

EPS 122: Physics of the Earth and Planetary Interiors  
Problem Set 4: Gravity and isostasy

1) Calculate the mass of the Earth.

2) Calculate the weight of a 60 kg astronaut on the Moon. How much less is this than the astronaut's weight on the Earth? (The Moon's mass is  $7.4 \times 10^{22}$  kg and its radius is 1738 km).

3a) Calculate the radius of orbit of a geostationary satellite (a satellite whose orbit is such that it remains above the same point on the Earth's surface).

b) Calculate the period of a satellite orbiting 200 km above the Earth.

c) Calculate the period of a satellite orbiting 200 km above the Moon (Moon mass =  $7.4 \times 10^{22}$  kg and radius = 1738 km).

4. A mountain range 4 km high is in isostatic equilibrium.

a) During a period of erosion, a 2 km thickness of material is removed from the mountains. When the new Isostatic equilibrium is achieved how high are the mountains?

b) How high would they be if 10 km of material were eroded away?

c) How much material must be eroded to bring the mountains down to sea level?

[Use crustal and mantle densities of  $2.8 \times 10^3$  kg/m<sup>3</sup> and  $3.3 \times 10^3$  kg/m<sup>3</sup>]

5) Calculate the depression of the land surface beneath (a) the Wisconsin ice sheet assuming, and (b) the Fennoscandia ice sheet, assuming that, prior to and after the emplacement of the ice sheet it was in isostatic equilibrium?