

# **ANCIENT ASTRONOMY STUDY GUIDE**

- This is a collaborative study guide. Select your section/name from the table of contents below, then edit your section of the text. No other classes can see your's and vice versa. This is how your entire class will study, and don't think they will not be mad if you:  
a) a super slacker and don't do it or  
b) are lazy and seriously skimp on your answer
- Bullet points and succinct sentences will make this much easier to follow.
- Remember I can see ALL revision history!!!!
- you can click directly on table of contents item to take you to appropriate place in the doc

## Roots of Modern Astronomy

[Archaeoastronomy \(Manny\)](#)

[Astronomy of Greece \(Manny\)](#)

[Aristotle and the Nature of Earth \(Manny\)](#)

[Ptolomaic Universe \(Erika\)](#)

[- Ptolemy thought the universe was geocentric \(meaning with the earth in the center\) and based on uniform circular motion.](#)

[- Beyond the orbits was a sphere of stars in fixed positions.](#)

[-Ptolemy believed that the sun, moon, planets and stars all revolved around the earth.](#)

## Copernican Revolution

[Ancient Universe-p 64-65 \(Erika\)](#)

[-For 2000 years, astronomers believed the heavens were perfect and all motion of the heavens moved at uniform rates. this idea was called "uniform circular motion".](#)

[-Earth was the only imperfect thing](#)

[-the universe was geocentric \(with earth at the center\)](#)

[Copernicus the Revolutionary \(Mikayla\)](#)

[The Copernican Model \(Mikayla\)](#)

[Galileo the Defender \(Tommy\)](#)

[The Trial of Galileo \(Tommy\)](#)

## The Puzzle of Planetary Motion

[Tycho the Observer \(jordan\)](#)

[Tycho Brahe's Legacy \(jordan\)](#)

[Kepler the Analyst \(shon\)](#)

[Kepler's 3 laws of motion \(shon\)](#)

[Modern Astronomy \(brief\) \(Tommy\)](#)

[Galileo and Newton \(John\)](#)

[galileo and motion \(John\)](#)

[Newton and laws of motion \(Shane\)](#)

[Mutual gravitation \(Shane\)](#)

[orbits \(Miriam\)](#)

[orbital velocity \(Miriam\)](#)

[calculating escape velocity \(Allana\)](#)  
[kepler's laws re-examined \(Allana\)](#)  
[orbiting Earth \(p94-p95\) \(Stevie\)](#)  
[Newton's version of Kepler's 3rd law \(Stevie\)](#)  
[tides and tidal forces \(Carina\)](#)  
[astronomy after Newton \(Carina\)](#)

## Roots of Modern Astronomy

### Archaeoastronomy (Manny)

- During the Stone and Bronze ages people discovered the cyclic motions of the stars in the sky
- 3000-1800 B.C. Stonehenge was constructed; thought to be used as a calendar
  - Aligns with the with sunset, sunrise, moonset, and moonrise
- Chaco Canyon: Sun Dagger aligns with the winter and summer solstices as well as the equinoxes
- Ivory Mammoth Tusk: 32,500 years old, found in Germany, and has a carving the resembles the constellation Orion

### Astronomy of Greece (Manny)

- Ancient Greece philosophy had the first preserved written documents of ancient astronomy
- Greeks were the first to study the motions of the sky in terms of mathematical models
- they came up with the idea of a geocentric universe (everything revolves around Earth)
- they assumed Earth was stationary because they were able to observe the parallaxes in the sky

### Aristotle and the Nature of Earth (Manny)

- Aristotle was the main authority of ancient Greek philosophy until the middle ages
- the Universe consists of 2 parts:
  - imperfect changeable Earth ( Geocentric Universe)
  - Perfect Heavens which can be described by spheres
- He expanded Eudoxus' model of 27 nested spheres to 55 spheres

### Ptolomaic Universe (Erika)

- Ptolemy thought the universe was geocentric (meaning with the earth in the

center) and based on uniform circular motion.

- Beyond the orbits was a sphere of stars in fixed positions.

- Ptolemy believed that the sun, moon, planets and stars all revolved around the earth.

- planets moved in epicycles (circular path a planet travels along)

## copernican Revolution

### Ancient Universe-p 64-65 (Erika)

- For 2000 years, astronomers believed the heavens were perfect and all motion of the heavens moved at uniform rates. this idea was called "uniform circular motion".

- Earth was the only imperfect thing

- the universe was geocentric (with earth at the center)

- Astronomers believed earth did not move because they saw no parallax (apparent motion of something because of point of view)

- Ptolemy suggested planets moved in epicycles (a planet rotation) that followed along the path of a bigger different ( path surrounding earth that planets followed)

### Copernicus the Revolutionary (Mikayla)

- Nicholas Copernicus (1473-1543)

- Made a heliocentric model of the universe

- Heliocentric means the sun is at the center instead of the earth(geocentric)

- Copernicus was apart of the church

- His findings went against the church, so he did not want them published because he could be charged with heresy

- After his death, his manuscript, *De Revolutionibus*, was published

### The Copernican Model (Mikayla)

- The Copernican model was the arrangement of and motion of the planets that

Copernicus devised to explain the motions in the sky

- Although his model won acceptance, it was flawed

- He put the sun at the middle of the universe

- In the Copernican system , Earth moves faster in it orbit than planets further away from the sun

- The Copernican model was inaccurate, but the Copernican hypothesis that the universe is heliocentric is correct

- Copernicus made Earth move in a path around the sun like the other planets, making

Earth a planet

- Europe did not accept the Copernican hypothesis because it was not a geocentric universe

### **Galileo the Defender (Tommy)**

- Galileo was born in 1564 and died in 1642
- He was a professor of mathematics for 18 years
- In 1609, he built a telescope and used it to see into space
- He discovered
  - ~The moon is imperfect
  - ~Jupiter's moons orbit Jupiter and orbit at different speeds
  - ~The sun has sunspots and also is imperfect
  - ~The phases of Venus which is evidence that it orbits the sun.
- Wrote his defense of the Copernican model in 1629

### **The Trial of Galileo (Tommy)**

- Questioning the Ptolemaic Universe, the pope put Galileo on trial
- The center of the trial was Galileo's defiance of his orders to stop pursuing astronomy
- The Inquisition condemned him for disobeying these orders
- The trial was significant because it was a conflict between two ways of thinking
- Since Galileo, scientists started to rely more on observation than on the bible to describe the physical world

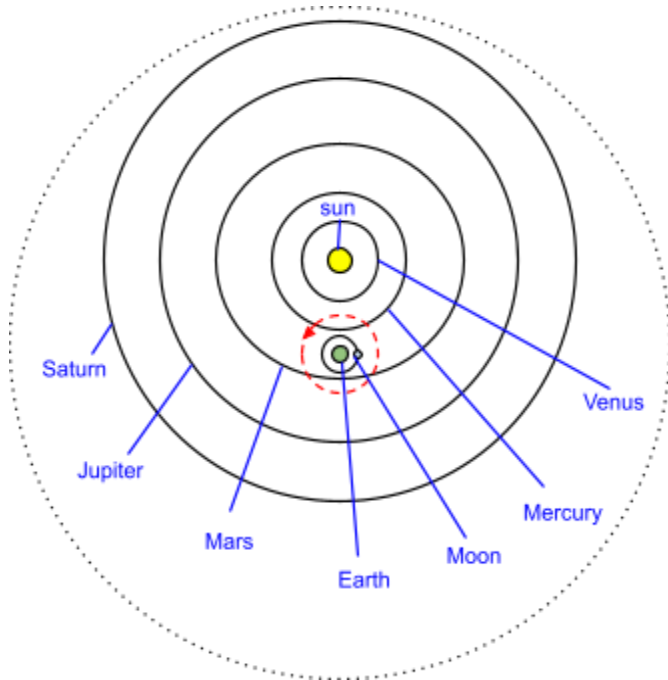
## **The Puzzle of Planetary Motion**

### **Tycho the Observer (jordan)**

- (1546) Born into a noble family.
- Expected to enter Danish politics, but showed interest in astronomy and mathematics.
- Wore a false nose made of gold and silver as a result of a duel.
- (1563) 1st astronomical observation: Jupiter and Saturn passing near each other, nearly converging onto a single point in the sky.
- (1572) Observations on a "new star" (Tycho's supernova), suggested a contradiction to Aristotle's theory of perfect and unchanging heavens.
- (1573) Published his discovery in "De Stella Nova", making Tycho famous among European astronomers.
- Offered funds, by King Frederik II, to build an observatory on the island of Hveen.
- Hveen later became an international center of astronomical study.

### **Tycho Brahe's Legacy (jordan)**

- Concluded Earth to be stationary, and created a new model in which Earth is placed in the center.



- Used measurements of angles to find the position of sun, moon, stars, and planets.
- (1596) Tycho left for Prague and became an imperial mathematician.
- New goal to revise *The Alfonsine Tables*, with his own Tychonic system, and rename it *The Rudolphine Tables*.
- (1601) Died in November, leaving his apprentice Kepler with his research material with the wish of finishing *The Rudolphine Tables*.

### Kepler the Analyst (shon)

- Kepler lived during 1571-1630.
- He was a German mathematician, astronomer and astrologer.
- He is best known for his eponymous laws of planetary motion.
- During his career, Kepler was a mathematics teacher at a seminary school. Later he became an assistant to Tycho Brahe.
- Additionally, he did fundamental work in the field of optics, invented and improved version of the refracting telescope.

### Kepler's 3 laws of motion (shon)

1. The path of the planets about the sun is elliptical in shape, with the center of the sun being located at one focus. (The Law of Ellipses)
2. An imaginary line drawn from the center of the sun to the center of the planet will sweep out equal areas in equal intervals of time. (The Law of Equal Areas)
3. The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distances from the sun. (The Law of Harmonies)

## Modern Astronomy (brief) (Tommy)

- The origin of modern astronomy was between the deaths of Copernicus and Galileo (1543-1642)
- It was the transition from the Ptolemaic model to the Copernican model
- These years lie at the foundation of the reawakening of learning in all fields
- Marked the beginning of the scientific method
- The first time math was used to explain science as a whole

## Galileo and Newton (John)

### galileo and motion (John)

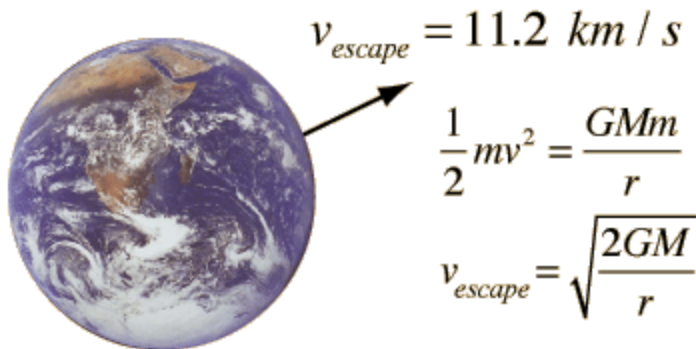
### Newton and laws of motion (Shane)

### Mutual gravitation (Shane)

### orbits (Miriam)

### orbital velocity (Miriam)

### calculating escape velocity (Allana)



- Speed at which the kinetic energy plus the gravitational potential of an object is zero
- The speed needed to break free from the gravitational pull of a massive body
- G is the gravitational constant ( $6.67 \times 10^{-11}$ )

## kepler's laws re-oexamined (Allana)

## orbiting Earth (p94-p95) (Stevie)

-

## Newton's version of Kepler's 3rd law (Stevie)

-Kepler's 3rd law is the relationship between the distance of a planet from the sun and the time it takes to orbit the sun.

-Newton created a formula to supplement all this information, and one that implemented the theory of gravity.

-Newton's formula is  $M_{\text{sub}1} + M_{\text{sub}2} = A^3 / P^2$

## Tides and tidal forces (Carina)

- Moon's gravity can explain the ocean tides
- Tides are caused by small differences in gravitational forces
- Ocean tides are caused by the accelerations Earth and the oceans feel as they move around their common center of mass
- Earth flexes, and the mountains and plains rise and fall by a few centimeters in response to the moon's gravitational acceleration
- Gravity is universal, so the sun, too, produces tides on the Earth
- Spring Tide- a tide just after a new or full moon, when there is the greatest difference between high and low water
- Neap Tide- a tide just after the first or third quarters of the moon when there is the least difference between high and low water

## Astronomy after Newton (Carina)

- Tidal forces can also affect orbital forces
- Principia changed astronomy and ushered in a new age
- Newton's law of motion and gravity made it possible for astronomers to calculate the orbits of planets and moons
- Particles move according to three rules of motion and attract each other with a force called gravity