Name: _____

NATS 101 Introduction to Weather and Climate, Section 54, Fall 2005
Quiz #4: Thursday, 3 December 2005.

Fronts and Mid-latitude Cyclogenesis [40]

1. Use yesterday's surface map projected on the screen in class to answer the following questions. Place your answer on the line provided. [10]

__B__a. Which city is warmer City A or City B?

__2__b. Which front (1, 2, 3, or 4) is a cold front?

__1__c. Which front (1, 2, 3, or 4) is an stationary front?

__mP__d. Identify Air Mass I (cP, cT, mP, mT).

e. What type of clouds are most likely formed over City C?

Cb (partial credit for Cu - from radar colors you should be able to figure out that they are rain clouds)

__c__ 2. Which of the following does ***not*** help find a front on a surface weather map? [5]

a. change in temperature over a short distance
b. clouds and precipitation patterns
c. vertical wind shear
d. pressure changes

__d__ 3. During the early stages of cyclogenesis, a _____ forms within a _____ front. [5]

a. high pressure, cold
b. high pressure, warm
c. low pressure, cold
d. low pressure, stationary

__a__ 4. In ***cold*** occlusion, _____ air ***in front of*** the warm front rides _____ air ***behind*** the cold front. [5]

a. cold, over relatively colder
b. cold, under relatively warmer
c. warm, over relatively colder
d. warm, under relatively warmer

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__a__ 5. A _____ front is formed in the most intense stage of the mid-latitude cyclone. [5]

a. occluded
b. cold
c. warm
d. stationary

__a__ 6. In the final stage of a mid-latitude cyclone, _____ air meets _____ air within the cyclone, causing it to dissipate. [5]

a. cold, cool
b. cold, warm
c. warm, cold
d. hot, warm

7. What type of clouds generally form in front of a ***cold*** front? Give ***one*** reason why. [5]

Cb, Cu. This is because a cold front has a (1) a steep front slope so upward movement is more rapid than for a warm front, (2) cold fronts move faster than warm fronts, again forcing air upwards quickly, (3) changes across a cold front boundary are more extreme than across a warm front in general.

EC. Given the conditions as of yesterday afternoon when this map was created, will Tucson experience warmer or colder weather in the coming days? Briefly explain your reasoning.

Colder because there is an approaching cold front (2 on the map).

<u>Thunderstorms, Lightning and Tornadoes</u> [60+9]

__b__ 8. For a thunderstorm to spawn a tornado, the updraft in the cloud must, [5]

a. be stronger than 100 knots
b. rotate
c. be larger than about 20 kilometers
d. be saturated

Name _____

9. Suppose a tornado is moving ***towards the east*** at 60 miles per hour. If the counter-clockwise rotational wind speed of the tornado is 100 miles per hour, then: [5]

___160___a. What is the maximum wind speed within the tornado? (Put your answer on the line provided.)

__south__ b. Would the maximum winds occur on the tornadoes north, south, east, or west side? (Put your answer on the line provided.)

__d__ 10. Lightning can occur, [5]

a. from cloud-to-cloud
b. from ground-to-cloud
c. from cloud-to-ground
d. all of the above

__c__ 11. Thunderstorms tend to form [5]

a. when cold, humid air rises in a conditionally unstable atmosphere
b. when cold, humid air rises in a stable atmosphere
c. when warm, humid air rises in a conditionally unstable atmosphere
d. when warm, dry air rises in a stable atmosphere

__d__ 12. Supercell thunderstorms tend to form [5]

a. when there is upper-level convergence
b. when there are strong winds aloft
c. when there is no wind shear
d. in the presence of vertical wind shear

__a__ 13. Electrification in a cloud occurs when ice crystals collide with graupel, inducing a _____ charge on the large graupel particle and a _____ charge on the lighter ice crystal. [5]

a. negative, positive
b. positive, negative

__d__ 14. The _____ typically induces a positive charge at the ground, causing a _____ to head back towards the cloud. [5]

a. first stroke, leader
b. charged ice crystals, return stroke
c. dart leader, lightning
d. stepped leader, return stroke

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__a__ 15. _____ dominate the cloud in the initial stages of thunderstorm development, while _____ dominate the cloud in the dissipation stage. [5]

a. updrafts, downdrafts
b. downdrafts, precipitation
c. gust fronts, updrafts
d. updrafts, entrainment

__d__ 16. Which of the following does ***not*** create a favorable environment for tornadoes to form? [5]

a. upper-level divergence
b. cold air over warm air at mid-levels
c. a cold front overrunning a warm front at the surface
d. constant wind speed and direction with height

17. What are the primary contributers to the formation of downdrafts in thunderstorms? [5]

entrainment and falling precipitation

18. Briefly describe how a mesocyclone forms inside a supercell thunderstorm. [5]

Wind shear creates a rotating tube of air or vortex tube near the surface. This tube is drawn rapidly up into the cloud by strong updrafts. As it is drawn into the cloud it is given a vertical orientation, creating a rotating mesocyclone within the cloud.

19. If given a choice, when facing a cyclonic tornado in a field that is coming at you, would you run toward ***your*** left or towards ***your*** right? Explain your reasoning. [5]

You should run towards your right since the slowest wind speeds are on the side of the tornado where the wind is opposing the forward motion, in this case on the right side.

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EC. What air masses near the surface contribute to the frequent formation of tornadoes in tornado alley? [5]

Typically the cP and mT air masses contribute to the formation of tornadoes in tornado alley.

EC. What is the approximate range of wind speeds for F0 through F5 tornadoes? Which category of tornado (weak, strong, or violent) is most common? Which category is least common? [4]

The range of wind speeds is about 40-318 mph (anything close to this range is acceptable). Weak (F0-F1) tornadoes are most frequent. Violent (F4 and higher) are least common.