Homework #5   GRADE SHEET
AS101 Summer 2006
Dr. Withers

Assigned: 2006.05.26
Due: 2006.05.30, start of class

1) Read Chapter 4

2) State each of Newton's Laws of Motion. For each law, give an example of its application.

Correct statement of one law and suitable application   5 points
Correct statement of three laws without any applications   5 points
Correct statement of two laws and suitable applications   15 points
Correct statement of three laws and suitable applications 25 points

An object moves at a constant velocity if there is no net (overall or total) force acting upon it. Example: A spaceship needs no fuel to keep moving in space
Force = mass x acceleration. Example: If you throw two things with the same force, the lighter one will go further
For any force, there is always an equal and opposite reaction force. Example: Earth and I gravitationally attract each other with the same amount of force. I am accelerated downwards and Earth is accelerated upwards by this pair of forces.

3) If a planet orbits the Sun in an elliptical orbit, does its energy change during one orbit? Does its momentum change? Does its angular momentum change? Explain your answers.

Energy does not change   5 points
Angular momentum does not change   5 points
Momentum does change   5 points
Energy is transferred between kinetic and gravitational potential energy   5 points
Momentum changes because the force of the Sun's gravity is acting on the planet, or momentum changes because direction of motion keeps changing, or momentum changes because speed is greater at aphelion than at perihelion.   5 points

4) Describe the structure of an atom

(Maximum of 25 points, even if all these topics are given in the answer)
Protons, neutrons, and electrons   5 points
Small nucleus containing protons and neutrons   5 points
Electrons form a large cloud around the nucleus   5 points
Protons and neutrons are much heavier than electrons   5 points
Electron energy levels are quantized   5 points
Definition of atomic number, atomic mass number, element, and isotope   5 points
Protons are positively charged, electrons are negatively charged, and

neutrons have no charge   5 points

5) The mass of one proton is 1.67×10^{-27} kg. Neutrons have the same mass and electrons have a much smaller mass. How many protons, neutrons, and electrons are in one molecule of water (symbol: H_2O)? How many molecules are in 1 kg of water?

One water molecule, 10p, 8n, and 10 tiny electrons, has a mass of 3×10^{-26} kg. There are 1 kg / (3×10^{-26} kg) = 3.3×10^{25} molecules in 1 kg of water.

One water molecule contains 10p, 8 n, 10 e   5 points
Writing that the mass of one water molecule equals 1.67×10^{-27} kg times total number of protons and neutrons in student's definition of water molecule   5 points
Obtaining correct mass for one student-defined water molecule   5 points
Writing that number of molecules in 1 kg of water equals 1 kg / student's mass for student-defined water molecule   5 points
Obtaining correct number from that equation   5 points