Name _____ Date _____ Period _____

The Physics of "Avatar"

CONCEPTUAL PHYSICS

Directions: Answer any <u>five</u> of the bulleted-questions below. Clearly number and answer in complete sentences to receive credit. Show all work when you are asked to use a physics equation to solve.
(**EXTRA CREDIT**: 3 points for each additional bulleted-question answered)

Equations:

$F = ma$ $F_g = mg$ $v = \frac{d}{t}$ $F = G\frac{m_1 m_2}{d^2}$ $p = mv$ $I = \frac{V}{R}$ $P = IV$

$v = v_0 + gt$ $d = \frac{1}{2}gt^2$ $t = \sqrt{\frac{2d}{g}}$ $PE = mgh$ $KE = \frac{1}{2}mv^2$

1. The term "slow gravity" was used to describe the gravitational acceleration *("g")* on Pandora.
   - What did they mean by this?
   - Which equation above would be used to support this claim?
   - What effects might "slow gravity" have on the human body?
   - How might "slow gravity" affect the growth of trees and plants on Pandora?

2. Unobtainium was the resource humans were mining on Pandora.
   - What was the importance of this material and what would it be used for?
   - How did the presence of unobtainium explain the "Hallelujah" Floating Mountains?
   - Using Ohm's Law ($I = \frac{V}{R}$), explain how unobtanium would increase the resulting current in an electrical circuit.
   - How would unobtanium affect the Power generated by an electrical device? $P = IV$
   - What is the Law of Conservation of Energy and how is it relavent to superconductors?

3. Pandora's acceleration due to gravity is only 80% of what it is here on Earth. Assuming your mass is 100 kg: *("g" on Earth equals 9.8 m/s^2)*
   - What would your mass be on Earth and on Pandora?
   - What would your weight be on Earth and on Pandora? $F_g = mg$
   - Assuming there is no air resistance and you were falling for 10 seconds, what would your velocity be on Earth and on Pandora? $v = v_0 + gt$
   - How would an object's momentum be effected by Pandora's decreased gravitational attraction (use equation for momentum to help answer question) $p = mv$

4. In the movie, the "*Na'vi*" said that the energy in their bodies is only borrowed.
   - Explain this in terms of the Law of Conservation of Energy.

5. The trip to Pandora took 6 years to travel the 4.37 light years away from Earth.
   (1 light year = 1.08 x 10^{12} kilometers)
   - What was their average speed during the trip? (*express in km/sec*) $v = \frac{d}{t}$
   - If the mass of the spacecraft was 1 million kilograms, what was the spacecraft's momentum? $p = mv$
   - What was the spacecraft's kinetic energy? $KE = \frac{1}{2}mv^2$