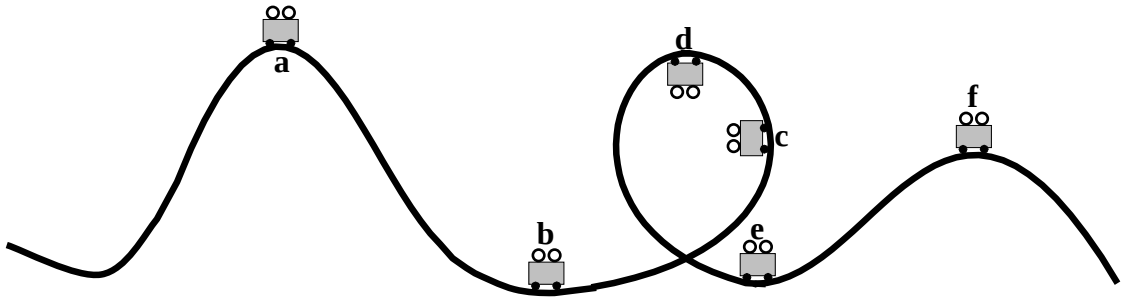
Name_____

Date_____ Pd____

Unit 6 Review:



1. At the top of the first hill of the rollercoaster, point "a," a 60 kg passenger feels as if she "weighs" 500 N. Explain which force provides the sensation of weight. How fast is the rollercoaster going over the 3.0 m radius hilltop to create this sensation? Draw a quantitative force diagram for the situation.

2. At point "b" the rollercoaster has reached a speed of 28 m/s. How large must the radius of the valley be so that a 100 kg rider will experience a normal force of five times their weight (5 G's)? Draw a quantitative force diagram for the situation.

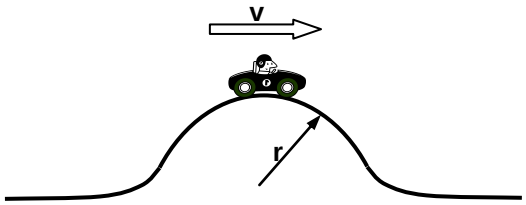
3. At point "c" a 70 kg rider is traveling at 20 m/s in a 7.0-meter radius curve. Draw a quantitative force diagram for the rider.

4. At point "d" a 40 kg child is upside-down at the top of the loop. How fast would the train have to pass through the 4.0-meter radius curve to produce a 200 N downward normal force on the child? Draw a quantitative force diagram for the child.

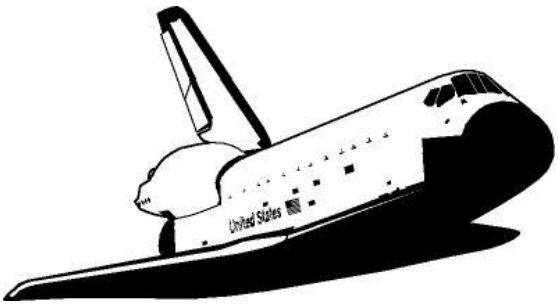
5. Exiting the loop at valley “e” the 2000 kg rollercoaster exerts a downward normal force on the track of 90,000 N. The track radius is 130 meters. Draw a quantitative force diagram for the rollercoaster train.

6. At the top of hill “f” the rollercoaster crests the 5.0-meter radius curve at 6.0 m/s. Draw a quantitative force diagram for a 60 kg passenger. How many G’s would any passenger feel at the top of the hill?

7. A car travels over a hill at constant speed. If the radius of the hill is 30 meters, at what speed would the centripetal force equal the force of gravity? If the car were to exceed this speed, what would happen to the car?



8. Here is the data for the space shuttle in its orbit around earth:



Shuttle mass in orbit = 94,802 kg
mass of the earth = 6×10^{24} kg
shuttle orbital height above the earth = 2.76×10^{5} m
radius of the earth = 6.38×10^{6} m
shuttle tangential velocity when in orbit = 7823 m/sec

a. Use the principles of circular motion to find the centripetal force necessary to keep the shuttle in its circular orbit around earth.

b. Use Newton's Law of Universal Gravitation to find the gravitational force the earth exerts on the shuttle when the shuttle is in orbit.

c. How do the values calculated in parts *a* and *b* compare to one another? Explain.