

Name \_\_\_\_\_ Date \_\_\_\_\_  
Period \_\_\_\_\_ Points available: \_\_\_\_\_


**Conceptual Physics**  
School Closure Agenda

- First priority: stay safe and healthy.
- Read all three sections in chapter 15 on energy and do the worksheets for each section.
- Do the worksheet on Potential and Kinetic energy problems.
- Do the Kinetic Energy Analysis worksheet. There is a piece of graph paper attached in the packet
- Do the worksheet on Roller Coaster Energy

I will miss all of you. If you have any questions about any of the assignments, text me at (860)-593-8592

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## Chapter 15 Energy

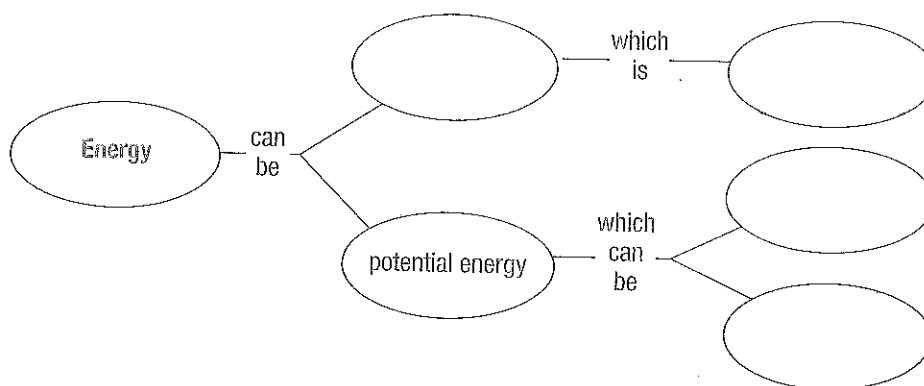
### Section 15.1 Energy and Its Forms

(pages 446–452)

*This section describes how energy and work are related. Kinetic energy and potential energy are defined, and examples are shown for calculating these forms of energy. Examples of various types of energy are discussed.*

#### Reading Strategy (page 446)

**Building Vocabulary** As you read, complete the concept map with vocabulary terms and definitions from this section. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.



#### Energy and Work (page 447)

1. What is energy? \_\_\_\_\_
2. When work is done on an object, \_\_\_\_\_ is transferred to that object.
3. Circle the letter of each sentence that is true about work and energy.
  - a. Energy in food is converted into muscle movement.
  - b. Energy is transferred when work is done.
  - c. Both work and energy are usually measured in joules.
  - d. One joule equals one meter per newton.

#### Kinetic Energy (pages 447–448)

4. The energy of motion is called \_\_\_\_\_.
5. Is the following sentence true or false? You can determine the kinetic energy of an object if you know its mass and its volume.  
\_\_\_\_\_
6. Write the formula used to calculate an object's kinetic energy.  
\_\_\_\_\_
7. Calculate the kinetic energy of a 0.25-kg toy car traveling at a constant velocity of 2 m/s. \_\_\_\_\_

Chapter 15 Energy

**Potential Energy** (pages 448–450)

8. What is potential energy? \_\_\_\_\_  
\_\_\_\_\_
9. Is the following sentence true or false? The work done by a rock climber going up a cliff decreases her potential energy.  
\_\_\_\_\_
10. An object's gravitational potential energy depends on its \_\_\_\_\_, its \_\_\_\_\_, and the acceleration due to gravity.
11. Is the following sentence true or false? Gravitational potential energy of an object increases as its height increases.  
\_\_\_\_\_
12. The potential energy of an object that is stretched or compressed is known as \_\_\_\_\_.
13. Complete the table about potential energy.

Potential Energy		
Type	Description	Example
Gravitational		
	Stretched or compressed objects	

**Forms of Energy** (pages 450–452)

For numbers 14 through 19, write the letter of the form of energy that best matches the description.

**Descriptions**

- \_\_\_\_\_ 14. Energy stored in gasoline, coal, and wood
- \_\_\_\_\_ 15. The sum of an object's potential energy and kinetic energy, excluding atomic-scale movements
- \_\_\_\_\_ 16. Produces the sun's heat and light
- \_\_\_\_\_ 17. Travels through space in the form of waves
- \_\_\_\_\_ 18. Produces lightning bolts
- \_\_\_\_\_ 19. Increases as atoms within an object move faster

**Forms of Energy**

- a. mechanical energy
- b. chemical energy
- c. electrical energy
- d. thermal energy
- e. nuclear energy
- f. electromagnetic energy

## Chapter 15 Energy

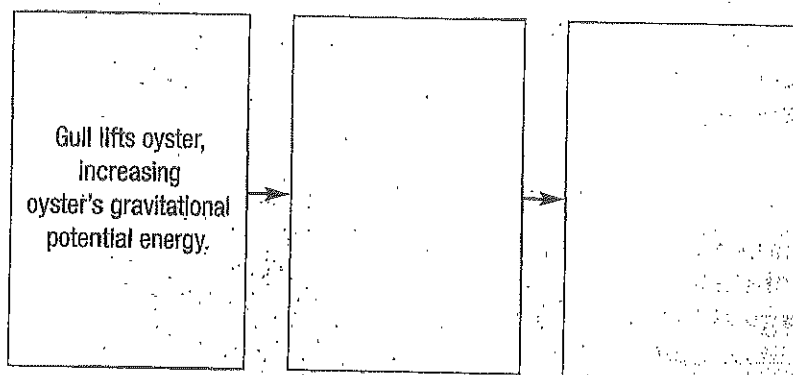
**Section 15.2 Energy Conversion and Conservation**

(pages 453–459)

*This section describes how energy is converted from one form to another. The law of conservation of energy also is presented.*

**Reading Strategy** (page 453)

**Relating Cause and Effect** As you read, complete the flowchart to explain an energy conversion used by some gulls to obtain food. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

**How Gulls Use Energy Conversions****Energy Conversion** (page 454)

1. Is the following sentence true or false? Energy can be converted from one form to another. \_\_\_\_\_
2. When a wind-up toy is set in motion, elastic potential energy that was stored in a compressed spring is converted into the \_\_\_\_\_ of the toy's moving parts.
3. Is the following sentence true or false? The action of striking a match shows that stored chemical energy in the match can be converted into thermal energy and electromagnetic energy of the flame in a single step. \_\_\_\_\_

**Conservation of Energy** (page 455)

4. What does the law of conservation of energy state? \_\_\_\_\_
5. Is the following sentence true or false? When an object slows down because of frictional force acting on it, an amount of energy is destroyed that is equivalent to the decrease in kinetic energy of the object. \_\_\_\_\_
6. A moving object slows down because friction causes a continual conversion of kinetic energy into \_\_\_\_\_

## Chapter 15 Energy

**Energy Conversions** (pages 456–458)

7. As an object falls, the gravitational potential energy of the object is converted into \_\_\_\_\_.
8. Circle the letter of each sentence that is true about pendulums.
- A pendulum consists of a weight suspended from a string that swings back and forth.
  - The weight at the end of a pendulum reaches maximum kinetic energy at the highest point in the pendulum's swing.
  - Potential energy and kinetic energy undergo constant conversion as a pendulum swings.
  - Frictional forces enable a pendulum to continue swinging without slowing down.
9. At what point during a pole-vaulter's jump is his gravitational potential energy the greatest? \_\_\_\_\_
10. Circle the letter of the type of energy that increases as the pole bends before it propels a pole-vaulter up into the air.
- kinetic energy
  - mechanical energy
  - frictional force
  - elastic potential energy
11. Is the following sentence true or false? For a mechanical change in an isolated system, the mechanical energy at the beginning equals the mechanical energy at the end of the process, as long as friction is negligible. \_\_\_\_\_
12. Tell whether the following situations illustrate *kinetic energy*, *potential energy*, or *both*.

What Type of Energy Is It?	
Situation	Form of Energy
A stationary wind-up toy with a compressed spring	
A descending roller coaster car	
A skier poised to take off at the top of a hill	
A car driving on a flat road	
A vibrating guitar string	

**Energy and Mass** (page 459)

13. What does Einstein's equation imply about mass and energy? \_\_\_\_\_
14. Is the following sentence true or false? Einstein's equation,  $E = mc^2$ , suggests that mass and energy together are conserved. \_\_\_\_\_

## Chapter 15 Energy

**Section 15.3 Energy Resources**

(pages 462–466)

*This section describes types of energy resources and ways to conserve them.***Reading Strategy** (page 462)

**Identifying Main Ideas** As you read the section, write the main idea for each heading in the table. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.

Heading	Main Idea
Nonrenewable energy resources	
Renewable energy resources	
Conserving energy resources	

**Nonrenewable Energy Resources** (page 462)

- What are nonrenewable energy resources? \_\_\_\_\_
- List four examples of nonrenewable energy resources.
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- Circle the letter of each resource that is considered to be a fossil fuel.
  - tree
  - uranium
  - oil
  - coal
- Is the following sentence true or false? Although fossil fuels are evenly distributed throughout Earth, they only represent ten percent of total energy consumed. \_\_\_\_\_
- What are some advantages and disadvantages of using fossil fuels as a source of energy? \_\_\_\_\_

**Renewable Energy Resources** (pages 463–464)

- An energy resource that can be replaced in a reasonably short period of time is called a(n) \_\_\_\_\_ resource.

## Chapter 15 Energy

7. Circle the letter of each sentence that is true about renewable energy resources.
- Wind and solar energy are both renewable energy resources.
  - Renewable energy resources are always more efficient than nonrenewable resources.
  - Renewable energy resources can be used to generate electricity and to heat homes.
  - Magma generates most renewable energy, either directly or indirectly.
8. Describe one energy conversion that takes place during the generation of hydroelectric power. \_\_\_\_\_

9. Is the following sentence true or false? One disadvantage of hydroelectric power is that it is among the most expensive energy sources. \_\_\_\_\_

For numbers 10 through 15, match the letter of each renewable *energy source* to its description.

Description	Renewable Energy Sources
_____ 10. Water pumped below ground is converted to steam.	a. hydroelectric
_____ 11. The most likely raw material is hydrogen.	b. solar
_____ 12. Mirrors concentrate sunlight to produce electricity.	c. geothermal
_____ 13. Kinetic energy of moving air is converted into rotational energy of a turbine.	d. wind
_____ 14. Energy is obtained from flowing water.	e. biomass
_____ 15. Chemical energy stored in wood, peat, and agricultural waste can be converted into thermal energy.	f. nuclear fusion

16. Is the following sentence true or false? Hydrogen fuel cells generate electricity by combining hydrogen with oxygen.  
\_\_\_\_\_

### Conserving Energy Resources (page 466)

17. What are two ways that energy resources can be conserved? \_\_\_\_\_
18. Name two practical ways in which people can conserve energy. \_\_\_\_\_



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**Conceptual Physics**  
Worksheet – PE and KE Problems

1. You are holding a 3 kilogram brick over the edge of a cliff, 67 meters above the ground below. How much potential energy does the brick have?

2. Does the brick have the ability to do work? If yes, how can a brick do work?

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3. It just snowed and you went sledding. Assume the hill you went sliding on has no friction when you slide down it. You weigh 60 kilograms and the hill you went sledding down is 36 meters high. At what point did you have the most potential energy? How much potential energy did you have at that point?

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4. At what point during your sledding trip did you have the most kinetic energy? How much kinetic energy did you have at that point? How fast were you going?

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5. Do you notice anything interesting when you compare your greatest potential energy during the sledding to your greatest kinetic energy during the sledding trip? What do you see?

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6. Attached is a diagram of a roller coaster ride? At what point does the coaster have the most potential energy? How much potential energy does it have at this point? At what point does it have the most kinetic energy? How much kinetic energy does it have at this point? Calculate how much potential and kinetic energy it has when the coaster is at point "E"? **Be sure to answer all of the questions in this example.**

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## Conceptual Physics

### Kinetic energy analysis

*Kinetic energy: The energy an object has due to its motion.*

What factors affect kinetic energy? If you want to increase the amount of kinetic energy an object has is it better to increase it's mass or increase it's speed? In this activity, you are to complete two data tables and graph both of them on a single graph. Once you have done this, you will compare the results by answering several questions.

One data table will be analyzing how increasing an object's mass affects the amount of kinetic energy an object has, and the other will be analyzing how increasing an object's speed affects the amount of energy an object has. This activity is to be completed during class, and will be collected and graded as a lab.

#### Step 1:

The data table below will allow you to analyze how changing a moving object's mass affects the amount of energy the object has. Complete the data table and move on to the next step

The object is moving at a constant speed of 5 meters/second. You are to complete the data table by calculating the kinetic energy each time the mass is increased.

#### Changing Mass

Mass of Object (kg)	Speed of Object (m/s)	Kinetic Energy of Object (J)
1	5	
2	5	
3	5	
4	5	
5	5	
6	5	
7	5	
8	5	
9	5	
10	5	

\_\_\_\_\_ Variable      \_\_\_\_\_ Variable      \_\_\_\_\_ Variable

In the space above identify each variable; independent, dependent, and constant

**Step 2:**

The data table below will allow you to analyze how changing a moving object's speed affects the amount of energy the object has. Complete the data table and move on to the next step

The object has a mass of 5 kilograms. You are to complete the data table by calculating the kinetic energy each time the speed is increased.

**Changing Speed**

Mass of Object (kg)	Speed of Object (m/s)	Kinetic Energy of Object (J)
5	1	
5	2	
5	3	
5	4	
5	5	
5	6	
5	7	
5	8	
5	9	
5	10	

\_\_\_\_\_ Variable      \_\_\_\_\_ Variable      \_\_\_\_\_ Variable

In the space above identify each variable; independent, dependent, and constant

**Step 3:**

On a single graph, plot the two graphs from the data tables you just completed. The "x" axis should be set up with two variables, one for each data table, but this should be done on the same graph to allow us to compare the results. Before you begin laying out your graph, determine what your domain and range need to be for the graph to allow both sets of data to be plotted. Once you have set up your graph, plot the data, and determine the line of best fit for each set of data. Then answer the following questions.

**Step 4:**

1. Look at the graph of the changing mass. How would you describe the relationship between the amount of mass a moving object has and the amount of kinetic energy the object has?

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2. Look at the graph of the changing speed. How would you describe the relationship between the speed of an object and the amount of kinetic energy that object has?

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3. If you wanted to increase the energy of a moving object, what would have a more significant impact; doubling the mass of the object, or doubling the speed of the object? Use data from your graphs and tables to support your answer.

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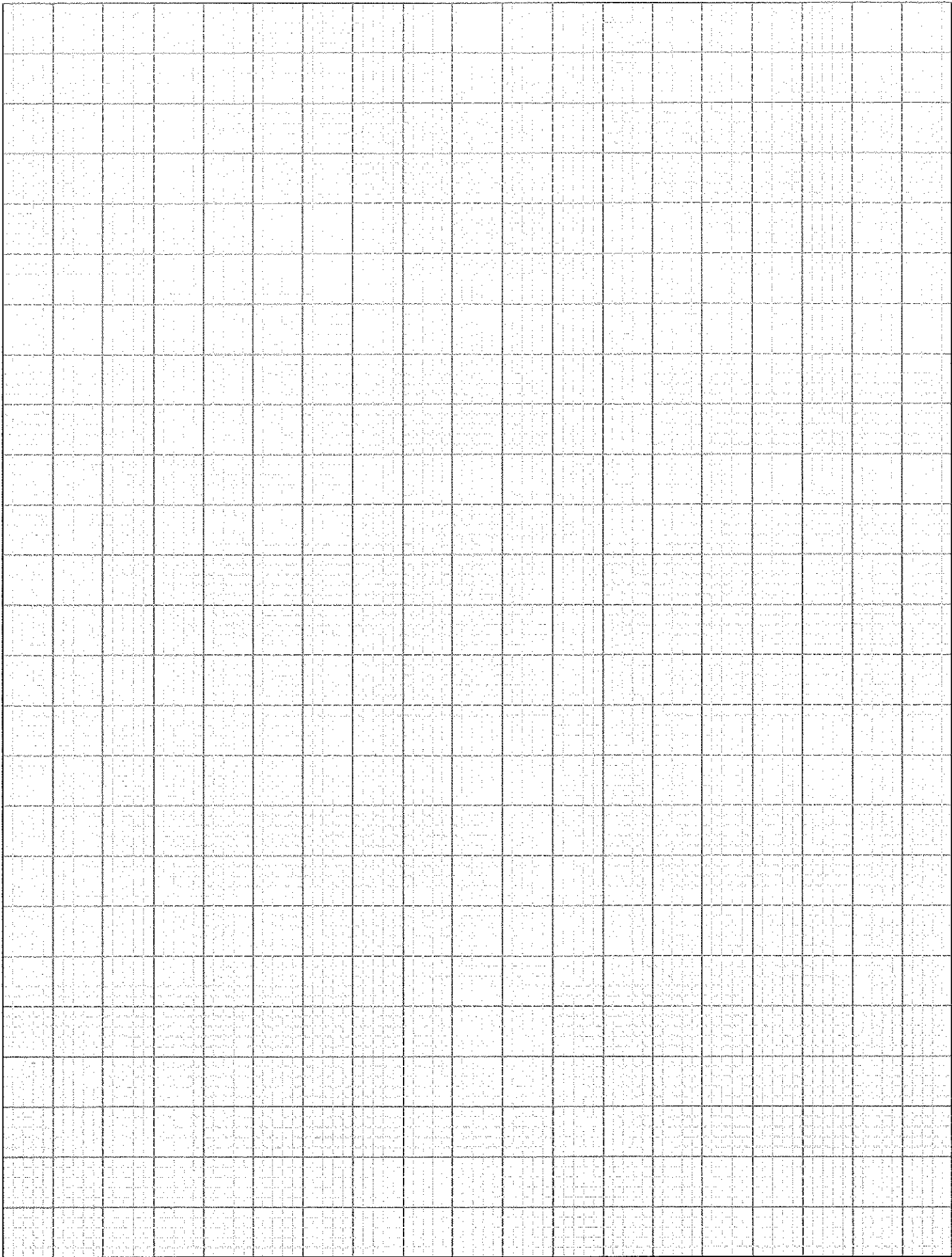
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## Conceptual Physics

### Worksheet – Roller Coaster Energy

**Directions:** Attached is a diagram of the Potential Express, a roller coaster at **Physics is Phun** theme park. Point “A” is before the ride starts, and the coaster does not apply the brakes to stop until after point “H”. All of the questions are about the roller coaster. For questions 1-6, assume there is no friction on the roller coaster. Answer the questions to the best of your ability. Explain all of your answers in terms of the physics we have been studying.

**Equations:**

$$PE = mgh$$

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

$$\Delta PE = \Delta KE$$

$$\text{Energy initial} = \text{Energy final}$$

1. (4 points) At what point on the ride is there the most potential energy? Why? How much potential energy is there at this point?

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2. (2 points) Is there any potential energy at point E? Why or why not? Explain your answer.

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3. (2 points) How much potential energy does the roller coaster have at point I? Explain your answer.

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4. (4 points) At point I, what is the kinetic energy of the coaster? What is the velocity of the roller coaster?

5. (4 points) Describe how the energy of the roller coaster cars changes as the car travels along the track. Explain what the energy is at each point (A-I) along the ride.

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6. (10 points) Calculate the potential energy, kinetic energy, and speed of the roller coaster at each point (A-I).

7. (4 points) How would your answer for the previous question change if there were friction on the roller coaster? Explain your answer in detail.

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# Potential Express

Mass of car = 300 kg

