GEF2200 Atmosfærefysikk

Oppgaver til 12. og 14. februar 2007

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Det blir oppgavegjennomgang 12/2 og første time 14/2. Andre time 14/2 går jeg gjennom sondediagram (kapittel 3.4.4).

Det er sannsynligvis flere oppgaver her enn vi rekker, men de vi ikke rekker overføres til neste gruppetime.

Oppgaver merket A.xx.T er egendefinerte oppgaver. WH06 angir læreboka, mens WH78 angir første utgave av boka.

A.1.T
What is the difference between R and R^*?

A.2.T
What is apparent molecular weight, and why do we use it?

A.3.T
For air, why is R dependent on humidity?

A.4.T
Show that the gas constant for moist air is greater than for dry air.

A.5.T
Why do we introduce virtual temperature?

A.6.T
Should we use virtual temperature when the gas in question is water vapor?

A.7.T
Assume that the maximum pressure value (saturated pressure) of water vapor in a sample of air at about 20 degrees Celcius is about 18hPa. What is the virtual temperature at the surface of Earth? How large is the difference between virtual temperature and temperature?

A.8.T
Show how the volume concentration can be expressed by mole fraction for an ideal gas.

WH06 3.19 (WH78 2.21)
(Hint: use result from A.8.T)

A.9.T
Derive the hydrostatic equation.

A.10.T
Derive the hypsometric equation

WH78 2.20f
Show that the pressure in the atmosphere increases exponentially with depth, whereas the pressure in the ocean increases linearly with depth.

WH78 2.22
Assuming an isothermal atmosphere with a temperature of -33°C and a surface pressure of 1000hPa, estimate the levels at which pressure equals 100, 10 and 1hPa, respectively.

WH06 3.27 (WH78 2.30)
(Hint: The hypsometric equation.)

A.11.T
The first law of thermodynamics states that $dq - dw = du$.
What is dq, dw and du?
Can we assume $dw = pd\alpha$ for air?

A.12.T
Define adiabatic process.

WH06 3.33 (WH78 2.23)

WH06 3.32 (WH78 2.24)

WH06 3.18j (WH78 2.20a)
Show that air released from a tire is cooler that its surroundings.

A.13.T
Define specific heat.
Show that $c_p = c_v + R$ for an ideal gas.

A.14.T
Derive the adiabatic lapse rate for dry air using the definition of enthalpy.

A.15.T
Derive the potential temperature.

WH06 3.31 (WH78 2.35)

WH06 3.28 (WH78 2.34)

WH06 3.29