Name: _____ Student ID Number _____

ESS55: Earth's Atmosphere / Homework #3 (due 5/1/2012)

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. During a radiation inversion, wind machines
   a. bring warm air down toward the surface
   b. lift cool, surface air to higher altitudes
   c. mix the air near the ground
   d. all of the above

____ 2. The most important reason why summers in the Southern Hemisphere are not warmer than summers in the Northern Hemisphere is that:
   a. the earth is closer to the sun in January
   b. the earth is farther from the sun in July
   c. over 80% of the Southern Hemisphere is covered with water
   d. the sun's energy is less intense in the Southern Hemisphere

____ 3. In July, at middle latitudes in the Northern Hemisphere, the day is _____ long and is _____ with each passing day.
   a. less than 12 hours, getting longer
   b. less than 12 hours, getting shorter
   c. more than 12 hours, getting longer
   d. more than 12 hours, getting shorter

____ 4. The main reason(s) for warm summers in middle latitudes is that:
   a. the earth is closer to the sun in summer
   b. the sun is higher in the sky and we receive more direct solar radiation
   c. the days are longer
   d. all of the above
   e. only (b) and (c) are correct

____ 5. In meteorology, the word insolation refers to:
   a. a well-constructed, energy-efficient home
   b. the solar constant
   c. incoming solar radiation
   d. an increase in solar output

____ 6. During an equinox:
   a. the days and nights are of equal length except at the poles
   b. at noon the sun is overhead at the equator
   c. the earth is not tilted toward nor away from the sun
   d. all of the above

____ 7. During the winter solstice in the Northern Hemisphere:
   a. astronomical winter begins in the Northern Hemisphere
   b. the noon sun is overhead at 23.5^{o} S latitude
   c. at middle latitudes in the Northern Hemisphere, this marks the longest night of the year
   d. all of the above

____ 8. To protect fruit trees from frost, it is important to keep the air as still as possible.
   a. true
   b. false

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____ 9. Radiational cooling typically occurs
   a. during the afternoon
   b. at night
   c. during the late morning

____ 10. The sun is directly overhead at Mexico City (latitude 19°N):
   a. once a year
   b. twice a year
   c. four times a year
   d. never

____ 11. Lines connecting points of equal temperature are called:
   a. isobars
   b. isotherms
   c. thermals
   d. thermographs

____ 12. For maximum winter warmth, in the Northern Hemisphere, large windows in a house should face:
   a. north
   b. south
   c. east
   d. west

____ 13. When it is January and winter in the Northern Hemisphere, it is _____ and _____ in the Southern Hemisphere.
   a. January and summer
   b. January and winter
   c. July and winter
   d. July and summer

____ 14. Suppose you drive to and from work on a street that runs east to west. On what day would you most likely have the sun shining directly in your eyes while driving to and from work?
   a. summer solstice
   b. winter solstice
   c. autumnal equinox
   d. during the summer months

____ 15. The strongest radiation inversions occur when
   a. skies are overcast
   b. skies are partly cloudy
   c. skies are clear
   d. precipitation is falling

____ 16. The primary cause of a radiation inversion is:
   a. infrared radiation emitted by the earth's surface
   b. infrared radiation absorbed by the earth's surface
   c. solar radiation absorbed by the earth's surface
   d. solar radiation reflected by the earth's surface
   e. infrared radiation absorbed by the atmosphere and clouds

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____ 17. The earth is tilted at an angle of 23.5° with respect to the plane of its orbit around the sun. If the amount of tilt were increased to 40°, we would expect in middle latitudes:
a. hotter summers and colder winters than at present
b. cooler summers and milder winters than at present
c. hotter summers and milder winters than at present
d. cooler summers and colder winters than at present
e. no appreciable change from present conditions

____ 18. In the Northern Hemisphere, this day has the fewest hours of daylight:
a. summer solstice
b. winter solstice
c. vernal equinox
d. autumnal equinox

____ 19. The greatest variation in daily temperature usually occurs:
a. at the ground
b. about 5 feet above the ground
c. at the top of a high-rise apartment complex
d. at the level where thermals stop rising

____ 20. Where are the days and nights of equal length all year long?
a. at 66.5°
b. nowhere
c. at 23.5°
d. at the Equator

____ 21. In the middle latitudes of the Northern Hemisphere on June 22, the sun:
a. rises in the east and sets in the west
b. rises in the southeast and sets in the southwest
c. rises in the northeast and sets in the northwest
d. rises in the northeast and sets in the southwest
e. rises in the southeast and sets in the northwest

____ 22. During the afternoon the greatest temperature difference between the surface air and the air several meters above occurs on a:
a. clear, calm afternoon
b. clear, windy afternoon
c. cloudy, calm afternoon
d. cloudy, windy afternoon

____ 23. In most areas the warmest time of the day about 5 feet above the ground occurs:
a. around noon
b. in the afternoon between 2 and 5 pm
c. in the early evening after 6 pm
d. just before the sun sets

____ 24. Which latitude below would experience the fewest hours of daylight on Dec. 22?
a. 60° S
b. 20° S
c. 0° (Equator)
d. 20° N
e. 60° N

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____ 25. Which of the following helps to explain why even though northern latitudes experience 24 hours of sunlight on June 22, they are not warmer than latitudes further south?
   a. solar energy is spread over a larger area in northern latitudes
   b. some of the sun's energy is reflected by snow and ice in the northern latitudes
   c. increased cloud cover reflects solar energy in the northern latitudes
   d. solar energy is used to melt frozen soil in the northern latitudes
   e. all of the above

____ 26. In clear weather the air next to the ground is usually _____ than the air above during the night, and _____ than the air above during the day.
   a. colder, warmer
   b. colder, colder
   c. warmer, colder
   d. warmer, warmer

____ 27. The maximum in daytime surface temperature typically occurs _____ the earth receives its most intense solar radiation.
   a. before
   b. after
   c. exactly when

____ 28. On what day would you expect the sun to be overhead at Lima, Peru (latitude 12^{o} S)?
   a. August 15
   b. December 22
   c. February 4
   d. March 10
   e. April 21

____ 29. The largest annual ranges of temperatures are found:
   a. at polar latitudes over land
   b. at polar latitudes over water
   c. at middle latitudes near large bodies of water
   d. at the Equator
   e. in the Northern Central Plains of the United States

____ 30. Although the polar regions radiate away more heat energy than they receive by insolation in the course of a year, they are prevented from becoming progressively colder each year by the:
   a. conduction of heat through the interior of the earth
   b. concentration of earth's magnetic field lines at the poles
   c. circulation of heat by the atmosphere and oceans
   d. the insulating properties of snow
   e. release of latent heat to the atmosphere when polar ice melts