NEXT-TIME QUESTION

The gravitational force between the Moon and Sun is more than twice as great as the gravitational force between the Moon and Earth. Why then, does the Moon orbit Earth, rather than the Sun?

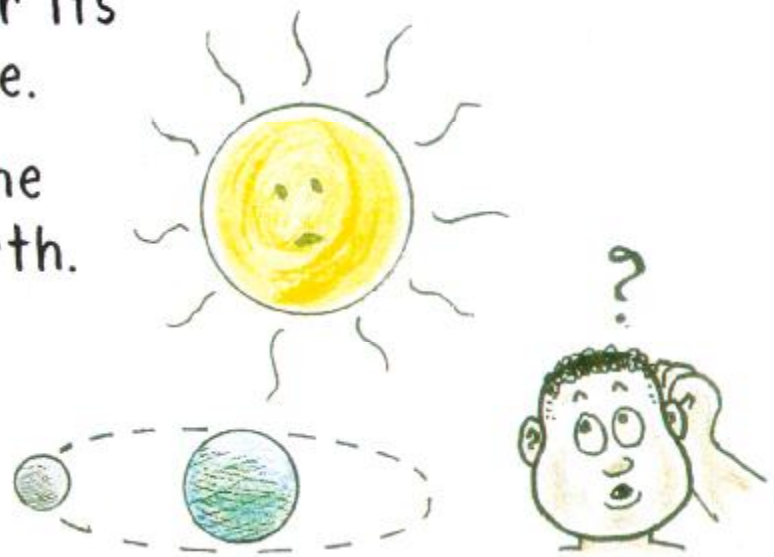
a) Moon is more "family" to planet Earth and responds more appropriately to Earth gravity.

b) The Sun is too far away for its greater force to be effective.

c) The Moon is much nearer the relatively weakly pulling Earth.

d) All of the above.

e) But the Moon DOES orbit the Sun!



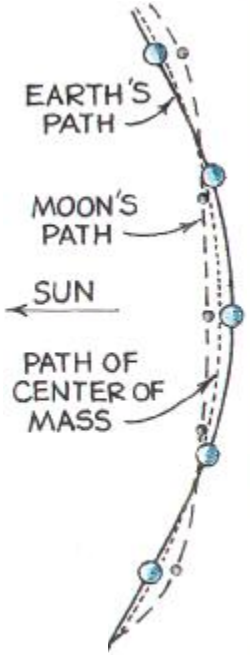
NEXT-TIME QUESTION

The gravitational force between the Moon and Sun is more than twice as great as the gravitational force between the Moon and Earth. Why orbit Earth, rather than the Sun?

a) Moon is more "family" to planet Earth and responds more appropriately to Earth gravity.
b) The Sun is too far away for its greater force to be effective.
c) The Moon is much nearer the relatively weakly pulling Earth.
d) All of the above.
e) But the Moon DOES orbit the Sun!

Answer: e

Like Earth, the Moon DOES orbit the Sun. Both Earth and Moon orbit the Sun once each year. Interestingly, it is the center of mass of the Earth-Moon system, rather than either Earth or Moon, that follows the neat elliptical orbit around the Sun. Both the Moon and Earth revolve monthly about this center of mass, called the *barycenter*. So while the Moon orbits the Sun in a not-quite elliptical path, it orbits Earth in a smaller purely elliptical path.



The *barycenter* is located inside the Earth, about one quarter the radial distance to Earth's center. It isn't attached to any particular "rock" but moves as Earth turns. Only Earth's center of mass neatly circles the barycenter monthly.

The barycenter traces out the smooth elliptical path about the Sun (dotted line). Earth's path (solid line) and Moon's path (dashed line) wobble as shown in this exaggerated view. Interestingly, The Moon's path about the Sun is everywhere 'concave' to the Sun. Likewise for Earth's path.

CONCEPTUAL Physics

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