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Thank you so much for buying my Energy, Work, and Power Physical Science (IPC) collection of worksheets. You will find that all my work is always aligned to objectives and those objectives correlate to state standards as best as I can.

I hope this listing helps you and your students! ☺

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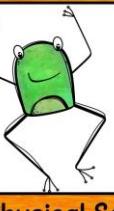
If you have any questions, feel
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Types of Forces

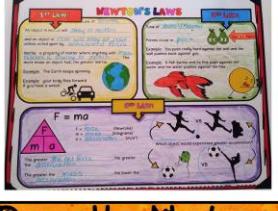
Doodle Notes

Claim-Evidence-Reasoning


Doodle Notes

Density
ALL Levels

Doodle Notes

Newton's Laws

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Thank You for Respecting My Work!

Delzer's
Dynamite
Designs

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Just Us Teachers

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;

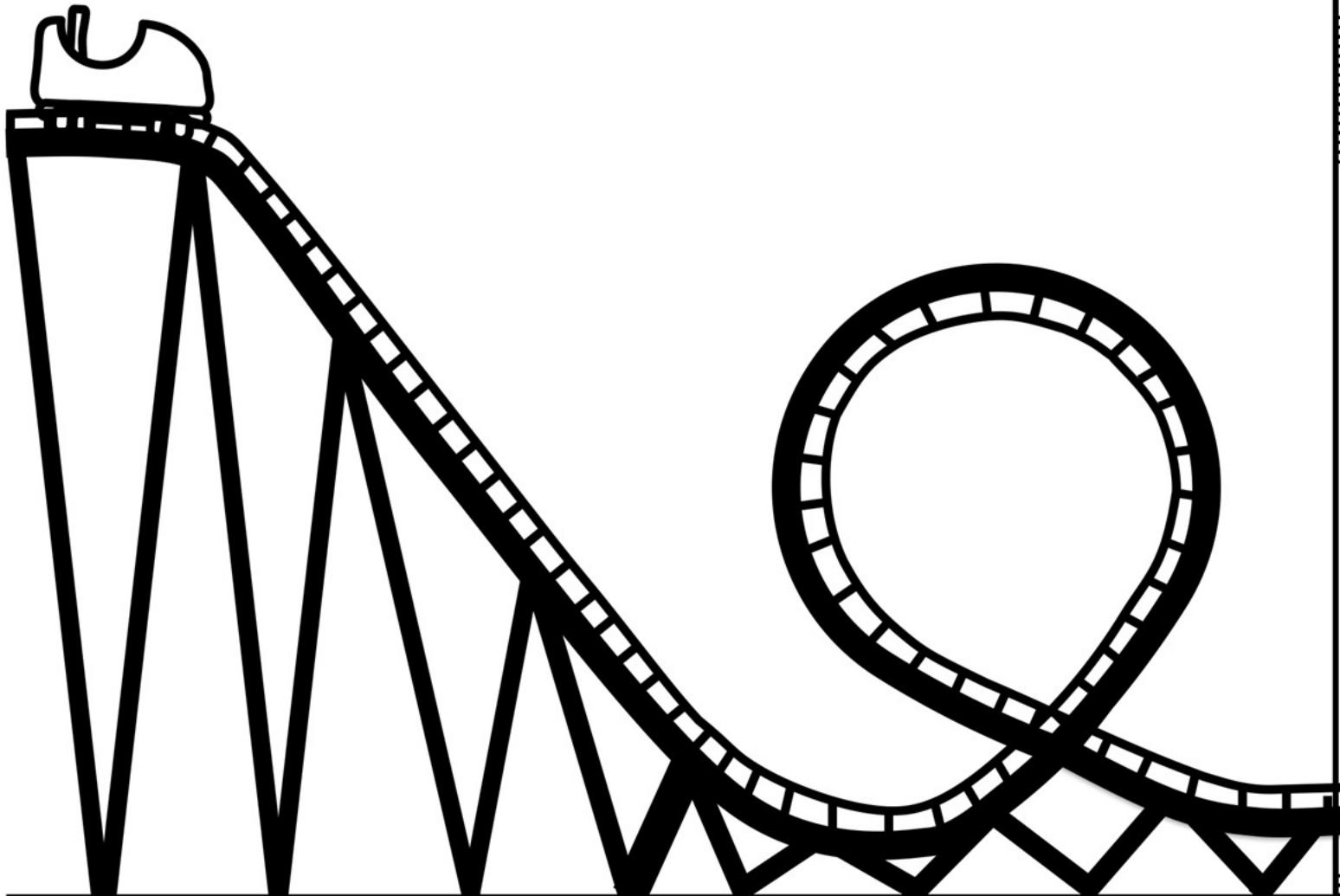
(D) investigate the law of conservation of energy;

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.

Student Worksheets



Name: _____
Period: _____

Date: _____

Identifying Forms of Energy

Directions: Answer the following in complete sentences. ☺

1) What is the definition of energy?

2) What unit is energy measured in?

Directions: Match the following types of energy to their definition.

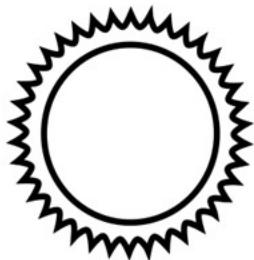
- | | |
|-------------------------------|--|
| _____ 1) Elastic energy | A) Energy from movement of electrons. |
| _____ 2) Sound energy | B) Energy that comes from a vibrating source and travels through solids, liquids, and gases. Cannot travel through space. |
| _____ 3) Electrical Energy | C) Energy that comes from vibrating atoms and molecules. All atoms and molecules are always moving and vibrating, except at Absolute Zero. |
| _____ 4) Thermal Energy | D) Energy due to position. Based on height and mass |
| _____ 5) Chemical Energy | E) Any kind of potential or kinetic energy |
| _____ 6) Radiant Energy | F) Energy from atoms combining or splitting |
| _____ 7) Mechanical Energy | G) Energy from the entire electromagnetic spectrum, including visible light. Can travel through space. |
| _____ 8) Gravitational Energy | H) Energy stored in bonds and released or absorbed during reactions |
| _____ 9) Nuclear Energy | I) Energy from compressing or stretching an object |

Name: _____
Period: _____

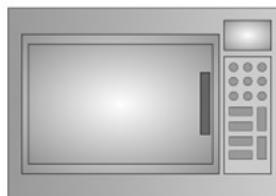
Date: _____

Identifying Forms of Energy

- 1) The sun creates energy



- 2) A microwave uses this type of energy to heat your food.



- 3) The energy that this pile of wood contains



- 4) The kind of energy transmitted in these wires.



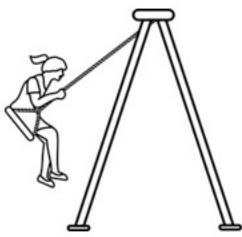
- 5) A monkey high up in a tree.



- 6) Stretching a rubber band.



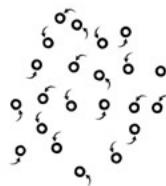
- 7) A swinging child.



- 8) The energy from these.



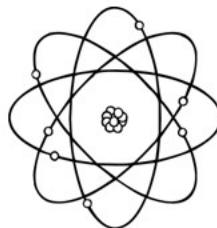
- 9) Gas molecules are very hot and moving quickly



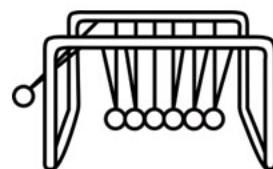
- 10) A trampoline bends when you jump on it.



- 11) Splitting atoms.



- 12) The ball bounces in the Newton's Cradle.



Name: _____
Period: _____

Date: _____

Potential Energy

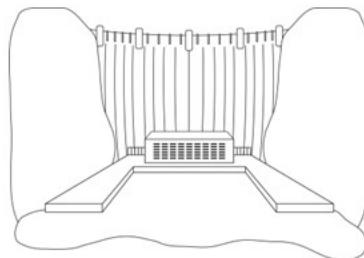
$$PE = mgh$$

Directions: Fill out everything for each problem. Write neatly!

- 1) How much potential energy does a monkey up in a tree have? The monkey has a mass of approximately 11 kg and is 14 meters high.



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



- 2) A city sets up a hydroelectric dam and they need about 25,000,000 Joules of energy produced every second. What is the mass of water that is necessary to create that kind of energy, if the dam is 42 meters high?

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

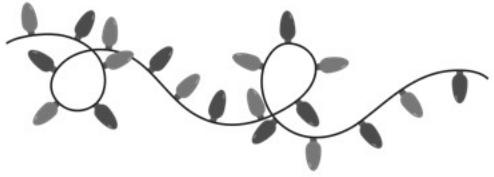
- 3) You and your friend decide to flip a quarter while on top of the Empire State building. Sadly, the quarter ended up flying off the top of the building, which is 381 meters high. If the quarter has a mass of 0.006 kg, what is its potential energy?



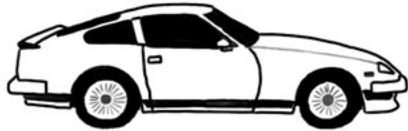
Define Variables	Write equation and show work	Answer w/ units
PE = m = g = h =		

$$PE = mgh$$

- 4) You decide to hang up Christmas lights from the second story of your house. If you have a mass of 75 kg and 6,700 Joules of Potential Energy, how high are you in the air?



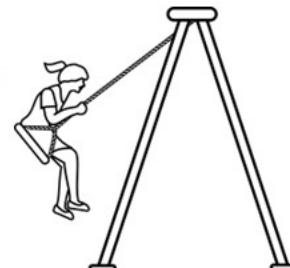
Define Variables	Write equation and show work	Answer w/ units
$PE =$ $m =$ $g =$ $h =$		



- 5) A 2,200 kg car goes flying off a highway overpass in a Hollywood movie. How much potential energy does the car have if the overpass is 25 meters high?

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

- 6) A kid has 650 Joules of potential energy when they are at the top of their swing. If the height is 1.3 meters, what is the mass of the kid?



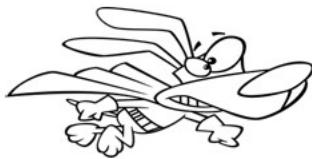
Define Variables	Write equation and show work	Answer w/ units
$PE =$ $m =$ $g =$ $h =$		

$$PE = mgh$$



- 7) A 1,350 kg package is dropped from a plane from a height of 760 meters. What is its potential energy right before it starts to fall?

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



- 8) A Super Dog! flies by and has 1,780 Joules of Potential Energy. If Super Dog! is flying at an altitude of 15 meters, what is its mass?
PS Must say Super Dog! in a superman voice. He is the goodest of all the good dogs after all.

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

- 9) A 56 kg meteor enters the atmosphere with a whopping 46,000,000 Joules of Potential Energy. What height does it enter our atmosphere?



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

$$PE = mgh$$

- 10) A 0.1 kg piece of hail forms about 6,100 meters high in the air. What is that piece of hail's potential energy at that height?



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



- II) Sans changes the gravitational field of Earth and it is suddenly tripled to 29.4 m/s^2 . If Chara is 110 meters in the air and has a mass of 55 kg, what is his potential energy in this new 3-g environment?

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

- 12) SuperKid has 12,500 Joules of Potential Energy as they swing through Dallas. If SuperKid has a mass of 75 kg, what height are they swinging?



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

Name: _____
Period: _____

Date: _____

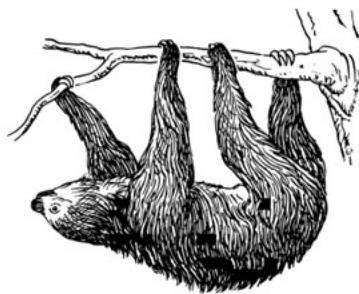
Kinetic Energy

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

Directions: Fill out everything for each problem. Write neatly!

- 1) A unicorn suddenly ran through the school at 5.6 m/s and it has a mass of 450 kg. What is the unicorn's kinetic energy?

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



- 2) The sloth is one of the slowest creatures on Earth. Despite being slow, they are really good swimmers! How fast must the sloth swim if they have a mass of 7.2 kg and 0.051 Joules of kinetic energy?

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

- 3) Usain Bolt is wicked fast. In fact, he is the fastest human in the world and ran at a crazy 10.1 m/s in the Olympic Games. What is his mass if he had 4,640 Joules of kinetic energy in that race? (Usain's fastest is a little over 22 mph!)



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

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

- 4) The world's fastest insect is the horse fly. A horse fly can top out at 90 mph! Find its velocity if it has a mass of 1.2×10^{-5} kg. The kinetic energy of the house fly is 0.019 Joules.



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



- 5) Quarter Horses are typically faster than Thoroughbreds over short distances. A racehorse can run at 18 m/s and has 195,000 Joules of kinetic energy. What is this racehorse's mass?

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

- 6) Santa's sleigh flies at 3 times the speed of sound. That's a whopping 1.04×10^6 m/s. Santa's sleigh actually makes a Sonic Boom when it surpasses the speed of sound! (keep your ears open for that on Christmas Eve!). How much kinetic energy must Santa's sleigh have if its mass is 7,500 kg? (Let us assume he is not carrying ALL 7.5 billion presents at once!)



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

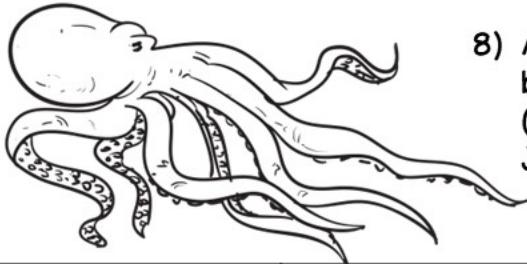
$$KE = \frac{1}{2} mv^2$$

- 7) The Blue Whale is the largest animal to have ever lived. As an adult it is as long as three school buses added together. A 170,000 kg Blue Whale cruises along at a modest pace. If it has 890,000 Joules of kinetic energy, what is its cruising speed?



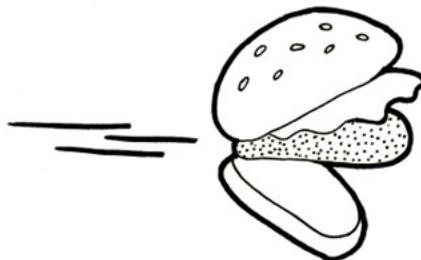
Define Variables	Write equation and show work	Answer w/ units
KE =		
m =		
v =		

- 8) An octopus spots its favorite meal ahead!, a lobster! (Me, too, boo. Me, too) What is the octopus' mass if it darts at 12 m/s (an octopus is faster than Michael Phelps!) and has 3,168 Joules of kinetic energy?



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

- 9) Food Fight! Someone throws a perfectly good hamburger across the cafeteria. What velocity does it experience if it has a mass of 0.35 kg and has 79 Joules of kinetic energy?



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

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



- 10) A boy is hit with a piece of cake. The cake has a mass of 0.56 kg and hit the boy at a speed of 17 m/s. What kinetic energy did the piece of cake have?

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



- II) SuperChicken! isn't just any ol' superhero. No, this chicken has a mass of 81 kg, is 6 feet tall, and can outrun a racehorse at 32 m/s. What is SuperChicken's kinetic energy?

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

- 12) In order to make the loop successfully (and not lose any passengers), a rollercoaster has to hit a critical speed before the loop. What is the velocity of a rollercoaster car if it has a mass of 7,600 kg and 4,750,000 Joules of kinetic energy?



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

Name: _____
Period: _____

Date: _____

Total Mechanical Energy

Directions: Fill out everything for each problem. Write neatly!

1) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

Total Mechanical Energy = 950 J

Potential Energy = 800 J

Kinetic Energy = 150 J

Total Mechanical Energy = _____

Potential Energy = _____

Kinetic Energy = 450 J

Total Mechanical Energy = _____

Potential Energy = 0 J

Kinetic Energy = _____

2) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

Total Mechanical Energy = 25,000 J

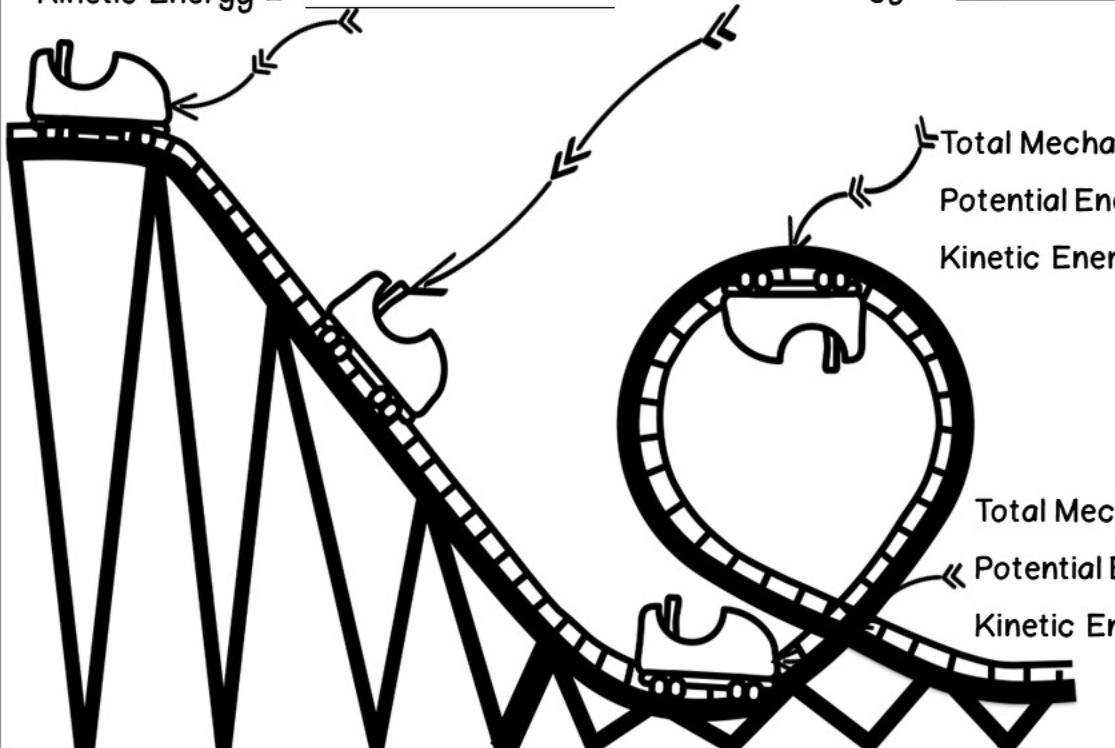
Potential Energy = 20,000 J

Kinetic Energy = _____

Total Mechanical Energy = _____

Potential Energy = _____

Kinetic Energy = 11,000 J



Total Mechanical Energy = _____

Potential Energy = 15,500 J

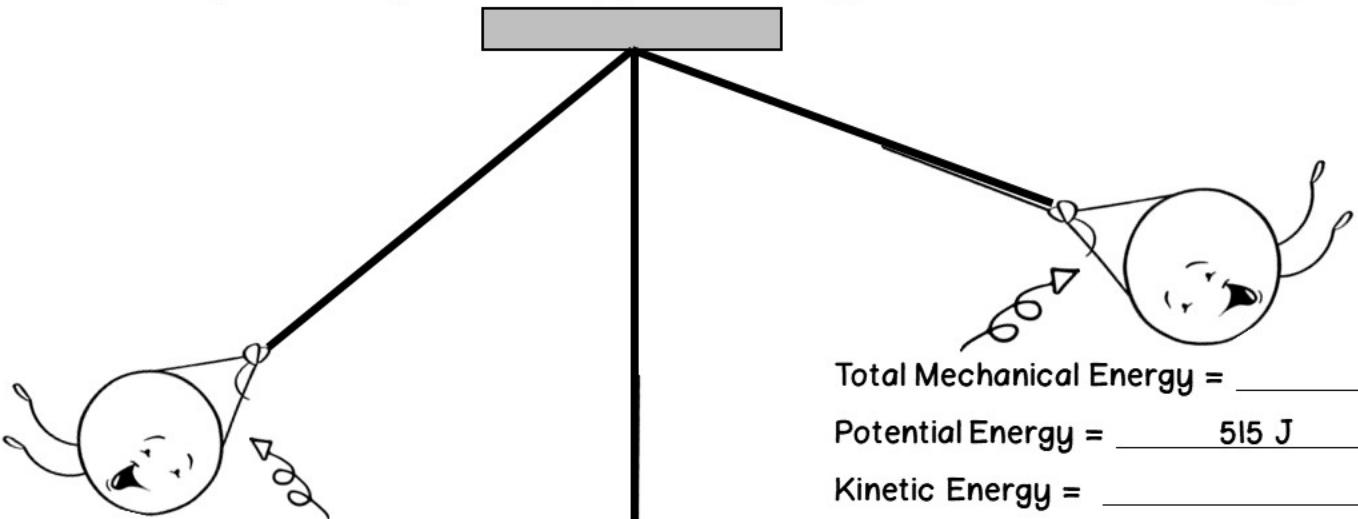
Kinetic Energy = _____

Total Mechanical Energy = _____

Potential Energy = _____

Kinetic Energy = _____

3) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.



Total Mechanical Energy = 515 J

Potential Energy = _____

Kinetic Energy = 235 J

Total Mechanical Energy = _____

Potential Energy = 515 J

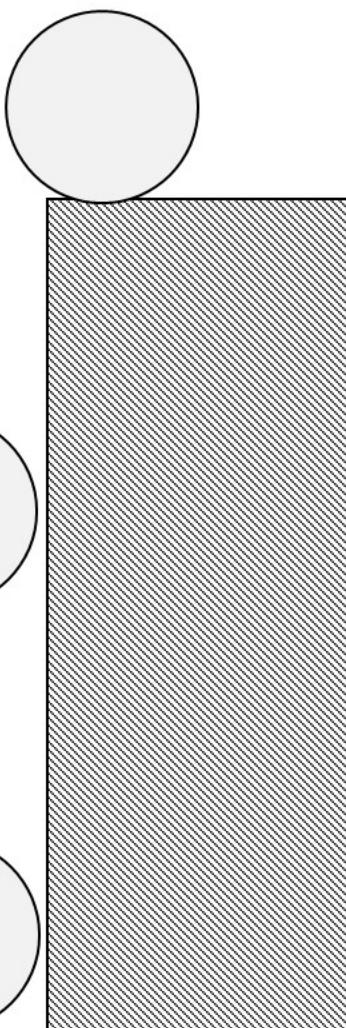
Kinetic Energy = _____

4) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

Total Mechanical Energy = 150,000 J

Potential Energy = _____

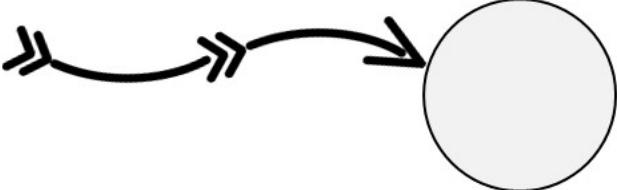
Kinetic Energy = 0 J



Total Mechanical Energy = _____

Potential Energy = _____

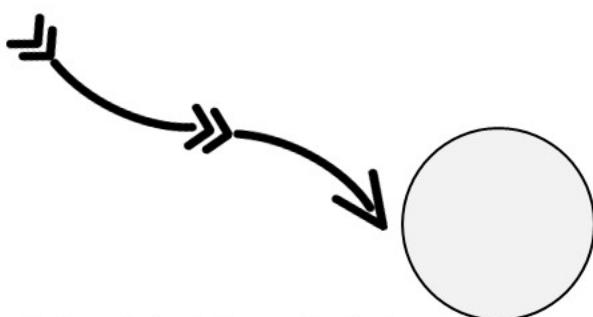
Kinetic Energy = 75,000 J



Total Mechanical Energy = _____

Potential Energy = 0 J

Kinetic Energy = _____

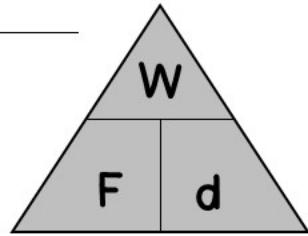


Name: _____
Period: _____

Date: _____

Work = Fd

Work



Directions: Fill out everything for each problem. Write neatly!

Is work being done? Yes or no? (Circle One)

- | | |
|--|------------|
| 1) You push and push against a wall and become very tired. | Yes or no? |
| 2) You throw a paper airplane | Yes or no? |
| 3) You hold your books while you walk to class. | Yes or no? |
| 4) You use breaks to slow down while riding your bike. | Yes or no? |

Match the units (answer may be used more than once)

- | | |
|-------------------|------------|
| _____ 5) Work | A) Meters |
| _____ 6) Energy | B) Newtons |
| _____ 7) Force | C) Joules |
| _____ 8) Distance | |

- 1) You run forward, pulling a sled behind you with a force of 250 N. If you expend 2,500 Joules, how many meters did you run?

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

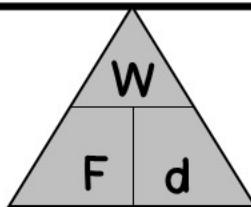
- 2) It took a 36,000 Newton force to make a car move 1,500 meters. How many Joules of work is performed to make the car move?

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

- 3) You decide to sell cookies around your neighborhood. You pull a wagon fully loaded with cookies and travel 1500 meters around your neighborhood. How much force did you use if you performed 151,000 Joules of work?

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

Work = Fd



Directions: Fill out everything for each problem. Write neatly!

- 4) The winning Tug O' War team pulls with 5,500 Newtons of force. They pull the other team 6.5 meters in order to win. How much work did they perform?

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

- 5) You climb a ladder that is 2.0 meters high and use the force of 1200 Newtons. How much work did you do?

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

- 6) A zombie horde is running toward you. You push the zombie horde with a school bus. The school bus moves the horde back 250 meters and uses 1,250,000 Joules. How much force was generated by the bus?

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

- 7) An elevator lifts a load of passengers with a force of 156,000 N and does 2,550,000 Joules of work. How many meters did the elevator transport passengers?

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

Name: _____
Period: _____

Date: _____

Power

Directions: Fill out everything for each problem. Write neatly!

$$W = Fd$$

+

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

=

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



- 1) You did 7,500 Joules of work by running up some stairs in 2.3 seconds. What power did you exert?

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

- 2) A machine performs with 756 watts of power over the course of 25 seconds. What work did this machine do?



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

- 3) How much time does it take to do 9,560 Joules of work with 860 watts of power?



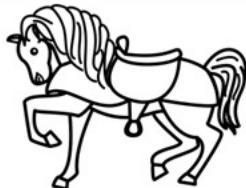
Define Variables	Write equation and show work	Answer w/ units
P = W = t =		

- 4) A 35,500 Newton car runs up a hill that is 45.5 meters high in 1.6 seconds. What power did the car exert?



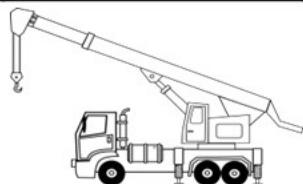
Define Variables	Write equation and show work	Answer w/ units
P =		
W =		
F =		
d =		
t =		

- 5) A horse pulls a wagon with a force of 1450 Newtons. How many meters did the wagon travel if the horse exerted 798 watts of power over 3.5 minutes? (convert min to seconds)



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

- 6) A crane exerts 56,000 Newtons of force over a distance of 4.5 meters. How much power was generated if it took 4.2 seconds to accomplish this?



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

- 7) The power rating of an electric law mower is 2200 watts. If the lawn mower is used for 30 minutes (convert to seconds!), and 650 Newtons of force was used, how much distance was covered?



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

- 8) A hairdryer is used for 600 seconds to dry hair. It has a 750 watt rating. How much work did the hairdryer do?



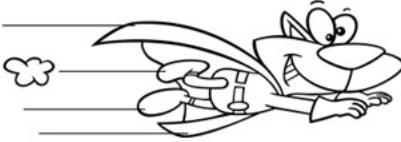
Define Variables	Write equation and show work	Answer w/ units
P =		
W =		
F =		
d =		
t =		

- 9) Zombie Al sweeps braaaains down a 45 meter hallway with a force of 75 Newtons. How long does it take Zombie Al to do this if he exerts 550 watts of power?



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

10) Super Cat! flies 8,500 meters to save someone. It takes Super Cat! 15 minutes to fly that far (convert to seconds!). What is the force exerted if Super Cat! exerts 425 watts of power?



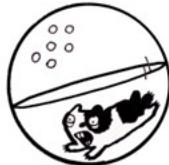
Define Variables	Write equation and show work	Answer w/ units
P =		
W =		
F =		
d =		
t =		

II) A 750 Newton passenger rides in an elevator (that is 22,000 Newtons). If the elevator ride is 95 seconds long and uses 7,700 watts of power, how far did the elevator move?



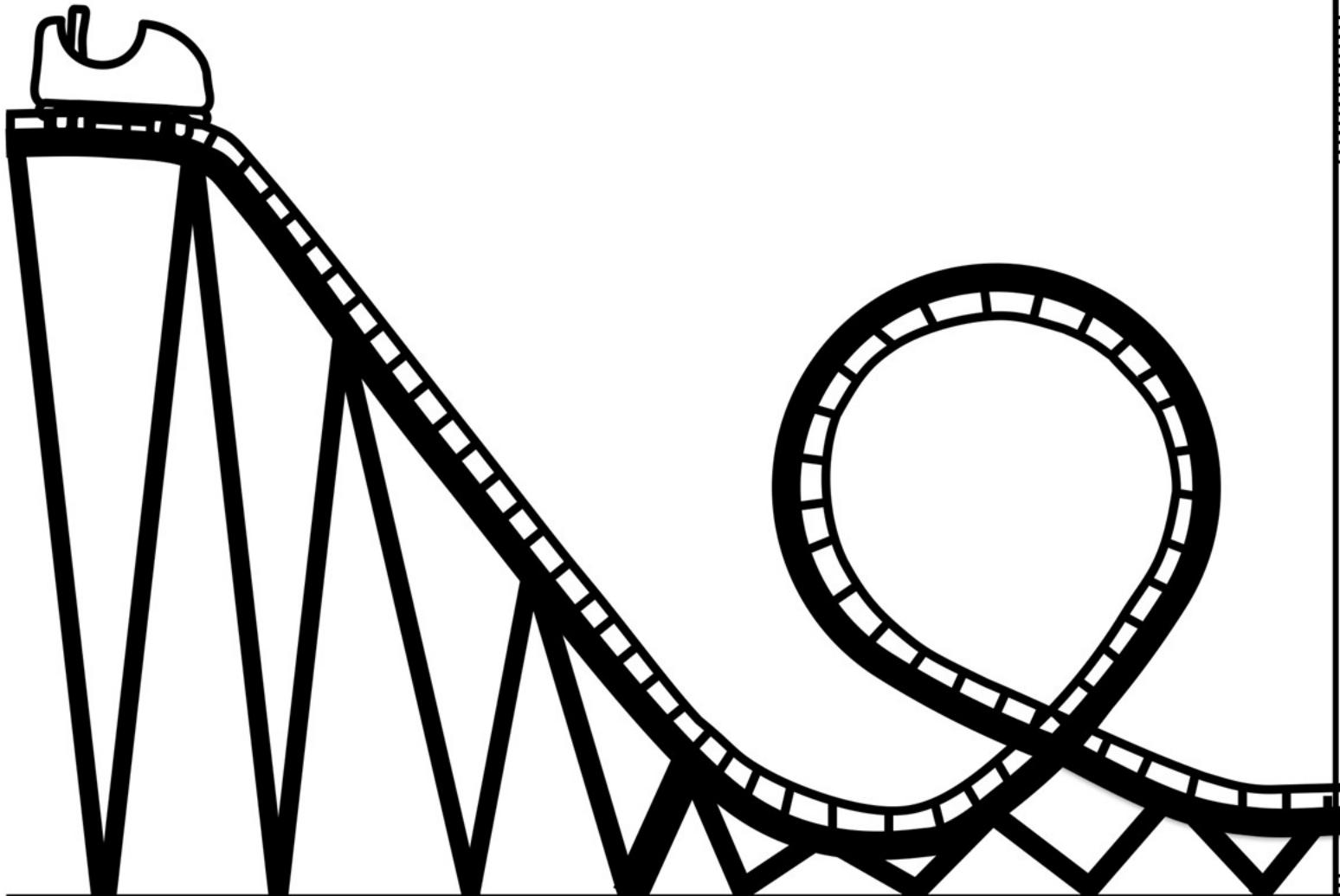
Define Variables	Write equation and show work	Answer w/ units
P =		
W =		
F =		
d =		
t =		

12) How much force did the Zombie Hamster use when she generated 38 watts of power running down the hallway? The hallway was 12 meters long and it took her 35 seconds to travel the length of the hallway.



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

Answer Key



Name: _____
Period: _____

Date: _____

Identifying Forms of Energy

Directions: Answer the following in complete sentences. ☺

1) What is the definition of energy?

Energy is the ability to create forces and cause motion, or stop motion.

2) What unit is energy measured in?

The unit of energy is Joules.

Directions: Match the following types of energy to their definition.

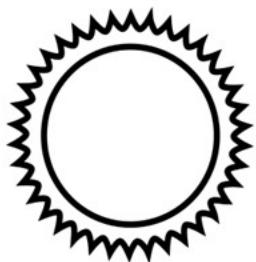
- | | | |
|---|-------------------------|--|
| I | 1) Elastic energy | A) Energy from movement of electrons. |
| B | 2) Sound energy | B) Energy that comes from a vibrating source and travels through solids, liquids, and gases. Cannot travel through space. |
| A | 3) Electrical Energy | C) Energy that comes from vibrating atoms and molecules. All atoms and molecules are always moving and vibrating, except at Absolute Zero. |
| C | 4) Thermal Energy | D) Energy due to position. Based on height and mass |
| H | 5) Chemical Energy | E) Any kind of potential or kinetic energy |
| G | 6) Radiant Energy | F) Energy from atoms combining or splitting |
| E | 7) Mechanical Energy | G) Energy from the entire electromagnetic spectrum, including visible light. Can travel through space. |
| D | 8) Gravitational Energy | H) Energy stored in bonds and released or absorbed during reactions |
| F | 9) Nuclear Energy | I) Energy from compressing or stretching an object |

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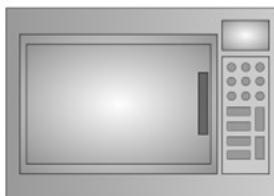
Identifying Forms of Energy

- 1) The sun creates energy



Nuclear

- 2) A microwave uses this type of energy to heat your food.



Radiant

- 3) The energy that this pile of wood contains



Chemical

- 4) The kind of energy transmitted in these wires.



Electric

- 5) A monkey high up in a tree.



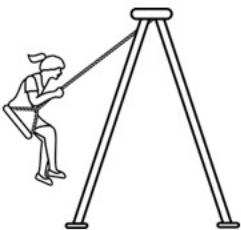
Gravitational

- 6) Stretching a rubber band.



Elastic

- 7) A swinging child.



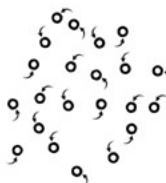
Mechanical

- 8) The energy from these.



Sound

- 9) Gas molecules are very hot and moving quickly



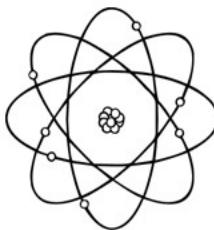
Thermal

- 10) A trampoline bends when you jump on it.



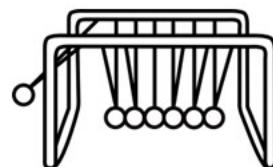
Elastic

- 11) Splitting atoms.



Nuclear

- 12) The ball bounces in the Newton's Cradle.



Mechanical

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Potential Energy

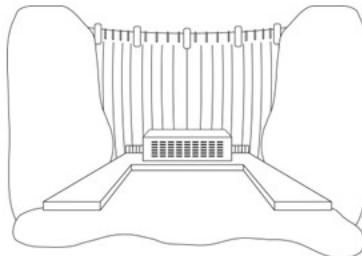
$$PE = mgh$$

Directions: Fill out everything for each problem. Write neatly!

- 1) How much potential energy does a monkey up in a tree have? The monkey has a mass of approximately 11 kg and is 14 meters high.



Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 11 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = 14 \text{ m}$	$PE = mgh$ $PE = (11)(9.8)(14)$ $PE = 1509.2$	$PE = 1500 \text{ J}$



- 2) A city sets up a hydroelectric dam and they need about 25,000,000 Joules of energy produced every second. What is the mass of water that is necessary to create that kind of energy, if the dam is 42 meters high?

Define Variables	Write equation and show work	Answer w/ units
$PE = 25,000,000 \text{ J}$ $m = ?$ $g = 9.8 \text{ m/s}^2$ $h = 42 \text{ m}$	$PE = mgh$ $25,000,000 = (m)(9.8)(42)$ $25,000,000 = 411.6(m)$ $M = 60,738.58$	$m = 61,000 \text{ kg of water}$

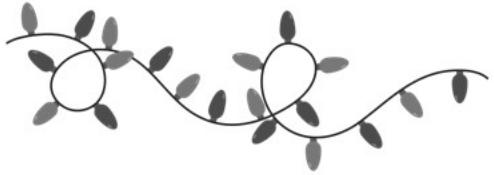
- 3) You and your friend decide to flip a quarter while on top of the Empire State building. Sadly, the quarter ended up flying off the top of the building, which is 381 meters high. If the quarter has a mass of 0.006 kg, what is its potential energy?



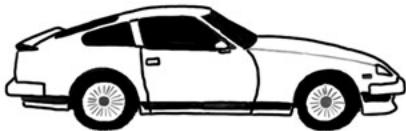
Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 0.006 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = 381 \text{ m}$	$PE = mgh$ $PE = (0.006)(9.8)(381)$ $PE = 22.4028$	$PE = 22 \text{ J}$

$$PE = mgh$$

- 4) You decide to hang up Christmas lights from the second story of your house. If you have a mass of 75 kg and 6,700 Joules of Potential Energy, how high are you in the air?



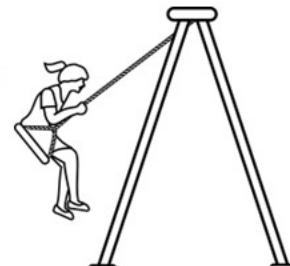
Define Variables	Write equation and show work	Answer w/ units
$PE = 6,700 \text{ J}$ $m = 75 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = ?$	$PE = mgh$ $6,700 = (75)(9.8)(h)$ $6,700 = (735)(h)$ $h = 9.115646259$	$h = 9.1 \text{ m}$



- 5) A 2,200 kg car goes flying off a highway overpass in a Hollywood movie. How much potential energy does the car have if the overpass is 25 meters high?

Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 2,200 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = 25 \text{ m}$	$PE = mgh$ $PE = (2,200)(9.8)(25)$ $PE = 539,000$	$PE = 540,000 \text{ J}$

- 6) A kid has 650 Joules of potential energy when they are at the top of their swing. If the height is 1.3 meters, what is the mass of the kid?



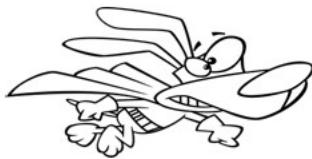
Define Variables	Write equation and show work	Answer w/ units
$PE = 650 \text{ J}$ $m = ?$ $g = 9.8 \text{ m/s}^2$ $h = 1.3 \text{ m}$	$PE = mgh$ $650 = (m)(9.8)(1.3)$ $650 = 12.74(m)$ $m = 51.0204$	$m = 51 \text{ kg}$

$$PE = mgh$$



- 7) A 1,350 kg package is dropped from a plane from a height of 760 meters. What is its potential energy right before it starts to fall?

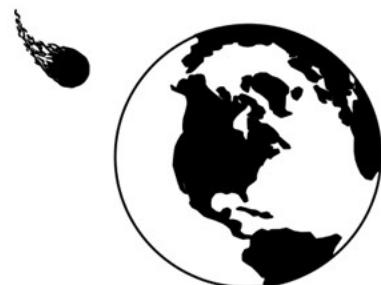
Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 1350 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = 760 \text{ m}$	$PE = mgh$ $PE = (1350) (9.8) (760)$ $PE = 10,054,800$	$PE = 10,050,000 \text{ J}$



- 8) A Super Dog! flies by and has 1,780 Joules of Potential Energy. If Super Dog! is flying at an altitude of 15 meters, what is its mass?
PS Must say Super Dog! in a superman voice. He is the goodest of all the good dogs after all.

Define Variables	Write equation and show work	Answer w/ units
$PE = 1780 \text{ J}$ $m = ?$ $g = 9.8 \text{ m/s}^2$ $h = 15 \text{ m}$	$PE = mgh$ $1780 = (m) (9.8) (15)$ $1780 = 147 (m)$ $m = 12.1088$	$m = 12.1 \text{ kg}$

- 9) A 56 kg meteor enters the atmosphere with a whopping 46,000,000 Joules of Potential Energy. What height does it enter our atmosphere?



Define Variables	Write equation and show work	Answer w/ units
$PE = 46,000,000 \text{ J}$ $m = 56 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = ?$	$PE = mgh$ $46,000,000 = (56) (9.8) (h)$ $46,000,000 = 548.8 (h)$ $h = 83819$	$h = 84,000 \text{ m}$

$$PE = mgh$$

- 10) A 0.1 kg piece of hail forms about 6,100 meters high in the air. What is that piece of hail's potential energy at that height?



Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 0.1 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = 6,100 \text{ m}$	$PE = mgh$ $PE = (0.1)(9.8)(6,100)$ $PE = 5978$	$PE = 6.0 \times 10^3 \text{ J}$



- II) Sans changes the gravitational field of Earth and it is suddenly tripled to 29.4 m/s^2 . If Chara is 110 meters in the air and has a mass of 55 kg, what is his potential energy in this new 3-g environment?

Define Variables	Write equation and show work	Answer w/ units
$PE = ?$ $m = 55 \text{ kg}$ $g = 29.4 \text{ m/s}^2$ $h = 110 \text{ m}$	$PE = mgh$ $PE = (55)(29.4)(110)$ $PE = 177870$	$PE = 180,000 \text{ J}$

- 12) SuperKid has 12,500 Joules of Potential Energy as they swing through Dallas. If SuperKid has a mass of 75 kg, what height are they swinging?



Define Variables	Write equation and show work	Answer w/ units
$PE = 12,500 \text{ J}$ $m = 75 \text{ kg}$ $g = 9.8 \text{ m/s}^2$ $h = ?$	$PE = mgh$ $12,500 = (75)(9.8)(h)$ $12,500 = 735(h)$ $h = 17.0068$	$h = 17 \text{ m}$

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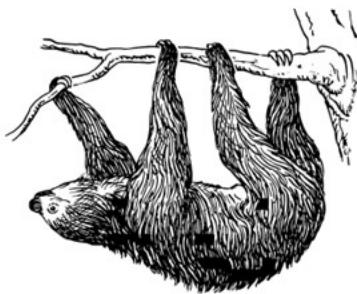
Kinetic Energy

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

Directions: Fill out everything for each problem. Write neatly!

- 1) A unicorn suddenly ran through the school at 5.6 m/s and it has a mass of 450 kg. What is the unicorn's kinetic energy?

Define Variables	Write equation and show work	Answer w/ units
$KE = ?$ $m = 450 \text{ kg}$ $v = 5.6 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $KE = \frac{1}{2} (450) (5.6)^2$ $KE = 7056$	$KE = 7100 \text{ J}$



- 2) The sloth is one of the slowest creatures on Earth. Despite being slow, they are really good swimmers! How fast must the sloth swim if they have a mass of 7.2 kg and 0.051 Joules of kinetic energy?

Define Variables	Write equation and show work	Answer w/ units
$KE = 0.051 \text{ J}$ $m = 7.2 \text{ kg}$ $v = ?$	$KE = \frac{1}{2} mv^2$ $0.051 = \frac{1}{2} (7.2) (v^2)$ $0.051 = 3.6 v^2$ $V^2 = 0.01416666$ $V = 0.1190238$	$V = 0.12 \text{ m/s}$

- 3) Usain Bolt is wicked fast. In fact, he is the fastest human in the world and ran at a crazy 10.1 m/s in the Olympic Games. What is his mass if he had 4,640 Joules of kinetic energy in that race? (Usain's fastest is a little over 22 mph!)



Define Variables	Write equation and show work	Answer w/ units
$KE = 4640 \text{ J}$ $m = ?$ $v = 10.1 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $4640 = \frac{1}{2} (m) (10.1)^2$ $4640 = 51.005 (m)$ $m = 90.97147$	$m = 91 \text{ kg}$

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

- 4) The world's fastest insect is the horse fly. A horse fly can top out at 90 mph! Find its velocity if it has a mass of 1.2×10^{-5} kg. The kinetic energy of the house fly is 0.019 Joules.



Define Variables	Write equation and show work	Answer w/ units
$KE = 0.019 \text{ J}$ $m = 1.2 \times 10^{-5} \text{ kg}$ $v = ?$	$KE = \frac{1}{2} mv^2$ $0.019 = \frac{1}{2} (1.2 \times 10^{-5}) (v^2)$ $0.019 = 6 \times 10^{-6} (v^2)$ $v^2 = 3166.67$ $v = 56.2731$	$v = 56 \text{ m/s}$



- 5) Quarter Horses are typically faster than Thoroughbreds over short distances. A racehorse can run at 18 m/s and has 195,000 Joules of kinetic energy. What is this racehorse's mass?

Define Variables	Write equation and show work	Answer w/ units
$KE = 195,000 \text{ J}$ $m = ?$ $v = 18 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $195,000 = \frac{1}{2} (m) (18^2)$ $195,000 = 162 (m)$ $m = 1203.704$	$m = 1200 \text{ kg}$

- 6) Santa's sleigh flies at 3 times the speed of sound. That's a whopping 1.04×10^6 m/s. Santa's sleigh actually makes a Sonic Boom when it surpasses the speed of sound! (keep your ears open for that on Christmas Eve!). How much kinetic energy must Santa's sleigh have if its mass is 7,500 kg? (Let us assume he is not carrying ALL 7.5 billion presents at once!)



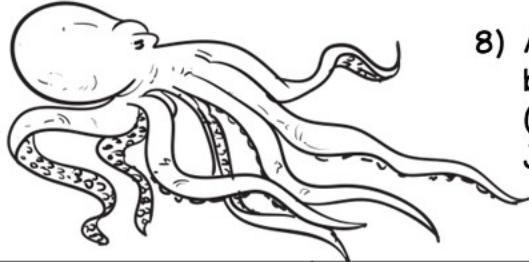
Define Variables	Write equation and show work	Answer w/ units
$KE = ?$ $m = 7,500 \text{ kg}$ $v = 1.04 \times 10^6 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $KE = \frac{1}{2} (7500) (1.04 \times 10^6)^2$ $KE = 4.056 \times 10^{15} \text{ J}$	$KE = 4.1 \times 10^{15} \text{ J}$

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

- 7) The Blue Whale is the largest animal to have ever lived. As an adult it is as long as three school buses added together. A 170,000 kg Blue Whale cruises along at a modest pace. If it has 890,000 Joules of kinetic energy, what is its cruising speed?



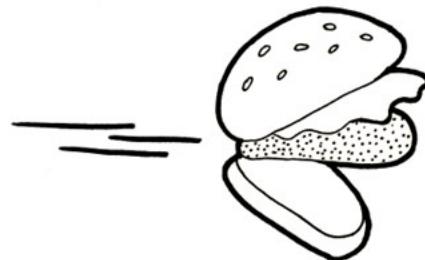
Define Variables	Write equation and show work	Answer w/ units
$KE = 890,000 \text{ J}$ $m = 170,000 \text{ kg}$ $v = ?$	$KE = \frac{1}{2} mv^2$ $890,000 = \frac{1}{2} (170,000) v^2$ $890,000 = 85,000 v^2$ $v^2 = 10.47058824$ $v = 3.235828833$	$v = 3.2 \text{ m/s}$



- 8) An octopus spots its favorite meal ahead!, a lobster! (Me, too, boo. Me, too) What is the octopus' mass if it darts at 12 m/s (an octopus is faster than Michael Phelps!) and has 3,168 Joules of kinetic energy?

Define Variables	Write equation and show work	Answer w/ units
$KE = 3,168 \text{ J}$ $m = ?$ $v = 12 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $3168 = \frac{1}{2} (m) (12^2)$ $3168 = 72 (m)$ $m = 44$	$m = 44 \text{ kg}$

- 9) Food Fight! Someone throws a perfectly good hamburger across the cafeteria. What velocity does it experience if it has a mass of 0.35 kg and has 79 Joules of kinetic energy?



Define Variables	Write equation and show work	Answer w/ units
$KE = 79 \text{ J}$ $m = 0.35 \text{ kg}$ $v = ?$	$KE = \frac{1}{2} mv^2$ $79 = \frac{1}{2} (0.35) (v^2)$ $79 = 0.175 (v^2)$ $v^2 = 451.4285714$ $v = 21.24684851$	$v = 21 \text{ m/s}$

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



- 10) A boy is hit with a piece of cake. The cake has a mass of 0.56 kg and hit the boy at a speed of 17 m/s. What kinetic energy did the piece of cake have?

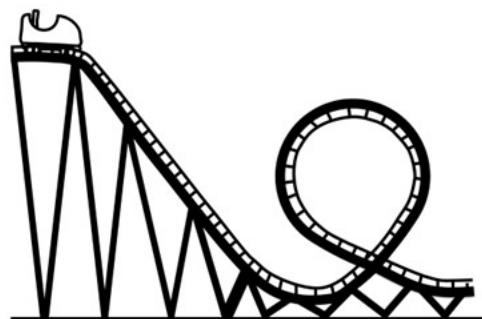
Define Variables	Write equation and show work	Answer w/ units
$KE = ?$ $m = 0.56 \text{ kg}$ $v = 17 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $KE = \frac{1}{2} (0.56) (17^2)$ $KE = 80.92$	$KE = 81 \text{ J}$



- II) SuperChicken! isn't just any ol' superhero. No, this chicken has a mass of 81 kg, is 6 feet tall, and can outrun a racehorse at 32 m/s. What is SuperChicken's kinetic energy?

Define Variables	Write equation and show work	Answer w/ units
$KE = ?$ $m = 81 \text{ kg}$ $v = 32 \text{ m/s}$	$KE = \frac{1}{2} mv^2$ $KE = \frac{1}{2} (81) (32^2)$ $KE = 41,472$	$KE = 41,000 \text{ J}$

- 12) In order to make the loop successfully (and not lose any passengers), a rollercoaster has to hit a critical speed before the loop. What is the velocity of a rollercoaster car if it has a mass of 7,600 kg and 4,750,000 Joules of kinetic energy?



Define Variables	Write equation and show work	Answer w/ units
$KE = 4,750,000 \text{ J}$ $m = 7,600 \text{ kg}$ $v = ?$	$KE = \frac{1}{2} mv^2$ $4750000 = \frac{1}{2} (7600) v^2$ $4750000 = 3800 v^2$ $v^2 = 1250$ $v = 35.35533906$	$v = 35 \text{ m/s}$

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Total Mechanical Energy

Directions: Fill out everything for each problem. Write neatly!

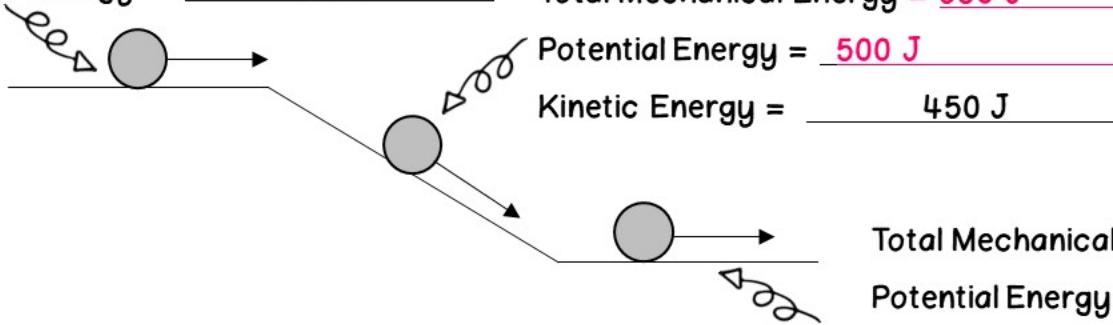
1) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

Total Mechanical Energy = 950 J

Potential Energy = 800 J

Kinetic Energy = 150 J

Total Mechanical Energy = 950 J



Potential Energy = 500 J

Kinetic Energy = 450 J

Total Mechanical Energy = 950 J

Potential Energy = 0 J

Kinetic Energy = 950 J

2) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

Total Mechanical Energy = 25,000 J

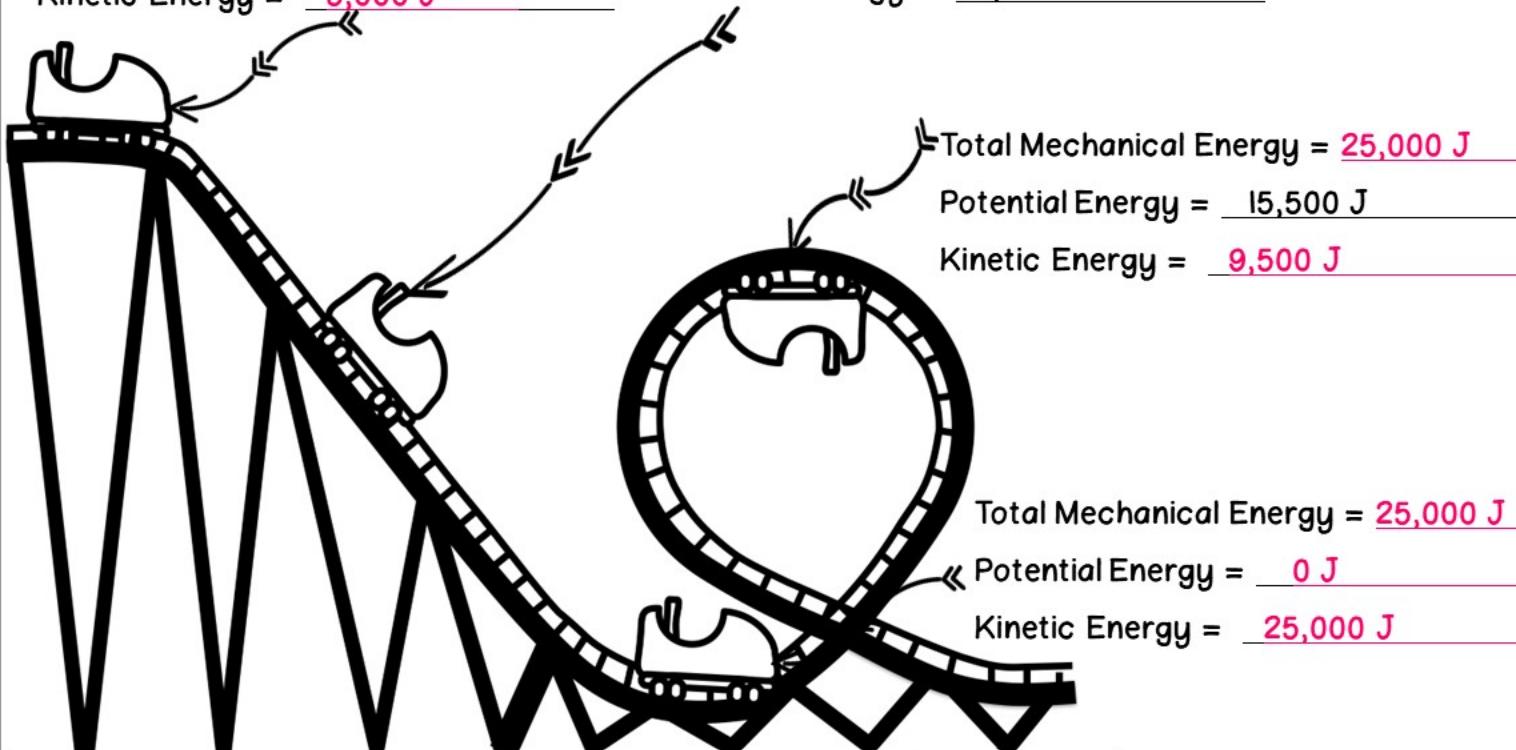
Potential Energy = 20,000 J

Kinetic Energy = 5,000 J

Total Mechanical Energy = 25,000 J

Potential Energy = 14,000 J

Kinetic Energy = 11,000 J



Total Mechanical Energy = 25,000 J

Potential Energy = 15,500 J

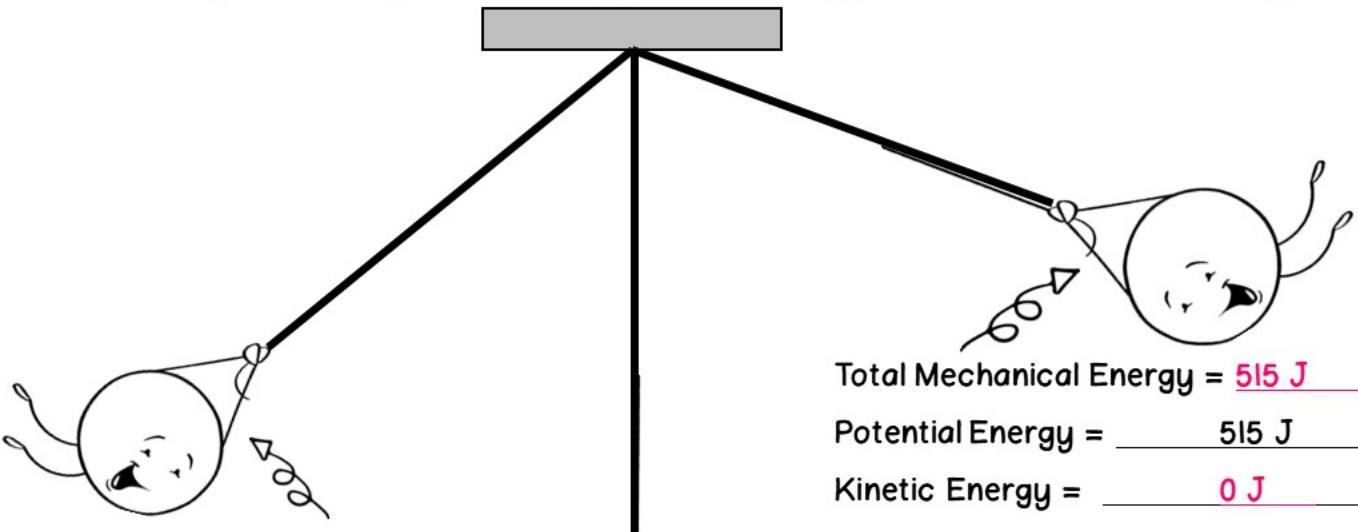
Kinetic Energy = 9,500 J

Total Mechanical Energy = 25,000 J

Potential Energy = 0 J

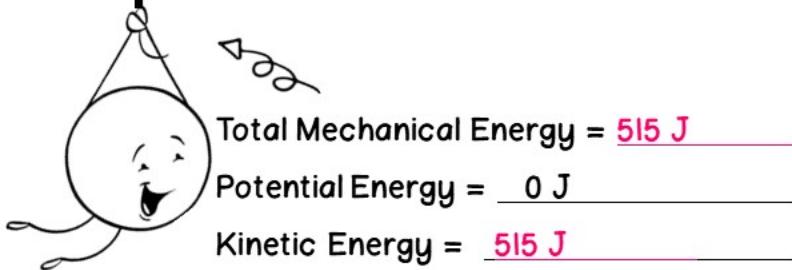
Kinetic Energy = 25,000 J

3) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.



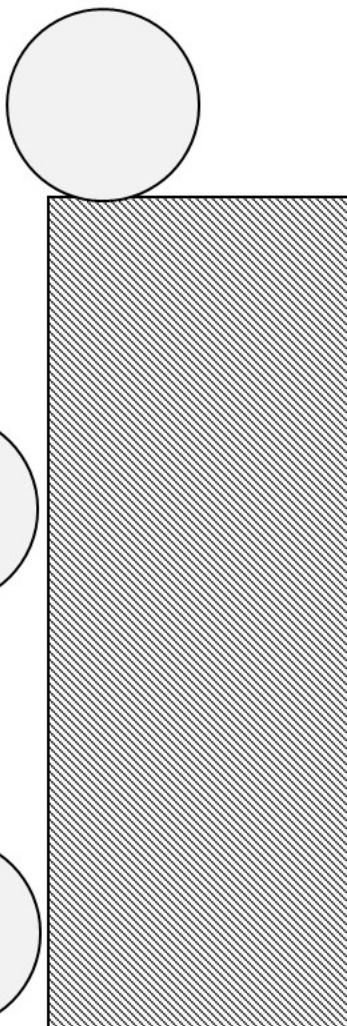
Total Mechanical Energy = 515 J
Potential Energy = 280 J
Kinetic Energy = 235 J

Total Mechanical Energy = 515 J
Potential Energy = 515 J
Kinetic Energy = 0 J

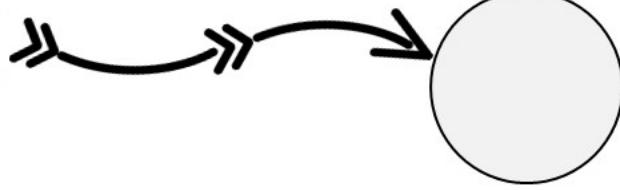


4) Fill in the missing values for potential energy, kinetic energy, and total mechanical energy.

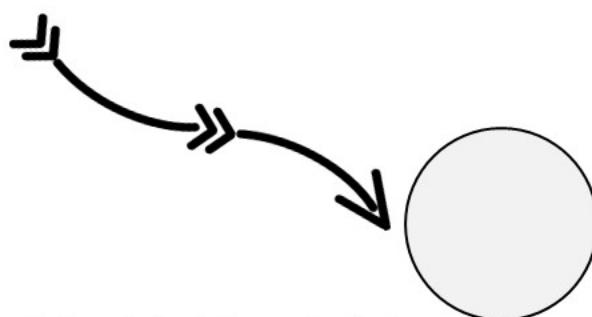
Total Mechanical Energy = 150,000 J
Potential Energy = _____
Kinetic Energy = 0 J



Total Mechanical Energy = 150,000 J
Potential Energy = 75,000 J
Kinetic Energy = 75,000 J



Total Mechanical Energy = 150,000 J
Potential Energy = 0 J
Kinetic Energy = 150,000 J

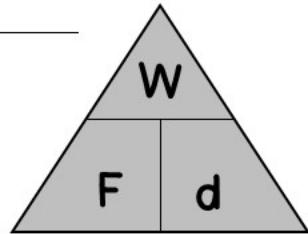


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Work = Fd

Work



Directions: Fill out everything for each problem. Write neatly!

Is work being done? Yes or no? (Circle One)

- | | |
|--|------------|
| 1) You push and push against a wall and become very tired. | Yes or no? |
| 2) You throw a paper airplane | Yes or no? |
| 3) You hold your books while you walk to class. | Yes or no? |
| 4) You use breaks to slow down while riding your bike. | Yes or no? |

Match the units (answer may be used more than once)

- | | | |
|----------|-------------|------------|
| <u>C</u> | 5) Work | A) Meters |
| <u>C</u> | 6) Energy | B) Newtons |
| <u>B</u> | 7) Force | C) Joules |
| <u>A</u> | 8) Distance | |

- 1) You run forward, pulling a sled behind you with a force of 250 N. If you expend 2,500 Joules, how many meters did you run?

Define Variables	Write equation and show work	Answer w/ units
$W = 2,500 \text{ J}$ $F = 250 \text{ N}$ $d = ?$	$W = Fd$ $2,500 = (250)d$ $d = 10 \text{ m}$	$d = 10 \text{ m}$

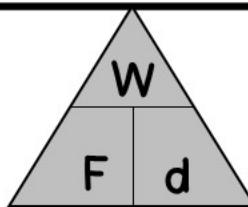
- 2) It took a 36,000 Newton force to make a car move 1,500 meters. How many Joules of work is performed to make the car move?

Define Variables	Write equation and show work	Answer w/ units
$W = ?$ $F = 36,000 \text{ N}$ $d = 1,500 \text{ m}$	$W = Fd$ $W = (36,000)(1,500)$ $W = 54,000,000 \text{ J}$	$J = 54,000,000 \text{ J}$

- 3) You decide to sell cookies around your neighborhood. You pull a wagon fully loaded with cookies and travel 1500 meters around your neighborhood. How much force did you use if you performed 151,000 Joules of work?

Define Variables	Write equation and show work	Answer w/ units
$W = 151,000 \text{ J}$ $F = ?$ $d = 1500 \text{ m}$	$W = Fd$ $151,000 = (F)(1500)$ $F = 100.6666667 \text{ N}$	$F = 100 \text{ N}$

Work = Fd



Directions: Fill out everything for each problem. Write neatly!

- 4) The winning Tug O' War team pulls with 5,500 Newtons of force. They pull the other team 6.5 meters in order to win. How much work did they perform?

Define Variables	Write equation and show work	Answer w/ units
$W = ?$ $F = 5,500 \text{ N}$ $d = 6.5 \text{ m}$	$W = Fd$ $W = (5,500)(6.5)$ $W = 35,750 \text{ J}$	$W = 35,750 \text{ J}$

- 5) You climb a ladder that is 2.0 meters high and use the force of 1200 Newtons. How much work did you do?

Define Variables	Write equation and show work	Answer w/ units
$W = ?$ $F = 1200 \text{ N}$ $d = 2.0 \text{ m}$	$W = Fd$ $W = (1200)(2.0)$ $W = 2400 \text{ N}$	$W = 2400 \text{ N}$

- 6) A zombie horde is running toward you. You push the zombie horde with a school bus. The school bus moves the horde back 250 meters and uses 1,250,000 Joules. How much force was generated by the bus?

Define Variables	Write equation and show work	Answer w/ units
$W = 1,250,000 \text{ J}$ $F = ?$ $d = 250 \text{ m}$	$W = Fd$ $1,250,000 = F(250)$ $F = 5,000 \text{ N}$	$F = 5,000 \text{ N}$

- 7) An elevator lifts a load of passengers with a force of 156,000 N and does 2,550,000 Joules of work. How many meters did the elevator transport passengers?

Define Variables	Write equation and show work	Answer w/ units
$W = 2,550,000 \text{ J}$ $F = 156,000 \text{ N}$ $d = ?$	$W = Fd$ $2,550,000 = (156,000)(d)$ $d = 16.346 \text{ m}$	$d = 16.3 \text{ m}$

Name: _____
Period: _____

Date: _____

Power

Directions: Fill out everything for each problem. Write neatly!

$$W = Fd$$

+

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

=

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

- I) You did 7,500 Joules of work by running up some stairs in 2.3 seconds. What power did you exert?



Define Variables	Write equation and show work	Answer w/ units
P = ? W = 7500 J t = 2.3 s	$P = \frac{w}{t} = \frac{7500}{2.3}$ $P = 3260.87$	P = 3300 W

- 2) A machine performs with 756 watts of power over the course of 25 seconds. What work did this machine do?



Define Variables	Write equation and show work	Answer w/ units
P = 756 w W = ? t = 25 s	$P = \frac{w}{t}$ $756 = \frac{w}{25}$ $P = 18,900$	P = 19,000 J

- 3) How much time does it take to do 9,560 Joules of work with 860 watts of power?



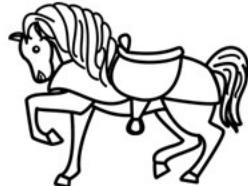
Define Variables	Write equation and show work	Answer w/ units
P = 860 w W = 9560 J t = ?	$P = \frac{w}{t}$ $860 = \frac{9560}{t}$ $t = 11.163$	P = 11 s

- 4) A 35,500 Newton car runs up a hill that is 45.5 meters high in 1.6 seconds. What power did the car exert?



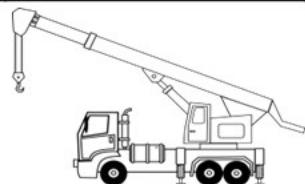
Define Variables	Write equation and show work	Answer w/ units
$P = ?$ $W =$ $F = 35,500 \text{ N}$ $d = 45.5 \text{ m}$ $t = 1.6 \text{ s}$	$P = \frac{F d}{t} \quad P = \frac{(35,500)(45.5)}{1.6}$ $P = 1,009,531 \text{ W}$	$P = 1,000,000 \text{ W}$

- 5) A horse pulls a wagon with a force of 1450 Newtons. How many meters did the wagon travel if the horse exerted 798 watts of power over 3.5 minutes? (convert min to seconds)



Define Variables	Write equation and show work	Answer w/ units
$P = 798 \text{ W}$ $W =$ $F = 1450 \text{ N}$ $d = ?$ $t = 210 \text{ s}$	$P = \frac{F d}{t} \quad 798 = \frac{(1450)(d)}{210}$ $d = 115.57 \text{ m}$	$d = 120 \text{ m}$

- 6) A crane exerts 56,000 Newtons of force over a distance of 4.5 meters. How much power was generated if it took 4.2 seconds to accomplish this?



Define Variables	Write equation and show work	Answer w/ units
$P = ?$ $W =$ $F = 56,000 \text{ N}$ $d = 4.5 \text{ m}$ $t = 4.2 \text{ s}$	$P = \frac{F d}{t} \quad 756 = \frac{(56,000)(4.5)}{4.2}$ $P = 60,000 \text{ W}$	$P = 60,000 \text{ W}$

- 7) The power rating of an electric law mower is 2200 watts. If the lawn mower is used for 30 minutes (convert to seconds!), and 650 Newtons of force was used, how much distance was covered?



Define Variables	Write equation and show work	Answer w/ units
$P = 2200 \text{ W}$ $W =$ $F = 650 \text{ N}$ $d = ?$ $t = 1800 \text{ s}$	$P = \frac{F d}{t}$ $2200 = \frac{(650)(d)}{1800}$ $d = 6092 \text{ m}$	$d = 6100 \text{ m}$

- 8) A hairdryer is used for 600 seconds to dry hair. It has a 750 watt rating. How much work did the hairdryer do?



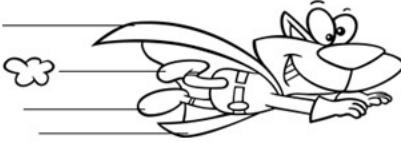
Define Variables	Write equation and show work	Answer w/ units
$P = 750 \text{ W}$ $W = ?$ $F =$ $d =$ $t = 600 \text{ s}$	$P = \frac{W}{t}$ $750 = \frac{W}{600}$ $W = 450,000 \text{ J}$	$W = 450,000 \text{ J}$

- 9) Zombie Al sweeps braaaains down a 45 meter hallway with a force of 75 Newtons. How long does it take Zombie Al to do this if he exerts 550 watts of power?



Define Variables	Write equation and show work	Answer w/ units
$P = 550 \text{ W}$ $W =$ $F = 75 \text{ N}$ $d = 45 \text{ m}$ $t = ?$	$P = \frac{F d}{t}$ $550 = \frac{(75)(45)}{t}$ $t = 6.136 \text{ s}$	$t = 6.1 \text{ s}$

10) Super Cat! flies 8,500 meters to save someone. It takes Super Cat! 15 minutes to fly that far (convert to seconds!). What is the force exerted if Super Cat! exerts 425 watts of power?



Define Variables	Write equation and show work	Answer w/ units
$P = 425 \text{ W}$ $W =$ $F = ?$ $d = 8500 \text{ m}$ $t = 900 \text{ s}$	$P = \frac{F d}{t}$ $425 = \frac{(F)(8500)}{900}$ $F = 45 \text{ N}$	$F = 45 \text{ N}$

II) A 750 Newton passenger rides in an elevator (that is 22,000 Newtons). If the elevator ride is 95 seconds long and uses 7,700 watts of power, how far did the elevator move?



Define Variables	Write equation and show work	Answer w/ units
$P = 7,700 \text{ W}$ $W =$ $F = 22,750 \text{ N}$ $d = ?$ $t = 95 \text{ s}$	$P = \frac{F d}{t}$ $7700 = \frac{(22,750)(d)}{95}$ $d = 32.15$	$d = 32 \text{ m}$

12) How much force did the Zombie Hamster use when she generated 38 watts of power running down the hallway? The hallway was 12 meters long and it took her 35 seconds to travel the length of the hallway.



Define Variables	Write equation and show work	Answer w/ units
$P = 38 \text{ W}$ $W =$ $F = ?$ $d = 12 \text{ m}$ $t = 35 \text{ s}$	$P = \frac{F d}{t}$ $38 = \frac{(F)(12)}{35}$ $F = 110.8 \text{ N}$	$F = 110 \text{ N}$