**Cumulative global warming exam version B**

1. Soot tends to warm the earth when it accumulates in atmospheric brown clouds.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

2. Computer modeling has conclusively established that anthropogenic warming has occurred since 1910.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

3. How is the validity of a computer model typically tested?

|  |  |
| --- | --- |
|  | a) all of these are true |
|  | b) by verifying its ability to calculate current climate conditions. |
|  | c) by verifying its ability to calculate past climate conditions. |
|  | d) by making predictions about future years and seeing if they come true. |

4. Approximately what percent of global warming can be attributed to a long-term trend (since 1978) in the sun's energy?

|  |  |
| --- | --- |
|  | a) 10% |
|  | b) 50% |
|  | c) 0% |
|  | d) 30% |

5. A rise in the sea level is associated with global warming because

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| --- | --- |
|  | a) water tends to expand as it warms |
|  | b) both of these are true |
|  | c) ice and snow melts |

6. While computer modeling indicate that the warming since 1970 is dominated by man-made greenhouse gas emissions, they are unable to conclusively ascertain whether the warming from 1910 to 1945 was anthropogenic.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

7. Anthropogenic means something that

|  |  |
| --- | --- |
|  | a) humans cannot repair |
|  | b) humans can repair |
|  | c) will hurt humans |
|  | d) human caused |

8. Compared with the first half of the twentieth century, the rate of earth's average temperature rise during the second (latter) half was

|  |  |
| --- | --- |
|  | a) about the same |
|  | b) twice as much |
|  | c) half as much |

9. The distinction between the urban heat island effect and land use changes is that the latter involves the earth's average temperature while the former involves only the temperature near weather stations where the measurements are made

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

10. in 2013, the IPCC stated that the largest driver of global warming is carbon dioxide (CO2) emissions from fossil fuel combustion. Other important sources of CO2 are

|  |  |
| --- | --- |
|  | a) cement production and waste disposal |
|  | b) cement production and land use changes |
|  | c) population growth |
|  | d) population growth and waste disposal |

11. No direct method exists that permits an independent measurement of the heat content of the oceans, other than the fact that the air is warming

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

12. Ocean temperatures are increasing more slowly than land temperatures because the oceans are absorbing less heat energy from the sun

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

13. Proxy temperatures measurements are defined as measurements made using measurements from space.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

14. Greenhouse warming acts to warm the stratosphere

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

15. The climate change community is divided between those who believe the goal should be to eliminate the earth's greenhouse effect altogether, and those who argue that we should attempt to minimize earth's greenhouse effect.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

16. Depleting the ozone layer cools the stratosphere because ozone allows UV radiation to penetrate.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

17. Depleting the ozone layer cools the stratosphere because ozone absorbs UV energy from the sun that heats the stratosphere.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

18. The largest temperature increases (from 2000-2009) have occurred

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| --- | --- |
|  | a) near the poles |
|  | b) on the ocean surface |
|  | c) near the equator |
|  | d) in the western hemisphere |

19. Which external force plays the smallest role in current efforts to model global warming?

|  |  |
| --- | --- |
|  | a) orbital cycles |
|  | b) greenhouse gasses |
|  | c) volcanic eruptions |
|  | d) solar luminosity (i.e. variations in energy from the sun) |

20. The Stefan-Boltzmann law plays a central role in establishing a planets temperature as the sun heats the planet with thermal (infra-red) radiation adding to the other solar radiation onto the planet

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

21. Stefan-Boltzmann radiation is called a negative feedback mechanism because if the sun's radiation increases, the Stefan-Boltzmann law ensures that more heat is lost from the planet to compensate.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

22. Analysis of the uncertainties associated with feedback suggests that the "worst-case" scenario is more difficult to model.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

23. What happens when water is heated?

|  |  |
| --- | --- |
|  | a) it absorbs CO2 |
|  | b) it expands at temperatures above 3.98°C and contracts below 3.98°C |
|  | c) it expands at temperatures below 3.98°C and contracts above 3.98°C |

24. In the arctic, soot tends to warm the earth.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

25. In the arctic, soot tends to cool the earth.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

26. In the twentieth century, the rate of earth's average temperature rise was closest to

|  |  |
| --- | --- |
|  | a) 0.7 °C per decade |
|  | b) 0.7 °C per year |
|  | c) 0.7 °C per century |

27. The 2007 IPCC report stated that most global warming was likely being caused by increasing concentrations of greenhouse gases produced by human activities. Among the science academies of the major industrialized nations, this finding was recognized by

|  |  |
| --- | --- |
|  | a) 90% of the academies of science |
|  | b) all but the US academy of science |
|  | c) 60% of the academies of science |
|  | d) all of the academies of science |

28. Emissions scenarios are

|  |  |
| --- | --- |
|  | a) estimates of how greenhouse gasses are absorbed and emitted by agriculture |
|  | b) estimates of how greenhouse gasses are absorbed and emitted by nature |
|  | c) estimates of changes in future emission levels of greenhouse gases |
|  | d) estimates of how greenhouse gasses are absorbed and emitted by the world's oceans |

29. "External forcings" refer to effects that can increase, but not decrease, the Earth's temperature.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

30. Stefan-Boltzmann radiation is called a negative feedback mechanism because if the sun's radiation increases, the Stefan-Boltzmann law ensures that this heat is retained by the planet.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

31. Changes in ice-albedo refers to changes in

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| --- | --- |
|  | a) how much the Earth's surface absorbs or reflects incoming sunlight |
|  | b) how much CO2 is absorbed by the sun |
|  | c) how much ice is melted during the summer months |

32. The lede's "[CO2 Emissions per Year](https://en.wikiversity.org/wiki/File:Global_Warming_Observed_CO2_Emissions_from_fossil_fuel_burning_vs_IPCC_scenarios.svg)" graph (1990-2010) shows solid straight lines that represent

|  |  |
| --- | --- |
|  | a) estimates of the contributions from fossil fuels alone |
|  | b) estimates of the contributions from everything except fossil fuels |
|  | c) estimates made in the year 2000 of what would happen in the future |
|  | d) estimates of the impact on land temperatures |

33. The Stefan-Boltzmann law plays a central role in establishing a planets temperature as the sun heats the planet until the thermal (infra-red) radiation away the planet rises to match the solar radiation onto the planet

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

34. The [Keeling curve](https://en.wikiversity.org/wiki/File:Mauna_Loa_Carbon_Dioxide_Apr2013.svg) shows that carbon dioxide concentrations

|  |  |
| --- | --- |
|  | a) show a steady rise in CO2 levels, with increasing slope, and regular and predictable annual fluctuations |
|  | b) show a steady rise in CO2 levels, at constant slope, and irregular fluctuations due associated with El Ninos and La Ninas. |
|  | c) show a steady rise in CO2 levels, at constant slope, and regular and predictable annual fluctuations |

35. In climate science, mitigation refers to:

|  |  |
| --- | --- |
|  | a) adaptation to the effects of global warming |
|  | b) climate engineering |
|  | c) reduction of green house emissions |
|  | d) building systems resilient to the effects of global warming |

36. Carbon dioxide contributes more to the greenhouse effect than does water vapor.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

37. Computer models accurately model feedback mechanisms associated with the role of clouds as a feedback mechanism.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

38. The [Reconstructed Temperature](https://en.wikiversity.org/wiki/File:2000_Year_Temperature_Comparison.png) (0-2000 AD) plot in "Observed Temperature Changes" shows temperature measurements, as well as what curious feature? (See also [Divergence problem](https://en.wikipedia.org/wiki/Divergence_problem))

|  |  |
| --- | --- |
|  | a) the Little Ice Age being less prominent than the Medieval Warming period |
|  | b) a divergence between the tree and pollen proxy measurements |
|  | c) a tiny gap at the end of the proxy measurements |
|  | d) the fact that the different proxy measurements deviate considerably from the average of all proxy measurements |

39. The [Reconstructed Temperature](https://en.wikiversity.org/wiki/File:2000_Year_Temperature_Comparison.png) (0-2000 AD) plot in "Observed Temperature Changes" shows temperature measurements. The solid black line represents

|  |  |
| --- | --- |
|  | a) tree proxy measurements |
|  | b) the Medieval Warming Period |
|  | c) the Little Ice Age |
|  | d) thermometer measurements |
|  | e) a 10 year average |

40. Soot tends to cool the earth when it accumulates in atmospheric brown clouds.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

41. "External forcings" refer to effects that can either increase or decrease, the Earth's temperature.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

42. It is expected that carbon emissions will begin to diminish in the 21st century as fossil fuel reserves begin to dwindle.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

43. Ocean temperatures are increasing more slowly than land temperatures because oceans have more heat capacity and because evaporation cools the water.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

44. Global dimming, caused by air-born particulates produced by volcanoes and human made pollutants

|  |  |
| --- | --- |
|  | a) exerts a cooling effect by increasing the reflection of incoming sunlight |
|  | b) is more related to the ozone problem than to global warming |
|  | c) exerts a heating effect by absorbing infra-red radiation from earth's surface |

45. Analysis of the uncertainties associated with feedback suggests that the "worst-case" scenario is easier to model.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

46. The urban heat island effect refers to the fact that urban areas tend to be hotter than rural areas. The urban heat island effect is estimated to account for approximately \_\_\_\_\_ of the temperature rise over the past century.

|  |  |
| --- | --- |
|  | a) 30% |
|  | b) 3% |
|  | c) 0% |
|  | d) 0.3% |

47. The lede's graphs of the "[Global Land Ocean Temperature Index (1880-2013)](https://en.wikiversity.org/wiki/File:Global_Temperature_Anomaly.svg)" indicates that from 1960 to 2012 the average temperature increased by approximately

|  |  |
| --- | --- |
|  | a) 1.6° Celsius |
|  | b) 0.16° Celsius |
|  | c) 16° Celsius |
|  | d) 0.06° Celsius |
|  | e) 0.6° Celsius |

48. Greenhouse warming acts to cool the stratosphere

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

49. The "[Greenhouse effect schematic](https://en.wikiversity.org/wiki/File:Greenhouse_Effect.svg)" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed at the earth's surface.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

50. The [cryosphere](https://en.wikipedia.org/wiki/cryosphere) refers to

|  |  |
| --- | --- |
|  | a) two of these are true |
|  | b) the north and south poles |
|  | c) the upper atmosphere |
|  | d) the highest mountains |

51. Water vapor contributes more to the greenhouse effect than does carbon dioxide.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

52. The lede's graph of the "[Global Land Ocean Temperature Index (1880-2013)](https://en.wikiversity.org/wiki/File:Global_Temperature_Anomaly.svg)" shows that since 1920, there has never been a decade of overall cooling

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

53. Proxy temperatures measurements are defined as indirect inferences gathered from ice cores, tree rings, and so forth

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

54. Which statement is FALSE about the lede's [map of the temperature anomaly](https://en.wikiversity.org/wiki/File:GISS_temperature_2000-09_lrg.png) (2000-2009)?

|  |  |
| --- | --- |
|  | a) Central Europe has warmed more than the continental United States |
|  | b) all portions of Antarctica have warmed |
|  | c) The United States has warmed more than Australia |
|  | d) Northern Asia has warmed more than southern Asia |

55. The [carbon cycle](https://en.wikipedia.org/wiki/carbon_cycle)

|  |  |
| --- | --- |
|  | a) is a proposal to trade carbon credits. |
|  | b) is an effort to store carbon in underground caves. |
|  | c) describes how carbon is absorbed and emitted by the oceans, soil, plants, etc. |

56. The "[Greenhouse effect schematic](https://en.wikiversity.org/wiki/File:Greenhouse_Effect.svg)" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed by the earth's atmosphere.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

57. Compared with the second half of the twentieth century, the rate of earth's average temperature rise during the first half was

|  |  |
| --- | --- |
|  | a) about the same |
|  | b) twice as much |
|  | c) half as much |

58. The Earth's average surface temperature rose by approximately \_\_\_\_\_\_\_ per decade over the period 1906–2005.

|  |  |
| --- | --- |
|  | a) 0.7°C |
|  | b) 7.0°C |
|  | c) 0.07°C |

59. The lede's "[CO2 Emissions per Year](https://en.wikiversity.org/wiki/File:Global_Warming_Observed_CO2_Emissions_from_fossil_fuel_burning_vs_IPCC_scenarios.svg)" graph (1990-2010) shows dips and rises that are caused by changes in

|  |  |
| --- | --- |
|  | a) the earth's distance from the sun |
|  | b) the world economy |
|  | c) worldwide efforts to curtail emissions |
|  | d) the sun's energy output |

60. Computer models accurately model feedback mechanisms associated with how the soil will retain or release CO2 as the earth warms.

|  |  |
| --- | --- |
|  | a) true |
|  | b) false |

61. The lede's graph of the "[Global Land Ocean Temperature Index (1880-2013)](https://en.wikiversity.org/wiki/File:Global_Temperature_Anomaly.svg)" shows little or no temperature rise over the last \_\_\_\_ years

|  |  |
| --- | --- |
|  | a) 10 |
|  | b) 30 |
|  | c) 300 |
|  | d) 100 |
|  | e) 3 |

62. Since 1971, 90% of earth's increased energy caused by global warming has been stored in the \_\_\_\_\_\_\_\_\_\_\_\_\_, mostly \_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
|  | a) land; near the equators |
|  | b) land; near the poles |
|  | c) sea; in the bottom kilometer |
|  | d) sea; in the top kilometer |
|  | e) air; in the water vapor |