MIDTERM II, May 23, 2002

Geography 4321/5321, Snow Hydrology

******DUE TUESDAY MORNING AT THE START OF CLASS******

Enjoy the weekend!

Name and Initials _____ SS# _____

Write only in the designated spaces. This test has 200 total points. Questions are worth different amounts. **Be explicit about the phase of water in your answers: ice, liquid, gas**. Show all equations and unit transformations. Note extra credit question.

FILL-IN THE BLANKS

1. A field test of avalanche stability where a section of the snowpack is isolated that is about the width of a ski is called a _____ test (5 points).
2. Fill in this table (1 point for each blank). 2..TS

AVALANCHE PATHS

Zone or Track Name	Slope Angle Range	Velocity Characteristics
_____	_____	_____
_____	_____	_____
_____	_____	_____

2..nr q +1

2. Avalanches tend to start at convexities in the snowpack, because this is where _____ is at its maximum (5 points).
3. The _____ equation calculates the total electromagnetic energy emitted by a black body (5 points).
4. We can find the wavelength at which the maximum amount of energy is emitted by a blackbody using (5 points) _____.

5. The attenuation coefficient of snow for light in the visible wavelengths is _____ compared to that of soot or dirt (5 points).

6. Emissivity is defined as _____ (5 points).

7. The primary factor in determining the length of the equilibrium drift on the lee side of a snowfence is _____ (5 points).

8. The most important transport mode for blowing snow is _____ (5 points).

9. For snowmelt to occur in a sub-freezing snowpack, enough energy must be added to fill the _____ of the snowpack (5 points).

10. In general, latent heat fluxes are similar in magnitude and _____ in sign compared to sensible heat fluxes (5 points).

11. Three different methods of calculating turbulent fluxes are:

    - _____ 5 points.
    - _____ 5 points.
    - _____ 5 points.

12. Sensible (H) and latent heat (LE) are collectively termed TURBULENT FLUXES. Explain why (10 points).

13. Calculate longwave emission from the snowpack, given that emissivity of snow is 0.97 and snow temperature is 0 degrees C. (20 points).

13. Calculate the shear stress (τ) in N m^{-2} in a snowpack given the following parameters (20 points):

density = 250 kg m^{-3};

snow height = 1 meter;

slope angle = 30°.

14 Conduct a unit analysis for U^* ; given that U^* is equal to the square root of shear stress divided by the density of air (20 points).

15 What is the impact pressure of an avalanche with a velocity of $50\,\mathrm{m\,s^{-1}}$ and a density of $500\,\mathrm{kg\,m^{-3}}$ (20 points)?

16 Calculate net incoming shortwave radiation, given (35 points):

Incoming direct shortwave radiation is 500 W m^{-2}

Albedo of incoming direct shortwave radiation is 0.90

Diffuse shortwave radiation is 0 W m^{-2}

Albedo of incoming direct shortwave radiation is 0.80

Emissivity of snow is 0.97

Emissivity of the atmosphere is 0.90

Snow surface temperature is –10°C

Air temperature is –20°C

Viewfactor is 0

EXTRA CREDIT (20 points)

What is cool about snow hydrology? Why?