Except for questions 22, 23, 24, 25, 39, and 40 marks/answers on these sheets are not graded.

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

1. 1.5×10^7 is 15000000.

2. If SI units (the "metric system") were being properly used an iPod "nano" would be a million times smaller than a normal iPod.

3. Diurnal circles are great circles.

4. Every vertical circle passes through the observer's zenith.

5. On the Earth's equator (latitude=0°) the celestial equator is a vertical circle.

6. On the Earth's equator (latitude=0°) the Sun will go through zenith every day.

7. The declination of the star Dubhe (in the Big Dipper) is about 62°, so it should take about a hand plus a scout-three to reach the star Polaris.

8. A star on the meridian tonight at 9 P.M. will be east of the meridian at 9 P.M. a month from today.

9. For a star the time between successive transits is $23^h 56^m$. For the Sun it is a bit more than that; for a retrograde moving planet it would be a bit less than that.

10. The larger the magnitude, the brighter the star.

11. The Moon follows roughly the same path on the Celestial Sphere as does the Sun, but it moves about 12 times faster and has retrograde loops at every opposition.

12. The sidereal period of the Moon is shorter than the synodic period of the Moon.

13. If in the morning the Sun is in the constellation Taurus, by the afternoon it would have moved on past the constellation Cancer.

14. On the winter solstice the right ascension of the Sun is 18^h and the declination is $-23\frac{1}{2}^\circ$.

15. An astronaut living in the crater Copernicus (on the near side of the Moon) would see a "new Earth" if folks on Earth see a "full Moon".

16. The changing direction of the Earth's axis (the axis pointing in different directions during the year), is the primary cause of the seasons.

17. A satellite orbiting the Earth in a circle at a constant speed is not accelerating.

18. 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.

19. If the radius of the Sun were to double (with the mass unchanged) there would be no change in the gravitational attraction between the Earth and the Sun.

20. The Sun subtends an angle of about $\frac{1}{2}^\circ$ as seen from Earth. At perihelion the angle would be a bit less; at aphelion it would be a bit more.

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 (mostly empty) sky map. Directly on this sheet sketch and label: meridian, north celestial pole, due east horizon. Assume the cross is a star pattern in the sky. Draw on your answer sheet a horizontal line representing the horizon and place a cross above your line showing how you would see this star pattern oriented in the sky.
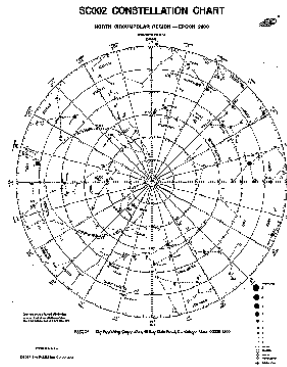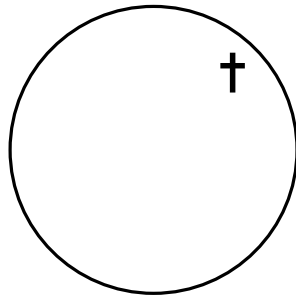
23. Consider the above right copy of your SC002 star map. Directly on this sheet clearly label: a diurnal circle, an hour circle and the north celestial pole. Draw an arrowing showing how the map would rotate if it were matching the rotation of the celestial sphere.

24. The below right cartoon shows the inner (Mars & in) Solar System as seen from a point high above the Earth's north pole. The arrows show which way the planets go around the Sun (which is also the way the Earth spins). The Moon was new yesterday; Venus is now an 'evening star' (following its superior conjunction 14-August); Mars will begin retrograde motion in about 4 months. Directly on the below diagram, map the Solar System as it is today. Mark "L" to denote the location of the Moon, "V" to denote the location of Venus, and "M" to denote the location of Mars.
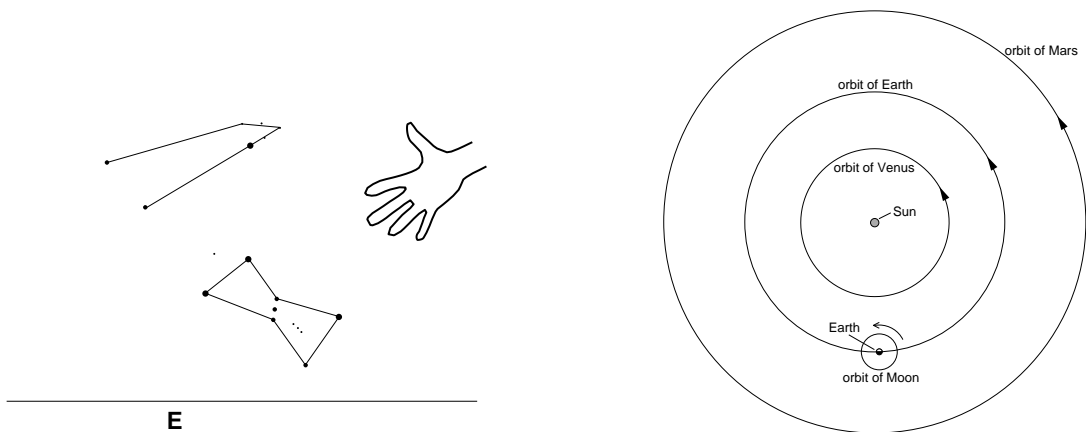
25. Consider the above left cartoon of a midnight view looking east at CSB/SJU tonight. Directly on top of this picture, sketch what the view would look like 1 hour later.
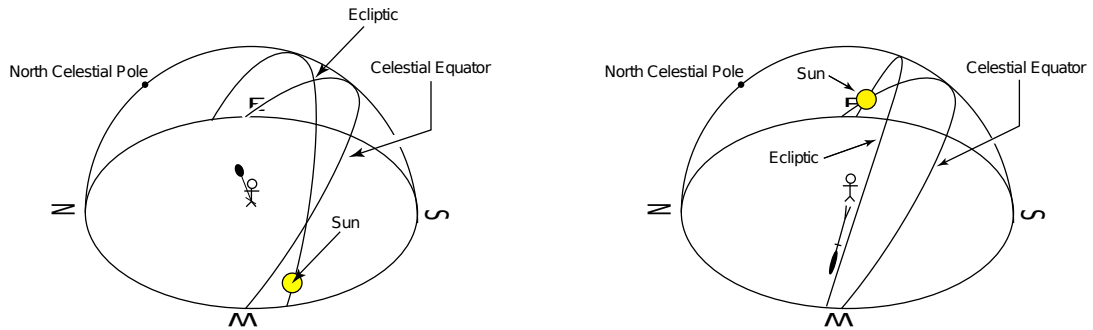
26. Consider the (re-touched) photocopy of your Star Locator shown right. Redraw the Star Locator's oval that represents the sky and clearly label where the following are found: zenith, north celestial pole, and east point on the horizon. Draw an arrow showing the direction the sky rotates.

27. What is the maximum altitude that the Sun achieves here at CSB/SJU on December 21? On June 21?

28. Explain why the stars seen at night during the winter differ from those seen at night during the summer.

29. Describe the cause of the seasons.

30. Draw a picture showing the relative positions of the Sun, Moon and Earth during a lunar eclipse. Explain why solar and lunar eclipses often occur in the same month just a couple of weeks apart and why this 'eclipse season' will occur about 3 weeks earlier next year.

31. The Moon was new yesterday. Thanksgiving is 8 weeks and 1 day from today. Report the Moon's phase on Thanksgiving (24-Nov-2011). Clearly explain *when* and *where in the sky* you could see the Moon on Thanksgiving.

32. Define *retrograde motion*.

33. Define *equant*. What phenomena caused Ptolemy to use equants?

34. Draw a picture of an orbit around the Sun with a large eccentricity. Label the position of Sun. Add to your diagram (and clearly label "small *e*") another orbit about the Sun with a smaller eccentricity. Which or your orbits has the longer period?

35. State two of Newton's "four" laws of motion.

Write out a complete answer (10 pts each)

36. Tripoli, Libya has a latitude of about 33°N and a longitude of about 13°E. On October 21 the planet Jupiter will have a right ascension of $02^h\,13^m$ and a declination of 12°. Report the time of day (on October 21) when Jupiter crosses the meridian and its maximum altitude at Tripoli (you must report your reasoning to receive any credit).

37. Report an important contribution to "heliocentrism" of each of the following people: Copernicus, Tycho, Kepler and Galileo.

38. The space shuttle can "orbit" the Earth, i.e., not fall down, for a long time. How does that work? What exactly is needed? Astronauts in the space shuttle float, i.e., nothing seems to hold them down. How does that work?

39. Consider the below diagrams of the dome of the sky. In the left diagram, the Sun is near the western horizon; in the right diagram the Sun is near the eastern horizon. Directly on the appropriate diagram, locate (with a label and an arrow pointing at the proper spot) where each of the following four Moons would be in the sky: (A) waning crescent, (B) waxing crescent, (C) waning gibbous, and (D) waxing gibbous. Draw what (A) and (B) would look like to the stick figure in the diagrams. (Remember to label which part of your drawn Moon you intend to be white and which part black.) Report the approximate date of each drawing.

40. Consider the below (re-touched) photocopy of your SC001 star map. Directly on this sheet clearly label the celestial equator and ecliptic. Locate and label the current position of: Sun, Moon, Mars, Venus, and Jupiter. (Questions 24 and 36 may help.) Show path (with arrows) that depicts the future retrograde of Mars.