HW 2 A2020 Out 1/25/2010 Due 02/02/2010

1. (3 pts) What is thermal energy? What is the difference between thermal energy and temperature?

2. (3pts) Questions regarding energy and the conservation of energy:

    a. Two galaxies are attracted by their mutual gravity and begin to fall toward each other. Gravitational potential energy is being converted into what kind of energy?

    b. In the nuclear reactions in the center of the Sun, what is being converted into energy?

    c. Sunlight heats up the surface of the Earth? What kind of energy is being converted into thermal energy?

3. (4 pts) If you travel to to the surface of the Moon, does your mass change? Does your weight change? Why?

4. Extra Credit (4pts). You want to detect the following objects, all of which emit (approximately) black body spectrum. At what wavelength should you look to maximize the flux you receive from the object?
    a. A star like the Sun with a temperature of 6000 K
    b. A planet like the Earth with a temperature of 290 K
    c. A white dwarf star with a temperature of 40,000K
    d. The cosmic microwave background (the residual radiation from the big bang) at a temperature of 2.7 K

    Use Wien's law ($\lambda(nm) = 2.9x10^6/T(Kelvin)$ or $T(Kelvin) = 2.9x10^6/\lambda(nm)$. Give wavelengths in nanometers or microns (one micron = 1000 nm) and state which wavelength regime the radiation is coming from (i.e. X-ray, infrared, visible….)