YUSO 2017 Remote Sensing

Answer Key

1. active
2. passive
3. Light Detection And Ranging, laser
4. both
5. absorption
6. scattering
7. scattering
8. absorption
9. f
10. d
11. c
12. b
13. a
14. cloud temperature/height
    water vapor concentrations
    sea surface temperature
    (allow other reasonable answers)
15. Doppler
16. Satellites:
    OCO-2; 2 July 2014
    GCOM-W1; 18 May 2012
    Aqua; 4 May 2002
    CloudSat; 28 April 2006
    CALIPSO; 28 April 2006
    Aura; 15 July 2004
    PARASOL; 18 December 2004 (no longer in train)
17. Order:
    1. OCO-2 is the lead spacecraft
    2. GCOM-W1 is 11 minutes behind OCO-2
    3. Aqua is 4 minutes behind GCOM-W1
    4. CloudSat is 2 minutes and 30 seconds behind Aqua
    5. CALIPSO is no more than 15 seconds behind CloudSat
    6. Aura is 15 minutes behind Aqua
18. NASA, National Aeronautics and Space Administration, United States. CSA/ASC, Canadian Space Agency/Agence Spatiale Canadienne, Canada. CNES, Centre national d'études spatiales (National Centre for Space Studies), France. JAXA, Japanese Aerospace Exploration Agency ((excessively pedantic) bonus points for: *Kokuritsu-kenkyū-kaihatsu-hōjin Uchū Kōkū Kenkyū Kaihatsu Kikō*, lit. National Research and Development Agency on Aerospace Research and Development), Japan

19. All of its constituent satellites have an equatorial crossing time of approximately 1.30 in the afternoon; the constellation was thus nicknamed Afternoon (A) Train.
20. The A-Train satellites are in a sun-synchronous (also called heliosynchronous) orbit. A sun-synchronous orbit is a type of geocentric orbit that combines altitude and inclination in such a way that the satellite passes over any given point of the planet's surface at the same local time. More precisely, it is an orbit that precesses once a year. A satellite in a sun-synchronous orbit may be placed in constant sunlight, and the surface illumination angle will be nearly the same every time that the satellite is above a given point on the planet's surface. This constant illumination is ideal for remote sensing.
21. OCO-2 (Orbiting Carbon Observatory 2). Spectral bands: 2.06 microns, 1.61 microns, 0.765 microns. One spectral band is used for column measurements of oxygen (A-band; 0.765 microns), and two are used for column measurements of carbon dioxide (weak band; 1.61 microns, strong band; 2.06 microns). OCO-2 uses three grated spectrometers (do not accept 'spectrometer' alone as a correct answer). Its main telescope is an f/1.8 Near-IR Cassegrain.
22. CALIPSO; the instrument is the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP). The lidar provides high-resolution profiles of aerosols and clouds. Supplementary instrument: imaging infrared radiometer (IIR). The IIR is used to detect cirrus cloud emissivity and particle size.
23. Wm^{-2} (i.e. W/m^2)
24. Methane / CH_4
25. Ozone / O_3
26. Cloud cover and snow/ice cover
27. B
28.
    - Thermal IR advantages
        - Better resolution
        - Record goes farther back
        - Insensitive to surface roughness and precipitation
        - Offer surface or skin profile of SST (radiation does not travel far below ocean surface)
    - Microwave advantages
        - Microwave radiation penetrates cloud cover / insensitive to cloud cover, better coverage
        - Microwave penetrates farther below the sea surface
        - Insensitive to atmospheric effects
        - Offer bulk profile of SST (radiation travels farther below ocean surface)
29. Passive microwave
30. A or D
31. TMI, AMSR-E, AMSR2, WindSat or GMI

See LaTeX'd answer sheet for solutions to 32-34.