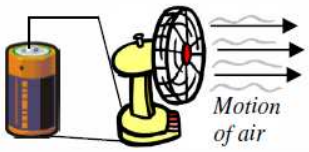
Name: _____

Period: _____

Energy

Energy

A battery stores energy in the form of chemicals.



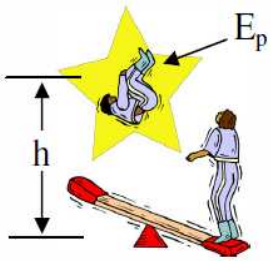
Motion of air

When connected to a motor the battery can create magnetic forces, causing the motor to move.

Something with more energy can create bigger forces. Something with more energy can make another object move more by hitting it.

Potential Energy (E_p)

Something above the ground has energy because when released it will cause motion: it will fall thru the air. Also, after falling it could hit another object, exerting a force and causing the other object to move.



An acrobat with potential energy can exert a force on the lever and make the other acrobat move.

Potential Energy (*in Joules*) → $E_p = mgh$

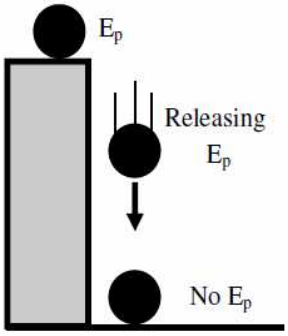
- m: mass (*in kilograms*)
- h: height (*in meters*)
- g: acceleration due to gravity (*9.8 m/s²*)

Potential energy equals mass times gravity times height.

Ex: A 4 kg object is 5 meters off the ground. How much potential energy does the object have?

m = 4 kg h = 5 m g = 10 m/s² E_p = _____	$E_p = mgh$ = (4)(10)(5) = (40)(5) E_p = 200 Joules

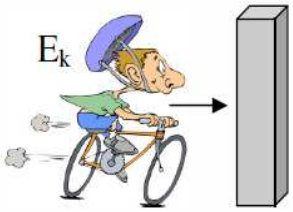
An object with potential energy has the *potential* to fall and release its energy.



Kinetic Energy (E_k)

Kinetic energy is energy of motion. An object must be moving to have kinetic energy.

A moving object has energy because it can exert a force on something it hits, causing the other object to move.



When the biker hits the wall, kinetic energy from the bike exerts a force on the wall, making the wall move backwards.

Kinetic Energy (*in Joules*) → $E_k = (\frac{1}{2})mv^2$

- m: mass (*in kilograms*)
- v: velocity (in *m/s*)

Kinetic energy equals one-half times mass times velocity squared.

Ex: A 10 kg object is traveling 3 m/s. How much kinetic energy does it have?

m = 10 kg v = 3 m/s E_k = _____	$E_k = \frac{1}{2}mv^2$ $E_k = \frac{1}{2}(10)(3)^2$ = (5)(9) = 45 Joules

The math.

v^2 means v times v.

Ex. $3^2 = 3x3 = 9$

To remove a square, use a square root.

If $v^2 = 25$

then $v = \sqrt{25}$

and v = 5 m/s

Types of Energy

There are many times of energy. All of them can create forces and motion. Often there are multiple types of energy present. Energy can be converted from one type to another.

Thermal Energy—Heat energy. A product of most other forms of energy. Can be created by friction.

Mechanical Energy—Any kind of Kinetic or Potential Energy. Includes Elastic Potential Energy due to springs.

Chemical Energy—Stored in chemical bonds; transferred during by chemical reactions. Includes energy in food, plants, and batteries (which produce electricity by combining chemicals).

Electrical Energy—Energy of moving electrons: lightening, static electricity, electric current (electricity).

Radiant Energy—Light energy. Electromagnetic radiation from light bulbs or the sun (renewable solar energy).

Nuclear Energy—Energy from nuclear reactions (radiation): fission (splitting the atom in nuclear reactors), or fusion (combining atoms in the sun); makes huge amounts of energy, but also long-term, radioactive waste.

1. Kinetic Energy	A. The units for energy.
2. Potential Energy	B. The ability to create forces or motion.
3. Energy	C. Energy because of an object's motion.
4. Height	D. Energy because of an object's position above the ground due to gravity.
5. Joules	E. Vertical distance above the ground.

How can you ***prove*** that something has energy?

Potential (E_p) or Kinetic (E_k) Energy

___ A car is traveling 45 mph.

___ A rock is on a ledge 5 meters high.

___ A car is resting at the top of a hill.

___ A ball is thrown into the air and is still moving.

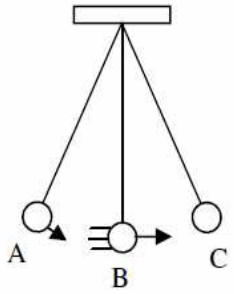
___ A ball rolling on the ground.

What kind of energy does the pendulum have in each of its positions?

A)

B)

C)



What kind of Energy?
Thermal; Nuclear; Radiant; Mechanical; Chemical; Electrical

___ A ball on top of a hill.

___ Gasoline.

___ Used to run a clock.

___ A hot stove.

___ Uranium in reactors.

___ Stored in food.

____Given off by the sun.

____A car going 50 mph.

____Heat from a fire.

____Light from a match.

____Stored in plants.

____Powers photosynthesis.

Give all the types of energy in a camp fire.

Give all the types of energy in a light bulb.

Give all the types of energy when a bullet is fired.

1. Thermal	A. Energy of the atom being split or fused.
2. Nuclear	B. Energy of moving electrons.
3. Radiant	C. Heat energy. Also caused by friction.
4. Mechanical	D. Light energy—electromagnetic radiation.
5. Chemical	E. Energy (kinetic or potential) stored in object and can do work.
6. Electrical	F. Energy of molecular bonds.

Circle the one with more Potential Energy

A 25 kg mass or a 30 kg mass at the top of a hill?

A car at the top of the hill or the bottom of a hill?

A plane on the ground or a plane in the air?

A full plane or an empty plane (both are flying)?

Circle the one with more Kinetic Energy

A 25 kg mass or a 30 kg mass going 5 m/s.

Two 10 kg masses, one going 75 m/s, one going 45 m/s.

A car at rest or a car rolling down a hill.

A heavy bike or a light bike.

A 4 kg rock is rolling 10 m/s. Find its kinetic energy.

Calculate the potential energy of a 10 kg rock at the top of a 6 m tall table.

A 8 kg cat is running 4 m/s. Find the cat's kinetic energy.

Find the potential energy of a 2 kg ball 15 m in the air.

A rolling ball going 3 m/s has 18 joules of kinetic energy. Find its mass.

A box is 4 m in the air and has 120 J of potential energy. What is the box's mass.

A 4 kg bird has 8 joules of kinetic energy. How fast is it flying?