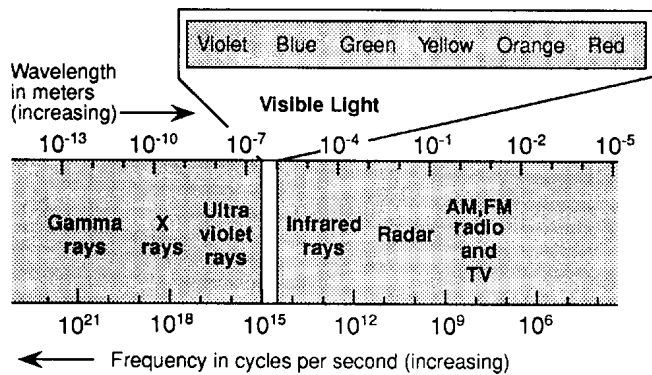




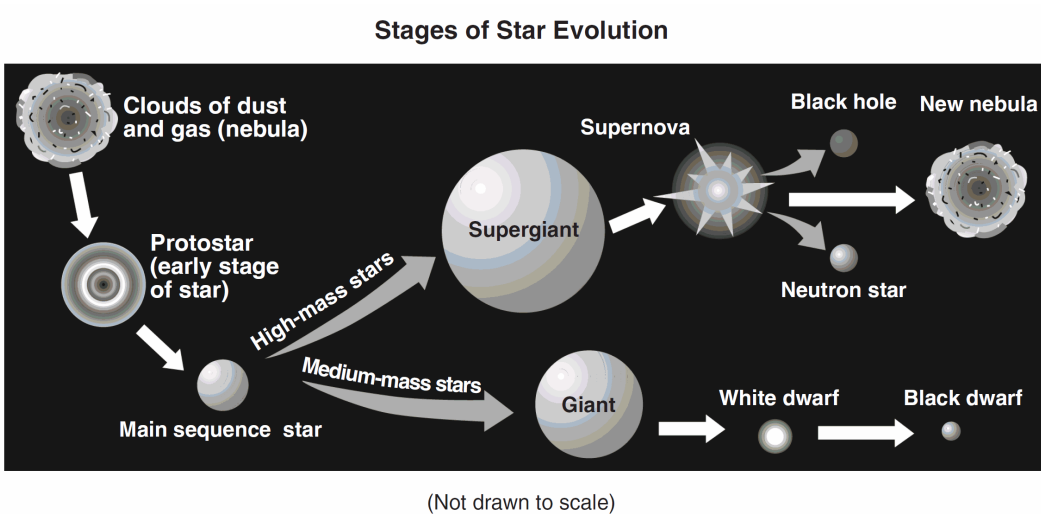
KEEP  
CALM  
AND USE  
YOUR  
ESRT

1. In which region of the electromagnetic spectrum is most of Earth's outgoing terrestrial radiation?  
A) infrared                      B) visible  
C) ultraviolet                  D) x-rays
2. Which form of electromagnetic energy has the longest wavelength?  
A) ultraviolet rays              B) visible light  
C) gamma rays                  D) radio waves
3. The diagram below shows part of the electromagnetic spectrum.



- Which form of electromagnetic energy shown on the diagram has the lowest frequency and longest wavelength?
- A) AM radio
  - B) infrared rays
  - C) red light
  - D) gamma rays
4. Most of the radiant energy released by the sun results from the process of  
A) nuclear fission  
B) nuclear fusion  
C) combustion  
D) electrical generation
  5. Which characteristics best describe the star *Betelgeuse*?  
A) reddish orange with low luminosity and high surface temperature  
B) reddish orange with high luminosity and low surface temperature  
C) blue white with low luminosity and low surface temperature  
D) blue white with high luminosity and high surface temperature

6. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents two possible sequences in the evolution of stars.



Which table includes data that are characteristic of the surface temperature and luminosity of some white dwarf stars?

- A)

Surface Temperature	5000 K
Luminosity	100
- B)

Surface Temperature	5000 K
Luminosity	0.001
- C)

Surface Temperature	10,000 K
Luminosity	100
- D)

Surface Temperature	10,000 K
Luminosity	0.001

7. Which two stars are most similar in luminosity?

- A) *Betelgeuse* and *Barnard's Star*  
B) *Procyon B* and *Proxima Centauri*  
C) *Polaris* and the Sun  
D) *Alpha Centauri* and *Sirius*

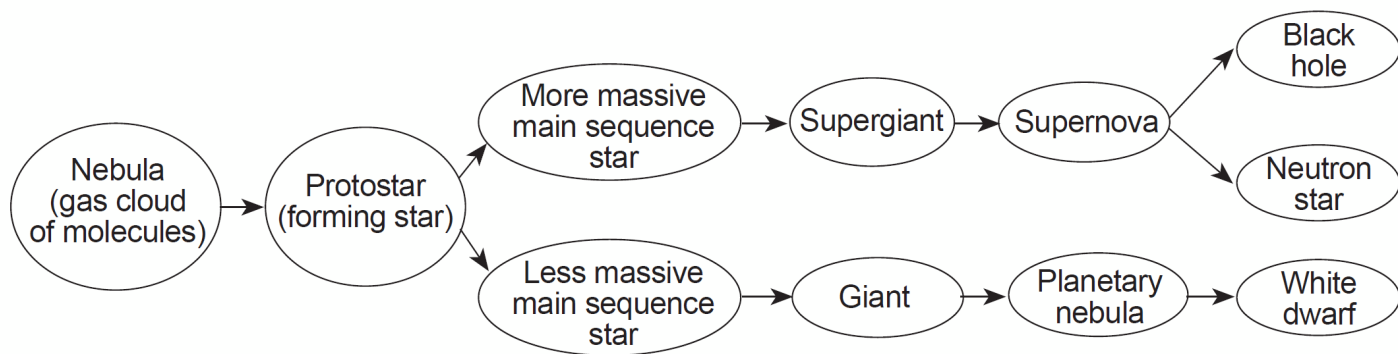
8. Which sequence of stars is listed in order of increasing luminosity?

- A) *Spica*, *Rigel*, *Deneb*, *Betelgeuse*  
B) *Polaris*, *Deneb*, *40 Eridani B*, *Proxima Centauri*  
C) *Barnard's Star*, *Alpha Centauri*, *Rigel*, *Spica*  
D) *Procyon B*, *Sun*, *Sirius*, *Betelgeus*

9. Compared to the luminosity and surface temperature of red main sequence stars, blue supergiants are

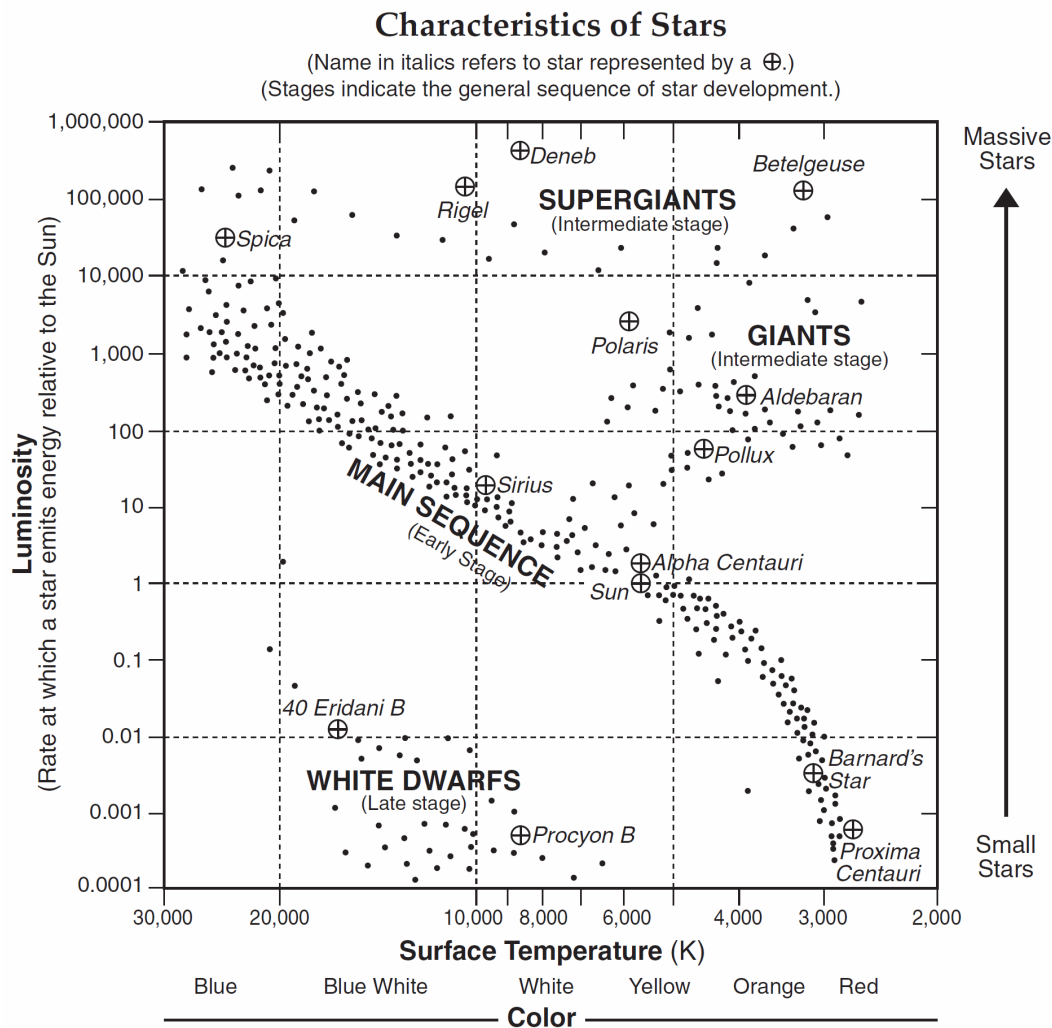
- A) less luminous and have a lower surface temperature  
B) less luminous and have a higher surface temperature  
C) more luminous and have a lower surface temperature  
D) more luminous and have a higher surface temperature

- 
10. Base your answer to the following question on the flowchart below and on your knowledge of Earth science. The flowchart shows the evolution of stars.



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

Base your answers to questions 11 and 12 on the Characteristics of Stars graph in your answer booklet and on your knowledge of Earth science.



11. Describe how the relative surface temperature and the relative luminosity of *Aldebaran* would change if it collapses and becomes a white dwarflike *Procyon B*.
12. The star *Canopus* has a surface temperature of 7400 K and a luminosity (relative to the Sun) of 1413. Above, use an **X** to plot the position of *Canopus* on the graph, based on its surface temperature and luminosity.
13. Base your answer to the following question on the *Luminosity and Temperature of Stars* graph in the *Earth Science Reference Tables*.
- Describe the relationship between temperature and luminosity of main sequence stars.

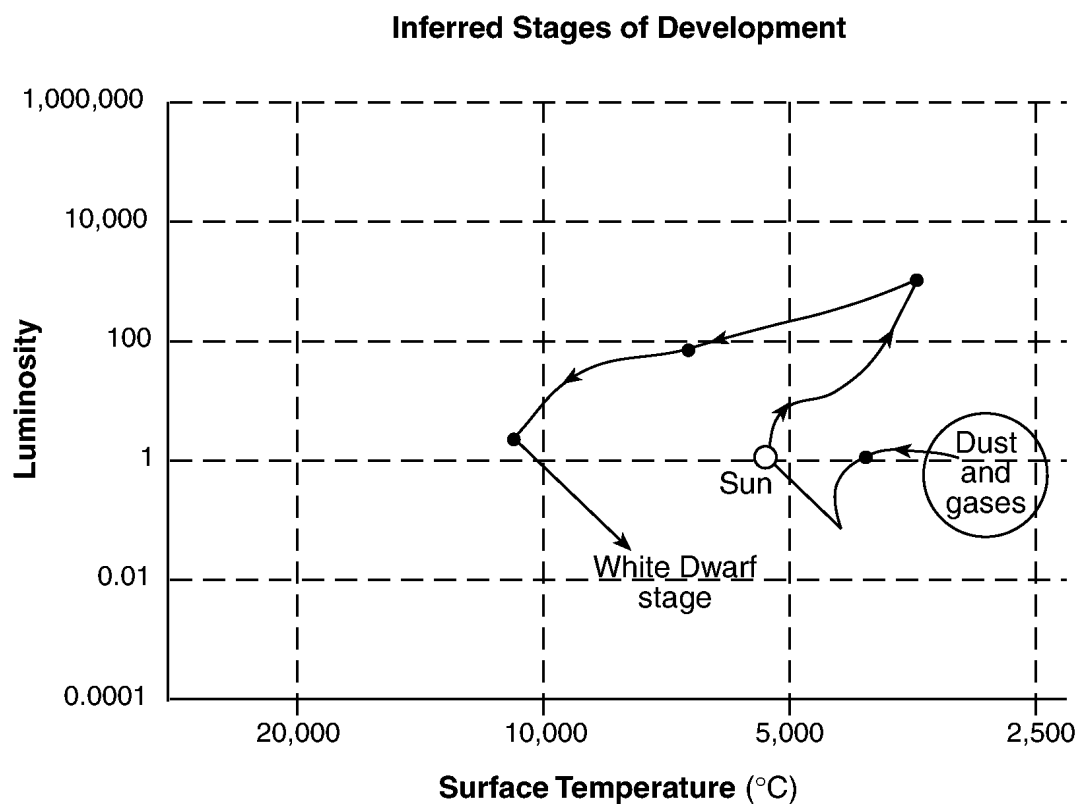
14. According to the graph, the Sun is classified as a

- A) main sequence star with a temperature of approximately 4,000°C and a luminosity of 100
- B) main sequence star with a temperature of approximately 6,000°C and a luminosity of 1
- C) white dwarf star with a temperature of approximately 10,000°C and a luminosity of 0.01
- D) blue supergiant star with a temperature of approximately 20,000°C and a luminosity of 700,000

15. The region of the H-R diagram occupied by most stars is the

- A) main sequence region
- B) red giant region
- C) white dwarf region
- D) quasar region

16. Base your answer to the following question on the graph below, which shows the inferred stages of development of the Sun, showing luminosity and surface temperature at various stages.



Describe the changes in luminosity of the Sun that will occur from its current Main Sequence stage to its final White Dwarf stage.

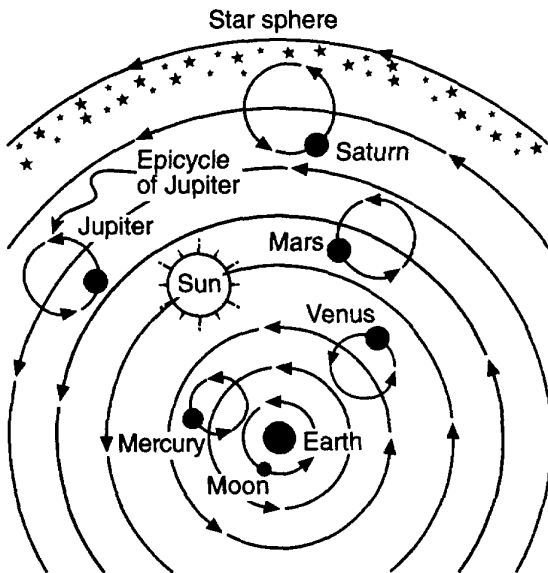
17. Compared to the surface temperature and luminosity of massive stars in the Main Sequence, the smaller stars in the Main Sequence are

- A) hotter and less luminous
- B) hotter and more luminous
- C) cooler and less luminous
- D) cooler and more luminous

18. In which type of model are the Sun, other stars, and the Moon in orbit around the Earth?

- A) heliocentric model    B) tetrahedral model
- C) concentric model    D) geocentric model

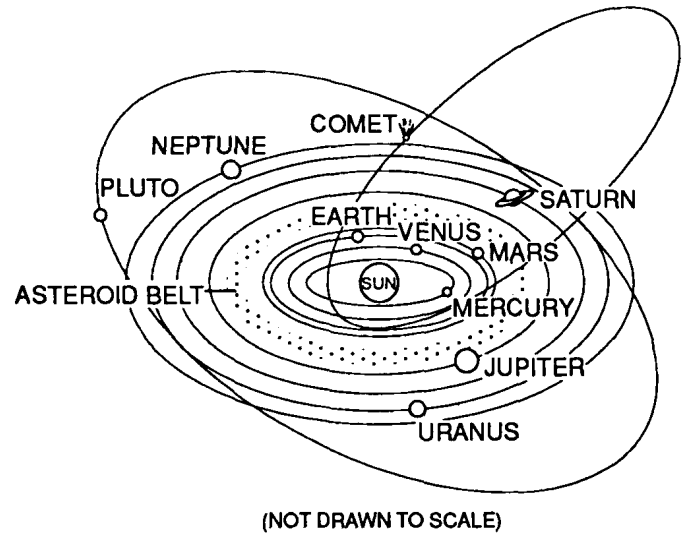
19. The diagram below shows one model of a portion of the universe.



What type of model does the diagram best demonstrate?

- A) a heliocentric model, in which celestial objects orbit Earth
- B) a heliocentric model, in which celestial objects orbit the Sun
- C) a geocentric model, in which celestial objects orbit Earth
- D) a geocentric model, in which celestial objects orbit the Sun

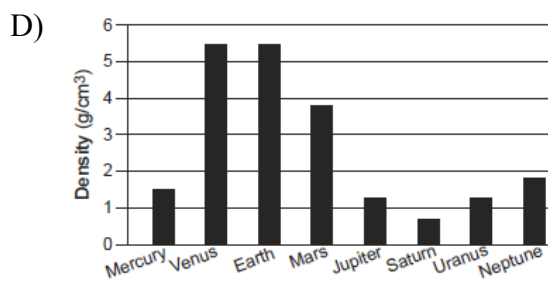
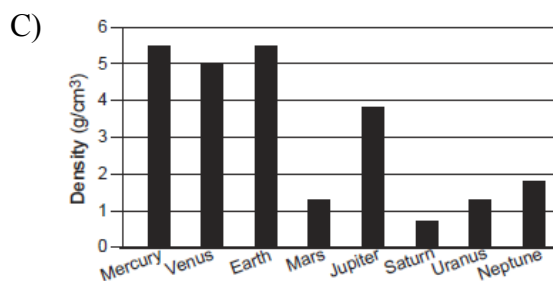
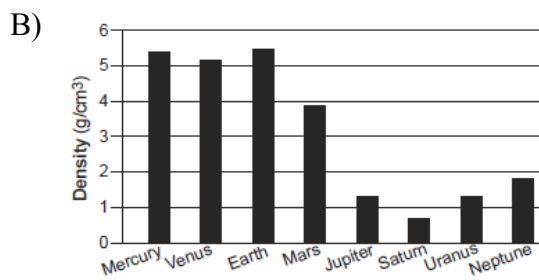
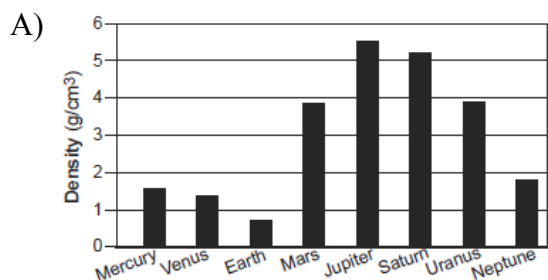
20. The diagram below represents our solar system.



This system is best classified as

- A) geocentric, with elliptical orbits
- B) geocentric, with circular orbits
- C) heliocentric, with elliptical orbits
- D) heliocentric, with circular orbits

21. Which graph best indicates the densities of the planets in our solar system?



22. Which characteristic of the planets in our solar system increases as the distance from the Sun increases?

- A) equatorial diameter
- B) eccentricity of orbit
- C) period of rotation
- D) period of revolution

23. Compared to the terrestrial planets, the Jovian planets are

- A) larger and less dense
- B) smaller and more dense
- C) closer to the Sun and less rocky
- D) farther from the Sun and more rocky

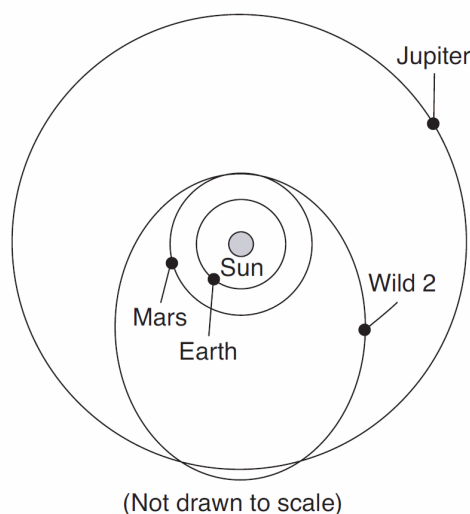
24. Compared to the size and density of Earth, the Moon has a

- A) smaller diameter and lower density
- B) smaller diameter and higher density
- C) larger diameter and lower density
- D) larger diameter and higher density

25. Compared to Jovian planets, terrestrial planets have

- A) larger masses
- B) larger equatorial diameters
- C) shorter periods of revolution
- D) shorter periods of rotation

26. The diagram below shows the orbital paths of Earth, Mars, Jupiter, and a comet named Wild 2.



What is the approximate distance between the Sun and Wild 2 when this comet is closest to the Sun?

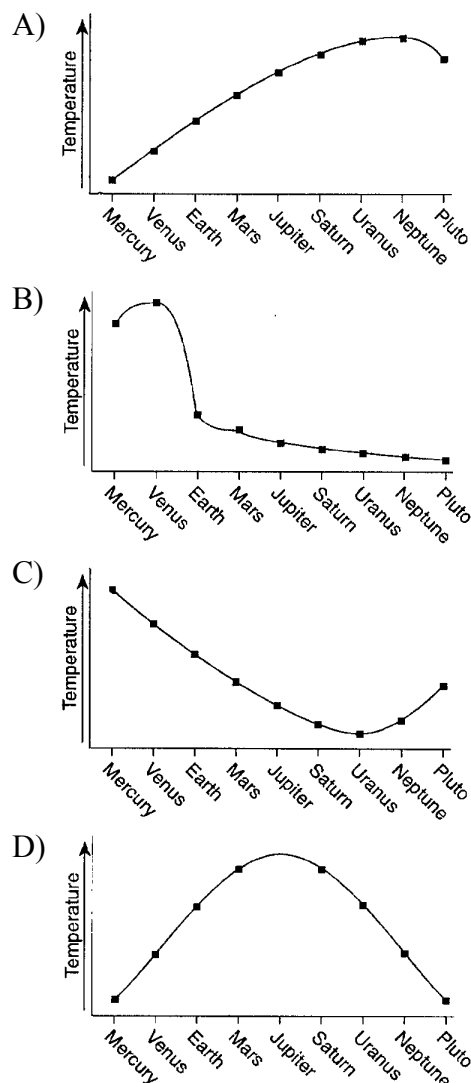
- A) 150 million kilometers
- B) 228 million kilometers
- C) 778 million kilometers
- D) 820 million kilometers

27. Which planet's diameter is approximately four times Earth's diameter?

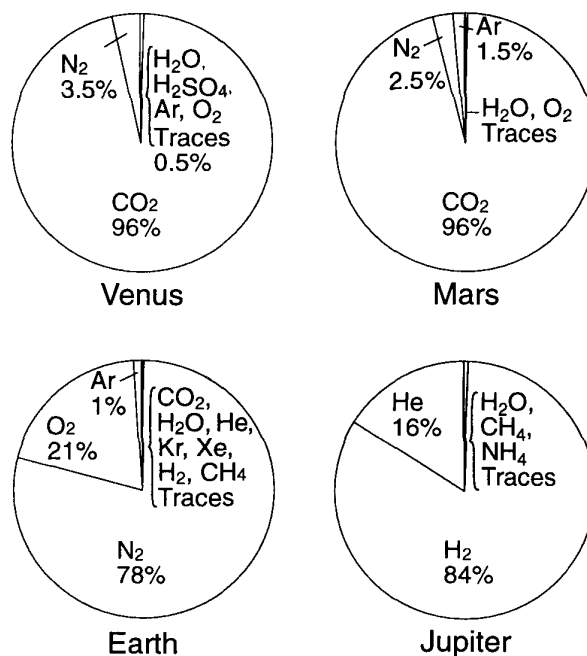
- A) Venus
- B) Jupiter
- C) Saturn
- D) Uranus



28. Which graph best illustrates the average temperatures of the planets in the solar system?



29. Base your answer to the following question on the graphs below. The graphs show the composition of the atmospheres of Venus, Earth, Mars, and Jupiter.



Which planet has an atmosphere composed primarily of CO<sub>2</sub> and a period of rotation greater than its period of revolution?

- A) Venus                      B) Mercury  
C) Earth                      D) Mars

30. Which is the largest planet in our solar system?

- A) Earth                      B) Uranus  
C) Saturn                      D) Jupiter

31. Which planet below has the highest average density?

- A) Earth                      B) Uranus  
C) Jupiter                      D) Saturn

32. Which of the following planets is a terrestrial planet?

- A) Jupiter                      B) Saturn  
C) Mars                      D) Neptune

33. Compared to the Jovian planets, terrestrial planets are

- A) more dense and more massive.  
B) less dense and more massive.  
C) more dense and less massive.  
D) less dense and less massive.

---

34. The solar system object in the photograph below is 56 kilometers long.



The object in the photograph is most likely

- A) an asteroid      B) Neptune      C) Earth's Moon      D) Mercury

Base your answers to questions **35** and **36** on on the data table below, which shows information about the four largest asteroids found in our solar system.

**Data Table**

<b>Name</b>	<b>Average Diameter (kilometers)</b>	<b>Period of Revolution (years)</b>
Ceres	848.4	4.60
Pallas	498.1	4.61
Juno	247.0	4.36
Vesta	468.3	3.63

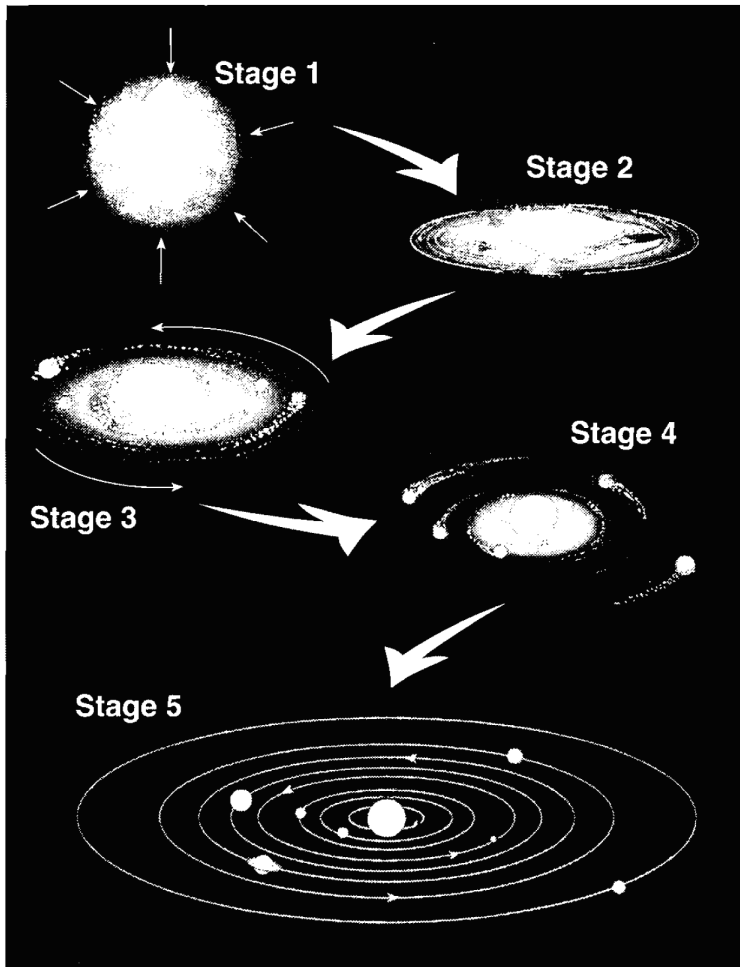
35. Compared to the diameter of Earth's Moon, the diameter of Ceres is about

- A) one-fourth of the Moon's diameter      B) one-half of the Moon's diameter  
C) twice the diameter of the Moon      D) four times the diameter of the Moon

36. The asteroids shown in the data table are located between the orbits of

- A) Venus and Earth      B) Earth and Mars  
C) Mars and Jupiter      D) Jupiter and Saturn
-

37. Base your answer to the following question on the diagram below. The diagram represents the inferred stages in the formation of our solar system. Stage 1 shows a contracting gas cloud. The remaining stages show the gas cloud flattening into a spinning disk as planets formed around our Sun.



(Not drawn to scale)

Which force was mostly responsible for the contraction of the gas cloud?

- A) friction      B) gravity      C) magnetism      D) inertia

38. What is the inferred age of our solar system, in millions of years?

- A) 544      B) 1300  
C) 4600      D) 10,000

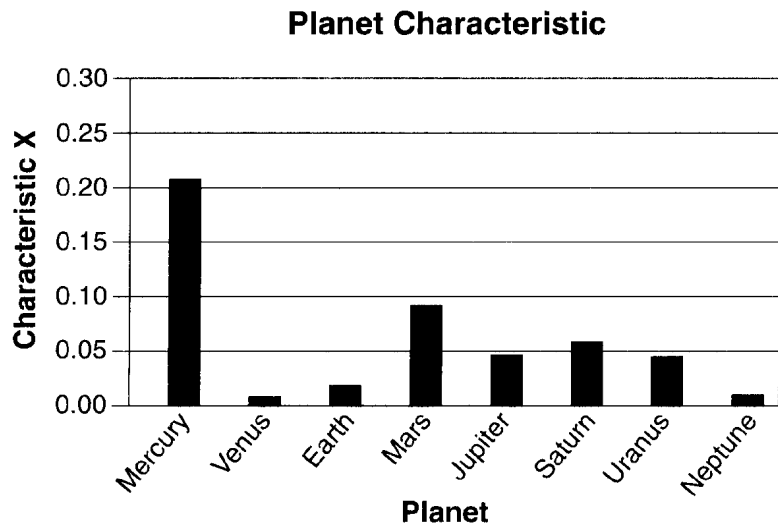
39. It is inferred that during the early Archean Era the atmosphere of Earth contained water vapor, carbon dioxide, nitrogen, and other gases in small amounts. These gases probably came from

- A) precipitation of groundwater  
B) volcanic eruptions  
C) evaporation of Paleozoic oceans  
D) convection currents in the mantle

40. The shape of the orbits of most of the planets in the solar system would best be described as

- A) elliptical and very oval  
B) circular  
C) nearly circular  
D) perfectly circular

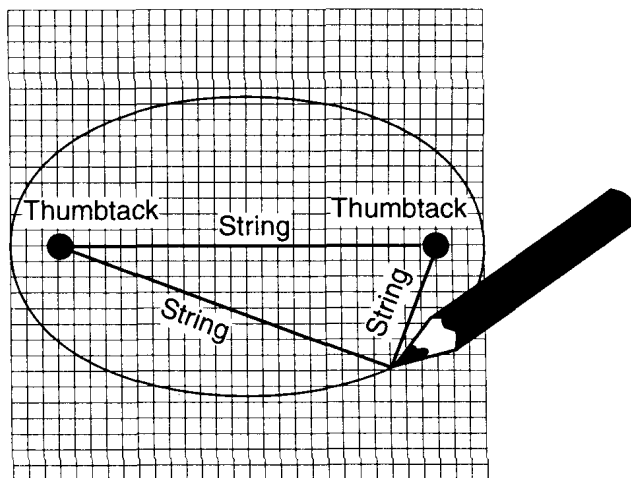
41. The bar graph below shows one planetary characteristic, identified as  $X$ , plotted for the planets of our solar system.



Which characteristic of the planets in our solar system is represented by  $X$ ?

- A) mass  
B) density  
C) eccentricity of orbit  
D) period of rotation
42. Which planet's orbit around the Sun is most nearly circular?
- A) Mercury  
B) Neptune  
C) Pluto  
D) Venus
43. Which planet has an orbital eccentricity most like the orbital eccentricity of the Moon?
- A) Pluto  
B) Saturn  
C) Mars  
D) Mercury
44. The constructed ellipse below is a true scale model of the orbit of a planet in our solar system. This ellipse best represents the orbit of the planet
- 
- Elliptical orbit
- Sun
- Focus      Focus
- 2 cm
- 8 cm
- A) Neptune  
B) Jupiter  
C) Pluto  
D) Mars

45. The diagram below represents a student's constructed laboratory drawing.

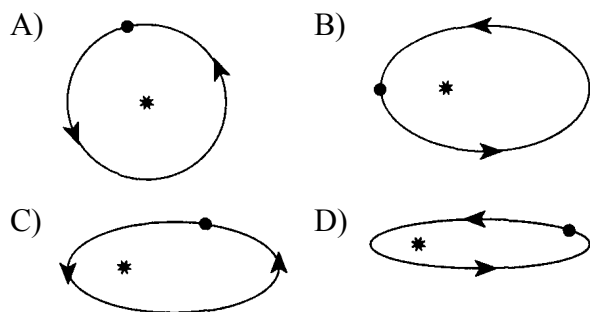


( Not drawn to scale )

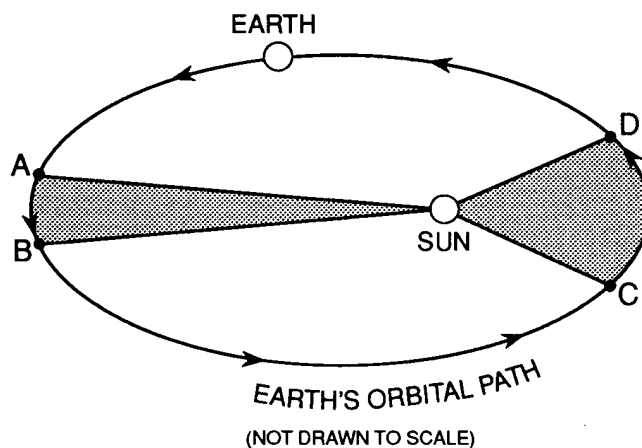
The student's drawing best represents the

- A) shape of Earth's Moon
  - B) shape of an elliptical orbit
  - C) path of an earthquake wave
  - D) path of a projectile deflected by Earth's rotation
46. Which diagram shows a planet with the *least* eccentric orbit?

( Key: • = planet \* = star )

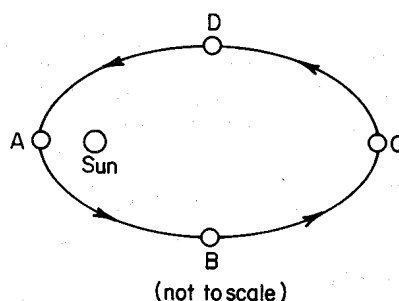


47. The diagram below represents the Earth's orbital path around the Sun. The Earth takes the same amount of time to move from *A* to *B* as from *C* to *D*.



Which values are equal within the system?

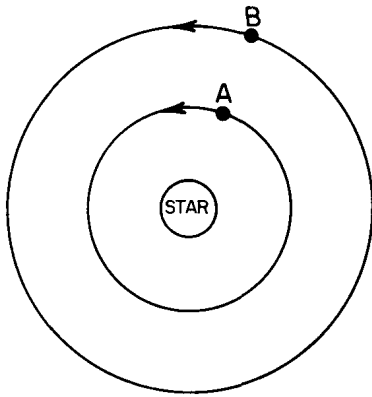
- A) The shaded sections of the diagram are equal in area.
  - B) The distance from the Sun to the Earth is the same at point *A* and at point *D*.
  - C) The orbital velocity of the Earth at point *A* equals its orbital velocity at point *C*.
  - D) The gravitational force between the Earth and the Sun at point *B* is the same as the gravitational force at point *D*.
48. The diagram below shows a planet's orbit around the Sun.



At which location is the planet's orbital velocity greatest?

- A) *A*
- B) *B*
- C) *C*
- D) *D*

- 
49. The diagram below shows the orbits of planets *A* and *B* in a star-planet system.



- The period of revolution for planet *B* is 40 days. The period of revolution for planet *A* most likely is
- A) less than 40 days
  - B) greater than 40 days
  - C) 40 days
50. The period of time a planet takes to make one revolution around the Sun is most dependent on the planet's average
- A) rotation rate
  - B) mass
  - C) insolation from the Sun
  - D) distance from the Sun
-