AST 101 ANSWERS TO ASSIGNMENT 6N

CHAPTER 25 "Meteorites, Asteroids, and Comets"

Questions

1. They are simply easier to spot. How many rocks have you seen strewn about in your life? How many iron chunks?

2. Their paths in the sky show them to be emanating from one point in the sky (the radiant) — a perspective effect akin to standing on railroad tracks and seeing them come together far from you. Meteors in showers are orbiting together, moving parallel to one another like railroad tracks. What could create an orbiting stream of dust? a comet. The gases may long since have dissipated, but the expelled dust continues to orbit, along with, somewhere in the same orbit, a small, dark, dissipated comet nucleus that now looks like for all intents and purposes, an asteroid of the carbonaceous chondrite type.

3. Remember the distinction between meteor and meteorite in the following . The material spewed from comets is mostly smaller, dust size and not much larger, made from the very beginning of the solar system in lower temperature conditions that did not result in much melting of rocky material into large pieces which can survive a plunge through earth's atmosphere to the surface. Asteroid chunks, made in a higher temperature regime, will be larger and more likely to reach the surface.

4. There are two parts to this question. The first part has two main reasons: meteorites are dark objects on a white background, so the contrast aids in their discovery. Also, over time, with ice compression and later evaporation, the surface shows a time concentration of meteorites. The second part is answered by the fact that stony meteorites stand out much better on an ice/snow field than in other areas which are already covered in similar looking rocks.

5. Widmanstätten patterns are crystalline patterns that result in a slow cooling of iron under moderately low pressures. This is exactly what we would expect for core material of early planetesimal-sized objects that we still see today as asteroids (now smaller from break-ups). Were these chunks always this size, or fragments of just somewhat larger objects, they would have cooled far too quickly for these patterns to form. (Smaller objects have a greater Area/Volume ratio, allowing rapid cooling.

8. Being larger and at the same distances from the sun as the smaller asteroids, the first to be discovered were simply the brighter, easier ones to see. It would have been incorrect for an early 19th century astronomer to conclude that most or all asteroids were hundreds of miles across.

Problems

12. The total mass of the Oort cloud will be the mass per comet times the # of comets, or 10^{14} kg/~~comet~~ x 2 x 10^{12} ~~comets~~ = 2 x 10^{26} kg. Relative to earth's mass, 6 x 10^{24} kg, this is a ratio of 0.33 x 10^{2} or 33. Since the total mass is a result of two estimates with one significant figure accuracy, all we are allowed (by the evidence) to say is that the total mass of all those comets out

there is comparable to roughly 30 earth masses.

CHAPTER 3 "The Cycles of the Moon"

Questions

2. Hint: This mystery question has you reversing your direction of view, doesn't it? Then what phase do you think you will seen earth in when viewed from the moon, itself viewed as being in full phase? Thinking...thinking...yes—the opposite phase. What's opposite full phase? New? 1st quarter? Waxing crescent? You were thinking, weren't you? That's the key to doing science—thinking.

6. He and other Greeks before him had recognized that the moon was in Earth's shadow during eclipse. He noted that the shadow edge was always circular. Only one kind of a solid object can always cast a circular shadow and that is a sphere. It just doesn't matter from what direction the sunlight comes; the Earth–and its shadow–will always look circular.

8. See Figures 3-12 and 3-13 on pp. 50 and 51, respectively (9th edition). The line of nodes is the straight line that marks the intersection of the moon's orbital plane and the earth's orbital plane. If you had Geometry in high school, you will be comfortable with the understanding that the intersection of two planes is a straight line. The line of nodes run through the earth and through the moon's orbit. Where it intersects the moon's orbit, those two points are called the nodes. Since the line is in both planes, should the moon be at or near a node during Full Moon phase, it will be eclipsed. That is, the line of nodes is aligned along the Sun-Earth-Moon line. Halfway between the nodes? The moon is farthest from the nodes and that means it is farthest above or below the Earth's orbital plane–an eclipse can't happen. The Earth's shadow passes over or under it. See Figure 3-12.

11. The problem is with the orientation of the crescent moon. Realize you are looking at the edge of the day side of the moon. So which direction must the sun be? Impossible if it's nighttime, as implied by the stars.

Problems

3. The period of the phases is the synodic period–NOT the sidereal period. Read again the chapter segments that deal with these periods. The synodic period is 29.5 days. The time from first-quarter to third quarter is two-quarters of the total orbit or ½ the period. One-half of 29.5 days is 14.75 days. Since the author just asked for "about how many days", you would answer 15 days.