

## Multiple Choice Questions

1. The most abundant gas in the atmosphere by volume is \_\_\_\_\_. This gas comprises 78% of the Earth atmosphere by volume.
  - a. Oxygen
  - b. Argon
  - c. Carbon Dioxide
  - d. Nitrogen
2. The definition of a variable gas is a gas that varies significantly from time to time and place to place. The most significant variable gas by volume in the planetary boundary layer in the atmosphere is:
  - a. Ozone
  - b. Water vapor
  - c. Oxygen
  - d. Carbon dioxide
3. An isobar is a line of constant \_\_\_\_\_.
  - a. Pressure
  - b. Density
  - c. Temperature
  - d. Dewpoint
4. Which of the following best explains how pressure decreases with height in the Earth's atmosphere?
  - a. It decreases at a constant rate (linear decrease)
  - b. It decrease quickly at first then more gradually (exponential decrease)
  - c. It decreases at a rate of 9.8 millibars per kilometer
  - d. It decreases in the troposphere, increases in the stratosphere, then decreases to the top of the atmosphere
5. In the vertical dimension, the upper level jet stream is located closest to which mandatory synoptic scale pressure level?
  - a. The 850 millibar level (1,500 meters)
  - b. The surface
  - c. The 500 millibar level (5,500 meters)
  - d. The 300 millibar level (9,500 meters)
6. The seasons of Spring, Summer, Winter, and Fall are a direct result of which phenomenon?
  - a. The sun's energy output and the Earth's proximity to the sun
  - b. Shifting of ocean currents
  - c. The 23.5 ° tilt of the Earth from vertical
  - d. The jet stream
7. \_\_\_\_\_ refers to the horizontal transport of air while \_\_\_\_\_ is the vertical transport of air.

- a. Advection, convection
- b. Convection, advection

8. Which of the following has the highest albedo and thus more reflected solar radiation?

- a. Fresh snow    c. Water
- b. Grass    d. Blacktop

9. Which of the following is NOT a primary "control" of climate?

- a. Altitude    c. Daily weather
- b. Latitude    d. Ocean currents

10. Water has a \_\_\_\_\_ heat capacity. This means a large amount of energy is needed to raise the temperature of water relative to other substances.

- a. Low
- b. High

11. A one degree temperature change on the Fahrenheit scale is equal a \_\_\_\_\_ degree change on the Celsius scale.

- a. 0.56    c. 1.8
- b. 0.90    d. 3.6

12. Unsaturated air rises at the dry adiabatic lapse rate which is \_\_\_\_\_ ° C per kilometer. This is also the same numerical value as the gravitational force constant in meters per second squared.

- a. 15.2    c. 6.5
- b. 9.8    d. 5.5

13. Which of the following processes ABSORBS the most latent heat?

- a. Melting    c. Evaporation
- b. Freezing    d. Condensation

14. Which of the following processes will result in a GREATER dewpoint depression at the surface? The dewpoint depression is the difference between the temperature and the dewpoint.

- a. Wet-bulb cooling
- b. Saturating previously unsaturated air
- c. Radiational cooling
- d. Solar heating

15. One saturated air parcel with a temperature of 10 ° C has a saturation mixing ratio of 7 grams per kilogram; A second air parcel with a temperature of 20 ° C has a saturation mixing

ratio of 14 grams per kilogram; From this information, what is the most likely saturation mixing ratio of a parcel of air at 30 ° C? Warmer air holds exponentially more water vapor, therefore the temperature/saturation mixing ratio relationship is not linear.

- a. 17.5 grams per kilogram
- b. 19.0 grams per kilogram
- c. 21.0 grams per kilogram
- d. 26.5 grams per kilogram

16. In which air mass type would a rising parcel's slope at the moist adiabatic lapse rate be closest to the dry adiabatic lapse rate? The moist adiabatic lapse rate is NOT a constant. The moist adiabatic lapse rate has a smaller slope than the dry adiabatic lapse rate if a parcel contains moisture. The amount of latent heat release depends on the temperature and moisture content of the air.

- a. Maritime tropical (warm and moist)
- b. Maritime polar (cool moist)
- c. Continental tropical (hot and dry)
- d. Continental polar (cold and dry)

17. Which of the following fronts GENERALLY has the smallest slope and is associated with light to moderate and widespread precipitation? This front is often found to the right of a mid-latitude cyclone in North America.

- a. Cold front
- b. Warm front
- c. Dryline
- d. Hurricane

18. Which of the following statements is FALSE:

- a. Cloud droplets freeze once temperature drops below 0 ° C.
- b. The vapor pressure is higher over water than over ice
- c. The typical raindrop is about 2 millimeters in diameter
- d. Salt particles make good condensation nuclei

19. The geostrophic wind is a balance of the pressure gradient force and the \_\_\_\_\_ force. This balance causes air to flow nearly parallel to the height contours in the mid and upper levels of the atmosphere.

- a. Friction
- b. Centrifugal
- c. Coriolis
- d. Gravity

20. When viewed from above the North Pole of the Earth, the earth rotates \_\_\_\_\_ and makes a complete turn in 24 hours. This causes low pressure to spin counterclockwise in the Northern Hemisphere. Clue: the sun rises in the east and sets in the west.

- a. Clockwise

b. Counterclockwise

21. The California Current off the US West Coast is a \_\_\_\_\_ ocean current while the Gulf Stream off the US East Coast is a \_\_\_\_\_ ocean current. This helps lead to dry summers in California and relatively wet summers in the SE US.

- a. Cold, Warm
- b. Warm, Cold

22. Which of the following is NOT conducive to lake effect snow?

- a. Continental polar air advecting over warm Great Lake waters
- b. Strong vertical directional and speed shear with positive LI's
- c. Orographic lifting and frictional convergence
- d. Large temperature difference between lake and overriding cP air

23. Where is the warm sector located in reference to a developed mid-latitude cyclone over the United States?

- a. To the north
- b. To the southeast
- c. To the west
- d. To the northeast

24. Rising motion due to vorticity and warm air advection are most commonly found to the \_\_\_\_\_ of the 500 millibar trough axis over the United States.

- a. Left
- b. Right
- c. North

25. This is the type of fog that forms on nights with light wind, clear skies, low dewpoint depressions, and moist soils.

- a. Warm air advection fog
- b. Thermal fog
- c. Upslope fog
- d. Radiational fog

26. Which of the following reasons explains why the stratosphere is absolutely stable.

- a. Air temperatures are too cold
- b. Air pressure is too low
- c. The absorption of radiant energy by ozone
- d. The wind speed is too strong

27. Which of the following reasons explains why ice crystals develop much more rapidly than liquid water drops in the upper and middle levels of thunderstorms?

- a. When temperatures drop below freezing, condensation of water vapor onto liquid water does not take place. The water vapor can, however, build on ice crystals due to deposition.
- b. Electrical currents within thunderstorms allow the building of water vapor on ice crystals more rapidly than on liquid water drops.
- c. It is because the vapor pressure of ice is less than that over water. This produces a vapor

pressure gradient between liquid and frozen water. This causes water vapor to move from liquid water drops toward ice crystals.

d. It is due to the turbulent motion of air. Condensation rates onto liquid water slow with increasing windspeed.

28. These clouds have some vertical development and are located in the upper levels of the atmosphere. The clouds have a lumpy appearance and are made of ice crystals. When viewed from the surface, each cloud element is about the size of a thumbnail.

- a. Nimbostratus    c. Altostratus
- b. Fair weather cumulus    d. Cirrocumulus

29. How can virga cause the atmosphere to become increasingly unstable?

- a. It can release large amounts of latent heat
- b. It can cool the mid-levels of the atmosphere
- c. It can cause a warming of the planetary boundary layer
- d. It can cause surface to 500 millibar cold air advection

30. When the temperature is below freezing from the surface to 500 millibars, what precipitation type would you expect?

- a. Snow    c. Sleet
- b. Rain    d. Freezing rain

#### Severe Weather Section (31-40)

31. The two weather disasters that result in the greatest loss of life are:

- a. Floods and Lightning    c. Floods and Hurricanes
- b. Hurricanes and Tornadoes    d. Lightning and Droughts

32. Which of the following is true of a "capping inversion"?

- a. It can prevent thunderstorms from developing
- b. It can enhance thunderstorm activity due to heat and moisture buildup in the planetary boundary layer
- c. It is a rapid temperature decrease with height above the planetary boundary layer
- d. Both a and b
- e. Both b and c

33. The air behind the forward flank downdraft associated with strong thunderstorms consists of \_\_\_\_\_ air while the rear flank downdraft consists of relatively \_\_\_\_\_ air.

- a. hot and dry; cold and moist
- b. cool and moist; warm and dry

- c. hot and moist; cold and moist
- d. cool and dry; warm and moist

34. Which of the following states has the most frequent and largest hail of the four choices below? Why?

- a. Kansas; many high CAPE days, freezing levels can be relatively low
- b. Florida; large number of thunderstorm days
- c. Michigan; high latitude, lake effect hail, many summer storms
- d. Oregon; orographic lifting, many thunderstorm days, jet stream

35. Minimum tropical storm force wind is \_\_\_\_\_ miles per hour while the minimum hurricane force wind is \_\_\_\_\_ miles per hour.

- a. 50; 100    c. 39; 74
- b. 25; 50    d. 44; 69

36. This is a synoptic scale boundary that separates maritime tropical (mT) air from continental tropical (cT) air. Dewpoint changes dramatically from one side of the boundary to the other. Severe thunderstorms can occur along this boundary, especially in Spring and early Summer.

- a. Gust front    c. Chinook
- b. Outflow boundary    d. Dryline

37. In which direction from a winter mid-latitude cyclone is heavy snow most likely to occur? The heaviest snow falls here due to the best combination of cold air and uplift. In this part of the cyclone, warm and moist air isentropically wraps up and over (wrap around precipitation) cold PBL air.

- a. To the southeast
- b. To the north
- c. To the southwest
- d. About a 100 miles south of the low track

38. In MOST cloud to ground lightning strikes, the ground tends to be \_\_\_\_\_ charged.

- a. Positively
- b. Negatively

39. Thunder travels at the speed of sound which is nearest to:

- a. 10 miles per hour
- b. 5 miles per second
- c. 1 mile every 5 seconds
- d.  $3 \times 10^8$  meter per second

40. The primary moisture source for severe thunderstorms in the Great Plains originates from the:

- a. Jet stream
- b. Mexican plateau and Rocky Mountains
- c. Pacific Ocean
- d. Gulf of Mexico

Climatology Section (41-50)

41. Many of the world's desert regions are located:

- a. Just north and south of the equator
- b. West coast regions along the Tropics of Capricorn and Cancer
- c. At 60 ° North and 60 ° South
- d. On the east coast of most continents

42. The sun is closest to the Earth in \_\_\_\_\_, this is known as \_\_\_\_\_ and has a \_\_\_\_\_ effect on seasons. Assume you are in the Northern Hemisphere.

- a. Summer; Aphelion; large
- b. Summer; Perihelion; small
- c. Summer; Perihelion; large
- d. Winter; Perihelion; small
- e. Winter; Aphelion; large

43. Which of the following is a diabatic process as compared to an adiabatic process?

- a. Convection
- b. Orographic lifting
- c. Radiational heating or cooling
- d. Rising air due to PBL convergence

44. If you stand with your back to the wind and rotate to the right 30 °, the surface pressure will be \_\_\_\_\_ to your left than your right.

- a. Lower
- b. Higher

45. In which location are hurricanes most likely to develop?

- a. In warm tropical waters 10 ° to 25 ° North and South of equator
- b. Along the equator over continental locations
- c. Along the west coast of continents at 35 ° North or South
- d. In either the Mediterranean Sea, off the east coast of South America, or just south of Australia

46. An "A" climate is characterized as having:
- a. Tropical forest climates and hot all seasons
  - b. A dry climate
  - c. Warm temperate rainy climates with mild winters
  - d. Cold forest climates with severe winters
  - e. Polar climate

47. Climate is a function of:
- a. Latitude
  - b. Altitude
  - c. Continentality
  - d. Ocean currents
  - e. All of the above

48. The mid-latitude winds in the Northern and Southern Hemispheres flow generally from which direction?
- a. From the east in both hemispheres
  - b. From the west in both hemispheres
  - c. From the west in the Northern Hemisphere and from the east in the Southern Hemisphere
  - d. From the east in the Northern Hemisphere and from the west in the Southern Hemisphere

49. Which of the following is NOT a high latitude climate?
- a. Polar    c. Tundra
  - b. Tropical wet and dry    d. Taiga

50. The word MONSOON as it applies to climatology refers to:
- a. Very heavy rain
  - b. The intensification of the polar jet
  - c. A seasonal reversal in wind direction and pressure distribution
  - d. A cyclone or typhoon with winds over 100 miles per hour