Name: _____ School: _____

_____

Meteorology- Answer Key

Holt Invitational

February 21, 2015

(Two questions were chosen for the tiebreaker and are marked on the test. If there still a tie, the tie will be broken by order of finish)

1. The two main factors that determine the climate of a region are:
   a. Temperature and precipitation
   b. Pressure and temperature
   c. Altitude and pressure
   d. Altitude and temperature

2. The following statements refer to either weather or climate. For each statement, **circle** the classification that most accurately describes it (either weather or climate.) 1 point each

The baseball game was rained out today	Weather	Climate
January is Chicago's coldest month	Weather	Climate
North Africa is a desert	Weather	Climate
The high this afternoon was 10°F	Weather	Climate
Last evening a tornado ripped through Lansing	Weather	Climate

3. In order of abundance, these are the major components in clean, dry air near the surface of the Earth:
   a. Oxygen, Nitrogen, Carbon dioxide
   b. Oxygen, Carbon dioxide, Argon
   c. Nitrogen, Oxygen, Carbon dioxide
   d. Nitrogen, Oxygen, Argon

4. A change of one degree on the Celsius scale is ____ a change of one degree on the Fahrenheit scale.
   a. equal to
   b. larger than
   c. smaller than
   d. is in the opposite direction of

5. The Earth's Ozone layer
   a. Has been thickening over the past decade
   b. Filters harmful ultraviolet radiation from the sun
   c. Exists over Antarctica
   d. Traps carbon dioxide in the stratosphere

6. Increased carbon dioxide may cause global warming by:
    a. Allowing more sunlight into the atmosphere
    b. Reflecting sunlight from Earth's surface
    c. Reducing the amount of Oxygen in the air
    d. Trapping more heat in the atmosphere

7. Of the gases listed below, which is NOT believed to be responsible for enhancing the earth's greenhouse effect?
    a. chlorofluorocarbons (CFCs)
    b. molecular oxygen (O_2)
    c. nitrous oxide (N_2O)
    d. carbon dioxide (CO_2)
    e. methane (CH_4)

8. Which of the following surface would have the most albedo?
    a. Thin Clouds
    b. Dark soil
    c. Fresh snow
    d. Sandy beach

9. The sun emits a maximum amount of radiation at wavelengths near ____, while the earth emits maximum radiation near wavelengths of ____.
    a. 0.5 micrometers, 30 micrometers
    b. 0.5 micrometers, 10 micrometers
    c. 10 micrometers, 30 micrometers
    d. 1 micrometer, 10 micrometers

10. If the earth's average surface temperature were to increase, the amount of radiation emitted from the earth's surface would ____, and the wavelength of peak emission would shift toward ____ wavelengths.
    a. increase; shorter
    b. increase; longer
    c. decrease; shorter
    d. decrease; longer

11. An increase in albedo would be accompanied by ____ in radiative equilibrium temperature.
    a. an increase
    b. a decrease
    c. no change
    d. unstable oscillations

12. If the amount of energy lost by the earth to space each year were not approximately equal to that received,
    a. the atmosphere's average temperature would change.
    b. the length of the year would change.
    c. the sun's output would change.
    d. the mass of the atmosphere would change

13. Sunlight passes through a thicker portion of the atmosphere at:

a. sunrise. b. noon. c. sunset. d. night. e. both sunrise and sunset.

14. In the northern hemisphere, a solar panel should be placed on the side of the roof facing:

a. east. b. west. c. north. d. south.

15. Solar radiation reaches the earth's surface as:

a. visible radiation only.
b. ultraviolet radiation only.
c. infrared radiation only.
d. visible and infrared radiation only.
e. ultraviolet, visible, and infrared radiation

16. The earth emits radiation with greatest intensity at:

a. infrared wavelengths.
b. radio wavelengths.
c. visible wavelengths.
d. ultraviolet wavelengths.

17. According to the normal lapse rate, the temperature drops _____ °C for every kilometer increase in altitude.

a. 1.5 b. 6.5 c. 10.6 d. 16.5

18. This gas absorbs five times more terrestrial radiation than all other gases combined accounting for warmer temperatures in the lower troposphere.

a. Carbon dioxide b. Methane c. Carbon monoxide d. Water vapor

19. Two objects, A and B, have the same mass but the specific heat of A is larger than B. If both objects absorb equal amounts of energy,

a. A will become warmer than B.
b. B will become warmer than A.
c. both A and B will warm at the same rate.
d. A will get warmer, but B will get colder.

20. Why are high mountains typically colder than sea level?

a. Mountains receive less solar radiation
b. Mountains are closer to the clouds
c. There is more wind at higher altitude
d. Temperature usually decreases with altitude

21. Which of the following climate zones is typically subject to the greatest diurnal variation in temperature?

a. humid subtropical b. arctic c. arid d. Mediterranean

22. Why is Anchorage, Alaska considered to have a subarctic climate under the Koppen climate classification system?

a. it receives over 75 inches of snowfall every year

b. it is located only a few degrees of latitude south of the Arctic Circle

c. average temperatures there exceed 10 degrees Celsius for between 1 and 3 months of the year

d. it is located adjacent to a cold ocean current

23. Which of the following best describes a climate that is heavily influenced by monsoons?

a. wet and rainy year-round

b. wet and rainy for part of the year, then very dry for the remainder of the year

c. hot and dry year-round

d. moderated by the trade winds

24. Most of the world's deserts (excluding Antarctica) are located at:

a. 0 degrees north latitude to 15 degrees north latitude

b. 15 degrees north latitude to 30 degrees north latitude

c. 30 degrees north latitude to 45 degrees north latitude

d. 45 degrees north latitude to 60 degrees north latitude

25. The term "rain shadow" refers to which of the following?

a. the decreased amount of sunlight that often occurs before precipitation

b. a scattered group of clouds that trails behind the remainder of a cold front

c. a region where precipitation is notably less because of a mountain barrier's cooling of the air as it rises

d. a region where precipitation is notably less because of a mountain barrier's warming of the air as it rises

26. Why do coastal cities tend to have milder temperatures than inland cities at the same latitude?

a. Water absorbs and holds more heat than land which transfers to the atmosphere warming the coastal cities

b. Water produces less rain and transfers less heat to coastal areas

c. The land absorb and holds more heat than water which transfer to the atmosphere warming the inland cities

d. None of the Above

27. 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 these

e. b and c only

28. Identify each description as fitting the **Köppen** or **Thornthwaite** climate classification system: (1 point each)

_____ **Köppen** _____ utilizes monthly temperature and precipitation data

_____ **Köppen** _____ Focuses on larger regions

_____ **Thornthwaite** ___ concentrates on a local scale and includes interaction with the local soil

_____ **Köppen** _____ identified five main climatic groups: A (tropical), B (arid), C (mesothermal or mid-latitude mild), D (microthermal or mid-latitude cold), and E (polar)

_____ **Thornthwaite**____ system dependent on the modified potential evapotranspiration (PET) of a region.

29. Michigan's approximate average yearly rainfall is: **(Tiebreaker #2)**

a. 16 inches
b. 32 inches
c. 61 inches
d. 93 inches

30. What is the length of a standard climate record?

a. 10 years
b. 30 years
c. 100 years
d. 1000 years

31. Most weather on Earth is caused by

a. winds moving energy around in the atmosphere due to the unequal heating of the Earth's surface
b. the greenhouse effect
c. temperature differences in the different layers of the atmosphere
d. the varying difference in the distance from the Earth to the sun as the Earth revolves around the sun

32. What is the name of the climatic condition which changes the normal flow of water in the western Pacific Ocean and climate around the world?

a. Coriolis Effect
b. El Niño
c. Monsoons
d. Greenhouse Effects

33. Rowland and Molina won the Nobel Prize for:

a. Showing how CFC's split ozone molecules
b. Discovering the ozone hole over Antarctica
c. Reducing CFC production by ½
d. Orchestrating the Montreal Protocol
e. Creating CFC's in the 1920's

34. Which of the following is **NOT** a way humans have brought about climate change:

a. Increased atmospheric carbon dioxide concentrations through industrial activities
b. Converted much of the native grassland prairies to agricultural cultivation
c. Increased amounts of visible light from cities during the night time
d. Deforestation in places like the Amazon

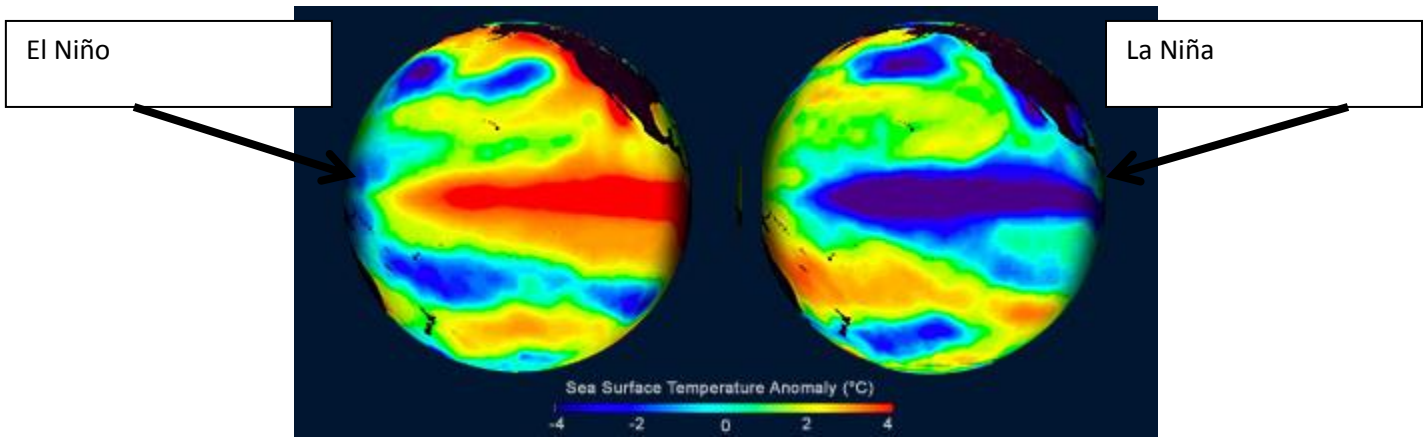
35. Climate change has been occurring since the Earth was formed.

a. True b. False

36. 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 the 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 that at present
e. No appreciable change from present conditions

37. Label the picture as either El Nino or La Nina or normal conditions



38. Look at the list of atmospheric phenomena below: (1 point each)

If an event is usually associated with El Niño, write an **A** next to the statement.

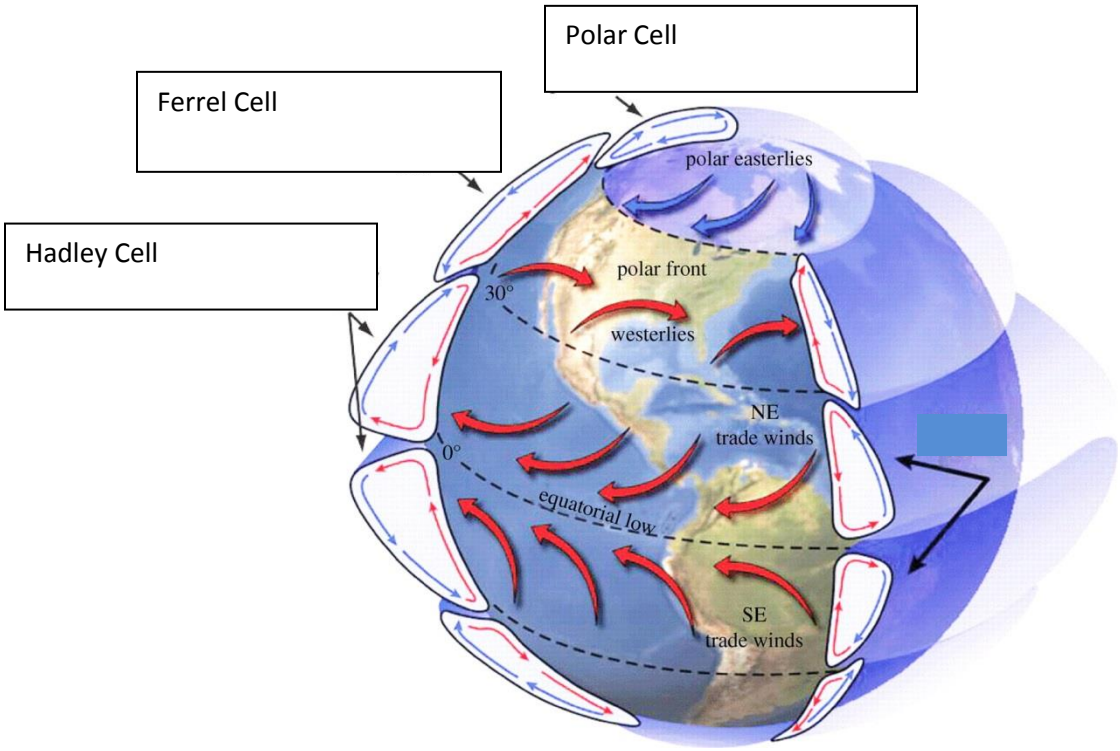
If an event is usually associated with La Niña, write a **B** next to the statement.

___A_____ Strong equatorial counter-current
___B_____ Strong Peruvian Current
___B_____ Strong Trade winds
___A_____ Wetter than average winter over Florida
___A_____ milder winters in Michigan
___A_____ Drier than average over Indonesia and Australia
___B_____ Stronger upwelling of ocean waters along the coast of Peru
___B_____ More hurricane activity

39. ENSO stands for:

a. Equatorial/Neap/Southern Oscillation
b. Eastern/Northern/Shore Oscillation
c. El Niño/Southern Oscillation
d. None of the above

40. Using the three cell model, label the global circulation patterns below: (1 point)



41. The Intertropical Convergence Zone exists because of:

a. Fronts
b. Trade winds
c. Thunderstorms
d. Tropical cyclones

42. A Santa Ana (or Chinook or Foehn) wind is a:

a. Cold, damp wind blowing off snow fields
b. Very dry, warm wind coming down a mountain slope
c. Wind associated with a blizzard
d. Very dry, cool wind rising up a mountain slope

43. Most of the United States is situated in which zone of prevailing winds?

a. Doldrums
b. Trade winds
c. Westerlies
d. Subpolar easterlies

44. The Coriolis effect occurs because of this characteristic of the earth:

a. Its atmosphere
c. Its rotation
b. Magnetic field
d. Its dense core

45. The thermohaline circulation is that part of the ocean circulation which is driven by:

a. Wind
c. Moon
b. Density differences
d. Heat sources at the ocean floor

46. If global warming results in increased rainfall in the North Atlantic, and the melting of glaciers and sea ice, the influx of warm freshwater onto the sea surface, this could slow or even stop the global ocean currents. Which region would most effected by drastic temperature changes:

a. Europe.
b. Gulf coast
c. West coast of North America
d. Africa

47. The cycles of Earth's orbit (eccentricity, obliquity, and precession) influences the amount of solar radiation striking different parts of the Earth at different times of the year, thus affecting the Earth's climate. These cycles are known as:

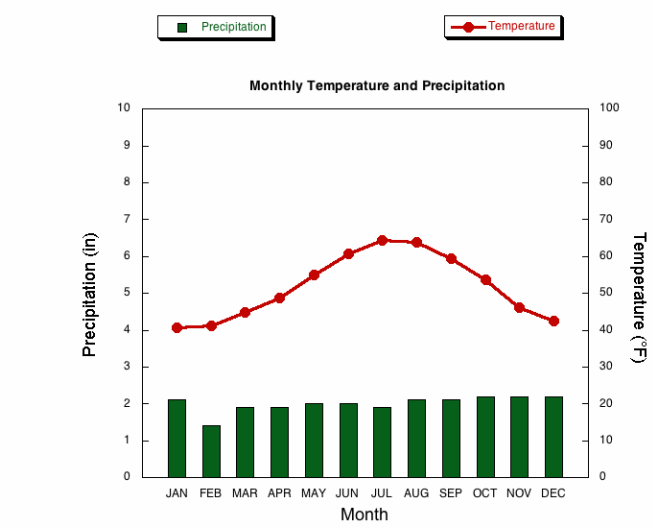
a. El Niño cycles
c. Köppen cycles
b. Radiation cycles
d. Milankovich cycles

48. The National Snow and Ice Data Center reported that 2010 Arctic sea ice extent was the third lowest on the satellite record at 4.6 million km^2 (1.78 million mi^2). The record was set in 2007 at 4.13 million km^2. The 2010 minimum was part of a larger pattern of overall Arctic sea ice decline dating back to at least the early 1970's. Which explanation best depicts the problem associated with this natural climate feedback?

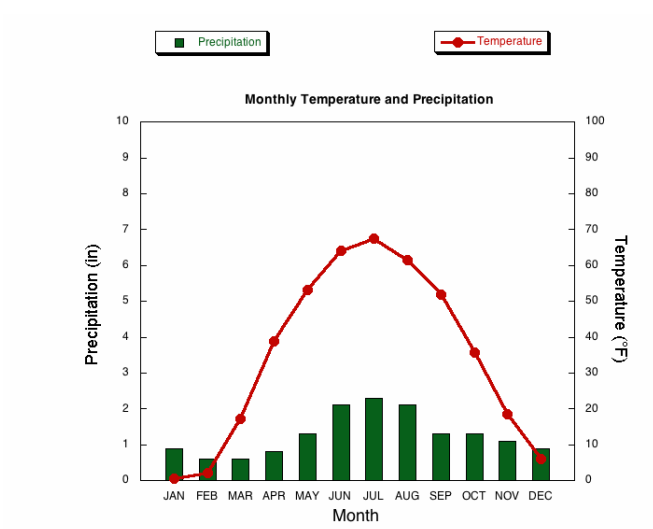
a. Exposing more open ocean allows a great deal of solar energy to be absorbed by the earth's surface causing temperatures to increase and leading to more melting and the cycle to continue.
b. Exposing more dark soil on land will allow for more solar energy to be absorbed by the earth's surface causing temperatures to increase and the cycle to continue.
c. Exposing less open ocean allows more solar energy to be absorbed by the earth's surface causing temperatures to decrease and the cycle to continue.
d. Sea ice extent is not a variable when considering earth's rise in global temperature.

49. The two climographs below are from areas with similar elevation and latitudes. Explain the temperature difference (**Tiebreaker #1**). A World map is included on the next page. (2 points)

Annual Climatology: London, England
Elev: 149 ft Lat: 51 º 29' N Long: 00 º 00'



Annual Climatology: Omsk, Russia
Elev: 279 ft Lat: 54 º 58' N Long: 73 º 20' E



London is a coastal city whereas Omsk is in the middle of the continent. London climate is greatly influenced by the warm ocean current passing by as a result of the global currents. Water absorbs and holds more heat than land which transfers to the atmosphere warming the coastal cities during colder months. Water's high specific heat also accounts for the lower variance in temperature throughout the year.

50. Explain how a volcanic eruption of sufficient magnitude emitting very large quantities of material into the lower stratosphere may have an effect on global and regional climate. (2 points)

Certain types of volcanic eruption can have an effect upon the climate. The eruption has to be of sufficient magnitude to emit very large quantities of material into the lower stratosphere (20-25km above the Earth's surface) and, for maximum impact, it should be in lower latitudes. Volcanic gas and particles can increase cloud coverage globally. This cloud coverage then affects the amount of the sun's energy which reaches the Earth's surface. Increase cloud coverage reflects more of the sun's energy therefore less is reaching the Earth's surface. As a result, significant cooling for many of the months can result after a major volcanic eruption. The Pinatubo eruption in 1991 was a good example of this effect. The northern summers of 1992 and 1993 were the coolest of the period from 1986 to the present.


WORLD
Cities Map
Anchorage
Juneau
Vancouver
Calgary
Winnipeg
Rapid City
Ottawa
Montreal
San Francisco
Las Vegas
Kansas City
New York
Washington DC
Los Angeles (LA)
Santa Fe
Dallas
New Orleans
Miami
Honolulu
Havana
San Juan
Mexico City
Caracas
Panama
Bogota
Galapagos
Quito
Lima
Brasilia
La Paz
Rio de Janeiro
São Paulo
Santiago
Buenos Aires
Reykjavik
Oslo
Helsinki
Saint-Petersburg
Copenhagen
Amsterdam
Moscow
Dublin
Berlin
Klev
London
Paris
Milan
Bucharest
Madrid
Rome
Istanbul
Lisbon
Athens
Ankara
Casablanca
Tripoli
Cairo
Jerusalem
Abu Simbel
Riyadh
Khartoum
Dakar
Accra
Nairobi
Dar-es-Salaam
Brazzaville
Johannesburg
Cape Town
Omsk
Irkutsk
Tashkent
Ulanbator
Vladivostok
Beijing
Tahran
Kabul
New Delhi
Karachi
Kathmandu
Shanghai
Tokyo
Osaka
Taipei
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Colombo
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