NATS 101-006 (Spring 2007)
Midterm Examination #2
Study Outline

Chapter 8 – Air Pressure and Winds

Pressure: *SI Units:* m^{-1} kg s^{-2} = Pa (Pascal)
The typical unit of atmospheric pressure is millibars
1 mb = 100 Pa

$$P = \frac{F}{A}$$

1 Atm = 1013 mb = 29.92 in Hg

What happens with air pressure as you increase in altitude?

Be able to understand and use the Ideal Gas Law, Boyle's Law and Charles's Law and all associated equations if asked! (Slides 7-10 of Lecture 14)

Newton's 1st and 2nd laws of motion. You should be able to state or explain each law. Acceleration can be a change in speed and/or a change in direction. Given a picture of an object's motion, you should be able to determine whether a net force is acting on the object or not. If a net force is present, you should have some idea what direction it must point.

Forces That Influence the Wind: Know the differences, balances (i.e. geostrophic, cyclostrophic, etc.) and definitions of Pressure gradient force (PGF), Coriolis force (CF), centripetal force and friction (F) ***slide 32, lecture 16***. Know the rules that determine the direction and strength of these forces. Which force can start stationary air moving? Which of these forces will only change the direction of the wind and not the wind speed? Which one of these forces can only change the speed of the wind?

Surface Winds vs Upper-Level Winds: Why do surface winds tend to cross the isobars, whereas upper level winds tend to be parallel to the isobars (or height contours)?

Troughs and Ridges: Know the difference between the two, and be able to draw one if asked to.

Air Columns that are Warm and Cold: Completely understand the concepts given in *slide 11, Lecture 15*.

Cyclonic vs Anti-Cyclonic: Which is which when dealing with lows and highs?

Chapter 9 – Wind: Small-Scale and Local Systems

Scales: Be able to differentiate the scales of different atmospheric motion (turbulent eddies vs. general circulation just as an example), if asked to do so.

Turbulence: Different mechanisms that cause turbulence, both mechanical & thermal. *(Slide 7, Lecture 17)*

Local Wind Systems: How does surface friction play a role in local winds? Know the importance and understand the physical mechanisms of sea breezes, land breezes, ***monsoon***, mountain and valley breezes, katabatic winds, Chinook winds and Santa Ana winds.

Chapter 10 – Wind: Global Systems

Global Winds: What is the difference between the Hadley Cell, Ferrel Cell and Polar Cell? What are the westerly winds and the Jet Stream? What is the general structure and function of the general circulation?

Global Wind Patterns and the Oceans: El Nino/La Nina/ENSO. Know the concept of winds and upwelling of the oceans. Know the differences between El Nino/La Nina and the normal state.

Chapter 11 – Air Masses & Fronts,

Air Masses: Be able to identify and classify be source and region cP, mP, mT, cT, mA, and cA.

Fronts: What is a front? Know the difference between a warm, cold, stationary and occluded front. What are the conditions like before and after each of these fronts pass?

Chapter 12 - Middle-Latitude Cyclones

Middle-latitude cyclones: Cyclogenesis, polar-front theory. Where do cyclones tend to form? What is the role of upper level divergence and convergence? Know the relationship to fronts and associated weather (e.g. Colorado Low example from Lecture 22).

Chapter 13 – Weather Forecasting

Simple Types: Persistence, Trend, Analogue, Climatology, Out of the Hat, Body Parts. Understand the difference amongst all these different weather forecast methods, and each of their short comings.
NWP: Numerical weather prediction, despite the long term, really means computer modeling. Understand the difference among the simple forecast methods and how are they used as a "sanity" check on numerical weather prediction. How do these models "see" terrain features, and why does this play an important factor? Provide examples of how these are useful. Know the different steps in NWP. How is an NWP model structured? What happens in post processing? What are the differences in limited area models & global climate models (GCMs)? How about the differences in climate prediction vs. weather prediction?
Chaos: Inherent in NWP and independent of the model. Simply know that a small change in an initial state will cause a big change in a future prediction. This puts a hard limit on weather forecasting of 2 weeks.

Note: **BE FAMILIAR WITH MR. PYTLAK'S LECTURES, AS THEY ARE FAIR GAME FOR EXAM QUESTIONS.** This exam may test the artistic skills of all.

-Professor Castro and Mr. Bieda