Problem Set #7 (due Nov 4)

1. A large block of ice with volume 10,000m3 calves from an ice shelf. What volume is seen floating above the water line?

2. Estimate the rise in sea level caused by a complete melting of the Greenland Ice Sheet. For simplicity, assume that the Ice Sheet has a rectangular planform with dimensions of 500km by 1000km, with a thickness of 2km. Assume that the ocean cover 2/3 of the earth's surface (and Re=6370km)

3. If the ocean water warmed by 1 C, compute the rise in sea level due to this effect. The volume thermal expansion coefficient of sea water is 210×10^{-6} (units of inverse degrees). [Example: A one degree rise will increase the volume by 0.00021 times the initial volume.]

4. Describe the mechanism of ice-albedo feedback.

5. Describe how the varying proportions of heavy and light isotopes in the ice in ice cores. (deuterium versus hydrogen and oxygen 18 versus oxygen 16) can be interpreted as a climate indicator. . Is a period with more heavy isotopes likely to be (circle one or more): colder, warmer, more ice caps, fewer ice caps. Explain your reasoning.

6. Describe how the varying proportions of heavy and light isotopes in deep sea sediments (oxygen 18 versus oxygen-16 in $CaCO_3$ in shells) can be interpreted as a climate indicator. Is a period with more heavy isotopes likely to be (circle one or more): colder, warmer, more ice caps, fewer ice caps. Explain you reasoning.

7. Describe and explain the change in earth climate caused by each of the following changes in the earth's orbit
   a. Change in axis tilt from 23.5 to 22 degrees

   b. Precession of the tilted axis so that perihelion occurs in June instead of January.

   c. Reduction in the eccentricity of the earth's orbit.

8. Describe the location and size of the Laurentide Ice Sheet. When did it reach its most recent maximum size? Estimate how much sea level was reduced due to this ice sheet.

9. Describe the relationship between isotope ratio and CO2 concentration in the Vostok ice core. Do the two signals correlate positively? Why or why not?