

## AE 3310 Introduction to Aerospace Vehicle Performance

### Homework #1

*Due Tuesday, May 22, 2001*

#### Aerospace Environment

1. By using Newton's Law of Gravitation

$$\vec{F} = G \frac{m_1 m_2 \vec{d}}{d^3}$$

the value of the constant  $G$  determined by Henry Cavendish as

$$G = 6.67259 \times 10^{-11} \frac{\text{m}^3}{\text{kg s}^2}$$

and the estimate of Earth's mass as  $M_{Earth} = 5.98 \cdot 10^{24} \text{ kg}$

determine the required radius for the orbit of a geosynchronous satellite. How many Earth radii does this distance represent?  $R_{Earth} = 6,367 \text{ km}$  (median value) What is the value of  $g$ , the acceleration due to gravity, at that distance?

2. In order to get a better appreciation for the properties of the Earth's atmosphere and their variation with altitude, estimate the distance (measured as the crow flies) between this classroom and the place where you live. Knowing that Atlanta is located at an approximate elevation of 1000 feet MSL (above *Mean Sea Level*) and assuming Standard Atmospheric conditions, imagine that instead of traveling home as usual you travel the same distance *straight up*. What would be the atmospheric temperature, pressure, air density, and speed of sound at that location? Would a human being be able to survive at that location for an indefinite period of time? (Hint: Federal Aviation Regulations 91.211 require the use of supplemental oxygen for crew members above 12,500 feet MSL cabin pressure – there are more elements to the provision, but they are irrelevant for the purpose of this exercise). In performing the calculations use either Standard Atmosphere tables or the website indicated in class.