**Cumulative global warming exam version D**

1. 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 |

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

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

3. 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 |

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

5. 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 |

6. Greenhouse warming acts to warm the stratosphere

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

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

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

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

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

9. In climate science, mitigation refers to:

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

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

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

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. 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

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

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

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

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

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

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

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

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

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

17. 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) 0% |
|  | c) 0.3% |
|  | d) 3% |

18. 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) 3 |
|  | d) 300 |
|  | e) 100 |

19. Greenhouse warming acts to cool the stratosphere

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

20. 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) thermometer measurements |
|  | d) a 10 year average |
|  | e) the Little Ice Age |

21. Emissions scenarios are

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

22. 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 |

23. 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 |

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

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

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

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

26. What happens when water is heated?

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

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

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

28. 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 |

29. 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 land use changes |
|  | b) population growth and waste disposal |
|  | c) cement production and waste disposal |
|  | d) population growth |

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

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

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

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

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

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

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

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

34. 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) ice and snow melts |
|  | c) both of these are true |

35. Anthropogenic means something that

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

36. 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 |

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

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

38. 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) all of the academies of science |
|  | d) 60% of the academies of science |

39. 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) 0.06° Celsius |
|  | c) 0.6° Celsius |
|  | d) 0.16° Celsius |
|  | e) 16° Celsius |

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

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

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

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

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. 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 |

44. 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 |

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

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

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

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

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

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

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

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

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

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

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

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

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

52. 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 |

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

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

54. 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 |

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

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

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

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

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

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

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

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

60. 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 |

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

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

62. 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 |