

# **StellarXplorers V Semifinal Round (Semi) Quiz Study Guide**

For Semifinal Round (Semi), the Quiz will come from all previous sections in the Understanding Space textbook but from the topics listed below. This Round will be timed but we highly recommend teams find the answers to the Study Guide questions prior to taking the Quiz.

## **Chapter 1**

### **Section 1.1**

1. Know the mission(s) of the following spacecraft: Pioneer, Mariner, Viking, and Magellan.

### **Section 1.2**

2. Know the definitions of Systems Engineering and Project Management.

## **Chapter 2**

### **Chapter 2 Introduction**

3. Be able to use the Timeline in Section 2 Introduction to determine when key events related to space occurred.

### **Section 2.1**

4. Know the key contributions of the Renaissance astronomers Nicholas Copernicus, Tycho Brahe, and Johannes Kepler.

### **Section 2.2**

5. Know the missions of the following early American Vanguard and Redstone rockets and the communications satellites Echo I and Telstar.

## **Chapter 3**

### **Section 3.1**

6. Know where different organizations define the beginning of space, in both kilometers and miles.

### **Section 3.2**

7. Describe the effects on spacecraft to the following hazards in the space environment: Gravity, Atmosphere, Vacuum, Micrometeorites and Debris, Charged Particles, and Electromagnetic Radiation.

## **Chapter 4**

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### Section 4.1

1. Know the speed needed for an object to match Earth's curvature.

### Section 4.2

2. Know how to calculate linear momentum and how to compare the linear momentum of two objects.

### Section 4.3

3. Know how the Total Mechanical Energy, Kinetic Energy, and Potential Energy of a person changes when a person is riding on a playground swing.

## Chapter 5

### Section 5.1

4. Know how each of the following six Classical Orbital Elements (COE) describe an orbit and a spacecraft's location within the orbit:
  - a. Semi-major Axis,  $a$
  - b. Eccentricity,  $e$
  - c. Inclination,  $i$
  - d. Right Ascension of the Ascending Node (RAAN),  $\Omega$
  - e. Argument of Perigee,  $\epsilon$
  - f. True Anomaly,  $\nu$
5. Know the relationship between an orbit's shape and its eccentricity.
6. Know the characteristics of the following types of orbits:
  - a. Geostationary
  - b. Geosynchronous
  - c. Semi-synchronous
  - d. Sun-synchronous
  - e. Molniya

### Section 5.3

7. Know the relationship between the inclination of an orbit and its ground track.

## Chapter 12

### Section 12.1

1. Know the various frequency and wavelength bands for the Electromagnetic (EM) radiation spectrum.

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## Chapter 13

### Section 13.1

2. Know the ways to increase the Signal-to-Noise Ratio (S/N).

### Section 13.2

3. Know typical values of Solar Cell Efficiency,  $\eta$ , for different types of solar cells.

### Section 13.3

4. 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

5. Know the Habitable Volume Limits per crew member based on mission duration.

### Section 13.5

6. Know the definitions of Proportional Limit, Yield Point, Ultimate Tensile Strength, and Failure Point.

## Chapter 9

### Section 9.1

1. Know the definitions of solar day and sidereal day and how they compare to each other.

### Section 9.2

2. Understand how the orbit inclination determines the number of launch windows per day from a specified launch site.

### Section 9.3

3. Know the definitions of the following velocities: Burnout Velocity ( $V_{bo}$ ), Design Velocity ( $\Delta V_{design}$ ), Velocity Needed ( $\Delta V_{needed}$ ), and Velocity Launch Site ( $V_{launch\ site}$ ).

## Chapter 14

### Section 14.1

4. For electrostatic rockets, know which parameters result in a higher thrust and which parameters result in higher specific impulse.

### Section 14.2

5. Know how the Hall Effect Thruster and Pulsed Plasma Thruster work.

### Section 14.3

6. Know the advantages and disadvantages of staging on launch vehicles.