

Carbon Dioxide (CO<sub>2</sub>) in the atmosphere absorbs the longwave ultra-violet radiation emitted by Earth, converts it to heat energy and warms the atmosphere

Name three sources of CO<sub>2</sub> on Earth?

1

Heinrich events are sudden expansions of the amount of arctic sea ice pack in the North Atlantic ocean. Name two reasons why an increase in the amount of sea ice would cause atmospheric temperature to decrease?

2

Methane gas (CH<sub>4</sub>) is the third most important Greenhouse gas by volume. CH<sub>4</sub> absorbs the ultraviolet radiation coming from Earth and converts it to heat energy which warms the atmosphere.

What is the #1 source of methane gas (CH<sub>4</sub>) on Earth?

3

Data from the Greenland Ice Core Project<sup>2</sup>, reveals that the quantity of Sodium dust (Na) in the atmosphere has changed throughout Earth's past.

What is the #1 source of Na dust on Earth?

4

In an equal length core deep sea sediments reveal a record of Earth's atmosphere that goes back in time further than does the ice core record. What might that tell you about the amount of detail recorded in an ice core?

5

The entire ocean system circulates like a giant conveyor belt. How long does it take for ocean water to circulate one time through the entire system?

- A. 10 years
- B. 100 years
- C. 1,000 years
- D. 10,000 years

6

During the Little Ice Age, from 1450 AD to 1850 AD, the climate on Earth turned dramatically colder in the period of only a few decades. Is this the only time that rapid worldwide climate changes have occurred during the Holocene (warm interglacial period) we are currently in?

7

The "engine" that drives the circulation of water throughout the world's oceans, in one long continuous belt, is the density of the sea water in the North Atlantic ocean. Dense surface water sinks and flows as a deep ocean current south to Antarctica. How can sea water be made more dense?

8

Deep sea sediments reveal dramatic changes in the shapes of zooplankton called Foraminifera that correspond to changes in the temperature of the sea water and the climate of Earth. What changes to the shell's shape takes place as the temperature changes?

9

The Younger Dryas event was a sudden change from warm to cold glacial like temperatures. How long did it take to go from warm temperatures back to cold glacial conditions? +/-100 yrs

10

The Milankovitch insolation cycle is a 100,000 year cycle of the movement of Earth around the Sun. How many times since the Eemian interglacial period has the Sun been at its closest point to Earth?

11

Solar cycles refer to cycles of change in the Sun such as solar flares, and expanding and contracting of the size of the Sun.

What does the term "insolation" cycles refer to?

12

The shells of the ocean zoo-plankton, Foraminifera, are made of limestone ( $\text{CaCO}_3$ ). During glacial periods the amount of  $\text{Ca}^{+}$  in the atmosphere (from ice core data) was higher. Why was sea level lower during glacial periods leaving more limestone exposed to erosion by the wind?

13

When Lief Erickson landed in Greenland in 1066 AD why did he name it Greenland?

14

Who discovered the South Pole?

15

In 1650, Johannes Kepler calculated the orbit of Earth around the Sun to be an ellipse. Earth moves closer to the Sun during one part of the orbit and farther away during another part of the orbit six months later. During what season is Earth (Northern Hemisphere) closest to the Sun?

16

Currently the average trend for all glaciers around the world is that they are growing larger or melting away?

17

What would be the effect if Earth was closer to the Sun (perihelion) and Earth's axis tilted the Northern Hemisphere toward the Sun (precession)?

18

What is albedo?

19

What percentage of a floating iceberg is under water?

20

What percent of time is the Holocene relative to the last 100,000 years?

21

What is the average worldwide temperature change necessary for another ice age to occur?

22

The current tilt of Earth's axis is 23.5 degrees. What is the maximum tilt of Earth axis (obliquity)?

23

What is the length of the Eemian interglacial period?

24

How long has it been since the last ice sheet covered North America?

25

How much does average sea level change from a glacial to interglacial period?

26

What is the name of the line of latitude that the Sun's direct rays fall on the first day of fall (Northern Hemisphere)?

27

What is the name of the North American glacial lake that emptied into the North Atlantic ocean around 13,000 years ago, possibly helping to initiate the quick, short return to glacial conditions called the Younger Dryas event?

28

Are icebergs fresh or salt water?

29

Why do icebergs float?

30

On a map of the world showing precipitation, Greenland is considered a desert. Then how can the Greenland ice sheet continue to grow?

31

What is the more dangerous to a glacier, warm winters or warm summers?

32

Which of the following is not a valid method for measuring Earth's climate history?

- A. Ice cores
- B. Deep sea sediments
- C. Coral reef
- D. Tropical tree rings

33

The oldest trees in the US are the Bristol Cone pines in California. How old are they ?

34

True or False  
In the past, average world temperatures changes of more than 10 degrees F have occurred in less than 100 years.

35

Was the climate maximum a cold or a hot period?

36

Was the Eemian a hot or cold period?

37

Is the Holocene a cold or hot period?

38

How long has it been since the Eemian Period?

39

Winds reach 70 mph on a regular basis on the Greenland ice sheet. What shape of building is best to cope with those conditions?

- A. Rectangle
- B. Dome
- C. Pyramid
- D. Triangular

40

Relative to today, what were global temperatures 50,000 years ago?

41

Would excessive dust in the atmosphere warm or cool the planet?

42

What is the #1 Greenhouse gas?

43

The precession (wobble) of Earth's axis is on a 22,000 year cycle. When was the last time Polaris was the North star?

44

What country operates Vostok, the Antarctic base where the deepest ice core has been drilled?

45

Name two types of penguins that live at the North pole?

46

Captain Scott died while involved in a race with Amundsen to be the first person to reach the South Pole. What "modern" inventions did Scott take with him to Antarctica for over-snow travel?

47

What country first laid claim to and now has sovereign rights to the mineral wealth in Antarctica?

48

What is the most dangerous thing in Antarctica, the cold or the polar bears?

49

If CO<sub>2</sub> is a by-product of respiration and combustion, where does CO (Carbo Monoxide) come from?

50

How many glacial periods have there been in the last 100,000 years?

51

How does freshly fallen snow become glacial ice?

52

Do glaciers presently exist at the equator?

53

What is the difference between a glacier and an ice sheet?

54

If all the glacial ice in the world melts, where would you go in Florida to buy beach front property?

55

Which has a higher albedo, rock or ice?

56

What does GISP2 stand for?

57

Most of the scientific experiments that are conducted on ice cores have to be conducted under what kind of conditions?

58

Which is a longer period of geological time, a period or an era?

59

In an ice core, the annual layers of snow that build up are still recognizable all the way to the bottom of the ice core. What changes happen to the snow layers as they become more deeply buried?

60

The bottom of the Greenland ice core is at an elevation below sea level due to the weight of the overlying ice. What is glacial rebound?

61

If all the glaciers on Earth melted away, what would happen to the overall albedo of the planet?

62

What does GPS stand for?

63

What percent of the world's fresh water is contained in the Antarctic ice sheet?

64

If there is a forest fire and the smoke from it settles out on a glacier, that "smoke" may be recovered in an ice core. What chemical component would scientists be most likely to find from that "smoke"?

65

In one molecule of CO<sub>2</sub>, how many atoms of carbon are there?

66

What is the name of the high altitude wind that encircles the globe?

67

Oxygen is very reactive. It is rarely found alone in nature as O but prefers to exist as O<sub>2</sub>. What is the common name for O<sub>3</sub>?

68

What is dendrochronology?

69

What radioactive dating method is used for dating wood (organic materials)?

70

How long does it take for the Thermohaline Current to circulate around the globe one time?

71

The movement of air or water on a circular motion as the warm air rises and the cold air sinks is called what kind of current?

72

An upwelling ocean current off of the coast of Chile, that affects weather as far a way as New England is called?

73

What is the term used to describe glaciers that move very rapidly?

74

What types of moraines are rock material that have been eroded and transported to the end of a glacier?

75

Cirques are bowl shaped depressions previously eroded by mountain glaciers?  
T or F

76

The accumulation area of a glacier is the area where most of the snow accumulates during the winter.  
T or F

77

Crevasses are formed on a glacier because of the elastic propoerties of ice?  
T or F

78

Tarns are mountain lakes that often form at the base of cirque glaciers?  
T or F

79

Large glacial deposits that resemble “tear drops” from the air.  
A. Drumlins  
B. Eskers  
C. Roche Mountannee  
D. Erractic

80

Any good farmer knows tha one thing that cows and glaciers that enter the sea have in common?

81

What is the name for seasonal couplets of sediment layers which are deposited in lakes?

82

Researchers in different disciplines ask different questions and employ different methods to answer the same questions. What questions would you ask and what methods would you employ to investigate global climate change if you were a plant biologist? or a science historian?

83

Why is some portion of every ice core drilled by scientists stored in the archive of the National Ice Core Laboratory in Denver Colorado?

84

Wind across Earth's surface is strongest when air moves between areas of greater temperature difference. How does greater wind strength influence the distribution of Greenhouse gases and particulate matter (dust, soot) in the atmosphere?

85

Global climate is determined by energy transfer from the sun at or near Earth's surface. How do clouds influence energy transfer from the sun to Earth? Give an example demonstrating that this is true.

86

Assume that human enterprises involving the burning of fossil fuels (driving cars, heating homes, manufacturing materials) do not affect global climate change, but there are harmful pollutants released. Where do the pollutants go if Earth is a closed system?

87

Explain the rock cycle in terms of the Calcium (Ca) dust found in ice cores. Where did the Ca come from, why was it exposed at Earth's surface, how did it get into ice cores?

88

Global patterns of atmospheric movement influence local weather. As the planet continues to warm which areas of Earth will become more productive and habitable and which areas may become less productive and habitable for humans?

89

The Thermohaline Circulation system (the ocean circulation system that moves around the entire globe) may be "driven" by the sinking of cold dense water in the Northern Atlantic ocean. If glaciers in the Northern Hemisphere melt and add fresh water to the system what will happen to the density of the water in the ocean and the ultimate distribution of heat around the globe?

90

Is the graph of climate change for the last 40,000 years smooth or does it contain many rapid climate changes?

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