

# MET 101 – Introduction to Meteorology

Spring Semester 2015

# MIDTERM EXAM

Thursday, March 12, 2015

Name: \_\_\_\_\_

Student ID #: \_\_\_\_\_

Instructions: Closed Book. Time limit is 50 minutes. **Total Points Attainable: 100**

Read carefully and answer all parts. Draw **diagrams or pictures** to aid your explanations as needed or as **directed**. Use the backs of the pages if you need more space. Responses should be *clear, logical, and thorough*. I can't figure out what you know if you don't say it, or if you say it in a way that I can't understand! **BONUS POLICY**: Particularly outstanding answers will receive an extra ½ point bonus.

## **Part A: Vocabulary Matching**

*Instructions:* This section is worth a total of 10 points. Match each definition with the correct term by writing the letter next the term in the space provided. Please Print Clearly and in CAPITAL letters! There are 5 extra definitions, so you'll have to choose the correct 10 to match the 10 terms!

<b>Term</b>	<b>Definition</b>
1) ____ Wind-Chill Index	(A) The temperature to which air must be cooled (at constant pressure and constant vapor content) for saturation to occur.
2) ____ Sleet	(B) The region on the leeside of a mountain where the precipitation is noticeably less than on the windward side.
3) ____ Ozone	(C) Electromagnetic radiation with wavelengths longer than X-rays but shorter than visible light.
4) ____ Dew-Point Temperature	(D) The percent of radiation returning from a surface compared to which strikes it.
5) ____ Rain Shadow	(E) Warming of an atmosphere by its absorbing and emitting infrared radiation while allowing the shortwave radiation to pass through.
6) ____ doldrums	(F) An area of high atmospheric pressure around which the wind blows clockwise in the Northern Hemisphere.
7) ____ albedo	(G) An area of low pressure around which the winds blow counterclockwise in the Northern Hemisphere.
8) ____ Greenhouse Effect	(H) Electromagnetic radiation with wavelengths between 0.7 and 1000 um. Longer than visible radiation but shorter than microwave radiation.
9) ____ Anticyclone	(I) The cooling effect of any combination of temperature and wind, expressed as the loss of body heat.
10) ____ Ultraviolet Radiation	(J) Type of frozen precipitation consisting of transparent pellets of ice 5 mm or smaller in diameter.
	(K) The region near the equator that is characterized by low pressure and light, shifting winds.
	(L) A wind blowing downslope. It is usually cold.
	(M) Colorless, odorless gas, the highest natural concentration is found in the stratosphere.
	(N) The process by which small particles in the atmosphere deflect radiation from its path into different directions.
	(O) An atmospheric condition whereby the level of water vapor is the maximum possible at the existing temperature and pressure.

## Part B: Vocabulary Fill in the Blank

*Instructions:* This section is worth 10 points, each blank is worth 1 point. Writing in the correct words in the blank spaces provided. The word bank has EXTRA words so there will be some left over. You can use **each word only once**. Please Print Clearly.

Fill-in-the-Blank Word Bank		
orographic lifting	trade winds	advection fog
Chinook	sea breeze	El Niño
valley breeze	mountain breeze	condensation
moist adiabatic lapse rate	trade winds	upslope fog
wind rose	Haboob	dry adiabatic lapse rate
convergence	relative humidity	land breeze

The United States has a variety of climates and each region experiences different weather phenomena and winds. In Florida for example, afternoon thunderstorms are caused by \_\_\_\_\_ as  
 11)

two \_\_\_\_\_ winds collide. As you drive from Florida to Colorado you might  
 12)

experience dangerous, visibility reducing \_\_\_\_\_ which is caused by the slow rising of  
 13)

air as elevation increases. Once in Colorado you would experience \_\_\_\_\_ in the  
 14)

morning and \_\_\_\_\_ in the evening due to the Front Range of the Rocky Mountains.  
 15)

The Rocky Mountains also are famous for another type of wind, known as a “Snow Eater,” that is technically called a \_\_\_\_\_. If we continue our drive west and visit San Francisco,  
 16)

California we maybe be lucky enough to snap a photo of \_\_\_\_\_ as it rolls in under  
 17)

the Golden Gate Bridge. Back home on Oahu, our prevailing winds are known as \_\_\_\_\_.  
 18)

We also experience strong \_\_\_\_\_ at night as the land cools faster than the ocean.  
 19)

During the day \_\_\_\_\_ causes air to rise along the mountains and form clouds.  
 20)

### Part C: True or False

*Instructions:* This section is worth a total of 10 points, each answer is worth 1 point. Answer true or false to each of these statements by marking "T" or "F" on the blank line in front of each statement.

<b>T</b>	<b>F</b>	<b>Statement</b>
T	F	21) An anemometer give us wind speed and direction.
T	F	22) Isobars represent lines of constant temperature on a weather map.
T	F	23) The Trade Winds are found between 30-60 N and 30-60 S.
T	F	24) Katabatic winds tend to be warm.
T	F	25) Frost is frozen dew.
T	F	26) The sun emits the majority of its energy as infrared radiation.
T	F	27) Aerosols can only be solid particles.
T	F	28) Growing-degree days are crop dependent.
T	F	29) El Niño events can cause both drought and flooding conditions in different regions.
T	F	30) Evaporation fog is usually found when the water is colder than the air above it.

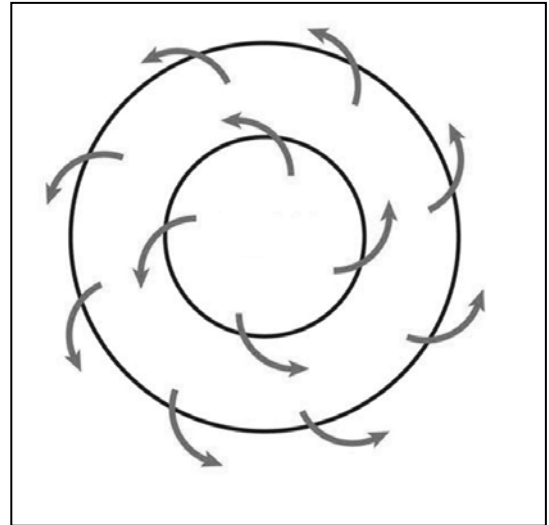
### Part D: Multiple Choice

*Instructions:* This section is worth a total of 10 points. Choose the best answer. Each question is worth 1 points. Write the answer on the blank line in front of each question with a CAPITAL letter so it's easy for me to read. If I can't tell the difference between a letter (i.e. a c and an e) I will mark it incorrect.

- 31) \_\_\_\_\_ Which statement is true of the polar jet stream?
- a) It moves closer to the equator during Northern Hemisphere summer.
  - b) The wind speeds are the same along the entire jet.
  - c) The wind speeds are strongest during Northern Hemisphere winter.
  - d) It is different than the mid-latitude jet.
  - e) Does not interact with mid-latitude cyclones.
- 32) \_\_\_\_\_ AM and shortwave radio broadcasts can often be heard at great distances from their source locations, especially at night. The layer of the atmosphere that makes this possible is:
- a) Mesosphere
  - b) Troposphere
  - c) Ionosphere
  - d) Lithosphere
  - e) Stratosphere
- 33) \_\_\_\_\_ On which day is the northern hemisphere pointed towards the sun while also being near its farthest distance away from the sun?
- a) Autumnal Equinox
  - b) Summer Solstice
  - c) Tropic of Capricorn
  - d) Winter Solstice
  - e) Spring Equinox
- 34) \_\_\_\_\_ Which of the following processes requires the greatest input of energy to occur?
- a) Converting one gram of liquid water into steam
  - b) Converting one gram of ice into steam
  - c) Converting one gram of steam into ice
  - d) Converting one gram of liquid water into ice
  - e) Converting one gram of ice into liquid water
- 35) \_\_\_\_\_ The Collision-Coalescence Process is associated with which phenomena:
- a) deposition
  - b) thunderstorm anvils
  - c) warm rain
  - d) evaporation
  - e) snow flakes

- 36) \_\_\_\_\_ Snow at the surface occurs when
- a) upper air is cold and surface air is warm
  - b) both surface and upper air are cold
  - c) both surface and upper air are warm
  - d) upper air is warm and surface air is cold
  - e) none of the above

- 37) \_\_\_\_\_ Based on the wind arrow directions, describe the type of pressure system that is shown in the diagram to the right:
- a) NH High Pressure
  - b) NH Low Pressure
  - c) SH High Pressure
  - d) SH Low Pressure
  - e) None of the above



- 38) \_\_\_\_\_ Which of the following would decrease the albedo of the earth-atmosphere system?
- a) less cloud cover
  - b) glacial shrinking
  - c) reduction of snow cover
  - d) all of the above
  - e) none of the above
- 39) \_\_\_\_\_ A cirrostratus cloud is recognized mainly by its
- a) obvious vertical dimension
  - b) darkness of color
  - c) precipitation
  - d) halo around the sun
  - e) puffy cauliflower features
- 40) \_\_\_\_\_ A low pressure system can be considered an event of what scale?
- a) microscale
  - b) mesoscale
  - c) macroscale
  - d) both microscale and mesoscale
  - e) both mesoscale and macroscale

## Part E: Short Answer

*Instructions:* This section is worth a total of 30 points. There are 8 questions. You MUST choose ONLY SIX (6) of them. That's right. You get to skip 2 of them that you are the least confident about. Please ONLY answer FIVE of them. You will NOT get extra credit for answering more than five. Each question is worth 5 points.

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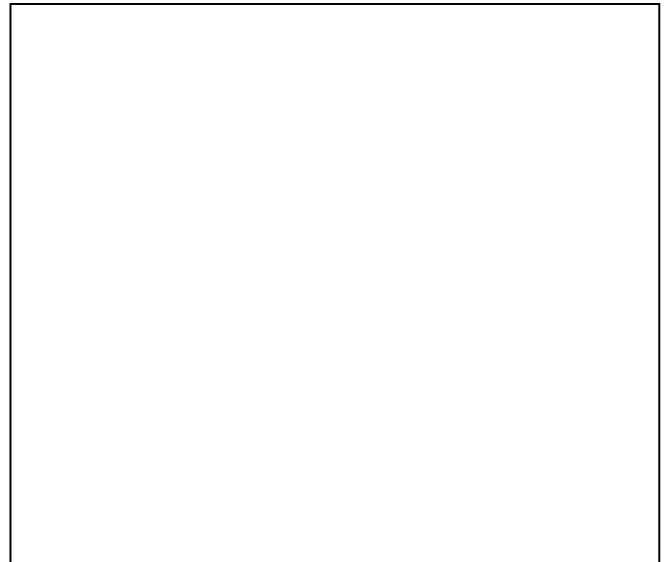
**41) (3 points) What is the mid-latitude jet stream? Why does it form?**

**(2 points) b) Why is it an important part of forecasting weather in the United States.**

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**42) 66) The most intense sea breezes develop along tropical coasts adjacent to cool ocean currents.**

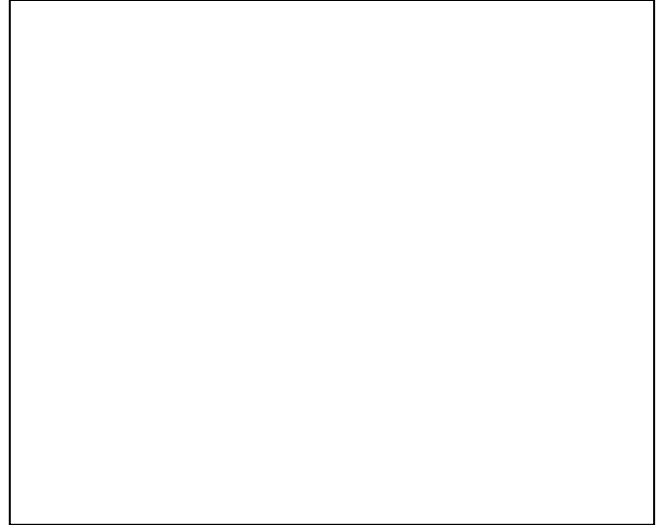
**a) (2.5 points) Explain why this is the case.**



**b) (2.5 points) DRAW a diagram showing how a sea breeze works in the box provided above.**

43) (2.5 points) a) Write a generalization relating the spacing of isobars to the speed of the wind.

(2.5 points) b) DRAW a diagram to support your description in the box provided to the right.



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44) (1 point) What variable (or property) is used to identify the layers of the atmosphere?

(2 points) b) What are the two bottommost layers called?

(2 points) b) How does this variable (or property) change within the bottom two layers?

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45) (3 points) What are the dry and wet adiabatic lapse rates (including the values)?

(2 points) b) Which rate is representative of a slower decrease in temperature, and why?

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46) Define freezing rain, and describe how it can form. Do the same for sleet. For each definition DRAW a diagram, in the boxes provided, showing how the vertical temperature in the atmosphere is related to the formation of the two types of precipitation.

(2.5 points) a) Define freezing rain, and describe how it can form.

(2.5 points) b) Define sleet, and describe how it can form.

FREEZING RAIN	SLEET

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47) (2 points) a) Name the two most common gases in the Earth's atmosphere (both words and symbol)

(3 points) b) Name 5 other gases (words and symbol) that are present in measurable amounts. Include their percentages.

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48) (2.5 points) a) Explain what the "dew point temperature" of an air parcel is.

(3 points) b) Is dew point temperature usually smaller, large, or the same as the ambient temperature of the air parcel?



## Part F: Long Answer

*Instructions:* This section is worth a total of 15 points. There are 2 questions. You MUST answer both of them.

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**49) (8 points total) Describe the FOUR ways to cause air to rise that were discussed in class in WORDS (4 points) and DRAW (4 points) a diagram showing where a cloud would form.**

1)	2)
3)	4)

*\*\*\* Draw one way to make air rise in EACH box. You should have 4 different cartoons and descriptions\*\**

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**50) (3 points) a) Explain why the Asian monsoon occurs (*Hint: Make sure to talk about seasons*).**

**b) (4 points) DRAW a diagram showing both the summer and winter monsoon. Make sure to draw where clouds would form and which monsoon (winter or summer) would experience precipitation.**

SUMMER	WINTER
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### Part G: Skill - Cloud Identification

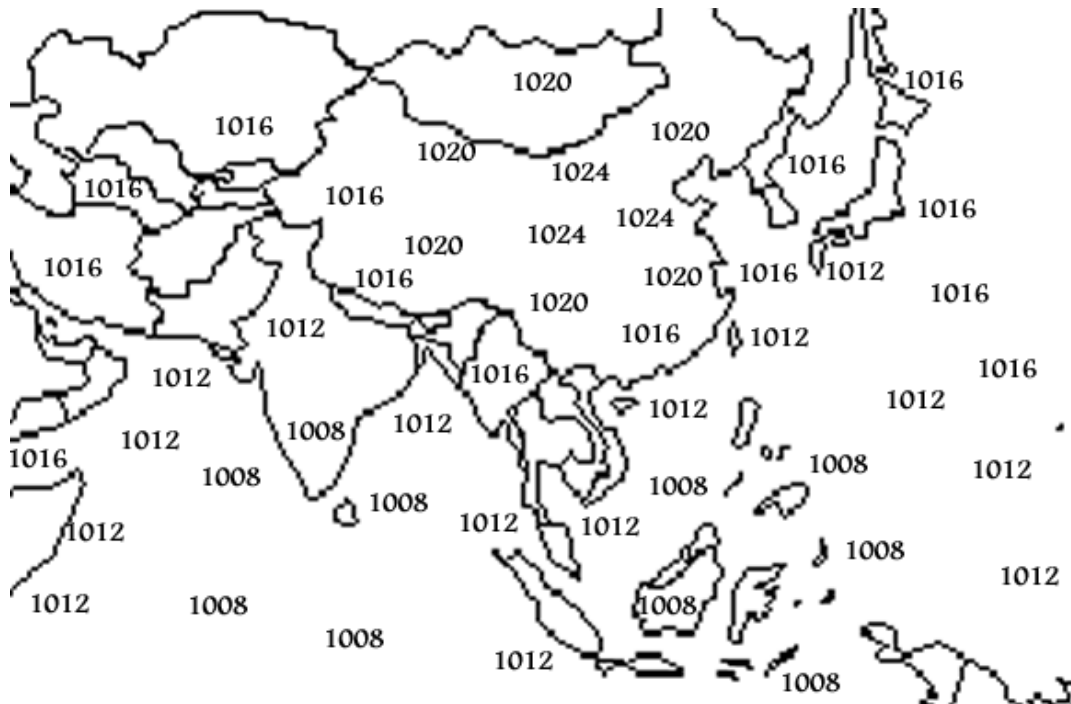
*Instructions:* This section is worth a total of 5 points. You receive 0.5 point for naming the cloud correctly and 0.5 point for identifying if the cloud is made up of liquid drops, ice crystals or both. Please Print your responses. The spelling must be correct to receive FULL credit for the cloud names.

<u>CLOUD NAME</u>	<u>LIQUID OR ICE (or both)</u>
a) _____	_____
b) _____	_____
c) _____	_____
d) _____	_____
e) _____	_____

### Part H: Skill- Isobars and Winds

*Instructions:* This section is worth a total of 10 points. The point break down is below:

- 1) (3 pt) draw the isobars connecting similar pressures
- 2) (3 pts) locate the high and low pressure centers by placing an "H" or an "L" in the appropriate locations on the map. Note: there may be more than one of each.
- 3) (4 pts) draw the wind due to ONLY the **PGF Force and Coriolis Force**.



**Extra Credit (2 points):** What Pressure System does this map represent? \_\_\_\_\_

**5 of 7 of the Extra Credit from the Podcasts for 5 points!**

The fastest wind recorded wind speeds were a 1999 tornado at \_\_\_\_\_ miles per hour.

One atmosphere (1 atm) is equivalent to \_\_\_\_\_ millimeters of mercury.

The highest temperature ever recorded in Antarctica is \_\_\_\_\_ F. This occurred on January 5<sup>th</sup>, 1974.

Death Valley has the highest U.S. temperature record of \_\_\_\_\_ degrees F.

Clouds can contain \_\_\_\_\_ of tons of water.