



QUIZ STUDY GUIDE

StellarXplorers Qualifying Round 3 (QR3)

The Quarterfinals/Prestige Round Quiz will come from Chapter 9, Sections 9.1 – 9.3, and Chapter 14, Sections 14.1 – 14.3, in the Understanding Space textbook. The correct answers will be based on information found in the textbook.

CHAPTER 9

Section 9.1

- Know the definitions of solar day and sidereal day and how they compare to each other.
- Know the definitions of Local Solar Time, Local Sidereal Time, and Greenwich Mean Time.

Section 9.2

- Understand how the orbit inclination determines the number of launch windows per day from a specified launch site.
- The Launch Window Sidereal Time (LWST) is a function of two angles. Know which angles and their definitions.

Section 9.3

- Be able to explain what occurs in each of the four distinct phases from the launch pad to orbit: Vertical Ascent, Pitch Over, Gravity Turn, and Vacuum Phase.
- The Earth's rotation provides a launch site with a tangential velocity in the eastward direction. Understand the benefits of launching from a site near the Equator, such as Kourou (50 N latitude) compared to launching from Kennedy Space Center (280 N latitude).
- Know the definitions of the following velocities: Burnout Velocity (V_{bo}), Design Velocity (ΔV_{design}), Velocity Needed (ΔV_{needed}), and Velocity Launch Site ($V_{launch\ site}$).

CHAPTER 14

Section 14.1

- Know the definitions of the following terms: mass flow rate, effective exhaust velocity, impulse, total impulse, specific impulse.
- Be able to define the terms of the thrust equation: $F = m\dot{C}$
- Be able to identify the Ideal Rocket Equation.
- Know the definitions of the following properties of a perfect gas: Adiabatic Flow, Reversible Flow, Frozen Flow, and Steady Flow.
- Know the conditions for the following nozzle expansion: Under-expansion, Ideal-expansion, Over-expansion.
- For electrostatic rockets, know which parameters result in a higher thrust and which parameters result in higher specific impulse

Section 14.2

- Know the advantages and disadvantages of a pressure-fed propellant delivery system compared to a pump-fed propellant delivery system.

- Know how pressure transducers, pressure-relief valves, and check valves work in a pumped propellant delivery system.
- Know examples of hypergolic propellants.
- Know the advantages and disadvantages of Monopropellant and Bipropellant Rockets.
- Be able to explain the thrust curves for different types of solid propellant grain designs and know which type was used on the Space Shuttle.
- Be able to identify typical propellants for Solid Rockets.
- Be able to compare the relative specific impulse and thrust of the following rocket types: resistojet, arcjet, electro-thermal, and nuclear thermal.
- Explain how the following types of electrodynamic rockets produce thrust: Electrostatic Rocket and Electromagnetic Rocket.
- Know how the Hall Effect Thruster and Pulsed Plasma Thruster work.
- Explain how a tether can be used to increase a payload's apogee altitude.

Section 14.3

- During launch, first stage rockets go from sea level to a near vacuum in a few minutes. Know how typical nozzles are designed to achieve ideal expansion during this phase.
- Know what percentage of a typical launch vehicle's liftoff mass propellant is.
- Know the advantages and disadvantages of staging on launch vehicles.