

# Astr 3010 History of Astronomy

## Samples for Exam 2

### Chapter 6

#### Multiple Choice Questions

1. The first publication of *Philosophiae Naturalis Principia Mathematica* was in
  - a) 1684.
  - b) 1690.
  - c) 1687.
  - d) 1677.
  
2. In his *Principia* Newton
  - a) derived Kepler's three laws of planetary motion.
  - b) derived the oblateness of rotating spherical bodies.
  - c) developed three laws of mechanical motion.
  - d) developed the beginnings of what is now called fluid dynamics...the study of the forces acting on fluids in motion.
  - e) All of the above.
  
3. Sections of *Principia* are overly complicated with mathematics because
  - a) Newton could not derive the principles involved without complex mathematics.
  - b) Newton wanted the level to be well beyond anything that Robert Hooke could understand.
  - c) Newton had not yet invented calculus so the mathematics had to be tedious and complex.
  - d) Newton did not consider the mathematics complex and couldn't understand why anyone would not be able to understand it.
  
4. The Greshamites were
  - a) a group of 17<sup>th</sup> century intellectuals who gathered at Gresham College.
  - b) former professors and students from Cambridge and Oxford who gathered at Gresham College.
  - c) mostly noblemen who dabbled in science as a hobby.
  - d) a group of radical anti-royalist who plotted to overthrow the English king in the mid 1600's.
  
5. The Royal Society was formed by
  - a) the Greshamites in November 1660.
  - b) the king of England in November 1660.
  - c) faculty at Cambridge University in November 1660.
  - d) faculty and students at Oxford University in November 1660.

6. Robert Hooke was
- a) the first Curator of Experiments for the Royal Society.
  - b) known as the Leonardo of London for his work in rebuilding London after the great fire of 1666.
  - c) a contemporary of Isaac Newton whom Newton held a long running grudge against.
  - d) the individual most credited with developing an understanding of the motion of a pendulum.
  - e) All of the above.
7. In his *Attempt to prove the Motion of the Earth*, Robert Hooke
- a) had three suppositions which outlined the basic nature of orbital motion and the force that propelled objects in orbits.
  - b) described gravity as an inverse square law.
  - c) showed that the force holding the Moon in orbit around Earth was the magnetic force.
  - d) proved that the Earth moved through his measurements of the aberration of light.
8. The go-between who was an acquaintance of both Hooke and Newton was
- a) Edmund Halley
  - b) Christopher Wren
  - c) John Wilkins
  - d) Christiaan Huygens
9. The position of "Astronomer Royal" is
- a) the personal astronomer to the king (or queen) of England.
  - b) the president of the Royal Society.
  - c) the director of the Greenwich Observatory.
  - d) the person chosen each year by the members of the Royal Society as the greatest astronomer in England.
  - e) None of the above, such a position doesn't exist.
10. The first person to use Newton's laws to calculate the orbit of a comet was
- a) Christiaan Huygens.
  - b) William Herschel.
  - c) Edmund Halley.
  - d) Robert Hooke.
11. In 1761 several groups of astronomers set out to a variety of locations around the world to observe
- a) a transit of Mercury across the sun.
  - b) a transit of Venus across the sun.
  - c) a total solar eclipse.
  - d) an occultation of Saturn by Jupiter.

12. The development of an accurate method of determining your longitude at sea was finally solved by

- a) the use of accurate observations of the moons of Jupiter followed by somewhat tedious calculations.
- b) the use of accurate observations on the position of the moon followed by referring to tables of previously calculated numbers.
- c) the use of a clock that could keep time accurately despite the rolling and pitching of the ship.
- d) the use of a string of ships stations every few dozen miles across the Atlantic firing off flares at midnight.

13. The transits of Venus in the 18<sup>th</sup> century provided solar parallax measurements that agreed to within

- a) a few minutes of arc.
- b) a few seconds of arc.
- c) a few tenths of a second of arc.
- d) a few degrees of arc.

14. The first experimental proof of the yearly motions of the planet Earth were found by

- a) observations of the change in solar parallax during the Venus transits of the 18<sup>th</sup> century.
- b) observations of variations in the change in declination of stars over the course of a year.
- c) observations of the change in parallax of Uranus over the course of the year.
- d) observations of the proper motion of a number of stars.

15. The use of mirrors in telescope did not see widespread use until

- a) 1757 when John Dollond developed a method of making better mirrors.
- b) 1720 when James Short developed a technique of grinding concave mirrors cheaply, efficiently and in a regular way.
- c) 1772 when Jesse Ramsden developed a method of silver plating glass mirror blanks.
- d) 1672 when Isaac Newton invented what is now called the Newtonian reflecting telescope.

16. Many of the most famous mathematicians of the 18<sup>th</sup> century developed their mathematical techniques

- a) while trying to solve the problem of the orbits of comets.
- b) while trying to solve the problem of the gravitational force due to a large, extended spherical mass.
- c) while trying to solve the “three-body” problem as applied to the orbits of the planets.
- d) while trying to solve the problem of the orbit of Uranus.

17. The asteroid Ceres was discovered by
- Piazzi in 1801.
  - Otto Struve in 1810.
  - William Herschel in 1789.
  - Wilhelm Olbers in 1797.
  - None of the above, Ceres has been known since ancient times.
18. The name given to the seventh planet from the Sun by its discoverer was
- Uranus.
  - Neptune.
  - Georgium Sidus.
  - Pluto.
19. Urbain Leverrier is credited with
- discovering the planet Uranus
  - being the first to observe the planet Neptune.
  - predicting the orbit of the planet Neptune based on perturbations of the orbit of Uranus.
  - predicting the orbit of Pluto based on perturbations of the orbit of Neptune.
20. The discrepancy between the observed precession of the perihelion of the orbit of Mercury and the calculated value is a mere
- 43° per century.
  - 43" per century.
  - 43' per century.
  - 43' per year.
  - None of the above, the perihelion of the orbit of Mercury does not precess.

## Essay Questions

- Describe as much of the contents of Newton's *Principia* as you can. What important laws were developed in the book? How were the laws derived and proven?
- Describe the process, through several drafts, of the writing of Newton's *Principia*. Who were the individuals that spurred Newton on in the writing and how did they contribute to the content?
- Discuss the formation of the Royal Society. Who were the individuals involved in its formation and what were some of their scientific contributions?
- Describe the 17<sup>th</sup> and 18<sup>th</sup> century hunt for missing planets. What objects were found and what was not found in the hunt? Who were the individuals involved in the hunt?
- Describe the 17<sup>th</sup> and 18<sup>th</sup> century attempts to solve the problem of determining the longitude at sea. What were some of the techniques proposed to solve the problem? Who finally came up with a workable solution and what was his solution? What nation was most vigorously encouraging the pursuit of a solution and how did they encourage it?
- Describe some of the efforts of astronomers and mathematicians to solve the three-body problem. What does the "three-body" problem refer to and how is it related to the solar system. What physical quantities were they trying to determine?

## Chapter 7

### Multiple Choice Questions

1. The supernova of 1572 was observed by
  - a) Johannes Kepler.
  - b) Tycho Brahe.
  - c) Galileo Galilei.
  - d) Nicolaus Copernicus.
  
2. The supernova of 1604 has astrological significance because
  - a) it was first observed during a lunar eclipse.
  - b) it occurred at the time of a conjunction between Jupiter, Saturn and Mars.
  - c) it occurred at the same time that a major comet was visible in the sky.
  - d) it occurred at the time of a conjunction between Venus, Mercury and the Sun.
  
3. Despite being observed as a “nova” by several astronomers, the first to recognize that Mira was a variable star and provide an explanation was
  - a) David Fabricius.
  - b) Johannes Holwarda.
  - c) Johannes Hevelius
  - d) Ismael Boulliau.
  
4. John Goodricke and Edward Pigott **did not** make observations of which variable star?
  - a) Algol
  - b) Delta Cephei
  - c) Eta Aquilae
  - d) Beta Lyrae
  - e) RR Lyrae
  
5. The discovery of the aberration of light is credited to
  - a) Edmund Halley
  - b) William Herschel
  - c) James Bradley
  - d) Friedrich W. Bessel
  
6. Friedrich Bessel reduced the raw data of which astronomer to catalogue the position of over 3,000 stars in his Fundamenta Astronomiae?
  - a) Edmund Halley
  - b) William Herschel
  - c) James Bradley
  - d) Friedrich W. Bessel (his own observations)

7. The first person to determine the direction of motion of the sun towards the constellation Hercules was
- Edmund Halley
  - William Herschel
  - James Bradley
  - Tobias Mayer
8. Prior to the first measurements of stellar parallax, several astronomers, including Isaac Newton, used which of the following techniques to estimate the distance to Sirius?
- Comparing the brightness of Sirius to the Sun or planet.
  - Comparing the size of Sirius to the size of the Sun or planet.
  - Comparing the color of Sirius to the color of the Sun or planet.
  - Comparing the proper motion of Sirius to the proper motion of other nearby stars.
9. Which of the following conclusions or discoveries was not a result of James Bradley's and Samuel Molyneux's attempts to measure the parallax of Gamma Draconis?
- The discovery of the aberration of light.
  - Proof that the Earth moved around the Sun.
  - The speed of light was a constant of the universe.
  - The largest stellar parallax must be less than one second of arc.
  - All of the above resulted from their attempts to measure the parallax of Gamma Draconis.
10. The first truly accurate measurement of stellar parallax which was widely accepted by other astronomers was done by
- William Herschel
  - Joseph Fraunhofer
  - Friedrich Bessel
  - Wilhelm Struve
11. Isaac Newton's universe had
- stars of different intrinsic brightness randomly distributed through space.
  - stars of identical intrinsic brightness uniformly distributed through space.
  - stars of different intrinsic brightness distributed mostly along the plane of the Milky Way.
  - stars of identical intrinsic brightness distributed randomly but with a slight preference towards the disk of the Milky Way.
12. Olbers Paradox is
- Why isn't the sky dark during the day?
  - Why isn't the night sky bright?
  - Why are the stars so far away?
  - Why are the stars not all the same?

13. Olbers solution to his paradox was
- a) the space between the stars was not perfectly transparent and absorbed some small fraction of starlight.
  - b) the universe was finite and of a fairly young age.
  - c) the stars in the universe were not uniformly distributed in space.
  - d) not all stars in the universe had the same intrinsic brightness.
14. The universe of Thomas Wright had
- a) the Sun located at the center of a vast sphere of uniformly distributed stars.
  - b) the Sun located on a thin spherical shell of stars with the "Abode of God" at the center of the sphere and darkness beyond the sphere.
  - c) the Sun located at the center of a thin circular disk of stars with darkness above and below the disk.
  - d) the Sun located at the half way to outer edge of a large rotating disk of stars.
15. William Herschel's most trusted assistant was
- a) his brother John Herschel
  - b) his sister Caroline Herschel.
  - c) his best friend James Feruson
  - d) his uncle Friedrich von Herschel.
16. After discovering Uranus, William Herschel was granted a royal pension of
- a) £200 per year.
  - b) £1000 per year.
  - c) £50 per year.
  - d) £10,000 per year.
17. The telescope used most by William Herschel was
- a) 20 feet in length with an aperture of 18 inches.
  - b) 40 feet in length with an aperture of 12 inches.
  - c) 10 feet in length with an aperture of 36 inches.
  - d) 60 feet in length with an aperture of 60 inches.
18. William Herschel estimated the shape of the Milky Way by
- a) measuring the parallax of as many stars in as many different directions as he could.
  - b) counting the numbers of stars in different directions and estimating their distances based on their magnitudes.
  - c) counting the number of stars in different directions and measuring the parallax to a few of the brightest stars in each direction.
19. The Leviathan of Parsonstown was
- a) a 6-foot diameter reflecting telescope built for William parsons in 1845.
  - b) a 36-inch refracting telescope built for the third Earl of Rosse in 1867.
  - c) a 48-inch reflector built by John Herschel in Bath.
  - d) a 100-inch reflecting telescope built for the Royal Observatory at Greenwich.

20. To extend his father's catalogue of nebulae and clusters, John Herschel made astronomical observations from

- a) Sydney Australia
- b) The Cape of Good Hope South Africa
- c) Punta Arenas Chili
- d) Wellington New Zealand

## Essay Questions

1. Discuss the observations made by and theories developed by the team of John Goodricke and Edward Pigott.
2. Describe the discovery of the aberration of light by James Bradley. What kind of observations was he making and what type of instrument was he using when he discovered it?
3. Describe some of the early attempts to measure the distance to the stars. Who was making them and what techniques were used? What were their results?
4. Describe the contributions of William Herschel to the science of observational astronomy. What types of observations was he making, what instruments was he using and where was he making the observations?
5. Discuss the importance of observing double stars. Who were some of the individuals making observations of double stars?
6. Describe some of the early theories on the structure of the universe. Who were the individuals making the theories and what were the important aspects of their theories?
7. Describe the contributions of John Herschel to the science of observational astronomy. What types of observations was he making, what instruments was he using and where was he making the observations?

## Chapter 8

### Multiple Choice Questions

1. The first regular astronomical journal to be published was
  - a) The Nautical Almanac and Astronomical Ephemeris
  - b) The Monatliche Correspondenz.
  - c) The Philosophical Transactions.
  - d) Astronomische Nachrichten
2. The International Astronomical Union was formed in
  - a) 1904.
  - b) 1899.
  - c) 1919.
  - d) 1953.
3. The earliest high quality spectra of the sun were taken by
  - a) Isaac Newton.
  - b) Joseph Fraunhofer.
  - c) Gustav Kirchhoff.
  - d) Julius Plucker.



4. The person most responsible for the development of the rules of spectroscopic identification is
  - a) Isaac Newton.
  - b) Joseph Fraunhofer.
  - c) Gustav Kirchhoff.
  - d) Julius Plucker.
5. The wavelength scale for spectral lines was made accurate and reproducible by
  - a) Joseph Fraunhofer.
  - b) Jean Foucault.
  - c) Anders Angstrom.
  - d) Auguste Comte.
6. While systematically searching for the planet Vulcan, Heinrich Schwabe discovered
  - a) the rotational period of the sun.
  - b) the sunspot cycle.
  - c) the magnetic fields associated with sunspots.
  - d) the chemical make-up of the sun.
7. The person most responsible for the establishment of magnetic observatories around the world was
  - a) Heinrich Schwabe.
  - b) Anders Angstrom.
  - c) Alexander von Humboldt.
  - d) C. F. Gauss.
8. The first individuals to observe a solar flare were
  - a) Heinrich Schwabe and Alexander von Humboldt.
  - b) C. F. Gauss and John Lamont.
  - c) R. C. Carrington and Richard Hodgson.
  - d) George E. Hale and Percival Lowell.
9. To observe features in the atmosphere of the sun, 19<sup>th</sup> century astronomers
  - a) build temporary observatories along the track of eclipses to make observations during total eclipses.
  - b) built eclipse generators for their telescopes that would produce an artificial eclipse.
  - c) built large permanent observatories all over the world in hopes that an eclipse would pass over one of them.
10. The development of a high dispersive spectrograph to study the solar corona and chromosphere is jointly credited to
  - a) P. J. Janssen and J. Norman Lockyer.
  - b) Gustav Kirchhoff and Robert Bunsen.
  - c) C. A. Young and Richard Hodgson.
  - d) Bengt Edlen and Anders Angstrom.

11. The most widely held theory for the source of the sun's energy in the mid to late 19<sup>th</sup> century was known as
  - a) nuclear fusion.
  - b) Kelvin-Helmholtz contraction.
  - c) combustion of hydrocarbons.
12. By the end of the 19<sup>th</sup> century the best refracting telescopes in the world were being made by
  - a) Joseph Fraunhofer.
  - b) William Herschel
  - c) Alvan Clark and Sons.
  - d) Justus von Liebig.
13. The first serious scientific studies of comets were done by
  - a) Charles Messier.
  - b) Giovan Donati.
  - c) H. W. Olbers
  - d) William Herschel
14. Using orbital calculations, John Couch Adams determined the source of most meteor showers were
  - a) asteroids in the asteroid belt.
  - b) periodic comets.
  - c) occasional impacts between asteroids and the Moon.
  - d) solar storms.
15. The discovery of the moons of Mars is credited to
  - a) William Herschel
  - b) Asaph Hall
  - c) Giovanni Schiaparelli
  - d) Percival Lowell
16. The Lowell Observatory near Flagstaff, Arizona was built primarily to
  - a) observe Mars.
  - b) observe the moons of Jupiter.
  - c) observe the rings of Saturn.
  - d) observe the sun.
17. The correct theory for the character of the rings of Saturn was proposed by
  - a) Percival Lowell.
  - b) George Bond
  - c) Giovanni Cassini
  - d) James Clerk Maxwell

18. The person responsible for the discovery of Pluto was
- John Couch Adams.
  - Clyde Tombaugh.
  - Giovanni Schiaparelli
  - William Herschel.
19. The nebular theory for the formation of the solar system was first proposed by
- Pierre-Simon Laplace.
  - James Clerk Maxwell.
  - William Herschel.
  - Percival Lowell.
20. The solar system formation theory proposed by Thomas Chamberlin was
- cometary impacts with the sun throwing off large amounts of material which coalesced into the planets
  - a passing star tidally pulling material off the sun which coalesced into the planets.
  - a collapsing cloud of gas and dust flattening into a disk with a central bulge out of which both the sun and planets form.
  - a divine creation out of nothingness.
21. The first stellar classification scheme was developed by
- Henry Draper.
  - Angelo Secchi.
  - William Huggins.
  - David Gill.
22. William Huggins proved that true nebulosity exists by taking spectra of
- the Orion nebula
  - the Cat's Eye nebula.
  - the Andromeda nebula.
  - the nebulosity around the Pleiades.
23. The observatory responsible for the classification of hundreds of thousands of stars in the Henry Draper catalogue was the
- Lowell Observatory.
  - Mount Wilson Observatory.
  - Harvard College Observatory.
  - Yerkes Observatory.
24. The individual who classified more stars than any other person in history was
- Cecilia Payne.
  - Annie Jump Cannon.
  - Henrietta Leavitt.
  - Williamina Fleming.

25. The Hertzsprung-Russell diagram is a graph of
- luminosity versus mass.
  - luminosity versus temperature.
  - mass versus temperature.
  - temperature versus spectral class.
26. The person most responsible for determining the abundance of hydrogen in stars was
- Annie Jump Cannon.
  - Cecilia Payne.
  - Henry Norris Russell.
  - Arthur Eddington
27. The person who finally proposed the correct method of how the sun gets its energy was
- Albert Einstein.
  - Cecilia Payne.
  - Hans Bethe.
  - Henry Norris Russell.
28. Subramanian Chandrasekhar determined
- that white dwarf stars are degenerate matter.
  - the maximum mass of a white dwarf star.
  - the minimum mass of a white dwarf star.
  - the chemical composition of white dwarf stars.

### Essay Questions

- Describe the expansion in astronomical publications beginning in the mid 1600's. What are some of the early journals and where were they being published?
- Describe the development of solar spectroscopy. Who were the individuals pioneering the science of spectroscopy? Include a discussion on the development of the instruments of spectroscopy.
- Discuss some of the advances in solar astronomy that took place in the second half of the 19<sup>th</sup> century. Who were some of the individuals involved and what types of measurements were they making?
- Discuss the advances in telescope making that took place in the 19<sup>th</sup> century. What types of telescopes were being made and who was making them? What advances in chemistry allowed for the construction of better reflecting telescopes?
- Discuss the developments in the study of comets and meteors in the 19<sup>th</sup> century. Who was conducting the studies and what were some of their theories?
- Discuss the discoveries of the moons and bodies in the solar system in the late 1800's and early 1900's. Who was making the observations and proposing the theories and what were some of the theories and discoveries?

7. Describe some of the theories for the formation of the solar system that were popular in the 1800's. Who proposed the theories and what were some of the problems of the theories.
8. Discuss the development of the stellar classification scheme. What were the earliest classifications based on? What was the final classification scheme and who was most responsible for it? Where and under what conditions were most of the stellar classifications being done?
9. Describe some of the "unusual" stars that were observed and theorized about in the 1800's and first half of the 1900's. Who was doing the theorizing and what were their theories?