**Unit D Project – Mechanical Waves**

**Part A:**

The jeep, whose mass is 1100 kg, has a good suspension system. Each wheel has a spring over it that is compressing 10 cm as the jeep bounces over the rough roads.

1. What is the spring constant on each spring?
2. When the jeep spring bounces back to the equilibrium position, how fast is it going?

The jeep tracks the baboon down to a specific area of the jungle where the natives have set traps to catch the baboons. One of the trackers who is 90 kg accidentally steps in one of the traps and is now swinging side to side with his leg trapped in a 4.25 m vine. He swings up to a vertical height of 2.0 m.

1. How fast is the tracker moving at the equilibrium position?
2. How long does it take for the man to complete one back and forth motion?
3. What is the frequency of his swing?
4. What is the restoring force required to bring the tracker back to the equilibrium position if the initial angle is 20o?

Hint: draw the free body and vector diagrams of the forces acting on the tracker

**Part B:**

The vine that was holding the tracker suddenly snaps, sending him flying through the air and he falls in to a lake, 10m from the shore.

1. ![MCj03666040000[1]]()If the wavelength is 0.3 and there are 1.7 waves per second, how long will it take for the wave to reach the shore?

An ambulance is racing to the scene to save the tracker when he washes up on shore if the crocs don’t get him first. It is a hot 40oC day.

1. How fast is the ambulance going if the apparent frequency is 942 Hz and the actual frequency is 796 Hz and the tracker is stationary on the shore?
2. To alert the paramedics, the tracker uses a long reed to make a flute that vibrates in the third harmonic. The frequency of the sound is 500Hz. What is the length of the reed the tracker used?

![MCAN00195_0000[1]]()Two crocodile![MCAN00195_0000[1]]()s nearby hear the sound made by the tracker and simultaneously take off toward the sound, each creating a wave pattern behind them.

1. Draw and label the wave pattern created by each croc as well as the wave pattern created when they interfere with each other.

The waves pass through a small channel and emerge out the other side.

1. Draw the resulting wave pattern that emerges from the channel.

