

**Review Sheet**  
**Exam 3**  
**Life in the Universe**

Chapter 8: Mars

- Lowell's canals and Martian Cities (Fig 8.2)
- Mars size, temperature, atmosphere, distance to sun (in AU) (Tab 8.1)
- Viking 1 and Pathfinder Missions (Figs 8.4, 8.5)
- Reasons for Seasons on Earth (Fig 8.6)
- Seasons on Mars (brief/long, hot/frigid/mild). Be able to explain them.
- Permafrost water on Mars, Sublimation of polar caps (cycle)
- Major Geological Eras (Fig 8.2, tab 8.2)
- Evidence that Mars had running water and substantial atmosphere (pp 272-276)
- How Martian atmosphere disappeared (pp 277-278)
- Basic finding of Viking Like experiments; not details of each (p 281, Fig 2.77)
- ALH84001 (Sec 8.5)

Chapter 9: Life on the Jovian Moons

- Basic Characteristics/Properties of Io, Europe, Ganymede, Callisto, and Titan
- Synchronous Rotation (Fig 9.6)
- Tidal Forces, Tidal Effects, Tidal Heating (Figs 9.7, 9.8, pp 302-303)
- Resonance Orbits of Jovian Moons (Fig 9.11)
- Combined significance of Resonance Orbits + Tidal Heating for sustaining life
- Io's interesting properties (Fig 9.9); The Io Torus, Jupiter's Aurorae (Notes)
- Where would life be, if it could be, on Europa, Ganymede, Callisto, or Titan
- Evidence for oceans on Europa, Ganymede, and Callisto

Chapter 10: The Nature and Evolution of Habitability

- Habitable Zone (surface water), inner/out boundaries (pp342-343, Fig 10;-4)
- Summary of Habitability Factors (p 341)
- Continuous Habitable Zone (CHZ)
- Role of planet distance, role of planet mass/size
- Evolution of Sun's Habitable Zone (Fig 10.5) factors
- History/Future of Earth within the Habitable Zone