

Test 1 Study Guide

For each of the equations below, you should know what all the letters in the formula mean, and how to apply it:

Gravity and orbits: $P^2 = a^3$ $(M + m)P^2 = a^3$ $F = \frac{GMm}{r^2}$

Light waves: $\frac{v_r}{c} = \frac{\lambda_1 - \lambda_0}{\lambda_0}$ $c = \lambda f$ $c = 3 \times 10^8$ m/s $E = hf$

Hot Stuff: $P = knT$ $\lambda_{\text{Peak}}T = 2900 \text{ K} \cdot \mu\text{m}$

Some other things to know:

Motions of the Heavens

- How the stars, etc., move over the course of a night, and what is causing this motion
- The cycles of the Sun, and how it changes over the course of the day and year
- The meaning of the ecliptic
- The cycles of the Moon, and how it changes over the course of about a month
- What we can learn about the Earth, Moon, and Sun from eclipses and the phases of the Moon
- How the planets move compared to the stars, and compared to the Sun and ecliptic

Early Astronomers

- Copernicus: How did he explain the motions of the planets
- Tycho Brahe: How his careful observations were used (by whom?)
- Kepler: His three laws of planetary motion
- Galileo: What important telescopic observations he made, and how it informed our picture of the universe
- Newton: His three laws, the law of universal gravitation, and his other contributions
- Newton: How he modified the laws of motion given by Kepler

Gravity

- How orbits work (qualitatively)
- Shapes of different orbits, and their relationship to escape velocity
- How the interplay of gravity, rotation, and pressure determines the shapes of objects
- Precession
- Why tidal forces exist, and where a single source (such as the Moon) causes tides on the Earth
- How the Sun and Moon cooperate to cause small and large tides
- How the Earth and Moon's tidal forces cause changes over time
- Tidal heating and the Roche limit

Physics Stuff

- Energy – some of the important types for astronomy
- The four forces of nature
- Electromagnetic waves: as wavelength increases, frequency and energy of a photon goes down
- EM waves: Types from longest to shortest wavelength
- Visible EM waves: Colors from longest to shortest wavelength
- Doppler shift; red and blue shift
- Atoms, the Bohr model
- Why each element has a distinct set of wavelengths for emitting/absorbing light

Hot stuff

- The Kelvin scale – room temperature is around 300 K, absolute zero
- Black body radiation

Telescopes

- A telescope can be as simple as two lenses
 - Mirrors can be substituted for lenses
- Which two types of astronomy can be done from the surface of the Earth
 - Others are done from space
- The idea behind adaptive optics