Name: _____

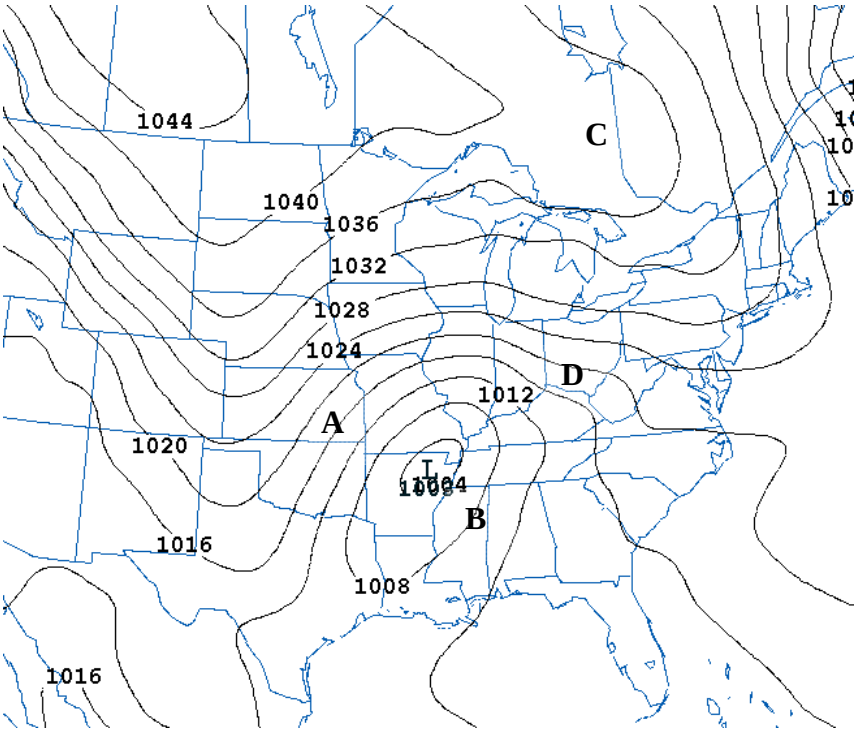
MEA 214 FUNDAMENTALS OF METEOROLOGY II
Quiz 1 (Spring 2011)

If you are confused about the intent of a given question, feel free to ask for help during the quiz. Good luck!

1.) Consider the NAM model sea-level pressure forecast, valid at 12 UTC (7:00 a.m. EST) this morning, shown below. The contour interval is 4 mb.

a.) Sketch, based on the information available, the location of any prominent frontal zones. Use the proper symbols to designate frontal type and direction of motion.

b.) For the 4 locations indicated, draw the station model plot at right below that you think would best correspond to the observed weather at that location. You must include temperature, dew point, pressure, wind, sky cover, and present weather conditions on the model.



○ **A**

○ **B**

○ **C**

○ **D**

___ 2.) Given that the Coriolis force deflects to the left of motion in the Southern Hemisphere, meaning that there is clockwise rotation around low-pressure centers, we

a.) Observe an easterly jet stream there as opposed to the westerly jet stream of the NH
b.) Still observe westerly flow because clockwise around the south pole gives us that.
c.) The jet stream in the Southern Hemisphere is easterly because the Coriolis force is opposite there.
d.) The lack of land masses in the Southern Hemisphere means that there isn't a jet stream there.

3.) Which of the following ***best explains*** the impact of cold-air damming (CAD) on the frequency of wintry precipitation (sleet and freezing rain) in the southeastern U.S.?

a.) CAD leads to cold air being transported southward, making snow more likely.

b.) The cold air during CAD is typically shallow, due to the relatively low elevation of the Appalachian Mountains. Shallow cold air makes snow less likely, and freezing rain more likely.

c.) CAD makes snow much more likely, because by cooling the air, not only does the potential for winter weather increase, but the cloud temperatures are more likely to support the Bergeron process, which leads to snow.

d.) There is no clear link between CAD and winter weather.

____ 4.) Which of the following explains why there is generally lower pressure aloft over the polar regions?

a.) The larger density of cold air is associated with higher pressure; the low pressure observed at the poles is due to the rotation of the earth, which centrifuges (via the centrifugal force) the air towards the equator.

b.) cold air at a given pressure is more dense than warm air at that pressure, meaning that pressure decrease more rapidly with height in cold air than in warm air.

c.) The lower stratosphere in the polar regions gives rise to warmer temperatures aloft there (as we saw when we examined the 100-mb temperature in lab). This warm air is associated with lower pressure

d.) both a.) and c.) are correct.

____ 5.) Which of the following best explains why the wind speed increases with increasing height up to the jet stream level (often around 10 km altitude) in the midlatitude troposphere?

a.) The effects of surface friction are reduced as one moves aloft. Above the troposphere, friction again increases due to the close proximity to the "top" of the atmosphere.

b.) Temperature gradients lead to pressure gradients above. Over a deep layer of consistent temperature contrasts, the overall pressure gradient continually increases with height.

c.) The horizontal temperature gradient generally increases with height up to the tropopause, then levels out again. Wind speed is directly determined by the strength of the temperature gradient at that level.

d.) The wind in the upper troposphere is generally in *gradient* balance, meaning that in order for the centrifugal force to become important, winds speed must increase with height.

____ 6.) Which of the following best explains why the wind speed decreases with increasing height above the core of the jet stream (often around 10 km altitude) in midlatitudes?

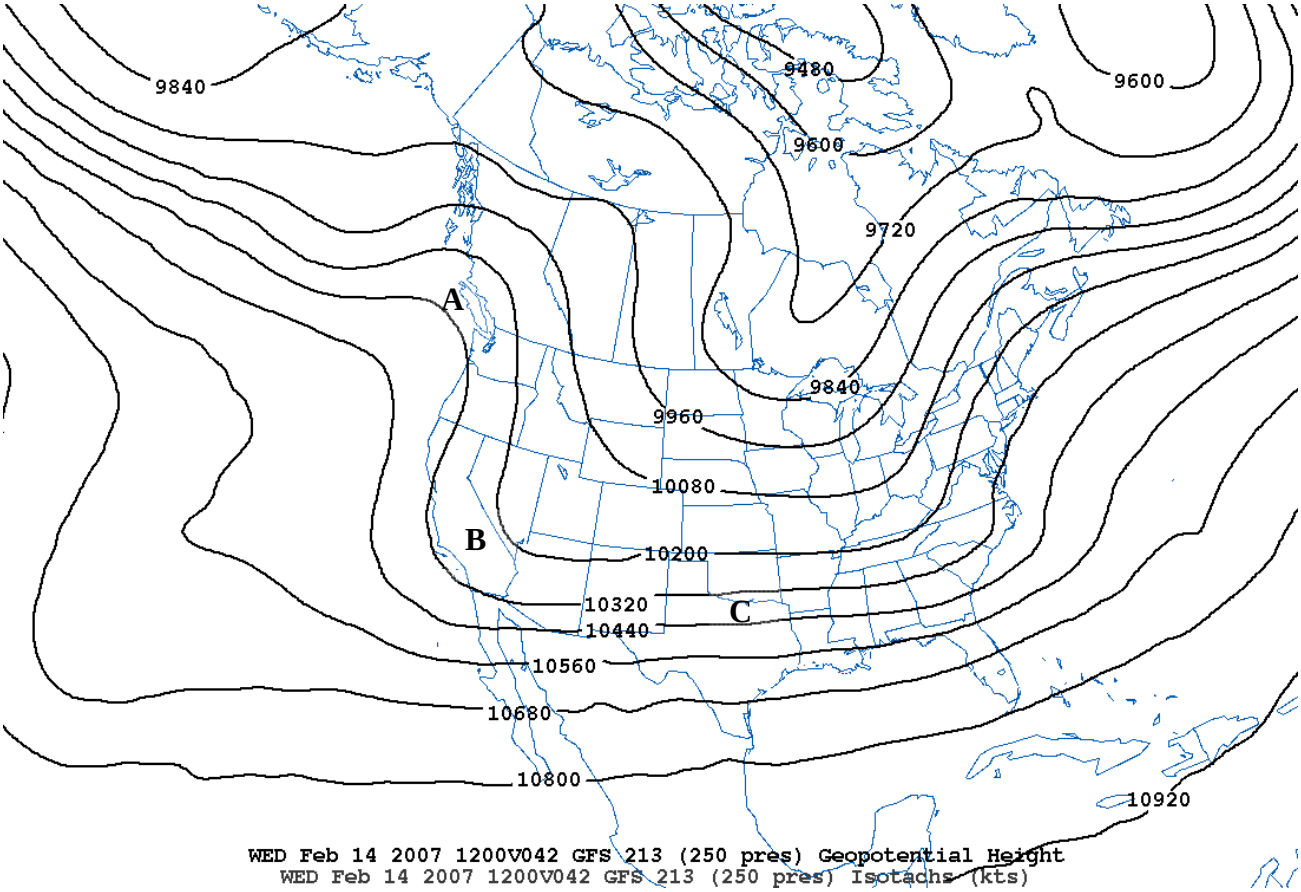
a.) The solar wind, important in the upper reaches of the atmosphere, blows opposite the jet stream and acts to slow the winds at these high altitudes.

b.) The temperature contrast reverses above the jet core, with warm air to the north of the jet and cold air to the south. This leads to a weakening of the pressure gradient above the jet.

c.) The horizontal temperature gradient generally increases with height up to the tropopause, then begins weakening above the jet. This leads to the wind weakening above the jet because wind speed is directly determined by the strength of the temperature gradient.

d.) The jet stream is strongest right at the tropopause but immediately above this level, air is in the stratosphere. Friction is larger in the stable stratosphere, meaning that the wind has greater resistance above the jet core, and is weaker there.

Consider the 250-mb map shown below, with height contours in meters. Use the following abbreviations for forces in the following questions.



hPGF = horizontal component of pressure-gradient force
vPGF = vertical component of pressure-gradient force
Fg = Gravity **CoF** = Coriolis force **CeF** = Centrifugal force **Fr** = Friction

7.) For each of the 3 points shown on the 250-mb map presented above, indicate, using the abbreviations provided, which forces you think would be important.

A:

B:

C:

8.) Indicate with a large letter "L" one location on the map above where you would expect to observe ***divergence aloft*** and a ***deepening low pressure center at the surface***.

9.) Consider the following sequence of cloud and weather parameters. Based on your knowledge of frontal properties, what type of front was most likely affecting the area? _____

Thickening clouds developed during the day, with cool temperatures and light southeasterly winds. Light snow began during the late afternoon, and changed to rain overnight with temperatures remaining in the 30's. After midnight, the wind shifted to northwesterly, and temperatures became only slightly cooler the following day with precipitation ending as flurries.

10.) True/False Lake-effect snow questions:

___ a.) This type of instability snow in North America is confined to the Great Lakes region.

___ b.) There is no such thing as "ocean-effect" snow.

___ c.) In the summer, the lake effect often brings strong thunderstorm activity to the lakes, which can affect fishing and shipping adversely.

___ d.) The land breeze circulation is an important mechanism in some lake-effect snow events.