REMOTE SENSING KEY!!

This is a really ugly cover page I'm sorry.

Name _____Key_____

Score ____ / 100

Directions: You have 50 minutes to take this test. You may use a cheatsheet (2 pages), a non-graphing calculator, a ruler, and a protractor. Good luck!

Matching

Match each term to the statement that best describes it. Some terms may be used twice, and some may not be used at all. (1 pt each, 15 pts total)

a. Specular reflection
b. Spatial resolution
c. Aerosol optical depth
d. Beam attenuation
e. Radiometric resolution
f. Geostationary
g. Spectral resolution
h. Mie scattering
i. Temporal resolution
j. Diffuse reflection
k. Push broom
l. Non-selective scattering
m. Geosynchronous
n. Whisk broom
o. Semi-synchronous
p. Rayleigh scattering
q. Sun-synchronous
r. Scatterometer

1. J Incident radiation is reflected equally in all directions
2. R Nonimaging radar device that quantitatively records backscatter of terrain as a function of incidence angle
3. C A measure of the extinction of the solar beam by dust and haze
4. P Makes the sky appear blue
5. Q An orbit where a satellite passes over a section of the Earth at the same time each day
6. K Satellite system that uses linear arrays
7. O The orbit typically used by GPS satellites
8. A Incident radiation is reflected in one direction
9. I The precision of a measurement with respect to time
10. G Inversely proportional to resolving power
11. L Occurs when atmospheric particles are much larger then the incoming radiation wavelength
12. E The ability of an imaging system to discriminate very slight differences in energy
13. N Until Landsat 8, all sensors aboard the Landsat series of satellites used this type of scanner
14. B The smallest discernible detail in an image
15. P Occurs when atmospheric particles are much smaller than the incoming radiation wavelength

Acronyms

Write out the full name for each of the following acronyms. (1 pt each, 6 pts total)

16. TIROS: Television Infrared Observation Satellite

17. VISSR: Visible Infrared Spin-Scan Radiometer

18. SONAR: Sound Navigation Ranging

19. TRMM: Tropical Rainfall Measuring Mission

20. NDVI: Normalized Difference Vegetation Index

21. CALIPSO: Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation

Multiple Choice

Select the best answer choice. (2 pts each, 30 pts total)

22. What color do living plants appear as on false-colour infrared images?
    a. Green
    b. Red
    c. Black
    d. Blue

23. What do negative values of NDVI (approaching -1) indicate?
    a. Water
    b. Barren areas of rock, sand, or snow
    c. Shrub and grassland
    d. Temperate and tropical forests

24. A satellite with an orbital period of three hours has what type of orbit?
    a. Low Earth orbit
    b. Medium Earth orbit
    c. High Earth orbit
    d. Geosynchronous orbit

25. How many satellites are in the GPS system?
    a. 6
    b. 12
    c. 18
    d. 24

26. What is the order of the A-train satellites as they appear over the equator each day?
    a. GCOM-Q1, Aqua, CALIPSO, OCO-2, Aura, CloudSat
    b. OCO-2, GCOM-W1, Aqua, CloudSat, CALIPSO, Aura
    c. Aqua, OCO-2, GCOM-W1, CloudSat, Aura, CALIPSO
    d. CALIPSO, CloudSat, Aqua, Aura, GCOM-W1, OCO-2

27. What does the term “climate noise” refer to?
    a. aerosol production
    b. sounds in the atmosphere
    c. lack of predictability
    d. anthropogenic factors

28. What is the dominant scattering mechanism in the upper atmosphere?
    a. Mie scattering
    b. Nonselective scattering
    c. Rayleigh scattering
    d. Volume scattering

29. Which of the following are variants of false color?
    a. Pseudocolor
    b. Density slicing
    c. Choropleth
    d. Two of the above
    e. All of the above

30. What percentage of aerosols are anthropogenic?
    a. 5%
    b. 10%
    c. 15%
    d. 20%

31. Which science question(s) does the Aura mission seek to answer? Choose all that apply.
    a. Is the stratospheric ozone layer recovering?
    b. What are the processes controlling air quality?
    c. How is Earth's climate changing?
    d. How is the global Earth system changing?

32. What is the wavelength range for far-infrared?
    a. 1-15 µm
    b. 10-100 µm
    c. 50-500 µm
    d. 15-1000 µm

33. What was the Terra satellite originally known as?
    a. EOS AM-1
    b. EOS AM-2
    c. EOS PM-1
    d. EOS PM-2

34. Which of the following does *not* describe the greenhouse effect?
    a. It influences how much heat is retained within the Earth's atmosphere
    b. It is beneficial to life on earth and essentially sustains the planet
    c. It speeds up the escape of heat from Earth
    d. Water vapor is its main contributor

35. _____ scattering occurs in a medium when electromagnetic radiation transmits from one medium to another medium.
    a. Mie
    b. Nonselective
    c. Rayleigh
    d. Volume

36. Which of the following is ordered from lowest to highest albedo?
    a. new concrete, water, conifer forests
    b. asphalt, woodlands, grasslands
    c. snow, desert, moon
    d. deciduous trees, ocean ice, soil

Calculations

Show work and units.

37. The frequency of a light wave is 4.92 * 10^5 GHz.

    a. Calculate the wavelength of light in nanometers. What color does the light wave correspond to? (3 pts)

        +0.5 for correct conversion: $4.92 * 10^5 GHz * \frac{10^9 Hz}{GHz}$ =4.92 * 10^{14} Hz (or s^{-1})

        +0.5 for correct work shown: $\lambda = \frac{c}{\nu} = \frac{3.0*10^8 ms^{-1}}{4.92*10^{14} s^{-1}} * \frac{1\ nm}{10^{-9}\ m}$

        +1 for correct answer with units: **609.76 nm** (may be rounded)

        +1 for correct answer: **orange**

    b. Calculate the energy per photon in joules. (1 pt)

        +0.5 for correct work shown: $E = h\nu = (6.626 * 10^{-34} Js)(0.262\ Hz)$

        +0.5 for correct answer with units: **1.736 * 10^{-34} J** (may be rounded)

38. Calculate the total energy radiated by a black body per unit surface area at a temperature of 5000°C in watts. (6 pts)

    +2 for Stefan-Boltzmann law: $q = \sigma A e T^4$

    +2 for correct work shown: $q/A = (5.67 * 10^{-8}\ Wm^{-2}K^{-4})(1)(5000 + 273\ K)^4$

    +2 for correct answer with units: **43,834,306.93 W** (may be rounded)

39. Calculate the equilibrium temperature (apparent effective average temperature) of Earth in Kelvin to the nearest integer. (6 pts)

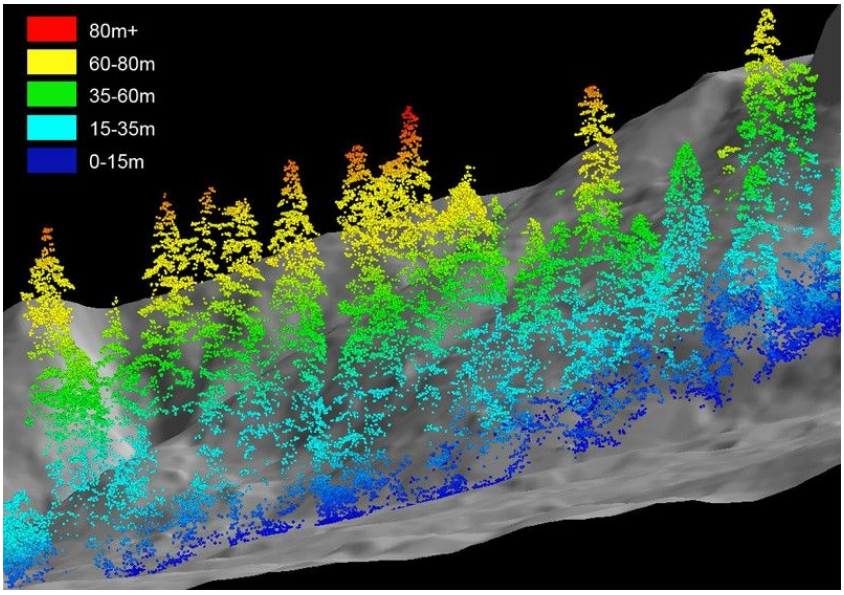
    +2 for correct equation: $T = \sqrt[4]{\frac{(1-a)S}{4\varepsilon\sigma}}$

    +2 for correct work shown: $T = \sqrt[4]{\frac{(1-0.3)(1367\ W \cdot m^{-2})}{4(0.612)(5.67*10^{-8} Wm^{-2}K^{-4})}}$

    +2 for correct answer with units: **288 K**

Image Interpretation

Use the image below to answer questions 40-43.



40. What instrument was used to make this image? (2 pts)

    LIDAR

41. What does the acronym of the instrument stand for? (1 pt)

    Light Detection and Ranging

42. What data can be collected from this image? (1 pt)

    The height of the trees

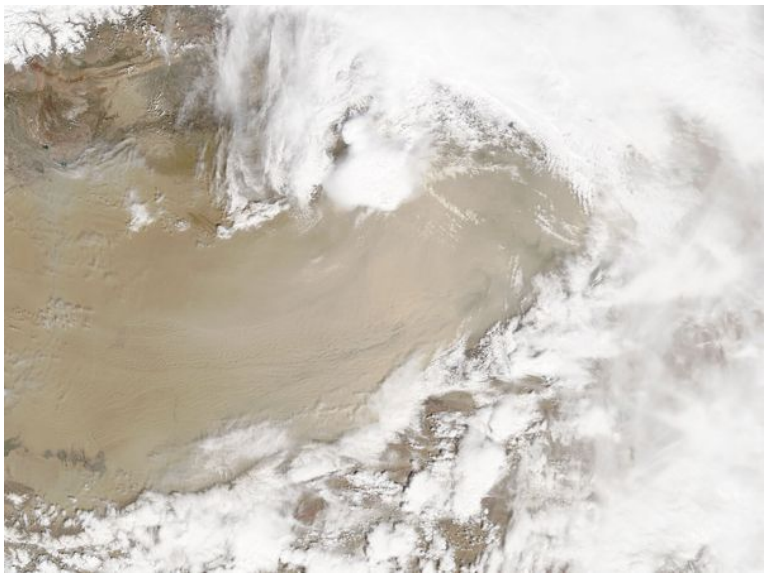
43. What does each dot in the image represent? (1 pt)

    Backscatter, “hit” and return of a laser pulse

Use the Landsat 5 image below to answer questions 44-46.

44. What is the diagonal white line at the top right of the image? (2 pts)
    Aircraft condensation trail (contrail)
45. Was Landsat 5 a low, medium, or high Earth orbit satellite? (2 pts)
    low Earth orbit satellite
46. What sensors did Landsat 5 have? (2 pts)
    Multispectral Scanner (MSS) and Thematic Mapper (TM)

Use the image below of China's Taklamakan Desert to answer questions 47-50.



47. What instrument acquired this image? Write out the full name (not just the acronym). (2 pts)
    MODIS: Moderate Resolution Imaging Spectroradiometer
48. What is happening in this image? In what season does this occur particularly often? (2 pts)
    Dust storm. Occurs particularly often in the spring.

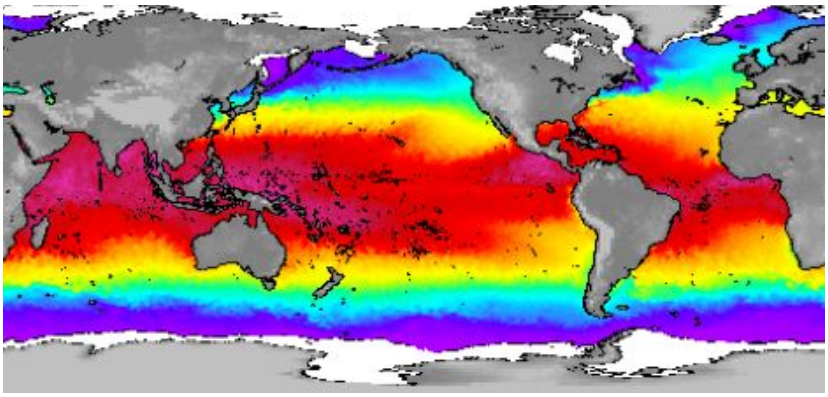
49. How does the event happening in this image (answer to question 48) affect Earth's climate? (2 pts)

    Dust storms scatter and absorb incoming solar radiation, and change the properties of clouds.

50. Prevailing low-altitude winds almost always blow from what direction? (2 pts)

    From the East

Use the image below, taken by AMSR-E, to answer questions 51-53.



51. What satellite is AMSR-E on? (1 pt)

    Aqua

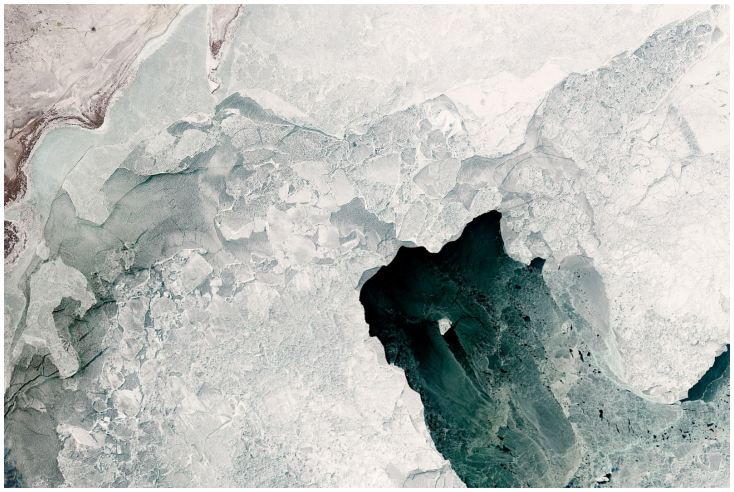
52. What does AMSR-E measure? List five things. (5 pts)

    Measures geophysical variables related to the earth's water cycle, including (list five) precipitation, oceanic water vapor, cloud water, water vapor, cloud properties, near-surface wind speed, sea surface temperature, soil moisture, radiative energy flux, surface water, snow cover, and sea ice parameters.

53. Why are its measurements important? (2 pts)

    These measurements are critical to understanding the Earth's water cycle and climate (they help determine if the water cycle is accelerating as a result of climate change).

Use the image below of the northern Caspian Sea, taken by OLI, to answer questions 54-57.



54. What does OLI stand for? (1 pt)

    Operational Land Imager

55. What type of scanner is OLI? (1 pt)

    Push broom scanner / Along-track scanner

56. What satellite does OLI fly on? (1 pt)

    Landsat 8

57. The northern areas of the Caspian Sea are more prone to freezing in wintertime. Why? (3 pts)

    In the north, temperatures are colder, and the water is fresher (less saline) and shallower. Fresh water freezes at a higher temperature than salty water, and shallower areas allow water to cool more readily throughout the water column than in the deeper parts. Thus, the northern Caspian Sea facilitates freezing more than the south.

YAY this is the end of the test yay!!!!! :D