

Name \_\_\_\_\_

Date \_\_\_\_\_ Pd \_\_\_\_\_

## Worksheet 8

Assume that the car shown below is going at a constant speed



Fig 1

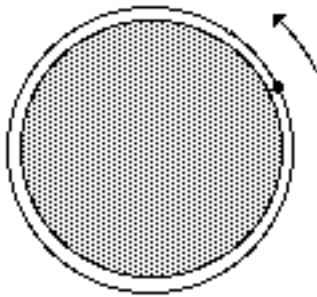
- 1 In what direction is the car experiencing an acceleration? If your response is yes, in what direction is the acceleration? Explain how you know.
- 2 Construct a qualitative force diagram for the car when it's at the top of the hill. (Justify the relative forces in your force diagram.)
- 3 Suppose the speed of the car is  $11.1 \text{ m/s}$  ( $\approx 25 \text{ mph}$ ) and the radius of curvature ( $r$ ) is  $25 \text{ m}$ ; determine the magnitude of the centripetal acceleration of the car.
- 4 If the mass of the car is  $1200 \text{ kg}$ , what  $\Sigma F$  would be required to cause this centripetal acceleration?
- 5 Now, construct a **quantitative** force diagram for the car.
- 6 At what speed would the centripetal force equal the force of gravity?
- 7 Suppose the car were going faster than the speed that you calculated for question 7; describe what would happen to the car.

The National Academy of Science, in order to gather information on deforestation, wishes to place a 500. kg infrared-sensing satellite in a polar orbit around the earth. The radius of the earth is approximately  $6.38 \times 10^3$  km (638000 m), and the acceleration of gravity at the orbital altitude of 160 km is very nearly the same as it is at the surface of the earth.

8. Construct a force diagram for the satellite described in the statement above.

9. What is the agent of the centripetal force for the satellite?

Assume that the diagram below represents the orbit of the satellite around the moon at an altitude of 100 km.



10. Construct a force diagram of the satellite in orbit.

11. If the satellite were to change its orbit so that it was now at an altitude of 50 km, would it have to speed up or slow down? By what factor is the velocity changed? Explain.