

Instructor(s): *Prof. Whiting*

## PHYSICS DEPARTMENT

MET 1010

1st Midterm Exam

Jan. 31, 2005

Name (print, last first): \_\_\_\_\_ 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) **Code your test number on your answer sheet (use 76–80 for the 5-digit number).** Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY.** Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** 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 with scratch work most questions demand.
- (4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink.** Do not make any stray marks or some answers may be counted as incorrect.
- (5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.
- (6) **Hand in the answer sheet separately.**

There are 40 multiple choice questions. Clearly mark the one best answer for each question. If more than one answer is marked, no credit will be given for that question, even if one of the marked answers is correct. Guessing an answer is better than leaving it blank. All questions are worth 0.5 percentage points. Good Luck!

1. The temperature of the *tropopause*:

- (1) is much colder than the temperature at the earth's surface
- (2) is close to the temperature at the earth's surface
- (3) has never been measured
- (4) is much warmer than the temperature at the earth's surface
- (5) is nearly the same as the sun's temperature

2. A radiation inversion is most commonly observed:

- (1) within a few meters of the ground
- (2) during the afternoon
- (3) at sunset
- (4) when it is raining
- (5) in the upper atmosphere

3. During the course of a year the sun will disappear from view near the North Pole on what date?

- (1) September 23      (2) June 21      (3) December 23      (4) January 1      (5) March 21

4. Which below is not considered a greenhouse gas?

- (1) oxygen (O<sub>2</sub>)    (2) nitrous oxide (N<sub>2</sub>O)    (3) water vapor (H<sub>2</sub>O)    (4) methane (CH<sub>4</sub>)    (5) carbon dioxide (CO<sub>2</sub>)

5. The amount of force exerted over an area of surface is called:

- (1) pressure      (2) weight      (3) temperature      (4) work      (5) density

6. A mirage is caused by:

- (1) the bending of light by air of different densities
- (2) being too thirsty
- (3) a thin layer of moist air near the ground
- (4) reflection of light from a hot surface
- (5) scattering of light by air molecules

7. Polar orbiting satellites:

- (1) on each successive orbit view an area to the west of the previous orbit
- (2) pass directly over the same place on each orbit
- (3) remain above a fixed point over the equator
- (4) follow a line of constant latitude around the earth
- (5) remain above a fixed point over the North or South Pole

8. When the air temperature of a parcel increases, the saturation vapor pressure will \_\_\_\_\_ and the relative humidity will \_\_\_\_\_ .

- (1) increase, decrease (2) decrease, increase (3) remain the same, decrease (4) increase, increase (5) decrease, decrease

9. Where are the days and nights of equal length all year long?

- (1) at the Equator (2) nowhere (3) at 23.5° (4) at the poles (5) at 66.5°

10. Low, gray, sheetlike clouds from which a light rain is falling are called:

- (1) nimbostratus (2) cirrus (3) cumulonimbus (4) altocumulus (5) cirrostratus

11. The fog that forms when you breathe out on a cold day is:

- (1) evaporation (mixing) fog (2) advection fog (3) radiation fog (4) acid fog (5) ice fog

12. The air temperatures in New Orleans (on the Gulf of Mexico) and in San Diego (in southern California) are both 95°F on a typical summer day. Which statement is most true?

- (1) the heat index is higher in New Orleans
- (2) the air in San Diego contains more actual water vapor
- (3) people sweat more in New Orleans, so they stay cooler
- (4) the wet bulb temperature in New Orleans is lower
- (5) the humidity in New Orleans makes the hot air more comfortable

13. When frozen water (ice) becomes liquid water:

- (1) latent heat of melting is absorbed from the environment
- (2) latent heat of melting is released to the environment
- (3) latent heat of evaporation is absorbed from the environment
- (4) latent heat of evaporation is released to the environment
- (5) heat capacity is released to the environment

14. A beaker with some water in it is sealed with a lid. The beaker and water are in equilibrium at a temperature of 25°C. What is the water vapor pressure in the air above the water? (see Figure)
- (1) 32 mb                      (2) 100 mb                      (3) 0 mb                      (4) 42 mb                      (5) 13 mb
15. What is the primary reason the earth has seasons?
- (1) the axis of rotation of the earth is tilted  
(2) the axis of rotation of the sun is tilted  
(3) the earth is closer to the sun in January  
(4) one side of the sun is brighter than the other  
(5) the output of the sun varies annually
16. The relative humidity is typically highest around:
- (1) 6:00 am                      (2) noon                      (3) midnight                      (4) 6:00 pm                      (5) 2:00 pm
17. About how much would a column of air weigh that reached from sea level to the top of the atmosphere and was 1 square inch in cross section?
- (1) 15 lbs                      (2) 0.2 lbs                      (3) 32 lbs                      (4) 54 lbs                      (5) 112 lbs
18. An anvil top is associated with which type of cloud?
- (1) cumulonimbus                      (2) altostratus                      (3) cirrus                      (4) stratocumulus                      (5) cirrocumulus
19. The effects most responsible for a rainbow are:
- (1) dispersion and total internal reflection  
(2) refraction and selective scattering  
(3) transmission and dispersion  
(4) selective reflection and refraction  
(5) Mie scattering and formation of crepuscular rays
20. 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 toward the hot sand  
(2) light scattered at very glancing angles always appears blue  
(3) hot sand acts as a mirror and specular reflection causes the sky to appear in the sand  
(4) dispersion causes blue light to be preferentially refracted upward  
(5) selective scattering of blue light by sand grains occurs because the grains are large compared to the wavelength of light
21. Hygroscopic nuclei:
- (1) attract water even below 100% relative humidity  
(2) repel water even when the air is supersaturated  
(3) are the smallest condensation nuclei  
(4) are nuclei composed entirely of ice  
(5) is another name for the nucleus of hydrogen atoms

22. What gas is considered a pollutant on the surface of the earth, but beneficial in the stratosphere?
- (1) ozone      (2) carbon dioxide      (3) nitrous oxide      (4) chlorofluorocarbons      (5) methane
23. High, wispy clouds composed mostly of ice crystals are:
- (1) cirrus      (2) cumulonimbus      (3) nimbostratus      (4) altocumulus      (5) stratus
24. In a blinding snowstorm in Vermont, the air temperature and dew point temperature are both 30°F. Meanwhile, under clear skies in Arizona, the air temperature is 85°F and the dew point is 38°F. From this information, you can conclude:
- (1) There is more water vapor in the air in Arizona.  
(2) There is more water vapor in the air in Vermont.  
(3) Arizona and Vermont have the same amount of water vapor in the air.  
(4) No conclusions can be drawn about the water vapor content of the air.  
(5) Arizona and Vermont are both being influenced by easterly winds.
25. Light reflected from a surface that is NOT flat is called:
- (1) diffuse scattered light      (2) refracted light      (3) absorbed light      (4) polarized light      (5) diffracted light
26. On a cold night, you are standing facing a large bonfire. Your front side is warm while your backside is cold. You are receiving heat from the bonfire primarily through:
- (1) radiation      (2) conduction      (3) convection      (4) latent heat      (5) osmosis
27. Evaporative coolers are primarily used in climates where summers are:
- (1) hot and dry      (2) hot and humid      (3) mild and humid      (4) cool and dry      (5) cool and humid
28. You fill a glass completely full of water and cover the top with a rigid, flat piece of plastic. When you turn the glass upside-down, the water stays inside the glass, rather than falling out. What holds the lid on?
- (1) atmospheric pressure      (2) gravity      (3) surface tension      (4) capillary action      (5) an inversion
29. Which statement is true of the stratosphere?
- (1) the temperature increases as you go higher  
(2) ozone is the most abundant gas  
(3) chlorofluorocarbons (CFC's) are the most abundant gas  
(4) it is the atmospheric layer in which most of the earth's weather occurs  
(5) the pressure increases as you go higher
30. The temperature at which water boils depends mainly on:
- (1) air pressure      (2) air density      (3) relative humidity      (4) air temperature      (5) the specific heat of air

31. If there were no atmosphere on the earth:
- (1) the sky would appear black during the day
  - (2) twilight would last longer
  - (3) the sky would appear white during the day
  - (4) the sky would still be blue
  - (5) the sun would appear red all day
32. An insulated glass beaker contains a mixture of ice and water at equilibrium. If a small amount of heat is **removed** from the contents of the beaker and it is allowed to come to equilibrium again:
- (1) some of the water will freeze, but the temperature of the mixture will remain constant
  - (2) the temperature of the mixture will drop
  - (3) some of the water will freeze and the temperature of the mixture will drop
  - (4) some ice will melt at constant temperature
  - (5) the temperature of the mixture will increase
33. Without the atmospheric greenhouse effect, the earth's average surface temperature would be:
- (1) lower than at present
  - (2) higher than at present
  - (3) the same as it is now
  - (4) more variable than it is now
  - (5) less variable than it is now
34. What gas is produced naturally in the stratosphere and is also a primary component of photochemical smog in polluted air at the surface?
- (1) ozone      (2) carbon dioxide      (3) carbon monoxide      (4) nitrogen dioxide      (5) hydrocarbons
35. The wind direction is:
- (1) the direction from which the wind is blowing
  - (2) the direction to which the wind is blowing
  - (3) always directly away from high pressure
  - (4) always directly toward low pressure
  - (5) always from the west
36. Much of Tibet lies at altitudes over 18,000 feet where the pressure is about 500 mb. At such altitudes, the Tibetans are above roughly:
- (1) 50% of the air molecules in the atmosphere
  - (2) 10% of the air molecules in the atmosphere
  - (3) 25% of the air molecules in the atmosphere
  - (4) 5% of the air molecules in the atmosphere
  - (5) 75% of the air molecules in the atmosphere
37. At what time of day is the relative humidity most likely to be at a minimum?
- (1) 3 pm      (2) 10 am      (3) midnight      (4) sunset      (5) sunrise

38. Frost forms when:

- (1) the saturation point is at or below freezing
- (2) the saturation point is above freezing
- (3) drops of dew freeze
- (4) the temperature falls below freezing without reaching saturation
- (5) fog droplets freeze

39. Radiation fog forms best on a:

- (1) clear winter night with a slight breeze
- (2) cloudy winter night with a strong breeze
- (3) clear summer night with a strong breeze
- (4) cloudy summer night with a slight breeze
- (5) cloudy winter night with a slight breeze

40. What is the main reason the sun *appears* to set later than it actually does?

- (1) refraction of sunlight in the atmosphere
- (2) scattering of sunlight in the atmosphere
- (3) selective (Rayleigh) scattering of sunlight
- (4) dispersion of sunlight in the atmosphere
- (5) reflection of sunlight in the atmosphere

41. When viewed from the surface, the smallest individual cloud elements (puffs) are observed with which cloud?

- (1) cirrocumulus      (2) stratocumulus      (3) cumulus      (4) altocumulus      (5) cumulonimbus

42. A halo around the moon means that:

- (1) cirrostratus clouds are present
- (2) the clouds overhead are low clouds
- (3) rain is falling from the clouds overhead
- (4) the clouds are composed of water droplets
- (5) a religious holiday is near

43. During the last 100 years, CO<sub>2</sub> in the atmosphere has:

- (1) been increasing in concentration
- (2) been decreasing in concentration
- (3) remained at about the same concentration from year to year
- (4) disappeared entirely
- (5) become concentrated at the equator

44. When the air is saturated, which of the following statements is **NOT** correct?

- (1) an increase in temperature will cause condensation to occur
- (2) the air temperature equals the wet-bulb temperature
- (3) the relative humidity is 100%
- (4) the air temperature equals the dew point temperature
- (5) the rate of evaporation equals the rate of condensation

45. If water vapor comprises 3.5% of an air parcel whose total pressure is 1000 mb, the water vapor pressure would be:

- (1) 35 mb                      (2) 350 mb                      (3) 1035 mb                      (4) 965 mb                      (5) 1000 mb

46. The horizontal transport of any atmospheric property by the wind is called:

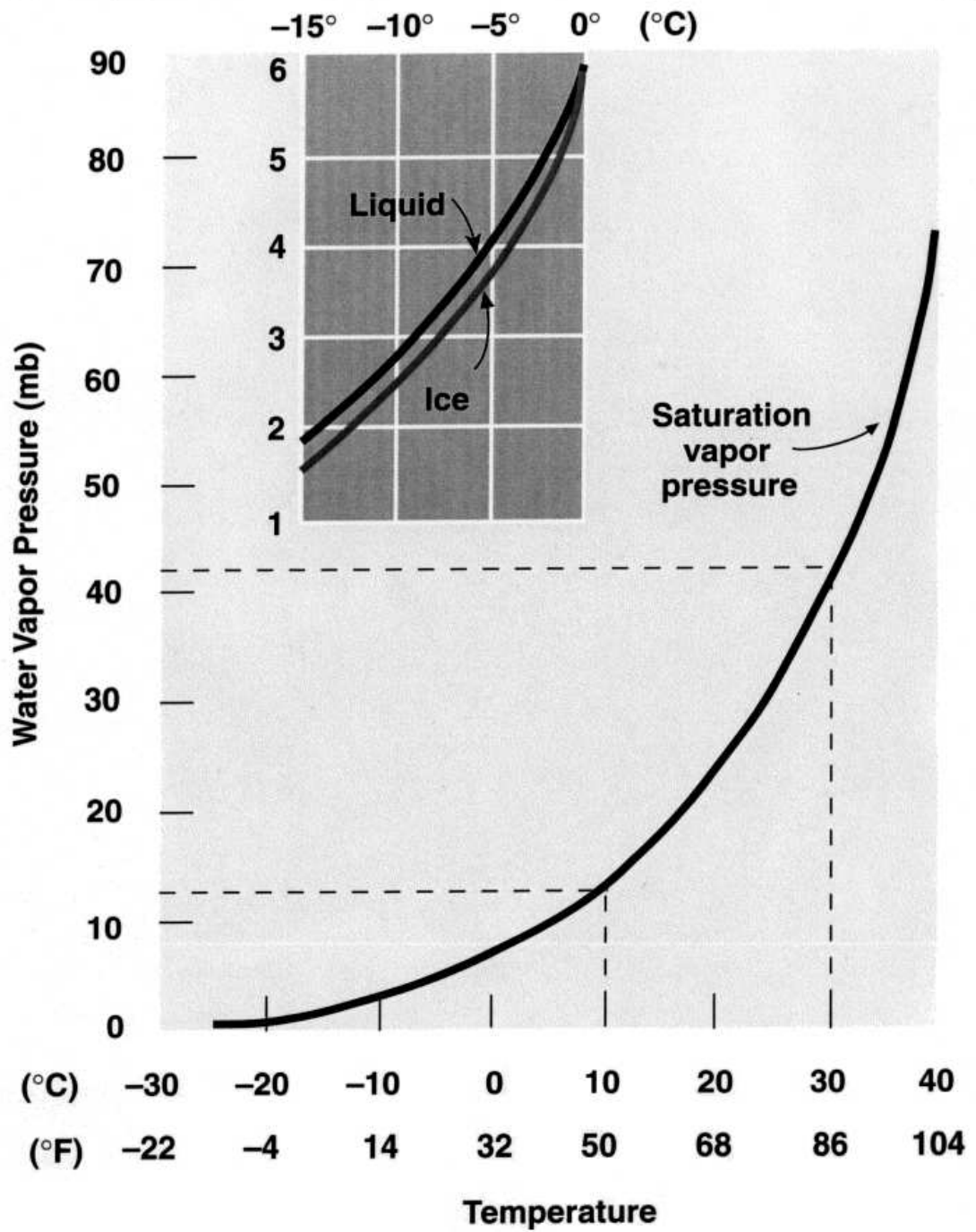
- (1) advection                      (2) radiation                      (3) conduction                      (4) latent heat                      (5) reflection

47. Most of the radiation emitted by a human body is in the form of:

- (1) infrared radiation and is invisible to the human eye  
(2) ultraviolet radiation and is invisible to the human eye  
(3) visible radiation, but is too weak to be visible  
(4) humans do not emit radiation  
(5) visible radiation, visible only in a completely dark room

48. Why is the sun red at sunset?

- (1) Because blue light is preferentially scattered by the atmosphere.  
(2) Because red light is preferentially scattered by the atmosphere.  
(3) Dust in the atmosphere is generally red (clay), which reflects red light.  
(4) The oceans absorb most of the blue light at the small angle during sunset.  
(5) Far from the sun, it always appears red.



***Saturation vapor pressure increases with increasing temperature***



FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE TYPE 1  
Q# S 4 Q# S 22 Q# S 34 TYPE 2 Q# S 10 Q# S 18 Q# S 23 Q# S 41 TYPE 3 Q# S 13 Q# S 32 TYPE 4 Q# S 6 Q#  
S 20 TYPE 5 Q# S 5 Q# S 30