

PHYSICS DEPARTMENT

MET 1010

Final Exam

May 1, 2008

Name (print): _____

Signature: _____

*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

- (1) Please print your name and your UF ID number and sign the top of this page and the back of the answer sheet.
- (2) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number).**
- (3) **This is a closed book exam** and books, calculators or any other materials are NOT allowed during the exam.
- (4) Identify the number of the choice that best completes the statement or answers the question.
- (5) Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink. Do not make any stray marks or the answer sheet may not read properly.
- (6) Do all scratch work anywhere on this printout that you like. At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.

There are 33 multiple choice questions, each of which is worth 3 points. In addition there is a bonus question (marked) worth 1 extra (bonus) point which you will get simply for answering the bonus question. Therefore the maximum number of points on this exam is 100. If more than one answer is marked, no credit will be given for that question, even if one of the marked answers is correct. There is no penalty for wrong answers, so it is better to guess an answer than to leave it blank. Good Luck!

1. The largest annual ranges of temperatures are found:

- (1) at polar latitudes over land
- (2) at polar latitudes over water
- (3) at middle latitudes near large bodies of water
- (4) in the Northern Central Plains of the United States
- (5) at the Equator

2. In terms of the three-cell general circulation model, the rainiest regions of the earth should be near:

- (1) 30° latitude and 60° latitude
- (2) the equator and 60° latitude
- (3) the equator and the polar regions
- (4) 30° latitude and the polar regions
- (5) the equator and 30° latitude

3. Clouds often form in the:

- (1) sinking air in the center of a high surface pressure area
- (2) rising air in the center of a high surface pressure area
- (3) —
- (4) sinking air in the center of a low surface pressure area
- (5) rising air in the center of a low surface pressure area

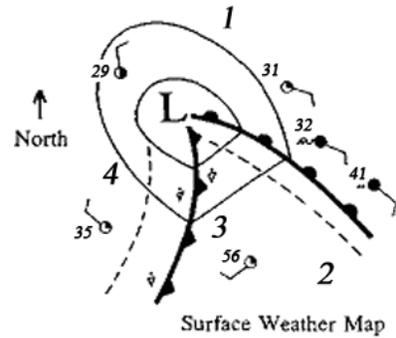
4. Which of the statements below is not correct concerning the pressure gradient force?

- (1) it is non-existent at the equator
- (2) the PGF points from high to low pressure in the Southern Hemisphere
- (3) it can cause the wind to speed up or slow down
- (4) it is perpendicular to the isobars
- (5) the PGF points from high to low pressure in the Northern Hemisphere

5. This and the following question refer to the illustration of a middle latitude cyclone. The dashed lines show the positions of the fronts 8 hours ago.

At which of the 4 positions would you expect to hear the following 12-hour forecast: “Cloudy and cold this morning with snow this afternoon and tonight?”

- (1) 2
 (2) 1
 (3) 4
 (4) 3
 (5) —



6. Refer to previous question. At which of the 4 positions would you expect to hear the following 12-hour forecast: “Partly cloudy and continued warm through this afternoon and evening?”

- (1) 4 (2) — (3) 1 (4) 3 (5) 2

7. Assuming that the night will remain clear, calm, and unsaturated, the predicted minimum temperature is 32°F. Suddenly the wind speed increases and remains gusty throughout the night. The minimum temperature will most likely be:

- (1) about the same as predicted, but will occur later in the night
 (2) much lower than predicted due to radiational cooling
 (3) higher than predicted due to the release of latent heat
 (4) higher than predicted due to mixing
 (5) about the same as predicted, but will occur earlier in the night

8. The main source of energy for a hurricane is the:

- (1) warm ocean water and release of latent heat of condensation
 (2) ocean currents and tides
 (3) rising of warm air and sinking of cold air in the vicinity of weather fronts
 (4) upper-level jet stream
 (5) the energy of the tropical winds

9. A dim, “watery” sun visible through a gray sheet-like cloud layer is often a good indication of _____ clouds.

- (1) cumulonimbus (2) altostratus (3) cirrocumulus (4) stratus (5) altocumulus

10. When upper-level divergence of air above a surface low pressure area is stronger than the convergence of surface air, the surface pressure will _____ and the storm itself will _____.

- (1) decrease, intensify (2) — (3) increase, dissipate (4) increase, intensify (5) decrease, dissipate

11. The air temperature at the surface is 25°C, while at 2000 m directly above you it is 15°C. What would this atmosphere be called? (The moist adiabatic rate is 6°C per 1000 m and the dry adiabatic rate is 10°C per 1000 m.)

- (1) an inversion (2) absolutely stable (3) conditionally unstable (4) absolutely unstable (5) neutrally stable

12. On a cold foggy day, when the relative humidity is 100%, water vapor occupies about what percentage of the air’s volume near the earth’s surface?

- (1) about 78% (2) almost 100% (3) less than 4% (4) about 50% (5) about 21%

13. One would expect a cP air mass to be:

- (1) cold, dry and unstable
- (2) cold, dry and stable
- (3) warm, moist and unstable
- (4) cold, moist and stable
- (5) cold, moist and unstable

14. Storms vary in size (diameter). Which list below arranges storms from largest to smallest?

- (1) tornado, middle latitude cyclone, hurricane, thunderstorm
- (2) middle latitude cyclone, hurricane, thunderstorm, tornado
- (3) hurricane, middle latitude cyclone, thunderstorm, tornado
- (4) hurricane, tornado, middle latitude cyclone, thunderstorm
- (5) middle latitude cyclone, tornado, hurricane, thunderstorm

15. The most frequent time of day for tornadoes to form is in the:

- (1) evening just after sunset
- (2) early morning just after sunrise
- (3) middle of the night
- (4) late morning just before noon
- (5) afternoon

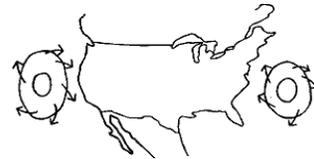
16. The surface wind around a surface low pressure center in the Southern Hemisphere blows:

- (1) counterclockwise and inward toward the center
- (2) clockwise and inward toward the center
- (3) —
- (4) clockwise and outward from the center
- (5) counterclockwise and outward from the center

17. Heat transfer outward from the surface of the moon can take place mostly by:

- (1) —
- (2) convection
- (3) radiation
- (4) conduction
- (5) latent heat

18. In the figure, the Bermuda _____ is shown just off the east coast of the US. The southerly (i.e. from the south) winds along the east coast are generally _____ than the northerly (i.e. from the north) winds along the west coast.



- (1) High, drier
- (2) High, moister
- (3) Low, moister
- (4) —
- (5) Low, drier

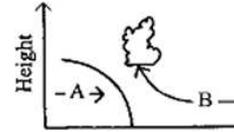
19. The strongest surface winds in a hurricane heading westward toward Florida would most likely be found on the _____ side of the eyewall.

- (1) east
- (2) south
- (3) west
- (4) this is a trick question, Florida only gets hit by eastward moving hurricanes.
- (5) north

20. Suppose it is a winter night and at about 11 pm the air cools to the dew-point temperature and a thick radiation fog develops. If the air continues to cool during the night, in 5 hours the dew point temperature will probably:

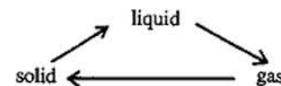
- (1) remain the same
- (2) decrease as the air becomes drier
- (3) increase as the air becomes moister
- (4) decrease as the air becomes moister
- (5) increase as the air becomes drier

21. The air mass A in the diagram is moving to the right, displacing the air mass B. The diagram therefore represents a side view of



- (1) an occluded front.
- (2) —
- (3) a warm front.
- (4) a stationary front.
- (5) a cold front.

22. How many of the phase changes indicated by the arrows in the figure release energy to the surroundings?



- (1) one
- (2) two
- (3) —
- (4) all three
- (5) none

23. Which of the following statements describes the snow-albedo positive feedback effect?

- (1) Rising temperatures would lead to melting of snow and increased amount of water vapor, which would cause warming of the earth due to the greenhouse effect.
- (2) Lowering temperatures would produce more snow which would reflect sunlight, leading to lower temperatures.
- (3) Rising temperatures would lead to melting of snow, which absorbs latent heat and causes cooling of the earth.
- (4) Lowering temperatures would produce more snow, which would trap infrared energy and cause warming of the earth
- (5) Rising temperatures would lead to more snowfall, which would reflect sunlight, leading to lower temperatures.

24. Suppose saturated polar air has an air temperature and dew point of -10°C , and unsaturated desert air has an air temperature of 35°C and a dew point of 10°C . The desert air contains _____ water vapor and has a _____ relative humidity than the polar air.

- (1) less, lower
- (2) more, lower
- (3) less, higher
- (4) more, higher
- (5) —

25. Which of the following is most likely associated with fair (i.e. clear and sunny) weather?

- (1) a low surface pressure area
- (2) a warm front
- (3) an occluded front
- (4) a cold front
- (5) a high surface pressure area

26. A high water vapor pressure indicates:

- (1) a relatively large number of water vapor molecules in the air
- (2) an abundant supply of condensation nuclei in the air
- (3) a relatively low rate of evaporation
- (4) a relatively small number of water vapor molecules in the air
- (5) a relatively high rate of evaporation

27. In Rio de Janeiro (located in Brazil at 22° south latitude) the wind aloft is blowing to the east. The low pressure center aloft is therefore located to the _____ of Rio de Janeiro.

- (1) West
- (2) South
- (3) East
- (4) North
- (5) —

28. Which below is not characteristic of a tropical wet climate (Af)?

- (1) greater temperature variation between day and night than between the warmest and coolest months of the year
- (2) abundant rainfall all year long
- (3) afternoon showers and high humidity
- (4) extremely high afternoon temperatures, usually much higher than those experienced in middle latitudes
- (5) —

29. (This is a bonus question worth one extra point. In order to claim the extra point, you need to select one and only one of the following answers. Please choose the answer which best applies to you. This question is simply an informal opinion poll regarding the usefulness of the workbook and study guide accompanying the textbook.)

- (1) I often used the workbook/study guide but did not find it particularly useful.
- (2) I did not purchase the workbook/study guide.
- (3) Workbook? What workbook?
- (4) I got the workbook/study guide but rarely used it.
- (5) I often used the workbook/study guide and found it quite useful.

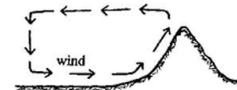
30. Why is the sun red at sunset?

- (1) Dust in the atmosphere is usually red (clay), which reflects red light.
- (2) Because blue light is preferentially scattered by the atmosphere.
- (3) Because red light is preferentially scattered by the atmosphere.
- (4) The oceans absorb most of the blue light at the small angle during sunset.
- (5) The color depends on the distance to the object—far objects always appear reddish.

31. Which type of precipitation necessarily requires a temperature inversion near the surface?

- (1) snow (2) sleet (3) rain (4) hail (5) drizzle

32. The mountain/valley breeze shown in the figure would form during the _____ when the mountain side is relatively _____ .



- (1) day, cold (2) night, cold (3) night, warm (4) day, warm (5) —

33. People see an oasis of water some distance ahead in a hot desert because:

- (1) of refraction through layers of air that decrease in density towards the hot sand
- (2) dispersion causes the blue light to be preferentially scattered towards the observer while red light is scattered towards the ground
- (3) light scattered at small angles always appears blue
- (4) hot sand acts as a mirror which reflects the blue sky
- (5) selective scattering of blue light by sand grains occurs because the sand grains are large compared to the wavelength of visible light

34. Which of the following is NOT proposed as a factor influencing climate change in the Milankovitch theory?

- (1) changes in the shape of the earth's orbit
- (2) precession of the earth's axis
- (3) changes in the eccentricity of the earth's orbit
- (4) periodic reversals of the earth's magnetic field
- (5) changes in the tilt of the earth's axis

Köppen cheatsheet

• TABLE 17.1

Köppen's Climatic Classification System

LETTER SYMBOL			CLIMATIC CHARACTERISTICS	CRITERIA	
1ST	2ND	3RD			
A	f		Humid tropical	All months have an average temperature of 18°C (64°F) or higher Wet all seasons; all months have at least 6 cm (2.4 in.) of rainfall Winter dry season; rainfall in driest month is less than 6 cm (2.4 in.) and less than $10 - P/25$ (P is mean annual rainfall in cm) Short dry season; rainfall in driest month is less than 6 cm (2.4 in.) but equal to or greater than $10 - P/25$	
	w		Tropical wet (rain forest)		
		w			Tropical wet and dry (savanna)
		m	Tropical monsoon		
B			Dry	Potential evaporation and transpiration exceed precipitation. The dry/humid boundary is defined by the following formulas: $p = 2t + 28$ when 70% or more of rain falls in warmer 6 months (dry winter) $p = 2t$ when 70% or more of rain falls in cooler 6 months (dry summer) $p = 2t + 14$ when neither half year has 70% or more of rain (p is the mean annual precipitation in cm and t is the mean annual temperature in °C)* The BS/BW boundary is exactly one-half the dry/humid boundary	
	S		Semi-arid (steppe)		
	W		Arid (desert)		
		h			Hot and dry
		k			Cool and dry
				Mean annual temperature is 18°C (64°F) or higher Mean annual temperature is below 18°C (64°F)	

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C			Moist with mild winters	Average temperature of coldest month is below 18°C (64°F) and above -3°C (27°F) Average rainfall of wettest summer month at least 10 times as much as in driest winter month Average rainfall of driest summer month less than 4 cm (1.6 in.); average rainfall of wettest winter month at least 3 times as much as in driest summer month Criteria for w and s cannot be met Average temperature of warmest month above 22°C (72°F); at least 4 months with average above 10°C (50°F) Average temperature of all months below 22°C (72°F); at least 4 months with average above 10°C (50°F) Average temperature of all months below 22°C (72°F); 1 to 3 months with average above 10°C (50°F)	
	w		Dry winters		
		s			Dry summers
		f			Wet all seasons
		a			Summers long and hot
		b			Summers long and cool
		c			Summers short and cool
D			Moist with cold winters	Average temperature of coldest month is -3°C (27°F) or below; average temperature of warmest month is greater than 10°C (50°F) Same as under Cw Same as under Cs Same as under Cf Same as under Cfa Same as under Cfb Same as under Cfc Average temperature of coldest month is -38°C (-36°F) or below	
	w		Dry winters		
	s		Dry summers		
	f		Wet all seasons		
		a			Summers long and hot
		b			Summers long and cool
		c			Summers short and cool
	d		Summers short and cool; winters severe		
E	T		Polar climates	Average temperature of warmest month is below 10°C (50°F) Average temperature of warmest month is greater than 0°C (32°F) but less than 10°C (50°F) Average temperature of warmest month is 0°C (32°F) or below	
		T	Tundra		
	F		Ice cap		

*The dry/humid boundary is defined in English units as: $p = 0.44t - 3$ (dry winter); $p = 0.44t - 14$ (dry summer); and $p = 0.44t - 8.6$ (rainfall evenly distributed); where p is mean annual rainfall in inches and t is mean annual temperature in °E.

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