

Homework #4
AS101 Summer 2006
Dr. Withers

GRADE SHEET

Assigned: 2006.05.25
Due: 2006.05.26, start of class

1) Read Chapter 4

2) Newton's Law of Gravity is $F = G M_1 M_2 / d^2$, where G is $6.67 \times 10^{-11} \text{ m}^3 / (\text{kg s}^2)$.
Use this equation to find the units of the force F in terms of kg, m, and s.

G has units of $\text{m}^3 / (\text{kg s}^2)$, M_1 and M_2 have units of kg, and d has units of m.

$$\frac{\text{m}^3}{\text{kg s}^2} \times \text{kg} \times \text{kg} \times \frac{1}{\text{m}^2} = \frac{\text{kg}^2}{\text{kg}} \times \frac{\text{m}^3}{\text{m}^2} \times \frac{1}{\text{s}^2} = \frac{\text{kg m}}{\text{s}^2}$$

Just stating units as $\text{kg m} / \text{s}^2$ 5 points
Attempting to cancel units in this way 15 points
Correctly cancelling the units in this way 25 points

3) Suppose another solar system has a star that is four times as massive as the Sun and a planet called Banana. If Banana is ten times as massive as Earth and orbits its star at 1 AU, what is its orbital period? You will not need a calculator to do this problem.

Stating equation $p^2 = a^3 \times 4\pi^2 / (G M_{\text{Star}})$ 10 points
Using information that a is the same for Banana and Earth and M_{Star} is four times larger for Banana than Earth 5 points
Showing that the square of Banana's period is four times smaller than the square of Earth's period 5 points
Showing that Banana's period is half of Earth's period, or half a year 5 points

4) What is the velocity of a car driving at the speed limit on the freeway from Boston to Florida?

A number between 50 and 75 0 points
A number between 50 and 75 and a southward direction 10 points
A speed between 50 and 75 mph 10 points
A speed between 50 and 75 mph and a southward direction 25 points

5) What causes tides?

Gravity 5 points
The Moon's gravity 15 points
The change in the Moon's gravity from one side of Earth to the other 25 points