

# Roller Coaster Physics

## Quiz 1

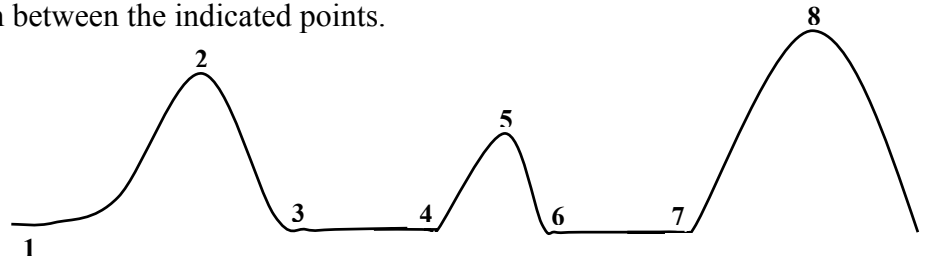
Name: \_\_\_\_\_

I. (12 points) Match the word with its definition. (*Question 1 has been done for you*).

- |    |       |  |   |
|----|-------|--|---|
| 1. | E     | The difference between two positions on a ride.  | A. <i>acceleration</i>                  |
| 2. | _____ | The speed and direction that a roller coaster train is moving.   | B. <i>potential energy</i>              |
| 3. | _____ | The rate at which a roller coaster train's velocity changes.   | C. <i>gravity</i>                       |
| 4. | _____ | The force exerted on an object is directly proportional to both the mass of the object and its acceleration. | D. <i>kinetic energy</i>                |
| 5. | _____ | A force that pulls all objects on Earth toward the Earth's center of mass.                                   | E. <i>displacement</i>                  |
| 6. | _____ | A stored form of energy that can produce motion.   | F. <i>velocity</i>                      |
| 7. | _____ | A form of energy directly related to the square of the velocity of the object.                               | G. <i>Newton's Second Law of Motion</i> |

II. (10 points) Refer to the Roller Coaster in the drawing below. The coaster is pulled up to point 2 by a chain-lift, released at point 2 and plunges down the first hill toward point 3. Assume there is no friction and the velocity at point 2 is essentially zero. Use the following key to describe the motion between the indicated points.

- A. accelerating
- B. decelerating
- C. constant speed
- D. stopped



*Question 1 has been done for you.*

- |                | Motion |
|----------------|--------|
| 1. From 1 to 2 | C      |
| 2. From 2 to 3 | _____  |
| 3. From 3 to 4 | _____  |
| 4. From 4 to 5 | _____  |
| 5. From 5 to 6 | _____  |
| 6. From 6 to 7 | _____  |

III. (5 points) Refer to II above. On the Roller Coaster drawing, place an "X" at the approximate spot where the car will come to an *initial stop after* it is released from the chain lift and starts down toward point 3. Discuss why you chose that spot.



3. (15 points) What is the speed of the coaster at the bottom of the first hill in meters per second. You **must** start with the general energy balance equation.
4. (15 points) How much work is done to lift the train to the top of the first hill? (Assume the velocity at the bottom of hill just as the train hooks onto the chain lift is zero.) You **must** start with the general energy balance equation.

5. (10 points) How much power (in horsepower) is needed to lift the car to the top of the first hill?

6. (10 points) What is the speed of the coaster at the top of the second hill?