MEA 214
Midterm Review, Spring 2011
Outline and Review Questions

As usual, I make no guarantee that 100% of the exam questions will come from this review document, but all or almost all of it will. I will make every effort to ensure that this sheet gives you a good representation of the majority of the exam material.

Some background knowledge from Chapters 5, 6, 7, and 8 is assumed, particularly relating to clouds and precipitation, stability, forces, and force balance.

I. Forces and force balance (Chapter 8)
II. The Jet Stream (parts of Chapter 10)
III. Fronts and Air Masses (Chapter 11)
IV. Cyclones, and cyclone weather (Chapters 12 and 13)
V. Weather Forecasting (Chapter 13)
VI. Thunderstorms (Chapter 14)

*Bring a ruler and colored pencils…You may have to draw fronts! Also bring a calculator.*

Specific Review Questions

1.) You are responsible for knowing the basic formation mechanisms of clouds and precipitation. What are CCN? How does the Bergeron process work? Given a sounding, be able to comment on the likelihood of precipitation, based on your knowledge of precipitation mechanisms. Why do some clouds produce precipitation, while others do not?

2.) Why is there a midlatitude jet stream? Why do wind speeds increase with height to the tropopause? Why is the jet stream narrow? What is the relation of the jet stream to fronts?

3.) Know the different forces, and given a weather map, be able to indicate arrows representing the different forces, given pressure and wind fields.

4.) Know which forces are involved in the various force balances (e.g., hydrostatic, geostrophic, gradient).

5.) Know how force balance relates to rising and sinking air, and weather conditions.

6.) Given information about *temperature*, how can you estimate where *pressure* gradients aloft (and the jet stream) would be located?

7.) Know the general characteristics of each of the main frontal types and air masses.
e.g., Which type of front is most likely to be accompanied by steady rain?
What are the characteristics of a mP air mass?

8.) Be able to explain the basic mechanism of lake-effect or ocean-effect snow (or rain).

9.) What dictates frontal type? In other words, given some data, how can you tell what type of front is present?

10.) Understand cyclone formation mechanisms: Upper waves, jet streaks, and "lee cyclone" formation.
e.g., Given an upper wave or jet streak, where will the cyclone be, and why?
Where would you expect divergence aloft, rising air, and clouds?
Why do cyclones require divergence aloft in order to strengthen?
Why do cyclones tend to form in certain geographical regions?

11.) In which geographical regions do cyclones tend to form? Why there?

12.) Understand the concept of vorticity, and how it relates to lee cyclogenesis, and everyday weather.

13.) Be familiar with the term "cold-air damming", and know how it affects the frequency of winter weather east of the Appalachian mountains.

14.) Know how to interpret and decode the station model plot for observations on a weather map.

15.) Be able to match observations/weather to a real or idealized cyclone, or draw station models for problems similar to the one on the quiz.

16.) Be ready to make and justify a forecast, provided current forecast information.

17.) Given a real or idealized 500-mb map, be able to identify regions where you would expect to find:
-diverging air aloft?
-a wave cyclone at the surface?
-an anticyclone at the surface?
-the strongest winds aloft (assuming gradient balance)?

18.) What are the main mechanisms that can cause air to rise?

19.) How are observations important to computer-generated weather forecasts?

20.) How do numerical weather forecast models work? What are the limitations of numerical weather prediction?

21.) Who were the early pioneers of numerical weather prediction, and how did their efforts shape the field of meteorology?

22.) When was the first operational numerical weather prediction made?

23.) What types of data go into numerical weather prediction models?

24.) Be prepared to locate a front, based on surface observations and a quick analysis.

25.) Know the physical interpretation of CAPE, CIN, and how these quantitities relate to weather conditions.

26.) Have a basic understanding of the theory and mechanisms for cloud electrification.

27.) Know the typical sequence of events for a cloud-to-ground lightning stroke. Why does lightning "flicker", and why does thunder "rumble"?

28.) Know the different kinds of lightning, and some characteristics.

29.) Is lightning possible outside of mixed-phase clouds?

30.) Be able to make a basic thunderstorm forecast. In other words, given a set of maps to work with, be able to recognize the necessary ingredients for severe convection.

31.) Be sure to be able to explain why westerly winds increase with height in the troposphere and decrease with height above the jet stream.

32.) Why do thunderstorms have anvils?

33.) Why is the surface of a hailstone typically warmer than the middle of it?

34.) What is a typical (ballpark) number of return strokes for a negative cloud-to-ground lightning discharge? 5, 50, or 500?

35.) What determines the type of structure that a given thunderstorm takes on? What are the different structures, and what are the characteristics of each?

36.) What is the definition of a "severe" thunderstorm?

37.) Know the basic mechanism of hail formation.

38.) What severe weather threats are most commonly associated with the different types of thunderstorm structure?

39.) What is "potential instability", and how does it relate to convective storm formation?

40.) Given some data, could you identify a day on which thunderstorms are more or less likely to form? What would you look for?