

Gravity, Part 2

Some useful numbers for this sheet. $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$

Mass of Earth: $6 \times 10^{24} \text{ kg}$
Mass of Moon: $7.4 \times 10^{22} \text{ kg}$

Radius of Earth: $6.4 \times 10^6 \text{ m}$
Radius of Moon: $1.74 \times 10^6 \text{ m}$

Distance Earth-Moon: $3.8 \times 10^8 \text{ m}$

Distance Earth-Sun: $1.5 \times 10^{11} \text{ m}$

1. The earth exerts a gravitational force of 7000 N on a satellite. What force does the satellite exert on the earth?
2. The Law of Universal Gravitation states that the gravitational force _____ as the mass increases and _____ as the distance increases.
3. Calculate the force of attraction between a 300 kg mass and a 550 kg mass that are 20 cm apart.
4. If the earth shrank to half its current size, but kept the same mass, how much would a 45 kg child weigh on the surface of the earth?
5. Imagine you and a friend are on a planet with a mass of $3.67 \times 10^{24} \text{ kg}$ and a radius of $7 \times 10^5 \text{ m}$.
 - a. How much would you weigh on that planet on this planet if your mass were 60 kg?
 - b. How much would your dog weigh on that planet if your dog's mass were 30 kg?
 - c. How much would a big 120 kg rock weigh on that planet?
 - d. Do you notice any pattern with your answers to parts a, b and c? (Hopefully you do.)
 - e. What is the acceleration due to gravity on that planet?

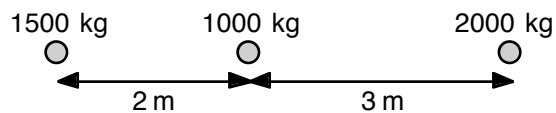
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6. Two masses are placed so that their centers are 0.26 m apart. The force between them is 2.75×10^{-12} N.
- a. If one mass is 0.025 kg, what is the other mass?

b. Calculate m_1 and m_2 if the masses are identical.

c. Calculate m_1 and m_2 if $m_1 = 2m_2$.

7. Calculate the net force on the 1000 kg mass in the diagram below.



8. Instead of 2000 kg, what should the third mass be so that the net force on the middle mass is zero?

Answers: 1) 7000 N 2) increases; decreases 3) 0.000275 N 4) 1760 N
 5. a) 300 N b) 150 N c) 600 N d) all 5x the mass; all proportional e) 5 m/s²
 6. a) 0.11 kg b) 0.053 kg c) 0.0373 kg & 0.0747 kg
 7) 1.02×10^{-5} N to the left 9) 3375 kg