Physics 1302-Section 004 Tutorial Quiz #1
February 1st 2012

Name (PRINT):_____
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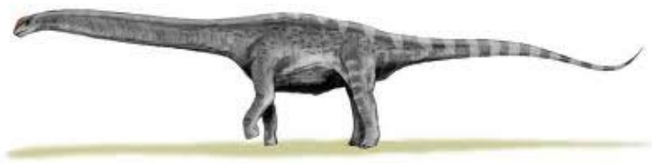
Part II: Problem (14 Points)

a) Blood Pressure in Argentinosaurus
This long necked, gigantic sauropod has a head height of 21 m and a heart height of 9 m. The tip of his tail was typically held at 8 m above ground. The hydrostatic gauge pressure in its blood at the heart was sufficient so that the blood pressure at the brain was 110 hPa, just enough to perfuse the brain with blood. Assume the blood had a density of 1.06 x 10^3 kg/m^3. What was the blood pressure in Pa at the tip of his tail? (h is 10^2 in the Pascal expression)



Solution: **4 marks**

004, tip of tail The gauge pressure at the tip of the tail of the *Argentinosaurus* is

$$p_{\text{tip of tailt}} = p_{\text{brain}} + \rho gh = 110\ \text{hPa} + \left(1.06 \cdot 10^3 \frac{\text{kg}}{\text{m}^3}\right)\left(9.81 \frac{\text{m}}{\text{s}^2}\right)(21\text{m} - 8\ \text{m})$$
$$= 1351.83\ \text{hPa}$$

b) A bubble in sparkling mineral water accelerates upward at a rate of 0.225 m/s^2 and has a radius of 0.5 mm. Assume ρ_{water} = 998 kg/m^3 and the bubble as a sphere. What is it's mass?

Solution: **5 marks**

$$\rho_{water} V g - \rho_{bubble} V g = \rho_{bubble} V a$$

$$\rho_{bubble} = \frac{\rho_{water}}{1 + \frac{a}{g}} = \frac{998\ \frac{kg}{m^3}}{1 + \frac{0.225 \frac{m}{s^2}}{9.81 \frac{m}{s^2}}} = 975.6\ \frac{kg}{m^3}$$

$$V_{bubble} = \frac{4}{3}\pi r^3$$

$$m = \rho V = 975.6 \frac{kg}{m^3} \frac{4}{3} \pi\ (0.5 \cdot 10^{-3} m)^3 = 5.11 \cdot 10^{-7}\ kg$$

c) There is fresh water behind a reservoir dam. The dam has a height of D = 15 m from its bottom to the water level. A cylindrical, horizontal pipe with a diameter of 4 cm passes through the dam at a depth d = 6 m under the water level. A plug secures the pipe opening. The plug is removed.
What water volume exists the pipe in 3 h?

Solution: **5 marks**

$$v = \sqrt{2gd} = \sqrt{2 \cdot 9.81 \frac{m}{s^2} \cdot 6m} = 10.85 \frac{m}{s}$$

$$V = Avt = \frac{\pi}{4} d^2 vt = \frac{\pi}{4} (0.04m)^2 \cdot 10.85 \ \frac{m}{s} \ 10800 \ s = 1.5 \cdot 10^2 m^3$$