NEWTON'S 2ND LAW

Unit 6 & 7 Dr. John P. Cise , Professor of Physics ,
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This Week Surfers Will Ride a Wave in the Amazon

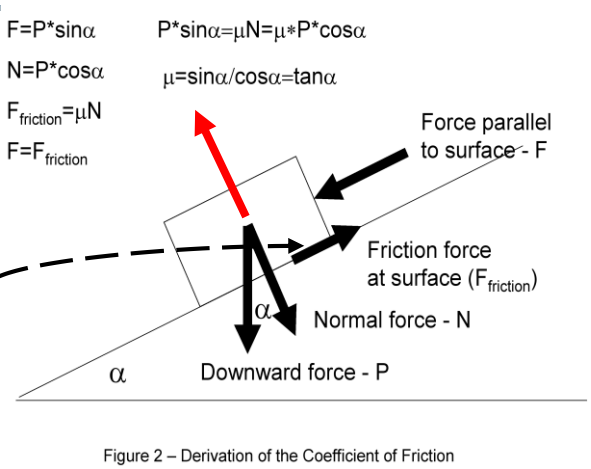

Figure 2 – Derivation of the Coefficient of Friction

People surf on the wave of a tidal bore known as "Pororoca" in March 2015 during an annual festival in Sao Domingos do Capim, Brazil.

The beast that river-dwellers have long feared is coming later this week. It's a wave called Pororoca, the great roar, and its low bellow can be heard up to an hour before it arrives. **It tumbles in from the ocean and travels up the Amazon on a path of destruction. While the region's residents accept the river's wrath and start moving their boats and animals, daredevils called bore riders grab their surfboards.** This beast that they will ride is called a tidal bore, a wave that flows in from the ocean and propagates to dozens of rivers around the world. **Along the Amazon, one of the strongest bore tides brings big waves that travel for miles and seem to last forever, perfect for a long ride.** During new and full moons, when the river is relatively shallow and the ocean tide is high, water flows in from the Atlantic, rather than the other way around. As river and ocean collide, the Amazon's flow reverses and a water swell speeds upstream with incredible force. The **strongest tidal bores occur on biannual equinoxes in September and March, when the sun, moon and Earth align; their combined gravitational pull brings ocean tides to their peak**. A full moon on March 23 combined with the equinox means good news for bore riders like **Serginho Laus, a surfer and Pororoca pioneer. He broke records in 2003 for (((*his 33.25-minute, 6.3-mile ride*)))** along the pororoca of the Araguari, a river in the Brazilian Amazon basin.

INTRODUCTION: Review the graphic in the upper right where Newton's second Law was used to find coefficient of friction between surfboard and water surface μ = tan. α . P = m g = weight of surfer & board. Since no acceleration parallel to water surface exists the sum of forces in that direction must be zero:

P sin. α – μ P cos. α = 0 , Thus, μ = sin.α/cos.α = tan.α

QUESTIONS: (a) The average coefficient of friction μ between surfboards and water as listed in Wikipedia is 0.25. Find angle α ? (b) Does this angle seem reasonable and plausible? (c) Convert 33.25 min. to hours? (d)Find surfer Serginho Laus's speed(in mph) riding the tidal bore wave in 2003?

HINTS: $F_{NET} = m\,a$, $X = V_{AVE}\,t$, 60 min. = 1 hr. ,

ANSWERS: (a) α = ~ 14° , (b) By the looks of the picture, yes plausible. (c) t = 0.554 hr. , (d) V = 11.37 mph