HW 7: Gravity Name:____

Answer the following questions. There is some reading material, attached, to remind you what we covered about this topic.

1. You visit a planetarium, and find a scale that lets you "weigh" yourself on different planets. Suppose you weight 100 lbs on earth. You find that you weigh 91 lbs on Venus, but 38 lbs on Mars. You also find that you weigh 89 lbs on Uranus – but you know that Uranus is much larger than Venus. What can you predict about each of these planets, based on what you know about the law of gravity?

2. A friend tells you that there is no gravity in space. Answer them, based on what you have learned in class. Give your reasons.

3. Explain how astronomers can determine the mass of a binary star system like Albireo.

How does gravity work?
by Julia Layton

Every time you jump, you experience gravity. It pulls you back down to the ground. Without gravity, you'd float off into the atmosphere -- along with all of the other matter on Earth.

You see gravity at work any time you drop a book, step on a scale or toss a ball up into the air. It's such a constant presence in our lives, we seldom marvel at the mystery of it -- but even with several well-received theories out there attempting to explain why a book falls to the ground (and at the same rate as a pebble or a couch, at that), they're still just theories. The mystery of gravity's pull is pretty much intact.

So what do we know about gravity? We know that it causes any two objects in the universe to be drawn to one another. We know that gravity assisted in forming the universe, that it keeps the moon in orbit around the Earth, and that it can be harnessed for more mundane applications like gravity-powered motors or gravity-powered lamps.

As for the science behind the action, we know that Isaac Newton defined gravity as a force -- one that attracts all objects to all other objects. Although many people had already noted that gravity exists, Newton was the first to develop a cohesive explanation for gravity, so we'll start there.

Newton publicized his Theory of Universal Gravitation in the 1680s. It basically set forth the idea that gravity was a predictable force that acts on all matter in the universe, and is a function of both mass and distance. The theory states that each particle of matter attracts every other particle (for instance, the particles of "Earth" and the particles of "you") with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

So the farther apart the particles are, and/or the less massive the particles, the less the gravitational force.
The standard formula for the law of gravitation is:

Gravitational force = (G * M1 * M2) / (A^2)

where **G** is the gravitational constant, **m1** and **m2** are the masses of the two objects for which you are calculating the force, and **A** is the distance between the centers of gravity of the two masses.

Some years before, Johannes Kepler had discovered a simple relationship between the average distance of a planet from the Sun (called its semi-major axis, A, measured in Astronomical Units) and the amount of time it takes a planet to orbit the Sun once (called its orbital period, P, measured in years). For objects orbiting the Sun, the semi-major axis to the third power equals the period squared:

$$A^3 = P^2$$

There were two problems with this relation. First, Kepler did not know how it worked, he just knew it did. Second, the relation does not work for objects which are not orbiting the Sun, for example, the Moon orbiting the Earth. Isaac Newton solved both these problems with his Theory of Gravity, and discovered that the masses of the orbiting bodies also play a part. Newton developed a more general form of what was called Kepler's Third Law that could apply to any two objects orbiting a common center of mass. This is called Newton's Version of Kepler's Third Law:

$$M_1 + M_2 = A^3 / P^2$$

This relation allows us to measure the mass of any two bodies in orbit around each other: a planet and its moon, two stars orbiting each other – even the sun orbiting the Milky Way galaxy (although we make some assumptions there.)

How does gravity work? By. Marianne Freiberger.Â Newton's theory of gravity, published in 1687, is remarkably accurate when it comes to most practical purposes, and went unchallenged for over 300 years. Problems arose, however, when Einstein developed his special theory of relativity in 1905. "According to Newton's theory, gravitational interaction is instantaneous. Suppose the Sun were to vanish from the horizon today. We would not notice its disappearance immediately just by looking at the Sun, because light takes some time to travel. But according to Newton's gravity, the effect of the Sun's vanishing would be fel How Does a Martian-Style Gravity Assist Actually Work? It's basically a perfectly elastic collision, like two bouncy balls colliding. Casey Chin. What the heck is a gravity assist and how does it work? The first question is easyâ€"a gravity assist (also called a gravity slingshot) is a space maneuver in which a spacecraft gets a speed boost by moving past a planet.Â Yes, this gravity assist was used by a bunch of spacecraft like both Voyager 1 and Voyager 2 to get out the outer part of the solar system (and beyond). The maneuver was also used by fictional spacecraft like the Hermes in the movie (and book) The Martian. OK, actually my interest in gravity assists started with this tweet. https://twitter.com/ZachWeiner/status/1069381104266854400. So, let's do it. How do space and time appear? Big Bang. How does gravity operate? A change of space and time give you a gravitation force. Like a change in position gives you velocity ($v=\Delta x$), a change in energy gives you work ($W=Î"KE$). A change is very important, it will give you another interesting entity.Â What it does not say is how space-time is able to interact with mass. We expect that a quantum field theory type process is involved, and a lot of work goes in to determining this. Relating GR and quantum theory is in fact the fundamental problem of theoretical physics. One of the key problems in solving this is in fact the very success of GR - we lack experimental evidence of it failing and hence providing a lead on where to improve it via quantum effects.