Finish reading Chp 5

6.1

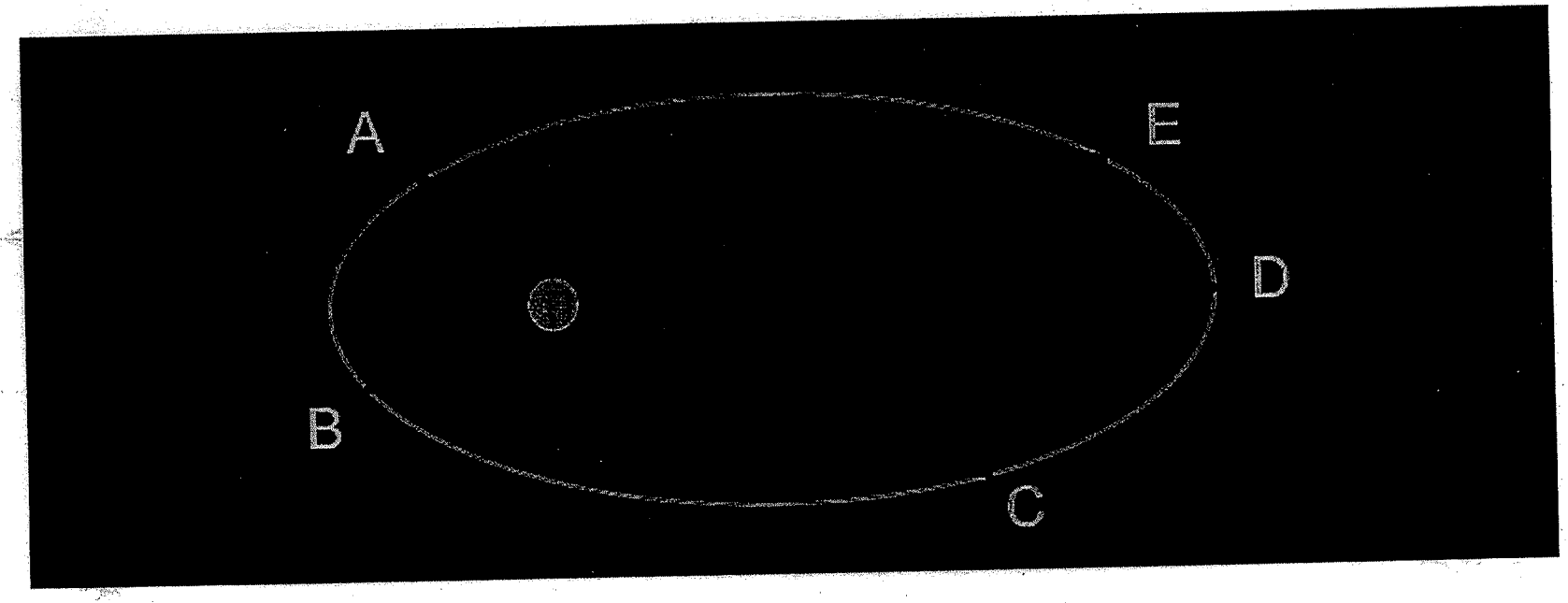
GP4 on D2L

Interactive Question

(A)

The figure below shows the orbit of a comet about the sun. The comet has the greatest velocity when traveling

A) from A to B.
B) from B to C.
C) from C to D.
D) from D to E.



<u>Problem:</u> Saturn is about 9.7 times as far from the sun as the earth is. What is the length of Saturn's year?

Given $r_S = 9.7 r_e$ or $\frac{r_S}{r_e} = 9.7$

$T_E = 1$ year

want T_S

$$\frac{T_S^2}{T_E^2} = \frac{r_S^3}{r_e^3}$$

$$T_S^2 = T_E^2 \frac{r_S^3}{r_e^3}$$

$$\left(\frac{r_S}{r_e}\right)^3$$

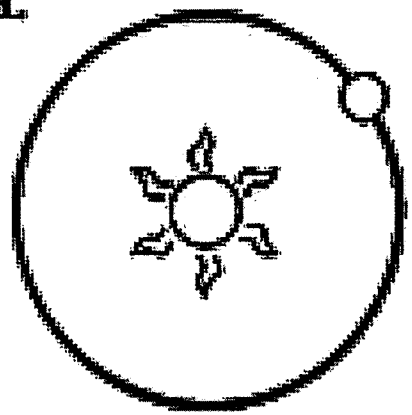
$$T_S = \sqrt{(1\text{ year})^2 (9.7)^3} = \underline{30 \text{ years}}$$

Interactive Question

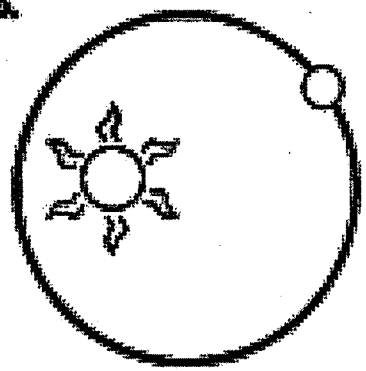
(A)

Which of the following diagrams most accurately depicts the shape of Earth's orbit around the Sun?

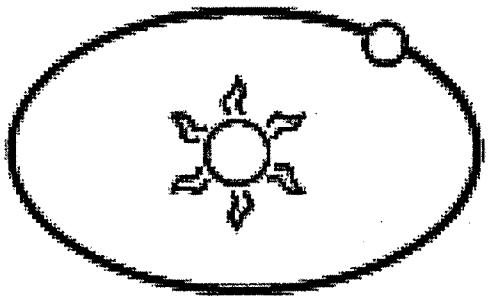
A.



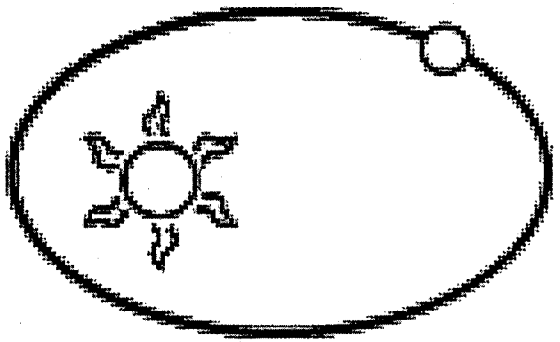
B.



C.



D.



Interactive Question

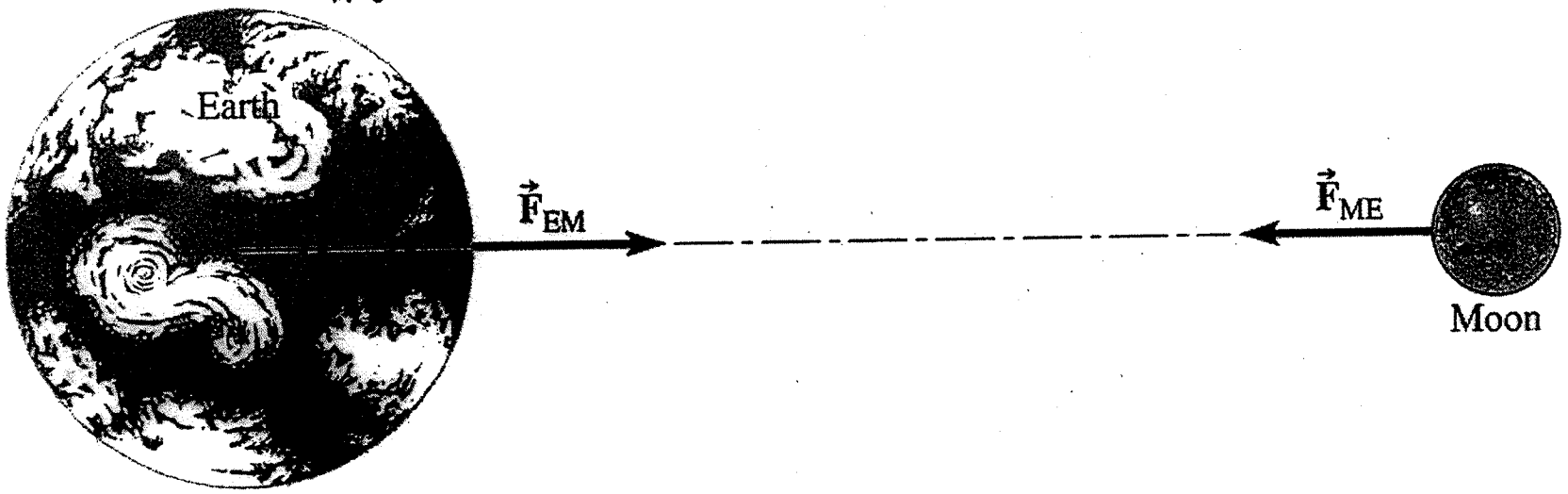
E

A spaceship is traveling to the moon. At what point is it beyond the pull of the earth's gravity? The mass of the moon is 1/80 the mass of the earth, and the surface gravity of the moon is 1/6 that of the earth.

A) When it gets out of the atmosphere.
B) When it is half-way there.
C) When it is 5/6 of the way there.
D) When it is 79/80 of the way there.
E) It is never beyond the pull of earth's gravity.

Interactive Question

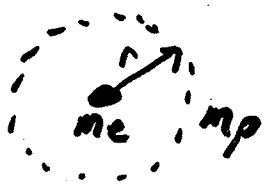
Which is stronger, the Earth's pull on the Moon, or the Moon's pull on the Earth?



A) The Earth's pull on the Moon
B) The Moon's pull on the Earth
C) They are the same
D) It depends on other factors

where does $T^2 \propto r^3$ come from

$$F = \frac{G m_p m_e}{r^2} = \frac{m_p v^2}{r}$$



$$v = \frac{2\pi r}{T}$$

$$\frac{G \cancel{m_p} m_e}{r^2} = \cancel{m_p}\left(\frac{2\pi r}{T}\right)^2 \frac{1}{\cancel{r}}$$

$$\frac{G m_e}{r} = \frac{4\pi^2 r^2}{T^2}$$

$$T^2 = \frac{4\pi^2}{G m_e} r^3$$

$\uparrow$ constant

$$T^2 = \text{constant}\ r^3$$

$$T^2 \propto r^3$$

Problem: (a) What is the magnitude and direction of the gravitational force on the Moon from the Earth? (b) What is the magnitude and direction of the gravitational force on the Earth from the Moon?

$$F = \frac{G m_E m_m}{(r_{em})^2}$$

Front of book

$m_E = 5.98 \times 10^{24}\,kg$

$m_m = 7.35 \times 10^{22}\,kg$

$r_{EM} = 3.84 \times 10^{8}\,m$

a) $$F = \frac{\left(6.67 \times 10^{-11}\,\frac{N \cdot m^2}{kg^2}\right)\left(5.98 \times 10^{24}\,kg\right)\left(7.35 \times 10^{22}\,kg\right)}{\left(3.84 \times 10^{8}\,m\right)^2}$$

$1.99 \times 10^{20}\,N$ pulling towards earth

b) $1.99 \times 10^{20}\,N$ pulling towards moon

Interactive Question

E

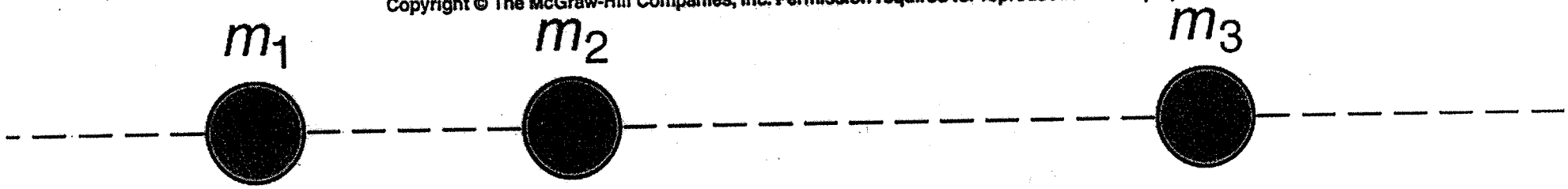
If the distance to the moon were halved, then the force of attraction between the earth and moon would be

A) quartered.
B) halved.
C) unchanged
D) doubled.
E) quadrupled.

Interactive Question

(A)

Three objects with equal masses are located as shown. What is the direction of the total force acting on the object labeled m_2?



A) To the left.
B) To the right.
C) The forces cancel such that the total force is zero.
D) It is impossible to determine from the figure.