What is Newton's Law of Gravitation?

Worksheet

Newton's Law of Gravitation states that any two masses attract each other with a force proportional to the product of their masses and inversely proportional to the square of the distance between them: F = Gmm/r.

$$F = G \frac{m_1 m_2}{r^2}$$

Questions

1. What is the formula for Newton's Law of Gravitation?

A) F = ma
B) F = Gmm/r
C) F = kx
D) F = Gmm/r

2. If the distance between two masses doubles, the gravitational force becomes

A) Half
B) One-quarter
C) Double
D) Four times

3. What is the approximate value of the gravitational constant G?

A) 9.8 N/kg
B) 310 m/s
C) 6.67410 Nm/kg
D) 1.610 C

4. Why does the Moon orbit the Earth rather than fly off in a straight line?

A) There is no force acting on it
B) Earth's gravity continuously pulls it toward Earth's center
C) The Moon has no mass
D) Air resistance curves its path

5. Two people of 50 kg each stand 2 m apart. Find the gravitational force between them.

6. Find the gravitational force on a 70 kg person at Earth's surface (Earth mass 5.9710 kg, radius 6.3710 m).

7. Earth (610 kg) and the Moon (710 kg) are 3.810 m apart. Find the gravitational force between them.

8. Define: What is Newton's Law of Gravitation?

9. Define: What is G?

10. Define: What happens to gravitational force if distance doubles?

Answer Key

1. B) F = Gmm/r - Gravitational force is F = Gmm/r - inversely proportional to the square of distance.

2. B) One-quarter - Force 1/r, so doubling r cuts force to (1/2) = 1/4.

3. C) 6.67410 Nm/kg - G 6.67410 Nm/kg, measured by Cavendish's experiment.

4. B) Earth's gravity continuously pulls it toward Earth's center - Gravitational attraction acts as the centripetal force that keeps the Moon in orbit.

5. F = Gmm/r F = 6.67410 (5050) / 2 F = 6.67410 2500 / 4 F 4.1710 N

6. F = Gmm/r F = 6.67410 (5.971070) / (6.3710) F = 6.67410 4.17910 / 4.05810 F 687 N (matches weight mg = 709.8)

7. F = Gmm/r F = 6.67410 (610710) / (3.810) F = 6.67410 4.210 / 1.44410 F 1.9410 N

8. Every two masses attract each other with F = Gmm/r - force proportional to the masses, inversely proportional to the square of distance.

9. The universal gravitational constant, G 6.67410 Nm/kg - the same everywhere in the universe.

10. It drops to one-quarter, since force is inversely proportional to r.