Thank you!

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I hope this listing helps you and your students! ☺

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If you have any questions, feel free to email me at:
bcsfamily@gmail.com

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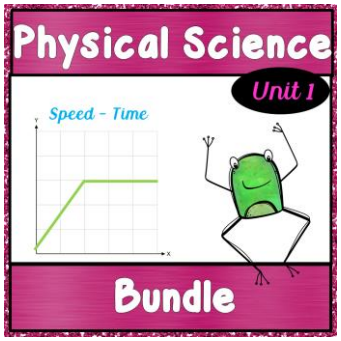

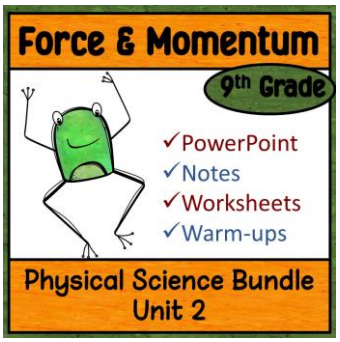

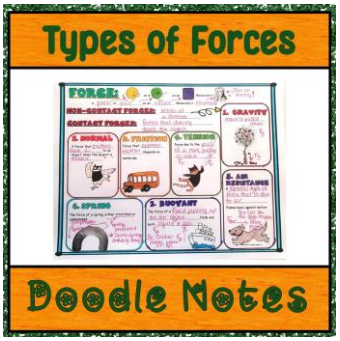

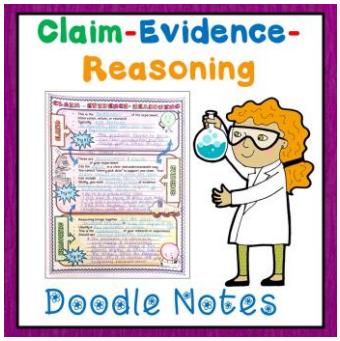

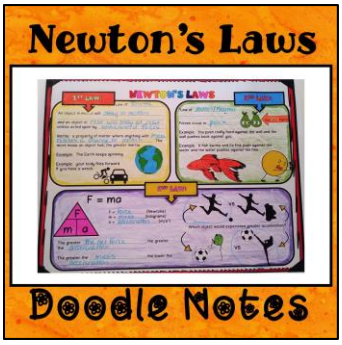

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Delzer's Dynamite Designs

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Work, Energy, and Power Unit
Objectives

Estimated Time: 10 days

1) I can identify 9 types of energy.
2) I can describe and calculate potential energy.
3) I can describe and calculate kinetic energy.
4) I can describe the conservation of energy and I can describe energy transfers between any of the 9 energy types.
5) I can describe and calculate the transformation of potential and kinetic energy (total mechanical energy) in a frictionless system.
6) I can describe and calculate work.
7) I can describe and calculate power.

NGSS

HS-PS3-2 Energy Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

Texas TEKS

(5) Science concepts. The student recognizes multiple forms of energy and knows the impact of energy transfer and energy conservation in everyday life. The student is expected to:
A) recognize and demonstrate that objects and substances in motion have kinetic energy such as vibration of atoms, water flowing down a stream moving pebbles, and bowling balls knocking down pins;
(B) recognize and demonstrate common forms of potential energy, including gravitational, elastic, and chemical, such as a ball on an inclined plane, springs, and batteries;
(D) investigate the law of conservation of energy;

Virginia SOL

PS.6 The student will investigate and understand forms of energy and how energy is transferred and transformed. Key concepts include potential and kinetic energy; and mechanical, chemical, electrical, thermal, radiant, and nuclear energy.
PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include physical changes; chemical changes; and nuclear reactions.

Work, Energy, and Power Unit
Unit Vocabulary

Biomass
Chemical Energy
Elastic Potential Energy
Electrical Energy
Electromagnetic Spectrum
Fission
Fusion
Gravitational Potential Energy
Kinetic energy
Law of Conservation of Energy
Mechanical energy
Nuclear Energy
Potential Energy
Radiant Energy
Sound
Thermal Energy

Name: _____ Date: _____

Period: _____

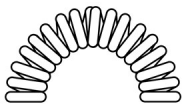
Work, Energy, and Power Unit
Notes

I) I can identify 9 types of energy.

Energy: the ability to cause motion (or stop motion) and create forces. Measured in Joules.

Chemical: Energy stored in chemical bonds or energy that is released or absorbed during chemical reactions.

Examples: energy stored in food, batteries, plants, biomass, petroleum, and natural gas.

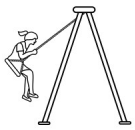


Elastic energy: energy from distortion of an object. Energy is stored when the object is compressed or stretched. The energy is released when the object returns to its normal shape.

Examples: springs, trampolines, a bow (archery), bent diving board

Electrical Energy: energy from movement of electrons.

Examples: lightening, static electricity, current electricity

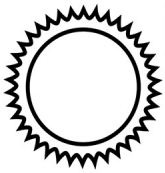


Gravitational Energy: Energy due to position. Based on height and mass.

Examples: lifting any object so that it can fall back to Earth. Such as roller coasters, or a boulder resting on a cliff.

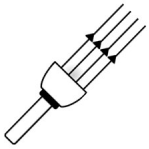
Mechanical Energy: any kind of potential or kinetic energy.

Examples: any movement such as cars, roller coasters, and walking. It also includes energy due to position such as boulders on a hill.



Nuclear Energy: energy from an atoms nucleus decaying, undergoing fission, or fusion. Drawback: Fission and fusion make radioactive waste.

Examples: Fission is splitting of an atom and is the type of atomic bomb dropped on Hiroshima and Nagasaki. Fusion is atoms smashing together to form new elements and is what happens in the sun.



Radiant Energy: light energy. Energy from the entire electromagnetic spectrum. This is energy that can travel in a vacuum such as space.

Examples: radio waves, tv waves, microwaves, ultraviolet light, visible light, gamma waves, x-rays, and infrared.

Sound: energy that comes from a vibrating source and moves through matter (it cannot move in space). It moves through solids, liquids, and gases.

Thermal Energy: the energy from vibrating atoms and molecules. All matter is constantly moving except at absolute zero (-273 °C). Friction causes thermal energy as well.

Examples: the hotter something is, the greater the movement of molecules.

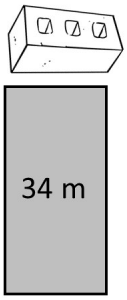
2) I can describe and calculate potential energy.

Potential Energy: This is energy due to position above ground. The potential energy is greater the higher it is, and the more mass the object has.

$$PE = mgh$$

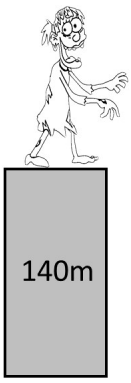
PE = potential energy in Joules (J)
m = mass in kilograms (kg)
g = acceleration due to gravity (9.8 m/s^2)
h = height in meters (m)

Example 1: A cinderblock is teetering on top of a building that is 34 meters high. If the cinder block has a mass of 16 kg, find its potential energy.

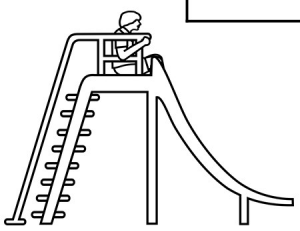


Define Variables	Write equation and show work	Answer w/ units
PE = m = g = h =		

Example 2: What is the mass of a zombie that is perched on top of a cliff that is 140 meters high and has potential energy of 96,000 J?



Define Variables	Write equation and show work	Answer w/ units
PE = m = g = h =		



Example 3: What is the height of the slide if a 38 kg kid has 560 J of potential energy at the top of the slide?

Define Variables	Write equation and show work	Answer w/ units
PE = m = g = h =		

3) I can describe and calculate kinetic energy.

Kinetic energy: the energy of motion. The object must be moving to have kinetic energy. It is dependent upon the mass of the object and the magnitude of the velocity.

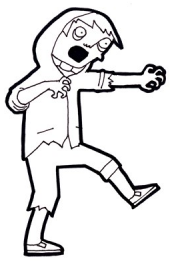
$$KE = \frac{1}{2} mv^2$$

KE = kinetic energy in Joules (J)
m = mass in kilograms
v = velocity in m/s

Example 1: What is the kinetic energy of a car if it has a mass of 1,100 kilograms and is moving at 35 m/s?

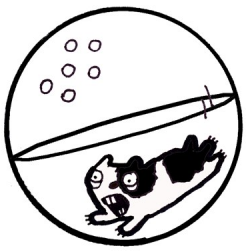
Define Variables	Write equation and show work	Answer w/ units
KE = m = v =		

Example 2: A zombie runs by at 12 m/s and has 8200 Joules of kinetic energy. What is the zombie's mass?



Define Variables	Write equation and show work	Answer w/ units
KE = m = v =		

Example 3: A zombie in a hamster ball goes rolling by. (don't ask questions. We don't know why). What is the velocity of the zombie hamster if it has a mass of 0.5 kg and 200 Joules of kinetic energy.



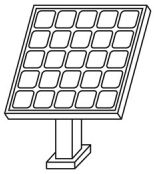
Define Variables	Write equation and show work	Answer w/ units
KE = m = v =		

4) I can describe the conservation of energy and I can describe energy transfers between any of the 9 energy types.

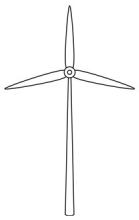
Conservation of Energy: energy is neither created nor destroyed. It is converted from one form to another.

You can describe the flow of energy between the types of energy.

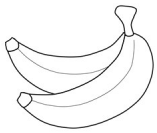
Example 1: Describe the energy transformations that happen with a solar panel.

Radiant energy →  → Electrical energy

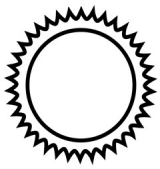
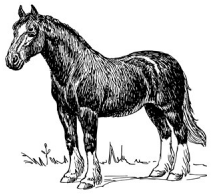
Example 2: Describe the energy transformations that happen with a wind turbine.

Mechanical energy of wind →  → Causes the mechanical energy of the spin → Electrical energy

Example 3: Describe the energy transformations of a person that eats a banana and goes on a run.

_____ →  → _____  → _____

Example 4: Energy starts in the sun and is transmitted to an apple that is eaten by a horse.

 → _____  → 

_____ _____

Example 5:. A car is filled with gasoline and races off. The car honks its horn and creates friction with the road.

 →  →  + friction w/ road

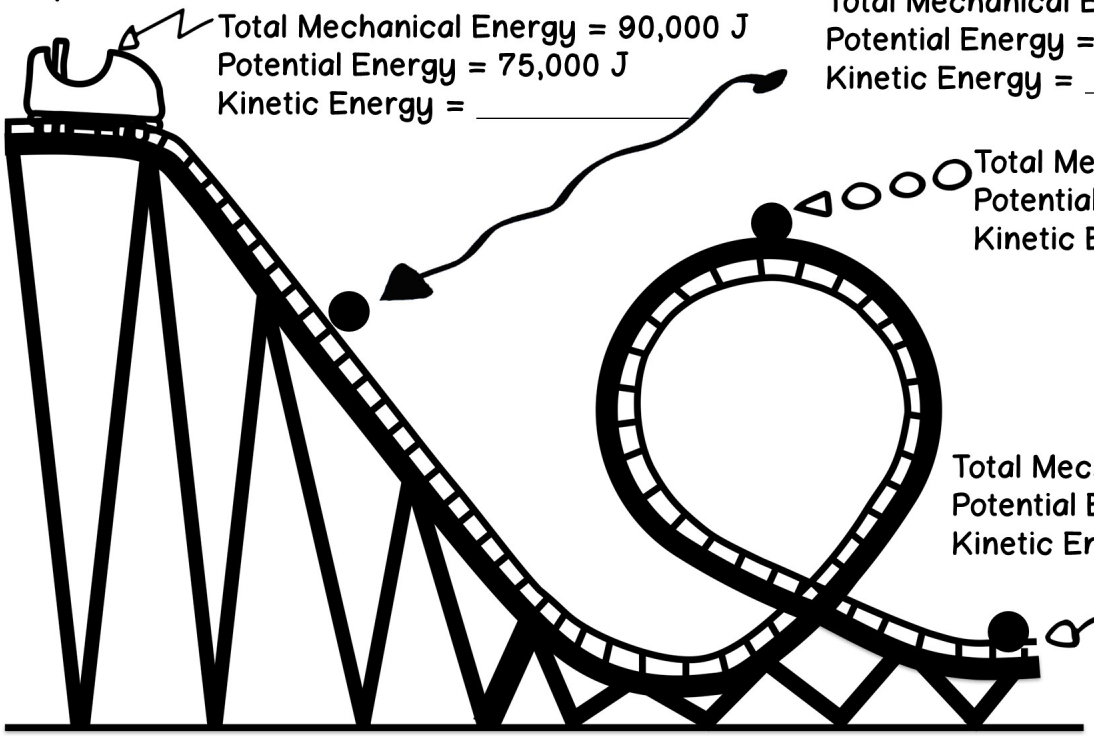
_____ _____ _____ _____

5) I can describe and calculate the transformation of potential and kinetic energy (total mechanical energy) in a frictionless system.

Mechanical Energy: is both energy of motion (kinetic energy) and energy of position (potential energy). In a frictionless system, energy is converted back and forth.

- You can add kinetic plus potential at each stage to track the energy
- Total mechanical energy: the sum of kinetic and potential at each point of movement.

Example 1: A rollercoaster



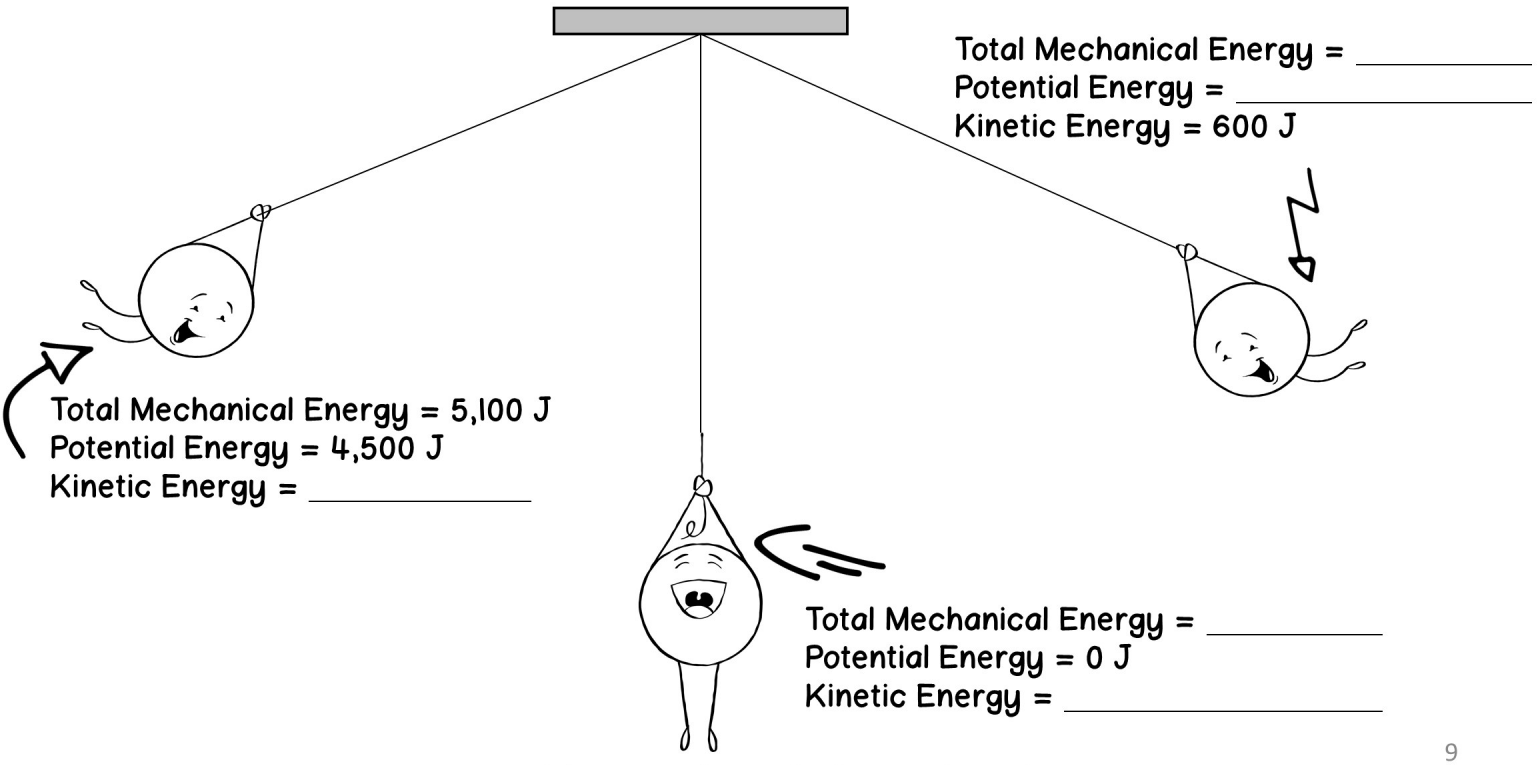
Total Mechanical Energy = 90,000 J
Potential Energy = 75,000 J
Kinetic Energy = _____

Total Mechanical Energy = _____
Potential Energy = 45,000 J
Kinetic Energy = _____

Total Mechanical Energy = _____
Potential Energy = _____
Kinetic Energy = 35,000 J

Total Mechanical Energy = _____
Potential Energy = 0 J
Kinetic Energy = _____

Example 2: A pendulum swinging back and forth.



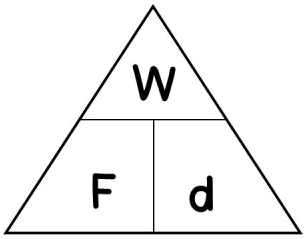
Total Mechanical Energy = _____
Potential Energy = _____
Kinetic Energy = 600 J

Total Mechanical Energy = 5,100 J
Potential Energy = 4,500 J
Kinetic Energy = _____

Total Mechanical Energy = _____
Potential Energy = 0 J
Kinetic Energy = _____

6) I can describe and calculate work.

Work: The transfer of energy through force. Measured in Joules.



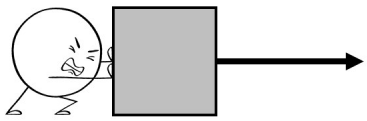
$$W = Fd$$

W = Work in Joules (J)
F = force in Newtons (N)
d = distance traveled in meters (m)

For work to happen, there are two conditions that must occur:

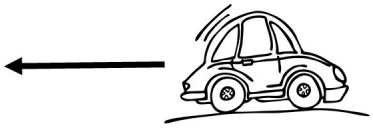
1. The object must move due to the force exerted upon it.
2. The force and the object must be parallel

Example A: Dot Dude pushes a block and accelerates it from rest to 2 m/s to the right



This is an example of positive work.

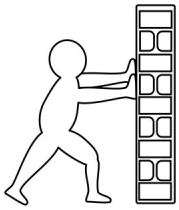
Example B: A car slows down from 20 m/s to 10 m/s.



slows from 20 m/s to 10 m/s

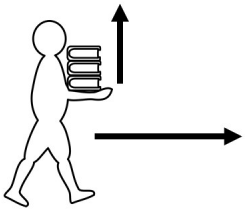
This is an example of negative work.

Non-Example A: You push really, really hard against a brick wall. You get sweaty and tired. The wall doesn't move.



This is an example of zero work. Why? The wall didn't move.

Non-Example B: You carry a super heavy stack of books (25 kg worth) across the room (10 meters). Your arms are tired afterwards.

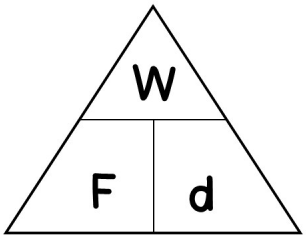


This is a tricky example of zero work. Why? Because the arms are pulling up and the walking is going forward. The force and the distance are perpendicular.

Example 1: You use 35 Newtons to push a lawn mower 15 meters. What is the work done on the lawn mower?

Define Variables	Write equation and show work	Answer w/ units
W = F = d =		

$$W = Fd$$



Example 2: You lift your backpack and use 25 Joules of energy. If it took you 59 Newtons of force, how far did lift your backpack?

Define Variables	Write equation and show work	Answer w/ units
W = F = d =		

Example 3: How much work is done to stop a car with a force 27,000 N of force over a distance 56 meters?

Define Variables	Write equation and show work	Answer w/ units
W = F = d =		

Example 4: An elevator lifts 12 people up 77 meters with 640,000 Joules of work. What is the force exerted on the elevator?

Define Variables	Write equation and show work	Answer w/ units
W = F = d =		

Example 5: A person is hauling their taco stand and it takes 3,500 Joules of work to stop the taco stand. What force was exerted on the taco stand if it took 1.5 meters to stop the motion?

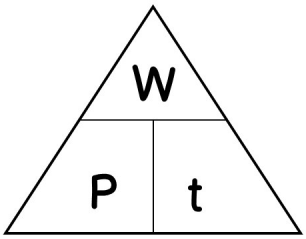
Define Variables	Write equation and show work	Answer w/ units
W = F = d =		

7) I can describe and calculate power.

Power: how fast you do work or transfer energy..

$$P = \frac{W}{t}$$

P = power in watts (W)
W = Work in Joules (J)
t = time in seconds (s)



Note: They can combine the power equation and the work equation for a two-step problem. Or you can use this modified equation:

$$W = Fd \quad + \quad P = \frac{W}{t} \quad = \quad P = \frac{Fd}{t}$$

Example 1: Machine A does 5000 Joules of work in 5 seconds. Machine B does 5000 Joules of work in 25 seconds. Find both powers. Which machine has more power?

Define Variables	Define Variables	Write equation and show work	Answer w/ units
P = W = t =	P = W = t =		

Example 2: How much power is created by lifting with 350 Newtons over 12 meters, if it took 5.2 seconds to accomplish this?

Define Variables	Write equation and show work	Answer w/ units
P = W = F = d = t =		

Example 3: A machine uses 4,500 Watts of power to do 25,000 Joules of work. How much time did the machine take to do this job?

Define Variables	Write equation and show work	Answer w/ units
P = W = F = d = t =		

Example 4: You do 540 Watts of power in 45 seconds by walking on some stairs. How high were the stairs if it took you 750 Newtons of force to move?

Define Variables	Write equation and show work	Answer w/ units
P = W = F = d = t =		

Example 5: You do chin-ups and move your body with 525 Newtons of force over a distance of 0.25 meters. It takes you 1.1 seconds. What power do you exert?

Define Variables	Write equation and show work	Answer w/ units
P = W = F = d = t =		