10/6/2014

Pg 1/2

Study Guide For Atms 317 Exam 1.

Coverage: Chapters 15, 1, 2, 3

By Knowledgeable about all homework Problems

Ch15: Solar + IR radiation drive atmos. motions.

ITCZ, cells [Hadley, Ferrell, Polar]

Tradewinds - why are they easterly?

CH1 Anatomy of a cyclone:

Air masses

4 types of fronts, Cold, warm, stationary, occluded.

Surface MAPS - What are they useful for?

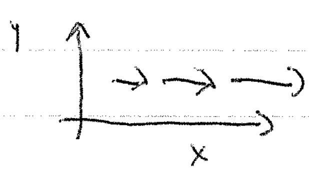
500mb map - what is it and why is it useful? How does it affect surface conditions?

Norwegian model of fronts - what is the typical lifecycle of a cyclone?

CH2 Scalars, vectors; Addition + subtraction

Scalar product, Vector Product of vectors

Gradient, d/dt and $d/dx\,\hat{i} + d/dy\,\hat{j} + d/dz\,\hat{k}$



$\vec{U}$ vectors

$\vec{U} = U(x)\,\hat{x}$

$\frac{\partial \vec{U}}{\partial x} > 0$

CH2

Eularian + Lagrangian frames

Advection, temperature, etc, by wind

[Fig 2.10 is a good example]

example $\frac{DT}{Dt}$, $\frac{\partial T}{\partial t}$, $\vec{U} \cdot \vec{\nabla} T$

Example on Pg 37 $\frac{\partial T}{\partial t} = \frac{DT}{Dt} - \vec{U} \cdot \vec{\nabla} T$

Practice with partial derivatives

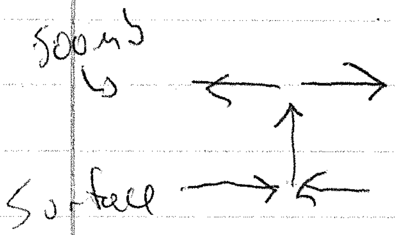
Ch 3:

Properties of fluids:

- Ideal gas equation
- Virtual temperature
- Potential temperature
- hydrostatic equation
- equation of continuity
- Dry adiabatic lapse rate
- Static Stability
- Brunt Väisälä frequency $N^2 = g\frac{d\ln\theta}{dz}$

$\frac{d\theta}{dz} > 0$ stable $\frac{d\theta}{dz} = 0$ neutral

$\frac{d\theta}{dz} < 0$ unstable



Dines Compensation $- \vec{\nabla} \cdot \vec{U} = 0$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

First Lecture in CH 1

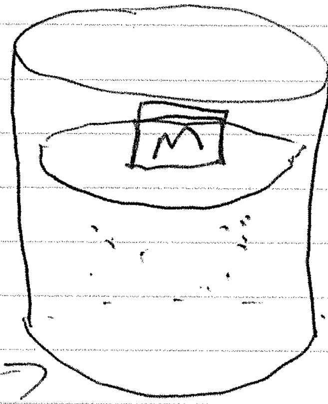
Back to basics Monday

Pg 1

meters
Kilogram
seconds

MKS units

Review Pressure T and ρ.



gas

frictionless Piston fitted with mass M. [Kg]

$A [m^2] =$ cross sectional area

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} \frac{[N]}{[m^2]} = \frac{mg}{A}$$

$$\text{Force} = \underbrace{m}_{\text{mass}}\ \underbrace{a}_{\text{acceleration}} \quad [Kg] \left[\frac{M}{S^2}\right]$$

$$a = \frac{dv}{dt} \quad \frac{\text{velocity}}{\text{time}} \quad \frac{M}{S}\frac{1}{S}$$

$$V = \frac{dz}{dt} = \frac{M}{S} \text{ units}$$

MKS units of pressure are PA

$$\text{Pressure} \Rightarrow \frac{Kg\,M}{S^2}\frac{1}{M^2} = \frac{Kg}{MS^2}$$

$$\equiv \underline{\text{PA units}}$$

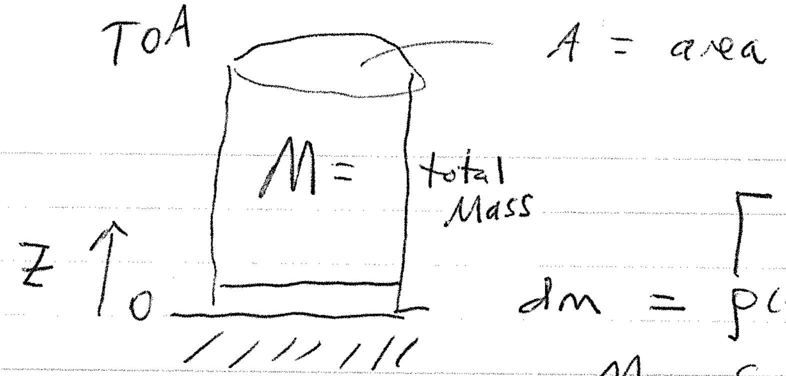
Especially important

Sea Level Pressure P_0

$$P_0 = 101325 \text{ PA} = 1013.25 \text{ hPA}$$

$$= 1013.25 \text{ mbar} = 1.01325 \text{ bar}$$

1 of hPA



Pg 2

Density as a function of Z.

$$dm = \rho(z)\,A\,dZ$$

$$M = \int dm = A\int_0^{TOA}\rho(z)\,dZ$$

Sea Level Pressure

$$P_0 = \frac{Mg}{A}$$

$$P_0 = \underbrace{\int_0^{TOA}\rho(Z)\,\frac{Kg}{\cancel{m^3}}\,\overbrace{dZ\,A}^{\cancel{m^3}}}_{Mass}\,g\left[\frac{m}{s^2}\right]\frac{1}{A\,\cancel{m^2}}$$

$$P_0 = g\int_0^{TOA}\rho(z)\,dZ \Rightarrow \text{Like } \frac{Mg}{A}$$

$\frac{8.3143 \cdot 1000}{29}$

$\frac{8.3143 \times 1000}{3}$

277

Density:

$$\rho = \frac{P}{R_d T} = \frac{101325\ PA}{287\ \frac{J}{Kg\,\cancel{K}} \cdot 273.15\ \cancel{K}}$$

$$= 1.29\ Kg\ \frac{PA}{J}$$

$$= 1.29\ Kg\ \overset{(PA)}{\frac{N}{m^2}}\ \underset{J}{\frac{1}{N \cdot M}}$$

$$\boxed{\begin{array}{ll} \text{STP} & \rho = 1.29\ \frac{Kg}{m^3} \\ \text{All in} & \\ \text{MKS} & T = 273.15\ K \\ \text{units} & P = 101325\ PA \end{array}}$$

$\Longleftarrow$ Important to remember