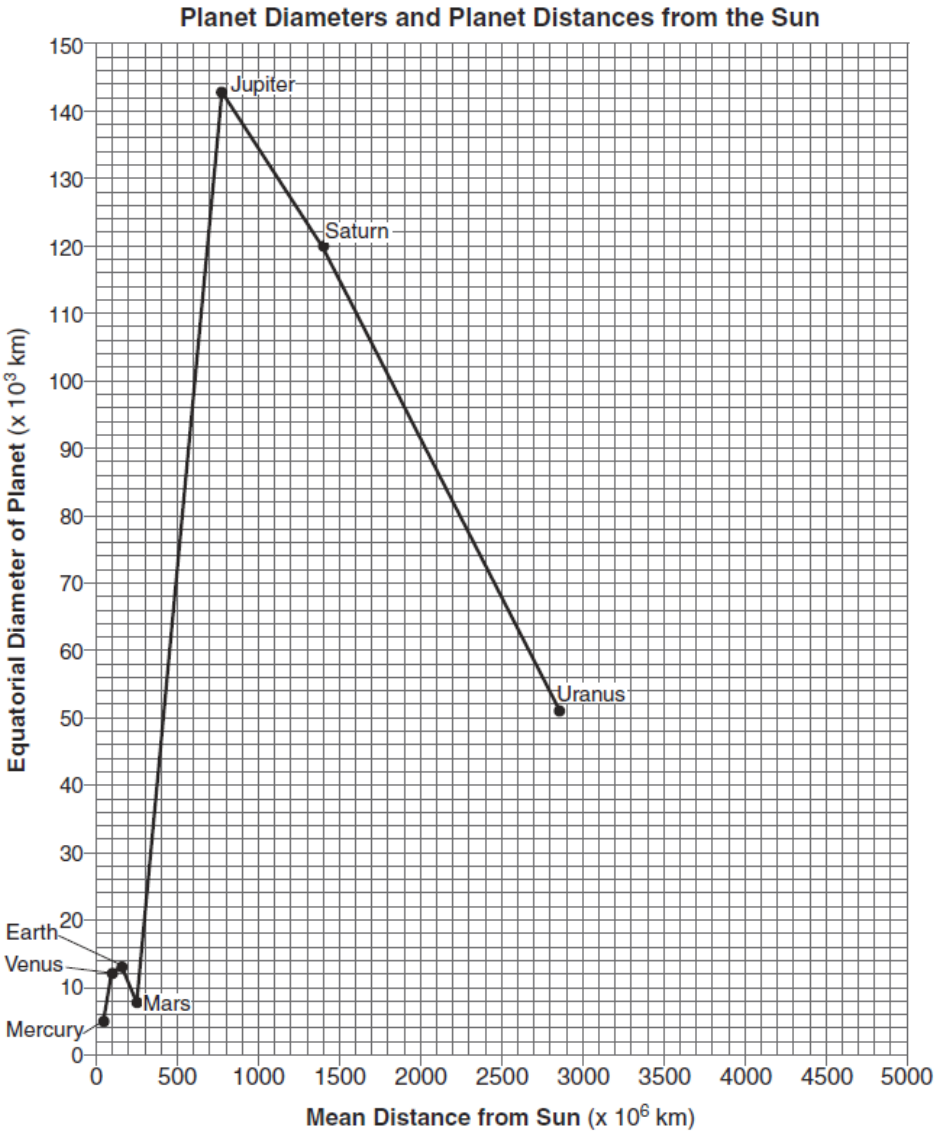
Base your answers to questions **1** and **2** on the graph and on your knowledge of Earth science. The graph shows planet equatorial diameters and planet mean distances from the Sun. Neptune is *not* shown.

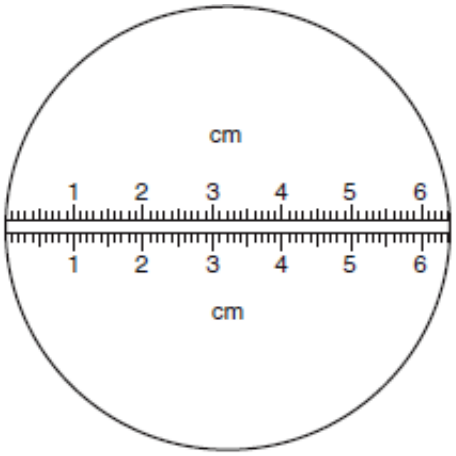


1. Compared to the periods of revolution and periods of rotation of the terrestrial planets, how are the periods of revolution and periods of rotation for the Jovian planets different?

   Jovian periods of revolution: _____

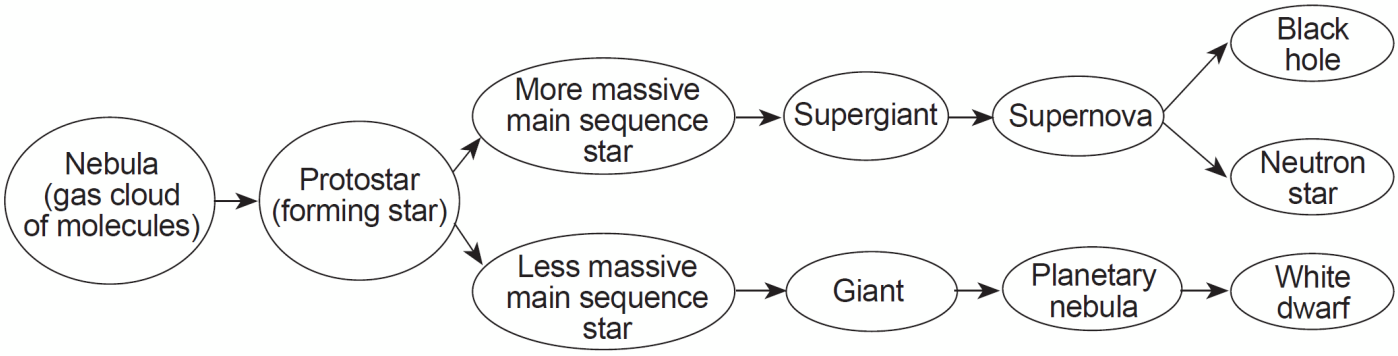
   Jovian periods of rotation: _____

2. The diagram in your answer booklet represents Earth drawn to a scale of 1 cm = 2000 km. Centimeter markings along the equatorial diameter of Earth are also shown on the diagram. On the diagram, shade in the space between the centimeter markings to represent the equatorial diameter of Earth's Moon at this same scale.



Scale: 1 cm = 2000 km

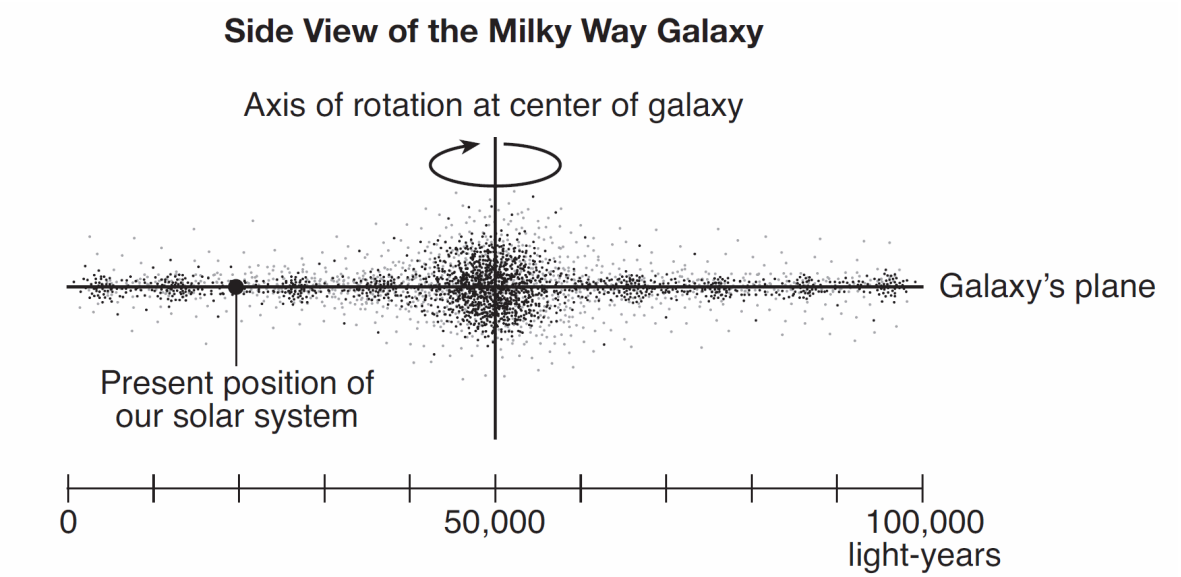
Base your answers to questions **3** and **4** on the flowchart below and on your knowledge of Earth science. The flowchart shows the evolution of stars.



3. Describe how the diameter and luminosity of a main sequence star change as the star becomes either a giant or a supergiant.

4. Identify the force responsible for the contraction of a nebula (a gas cloud of molecules) to form a protostar.

Base your answers to questions **5** through **7** on the diagram below and on your knowledge of Earth science. The diagram represents the present position of our solar system in a side view of the Milky Way Galaxy. The distance across the Milky Way Galaxy is measured in light-years.



5. List the following astronomical features, in order of relative size, from smallest to largest.
   Sun
   Jupiter
   Milky Way Galaxy
   Universe
   Our solar system

6. Galaxies are classified based on their shape. What is the shape of the Milky Way Galaxy when viewed from directly above?

7. What is the distance, in light-years, from the center of the Milky Way Galaxy to our solar system?

Base your answers to questions **8** and **9** on the passage below.

Meteorite Composition

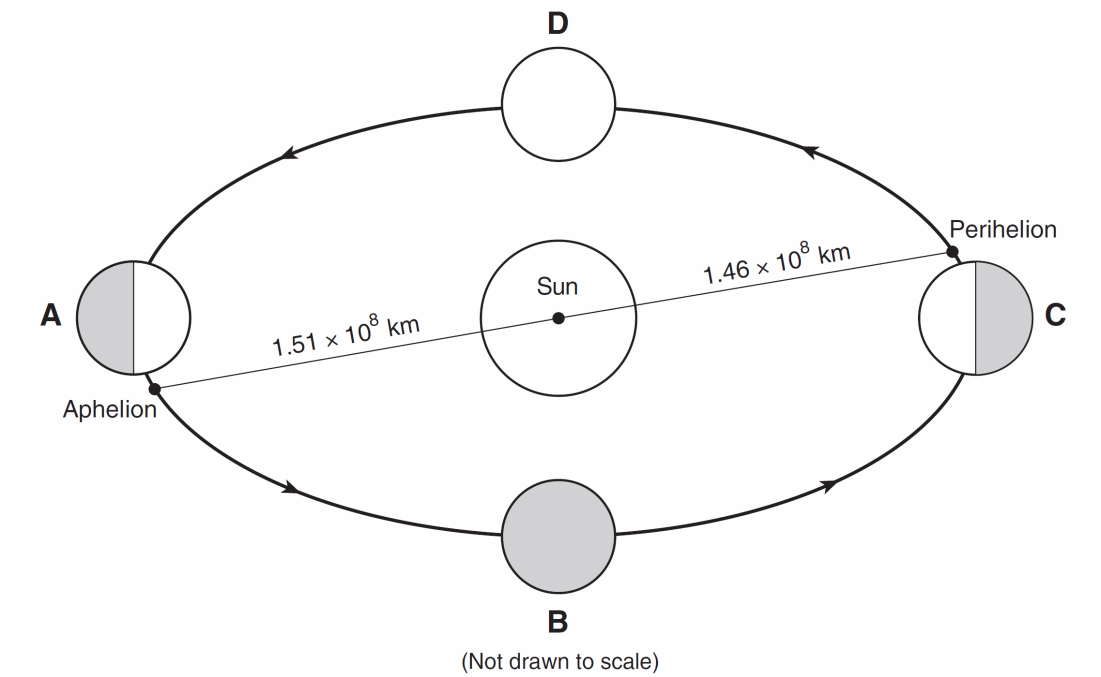
Meteors that strike Earth's surface are called meteorites. Analysis of meteorite composition has provided scientists with information regarding the formation of Earth and our solar system, and possibly the development and evolution of life on Earth.

Two types of meteorites are iron meteorites and chondrites. Iron meteorites consist mostly of iron and nickel, and are inferred to be from core materials of early planetary bodies in our solar system. More than 60% of meteorites studied have been identified as chondrites. Chondrites are made of millimeter-sized spheres of olivine and pyroxene crystals embedded in a mass of mineral and metal grains. The chondrites are thought to represent fragments of the earliest solid materials in our solar system. One type of chondrite, the carbonaceous chondrite, contains water, organic compounds, and minerals that represent the chemical composition necessary for life to form.

8. Identify the type of meteorite that is inferred to have a composition similar to the composition of Earth's core.

9. What is the estimated age, in years, of Earth and our solar system?

Base your answers to questions **10** through **13** on the diagram in your answer booklet. The diagram shows Earth revolving around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's location in its orbit on the first day of the four seasons. Aphelion (farthest distance from the Sun) and perihelion (closest distance to the Sun) are labeled to show the approximate times when they occur in Earth's orbit.



10 Explain why the gravitational attraction between the Sun and Earth *decreases* as Earth travels from location *D* to location *A*.

11 Approximately how many days does it take Earth to travel from location *B* to location *C*?

12. On the diagram, draw an arrow on Earth at location *D* to show the direction of Earth's rotation. Extend the arrow from one side of Earth to the other side of Earth.

13. On the diagram, draw a line through Earth at location *A* to represent Earth's tilted axis on the first day of summer in the Northern Hemisphere. Label the North Pole end of the axis.

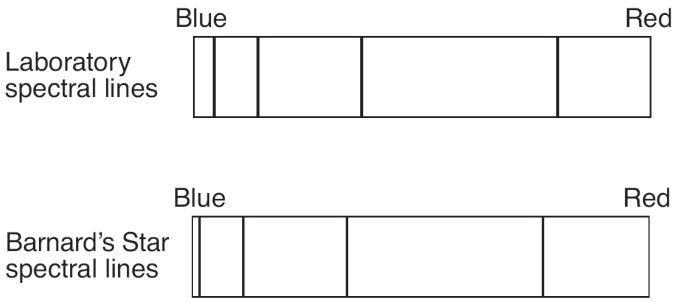
Base your answers to questions **14** through **16** on the table below, which lists some information about *Barnard's Star*.

Barnard's Star

Distance from Sun	• 6.0 light-years* • currently moving toward the Sun (and Earth) and will get as close as 3.8 light-years in approximately 11,000 years
Characteristics of Barnard's Star	• less than 17 percent of the Sun's mass • approximately 20 percent of the Sun's diameter • age thought to be between 11 and 12 billion years old and may last another 40 billion years • no planets observed orbiting Barnard's Star

* A light-year is the distance light travels in one year.

14. The diagram below shows four spectral lines produced by glowing hydrogen gas in a laboratory and four spectral lines produced by hydrogen gas as seen in the light from *Barnard's Star*.



Explain why the positions of the spectral lines of *Barnard's Star* are all shifted toward the blue end of the spectrum.

15. If a planet with the same mass as Earth were discovered orbiting *Barnard's Star* at the same distance that Earth is orbiting the Sun, why would there be less gravitational attraction between this new planet and *Barnard's Star* than there is between Earth and the Sun?

16. List *Barnard's Star*, the Sun, and the universe in order by age from oldest to youngest.

17. Base your answer to the following question on the table below, which shows information about five large objects in the Kuiper Belt. The Kuiper Belt is located approximately 30 to 1000 astronomical units (AU) from the Sun. An astronomical unit is the average distance between Earth and the Sun, 149.6 million kilometers.

Kuiper Belt Data

	Orbit Characteristics			
Kuiper Belt Objects	**Closest Distance to the Sun** (AU)	**Farthest Distance from the Sun** (AU)	**Eccentricity**	**Approximate Equatorial Diameter** (km)
Varuna	40.47	45.13	0.053	900
Eris	37.77	97.56	0.442	2400
Quaoar	41.92	45.28	0.039	1260
Sedna	76.15	975.05	0.855	1500
Ixion	30.04	49.36	0.243	1065

Identify the Kuiper Belt object with the longest period of revolution and state the evidence that supports that conclusion.

Object:_____

Evidence:_____