**Unit C Project Circular Motion, Work & Energy**

**Part A:**

Unbeknownst to the baboon, a satellite is tracking its motion in order to gather information about its behavioral patterns. The satellite is called EnviSat and carries an array of nine Earth observation instruments.

1. Why does the satellite stay in orbit?
2. What is the gravitational field strength 790 km above the surface of Earth where the satellite is in orbit?
3. What is the weight of the satellite if its mass is 8211 kg?
4. What is the velocity of the orbiting satellite?
5. At what height would the satellite need to be placed above Earth to make it geosynchronous? The speed of a satellite in a geosynchronous orbit is 11 068 km/h.

HINT: Use V = 2(pi)R / T to use the period

The scientists tracking the baboon are driving on the Serengeti Plains. They must negotiate an unbanked curve with a radius of 15 m. The coefficient of kinetic friction is 0.350 and the mass of their jeep is 1600 kg.

1. How fast can the jeep travel around the turn without skidding?
2. Once it begins raining and the ground becomes slippery, friction becomes negligible. At what angle must the road be banked in order to allow the jeep to safely negotiate the turn at the same speed?

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| car on level road | car on banked road | http://www.batesville.k12.in.us/Physics/PhyNet/Mechanics/Circular%20Motion/Images/banked_car3.gif |
| **A Car on a Level Surface**  All forces on the car are vertical, so no horizontal force can be generated. | **A Car on a Banked Turn**  The normal force on the car due to the road is no longer vertical, so a component of the normal force acts in the horizontal direction. | **The Centripetal Force**  The horizontal component of the normal force is shown in blue in the diagram above. This force can supply a centripetal force to turn the car. |

The scientists approach a 30.0 m hill with a slope of 10o. Because of the slippery conditions, they slow down the jeep to a speed of 5.0 km/h at the top of the hill and shift it to neutral and coast down the hill.

1. What is the speed of the jeep at the bottom of the hill?

At the bottom of the hill, the jeep, which is unable to stop, hits a large rock which slides 23.8 m forwards as the jeep is brought to a complete stop.

1. What force did the jeep exert on the large rock?

