Q12.1

The mass of the Moon is \(\frac{1}{81}\) of the mass of the Earth.

Compared to the gravitational force that the Earth exerts on the Moon, the gravitational force that the Moon exerts on the Earth is

A. \(81^2 = 6561\) times greater.

B. 81 times greater.

C. equally strong.

D. \(\frac{1}{81}\) as great.

E. \((\frac{1}{81})^2 = \frac{1}{6561}\) as great.
A12.1

The mass of the Moon is $1/81$ of the mass of the Earth.

Compared to the gravitational force that the Earth exerts on the Moon, the gravitational force that the Moon exerts on the Earth is

A. $81^2 = 6561$ times greater.

B. 81 times greater.

C. equally strong.  

✓ C. equally strong.

D. $1/81$ as great.

E. $(1/81)^2 = 1/6561$ as great.
Q12.2

The planet Saturn has 100 times the mass of the Earth and is 10 times more distant from the Sun than the Earth is.

Compared to the Earth’s acceleration as it orbits the Sun, the acceleration of Saturn as it orbits the Sun is

A. 100 times greater.
B. 10 times greater.
C. the same.
D. 1/10 as great.
E. 1/100 as great.
The planet Saturn has 100 times the mass of the Earth and is 10 times more distant from the Sun than the Earth is.

Compared to the Earth’s acceleration as it orbits the Sun, the acceleration of Saturn as it orbits the Sun is

A. 100 times greater.
B. 10 times greater.
C. the same.
D. 1/10 as great.
E. 1/100 as great.

✓ E. 1/100 as great.
Compared to the Earth, Planet X has twice the mass and twice the radius. This means that compared to the Earth’s surface gravity, the surface gravity on Planet X is

A. 4 times as much.
B. twice as much.
C. the same.
D. 1/2 as much.
E. 1/4 as much.
Compared to the Earth, Planet X has twice the mass and twice the radius. This means that compared to the Earth’s surface gravity, the surface gravity on Planet X is

A. 4 times as much.
B. twice as much.
C. the same.
D. 1/2 as much.  
E. 1/4 as much.

Answer: D. 1/2 as much.
Q12.4

Compared to the Earth, Planet X has twice the mass and twice the radius. This means that compared to the amount of energy required to move an object from the Earth’s surface to infinity, the amount of energy required to move that same object from Planet X’s surface to infinity is

A. 4 times as much.

B. twice as much.

C. the same.

D. 1/2 as much.

E. 1/4 as much.
Compared to the Earth, Planet X has twice the mass and twice the radius. This means that compared to the amount of energy required to move an object from the Earth’s surface to infinity, the amount of energy required to move that same object from Planet X’s surface to infinity is

A. 4 times as much.

B. twice as much.

C. the same.  

D. 1/2 as much.

E. 1/4 as much.
A satellite is moving around the Earth in a circular orbit. Over the course of an orbit, the Earth’s gravitational force

A. does positive work on the satellite.

B. does negative work on the satellite.

C. does positive work on the satellite during part of the orbit and negative work on the satellite during the other part.

D. does zero work on the satellite at all points in the orbit.
A satellite is moving around the Earth in a circular orbit. Over the course of an orbit, the Earth’s gravitational force

A. does positive work on the satellite.

B. does negative work on the satellite.

C. does positive work on the satellite during part of the orbit and negative work on the satellite during the other part.

D. does zero work on the satellite at all points in the orbit.
A planet \((P)\) is moving around the Sun \((S)\) in an elliptical orbit. As the planet moves from apheilon to perihelion, the Sun’s gravitational force

A. does positive work on the planet.

B. does negative work on the planet.

C. does positive work on the planet during part of the motion and negative work during the other part.

D. does zero work on the planet at all points between apheilon and perihelion.
A planet \((P)\) is moving around the Sun \((S)\) in an elliptical orbit. As the planet moves from aphelion to perihelion, the Sun’s gravitational force

- A. does positive work on the planet.
- B. does negative work on the planet.
- C. does positive work on the planet during part of the motion and negative work during the other part.
- D. does zero work on the planet at all points between aphelion and perihelion.
A planet (P) is moving around the Sun (S) in an elliptical orbit. As the planet moves from aphelion to perihelion, the planet’s angular momentum

A. increases during part of the motion and decreases during the rest of the motion.

B. increases at all times.

C. decreases at all times.

D. remains the same at all times.
A planet ($P$) is moving around the Sun ($S$) in an elliptical orbit. As the planet moves from aphelion to perihelion, the planet’s angular momentum

A. increases during part of the motion and decreases during the rest of the motion.

B. increases at all times.

C. decreases at all times.

D. remains the same at all times.

✓
Star X has twice the mass of the Sun. One of Star X’s planets has the same mass as the Earth, and orbits Star X at the same distance at which the Earth orbits the Sun.

The orbital speed of this planet of Star X is

A. faster than the Earth’s orbital speed.
B. the same as the Earth’s orbital speed.
C. slower than the Earth’s orbital speed.
D. not enough information given to decide
Star X has twice the mass of the Sun. One of Star X’s planets has the same mass as the Earth, and orbits Star X at the same distance at which the Earth orbits the Sun.

The orbital speed of this planet of Star X is

- A. faster than the Earth’s orbital speed.
- B. the same as the Earth’s orbital speed.
- C. slower than the Earth’s orbital speed.
- D. not enough information given to decide
Suppose the Sun were to shrink to half of its present radius while maintaining the same mass. What effect would this have on the Earth’s orbit?

A. The size of the orbit would decrease and the orbital period would decrease.

B. The size of the orbit would increase and the orbital period would increase.

C. The size of the orbit and the orbital period would remain unchanged.

D. none of these
Suppose the Sun were to shrink to half of its present radius while maintaining the same mass. What effect would this have on the Earth’s orbit?

A. The size of the orbit would decrease and the orbital period would decrease.

B. The size of the orbit would increase and the orbital period would increase.

C. The size of the orbit and the orbital period would remain unchanged.

D. none of these

A12.9