

Universal Gravitation Worksheet

Ex 1: Marie (40 kg) and her dog (5 kg), Fluffy, are at opposite ends of the house, 20 meters away. Calculate the gravitational force of Marie on Fluffy. What is the gravitational force of Fluffy on Marie? (3.33×10^{-11} N)

Ex 2: Jack (60kg) and Jill (40kg) have a gravitational force of 4×10^{-9} N between them. How far are Jack and Jill away from each other? (6.3 m)

1. A person with a mass of 80kg is standing on the Earth. The weight of the man at this location is 782 N and the mass of the Earth is 6.0×10^{24} kg. What is the distance between the person and the center of the Earth? (6.4×10^6 m)
2. The Earth and moon are located 3.844×10^8 m away from each other and the gravitational force between them is 2×10^{20} N. Using the mass of the Earth, 6×10^{24} kg, calculate the mass of the moon. (7.36×10^{22} kg)
3. Suppose that you have a mass of 70 kg (equivalent to a 154-pound person). How much mass must another object have in order for your body and the other object to attract each other with a force of 1-Newton when separated by 10 meters? (2.14×10^{10} kg)
4. True or False: A gravitational force only exists between large bodies (like planets) and other objects.
5. True or False: There is no gravity on the moon.
6. A gravitational force exists between Earth and Jupiter. This gravitational force is between
 - a. The center of Earth and the center of Jupiter.
 - b. The surface of Earth and the surface of Jupiter.
 - c. The surface of Earth and the center of Jupiter.
7. If both objects are equidistance from each other, would a greater gravitational force exist between:
 - a. a DVD and TV or
 - b. a DVD and house

Explain why you chose this answer.

8. Would a greater gravitational force exist between
 - a. a man on top of Mt. Everest and Earth or
 - b. a man orbiting Earth in a space shuttle and Earth.

Why did you choose this answer?

9. A gravitational force of 4 N exists between 2 objects. If the mass of one of the objects is tripled and the distance between the objects is doubled, then what is the new force of attraction between the objects? (Ans: 3 N)

10. A gravitational force of 10 N exists between 2 objects. If the mass of one object is halved, the mass of the other is tripled, and the distance between them is $\frac{1}{4}$ the original distance, then what is the new gravitational force between them. (Ans: 240N)
11. A 200kg car is located 4×10^6 m from the center of Mars. The gravitational force between the car and Mars is 533.6 N. What is the mass of Mars? (Ans: 6.4×10^{23} kg)
12. A 70 kg man stands at the top of Mt. Everest, which is 8848 m above the surface of the Earth. The Earth has a radius of 6378100 m and a mass of 6×10^{24} kg. What is the gravitational force between the Earth and man? (Ans: 686.7 N... the answer is NOT 688.6 N)
13. A bat and baseball are 18 m away from each other. The pitcher throws the ball. How many times greater is the gravitational force between the ball and bat when the ball is $\frac{1}{4}$ the original distance from the bat. (Ans: 16 times)
14. Mercury orbits the sun because of a gravitational force of 1.31×10^{20} N. The mass of Mercury is 3.3×10^{23} kg and the mass of the sun is 2×10^{30} kg. On average how far is Mercury from the sun? (Ans: 5.8×10^{11} m) How many kilometers? (Ans: 5.8×10^8 km)