How strong is the force of gravity on a 170 lb person (~77 kg) at the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, R_{Earth} = 6378 km)

$7.55 * 10^2$ N

How strong is the force of gravity on a 170 lb person (~77 kg) at the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, $R_{Earth} = 6378$ km)

We know that $F_{grav} = G \frac{m_1 * m_2}{d^2}$

This equation ALWAYS describes the force of gravity between 2 objects with mass m_1 and m_2.

Remember d is the distance between the centers of the two objects.

How strong is the force of gravity on a 170 lb person (~77 kg) at the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, $R_{Earth} = 6378$ km)

We know that $F_{grav} = \frac{G * m_1 * m_2}{d^2}$

You can use this equation, but you MUST REMEMBER PROPER UNITS! Any mass always must be in kg, any distance always must be in m, any time must always be in s.

How strong is the force of gravity on a 170 lb person (~77 kg) at the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, R_{Earth} = 6378 km)

We know that $F_{grav} = \frac{G * m_1 * m_2}{d^2}$

If you wanted to use this equation, you can use d = $6.378 * 10^6$ meters. Technically d is the distance between the centers of the 2 objects, but a ~6 foot tall person only changes the d from $6.368 * 10^6$ to ($6.368 * 10^6 + 1.8$ m), a completely negligible difference

How strong is the force of gravity on a 170 lb person (~77 kg) at the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, R_{Earth} = 6378 km)

We know that $F_{grav} = \frac{G * m_1 * m_2}{d^2}$

You can use this equation and if you plugged it in correctly, you will get the right answer. However, please remember that FOR ANY OBJECT NEAR THE SURFACE OF THE EARTH YOU CAN USE $F_{grav} = m * a$, where $a = g = 9.8\ m/s^2$. That greatly simplifies the problem, and makes it very easy to answer.

How strong is the force of gravity on a 170 lb person (~77 kg) 7000 km above the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, $R_{Earth} = 6378$ km)

$1.7 * 10^2$ N

How strong is the force of gravity on a 170 lb person (~77 kg) 7000 km above the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, R_{Earth} = 6378 km)

We know that $F_{grav} = \frac{G * m_1 * m_2}{d^2}$

You MUST use this equation, because you are no longer at the surface of the Earth. You MUST REMEMBER PROPER UNITS! Any mass always must be in kg, any distance always must be in m, any time must always be in s.

How strong is the force of gravity on a 170 lb person (~77 kg) 7000 km above the surface of the Earth?

($G = 6.67 * 10^{-11}$ N m^2/kg^2, $M_{Earth} = 5.98 * 10^{24}$ kg, R_{Earth} = 6378 km)

We know that $F_{grav} = \frac{G * m_1 * m_2}{d^2}$

d will be (7000 km + 6378 km), but you MUST convert it into meters first!

If you converted the units properly you should end up with the right answer. This should make sense – it's smaller than the force on the surface of the Earth.

Planet X has a mass of 3.2 times that of the Earth, and the same radius of the Earth. What is g (acceleration due to gravity) at the surface of Planet X?

31.36 m/s^2

$$g = \frac{G\, M_{planet}}{d^2}$$

If d remains the same and M increases, 'g' will increase by the same amount. The new g would be 3.2 * gEarth

IN CLASS THOUGHT EXPERIMENTS

Noman learned in his first physics course that objects weight different amounts at different distances from the Earth's center. He devises a business plan to buy gold at the weight at one altitude, and sell it at another altitude at the same price per weight. What is he going to do?

a. Buy at high altitude, sell at low
b. Buy at low altitude, sell at high

Noman learned in his first physics course that objects weight different amounts at different distances from the Earth's center. He devises a business plan to buy gold at the weight at one altitude, and sell it at another altitude at the same price per weight. What is he going to do?

A. The mass of the purchased gold would be the same at both altitudes. Yet it would weight less at higher altitudes. So to make a profit, he should buy at high altitudes and sell at low altitudes. He would have more gold (by weight) to sell at the lower altitudes.

F_{grav} is proportional to $1/d^2$, so the larger d (ie the higher above the surface of the earth) the smaller the force due to gravity, or weight of the gold

Astronauts on the orbiting space station are weightless because

a. There is no gravity in space and they do not weigh anything
b. Space is a vacuum and there is no gravity in a vacuum
c. Space is a vacuum and there is no air resistance in a vacuum
d. They are far from the Earth's surface, so gravitation has a minimal effect
e. None of the above

Astronauts on the orbiting space station are weightless because

a. There is no gravity in space and they do not weigh anything

This can't be right – we now know the orbit of the moon and the planets around the sun is due to ONLY the force of gravity acting on them. The force of gravity exists in space.

Astronauts on the orbiting space station are weightless because

b. Space is a vacuum and there is no gravity in a vacuum

Same reasoning as previous option, we know gravity exists in space

Astronaunts on the orbiting space station are weightless because

c. Space is a vacuum and there is no air resistance in a vacuum

Hmm, this is an interesting thought. Let's come back to it in a minute.

Astronauts on the orbiting space station are weightless because

d. They are far from the Earth's surface, so gravitation has a minimal effect

Again the same reasoning that leads you to reject options a and b should also lead you to reject this