

## StellarXplorers Qualifying Round 2 (QR2) Quiz Study Guide

The Qualifying Round 2 (QR2) Quiz will come from Chapter 12, Sections 12.1, and Chapter 13, Sections 13.1, 13.2, 13.3, 13.4, and 13.5 in the *Understanding Space* textbook. The correct answers will be based on information found in the textbook.

### Chapter 12

#### Section 12.1

1. Know the various frequency and wavelength bands for the Electromagnetic (EM) radiation spectrum.
2. Know how the wavelength and frequency are related for Electromagnetic (EM) radiation.
3. Know how the energy in Electromagnetic (EM) radiation related to frequency.
4. Know the definition of an atmospheric window and know the most notable atmospheric windows.
5. Know how Electromagnetic (EM) radiation allows humans to see colors, such as grass appearing green.
6. Know how the total energy output of radiation is related to temperature using the Stephan-Boltzmann equation.
7. Know the definitions of Field-of-Regard (FOR) and Field-of-View (FOV).
8. Know how cameras and telescopes collect light energy.
9. Know how a radio frequency antenna collects Electromagnetic (EM) energy.
10. Know the definition of angular resolution ( $\Theta$ ) and how it is related to wavelength and lens aperture.
11. Know the common uses for the following technologies: Charge-Couple Device (CCD) and Complementary Metal-Oxide Semiconductor (CMOS).

### Chapter 13

#### Section 13.1

12. Know the technical requirements which constrain on the range of frequencies we use on certain missions, such as transmitting signals from a spacecraft to the ground.
13. Know the definitions of Antenna Gain (G) and Effective Isotropic Radiated Power (EIRP).
14. Know the ways to increase the Signal-to-Noise Ratio (S/N).
15. Know the definitions of a transducer and a data bus.
16. Know how the amount of software code has grown when the Mariner-6 spacecraft was launched in 1969 through the Mars Science Lab, Curiosity 40 years later.
17. Know how the Nyquist Criterion is used to represent an analog signal as a digital value.
18. Know the definition of data budget.

#### Section 13.2

19. Know the definitions of voltage, current, charge, and electrical potential.
20. Know typical values of Solar Cell Efficiency,  $\eta$ , for different types of solar cells.
21. Know the definition of Depth-of-discharge (DOD) and how it varies with the altitude of the spacecraft's orbit.
22. Know the advantages and disadvantages of using fuel cells to generate electrical power.

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### **Section 13.3**

23. Know the definition of albedo.
24. Know the most effective long-term method for ejecting heat.
25. Know how different types of passive and active thermal control systems, such as flash evaporators, Multi-Layer Insulation (MLI), and heat pipes, are used for thermal control on spacecraft.

### **Section 13.4**

26. Know the procedures astronauts use to prevent potential decompression problems during Extravehicular Activity (EVA or spacewalk).
27. Know the water requirements for astronauts.
28. Know the Habitable Volume Limits per crew member based on mission duration.
29. Know the approximate amount of water NASA's Water Recovery System (WRS) recycles.

### **Section 13.5**

30. Know the definition of dry mass and typically values for a spacecraft structure.
31. Know the definitions of stress, strain, and shear.
32. Know the definitions of Proportional Limit, Yield Point, Ultimate Tensile Strength, and Failure Point.
33. Know the purpose of different types of models, such as Proto-Flight Model, Qualification Model, and Flight Model.