



## QUIZ STUDY GUIDE

### StellarXplorers Semifinal Round (SEMI)

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

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

##### Section 1.2

- Know the definitions of Systems Engineering and Project Management.

#### CHAPTER 2

##### Introduction

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

##### Section 2.1

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

##### Section 2.2

- 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

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

##### Section 3.2

- 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

##### Section 4.1

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

## Section 4.2

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

## Section 4.3

- 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

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

### Section 5.3

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

## CHAPTER 9

### Section 9.1

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

### Section 9.2

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

### Section 9.3

- 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 12

### Section 12.1

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

## CHAPTER 13

### Section 13.1

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

### Section 13.2

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

### Section 13.3

- 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

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

### Section 13.5

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

## CHAPTER 14

### Section 14.1

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

### Section 14.2

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

### Section 14.3

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