# Boyceville Science Olympiad 2016 – Remote Sensing Solution Packet

**Total** Key / **120**

Team Name: Key Team Number: ____

Team Members: _____ & _____

**Part A: Remote sensing instrumentation and physics.**

1 (9 pts)

Type: Rayleigh Scattering : Particle size less than wavelength of light

Example:

Sky is blue

Type: Mie Scattering : Particle size about the same as wavelength of light

Example:

Fog, Milk with light passed through (Tyndall Effect)

Type: Non-Selective Scattering : Particle size greater than size of wavelength of light

Example:

Smog, large particulates

2 (4 pts)

Sensor that uses energy that is naturally available

Ex: Visible Satellite, LANDSAT

3 (4 pts)

Sensor that provides energy to use for sensing

Ex: RADAR, Laser fluorosensor, Synthetic aperture radar

4 (2 pts)

Light Detection and Ranging

5 (4 pts)

$11.0\ \mu m = 11.0 \times 10^{-6}\ m$

6 (5 pts)

$9.57\ \mu m = 9.57 \times 10^{-6}\ m$

7 (2 pts) C

**Part B: Interpretation of remote sensing images and data sets.**

8 (3 pts)
Energy flux incoming from sun
Energy input per unit area per second.

9 (3 pts)
More direct sunlight at equator
On Average closer to sun than polar regions

10 (3 pts)
LIDAR

11 (3 pts)
Height of trees

12 (3 pts)
Not precise enough data
Can't determine height from LANDSAT

13 (3pts)
Sahara Desert – Little Urbanization, little pollution

14 (3 pts)
Deforestation + Urbanization (related to deforestation)

15 (3 pts)
Heavy industrialization + urbanization

16 (3 pts)
El- Niño

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Total ____/ 120

17 (3 pts) Dramatic flooding - repair infrastructure
loss of crops
loss of economic productivity

**Part C: Climate processes and climate change. 2 Points each.**

18. C
19. A
20. B
21. B
22. A
23. A
24. C
25. A
26. E
27. B
28. D
29. C
30. B
31. A
32. D

**Part IV. Using, applying, and interpreting the output of small-scale models of planetary energy balance.**

33 (8 pts) $(1-0.3)\left(1367 \frac{W}{m^2}\right)\pi r^2 = 4\pi r^2 (0.612)\left(5.67\times10^{-8} \frac{J}{K^4 m^2 s}\right) T^4$

$$\sqrt[4]{\frac{0.7(1367)}{4\cdot 0.612(5.67\times10^{-8})}} = T = \sqrt[4]{\frac{956.9}{1.39\times10^{-7}}} = \sqrt[4]{6.894\times10^{9}} = 288K$$

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34 (8 pts)

$$(1-0.4)\left(1367\ \tfrac{W}{m^2}\right)\pi r^2 = 4\pi r^2 (0.612)\left(5.67\times10^{-8}\ \tfrac{J}{K^4 m^2 s}\right) T^4$$

$$\sqrt[4]{\frac{0.6(1367)}{4(0.612)(5.67\times10^{-8})}} = T = \sqrt[4]{\frac{820.2}{1.388\times10^{-7}}} = \sqrt[4]{5.909\times10^{9}} = 277\ K$$

35 (6 pts)

Increased Evaporation - More Clouds - More Energy Reflected Back Away from Earth

36 (8 pts)

$$(1-0.4)\left(1367\ \tfrac{W}{m^2}\right)\pi r^2 = 4\pi r^2 (0.60)\left(5.67\times10^{-8}\ \tfrac{J}{K^4 m^2 s}\right) T^4$$

$$\sqrt[4]{\frac{0.6(1367)}{4(0.6)(5.67\times10^{-8})}} = T = \sqrt[4]{\frac{820.2}{1.361\times10^{-7}}} = \sqrt[4]{6.027\times10^{9}} = 279\ K$$