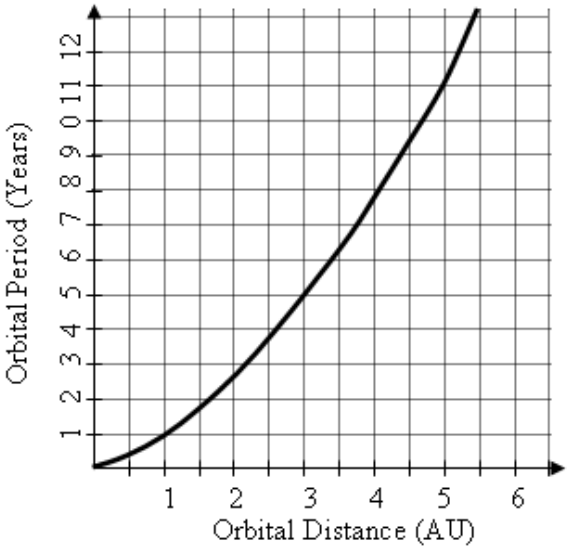
Test 1 --- Natural Sciences 102 Section 7 11am **VERSION A**
February 6, 2008

Correct answers in boldface. Be sure to write your name and student ID number on the first blank at the bottom of the form. Please mark the version (A) in the "Key ID" space at the top of the Scantron. If you need to erase an answer, please do so carefully and remove all of the old mark.



1. Mars is 1.5 AU from the Sun. Using the graph at right, how long does it take Mars to orbit the Sun?

a. 1 year **b. 1.9 years** c. 1.25 years
d. 4 years e. More information is needed

2. Scientists
   a. can solve any problem
   b. work only to apply old theories to new observations
   c. make observations of nature so they can test theories
   d. derive new theories without reference to observations
   e. do not accept observations that disagree with theory

3. The most important contribution of the Greeks to science was
   a. to measure the size of the moon
   b. to develop sophisticated machines for experiments
   c. to invent scientific terminology
   d. to determine the underlying nature of matter
   e. to show how to think about nature in a scientific way

4. The Maya
   a. had little interest in astronomy
   b. made accurate observations they used to advise their rulers on important decisions
   c. were comparable in astronomical science to the Greeks
   d. were far behind the Babylonians in astronomy
   e. left no evidence one way or the other regarding their interest in astronomy

5. The retrograde motions of the planets
   a. were not noticed by ancient astronomers
   b. were completely explained by ancient astronomers
   c. posed a puzzle that was an important issue in theories of the motions of the planets
   d. were not real, but just predicted by some ancient religions
   e. only appeared in particular places on Earth

6. Our modern calendar
   a. Is based on the ancient Egyptian calendar
   b. Was brought down unchanged from the Babylonian astronomers
   c. Has been strongly influenced by Mayan records.
   d. Is based on a calendar set up by Julius Caesar in ancient Roman times
   e. Is still not well tuned to the mismatch of the day to the year and will need adjustment soon

7. Suppose two comets, comet A and comet B, were orbiting the sun, having the same average orbital radii. If comet A had a higher orbital eccentricity than comet B, which comet would, during some portion of its orbit, have the lower orbital speed?

a. A b. B c. both would be the same d. impossible to tell

8. North of the equator, the stars rise in the east and set in the west and revolve in a counter-clockwise direction around the north celestial pole. South of the equator, they
a. rise in the west, set in the east, and revolve clockwise around the south celestial pole
b. rise in the east, set in the west, and revolve clockwise around the south celestial pole
c. rise in the west, set in the east, and revolve counter-clockwise around the south celestial pole
d. rise in the east, set in the west, and revolve counter-clockwise around the south celestial pole

9. Theories of the solar system were severely challenged for centuries by
a. changes in brightness of the planets as they get closer or farther away from the earth
b. why the planets all seemed to move along the same zone in the sky
c. the motions of the stars
d. errors in predicting the motions of the planets
e. the phases of Jupiter

10. Kepler's "music of the spheres" theory
a. was an impressively good fit to the planetary orbital periods
b. was an impressively good fit to the eccentricity of the orbits of the planets
c. related the day to the month and year
d. was a hopelessly bad fit to the planetary orbits
e. was an impressively good fit to the motions of the stars

11. During the period each year when we see Mars undergoing apparent retrograde motion in our sky, what is really going on in space?
a. The Earth and Mars are getting closer together.
b. Mars is moving around the Sun in the opposite direction from which Earth is moving around the Sun.
c. Earth and Mars are on opposite sides of the Sun.
d. Earth is catching up with and passing by Mars in their respective orbits.
e. Mars is going around on an epicycle

12. Kepler's three laws of planetary motion did NOT
a. provide an underlying physical cause for the planetary motions
b. correctly predict the speed with which a planet goes at different places around its orbit
c. correctly state the shapes of the orbits of the planets
d. give a valid comparison of the "years" for planets at different distances from the sun - the time for them to go around the sun
e. they did all of the above

13. Parallax was difficult to observe because
a. the orbit of the earth is tiny compared to the distances to the nearest stars
b. astronomers measured the wrong stars
c. parallax is only obvious in earth-centered solar systems
d. it is just one of those things that no one thought was important
e. astronomers did not know where to look

14. Ptolemy and previous astronomers assumed that the earth was surrounded by celestial spheres that
a. stayed fixed so the stars would have something solid to move on b. never moved
c. rotated around the earth in a year **d. rotated from east to west every day**
e. changed shape as the planets moved on them

15. People often refer to the side of the moon away from the earth as the "dark side". Is this term correct?
a. no b. yes

16. Tycho showed that comets
    a. interact with the atmosphere of the earth
    b. orbit the sun
    c. are part of the solar system and not associated only with the earth
    d. are not the cause of plagues, and other troubles on earth
    e. will occasionally collide with the earth

17. Medieval scientists
    a. made no progress at all
    b. only recovered the Greek scientific writings
    c. went backwards in science
    d. there were no real Medieval scientists.
    e. made progress that set the stage for the Renaissance

18. Progress in astronomy was particularly difficult during Medieval times because
    a. a long period of cloudy weather made observations difficult
    b. Aristotle's theories were particularly advanced on astronomy, making improvements difficult
    c. Aristotle's views were adopted and codified as part of the Catholic religion
    d. Ptolemy's writings had been lost
    e. the calendar was out of synchronization with the seasons

19. Newton explained Kepler's Laws
    a. by a more sophisticated version of Kepler's "music of the spheres"
    b. by giving them a sound religious foundation
    c. by making them consistent with Aristotle's works
    d. by showing mathematically that the planets move according to a few simple and universal principles of physics
    e. by developing an explanation of Kepler's works that could be more easily understood

20. At the time of Copernicus and Kepler, indications that Ptolemy's theory had weaknesses included all of the following except one, which is:
    a. it had gotten more and more complex
    b. it could not make accurate predictions
    c. there was no underlying physical explanation for it
    d. it needed constant updating
    e. it could not explain parallax

21. Ptolemy's model of the system was not perfectly scientific because
    a. it did not start from simple assumptions
    b. it was not based on observations
    c. it was later shown to be wrong
    d. it was developed before people thought scientifically
    e. it was not based on broad principles that could be applied in other situations

22. If a planet is in a circular orbit at a distance of 1 AU (earth orbit) from a star, compare the force of gravity on it with another planet in a circular orbit three times as large (3 AU)
    a. three times as large
    b. nine times less
    c. three times less
    d. nine times more
    e. cannot determine from the facts given

23. Galileo's dispute with the Church
    a. was purely a case of a hard-working scientist being persecuted for his views
    b. was a public relations scheme by the church to dramatize its power
    c. reflected deep and fundamental philosophical differences about science and what it could do
    d. was trumped up by the Church with no provocation from Galileo
    e. should never have occurred because Galileo had absolute proof of all of his claims

24. If you were on the moon, could you observe total eclipses of the sun by the earth?
a. no **b. yes**

25. If the moon is rising during sunset, what phase is it in?
a. new b. first quarter **c. full** d. last quarter

26. If you were on the moon and the moon were full as viewed from earth, what phase would the earth be at?
a. new b. first quarter c. full d. last quarter

27. A month was set to be the time for
a. the earth to rotate on its axis b. the earth to orbit the sun c. the sun to rotate on its axis
d. 30 days to pass **e. the moon to orbit the earth**

28. The seasons are primarily due to
a. the earth getting closer to and farther away from the sun as it goes arount its orbit
b. the tilt of the axis of the earth so one hemisphere is toward the sun in one part of the orbit and the other hemisphere tilts toward the sun in the other part
c. greenhouse effects
d. changes in the output of the sun
e. large scale movements of air

29. When we look at a galaxy that is 10 million light years away, the light we see
a. was created 10 million years ago, before there were humans
b. is as it was 10 million light-years ago
c. has dimmed by 10 million times in reaching us
d. will be spread over the next 10 million years
e. looks the same as it would have 10 million years ago

30. 2.34×10^{11} is
a. 23411 b. 0.0000000000234 c. 2.34 d. 2341011 **e. 234000000000**

31. Galileo's greatest contribution to science was
a. he did experiments
b. he showed that science was superior to religion
c. he wrote his results up in books and had them published for general circulation
d. he built telescopes
e. he proved that the Copernican system was correct

32. The astronomical wisdom of the Greeks and Egyptians was
a. completely lost until recent research rediscovered it
b. preserved in the great library at Alexandria, where medieval scholars could find it
c. preserved by Arabic scholars
d. written down and stored in caves, where medieval scholars found it
e. passed down to medieval scholars in the works of Aristotle

33. Two stars are identical in all respects but one: Star A is two times closer to us than Star B. What are the relative brightnesses of these two stars?
a. Star A is two times fainter than Star B b. Star B is two times fainter than Star A
c. Star A is four times fainter than Star B **d. Star B is four times fainter than Star A**
e. The stars appear equally bright

34. What is the seasonal event for us when the sun is highest in the sky at noon for people in Sydney Australia?
a. summer solstice b. autumnal (fall) equinox **c. winter solstice** d. vernal (spring) equinox

35. Jupiter is about 5 times farther away from the sun than the earth is, and about 325 times more massive. Compare the gravitational forces holding the earth and Jupiter on their orbits.
a. there is not enough information to tell
b. the force on the earth is greater than that on Jupiter
c. the forces are equal
d. the force on Jupiter is 13 times greater than the one on the earth
e. the force on Jupiter is 325 times greater than the one on the earth

36. Tides arise because
a. The gravity of the sun and moon distort the earth, and the distortion is larger for the water than the land
b. The gravity of the moon pulls the oceans outward
c. The gravity of the sun and moon cause the earth to move in a spiral pattern, setting up a large scale ocean wave movement
d. The gravities of the sun and moon do not exactly cancel, leaving a residual that pulls the oceans out of spherical shape
e. Friction between the ocean floors and the water interacts with tidal forces

37. When an object is about to fall and is high above the ground,
a. Its potential energy is at a maximum and its kinetic energy is at a minimum
b. Both its potential and kinetic energies are at a maximum
c. Both its potential and kinetic energies are at a minimum
d. Its potential energy is at a minimum and its kinetic energy is at a maximum
e. There is no fixed relation between its kinetic and potential energies

38. You live by the seashore on a planet with three moons in orbit around it. You will see
a. one high tide per day b. two high tides per day
c. three high tides per day d. an unpredictable tide pattern
e. a complicated pattern of tides depending on the relative locations of the moons

39. An astronaut on the moon dropped a hammer and a feather from a height of 1.5 meters.
a. the hammer hit the surface first b. the feather hit the surface first
c. they hit the surface at the same time d. which hit first depends on the type of feather
e. which hit first cannot be predicted

40. If a star is moving away from you at constant speed, how do the wavelengths of the absorption lines change as the star gets farther and farther?
a. they get farther and farther to the red b. they move toward the blue
c**. they stay shifted the same amount to the red**

41. An object that emits light with a peak wavelength at 250nm has a temperature _____ that of an object whose emission peaks at 500nm. (1nm = 10^{-9} meters)
a. the same as b. 4 times **c. 2 times** d. one half e. Cannot be computed from the information given.

42. If you know the frequency of a photon, you can compute
a. its position b. its wavelength c. its energy d. its position, wavelength, and energy
e. its wavelength and energy

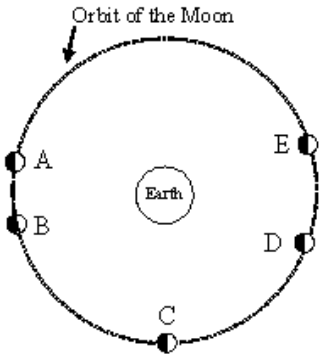
43. A box contains a collection of molecules (for example, the box might be full of air). We have a gauge that records how much force is exerted on the walls of the box by molecules. We take data for awhile and then notice that the force decreased. What might have happened?
a. nobody knows **b. the temperature decreased** c. the pressure increased
d. the temperature increased e. some molecules entered the box

44. At what temperature does an object produce radiation?
a. 212° F or 100° C b. 32° F or 0° C c. 5500° K d. at no temperature
e. at any temperature above absolute zero

45. Visible light comprises
a. nearly the entire electromagnetic spectrum
b. only a small portion of the electromagnetic spectrum
c. the lowest energy portion of the electromagnetic spectrum
d. the highest energy portion of the electromagnetic spectrum
e. none of the electromagnetic spectrum

46. Electrons have a wave character which means that
a. they can only exist in selected orbits within atoms b. they are not particles
c. they cannot have an electrical charge d. they must be found only outside atoms
e. they have the same mass as protons

47. Examine the figure below. Which moon position results in the moon appearing to people on earth as shown in the upper right corner of the figure?
A. B. **C.** D. E.



48. Creation myths
a. are examples of scientific thought b. evolved into advanced science
c. do not lend themselves to scientific probing d. have generally been proven eventually by scientists
e. were the result of the work of scientists, made more interesting for the masses

49. Which controls accelerate a car, according to Newton's Laws?
a. the accelerator b. the brake c. the clutch d. the steering wheel **e. all but the clutch**

50. Electromagnetic radiation behaves like
a. particles called photons b. waves of electric and magnetic fields
c. something that always moves at the speed of light d. something that can be destroyed by interference
e. all of the above