

Name: _____ **CLIM301 Final Exam Part 1** **Fall 2014**

Assume all questions apply to the Northern Hemisphere.

For all maps, assume North is towards the top.

For this test, choose answers that best apply the material learned in the CLIM301 class.

For Part 1 of the Exam, each question is worth 1 point unless otherwise indicated (total 50 points).

For multiple choice questions, choose the best single answer, unless otherwise indicated.

True-or-False questions are indicated by a "T / F". For these questions, choose T (true) if the statement is more true than false. Choose F (false) if the statement is more false than true.

For fill-in-the-blank questions, provide a short answer of one or two words, or a numeric value if called for.

1) (2 points) The wind is blowing towards the southeast. In what direction is the coriolis force acting on the moving air?

- a) Northeast
- b) Southeast
- c) Southwest
- d) Northwest

2) (2 points) A radiosonde measures the 500mb temperature as -15°C . At the same station, an air parcel lifted from the surface, to its LCL at 900mb, and then upward to the 500mb level, achieves a temperature of -8°C at 500mb. Choose all the following statements that correctly describe the parcel at 500mb:

- a) the parcel is buoyant
- b) the parcel is below its Level of Free Convection (LFC)
- c) the parcel is cooling as it rises
- d) the parcel is saturated

3) The u wind component is positive and the v wind component is zero. The wind is blowing towards the:

- a) North
- b) East
- c) South
- d) West

4) The v wind component is negative, and the u wind component is zero. The wind is blowing towards the:

- a) North
- b) East
- c) South
- d) West

5) Consider the following three air parcels:

- A) Pressure=1013mb Temperature= 70°C RH = 50%
- B) Pressure=1013mb Temperature= 80°C RH = 33%
- C) Pressure=2013mb Temperature= 70°C RH = 99%

Which of the following is correct:

- a) The saturation vapor pressure for parcel A is the same as for parcel B
- b) The saturation vapor pressure for parcel A is the same as that of parcel C
- c) The saturation vapor pressure for parcel B is the same as that of parcel C
- d) All the parcels have the same saturation vapor pressure.

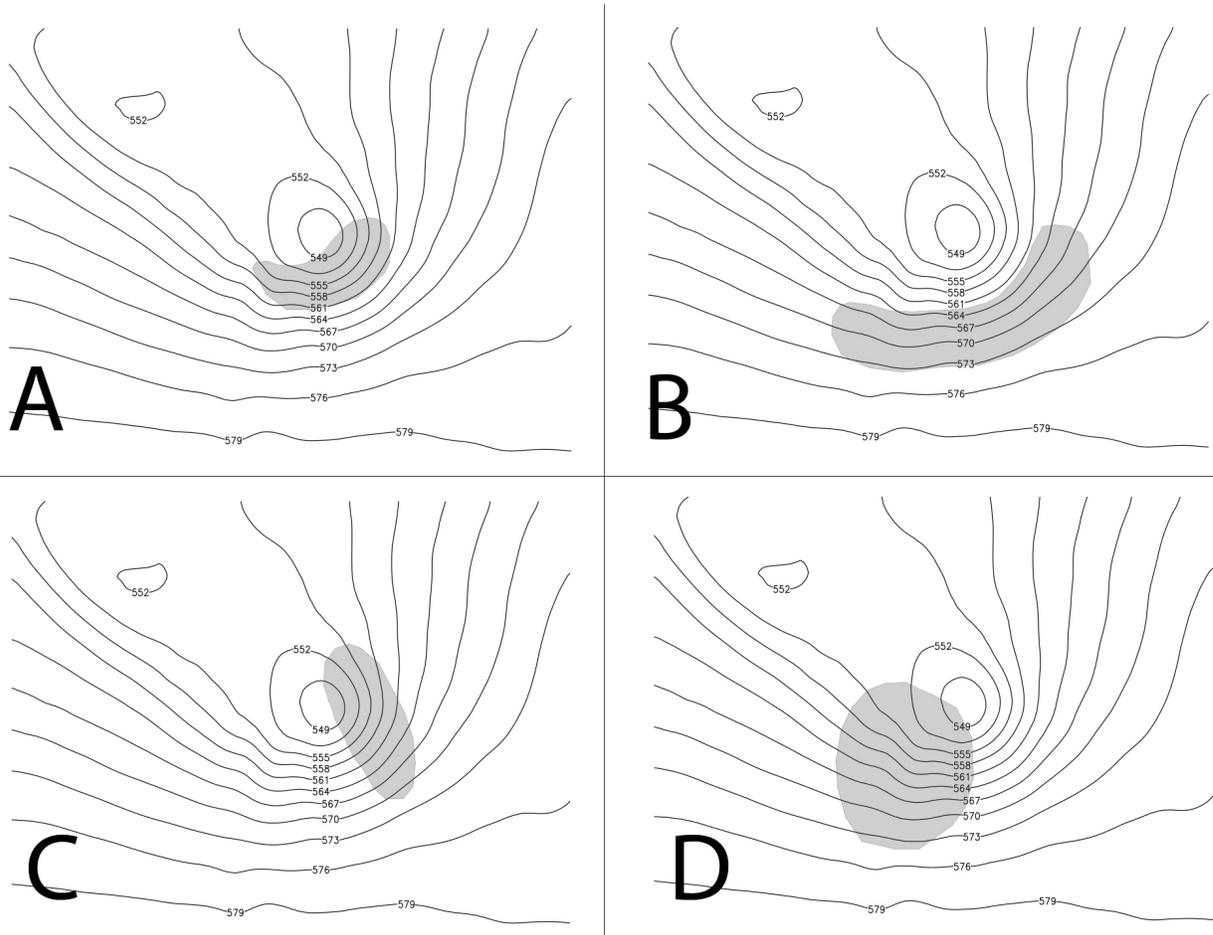
- 6) (2 points) The "box" method of advection involves (choose all that apply):
- a) Two fields are plotted together: contour lines of SLP or heights, and contour lines of a field to be advected (such as temperature or thickness).
 - b) It is assumed the contour lines of SLP or heights show the direction of wind flow.
 - c) It is assumed the net radiation balance determines the wind speed.
 - d) It is assumed the gradient of SLP or heights determines the wind speed.
 - e) The smallest boxes are found, because they show the region of greatest advection.
- 7) (2 points) Which of the following map/chart features are indications of upward vertical motion (choose all that apply):
- a) Positive Vorticity Advection (PVA)
 - b) Low Level Warm Air Advection (WAA)
 - c) Right Rear Quadrant (RRQ) of a 300mb jet streak
 - d) Precipitation
 - e) A strong cold front
 - f) A surface low pressure center
- 8) Perturbation ensemble forecasts are made to assess the impact of what kind of model forecast error?
- a) Initial condition
 - b) Parameterization
 - c) Numerical truncation
 - d) Software bugs
- 9) (2 points) Which of the following are NOT favorable factors for the development of a tropical cyclone? Choose all that apply.
- a) Sea surface temperatures above 26.5C
 - b) Strong vertical wind shear
 - c) Near or at the Equator
 - d) An unstable atmosphere
 - e) A moist environment
- 10) The vertical sounding data observed at 2am local time shows a shallow layer of temperature inversion near the surface, with a decrease of humidity in the inversion layer. This is most likely a:
- a) Subsidence inversion
 - b) Radiational inversion
 - c) Frontal inversion
 - d) None of the above
- 11) Which of the following cannot be measured by a Doppler radar (choose all that apply):
- a) rainfall, hail
 - b) reflectivity
 - c) Radial velocity
 - d) Pressure
 - e) Humidity
- 12) In a pseudo adiabatic process, which of the following assumptions are true:
- a) Latent heat is kept in the parcel
 - b) Moisture is squeezed out of the parcel
 - c) No heat is exchanged between the parcel and the environment
 - d) All of the above
- 13) T / F Contour lines of different values may cross at a singularity point.
- 14) T / F Data values are higher on one side of a contour line and lower on the other side, for the entire length of the contour line.
- 15) T / F Cirrus clouds are typically found at the 850mb pressure level.

16) There are four 500mb charts shown below. The shaded area on each chart is supposed to show the area of maximum positive shear vorticity, assuming the winds are in geostrophic balance. Which map is most correct?

A) B) C) D)

17) Use the same four 500mb charts shown below. Now assume the shaded area on each chart is supposed to show the area of maximum Positive Vorticity Advection (PVA), assuming the winds are in geostrophic balance. Which map is most correct?

A) B) C) D)



(18 and 19) Directly to the east of a Doppler radar is a couplet. The north side of the couplet has outbound velocity of 35mph. The south side of the couplet has inbound velocity of 65mph.

18) T / F The couplet shows an anticyclonic rotation.

19) T / F The storm is moving towards the radar at 15mph.

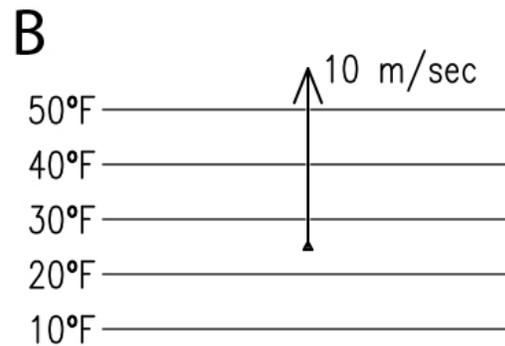
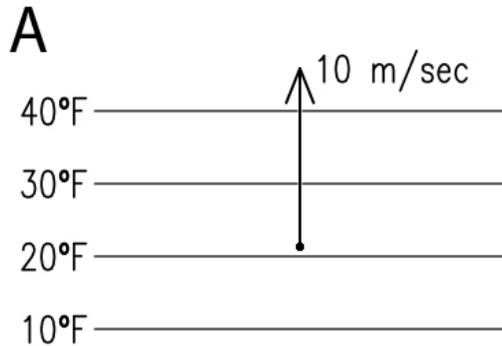
20) T / F A sun synchronous orbit is best suited for studying polar phenomena.

21) T / F In an IR satellite image, high clouds are bright because they tend to be cold.

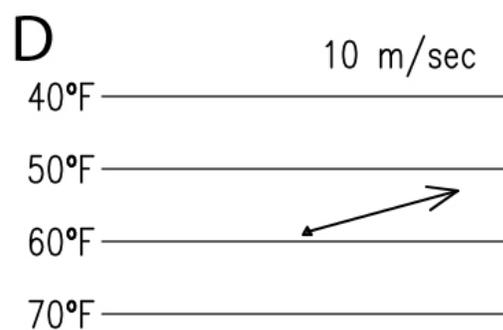
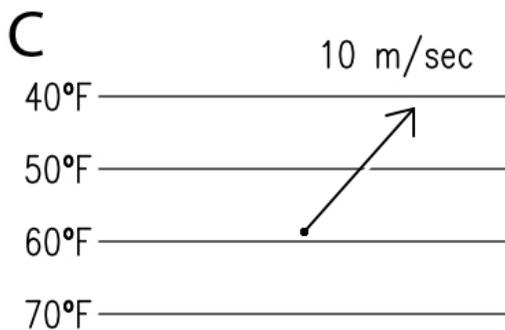
22) T / F A hook echo or comma echo on radar indicates a severe thunderstorm.

23) T / F In tropical weather analysis, the geopotential heights and thickness are often used because they indicate the mean temperature of the atmospheric layers.

- 24) T / F Cold Air Advection (CAA) is taking place for both cases A and B, shown below.
- 25) T / F Case A has stronger advection (warm or cold) than case B.



- 26) T / F Cold Air Advection (CAA) is taking place for cases C and D, shown below.
- 27) T / F Case C has stronger advection (warm or cold) than case D.



- 28) T / F Sub-grid scale processes that cannot be directly simulated by a numerical forecast model are ignored by the model.
- 29) T / F The wind is blowing towards the northeast ("math" angle of 45 degrees). The u and v components of this wind are equal in sign and magnitude.
- 30) T / F The wind is blowing towards the southeast ("math" angle of 315 degrees). The u and v components of this wind are equal in sign and magnitude.
- 31) T / F A cloud layer overhead will result in a reduction of the net outgoing longwave radiation from the surface.
- 32) The four stages of the forecast process are: Observation, Analysis, _____, and Prognosis.
- 33) Force per unit area (Newtons per square meter) is the definition of _____.
- 34) The hypsometric equation tells us: when the 1000-500mb layer thickness increases, the mean _____ also increases.
- 35) Wind blowing from warm to cold is _____ advection.
- 36) T / F At point A (latitude 40N) the geostrophic wind is 40 m/sec. At point B (also latitude 40N) the geostrophic wind is 60 m/sec. This implies that the pressure gradient force is stronger at point A than point B.
- 37) T / F An inversion means the temperature is falling rapidly with height.

38) (2 points) Give the precipitation type for each weather symbol:



P-Type: _____



P-Type: _____



P-Type: _____



P-Type: _____

39) (2 points) Give the wind speed shown by each wind flag:



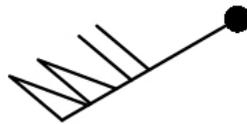
Speed: _____



Speed: _____



Speed: _____



Speed: _____

40) T / F To make a forecast, first establish a unified picture of the atmospheric state, then carry that picture forward into the future using prognosis tools such as numerical models.

41) T / F The positive vorticity found on the north side of a west-to-east jet streak is primarily due to shear.

42) T / F The direction of the geostrophic wind is perpendicular to the 500mb height contour lines.

43) T / F For the two soundings shown below, sounding A has greater CAPE than sounding B.

