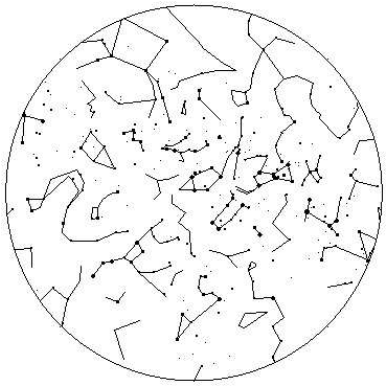
Answer *TRUE* or *FALSE* (<u>not</u> *T* or *F*) (2 pts each)

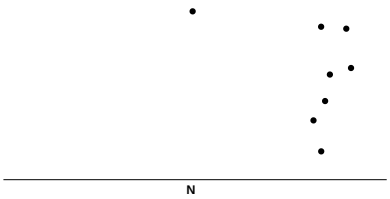
1. A kilometer (km) is about 1.6 miles.
2. The larger the magnitude, the brighter the star.
3. If in the morning the Sun is in the constellation Taurus, by the afternoon it would have moved on past the constellation Cancer.
4. The meridian is both a vertical circle and an hour circle.
5. *Altitude* is the angle between a star and the celestial equator.
6. In 24 hours a star traces a complete diurnal circle and a bit more, ending up further to the west than it was 24 hours earlier.
7. On the equinoxes the Sun is 90° from the celestial poles.
8. When the Moon moves into its first quarter phase, only about 25% of its surface is exposed to sunlight.
9. An astronaut living in the crater Copernicus (on the near side of the Moon) would see a "full Earth" if folks on Earth see a "new Moon".
10. During a solar eclipse the Moon casts its shadow onto the Sun.
11. Generally the Moon is a bit above or below the ecliptic. It is only on the ecliptic if it is at one of the two *nodes*.
12. Newton died before 1776.
13. Copernicus and Luther were alive at the same time.
14. Galileo noticed that Venus, like the Moon, showed all possible phases, and hence, like the Moon, had to orbit the Earth.
15. Since Venus and Saturn both orbit the Sun, from Earth we see both of them displaying all possible phases from new to full.
16. The changing direction of the Earth's axis (the axis pointing in different directions during a year) is the cause of the seasons.
17. Since the Earth is more massive than the Moon, the gravitational force of the Earth on the Moon is greater than the gravitational force of the Moon on the Earth.
18. Newton's second law states that the speed of an object is proportional to the force and inversely proportional to its mass.
19. If the size of the Earth were to double (with the mass unchanged) there would be no change in the gravitational attraction between the Earth and the Sun.
20. Since an ice skater spins faster and faster as she draws her arms in close to her body, her angular momentum is increasing.

Give a short explanation (5 pts each)

21. A biology book says that a cell is a circle 10^{-5} m in diameter and that the cell's nucleus is 2×10^{-6} m in diameter. The picture of the cell in the book shows a circle with a 2 inch diameter representing the cell. What is the diameter of the circle representing the nucleus?

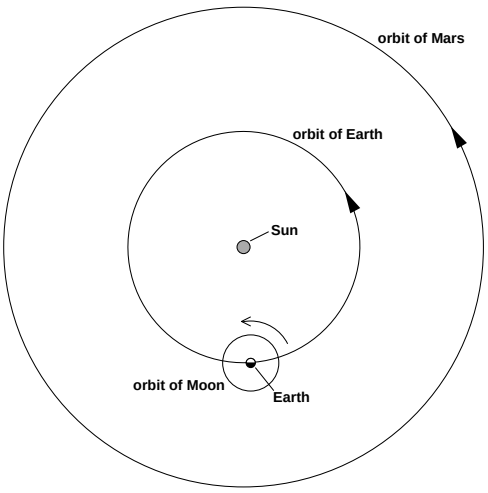
22. The below left is a strangely oriented sky map for February nights. On this sheet of paper, find and label the cardinal directions north, south, east, west, zenith. Label the location of the north celestial pole.

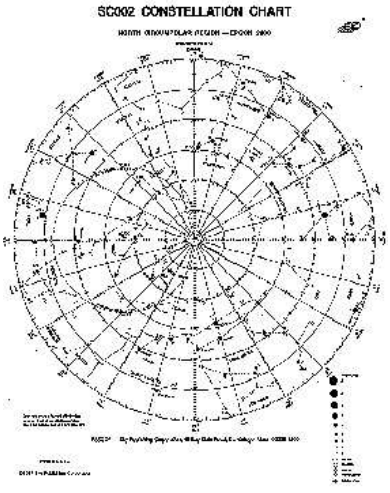




23. Consider the above right picture of a 9 P.M. view looking north at CSB/SJU. Directly on top of this picture, sketch what the view would look like 6 hours later.

24. The below left diagram shows the orbits of Mars and the Moon (not to scale). Tonight Mars will rise at about 4 A.M. and the Moon is in a waxing crescent phase. Directly on the below diagram, write a "L" to denote the location of the Moon in the Solar System, and "M" to denote the location of Mars.





25. Consider the above right copy of your SC002 star map. Directly on this sheet clearly label: a diurnal circle, an hour circle and the north celestial pole.

26. How far will the Sun be from *zenith* here at CSB/SJU at noon on December 21? How far will the Sun be from zenith here at CSB/SJU at noon on June 21?

27. Why do we see different stars December evenings than we do June evenings?

28. This year Easter is April 20. The Moon will be new on April 1. What phase of Moon should you expect to see on Easter? State a time-of-day and the location in the sky (e.g., approximate direction) where you would see the Moon on Easter.

29. On April 21 Venus will have a RA of about 00^h00^m and dec $-1°$. At what time of day and in which direction should you look for Venus on April 21? Explain!

30. Sketch the rectangle that represents the celestial sphere on the SC001. (See question 39, if you forget what this looks like.) Draw the path of Saturn on this map over say a five year period. Label the beginning of the path and a location where Saturn is moving retrograde.

31. Identify an important contribution of each of the following people: Copernicus, Tycho, and Ptolemy.

32. State two of Newton's laws of motion.

33. State two of Galileo's observations that supported the heliocentric theory of the Solar System.

34. Consider a planet orbiting the Sun. Sketch the path of the planet around the Sun, and show: the direction of all forces acting on the planet and the direction the planet would go if no forces acted on it.

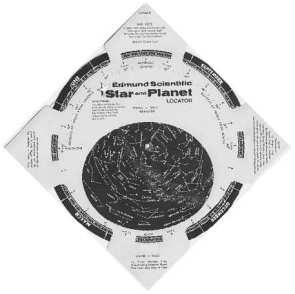
35. While holding above your head a non-spinning wheel, you step on an unmoving spin table. While on the spin table you grab the wheel and start it rotating clockwise. What happens? You now flip the wheel over so it's now spinning the other way. What happens? You now grab the spinning wheel, stopping its motion. What happens? (Assume that throughout this experiment you never touch the ground and that the spin table has no friction.)

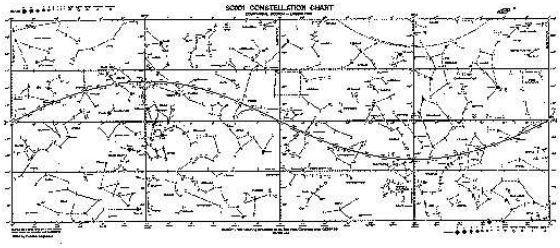
Write out a complete answer (10 pts each)

36. Baghdad, Iraq has a latitude of about 33°N and a longitude of about 44°E. On April 21 the planet Saturn will have a right ascension of 05^h38^m and a declination of 22°. Report the time of day (on April 21) when Saturn crosses the meridian and its maximum altitude at Baghdad (you must report your reasoning to receive any credit).

37. State the three laws of planetary motion discovered by Kepler. Kepler's laws involve ellipses. Draw an ellipse, label it "A", and display on your drawing the location of the Sun and a semi-major axis. Define eccentricity and draw an additional ellipse with larger eccentricity than your ellipse A. Label this new ellipse "B". Display on ellipse B the location of the Sun and where the planet would be moving its fastest and its slowest. Kepler's third law has to do with the period of a planet's motion about the Sun. Draw a third ellipse (labeled "C") on which a planet would take three times as long to orbit the Sun as the planet on your ellipse A.

38. Consider the below left photocopy of your Star Locator. Redraw on your answer sheet the Star Locator's oval that represents the sky and clearly label where the following are found: horizon, meridian, zenith, north celestial pole, celestial equator, north, south, east, and west points on the horizon. Add a dot (and label it) to show where a star with altitude 30°, azimuth 270° would be located.





39. Consider the above right photocopy of your SC001 star map. Redraw the map's rectangle that represents part of the celestial sphere and clearly label where the following are found: celestial equator, ecliptic, an hour circle and a diurnal circle. For the date 20-Apr-2003 (Easter), label the SC001 location of the Sun, Venus, and the Moon (see questions 28 and 29).

40. Consider the below diagrams of the dome of the sky which show possible positions for the Moon. In the left diagram, the position of the Sun is displayed; in the right diagram, it is midnight so the Sun is below the horizon. For each possible position of the Moon you are to draw what the Moon would look like. Thus for each Moon position, you will want to draw a horizontal line representing the horizon and a shaded circle representing the Moon. Show and label which parts of the Moon would be bright and which parts would be dark. In the left diagram the Sun is in the west and Moon positions A and B are respectively west and east of the meridian. In the right diagram it is midnight; Moon position C is in the east, Moon position D is on the meridian and Moon position E is in the west.