CHAPTER 15

CLIMATE AND CLIMATE CHANGE

MULTIPLE CHOICE QUESTIONS

1. Climatology varies
   a. spatially
   b. temporally
   *c. both spatially and temporally

2. Climate
   a. does not change through time.
   b. changes everywhere in the same direction.
   *c. is naturally variable.
   d. is determined by latitude alone.
   e. None of the above is correct.

3. By international agreement, climatic averages are computed from weather records compiled over a ______ year period.
   a. 5
   b. 10
   c. 20
   *d. 30
   e. 100

4. For any month across the entire nation, temperature and precipitation anomalies exhibit
   a. the same sign (direction) everywhere.
   b. the same magnitude everywhere.
   c. the same sign but different magnitudes.
   *d. different signs and different magnitudes.
   e. None of the above is correct.

5. Typically, monthly temperature anomaly patterns are ______ rainfall anomaly patterns.
   a. more complex than
   *b. less complex than
   c. about as complex as

6. The ocean
   a. influences radiational heating and cooling of the planet
   b. absorbs a majority of the solar radiation striking the Earth’s surface
   c. transfers heat to the atmosphere via latent heating
   *d. All of the above are correct.
   e. None of the above is correct
7. The latitude of highest mean annual surface temperature, the heat equator, is located about _____ degrees north of the geographical equator.
   a. 5
   *b. 10
   c. 15
   d. 20

8. If this morning's low temperature was 20 °F and this afternoon's high temperature was 64 °F, the day's average temperature was ______ °F.
   a. 84
   b. 35
   c. 44
   *d. 42
   e. 60

9. The spatial variability of annual precipitation can be attributed to
   a. topography.
   b. the distribution of land and sea.
   c. planetary-scale circulation.
   *d. All of the above are correct.

10. Typically, trends in climate are geographically non-uniform in
    a. magnitude only.
    b. sign (direction) only.
    *c. both magnitude and sign (direction).

11. Which of the following climate controls varies in the most regular manner?
    *a. solar radiation
    b. monsoon circulation
    c. westerly wave pattern
    d. storm tracks

12. As compared to the climate that prevailed through most of geological time, the climate of the past two million years has
    a. had average global temperatures around 10 Celsius degrees higher than in the past.
    b. seen an increase in severe weather events.
    *c. favored the development of huge glacial ice sheets.

13. As a rule, ______ skies increase the diurnal (day-to-night) temperature range.
    a. overcast
    *b. clear
    c. partly cloudy

14. The scientific community did not widely accept the theory of plate tectonics until
   *a. the 1960s
b. the 1930s.
c. the 1970s.

15. An increase in the magnitude of a temperature change with increasing ______ is known as polar amplification.
a. elevation
b. albedo
*c. latitude
d. precipitation

16. Localities downwind of a large body of water are characterized by ______ climates.
a. continental
*b. maritime

17. Localities in the continental interior of North America and Asia are characterized by ______ climates.
*a. continental
b. maritime

18. The Sun’s energy output varies ______ with sunspot number.
*a. directly
b. indirectly

19. Plate tectonics was an important control of climate
a. over the past 100 years.
b. over the past 1000 years.
c. during the Ice Age.
*d. during the hundreds of millions of years that constitute geologic time.
e. None of the above is correct.

20. The creation of national weather services and the foundation of the International Meteorological Organization (today’s WMO) have provided us with detailed temperature records for the past ______ years.
a. 1000 or so
*b. 100 or so
c. 10,000 or so
d. 25
e. 10

21. The peak of the last major glacial advance over North America occurred about ______ years ago.
a. 1 million
b. 2 million
c. 100,000
*d. 18,000-20,000
e. 10,500
22. A climatic episode favoring the thinning and retreat of existing glaciers is
a. a glacial climate.
b. a maritime climate.
c. an interglacial climate.  
d. the Hypsithermal.
e. the Medieval Warm Period.
23. Polar amplification of climate change
a. likely took place during the Pleistocene Ice Age.
b. consists of an increase in the magnitude of climate change with increasing latitude.
c. is an example of the geographical nonuniformity of climate change.
d. All of the above are correct.
e. None of the above is correct.
24. The Younger Dryas
a. was a period of cooler temperatures.
b. triggered re-advances of glacial ice sheets.
c. was relatively short-lived.
d. All of the above are correct.
e. None of the above is correct.
25. The Little Ice Age
a. lasted from about 1400 to 1850.
b. was a period of renewed continental-scale glaciation over the northern United States.
c. was caused by volcanic eruptions.
d. was a period when the globe was at least 6 Celsius degrees colder than at present.
e. took place long before civilization was established.
26. The Medieval Warm Episode lasted from about ______ to ______.
a. 1400……………1850
b. 950……………1250
b. 1945……………1978
c. 1850……………1950
e. 720…………….1853
27. A period when the global average annual temperature trended downward was
a. 1980s through the 1990s.
b. 1880s through the 1930s.
c. 1960s through the 1970s.
27. The warmest decade of the 20th century:
a. 1980s
b. 1920s
c. 1930s
d. 1990s
29. From the 1980s into the early 21st century, the trend in global average annual temperature was
   *a. upward.
   b. downward.

30. Climate change may consist of
   a. more frequent weather extremes.
   b. an upward trend in mean temperature.
   c. less frequent drought.
   d. a downward trend in mean monthly precipitation.
   *e. Any of the above is correct.

31. A possible source of error in the long-term, instrument-based climate record:
   a. changes in reliability of weather instruments
   b. gaps in monitoring networks
   c. moderating influence of urbanization
   *d. All of the above are correct.
   e. None of the above is correct.

32. A statistically significant cycle in the instrument-based climatic record is
   a. the annual radiation/temperature cycle.
   b. the diurnal radiation/temperature cycle.
   *c. Both of the above are correct.

33. Numerical global climate models predict that a ______ change in the Sun’s energy output could significantly alter the mean temperature of the Earth-atmosphere-ocean system.
   *a. 1%
   b. 10%
   c. 25%
   c. 5%

34. The Sun’s total output of radiation
   a. varies slightly with sunspot number.
   b. varies slightly from one year to the next.
   c. is most accurately measured by instruments onboard Earth-orbiting satellites.
   *d. All of the above are correct.
   e. None of the above is correct.

35. The temperature of a sunspot is ______ the temperature of the Sun’s photosphere, giving the sunspot a dark appearance.
   *a. lower than
   b. about the same as
   c. higher than
36. The sunspot cycle is approximately ______ years.
   *a. 11  
   b. 22  
   c. 44  
   d. 68  
   e. 100

37. Solar energy output ______ as the sunspot number decreases.
   a. increases  
   *b. decreases  
   c. does not change

38. The Maunder minimum  
   a. refers to a period of greatly diminished sunspot activity.  
   b. occurred during the Little Ice Age.  
   c. is linked to changes that took place on the Sun.  
   *d. All of the above are correct.  
   e. None of the above is correct.

39. Milankovitch argued that regular changes in the Earth-Sun geometry explained the large-scale climatic fluctuations during the Ice Age primarily by  
   a. altering the solar constant.  
   *b. changing the seasonal and latitudinal distribution of solar radiation on Earth.  
   c. producing sunspots.  
   d. increasing the planetary albedo.  
   e. altering the aerosol content of the troposphere.

40. Evidence from ______ firmly established Milankovitch cycles as a cause of climatic fluctuations.  
   a. tree growth-ring records  
   *b. deep-sea sediment cores  
   c. ancient pollen records  
   d. records of grape harvests on Cape Cod  
   e. volcanic lava flows

41. As the tilt of the Earth’s axis increases, winters become ______ and summers become ______ in both hemispheres.  
   *a. colder……warmer  
   b. warmer……colder

42. The large-scale climatic impact of violent volcanic eruptions depends on the volume of ______ injected into the stratosphere.  
   a. CFCs  
   *b. sulfur oxide gases and aerosols  
   c. methane  
   d. carbon dioxide
43. The residence time of an aerosol in the stratosphere is generally longer than its residence time in the troposphere because
   a. there is no precipitation in the stratosphere.
   b. the stratosphere is extremely stable.
   c. little exchange of air occurs between the stratosphere and the troposphere.
   *d. All of the above are correct.
   e. None of the above is correct.

44. A more reflective Earth is a ______ Earth.
   a. warmer
   *b. cooler

45. Carbon dioxide levels in the atmosphere have been rising primarily because of
   *a. burning of coal and other fossil fuels.
   b. clearing of forests.
   c. the greenhouse effect.
   d. widespread use of CFCs.

46. All other factors unchanged, rising levels of carbon dioxide will likely cause surface air temperatures to continue to
   *a. rise.
   b. fall.

47. Levels of atmospheric carbon dioxide ____________ during the growing season and ___________ in winter.
   a. rise……………fall.
   *b. fall……………rise.

48. The net effect of more sulfate aerosols in the troposphere:
   a. an enhanced greenhouse effect
   *b. lower air temperatures
   c. a lower planetary albedo

49. Sea level rise would
   a. disrupt coastal ecosystems.
   b. ruin agricultural lands.
   c. threaten historical, cultural, and recreational resources.
   *d. All of the above are correct.

50. If global warming persists, sea level is expected to rise because of
   a. partial melting of the polar ice caps.
   b. thermal expansion of sea water.
   *c. Both of the above are correct.