

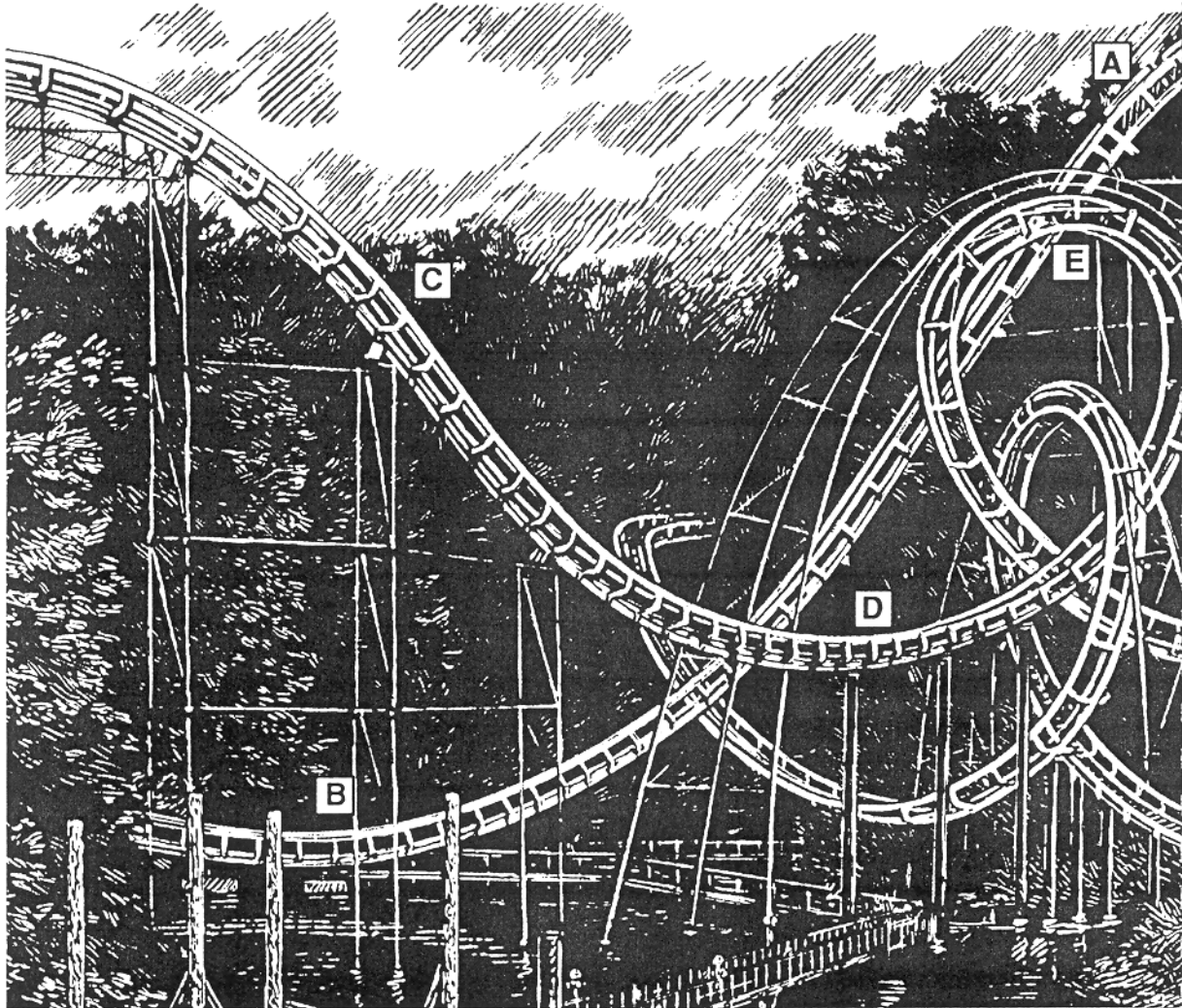
Roller Coaster Physics

Assignment 9

Name: _____

Use the following information on the Loch Ness Monster for questions 1 and 2.

Loch Ness Monster



Suppose you measured the velocity at the bottom of hill (B) to be 25.9 m/sec, the bottom of hill (D) to be 16.8 m/sec, and the velocity at the top of loop (E) to be 11 m/sec. You are given the following radii of curvature at points B, D, and E:

- Radius at B = 29.9 meters
- Radius at D = 15.8 meters
- Radius at E = 4.6 meters

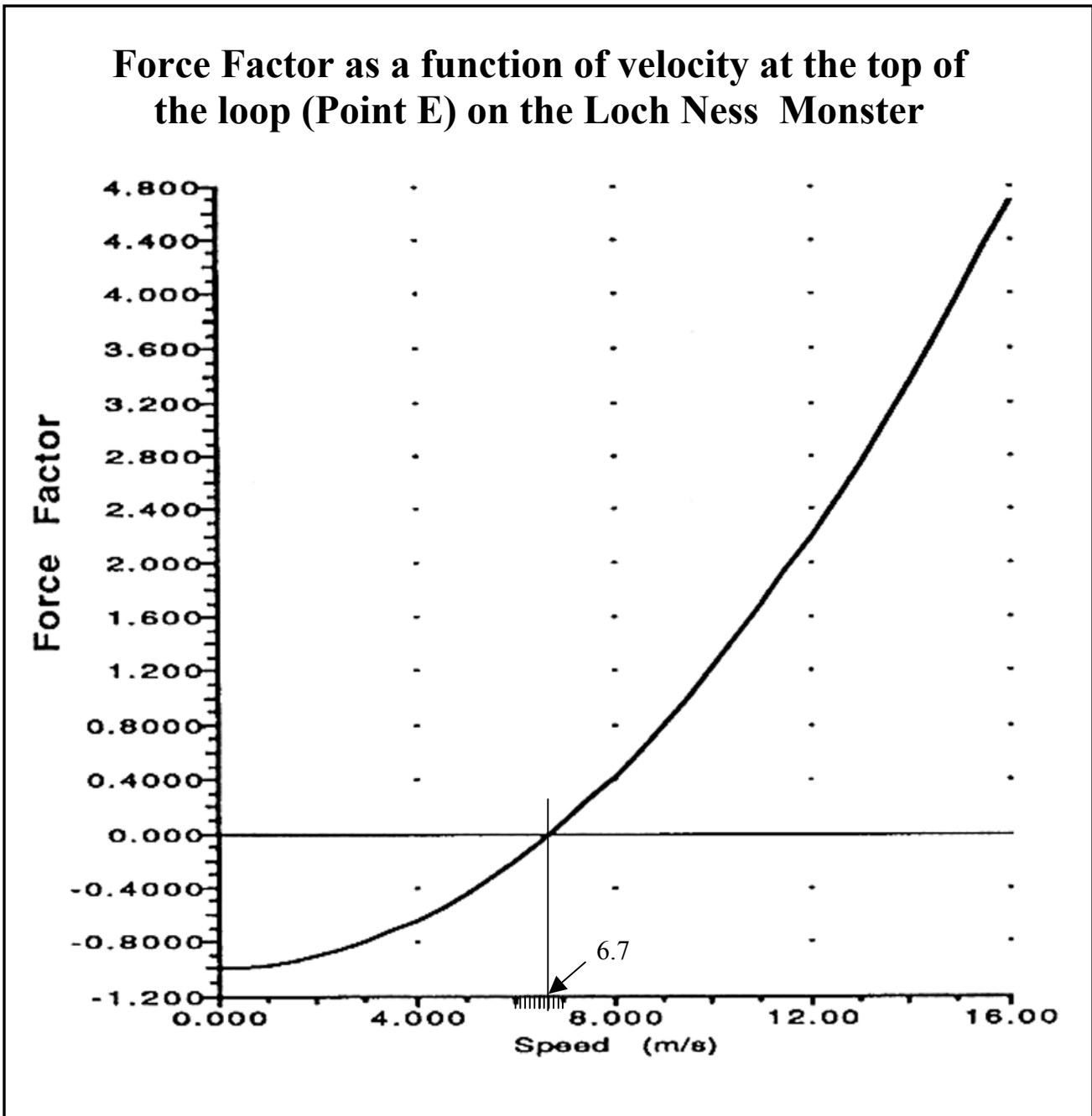
1. Compute the force factors at points B, D, and E on the Loch Ness Monster. You must show all your work.

2. The shape of the loop is called a *clothoid*. It has a large radius of curvature at the bottom (Point D) and a small radius at the top (Point E). To investigate what the loop would be like without this variable radius (smaller at top than at bottom), first find the force factor at the bottom of the loop (Point D) if the radius at the bottom were the same as the top of the loop (4.6 meters).

Next, find the force factor at the top of the loop (Point E) if the radius at the top were the same as the radius at the bottom (29.9 meters).

Discuss your findings.

Use this graph for question 3.



3. Refer to the graph of Force Factor as a function of velocity at the top of the loop (Point E) on the Loch Ness Monster (on previous page). Show your work on the graph.
- a. What is the minimum velocity required to get through the loop safely (nobody falls out of the car)?

 - b. What range of velocities will allow you to get through the loop but will produce a light feeling at the top of the loop?

 - c. What should the coaster designer use as the maximum speed at the top of the loop so that the passengers do not experience a Force Factor greater than 4.5?

 - d. Using a velocity at the top of the loop of 39.4 ft/sec, find the force factor. (See your handout titled "Some Important Formulas, Constants and Conversion Factors").