SCIENCE OLYMPIAD
AT THE
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Meteorology B Test

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

Score: _____

UF SCIENCE OLYMPIAD
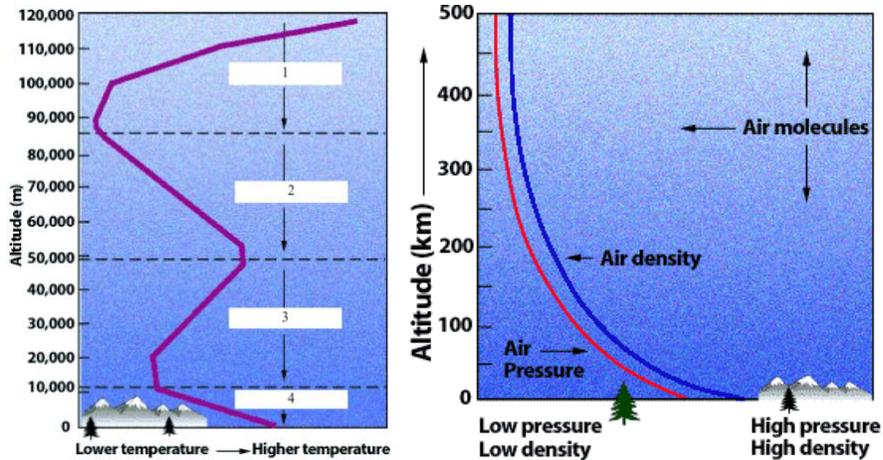METEROLOGY DIVISION B
JANUARY 19, 2019

Figure 1. Shown is a temperature profile and pressure/density profile of the Earth's atmosphere given as a function of elevation above the Earth's surface.

The following questions refer to Figure 1:

1. Which of these sections contains the Ozone Layer? Report the corresponding number from Figure 1 and name (2 pt.)

2. Give the name of Section 1 in Figure 1and explain why temperature increases in this layer (3 pt.)

3. In which of the layers in Figure 1 does the majority of Earth's weather occur? Report the corresponding number from Figure 1 and name (2 pt.)

4. In which layer(s) of the layers in Figure 1 does air travel occur? Report the corresponding number(s) from Figure 1 and name(s). More than one layer may be correct. (4 pt.)

5. At approximately what elevation does minimum atmospheric temperature occur? (2 pt.)

6. At approximately what elevation does pressure appear to reach a constant value? (2 pt.)

7. What is the average pressure at an elevation of 0 km? (1 pt.)

8. Would you expect the pressure (a) on Mt. Kilomanjaro and (b) in the Mariana Trench to be higher or lower than your answer in question? (2 pt.)

Figure 2. Map of North and South America showing the areas largely affected by specific meteorological events.

Match the following meteorological events to their location on Figure 2. The answer will be a number corresponding to the map. (4 pt.)
   9. Santa Ana Winds ___
   10. Chinook Winds ___
   11. Alberta Clippers ___
   12. La Niña ___

State whether the following are True or False. (8 pt.)
   13. Virga is an observable streak of precipitation extending from its cloud of origin to the ground. ___
   14. Stratus clouds occur mainly in the stratosphere. ___
   15. The Two Cell Model of atmospheric circulation does not account for axial tilt and the Coriolis Effect. ___
   16. In the Three Cell Model of atmospheric circulation, the Hadley Cell is a cold cell resulting from the Coriolis Effect. ___
   17. The Polar Cell occurs only at the Antarctic (South) pole. ___
   18. The Ferrel Cell is a mid latitude, warm cell. ___
   19. The Coriolis Effect accounts for the difference in atmospheric circulation patterns between the Northern and Southern Hemispheres. ___
   20. An occluded front occurs where a warm front overtakes a cold front. ___


21. How many of the following statements are true: (4 pt.)
   I.   A hygrometer can be used to measure humidity.
   II.   A wind vane can be used to measure wind speed.
   III. A psychrometer can be used to measure temperature.
   IV.   A radiosnode can be used to measure temperature.
   a. 0   b. 1   c. 2   d. 3   e. 4

Table 1. Meteorological Data from October in Panama City Beach, FL at Tyndall Air Force Base (courtesy of wunderground.com).

	Mean Temperature (F)	Maximum Precipitation (in/day)	Mean Dew Point Temperature (F)
2014	70	0.77	62
2015	72	1.07	62
2016	73	0.20	61
2017	72	0.82	63
2018	75	2.36	66

22. What meteorological event occurred in 2018 that likely contributed to the spike in precipitation in that year? Report the specific name. (2 pt.)

23. Which of the following statements about dew point is true? (4 pt.)
    a. Dew point is not dependent on relative humidity.
    b. Dew point is constant throughout the day.
    c. Dew point temperature is low before a cold front.
    d. Dew point temperature occurs when relative humidity is at its lowest.
    e. Dew point is the temperature at which water vapor condenses.

24. What was the average Dew Point Temperature from 2014 to 2017? (4 pt.)

25. For October of 2016, report the Mean Temperature and Mean Dew Point in METAR notation. (4 pt.)

26. If the barometric pressure was 919 mb in October 10, 2018, report the value in "in Hg" using METAR notation. (6 pt.)

27. Use the climatology method to forecast the temperature for October of 2019 based on currently available data from Table 1. (4 pt.)

Figure 3. Map and Satellite Image of Hurricane Michael making landfall.
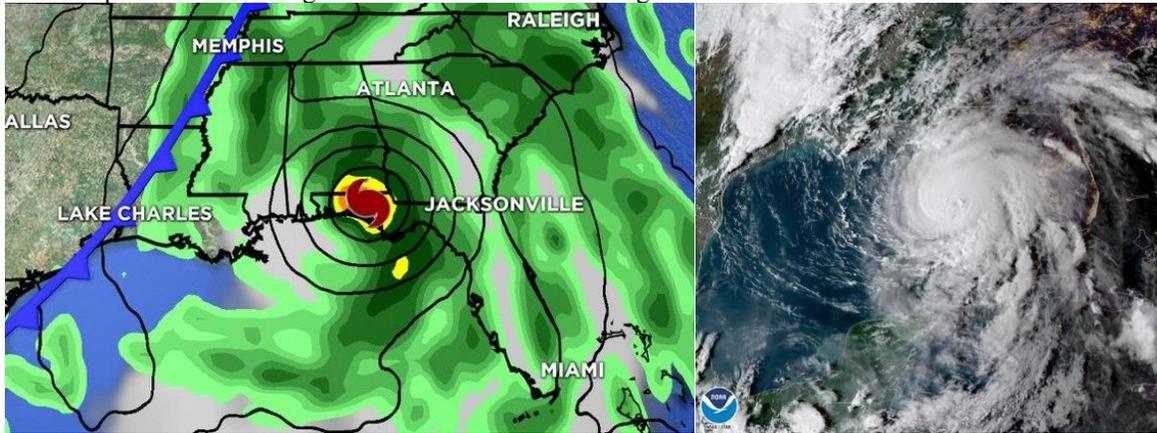
28. What type of front is passing through Lake Charles and Memphis, indicated by the blue arrows? (2 pt.)

29. Which of the following cloud types are *most commonly* associated with this front? (2 pt.)
   a. Cirrus
   b. Cumulonimbus
   c. Nacreous
   d. Stratus
   e. Cumulus

30. What is the maximum potential convective draft in these clouds? (2 pt.)

31. Based only on the map provided on the left side of Figure 3, would you expect the temperature to be colder in Dallas or Lake Charles? (3 pt.)

32. Interpret the following station model from Hurricane Michael. Read the following: Temperature (F), Sea Level Pressure (mb), Due Point (F), Wind Direction (cardinal), Wind Speed (knots). (10 pt.)
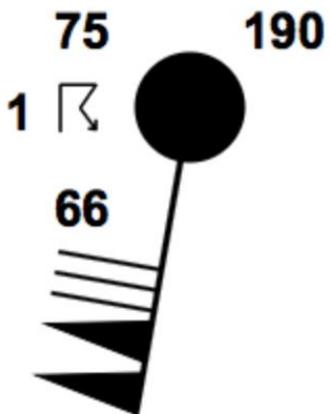
33. Tie-Breaker: Kent Fuchs, the President of UF, saw a very scary video on Facebook about El Niño and contracts you to help him build infrastructure to protect UF from the impacts of this deadly weather event. However, because you are a super smart engineer you know that nothing needs to be done. Briefly explain what El Niño is (where it occurs and what happens with precipitation, pressure, temperatures, etc.) and your recommendations to President Fuchs on what to do. (10 pt.)

34. Tie-Breaker: Again, Kent Fuchs sees another video on Facebook- but this time he's excited! The video talks about geo-engineering Mars, aka changing the atmosphere and weather patterns on the planet to make it livable for humans. Based on what you know about Earth's atmosphere, briefly describe to President Fuchs the composition of our atmosphere. (5 pt.)

35. Tie-Breaker: President Fuchs then suggests that perhaps Venus, Earth's twin, may be appropriate for human life. Because he is not very smart and you know that Venus is too hot, explain how we could use engineering to make Venus livable (hint: potential discussion points include cloud seeding, albedo, radiative budget). (5 pt.)