

Write your **best** answer on the room provided.

1.
 - a. Given that Earth's surface temperature is 288 K, calculate the peak wavelength of light given off by the Earth. (2 pts)

 - b. If the amount of radiation hitting the Earth is 1.74×10^{17} W, calculate the theoretical surface temperature of the Earth if it has an albedo of 0.3. (3 pts)

 - c. What is the main reason for the discrepancy between the value given in part a and the value calculated in b? (2 pts)

2. A satellite has two sensors. One sensor is an IR sensor which records sea surface temperature. The other sensor records the time it takes for a laser beam pulsed by the satellite to be reflected back. Which sensor is active and which sensor is passive? (2 pts)

3. Describe the differences between geostationary orbits and polar orbits. (5 pts)

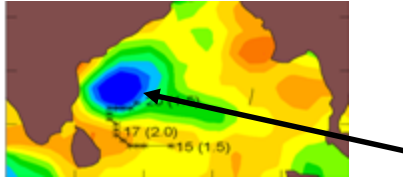
4. Which law describes the spectral energy distribution of an ideal blackbody? (1pt)

- 5.
- If a satellite with a 200 cm wide sensor is in a geostationary orbit, can it resolve two hot tubs, 3 meters in diameter, that are side by side if the water temperature is 38? Assume the sensor detects light at the water's wavelength of peak emission. (2 pts)
 - What is the minimum diameter of the hot tubs so that they could be resolved by satellite? (3 pts)
 - If the size of the sensor is fixed, what could hypothetically be adjusted to resolve the two hot tubs, and what would it have to be adjusted to? (3 pts)
 - Why would the above solution not be practical? (1 pt)
6. What are two ways that the efficiency of a sensor can be measured? (2 pts)
7. What type of sensor is the most commonly used on satellites? (1 pt)
8. List the three main types of light scattering and the condition for each type. (3 pts)
9. If a satellite is observing in the middle of the visible spectrum, what size would a particle be to scatter a photon via Mie scattering? (2 pts)
10. What are the energy in eV and frequency in THz of a photon with wavelength 600 NM? (4 pts)
11. Why can't a satellite image the Earth in the UV? (1pt)
12. What is the name for the portions of the electromagnetic spectrum that are not absorbed by the atmosphere? (1 pt)

13. A satellite measuring sea surface temperature sees a band of warm water stretching across the equatorial Pacific.

- a. What is the name of this phenomenon? (1 pt)
- b. What is the name of its cold water counterpart? (1 pt)_
- c. How often does this phenomenon occur? (1 pt)_
- d. What atmospheric process is responsible for this phenomenon? (1 pt)

14. Refer to Image 1



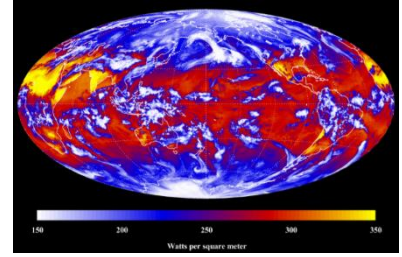
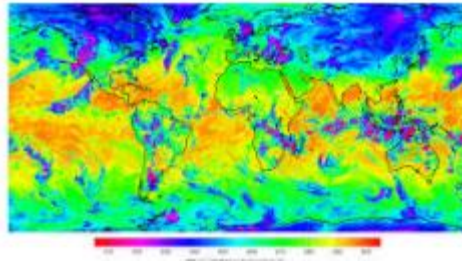
- a. What is the satellite that took Image 1 measuring? (1 pt)
- b. What is the feature that the black arrow is pointing to? (1 pt)

15. Which factor limits how small an object a satellite can image? (1 pt)

16.

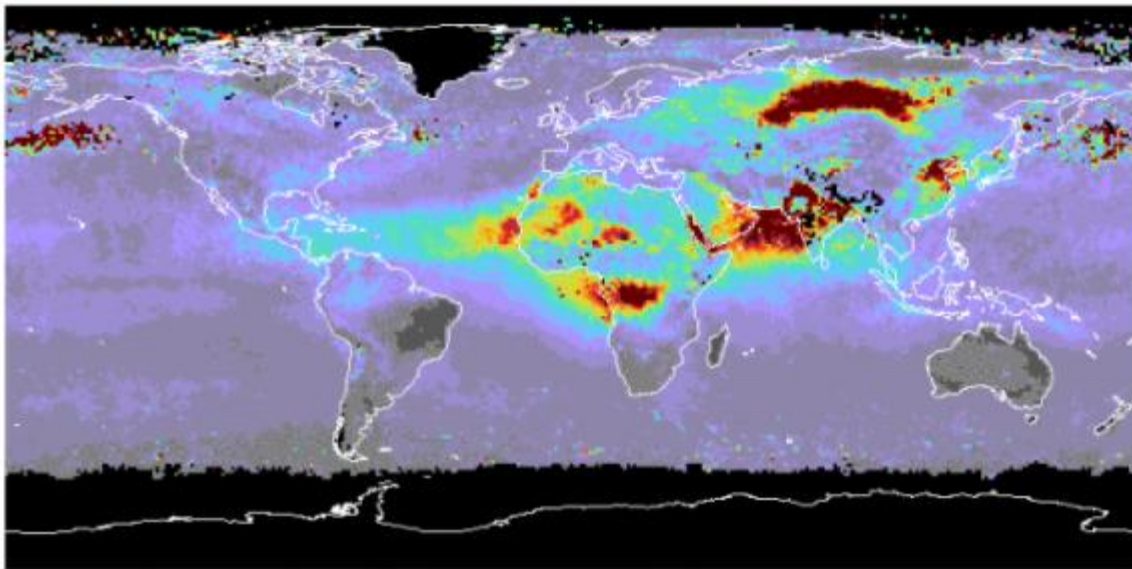
- a. What kind of orbit is the GOES-16 satellite in? (1 pt)
- b. Which band & wavelength does the satellite use to measure tropospheric temperature? (1 pt)
- c. Which band & wavelength does the satellite use to measure sea surface temperature? (1 pt)

17. Refer to images 2, 3 and 4



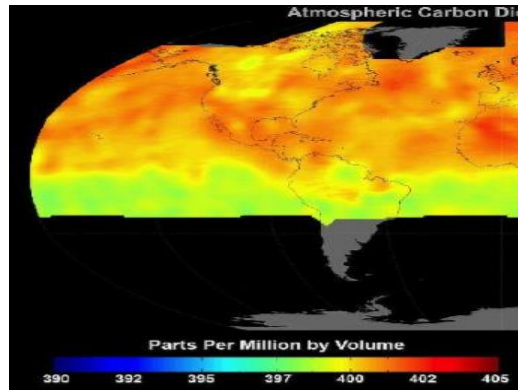
- a. What instrument is Image 2 from? (1 pt)
- b. Which satellite is the instrument part of? (1 pt)
- c. Which instrument on the same satellite is Image 3 taken by? (1 pt)
- d. Which other instrument on the same satellite is Image 4 taken by? (1 pt)

18. Refer to Image 5



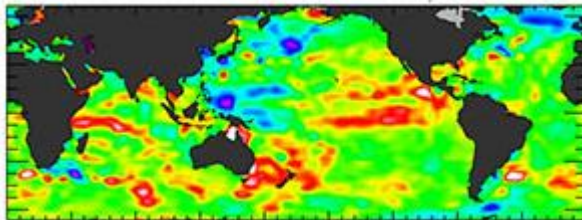
- a. Which instrument is Image 5 taken by? (1 pt)
- b. What is being measured in this image? (1 pt)
- c. What causes the dark band extending from northern Africa to the mid-Atlantic? (1 pt)

19. Refer to Image 6



- Which satellite took Image 6? (1 pt)
- What happened to the satellite mission that preceded this one? (1 pt)
- What will be built with this mission's spare parts, and where will it be located? (1 pt)

20. Refer to Image 7

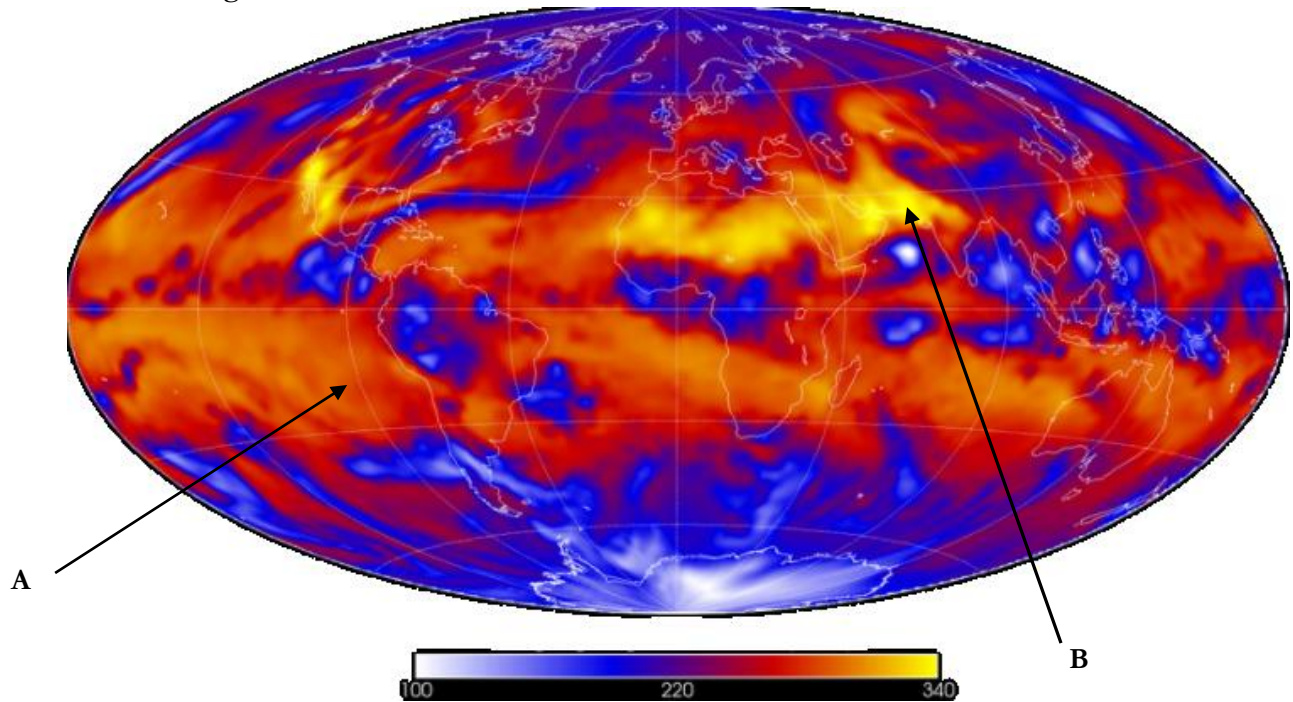


- Which satellite took Image 7? (1 pt)
- What quantity is being measured, and what technology is used to measure it? (1 pt)
- Which satellite launched in 1992 was the first to measure this quantity? (1 pt)
- Which mission will supersede this one, and which satellite will it be located on? (1 pt)

21. What does a radar device measure to determine the radial velocity of the reflector? (1 pt)

22. What unit is the strength of radar reflectance measured in? (1 pt)

23. Refer to Image 8



- What is Image 8 representing? (1 pt)
- What units are the numbers measured in? (1 pt)
- What kind of radiation is represented by letter A? (1 pt)
- What is the value of B? (1 pt)
- Why is the solar constant four times the value of B? (1 pt)
- What is the source of the radiation represented by letter C? (1 pt)

24. **What is the term for the difference between the energy absorbed by the Earth and the energy radiated back into space? (1 pt)**

25. **What is the most abundant greenhouse gas in the atmosphere? (1 pt)**