using a ball

☐ All of the above

4) True or False: Different types of surfaces create different amounts of friction.

☐ TRUE

FALSE



5) The measurement of the amount of friction a surface will generate is called the _____ of friction.

- ☐ Calibration
- ☐ Coefficient
- ☐ Smoothness
- ☐ Description
- ☐ Fact

6) A bowling ball on a bowling lane is an example of what type of friction?

- ☐ Dry friction
- ☐ Rolling friction
- ☐ Fluid friction
- ☐ Static Friction
- ☐ None of the Above

7) A child sliding down the slide at a park is an example of what type of friction?

- ☐ Dry friction
- ☐ Rolling friction
- ☐ Fluid friction
- ☐ Static Friction
- ☐ None of the Above

8) A block sitting still on the side of a ramp is an example of what type of friction?

- ☐ Dry friction
- ☐ Rolling friction
- ☐ Fluid friction

9) Air resistance on a flying airplane is an example of what type of friction?

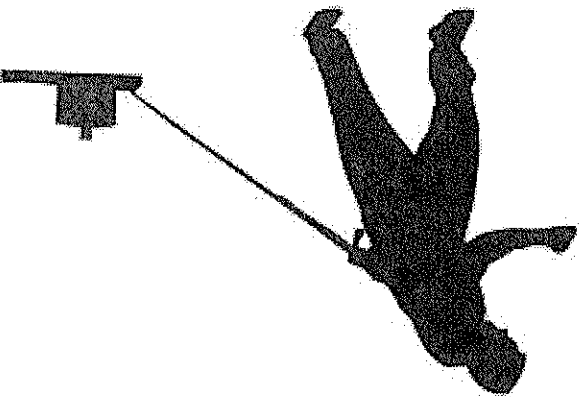
- ☐ Static Friction
- ☐ None of the Above

10) In what way does friction help us in our everyday life?

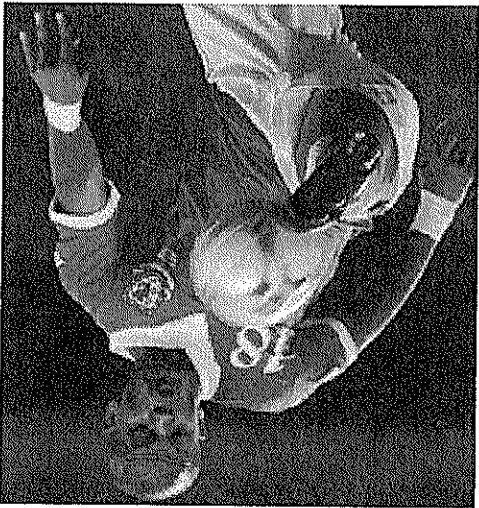
- ☐ Brakes on a car
- ☐ Standing up
- ☐ Climbing a hill
- ☐ Skiing down a slope
- ☐ All of the above

Physics for Kids

Laws of Motion



A force is anything that can change the state of motion of an object, like a push or a pull. You use force when you push a letter on the computer keyboard or when you kick a ball. Forces are everywhere. Gravity acts as a constant force on your body, keeping you secure on planet Earth so you don't float away.



To describe a force we use the direction and strength. For example when you kick a ball you are exerting force in a specific direction. That is the direction the ball will travel. Also, the harder you kick the ball the stronger the force you place on it and the farther it will go.

Laws of Motion

A scientist named Isaac Newton came up with three Laws of Motion to describe how things move scientifically. He also described how gravity works, which is an important force that affects everything.

First Law of Motion

The first law says that any object in motion will continue to move in the same direction and speed unless forces act on it.

That means if you kick a ball it will fly forever unless some sort of forces act on it! As strange as this may sound, it's true. When you kick a ball, forces start to act on it immediately. These

include resistance or friction from the air and gravity. Gravity pulls the ball down to the ground and the air resistance slows it down.

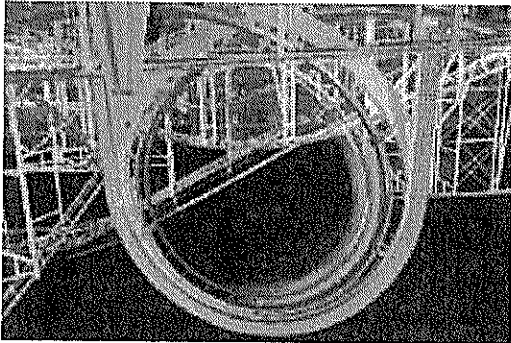
Second Law of Motion

The second law states that the greater the mass of an object, the more force it will take to accelerate the object. There is even an equation that says $\text{Force} = \text{mass} \times \text{acceleration}$ or $F=ma$.

This also means that the harder you kick a ball the farther it will go. This seems kind of obvious to us, but having an equation to figure out the math and science is very helpful to scientists.

Third Law of Motion

The third law states that for every action, there is an equal and opposite reaction. This means that there are always two forces that are the same. In the example where you kicked the ball there is the force of your foot on the ball, but there is also the same amount of force that the ball puts on your foot. This force is in the exact opposite direction.



Fun facts about Forces and Motion

- It is said that Isaac Newton got the idea for gravity when an apple fell off a tree and hit him on the head.
- Forces are measured in Newtons. This is after Isaac Newton, not fig newtons, even if they are tasty.
- Gases and liquids push out in equal forces in all directions. This is called Pascal's Law because it was discovered by the scientist Blaise Pascal.
- When you go upside down in a roller coaster loop-the-loop, a special kind of force called "centripetal force" keeps you in your seat and from falling out.

Physics: Laws of Motion

Test Quiz

Questions on this quiz are based on information from
Physics: Laws of Motion.

- 1) A _____ is anything that can change the state of motion of an object.
- ☐ Mass
 - ☐ Force
 - ☐ Weight
 - ☐ Velocity
 - ☐ Temperature

2) What scientist came up with the Three Laws of Motion?

- ☐ Thomas Edison
- ☐ Alexander Graham Bell
- ☐ Isaac Newton
- ☐ Bill Gates
- ☐ Leonardo da Vinci

3) Which of the following is an example of a force in physics?

- ☐ Gravity
- ☐ Kicking a ball
- ☐ Pushing a key on a keyboard
- ☐ All of the above
- ☐ None of the Above

4) Which of the following is the First Law of Motion?

- ☐ The greater the mass of an object, the more force it will take to accelerate the object
- ☐ Any object in motion will continue to move in the same direction and speed unless forces act on it

☐ For every action, there is an equal and opposite reaction



5) Which of the following is the Second Law of Motion?



☐ The greater the mass of an object, the more force it will take to accelerate the object

☐ Any object in motion will continue to move in the same direction and speed unless forces act on it



☐ For every action, there is an equal and opposite reaction



6) Which of the following is the Third Law of Motion?



☐ The greater the mass of an object, the more force it will take to accelerate the object

☐ Any object in motion will continue to move in the same direction and speed unless forces act on it



☐ For every action, there is an equal and opposite reaction



7) Which law of motion says that the harder you kick a ball, the farther it will go?



☐ Second Law of Motion



☐ Third Law of Motion



8) Which law of motion says that when you kick a ball, there is an equal force on your foot as there is on the ball?



☐ First Law of Motion



☐ Second Law of Motion



☐ Third Law of Motion



9) Which law of motion says that a kicked ball would fly forever if it wasn't for forces like air friction and gravity?



First Law of Motion



Second Law of Motion



Third Law of Motion



10) What is the unit of measurement used in physics for force?



Liters



Kilograms



Meters



Kelvins



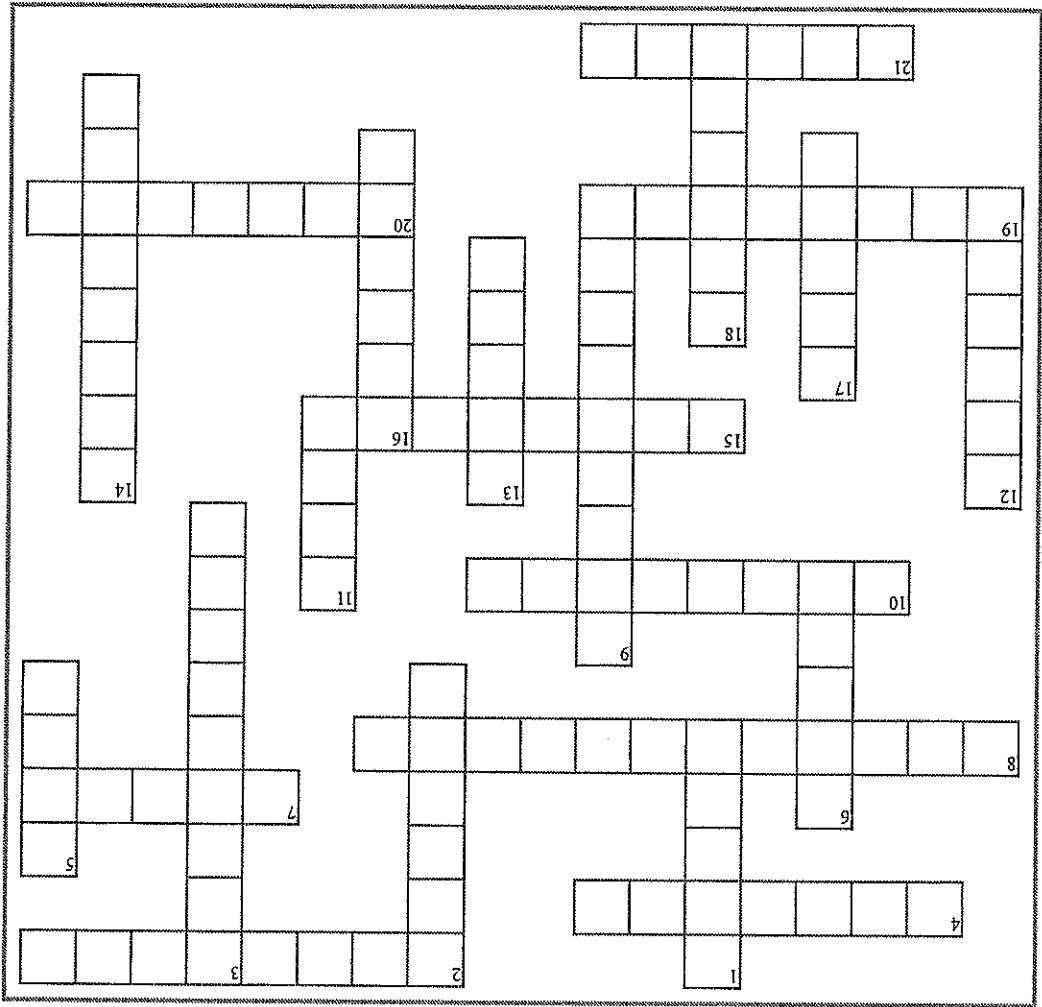
Newtons

Crossword Puzzle

Interactive version

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Physics - Motion



Across

Down

1. Simple machine that includes knives, chisels, and axes
2. A property that has both a magnitude and a direction
3. When two objects bump into each other
4. Forces that hold atoms together
5. Inclined _____ simple machine
6. The change in an object's velocity
7. The force when one object rubs against another
8. Simple _____, for example lever, wheel and axle, pulley, wedge, screw
9. For every action, there is an equal and opposite _____

1. Simple machine that includes knives, chisels, and axes
2. A property that has both a magnitude and a direction
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6. The change in an object's velocity
7. The force when one object rubs against another
8. Simple _____, for example lever, wheel and axle, pulley, wedge, screw
9. For every action, there is an equal and opposite _____

20. A force that keeps us on planet Earth
21. Isaac _____ discovered gravity

11. A measurement of the matter contained
in an object
12. A measurement of only magnitude, not
direction
13. _____ law of motion, any object in motion
will continue to move in the same
direction unless an external force acts
on it
14. The measurement of mass in motion
16. Kinetic and potential
17. Mass times acceleration
18. The measure of the force of gravity on
an object

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Physics of Motion

Find the words listed inside the word search puzzle. Go here for the online version.

Velocity solve	S	O	H	Q	N	M	I	O	W	V	P	D	F	R	Y	L	S	W
Newton solve	P	J	Y	E	B	A	E	L	F	A	W	N	F	S	T	P	E	B
Acceleration solve	P	M	W	I	B	C	S	M	D	I	P	O	I	M	E	P	Q	R
Gravity solve	S	B	E	U	T	H	L	Z	L	I	E	I	A	E	R	M	T	E
Impulse solve	Y	L	I	Z	U	I	U	N	F	M	B	T	D	V	B	O	N	W
Friction solve	N	H	G	G	N	N	P	O	G	U	O	C	T	X	G	T	W	O
Energy solve	S	U	H	N	U	E	M	I	N	T	M	I	M	H	K	I	K	P
Momentum solve	Q	J	T	W	M	S	I	T	P	N	A	R	V	R	W	O	X	P
Three Laws solve	Q	V	U	S	X	T	Y	A	N	E	S	F	O	P	T	N	T	R
Speed solve	A	R	B	W	T	Q	T	R	L	M	S	W	F	E	V	Y	B	E
Work solve	V	A	M	A	Z	M	I	E	T	O	G	O	P	E	Q	T	B	S
Vector solve	I	L	N	L	U	N	V	L	O	M	R	X	C	A	N	I	D	S
Scalar solve	N	A	C	E	B	J	A	E	N	C	S	T	U	X	E	C	G	U
Power solve	E	C	D	E	T	L	R	C	E	K	O	P	W	V	V	O	A	R
Force solve	W	S	R	R	F	D	G	C	O	R	P	D	G	Z	C	L	N	E
Pressure solve	T	Z	K	H	G	Y	W	A	B	D	Y	G	R	E	N	E	W	K
Mass solve	O	D	L	T	P	C	Q	E	G	I	N	R	T	K	I	V	S	B
Machines solve	N	H	N	P	G	R	P	S	V	Y	N	U	R	H	Z	C	K	Z

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Physics for Kids

Potential Energy

What is potential energy?

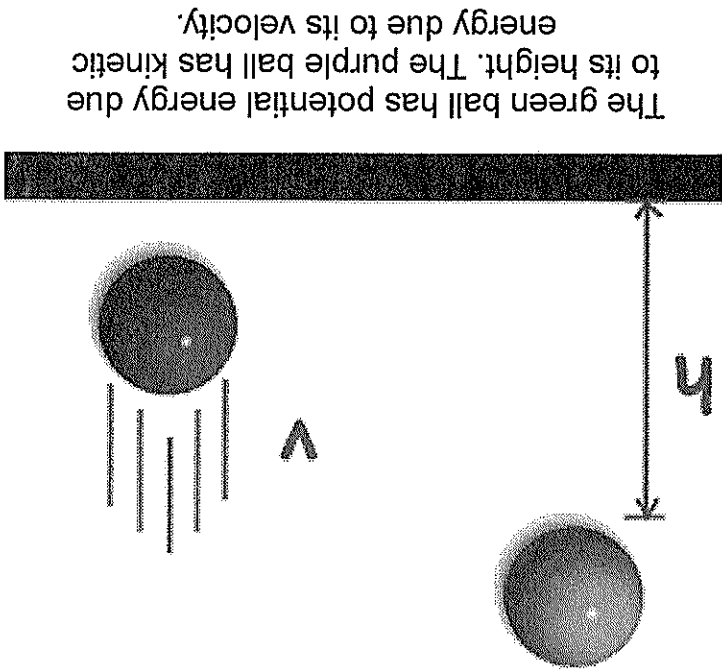
Potential energy is the stored energy an object has because of its position or state. A bicycle on top of a hill, a book held over your head, and a stretched spring all have potential energy.

How to Measure Potential Energy

The standard unit for measuring potential energy is the joule, which is abbreviated as "J."

How is it different from kinetic energy?

Potential energy is stored energy while kinetic energy is the energy of motion. When potential energy is used it is converted into kinetic energy. You can think of potential energy as kinetic energy waiting to happen.



A Car on a Hill

We can compare potential and kinetic energy by considering a car on a hill. When the car is at the top of the hill it has the most potential energy. If it is sitting still, it has no kinetic energy. As the car begins to roll down the hill, it loses potential energy, but gains kinetic energy. The potential energy of the car at the top of the hill is getting converted into kinetic energy.

Gravitational Potential Energy

One type of potential energy comes from the Earth's gravity. This is called gravitational potential energy (GPE). Gravitational potential energy is the energy stored in an object based on its height and mass. To calculate the gravitational potential energy we use the following equation:

$$\text{GPE} = \text{mass} * g * \text{height}$$

$$\text{GPE} = m * g * h$$

Where "g" is the standard acceleration of gravity which equals 9.8 m/s^2 . The height is determined based on the height the object could potentially fall. The height may be the distance above the ground or perhaps the lab table we are working on.

Example problems:

What is the potential energy of a 2 kg rock sitting at the top of a 10 meter high cliff?

$$\text{GPE} = \text{mass} * g * \text{height}$$

$$\text{GPE} = 2\text{kg} * 9.8 \text{ m/s}^2 * 10\text{m}$$

$$\text{GPE} = 196 \text{ J}$$

Potential Energy and Work

The potential energy is equal to the amount of work done to get an object into its position. For example, if you were to lift a book off the floor and place it on a table. The potential energy of the book on the table will equal the amount of work it took to move the book from the floor to the table.

Other Types of Potential Energy

- Elastic - Elastic potential energy is stored when materials stretch or compress. Examples of elastic potential energy include springs, rubber bands, and slingshots.
- Electric - Electric potential energy is the capacity for doing work based on the object's electric charge.
- Nuclear - The potential energy of the particles inside an atom.
- Chemical - Chemical potential energy is the energy stored up in substances due to their chemical bonds. One example of this is the energy stored in gasoline for a car.

Interesting Facts about Potential Energy

- Scottish scientist William Rankine first coined the term potential energy in the 19th century.
- The equation for calculating the potential energy of a spring is $\text{PE} = 1/2 * k * x^2$, where k is the spring constant and x is the amount of compression.
- The concept of potential energy goes all the way back to Ancient Greece and the philosopher Aristotle.

Physics: Potential Energy

Test Quiz

Questions on this quiz are based on information from
Physics: Potential Energy.

1) Potential energy is the energy an object has due to its _____.

☐ Position

☐ Weight

☐ Mass

☐ Gravity

☐ Motion

2) What is the standard unit of measurement for potential energy?

☐ Ampere

☐ Volt

☐ Newton

☐ Joule

☐ Watt

3) Kinetic energy is the energy an object has due to its _____.

☐ Position

☐ Weight

☐ Mass

☐ Gravity

☐ Motion

4) Where does a car on a hill have the most potential energy?

☐ Top of the hill

☐ Bottom of the hill

Half way down the hill

It has the same potential energy at all points

5) Gravitational potential energy is the potential energy of an object based on its

Weight and velocity

Height and acceleration

Height and mass

Mass and speed

Speed and height

6) Which of the following formulas is used to find gravitational potential energy?

$GPE = m \cdot g/h$

$GPE = 1/2 \cdot m \cdot h^2$

$GPE = w \cdot g \cdot v$

$GPE = m \cdot g \cdot h$

$GPE = m/g \cdot 1/2 \cdot h^2$

7) What is the gravitational potential energy of a 1 kg ball that is 2 meters above the floor?

3 J

9.8 J

19.6 J

21 J

29.8 J

8) What is the gravitational potential energy of a 3 kg ball that is 1 meter above the floor?

3 J

9.8 J

19.6 J

9) If a red ball is higher than a blue ball and both balls have the same mass, which ball has more potential energy?

☐ 21 J

☐ 29.4 J

☐ Red ball

☐ Blue ball

☐ They both have the same potential energy

10) If a 2 kg rock has 196 J of gravitational potential energy, how high is it?

☐ 1 meter

☐ 2 meters

☐ 5 meters

☐ 10 meters

☐ 20 meters

Physics for Kids

Kinetic Energy

What is kinetic energy?

Kinetic energy is the energy an object has due to its motion. As long as an object is moving at the same velocity, it will maintain the same kinetic energy.

The kinetic energy of an object is calculated from the velocity and the mass of the object. As you can see from the equation below, the velocity is squared and can have a significant impact on the kinetic energy.

Here is the equation for calculating kinetic energy (KE):

$$KE = 1/2 * m * v^2$$

where m = mass and v = velocity

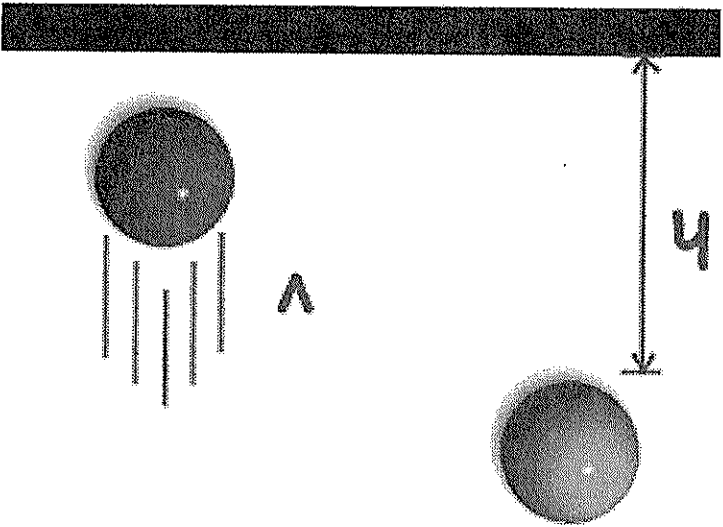
How to Measure Kinetic Energy

The standard unit for kinetic energy is the joule (J). The joule is the standard unit for energy in general. Other units for energy include the newton-meter (Nm) and the kilogram meter squared over seconds squared ($\text{kg m}^2/\text{s}^2$).

Kinetic energy is a scalar quantity, which means it only has a magnitude and not a direction. It is not a vector.

How is it different from potential energy?

Kinetic energy is due to an object's motion while potential energy is due to an object's position or state. When you calculate an object's kinetic energy, its velocity is an important factor. Velocity, however, has nothing to do with an object's potential energy.



The green ball has potential energy due to its height. The purple ball has kinetic energy due to its velocity.

Example Using A Roller Coaster

One way to think of potential and kinetic energy is to picture a car on a roller coaster. As the car travels up the coaster it is gaining potential energy. It has the most potential energy at the top of the coaster. As the car travels down the coaster, it gains speed and kinetic energy. At the same time it is gaining kinetic energy, it is losing potential energy. At the bottom of the coaster the car has the most speed and the most kinetic energy, but also the least potential energy.

Example problems:

1. A car and a bicycle are traveling at the same speed, which has the most kinetic energy?
The car does because it has more mass.

2. A ball weighs around 1 kg and is traveling at 20 meters per second, what is its kinetic energy?

$$KE = \frac{1}{2} * m * v^2$$
$$KE = \frac{1}{2} * 1kg * (20 \text{ m/s})^2$$
$$KE = 200 \text{ J}$$

3. A boy weighs 50 kg and is running 3 meters per second, what is his kinetic energy?

$$KE = \frac{1}{2} * m * v^2$$
$$KE = \frac{1}{2} * 50 \text{ kg} * (3 \text{ m/s})^2$$
$$KE = 225 \text{ J}$$

Interesting Facts about Kinetic Energy

- If you double the mass of an object, you double the kinetic energy.
- If you double the speed of an object, the kinetic energy increases by four times.
- The word "kinetic" comes from the Greek word "kinesis" which means motion.
- Kinetic energy can be passed from one object to another in the form of a collision.
- The term "kinetic energy" was first coined by mathematician and physicist Lord Kelvin.

Physics: Kinetic Energy

Test Quiz

Questions on this quiz are based on information from
Physics: Kinetic Energy.

1) Kinetic energy is the energy an object has due to its _____.

Position

Weight

Mass

Gravity

Motion

2) Kinetic energy can be calculated from what two measurements?

Mass and power

Velocity and mass

Acceleration and weight

Speed and momentum

Acceleration and velocity

3) What is the standard unit of measurement for kinetic energy?

Ampere

Volt

Newton

Joule

Watt

4) Potential energy is the energy an object has due to its _____.

Position

Weight

5) True or False: Kinetic energy is a vector measurement because it has both a magnitude and direction.

- ☐ Mass
- ☐ Gravity
- ☐ Motion

☐ TRUE

☐ FALSE

6) Where would a car traveling on a roller coaster have the most potential energy?

- ☐ At the bottom
- ☐ Halfway to the top
- ☐ At the top
- ☐ Halfway to the bottom
- ☐ It is always the same

7) What would happen to the kinetic energy of an object if you doubled the mass?

- ☐ The kinetic energy would be cut in half
- ☐ The kinetic energy would double
- ☐ The kinetic energy would triple
- ☐ It would stay the same

8) If a plane was traveling at the same velocity as a bird, which would have the most kinetic energy (assuming the plane has more mass)?

- ☐ Plane
- ☐ Bird
- ☐ They have the same amount of kinetic energy